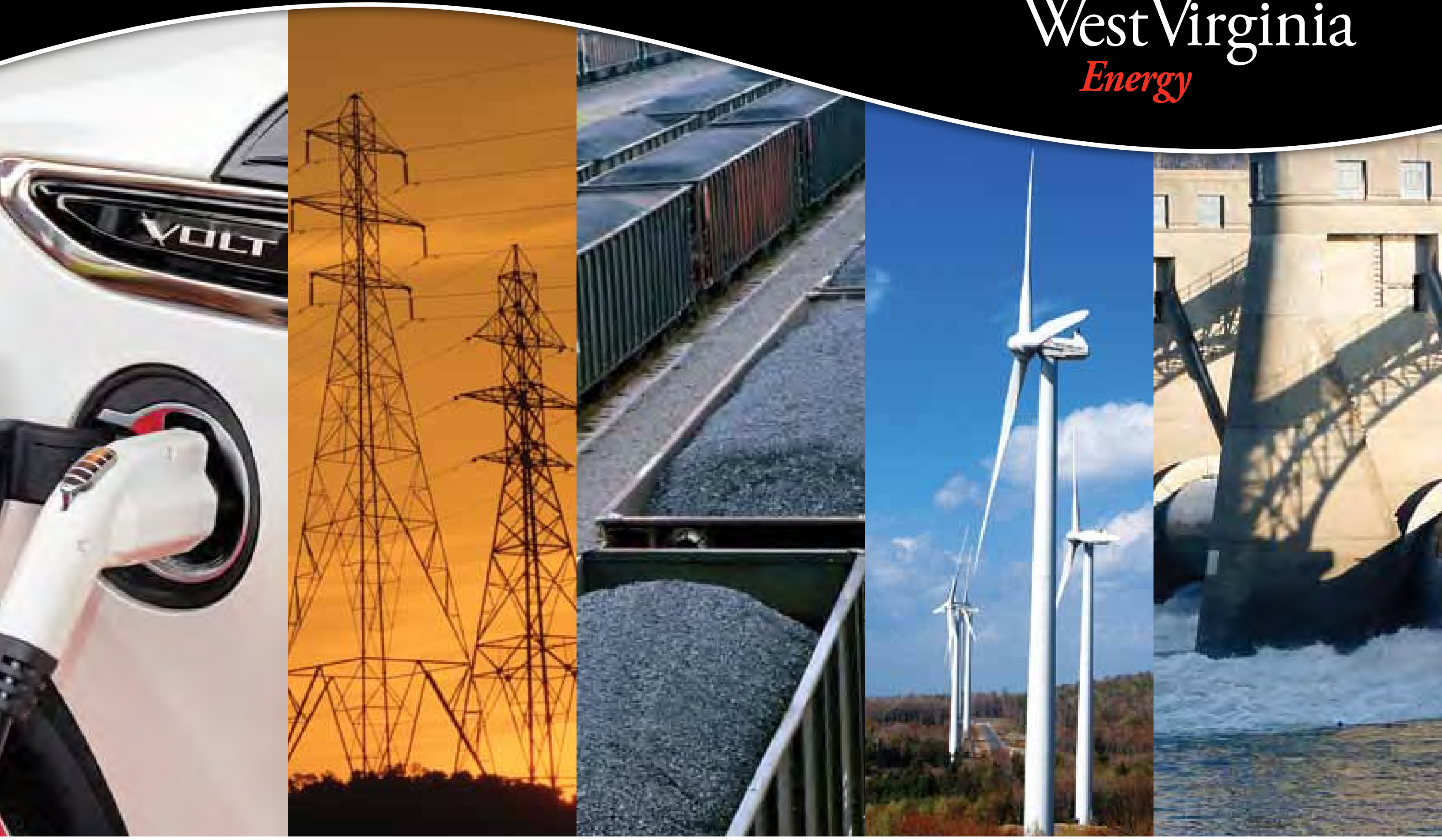
West Virginia
Energy



ENERGY PLAN 2013-2017

WEST VIRGINIA

Earl Ray Tomblin
Governor

WEST VIRGINIA DIVISION OF
ENERGY

Jeff Herholdt
Director

MEMORANDUM

To: President Jeff Kessler, Chair
Speaker Richard Thompson, Chair
Joint Committee on Government and Finance

cc: Jason Pizatella, Legislative Director
Keith Burdette, Cabinet Secretary, West Virginia Department of Commerce

From: Jeff Herholdt, Director
West Virginia Division of Energy

Date: March 4, 2013

Subject: Transmittal of 2013-2017 West Virginia State Energy Plan

As directed by state code §5B-2F-2(d), we are hereby submitting West Virginia's second five-year energy plan.

Using the expertise of Marshall University and West Virginia University, as well as input of West Virginians throughout the state, a plan has been formulated to help guide the development of West Virginia's extensive energy resources. Discussions and recommendations contained in the plan, as required by statute, address our fossil, renewable and energy efficiency opportunities. The Plan provides background information on our energy resources as prepared by Marshall and WVU as well as specific recommendations from Governor Tomblin on the development of these resources.

We look forward to continued energy resource development in West Virginia for the benefit of all of our citizens.

Letter from the Director

DEAR READER,

The Division of Energy was created in 2007. Our first mission was to prepare West Virginia's first five-year energy plan. The document that follows is West Virginia's second five-year plan, building on the continued development of West Virginia's fossil, renewable and energy efficiency resources.

Energy stands as one of the principal strengths of West Virginia's economy. Our state is taking a lead in meeting the country's energy needs through traditional resources and advanced technology. The preparation of this energy plan enables one to appreciate both the magnitude of our resources and the national dependence on West Virginia energy. Our approach is truly an all-of-the-above strategy including advanced coal technologies, natural gas production and utilization of biomass, hydro, wind and solar power.

Our resources have and will continue to compete in a free-market economy in compliance with environmental regulations. Our energy resources can be affordable, reliable and sustainable. They can power our nation in the twenty-first century and beyond. We will be a leader in fostering an innovative clean energy economy.

The inspiration for this plan has come from the leadership and vision of Governor Tomblin. Analysis and projections for the plan were contributed by Tom Witt, former director of the Bureau of Business and Economic Research at West Virginia University; Cal Kent, former vice president of Business and Economic Research at Marshall University, and Christine Risch, director of research for the Center for Business and Economic Research at Marshall University. The Division of Energy thanks them for their time and effort on this project.

We would also like to thank the citizens of West Virginia who attended three public meetings to offer comments on the plan, as well as those who submitted comments online. Those can be accessed at www.energywv.org/publiccomments.

By working together, we can develop and implement an energy plan for the benefit of all West Virginians.

Sincerely,

Jeff Herholdt
Director, West Virginia Division of Energy

PREFACE by Governor Earl Ray Tomblin

Earl Ray Tomblin

AS ONE OF THE NATION'S TOP energy producing states, West Virginia shoulders a lot of responsibility when it comes to fueling our state and nation. Together, members of our energy sector — coal, oil, natural gas, hydro and wind power, and more, share this responsibility so we can build a brighter future for West Virginia. West Virginia is blessed to have a diverse, strong, and growing energy sector as energy stands as one of the traditional strengths of the state's economy. We continue to embrace innovative ideas evolving our long-established energy resources to meet today's expectations. We're also making the most of the opportunities associated with our abundant natural gas. Coal continues to enable West Virginia to be a national leader. For our families, economy and communities, the many benefits we enjoy today are directly related to our energy sector and its evolving abilities.

West Virginia has been a leader in America's energy program for years, and today our 20,000 miners produce approximately 13 percent of this country's coal, which is more than any other state in the East or Midwest. West Virginia has been the benefactor of strong energy markets, strong pricing and world demand which has contributed to our fiscal stability. During the global recession, West Virginia has consistently maintained balanced budgets with annual surpluses, resulting in "rainy day" funds of unprecedented levels. I believe we must do everything possible to sustain our role as an energy leader in this nation, protecting our skilled workers, providing clear-cut rules and expectations while encouraging investment so we can take full advantage of our proximity to high-demand areas and outbound export points on the eastern seaboard and the Gulf coast.

Our coal transportation infrastructure is vital to our success. One out of every two tons of coal exported from America comes from West Virginia and our coal is shipped to 30 countries across the world, throughout Europe and Asia. In 2011, West Virginia led the nation in coal exports, $5.3 billion worth, which helped our state's exports as a whole reach historic highs. The world wants our coal and needs our coal. According to the International Energy Agency's Medium-Term Coal Market Report, by 2017 coal is expected to rival oil as the as the world's top energy source.

> *"This report sees that trend continuing. In fact, the world will burn around 1.2 billion more tons of coal per year by 2017 compared to today — equivalent to the current coal consumption of Russia and the United States combined. Coal's share of the global energy mix continues to grow each year, and … coal will catch oil within a decade," said IEA executive director Maria van der Hoeven.*

Our more than 500 mines are often among the largest private employers in a majority of the 30 West Virginia counties in which they operate. West Virginia's coal miners are the best in the world and are among the highest-paid industrial workers in our state. They are safe, caring, professional and true craftsmen who work every day to meet our energy needs, maintaining our standard of living in an environmentally responsible and safe manner.

West Virginia's 16 electric-generating plants utilize more than 32 million tons of coal each year to make some of the lowest-cost, most reliable electricity in the country. Because 97 percent of our electrical needs in West Virginia are met with this coal-fired generation, our citizens have some of the lowest electricity rates in America. Our productive energy sector enables our state to rank third in the country in net interstate sales of electricity and our industrial rates are among the lowest in the east. This protects our people and their lifestyles. While 44 percent of our yearly 80 million MWh (megawatt-hours) of generation is used here in West Virginia, the remaining 56 percent of that electricity is exported to other states. In fact, West Virginia stands out as being one of only two states in the Mid-Atlantic Region that is a net producer of electricity. We make more electricity than we need with our plants being in compliance with the nation's Clean Air Act. Longview Power Plant in Morgantown is the cleanest and most efficient coal burning power plant in the Eastern United States. And it was conceived, built and is operated every day by West Virginians, burning local coal to make low-cost power that is dispatched across the grid 24 hours a day, seven days a week. West Virginia's electric-generating infrastructure is leading by example and will never be duplicated in any other state, particularly in today's world.

Since records have been kept, we have mined more than 14 billion tons of coal and, according to the experts, we have some 50 billion tons of coal remaining to be mined. However the challenges are increasing and real. In order to retain its viability in domestic and world markets, West Virginia's coal industry must become more efficient and competitive. The industry has pledged its commitment to operating in the safest and most efficient manner possible with uncompromising detail to environmental quality. As a vital component to our energy sector, a continuously strong and robust coal industry will help us meet the demands of foreign as well as domestic markets, and that of our families.

Long before West Virginia began producing enough energy for our nearly two million residents and millions of fellow Americans, three families made a monumental discovery. In the 18th century, these three families found oil and gas deposits among our hills. I believe our resources and skills have evolved beyond our ancestors' dreams—and dreams of those who worked in the natural gas industry less than a decade ago. According to the West Virginia Geological and Economic Survey, in 2011 the state's oil and natural gas production was the highest on record[1] and leading indicators suggest 2012 exceeded those numbers. In conjunction with Pennsylvania, West Virginia accounts for more than 85 percent of the total natural gas produced in the northeastern United States. In just five years, natural gas production in the Northeast increased from less than two billion cubic feet per day in 2007 to more than nine billion cubic feet per day in 2012. With our abundant natural gas, West Virginia is fortunate to be able to export nearly 60 percent of the gas we produce to the rest of the nation. With the discovery of the Marcellus and Utica Shale deposits, our potential is astounding.

Billions of dollars of risk capital have been invested in the Marcellus Shale fields of West Virginia and regionally. Likewise, billions of dollars of investment in necessary ancillary activities such as natural gas processing and fractionation plants, compressor stations, pipeline infrastructure, and even professional services from engineering firms, accounting firms, law firms, and environmental specialists have followed. There is a true renaissance going on in the Marcellus Shale fields of northern and north central West Virginia. Natural gas industry-related jobs and investments helped drive our economy for the past

[1] West Virginia Geological and Economic Survey, 2013

four years and the industry's impact is expected to strengthen as development of the shale deposits progresses.

We are making sure those in search of natural gas responsibly undertake their efforts in accord with a body of law that is reasonable, clear, responsive to the need to conserve and protect our environment while allowing for the important function of production of natural gas to occur, and keep our communities safe. With broad bi-partisan support, I led the effort to pass legislation that set out clear rules to foster the development of the Marcellus Shale responsibly. As a first-of-its-kind law in the region to deal with the unique dynamics of horizontal drilling and hydraulic fracturing to stimulate well production, I am proud to say West Virginia is a leader. The Horizontal Well Act of 2011 is the framework for what we now know will be many, many years of sustained activity in the natural gas fields of West Virginia.

In certain areas of the state, and the region, natural gas fields are home to natural gas that is also rich in liquid content — commodities, such as propane, butane and ethane that may be extracted from the natural gas and utilized in a variety of capacities, further enhancing the economics of drilling in the region, but also opening up an entire new world of opportunity. Liquid elements extracted from the rich Marcellus gas, particularly ethane, can be the commodity that alone revitalizes the manufacturing sector of the regional economy and beyond. Ethane crackers produce ethylene, propylene and other raw materials that supply manufacturers of plastics and materials used in all manner of products. An ethane cracker project involving billions of dollars of investments, thousands of construction jobs and hundreds of permanent jobs, is just the beginning in terms of reinvigorating the regional economy. With raw materials abundant and close by, there is every reason to believe old manufacturing sites in West Virginia can become active; and there is every reason to believe non-resident manufacturers will relocate to the region to take advantage of the availability of raw materials they must have to produce their goods — everything from plastic bags to parts for automobiles and everything in between. This is a vision for the northern half of West Virginia that can and will be realized.

The Marcellus Shale and other shale formations throughout the country which have now been found to have supplies of natural gas not previously thought recoverable, are changing our world and illuminating the way for jobs for the current and next generation of West Virginians. Our desire to help our nation become an energy independent country is closer than ever. My Natural Gas Vehicle Task Force — formed last year — has been working to support the use of compressed natural gas (CNG) vehicles on our highways. I tasked the group with encouraging investment in the necessary infrastructure to support natural gas vehicles in West Virginia. We've spent months researching the most appropriate areas of the state for natural gas-fueling infrastructure. In January 2013, I'm pleased to say we've received our first private-sector investment, totaling $10 million, to establish compressed natural gas-fueling stations in Bridgeport, Jane Lew, and Charleston. I'm committed to using CNG vehicles as a part of our state fleet so we can save taxpayer dollars and make use of the very resources indigenous to our beautiful state. I'm pleased to say 13 other governors have joined me in pledging to convert part of their state fleets to this cost-efficient, abundant fuel source.

For the last decade, West Virginia's production of electricity using renewable resources has ranged from 1.1 to 3.4

percent of total energy generation. The majority of that generation is hydro power with the remainder wind. The state's hydroelectric generating facilities are among the oldest in the nation, yet continue to evolve. When completed in 2013, an upgraded hydropower plant will generate enough electricity to power 4,500 homes a year. Wind power has been generating in West Virginia for more than 10 years and this class of generation will expand as additional facilities are permitted and construction is completed. The state's largest solar installation company, Mountain View Solar, located in Berkeley Springs, has grown from five employees in 2009 to 20 today. Mountain View Solar serves residential, commercial and municipal clients in West Virginia and surrounding states. In 2011, West Virginia's first landfill gas-to-energy project began generating power. This new power source could help contribute to the state's alternative and renewable portfolio.

From the transformation and continuation of our traditional energy sources to new cutting-edge renewable and alternative sources, West Virginia is firmly rooted as a powerhouse for the United States of America. Our state has embarked on a trailblazing effort toward lowering our nation's dependence on foreign sources of energy. While there is much to give us hope for the future in West Virginia, there is nothing more prominent in that sphere than the potential held by the opportunities presented by the further development of our energy sector and all of the ancillary benefits it delivers to us.

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Introduction

AS PART OF ITS LEGISLATIVE CHARTER, the West Virginia Division of Energy is tasked with development of the 2013-2017 West Virginia State Energy Plan. This plan, updated every five years, contains several sections. Included are three reports, developed by West Virginia University and Marshall University, with energy market analyses that helped to guide in the development of the energy initiatives. The plan also includes a section of public comments from the public, reflecting general concerns and recommendations of individuals and organizations that are involved in energy issues in the state. These comments can be accessed at www.energywv.org/publiccomments.

Energy stands as one of the strengths of West Virginia's economy. The state is taking a lead in meeting the country's energy needs through traditional resources and advanced technology. Policies will include all forms of energy, including clean coal, coal liquefaction, natural gas, biomass, hydrogen, hydro, wind, solar power and energy efficiency. The state is committed to implementing a comprehensive energy policy and plan that is technically feasible, environmentally responsible and financially sound for the benefit of all West Virginians.

Governor's Energy Recommendations

Fossil Energy

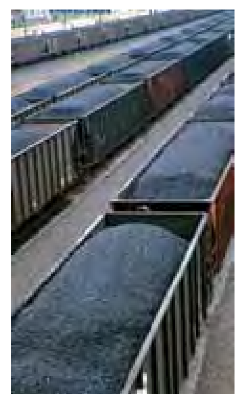
General

- Continue to monitor and publicize energy production, consumption and related data available from state, federal and private-sector vendors and report on the implications for the continued growth and development of the state's energy sector

- Advocate the economic importance of West Virginia's energy resources at the national, regional and state level both in terms of their contributions to the state economy as well as their importance in maintaining affordable and secure energy supplies

- Convene meetings with industry, academia, federal agencies and public officials on a regular basis to assess current fossil energy production and value-added opportunities

Coal



- Partner with industry to continue development of polygeneration plant(s) converting coal to liquids

- Given the increasing importance of international markets, develop an annual international coal export conference in collaboration with industry, bringing together coal producers, shippers, traders and foreign consumers with a focus on new international market developments, transportation, export facilities and networking opportunities

- Promote the continued use of surface-mined lands for local economic development or community needs

- Work with county economic development authorities in assessing opportunities for surface-mined lands

- Utilize the GIS and planning expertise of the Rahall Transportation Institute in order to provide assistance to counties in the development of Land Use Master Plans (LUMP)

- Provide briefings on the status of coal to the executive and legislative branches

- Interact with the National Energy Technology Laboratory (NETL), Coal Utilization Research Council, West Virginia University and other coal states on the research, technology needs, and environmental challenges facing coal

- Promote coal technology research funding administered through NETL, and arrange for briefings by NETL on the status of coal R & D activities

- Interact with the West Virginia Geological and Economic Survey on coal, oil and natural gas resource and infrastructure issues

- Advocate the importance of retaining coal-powered electric generation to ensure the continuation of affordable electricity to residential, commercial and industrial users

- Market West Virginia as a location where industrial energy users have access to affordable, reliable electricity supplies

- Partner with industry to assess the commercial feasibility of carbon capture and storage technology coupled with enhanced oil recovery (EOR)

- Consider incentives for the use of CO_2 for use in EOR to permit extraction of significant oil resources remaining in the state

- Determine the need for providing the right of eminent domain to CO_2 pipelines

- Continue to support development and adoption of state-of-the-art coal technologies including oxy-combustion technology to meet emission requirements

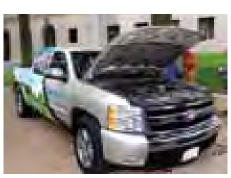
- Continue to monitor federal regulations regarding emissions as well as other federal initiatives and proposed regulations potentially impacting fossil energy resources

Natural Gas

- Monitor and encourage development of midstream natural gas gathering and processing facilities as well as pipeline infrastructure

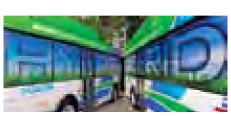
- Continue the efforts of the Marcellus to Manufacturing Task Force, West Virginia Department of Commerce, local development authorities, and industry in attracting downstream petrochemical manufacturing facilities

- Determine the potential opportunities for additional value-added energy investments within the state



Alternative Fuels

- Promote alternative fuel vehicles to units of local government and private-sector fleets



- Work to implement recommendations of the Governor's Natural Gas Task Force through state and local agencies, private sector representatives, transportation agencies and the task force itself

- Monitor the implementation of the hydrogen fueling station at West Virginia University to determine the commercial feasibility of expanding hydrogen as a transportation fuel

Renewable Energy

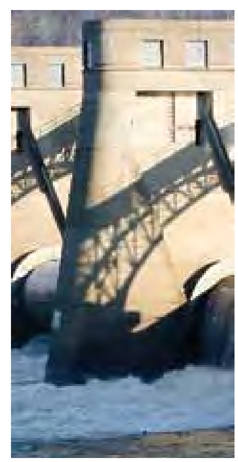
Solar

- Maintain current state income tax credit for PV installations
- Monitor national solar integration activities, policies and research
- Review the performance of photovoltaic systems installed at state and local government facilities
- Monitor and update net metering policies as necessary
- Continuation of the current 30% residential solar energy tax credit (limit $2,000)

Wind

- Maintain current state legislative policy for wind. The two existing State tax incentives for commercial wind development have allowed some cost savings for developers while also assisting in the development of wind resources in rural areas of West Virginia
- Monitor national wind integration activities, policies and research
- Given most West Virginia wind projects are located on surface-mined land, extend efforts to determine if adequate wind resources exist to support commercial wind development on additional surface mined sites

Hydro



- Continue efforts with federal agencies and private companies to ensure that the current preliminarily licensed hydro projects are completed in a timely fashion
- Regarding small-scale hydro power:
  - Determination should be made if there are public sites such as recreational areas that are not currently served by electrical connections for which development of mini- and micro-scale hydro is appropriate
  - Current rules and regulations impacting small-scale hydro should be reviewed to determine which, if any, could be eliminated or modified for application specifically to small-scale hydro
  - Similar tax incentives to those granted to direct use solar and wind facilities should be considered for mini- and micro-hydro installations

Geothermal

- Monitor technological advancements in geothermal heat recovery
- Should commercial geothermal generation opportunities become a reality, tax credits similar to those provided to the wind industry could be considered in order to promote the development of commercial geothermal projects

Biomass

- Continue data collection on wood biomass availability and site-specific evaluations of wood biomass utilization for industry specific and electrical generation
- Evaluate the feasibility of creating rural woody biomass industry centers as a form of rural community development
- Determine if the use of small-scale wood-powered systems would be beneficial or cost-effective for government-owned facilities
- Promote the use of wood pellets in residential and commercial buildings
- Review wood pellet incentive programs offered by other states

Landfill Gas

- Continued monitoring of developments in the utilization of landfill gas as a fuel is merited in light of the nine state landfills that are "candidates" as identified by the U.S. Environmental Protection Agency's Landfill Methane Outreach Program (LMOP). Continue to monitor if any of these sites can be readied for use within the five-year time frame of this plan

Poultry Litter

- Support the utilization of poultry litter as a fuel source or value-added product

Energy Efficiency

- Support the adoption of the 2009 IECC and 2007 ASHRAE standards for state-funded construction and public buildings
- Energy code adoption should be no further than one series of codes behind the most recent version
- Consider the appointment of an energy management specialist to an ex-officio role on the State Fire Commission to provide the expertise and advocacy necessary to ensure the future promulgation of updated building energy codes in the rule-making process
- Make training on energy codes and energy efficient building components available to home builders, local governments, and the built community
- Continue providing energy services to West Virginia manufacturers in order to maintain a competitive advantage in energy costs. This enables West Virginia to preserve its low energy cost environment that has been a recruitment and retention incentive for energy-intensive industries
- Provide technical assistance to manufacturing and small businesses using the resources of Projects with Industry Program, Manufacturing Extension Partnership and Industrial Assessment Center
- Establish benchmark programs for state, county school systems and local governments. Benchmarking programs, such as the ENERGY STAR® Portfolio Manager program, will allow decision-makers to effectively assess the energy efficiency and necessary actions needed to increase energy savings in their facilities
- Establish, in tandem with electric utilities, an energy savings target for utility energy efficiency initiatives. This will help reinforce the concept that energy efficiency is a quantifiable energy resource

West Virginia University®
COLLEGE OF BUSINESS AND ECONOMICS

Bureau of Business and Economic Research

Fossil Energy Opportunities For West Virginia

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Fossil Energy Opportunities

For West Virginia

By

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This draft report was prepared under a contract between the West Virginia University Bureau of Business and Economic Research and the West Virginia Division of Energy. The opinions herein are those of the authors and do not necessarily reflect those of the West Virginia University Board of Governors, West Virginia Higher Education Policy Commission or the West Virginia Division of Energy.

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List of Abbreviations

AEO2012 – Annual Energy Outlook 2012

AEP – American Electric Power Company Inc.

AFV – alternative fuel vehicle

ATV – Advanced technology vehicle

BBER – Bureau of Business and Economic Research

Bcf – billion cubic feet

Btu – British thermal unit

CBER – Center for Business and Economic Research

CCS – Carbon Capture and Storage

CFB – circulating fluidized bed

CMAQ – Congestion Migration and Air Quality Improvement program

CMB – coalbed methane

CNG – Compressed natural gas

CO_2 – carbon dioxide

DEP – WV Department of Environmental Protection

DOE – US Department of Energy

EIA – US Energy Information Administration

EOR – Enhanced Oil Recovery

EPA – US Environmental Protection Agency

EVA – Energy Ventures Analysis

EWV – Ergon West Virginia Inc.

GDP – Gross Domestic Product

GHGs – greenhouse gases

GW – gigawatt

IGCC – integrated gasification combined cycle

IHS – IHS Global Insight

kg – kilogram

kW – kilowatt

LDV – light-duty vehicle

LNG – liquefied natural gas

LPG – liquefied petroleum gas

MATS – Mercury and Air Toxics Standards

mmBtu – million British thermal units

MMcf – million cubic feet

MWh – megawatt hours

NAFTC – National Alternative Fuels Training Consortium

NAICS – North American Industry Classification System

NCDC – National clean diesel campaign

NERC – North American Electric Reliability Corporation

NETL – National Energy Technology Laboratory

NGCC – natural gas combined cycle

NGV – Natural gas Vehicle

NGVA – Natural Gas Vehicles for America

NO_x – mono-nitrogen oxide

OPEC – Organization of Petroleum Exporting Countries

SMCRA – Surface Mining Control and Reclamation Act

SO_2 – sulfur dioxide

Tcf – Trillion cubic feet

TWh – terawatt hours

VALE – voluntary airport low emission program

WVGES – West Virginia Geological and Economic Survey

1 Introduction and Overview

The US Energy Information Administration (hereafter EIA) reports that in 2010 the following production and consumption data (trillions of Btus) produced, consumed and the difference (exports) in West Virginia[5,6]:

Table 1: Energy production and consumption, West Virginia 2010

Energy Production	Trillions of Btus
Coal	3,346.1
Natural Gas	283.0
Crude Oil	8.9
Total	3,674.0
Energy Consumption	739.0
Difference	-2,935.0

Source: EIA, State Energy Data, 2010

Nearly 80 percent, or 2,935 trillion Btu, of West Virginia's energy production is exported, second only to Wyoming, which has 9,998 trillion Btu exported. Thus, West Virginia is a major energy state with this sector playing a significant role in the state and national economy. With this in mind, the state needs to ensure that the future growth and development of this sector plays a continuing role in the creation of jobs and wealth within the state, while at the same time protecting the environment for future generations. The opportunities to attract new industry, enhance efficiency of existing industries, maintain the affordability of energy and increase security for energy resources and production are additional goals for state policy makers.

The West Virginia Division of Energy has commissioned the Center for Business and Economic Research (CBER) at Marshall University and the Bureau of Business and Economic Research (BBER) at West Virginia University to assist in the development of its energy policy for submission to the Governor and the Joint Committee on Government and Finance.[7] This policy sets forth a five-year plan for the state's energy policies and provides a direction for the private sector. Responsibility for the fossil energy section was provided to BBER while CBER covers energy efficiency and renewable energy.

This report focuses on the fossil fuels and is divided into the following sections:

US and West Virginia Economic and Energy Outlook

- Coal
- Natural Gas
- Nuclear Energy
- Electric Power
- Hydrogen

5 EIA converts the physical units of the energy source (short tons, mcf, kwh, barrels) into the heat equivalent-BTUs. This data omits biofuels.
6 US Energy Information Administration, "State Energy Data System - State," (2012).
7 See West Virginia code §5B-2F-2.

- Short-term Development Goals

Each section contains statistics and analysis pertaining to that particular energy source and key observations relevant to the development of short-term policies.

2 Economic and Energy Outlook Overview

The US and state economic outlooks, coupled with the US energy outlook, will set the stage for the energy opportunities, options, and strategies identified later in the report. The project team used the IHS Global Insight (IHS) US Economic Outlook 2012-2017,[8] released in March 2012, as a starting point for understanding where the national economy is headed. The associated outlook for the West Virginia economy is based on the West Virginia University Bureau of Business and Economic Research (BBER) annual economic outlook released in November 2011. Finally, the US energy outlook is based upon the US Energy Information Administration's (EIA) *Annual Energy Outlook* (*AEO2012*) Early Release Overview, released in January 2012.

2.1 United States economic outlook 2012 - 2017

A summary of the US economic outlook from IHS in March 2012 is provided in Table 2. While the likelihood that the United States will relapse into recession is decreasing, the nation is far from fully recovered from the Great Recession, and certain risk factors remain that could push back economic recovery. In 2011Q4, the national GDP growth rate was 3.0 percent, but this is expected to slow to 1.9 percent during 2012Q1. The federal budget deficit for FY2011 was $1.3 trillion or 8.7 percent of GDP. Tighter fiscal policies in 2012 suggest that the budget deficit will decrease to $1.0 trillion. Over the course of the calendar year, real state and local government spending is expected to decrease by 1.4 percent. There are many fiscal deadlines set for the end of 2012 and beginning of 2013, including the expiration of the remaining Bush tax cuts, as well as emergency unemployment insurance benefits and a significant cut in defense spending. This forecast calls for a last-minute bargain in Congress wherein entitlement spending cuts and tax increases will be phased in over a number of years.

The Federal Reserve Open Market Committee has signaled its intent to keep interest rates low through 2014. Based on its forecast assumptions, IHS does not expect the rate to increase significantly before 2015. Yields on ten-year Treasury bonds should stay between 2.0 and 2.5 percent through the end of 2012, but are expected to increase over the long term. While the dollar is expected to strengthen against the euro, it will weaken against emerging currencies with the pace dependent upon how quickly China lets the renminbi appreciate. US export growth is expected to slow from 6.8 percent in 2011 to 4.2 percent in 2012, making the current account deficit 3.4 percent of GDP (up from 3.1 percent in 2011).

Though payroll employment is increasing, IHS does not expect the unemployment rate to decline significantly during 2012. During 2011Q4, an average of 245,000 payroll jobs were added each month, and throughout 2012 job growth is projected to average 190,000 positions per month. Because IHS expects increases in job availability to attract people back into the labor force, there will be a slow reduction in the unemployment rate from 8.3 percent in the first two months of 2012 to 8.1 percent by year's end.

Consumer spending, though positively impacted by job growth, is rising more slowly than anticipated. During 2012Q1, consumer spending rose by 1.5 percent on an annualized basis. By the end of 2012, IHS expects consumer spending growth to reach 1.9 percent on an annualized basis, which is lower than it was in 2011 (2.2 percent). Certain areas of consumer spending are expected to improve as employment

[8] Nariman Behravesh and Nigel Gault, *US Economic Outlook 2012-2017: Executive Summary*,[Mar. 2012].

increases; light-vehicle sales are expected to rise as income increases enable consumers to satisfy demands deferred during the recession. The same is expected to be true of housing starts. As young people who stayed at home during the recession want to move out, housing starts, especially in the multifamily segment, are expected to increase in 2012 accompanied by a continued decline in prices. Despite a more positive outlook, consumer spending is not expected to be a major force behind economic recovery in 2012.

Growth of business spending on equipment and software slowed to 4.8 percent in 2011Q4, but is expected by IHS to increase to 7.9 percent on an annualized basis during 2012. Businesses still have to make a lot of capital equipment repairs and replacements that they deferred during the recession, and will now have the cash necessary to undertake improvements. Thus, a three percentage point improvement in capital spending growth is expected by year's end. Spending growth in the business structures area also decreased in 2011Q4, but unlike equipment and software spending, significant building spending growth is not expected until 2013. One factor that will effect business spending in 2012 is the increase in employment. Labor costs are increasing faster than final demand and productivity, resulting in smaller profit margins for employers and a slower pace for corporate earnings growth.

Extra focus on rising oil and gasoline prices and international relations with Iran are also particularly important when looking at US economic outlook for 2012. Average oil price projections for 2012 have increased by about $12 per barrel from 2011 levels. Though recent gasoline prices have actually fallen, the national average price of gasoline was expected by IHS to exceed $4 per gallon in the second quarter of 2012. This projected price increase would have been harmful, according to IHS, decreasing 2012 GDP growth by 0.1 percent. While current oil and gasoline prices are not high enough to drive the US economy back into recession, a significant supply disruption would cause serious economic problems. As tensions over Iran's nuclear program escalate, so do the risks of oil price increases that could derail global economic recovery. IHS estimates a 20 percent probability of hostilities in the Persian Gulf, whether they are accidental or deliberate. The risk premium related to tensions with Iran has increased current oil prices by $20 to $30 per barrel from a more 'normal' level.

Table 2: IHS US economic outlook summary forecast March 2012

	2011	2012	2013	2014	2015	2016	2017
Composition of Real GDP (% change)							
Gross Domestic Product	1.7	2.1	2.3	3.4	3.2	2.7	2.5
Total Consumption	2.2	1.9	2.1	2.4	2.3	2.2	2.0
Nonresidential Fixed Investment	8.7	6.6	5.8	7.7	7.1	5.1	4.6
Equipment & Software	10.2	7.9	7.2	7.5	6.1	4.1	4.0
Structures	4.4	3.2	1.8	8.0	9.9	7.9	6.1
Exports	6.8	4.2	7.2	7.6	7.3	6.9	6.7
Federal Government	-1.9	-2.0	-3.4	-2.8	-2.0	-1.2	-0.8
State & Local Government	-2.3	-1.4	-0.7	0.3	0.7	0.8	0.8
Contribution to Real GDP Growth							
Consumption	1.53	1.35	1.48	1.70	1.59	1.57	1.42
Gross Private Domestic Investment	0.59	1.12	0.83	1.54	1.33	0.70	0.59
Nonresidential Fixed Investment	0.83	0.67	0.61	0.83	0.80	0.59	0.54
Equipment & Software	0.71	0.58	0.56	0.61	0.83	0.59	0.54
Structures	0.11	0.09	0.05	0.22	0.29	0.25	0.20
Net Exports	0.06	-0.05	0.34	0.36	0.33	0.45	0.50
Exports	0.87	0.57	1.00	1.11	1.10	1.08	1.07
Government	-0.44	-0.33	-0.34	-0.17	-0.06	0.01	0.04
Federal	-0.17	-0.17	-0.26	-0.21	-0.11	-0.08	-0.05
State & Local	-0.28	-0.17	-0.08	0.03	0.08	0.09	0.09
Other Key Measures							
Productivity (%ch)	0.8	0.3	0.9	1.7	1.4	1.5	1.7
Total Industrial Production (%ch)	4.2	4.1	2.8	3.6	3.1	2.6	2.4
Unemployment Rate (%)	9.0	8.2	8.0	7.4	6.7	6.3	6.0
Payroll Employment (%ch)	1.2	1.5	1.5	1.7	1.7	1.5	1.1
Current Account Balance (Bil. $)	-471.3	-537.3	-484.1	-469.5	-497.5	-525.1	-507.0
Financial Markets, NSA							
Federal Funds Rate (%)	0.10	0.10	0.10	0.11	1.23	3.27	4.00
10-Year Treasury Note Yield (%)	2.79	2.22	2.69	2.91	3.54	4.57	4.88
Exchange Rate, Maj. Trade Partners	0.846	0.871	0.880	0.877	0.867	0.854	0.847
Exchange Rate (%ch)	-5.9	3.1	1.0	-0.3	-1.2	-1.5	-0.9
Incomes							
Personal Income (%ch)	5.1	3.7	3.9	4.9	4.9	4.8	4.4
Real Disposable Income (%ch)	1.3	1.2	1.6	2.9	2.7	2.7	2.4
Saving Rate (%)	4.7	4.2	3.7	4.1	4.5	4.8	5.0
After-tax Profits (Bil. $)	1476	1494	1601	1689	1620	1556	1508
Billions of Chained 2005 Dollars							
Real GDP	13315.3	13593.4	13908.3	14384.5	14844.5	15249.4	15636.9
Personal Consumption Expenditures	9421.7	9600.3	9800.2	10033.7	10259.8	10490.3	10704.3
Fuel Oil & Other Fuels	14.9	14.6	14.6	14.5	14.5	14.5	14.4
Nonresidential Fixed Investment	1433.4	1527.9	1616.6	1740.6	1864.2	1959.6	2050.1
Equipment & Software	1123.8	1212.4	1300.3	1398.3	1483.9	1544.7	1607.1
Structures	322.8	333	338.9	366.2	402.4	434.1	460.4
Exports	1775.9	1849.7	1982	2133.1	2288.7	2446.7	2610
Imports	2187.9	2264.5	2347	2443.2	2544.8	2629.8	2711.3
Government Purchases	2502.4	2461	2418	2395.4	2388.1	2388.8	2394.3
Federal	1055	1033.6	998.9	970.8	951.7	939.9	932.2
State & Local	1453.5	1433.1	1423.6	1427.8	1438.3	1449.9	1462.2

Source: IHS Global Insight, US Economic Outlook 2012-2017: Executive Summary Table

2.2 West Virginia economic outlook

The economic outlook for West Virginia was released by BBER in November 2011 and covers the period 2011 to 2016 .[9] BBER's forecast was based on IHS's September 2011 forecasts and thus does not reflect any revisions since that time. Table 3 presents a summary of this forecast. Table 4 summarizes key elements of that forecast.

The West Virginia economy has recovered from the recent recession but is still below its peak employment levels. Between 2009Q4 and 2011Q2, the state gained back about one half of the jobs lost during the recession, averaging a slightly faster rate of job growth than the nation. The state unemployment rate peaked at 9.7 percent of the labor force in December 2010, and decreased to 8.5 percent by mid-2011, which was lower than the national rate though still significantly higher than pre-recession unemployment (4.2 percent in 2008).

State coal production during the first half of 2011 was up 1.3 percent from the previous year. The northern coal fields accounted for most of the growth (8.0 percent), while the southern fields decreased production. Coal production growth is attributed to increasing demand for steam and metallurgical coal from the nation and across the globe. Increased global demand has raised prices for Northern and Central Appalachian coals, which are $10 to $20 above what they were in 2010. Natural gas production in West Virginia has also increased (40.9 percent between 2003 and 2009), primarily due to the development of Marcellus shale.

The state population increased by 46,952 residents between 2000 and 2010, an average of 0.3 percent per year, which was significantly lower than the national average (0.9 percent). Per capita personal income reached $31,999 in 2010, before adjusting for inflation, which represented a 3.0 percent growth rate since 2009. This was higher than the national rate and the inflation rate – the West Virginia standard of living improved in 2010.

Real state GDP growth sped up in 2010, surpassing the national growth rate and the growths rates of all except four other states. Over the past three years, West Virginia real GDP has been growing faster than the nation's real GDP due to gains in sectors including mining; real estate, rental, and leasing; manufacturing; and retail trade, as well as other sectors.

Job growth is expected to be positive in the state between 2011 and 2016, though at a slower rate than national job growth. Natural resources and mining job growth is expected to slow over this time due to declining coal production and increasing regulations on air and water quality. This should be somewhat offset by gains in oil and gas mining employment as Marcellus shale development plays a bigger part in the West Virginia economy. Job growth in the construction and manufacturing sectors is expected to be positive, but the major growth will take place in the service-providing sectors: health care; professional and business services; and trade, transportation, and utilities. Employment in the government sector is expected to decline as state, local, and federal budgets tighten.

The overall positive job growth in the state will contribute to a gradual decline in the West Virginia unemployment rate between 2011 and 2016. The state unemployment rate should fall to 6.4 percent in 2016. Job growth will also result in income growth for the state. The real per capita income growth rate is

[9] George W. Hammond, *West Virginia Economic Outlook 2012* (Morgantown WV: Bureau of Business and Economic Research, West Virginia University, 2011).

expected to be 1.8 percent, which is higher than the expected national rate. Because the job growth rate is above the national average, West Virginia can also expect an influx of residents and job seekers.

The positive growth expected between 2011 and 2016 is fragile. West Virginia's growth depends on the growth of its trading partners—a downturn in the national or global economies could easily push West Virginia back into recession. There are also internal risks related to the demand for and regulation of the production of coal and natural gas. Environmental regulations pose limitations to the exploration and development of Marcellus shale plays in the state, and overall production depends on national and international demand. While the health care sector is expected to be a significant source of job growth over the forecast period, actual employment increases depend on the continued funding of the Medicaid and Medicare programs, an issue that is still under consideration. The leisure and hospitality sector has been contributing significantly to job growth in the state, primarily due to increases in the gaming industry, but even this industry faces stiff competition from neighboring states.

2.3 US energy outlook

In January 2012, the EIA released its annual US energy outlook summary (*AEO2012*), which primarily covers 2010 through 2035.[10] The complete outlook report was released in June 2012 .[11] The EIA's reference case assumes that the laws and regulations in place at the time of publication will remain in effect over the projection period, unless they have specific sunset dates. There are a few exceptions to this rule throughout the report and they are openly noted. Also, the economic assumptions made in *AEO2012* do not account for short-term fluctuations.

When projecting energy prices, consumption, production, generation, etc., one must consider the state of the nation's economy. National recovery from the Great Recession is expected to happen more slowly than any other recessional recovery since 1960. The resulting slower rates of employment and income recovery will have an effect on the US energy outlook for the next 25 years. Table 4 presents a summary of the key forecast values in 2025 and 2035.

2.4 Energy production and price forecasts

2.4.1 Crude oil

Prices averaged between $85 and $110 per barrel in 2011, and the *AEO2012* puts the 2016 price at $120 per barrel. By 2035, the price is projected to rise to $145 (2010 dollars) or $230 nominal dollars. This price increase is the result of expected pipeline capacity increases, world economic recovery, and global demand growth outpacing the supply available from non-Organization of the Petroleum Exporting Countries (OPEC)-producers. The *AEO2012* also assumes that these non-OPEC producers have significant potential to produce a lot of liquid fuels in the long-term, due to high oil prices and more infrastructure and investment in exploration and drilling. Upon delivery to the transportation industry, motor gasoline and diesel had real prices of $2.76 and $3.00 per gallon respectively in 2010. The *AEO2012* has marked these figures up to $4.09 and $4.49 (2010 dollars) per gallon for 2035. Diesel prices are expected to stay above gasoline prices on average, due to higher demand for the former fuel.

[10] US Energy Information Administration, "Annual Energy Outlook 2012 Early Release," (2012).
[11] US Energy Information Administration, *Annual Energy Outlook 2012*,[2012b].

2.4.2 Natural gas

Production is expected to increase, but prices will stay below $5 Mcf (2010 dollars) until 2024, as the industry develops wells in shale basins across the nation. Drilling levels should remain high partly due to high oil prices, because drilling into many, but not all, shale formations yields both natural gas and crude oil. Prices for natural gas are expected to increase beginning in 2024, reaching $6.52 Mcf (2010 dollars) in 2035, as domestic demand increases and external US supplies dwindle.

2.4.3 Coal

Prices at the mine mouth are expected to increase by 1.4 percent per year resulting in an increase of $1.76 per million Btu in 2010 to $2.51 per million Btu in 2035 (2010 dollars). This price increase reflects a higher cost of production, as coal companies mine reserves that are more costly to reach.

2.4.4 Biofuel

Consumption is expected to become increasingly important over the projection period, even though challenges remain in the marketplace for certain types of biofuel. Ethanol must be below a certain saturation level to be used in the gasoline pool. Until consumer demand and infrastructure adjust to energy price changes, it will take more time for the volumes of ethanol above the saturation level to reach the market. The EIA suggests that by 2035 biofuels will replace 600,000 barrels/day of other liquid fuels, like gasoline and diesel.

2.4.5 Electricity

Real average delivered electricity prices are expected to decline from 9.8 cents per kilowatt hour in 2010 to 9.2 cents in 2019. The decline results from natural gas prices remaining relatively low, resulting in fuel switching from coal to natural gas at electric generation plants. These plants often have the lowest cost and thus set the wholesale price of electricity. By 2035, the EIA expects electricity prices to rise to 9.5 cents per kilowatt hour based on rising natural gas prices as demand increases in the power sector for natural gas-fired generation.

2.5 End-user consumption

2.5.1 Transportation

This sector is expected to consume an increasing amount of energy over the projection period, from 27.6 quadrillion Btu in 2010 to 28.8 quadrillion Btu in 2035. This consumption can be broken down into light-duty vehicle (LDV) consumption and heavy truck consumption. LDV energy consumption is expected to decline over the first 15 years of the projection, primarily due to improvements in gas mileage for highway vehicles, but also to fewer miles traveled due to lower economic growth and employment rates. LDV energy consumption should increase after 2025, though it is not expected to exceed the 2010 consumption level. Where heavy trucks are concerned, the EIA projects an overall increase in energy demand.

2.5.2 Industrial

In 2010, this sector accounted for about one-third of all the energy consumed in the United States. The *AEO2012* projects an increase of 16 percent from 2010 (23.4 quadrillion Btu) to 2035 (27.0 quadrillion Btu). In 2010, the bulk chemicals industry held the largest percentage of energy consumption in the industrial sector, but the EIA expects the refining industry to hold this title by 2026.

2.5.3 Residential

Delivered energy consumption in the residential sector is expected to increase from 11.7 quadrillion Btu in 2010 to 12.0 quadrillion Btu in 2035. The EIA suggests that some natural gas and petroleum consumption in this sector will be transferred to electricity consumption, with consumption of the latter outpacing natural gas consumption before 2035.

2.5.4 Commercial

The EIA expects the commercial sector's energy consumption to grow at a fairly slow rate, about one percent per year, which is on par with the growth rate of commercial floor area. Commercial energy consumption was 8.7 quadrillion Btu in 2010, while the forecast puts it at 10.3 quadrillion Btu in 2035.

2.6 Fuel consumption

2.6.1 Total energy consumption

The EIA reports that in 2010 total primary energy consumption was 98.2 quadrillion Btu and is expected to reach 108.0 quadrillion Btu by 2035. Fossil fuels will make up a smaller percentage of total energy demand in the US by the end of the same period, shrinking from 83 percent in 2010 to 77 percent in 2035.

2.6.2 Total liquid fuels consumption

This is expected to increase from 19.2 million barrels per day in 2010 to 20.1 million barrels per day in 2035. The transportation sector represents the greatest share of demand for liquid fuels over the projection period, though its share only increases by one percent during the twenty-five year timeframe.

2.6.3 Natural gas consumption

This is expected to increase from 24.1 trillion cubic feet in 2010 to 26.5 trillion in 2035, according to the *AEO2012*. A large part of this growth is due to increased demand for natural gas to be used for electricity production.

2.6.4 Coal consumption (including coal-to-liquids)

The EIA forecasts an increase from 1,051 million short tons in 2010 to 1,155 million short tons in 2035. Most of the coal consumption will be directed toward electricity generation and will slow down through 2015, when some of the coal-capacity begins to be retired. After 2015, however, coal-fired electricity generation increases as production depends more on the smaller number of plants.

2.6.5 Renewable fuels

The EIA forecasts total marketed renewable fuels consumption growing at a rate of 2.8 percent per year between 2010 and 2035. This growth is thought to be the result of federal and state programs that encourage and regulate the use of renewable fuels such as wood, biomass, municipal waste, hydroelectricity, geothermal, ethanol, solar, and wind. Renewable energy sources, apart from hydroelectricity, are expected to make up an increasing share of electric power generation, from 1.4 quadrillion Btu in 2010 to 3.4 quadrillion in 2035. The majority of this growth will come from wind and biomass energy.

2.7 Per capita energy consumption

According to the EIA, per capita energy consumption will decrease over the projection period due to increased electricity efficiency, as well as the slow economic recovery from the Great Recession. Even though the nation's population is expected to increase by one-fourth over the twenty-five year period, energy use only grows by ten percent, resulting in a decline in per capita usage at an annual rate of 0.5 percent on average between 2010 and 2035. Energy usage per dollar of GDP will also decrease, as will CO_2 emissions per dollar of GDP.

2.8 Energy imports

Over the projection period, the nation's net energy imports decline in both percentage of imports and absolute volume. Increased domestic production, rising prices, increased efficiency standards, and decreased demand are responsible for this change. While net import share of total energy consumption in the US was 22 percent in 2010, by 2035 it drops off to 13 percent.

Other key results in the EIA's *AEO2012* include:

- Domestic crude oil production was 5.5 million barrels per day in 2010 and is expected to increase to 6.7 million in 2020. A slight decline takes oil production down to 6.1 million barrels per day by 2035.
- United States dependence on liquid fuels from outside sources continues to decline due to increased domestic oil and biofuel production, as well as falling demand for transportation fuels. Liquid fuel, as a share of national imports, continues to decline from 50 percent in 2010 to 37 percent in 2035.
- Recoverable resources of the nation's shale gas are estimated to be 482 trillion cubic feet. About 84 trillion cubic feet of this is from the Marcellus shale plays and another 16 trillion is from Utica plays in the Northeast. In 2016, the nation emerges as a net exporter of liquefied natural gas (LNG), initially exporting 1.1 billion cubic feet per day that year. By 2021, the United States should become a net exporter of all natural gas products, adding on the distinction of being a pipeline exporter in 2025. Imports from Canada will decrease by 62 percent, and exports to Mexico will increase by 440 percent.
- Coal is still the primary fuel used for electricity generation in the United States. Between 2010 and 2035, domestic coal production grows by an average rate of 0.3 percent per year, starting at 1,084 million short tons and reaching 1,188 million in the last year of the projection. Western mines account for most of this production increase and represent a growing share of coal production in the United States. In 2010, western mines held 47 percent of domestic coal production, but that figure is expected to increase to 56 percent by 2035. Coal production in Appalachia represents a decreasing share of domestic production over the forecasting period, and the middle of the nation holds a steady share, though production in that region increases overall between 2010 and 2035. The EIA estimates that 93 percent of total national coal consumption is by electricity generation; by 2035, the electricity sector should consume about 19.6 quadrillion Btu of coal.
- Total electricity consumption is expected to increase from 3,879 billion kilowatt hours in 2010 to 4,775 billion in 2035, with an average annual increase of 0.8 percent. While coal remains the primary source for electricity generation, its share of total production declines as natural gas and nuclear power become more prominent. Renewable energy represents a large part of overall growth in electricity generation over the projection period.
- The nation's CO_2 emissions related to energy consumption increased by about four percent in 2010. Between 2005 and 2035, the EIA estimates that CO_2 emissions per capita drop by one

percent per year on average. This is because of new regulations and increased fuel prices that will shift production away from coal-fired practices toward lower carbon fuels.

- Between 2010 and 2035, the electricity-related CO_2 emissions will increase by 4.9 percent, and transportation-related emissions are expected to slow compared to their pre-recession levels. Overall CO_2 emissions are 3 percent higher than 2010 levels by the end of the projection period, and the carbon intensity of national energy consumption is expected to have fallen. The EIA anticipates energy-related CO_2 emissions per dollar of GDP to drop by 45 percent over the 25 year span.

2.9 Key observations

- Since the release of the national state and energy outlooks cited above by IHS Global Insights, EIA and BBER, international and national economic forecasts continue to point towards much slower economic growth than was experienced in the 1990s and early part of this century. Continued deterioration in the European economy and slowdowns in Asian economies may jeopardize economic growth in the US. The looming ‘fiscal cliff’ facing Congress after the elections has resulted in a reduction in current domestic investment and consumption and could result in the US economy tipping back into recession.
- Since increases in energy demand are driven by economic growth, the energy forecasts could be too optimistic if the economy continues to languish. This could affect the levels of production of various fossil fuels nationally as well as the energy demands by the various consumption sectors.

Table 3: WV employment, labor force, and unemployment rate forecasts

Indicator	**Actual**	**Forecast**					
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Total Jobs	692.0	698.4	702.3	706.7	714.5	724.4	734.9
Goods Producing	112.8	116.6	116.7	117.1	120.2	124.5	127.3
Natural Resources & Mining	31.1	34.4	35.1	34.9	34.9	35.0	35.3
Mining	29.3	32.8	33.5	33.4	33.4	33.5	33.9
Coal Mining	20.5	22.7	22.4	21.7	21.3	21.1	21.1
Other Mining	8.8	10.1	11.1	11.7	12.1	12.4	12.8
Natural Resources	1.8	1.6	1.6	1.5	1.5	1.5	1.4
Construction	32.7	32.7	31.9	32.1	34.7	37.9	39.9
Manufacturing	49.1	49.4	49.7	50.0	50.7	51.6	52.1
Durable Manufacturing	29.6	30	30.6	31.3	32.3	33.3	34.0
Wood Products	6.5	6.5	6.6	7.1	7.9	8.6	9.0
Nonmetallic Minerals	3.1	2.8	2.7	2.6	2.7	2.7	2.8
Primary Metals	4.7	4.8	5.0	4.9	4.8	4.8	4.7
Fabricated Metals	5.8	6.0	6.0	6.0	6.1	6.2	6.3
Transportation Equipment	4.4	4.5	4.7	5.0	5.3	5.5	5.5
Other Durables	5.2	5.4	5.5	5.6	5.5	5.6	5.6
Non-Durable Manufacturing	19.5	19.4	19.0	18.7	18.4	18.2	18.1
Food Products	3.4	3.4	3.3	3.2	3.2	3.2	3.1
Chemicals	9.4	9.3	9.2	9.2	9.1	9.2	9.3
Plastics & Rubber	3.3	3.4	3.4	3.4	3.3	3.3	3.3
Other Non-Durables	3.4	3.3	3.1	2.9	2.7	2.6	2.4
Service Producing	579.2	581.8	585.6	589.7	594.2	600.0	607.6
Trade, Transportation, & Utilities	131.4	132.7	134.4	135.9	136.2	137.2	138.1
Wholesale Trade	23.0	23	23.4	23.6	23.9	24.2	24.5
Retail Trade	86.6	87.7	89.0	90.3	90.3	90.7	91.0
Utilities	5.6	5.5	5.6	5.6	5.6	5.7	5.9
Transportation & Warehousing	16.2	16.5	16.4	16.4	16.4	16.5	16.7
Information	10.3	10.7	10.8	10.8	10.9	11.1	11.2
Financial Activities	26.4	26	25.6	25.6	25.7	26.0	26.2
Professional & Business Services	60.4	61.8	61.3	61.9	64.4	67.1	69.6
Educational & Health Services	115.2	117.1	120.0	121.6	123.6	125.5	129.3
Educational Services	5.5	5.6	5.5	5.4	5.2	5.1	5.0
Health Care & Social Assistance	109.7	111.4	114.5	116.2	118.4	120.3	124.3
Leisure & Hospitality	72.1	71.4	72.2	72.6	72.5	72.6	72.8
Other Services	20.7	20.6	20.4	20.3	20.3	20.2	20.2
Government	142.6	141.4	141.0	141.1	140.7	140.3	140.3
Federal Civilian	24.4	23.5	23.5	23.6	23.4	23.2	23.2
State & Local	118.3	117.9	117.6	117.5	117.3	117.2	117.1
Labor Force	782.2	781.2	781.5	782.7	783.3	783.8	785.3
Employed	711.1	712.1	713.5	717.3	722.5	728.5	734.8
Unemployment Rate (%)	9.1	8.8	8.7	8.4	7.8	7.1	6.4

Data are measured in Thousands.

*These columns contain the average yearly change during the 2010-2016 period

**Beginning with the West Virginia Economic Outlook 2008, employment is measured by covered employment (ES-202).

Table 4: Annual energy outlook 2012 summary data

Energy and economic factors	2010	2025	2035
Primary energy production (quadrillion Btu)			
Petroleum	14.37	17.48	16.81
Dry natural gas	22.10	26.63	28.51
Coal	22.08	22.51	23.51
Nuclear Power	8.44	9.60	9.35
Hydropower	2.51	2.97	3.06
Biomass	4.05	6.73	9.68
Other renewable energy	1.34	2.13	2.80
Other	0.64	0.76	0.88
Total	**75.52**	**88.79**	**94.59**
Net imports (quadrillion Btu)			
Liquid fuels[a]	20.35	16.33	16.22
Natural gas	2.66	-0.81	-1.39
Coal/other (- indicates export)	-1.58	-1.44	-1.29
Total	**21.43**	**14.08**	**13.54**
Consumption (quadrillion Btu)			
Liquid fuels[a]	37.25	37.04	38.00
Natural gas	24.71	25.80	27.11
Coal	20.76	20.60	21.57
Nuclear power	8.44	9.60	9.35
Hydropower	2.51	2.97	3.06
Biomass	2.88	4.52	5.85
Other renewable energy	1.34	2.13	2.80
Net electricity imports	0.29	0.28	0.24
Total	**98.16**	**107.95**	**107.97**
Liquid fuels (million barrels per day)			
Domestic crude oil production	5.47	6.42	6.12
Other domestic production	6.42	5.71	6.66
Net imports	9.53	7.39	7.36
Consumption	19.17	19.46	20.08
Natural gas (trillion cubic feet)			
Dry gas production + supplemental	21.65	26.07	27.90
Net imports	2.58	-0.84	-1.43
Consumption	24.13	25.20	26.48
Coal (million short tons)			
Production	1,098	1,202	1,204
Net imports	-64	-19	-49
Consumption	1,051	1,182	1,155
Prices (2010 dollars)			
Imported low-sulfur, light crude oil ($/barrel)	79.39	132.50	144.56
Imported crude oil ($/barrel)	75.87	121.23	132.69
Domestic natural gas at wellhead ($/thou. ft^3)	4.16	5.23	6.52
Domestic coal at minemouth ($/short ton)	35.61	43.87	49.24
Average electricity price (cents/kilowatt hour)	9.8	9.3	9.5
Economic indicators			
Real GDP (billion 2005 dollars)	13,088	19,176	24,639
GDP chain-type price index (2005 = 1.000)	1.110	1.459	1.762
Real disposable personal income (bil. 2005 dollars)	10,062	14,474	18,252
Value of manufacturing shipments (bil. 2005 dollars)	4,260	5,735	6,270
Primary energy intensity (thou. Btu/2005 dollar of GDP)	7.50	5.37	4.38
Carbon dioxide emissions (million metric tons)	5,634	5,618	5,806

[a]Includes petroleum-derived and non-petroleum derived fuels and petroleum coke, which is
Source: US EIA *AEO2012* National Energy Modeling System.

3 Coal

3.1 Introduction

Coal has been an integral part of the West Virginia economy since its discovery in Boone County in 1742. Coal extraction and use has created employment, income, gross state product and wealth for countless generations of West Virginians. This has not been without controversy, as mining, distribution, and consumption of coal have resulted in environmental externalities, many of which have been addressed through both private efforts as well as public policy. Coal today is much cleaner than it was in the early part of the twentieth century and will continue to play a vital role in West Virginia's energy future.

This report addresses the current status of the coal industry and the opportunities for future use. The subsequent discussion will address coal markets, electric power generation using coal, coal bed methane, waste coal, and transportation. Opportunities for additional value added uses for coal are identified along with strategies and public policy options for this fossil fuel.

The coal mining industry encompasses all establishments whose primary activity involves one or more of the following: mining bituminous coal, anthracite, and lignite by underground mining, auger mining, strip mining, culm bank mining and other surface mining; developing coal mine sites; and preparing coal.[12]

3.2 Overview

The EIA Annual Coal Report provides an overview of annual data on coal production, prices, recoverable reserves, employment, productivity, productive capacity, consumption and stocks.[13] In 2010:

- US coal production totaled 1,084.4 million short tons, about 0.9 percent increase from the 2009 total of 1,074.9 million short tons. Table 5 provides the coal production by state in 2010, the latest available data. Wyoming led all states, with the bulk coming from the Powder River Basin. West Virginia ranked second with 135, 220 thousand short tons, which was significantly above Kentucky production of 104,960 thousand short tons. It should be noted that the Black Thunder Mine and North Antelope Rochelle Mine is Wyoming produce almost as much coal (in tons) as is produced in the entire state of West Virginia.
- Table 6 provides the employment and wages in mining (except for oil and natural gas) by state in 2010. West Virginia led all states with 22,032 employees making over $1.6 billion in wages.
- Coal consumption totaled 1,048.5 million short tons, up 5.1 percent from the 2009 consumption level of 997.5 million short tons. This increase can be attributed to higher consumption in the electric power, manufacturing, and coke sectors in 2010.
- Coal stocks fell to 231.7 million short tons at the end of 2010, compared to 244.8 million short tons at the end of 2009.
- Coal mine employment was 86,195 in 2010, a 1.8-percent-drop from the 2009 level of 87,755 mine employees.
- Coal mine productivity declined by 1.1 percent to 5.55 tons per miner per hour, slightly below the 2009 level of 5.61 tons per miner per hour.

[12] NAICS Association, "The History of NAICS," (2012).
[13] The Energy Information Administration, US Department of Energy, provides significant statistical information and analysis of all energy sources including coal. Each fall EIA releases *Annual Coal* Report with subsequent updates, and has a series of weekly and monthly updates throughout the year. These highlights are extracted from the July 3, 2012 revised version of the *Annual Coal Report*. http://www.eia.gov/coal/annual/.

Table 5: US coal production 2010

State	Thousand Short Tons
Alabama	19,915
Alaska	2,151
Arizona	7,752
Arkansas	32
Colorado	25,163
Illinois	33,241
Indiana	34,950
Kansas	133
Kentucky	104,960
Louisiana	3,945
Maryland	2,585
Mississippi	4,004
Missouri	458
Montana	44,732
New Mexico	20,991
North Dakota	28,949
Ohio	26,707
Oklahoma	1,010
Pennsylvania	58,593
Tennessee	1,780
Texas	40,982
Utah	19,351
Virginia	22,385
West Virginia	135,220
Wyoming	442,522
US Total	1,084,368

Source: US Energy Information Administration

Table 6: Selected US mining (except oil and gas) employment and wages, 2010

State	Employment	Total Wages
Kentucky	19,085	$1,258,391
Maryland	1,386	$53,290
Ohio	6,458	$332,652
Pennsylvania	17,219	$820,812
Virginia	7,606	$454,475
West Virginia	22,032	$1,669,187

Source: US Bureau of Economic Analysis,
Tables SA07N and SA25N

3.3 Coal industry trends

To put this industry's performance in perspective, Figure 1 shows the US and West Virginia coal production from 1995 through 2011. West Virginia coal production was highest in 1997 and has declined since, with the most recent significant decline coinciding with the advent of the 2008 recession. US production climbed during the entire period, largely due to expanded production from the Powder River Basin; however, this production fell off in the 2008 recession and started returning to higher levels in 2011.

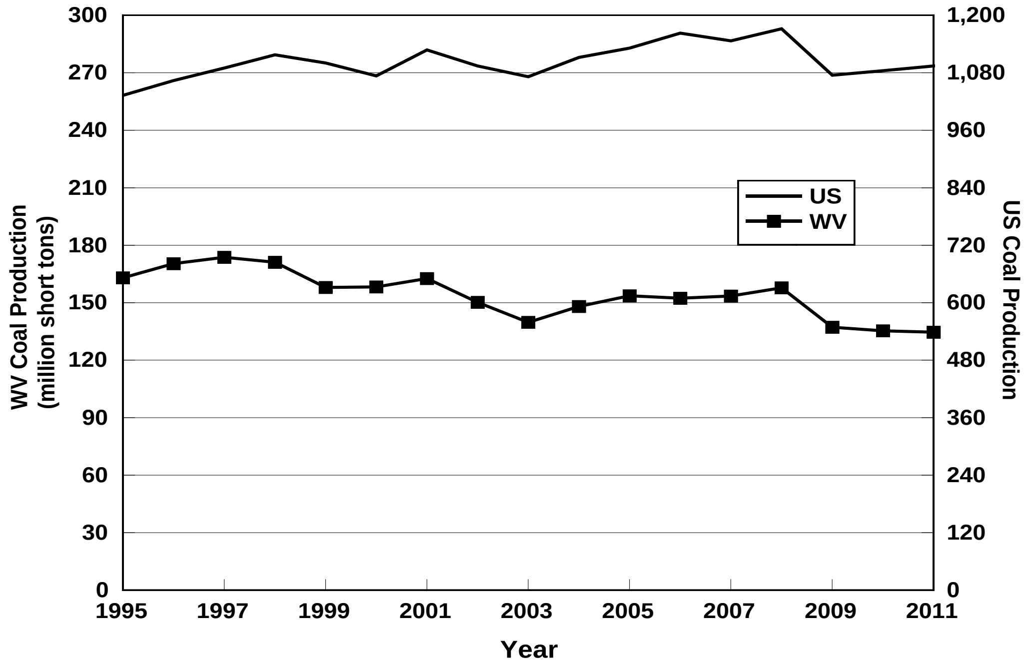
Some other notable trends in the West Virginia coal industry are noted in Figure 2- Figure **8**. Figure 3 shows the annual productivity (short tons per miner per hour) of West Virginia and US mines. From 1990 to around 200 there were advances in productivity, particularly in other states due to the expansion of mining in the Powder River Basin. From 2001 to the first quarter of 2011 there has been a decline in the amount of coal produced per miner that is more pronounced in West Virginia than elsewhere. In part this is a reflection of shifts in the coal resources being mined to seams with more challenging geological conditions. Productivity in West Virginia mines today is less than in 1990 even though there are more advanced mining technologies, such as long wall machines, in operation.

Figure 4 shows the month coal production by region within West Virginia from 1996 to the first quarter of 2012.[14] Production in Northern West Virginia has averaged less than 50 million tons per year over this period. On the other hand, Southern West Virginia has been declining from the late nineties to the present, a reduction of up to nearly 50 million tons per year. A significant part of the Southern West Virginia production decline is due to issues with permits for new and existing mines as well as greater geological problems with resource extraction.

Figure 5 traces the average mine price of West Virginia coal in both nominal and real terms since 1980. While nominal prices were reasonable stable from 1980 to 2003, there has been a significant increase to the present time. Once one adjusts for inflation, the real price decline from 1982 to a trough in 2003 and has rapidly escalated since that time. One of the major contributing factors in the recent real price increase is the significantly higher prices for high quality metallurgical coal relative to steam coal, the latter of which is often produced under long-term contracts with electric utilities. The EIA also predicts real coal prices will continue to rise through 2035 (see Figure 2).

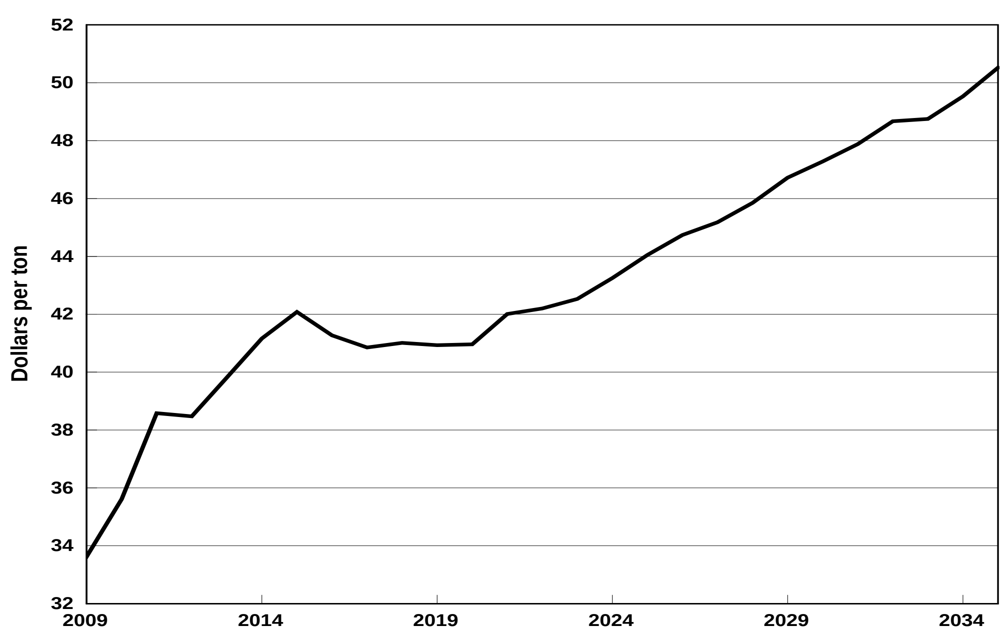
[14] Coal production data for West Virginia is divided into two regions: Northern and Southern. The Northern district is defined as mines in the following counties: Barbour, Brooke, Braxton, Calhoun, Doddridge, Gilmer, Grant, Hancock, Harrison, Jackson, Lewis, Marion, Mineral, Monongalia, Ohio, Pleasants, Preston, Randolph, Ritchie, Roane, Taylor, Tyler, Upshur, Webster, Wetzel, Wirt, and Wood. The Southern district is defined as mines in the following counties: Boone, Cabell, Clay, Fayette, Greenbrier, Kanawha, Lincoln, Logan, Mason, McDowell, Mercer, Mingo, Nicholas, Pocahontas, Putnam, Raleigh, Summers, Wayne, and Wyoming.

Figure 1: Annual coal production WV and US, 1995-2011



Source: US Energy Information Administration

Figure 2: Minemouth coal forecast prices (2010 dollars per ton)



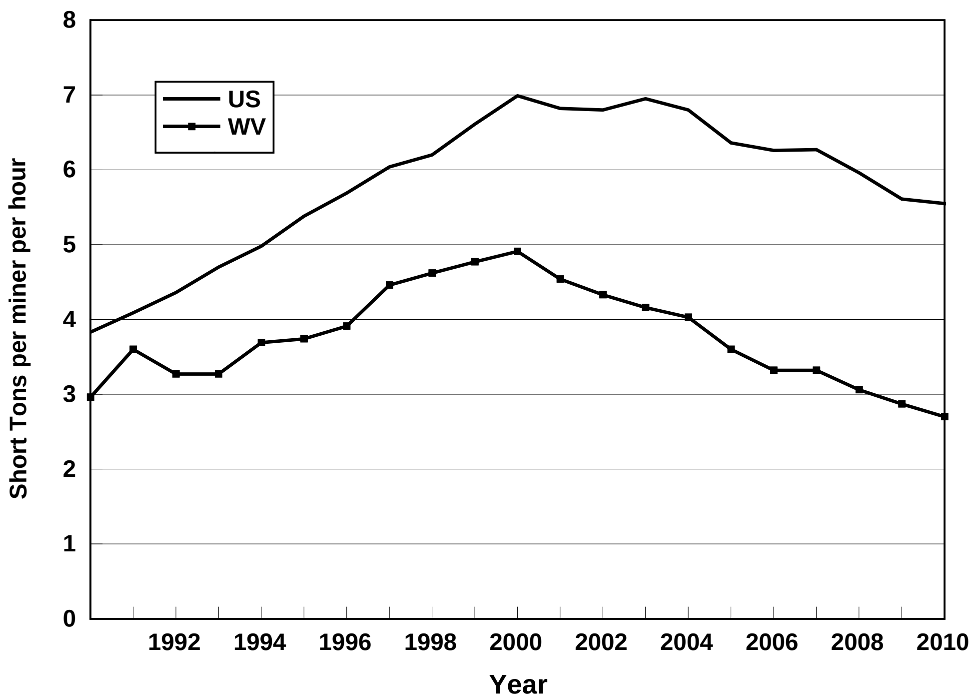
Source: US Energy Information Administration

While West Virginia and US coal mining employment declined from 1990 to about 2004, West Virginia employment has been increasing until recently (Figure 6). Since the beginning of 2012, many coal companies have been curtailing operations either temporarily or permanently. The recent bankruptcy filing by Patriot Coal was just one of many structural changes in the industry in response to reduced demand by utilities for coal relative to natural gas. Adding to the coal market stresses, Patriot also had significant pension and health care costs that strained its financial resources.

Mining continues to be a major contributor to the West Virginia economy as measured by its gross domestic contribution. From 2000 to 2011 mining (except oil and gas) increased its share of GDP from around six to over eight percent. During the same period the relative shares of manufacturing, construction and retail trade fell considerably.

In 2010 *The West Virginia Coal Economy 2008* publication provided an overview of the economic impact of the industry including estimates of the total economic impact of the industry in 2008.[15] This publication provided a detailed overview of the coal industry with a focus on the industry's production, employment, compensation and wages, gross domestic product, taxes and exports. While the data in this report provided reflected calendar year 2008, recent developments and future prospects necessitate reviewing the current status of the industry.

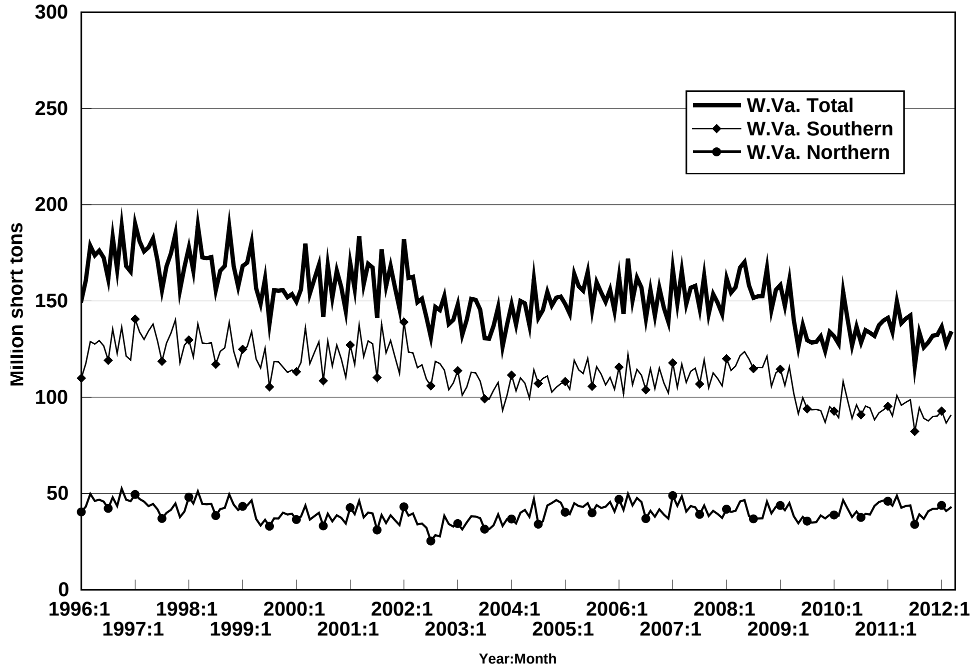
Figure 3: Annual productivity WV and US, 1992-2010



Source: US Energy Information Administration

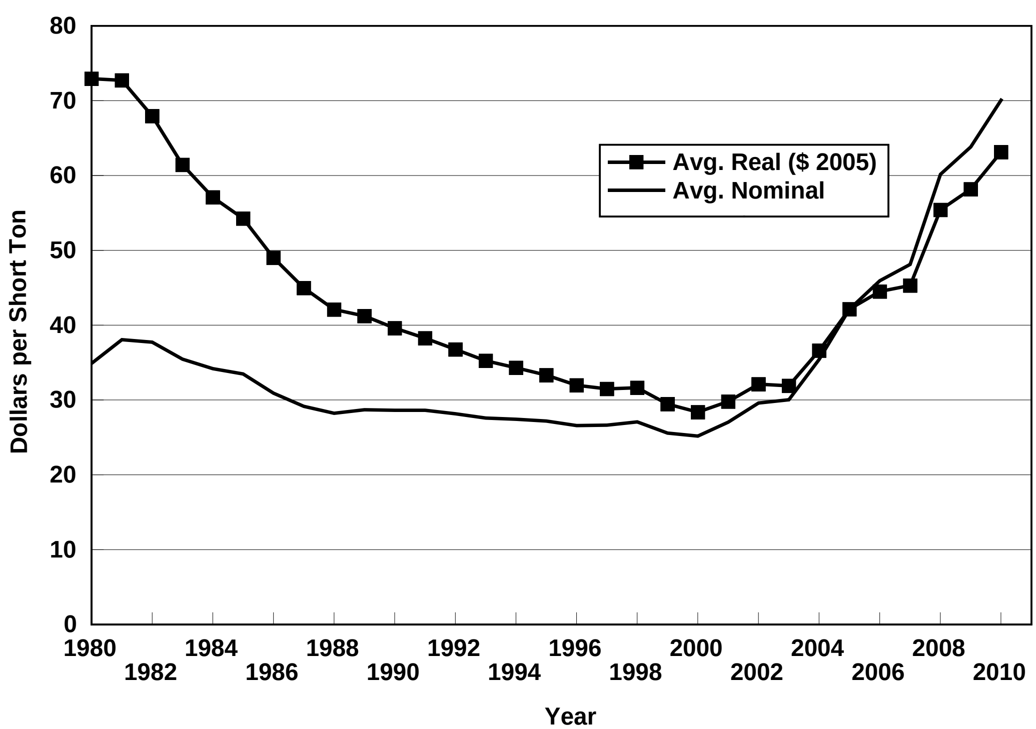
[15] Marshall University Center for Business and Economic Research and West Virginia University Bureau of Business and Economic Research, *The West Virginia Coal Economy 2008*,[2010].

Figure 4: WV monthly coal production by region (non-seasonally adjusted, annualized in million tons), 1996-2011



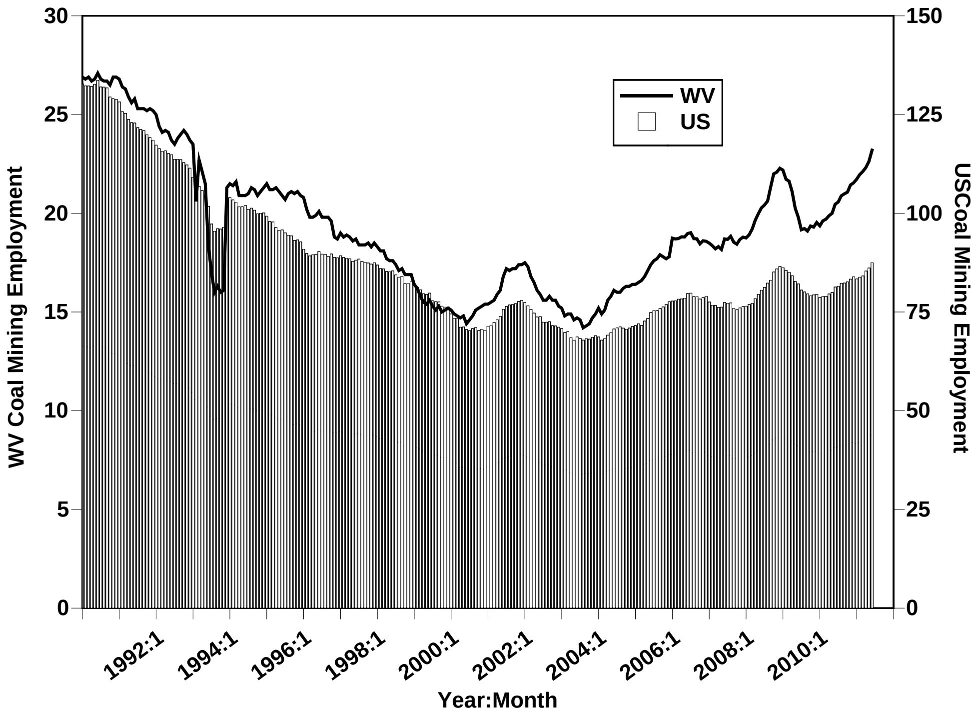
Source: U.S. Energy Information Administration

Figure 5: Average mine price of WV coal, 1980-2010



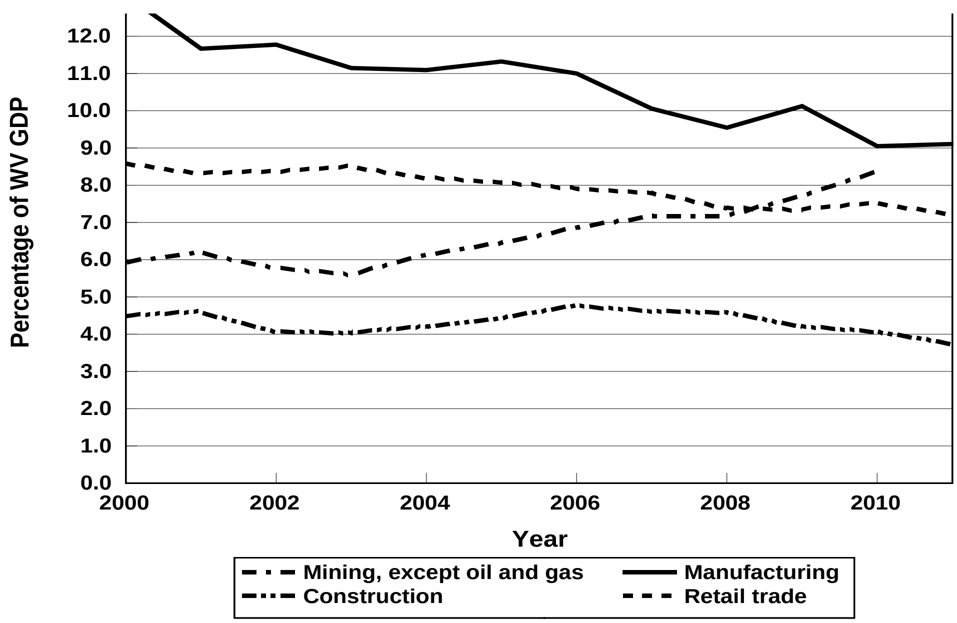
Source: US Energy Information Administration and Bureau of Economic Analysis

Figure 6: Coal mining employment WV and US (non-seasonally adjusted, in thousands), 1992-2010



Source: US Bureau of Labor

Figure 7: WV gross domestic product by major sector, 2000-2011



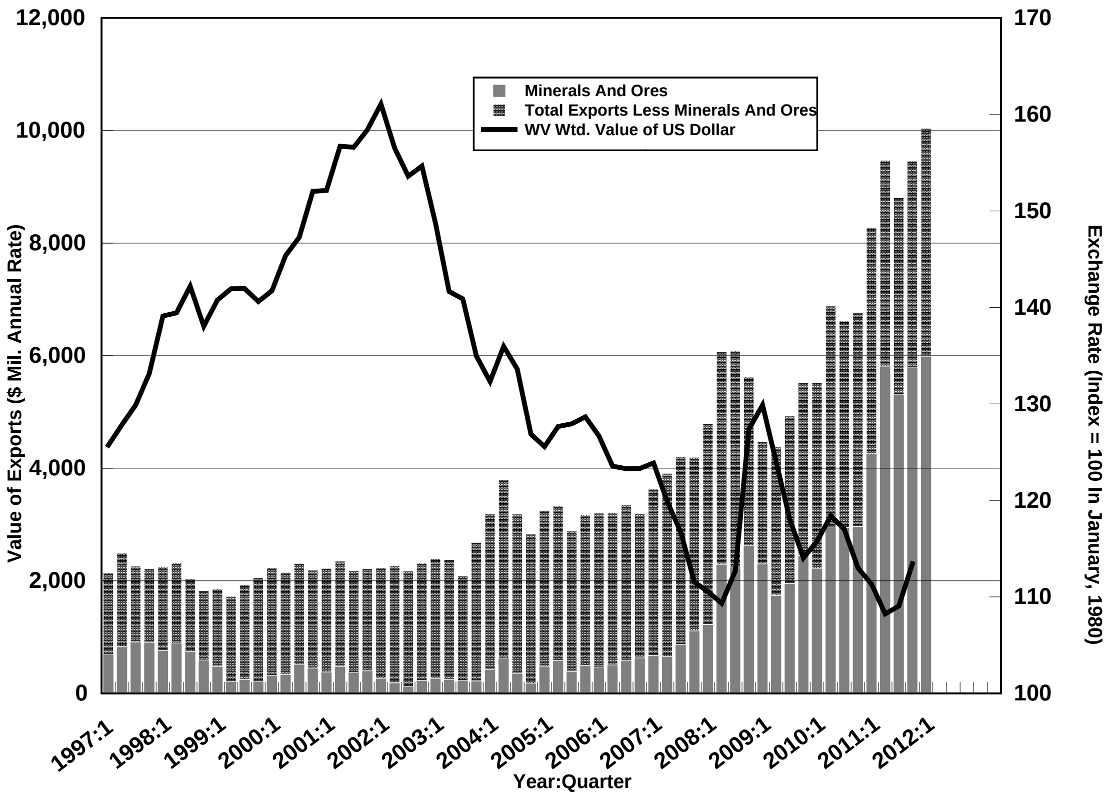
Source: US Bureau of Economic Analysis

Table 7: US coal exports, by type and WV share of total (short tons)

	2009	2010
Metallurgical	37,261,568	56,113,816
Steam	21,835	25,601,859
Total US Coal	59,096,951	81,715,675
Metallurgical Share	63.05%	68.67%
Steam Share	36.95%	31.33%
WV Export Tons	21,373,000	24,537,690
US Export Tons	55,601,000	66,922,480
WV Export Share	38.44%	36.67%

Source: US Energy Information Administration, Quarterly Coal Report and Annual Coal Distribution Report

Figure 8**:** Value of WV commodity exports, 1997-2012



Source: WISERTrade & BBER Calculations

Table 8: Top 10 rankings by value (millions of dollars) and destination of WV coal exports 2008-2011

	2008		2009		2010		2011	
Rank	Total WV Exports	$5,643	Total WV Exports	$4,286	Total WV Exports	$6,449	Total WV Exports	$9,002
1	Canada	$1,286	Canada	$1,201	Canada	$1,474	Canada	$1,532
2	Japan	$497	Brazil	$407	Japan	$408	Brazil	$695
3	Brazil	$357	Netherlands	$364	Brazil	$400	Netherlands	$689
4	Belgium	$323	Belgium	$313	Netherlands	$362	India	$644
5	Netherlands	$302	China	$296	China	$360	Italy	$614
6	India	$293	France	$288	India	$359	Ukraine	$500
7	France	$290	Ukraine	$227	Belgium	$338	Japan	$449
8	China	$252	Japan	$218	U.K.	$277	China	$419
9	Ukraine	$222	India	$208	Italy	$255	South Korea	$377
10	Italy	$174	Italy	$166	Ukraine	$245	U.K.	$357

Source: US Census Bureau, Foreign Trade Statistics

Table 9: Top ten WV mineral and ores export destinations ranked by value of commodity exports in 2011 (millions of dollars)

Rank	Country/Region	2009	2010	2011
1	India	173.9	302.8	593.4
2	Italy	139.9	224.2	581.4
3	Brazil	312.9	280.4	546.9
4	Netherlands	212.4	203.0	524.6
5	Ukraine	50.2	245.1	499.4
6	United Kingdom	189.0	221.3	287.5
7	Turkey	44.5	154.6	274.3
8	Korea, Republic Of	8.3	9.6	267.1
9	France	257.9	151.2	248.8
10	Canada	4.9	103.9	214.2
	European union (27)	1,304.9	1,349.0	2,295.5
	Pacific Rim, including China	60.8	73.5	389.9
	Mexico, Latin America, Caribbean	381.8	350.1	685.3
	Total Mineral and Ores	2,110.0	2,771.7	5,292.6

Source: WISER Trade

Table 10: Top ten WV export industries ranked by value of commodity exports in 2011

Rank	NAICS	Industry	2009	2010	2011
1	212	Minerals and Ores	2,110.0	2,771.7	5,292.6
2	325	Chemicals	1,181.7	1,568.1	1,596.0
3	336	Transportation Equipment	416.1	629.3	977.3
4	331	Primary Metal Manufacturing	170.6	231.4	209.8
5	327	Nonmetallic Mineral Products	90.6	151.4	151.9
6	333	Machinery, Except Electrical	364.0	532.1	142.0
7	339	Miscellaneous Manufactured Commodities	108.0	126.3	138.8
8	334	Computer and Electronic Components	54.1	69.4	104.9
9	326	Plastics and Rubber Products	29.6	44.1	65.8
10	324	Petroleum and Coal Products	44.2	53.8	64.3
		Total All Industries	4,825.6	6,449.2	9,002.2

Source: WISER Trade

3.4 West Virginia coal industry forecasts

BBER recently released updated consensus coal production and coal forecasts for West Virginia for the period 2012-2030.[16] This forecast is derived from forecast of production provided by the EIA (EIA reference case forecast), BBER and Energy Ventures Analysis (EVA). Coal price forecasts are provided by EIA and EVA and details regarding these forecasts are included in the report appendix.

The consensus coal production forecast is summarized in Figure 9 and Table 11. This forecast indicates a decline in West Virginia coal production from 134.6 million tons in 2011 to 130.5 million tons in 2012 and reflects weak demand from the beginning of 2012 accelerating through the end of the year. According to this report:

> The consensus report then calls for state coal production to decline rapidly through 2020. Indeed, production is forecast to fall to 96.0 million tons by 2020, a decline of 28.7 percent during the nine year period. Thereafter, coal production stabilizes and eventually rises to 99.2 million tons by 2030, as natural gas prices begin to gradually rise.[17]

On the other hand, the consensus coal prices rise during the forecast period, primarily the result of inflation and rising mining cost due to depletion of easily mineable reserves, particularly in the southern production regions. Figure 10 and Table 11 summarize the price forecasts.

The projected decline in coal production is due to several factors affecting the demand for and supply of coal. As indicated by BBER:

[16] George W. Hammond, *Consensus Coal Production and Price Forecast for West Virginia*,[June 2012 Update].
[17] (Hammond June 2012 Update p. 11).

On the demand side, coal is likely to be a less attractive fuel for electricity generation, as natural gas production rises and prices remain competitive. Further, restrictions on SO_2, NO_x, and mercury (and hazardous air pollutants, more generally) emissions and the related investments in pollution control equipment by electric power producers tend to make coal produced in the southern part of the state less attractive than coal produced in Northern Appalachia and other regions of the country. Compounding these effects will be efforts by electricity producers to start positioning themselves for the eventual regulation of greenhouse gases (including increasing generation from renewables). These forces contribute to the expectation that utilities will phase out less efficient coal-fired plants in favor of those with fewer problematic emissions (such as scrubbed coal-fired plants and plants that burn natural gas and other non-coal fuels, such as biomass). This includes coal-fired plants located in West Virginia (Kanawha River, Phillip Sporn, and Kammer) slated for shut-down by AEP.

Supply-side issues will also contribute to lower coal production in the state. These include the increasingly challenging geological conditions that tend to raise production costs, particularly in the southern part of the state. In addition, the increasing scrutiny of surface mining permits by the Regulations from the US Environmental Protection Agency are also expected to contribute to declining productivity at surface mines, and thus increasing production costs, in southern West Virginia.[18]

Figure 11shows the percent change in central and northern Appalachian coal production given different potential economic scenarios.

[18] (Hammond June 2012 Update) pp.11-12.

Figure 9: WV consensus forecast coal production, 1990-2030

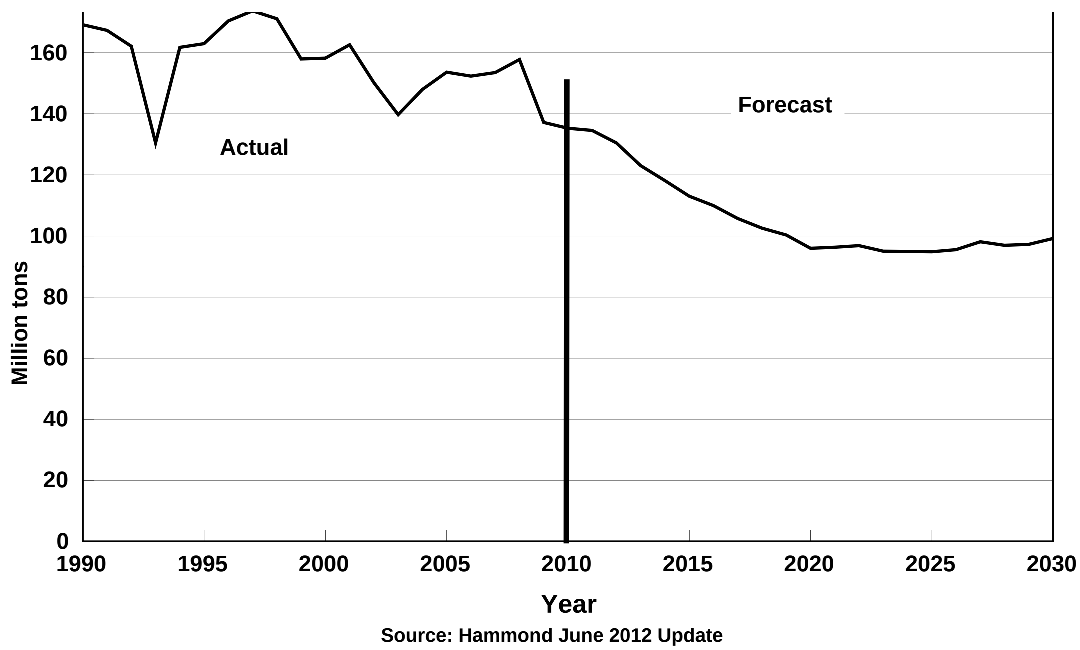


Figure 10: WV consensus forecast nominal coal prices, 2001-2030

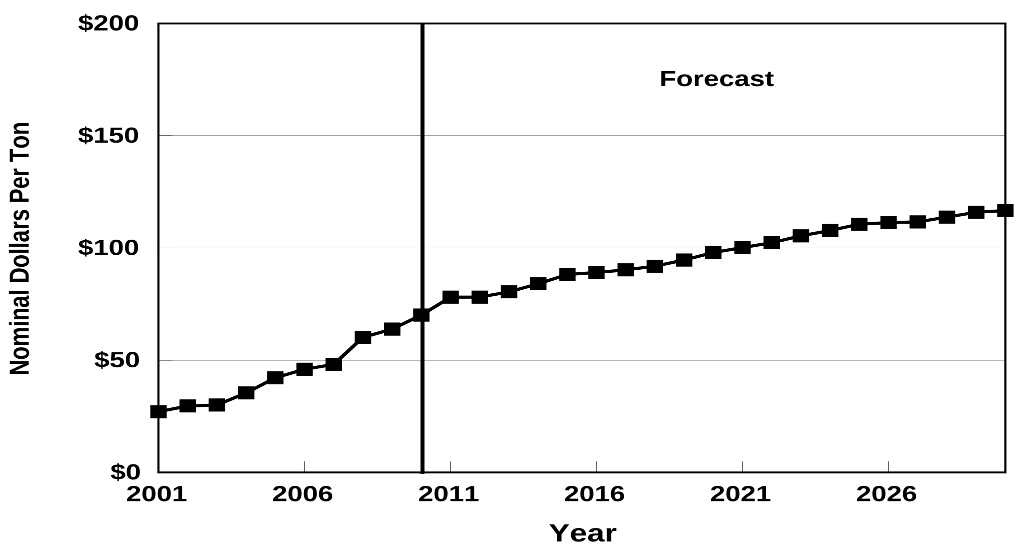
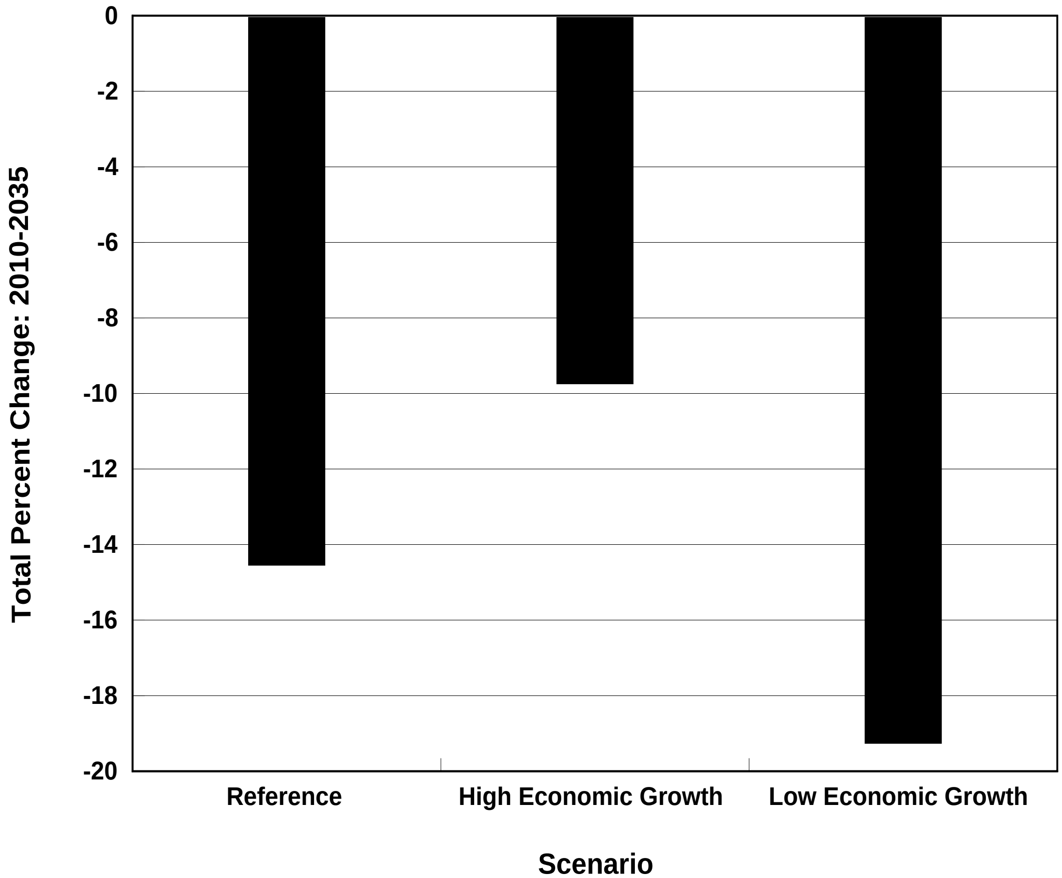


Table 11: WV coal production and consensus forecast (millions of tons and nominal price per ton*)

				Actual			
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**Ann. Gr. (%)**
WV Coal Production	152.4	153.5	157.8	137.2	135.3	134.6	-2.5
WV Nominal Coal Price	45.94	48.12	60.16	63.83	70.07	78.08	11.2
				Forecast			
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**Ann. Gr. (%)**
WV Coal Production	130.5	123.1	118.1	113.1	110.0	105.8	-4.1
WV Nominal Coal Price	78.07	80.43	84.00	88.19	89.09	90.23	2.9
				Forecast			
	2018	**2019**	**2020**	**2021**	**2022**	**2023**	**Ann. Gr. (%)**
WV Coal Production	102.6	100.4	96.0	96.3	96.9	95.1	-1.5
WV Nominal Coal Price	91.85	94.61	97.92	100.20	102.34	105.38	2.8
				Forecast			
	2024	**2025**	**2026**	**2027**	**2028**	**2029**	**Ann. Gr. (%)**
WV Coal Production	95.0	94.9	95.6	98.1	97.0	97.3	0.5
WV Nominal Coal Price	107.80	110.59	111.29	111.62	113.77	115.93	1.5
				Forecast			
	2030						
WV Coal Production	99.2						
WV Nominal Coal Price	116.67						

*The coal price for 2011 is forecast. Coal prices are an average of contract and spot prices

Figure 11: Percent change in central and northern Appalachian coal production: three EIA scenarios, 2010-2035



3.5 Potential new coal markets

Though coal has traditionally been used primarily in the electric power sector, technological advances have made it possible to use coal in other applications, as well as extract methane from the coal bed. These advances have allowed coal mines to enter new markets with greater revenue potential.

3.5.1 Waste coal and gob

One of the potential energy sources is the use of waste coal and gob as an energy source for the generation of electricity. These supplies are potentially available through re-mine of numerous waste sites throughout the state. This resource has been extensively reviewed by the 2006 Marshall University study on this subject.[19] This study identified at least 864 disposal sites in West Virginia with reclaimed or unclaimed coal slurry impoundments. Key issues regarding its use for energy production include:

- Size, location, age and energy content of coal waste and gob.
- Cost of reclamation of re-mined site to comply with federal Surface Mining Control and Reclamation Act (SMCRA) guidelines.
- Ability to be cost-effective when used in coal-fired generation systems

[19] Calvin Kent and Christine Risch, *Innovative Energy Opportunities in West Virginia: Final Report*,[2006].

The major use of waste coal and gob is in circulating fluidized bed (CFB) power plants. These plants use a combination of waste coal and unwashed new coal (up to 25 percent) and can meet emission standards. The following is a summary of current or recently announced/cancelled plants in West Virginia.

- Western Greenbrier Co-Production Demonstration Project was a joint project of three West Virginia municipalities and the US DOE. The project was a 98-megawatt CFB plant designed to use wood waste along with waste coal. While permits were approved for the project, the costs rose to nearly $450 million. In 2008 the DOE announced the plant was canceled.
- Grant Town is an 80-megawatt CFB plant that became operational in 1993. The fuel source is waste coal and pond fines from mine sites. Power from this facility is sold to FirstEnergy under a long term power sales contract.
- North Branch is a 74-megawatt CFB that became operation in 1992.This plant is owned and operated by Dominion. Dominion has broken ground for a Warren County Power State (natural gas fired) in Virginia. Under the air permit granted for Warren Dominion will close North Branch.
- Morgantown Energy Associates owns and operates a 50-megawatt CFB that became operational in 1992. Capacity and energy from this facility is sold to Monongahela Power. Steam from this plant is used by West Virginia University.

The future prospects for additional power projects using waste coal and gob is problematic given the capital cost of these plants and their ability to compete in both capacity and power markets.

3.5.2 Coalbed methane

Coalbed methane (CBM) is methane extracted from coal seams.[20] CBM production occurs in conjunction with dewatering of coal seams to allow the methane to be liberated from coal. Coal stores significantly more methane than in is found in the geological formation associated with conventional natural gas reservoirs. The methane liberated through drilling permits the preparation of the coal for further exploitation. The end result in many cases is a safer working environment for underground miners.

CMB production is attractive due to several factors. Coal stores six or seven times as much gas as a conventional natural gas reservoir of equal rock volume due to the large internal surface area of the coal. Since coal is available at shallow depths, well drilling and completion are relatively inexpensive. The costs of finding the methane are also low since methane occurs in coal deposits and the location of coal resources is well known.[21] A comparison of CBM and conventional gas reservoirs is shown in Table 12.

Initially, CBM was produced using vertical wells. Through the adoption of horizontal drilling, fewer wells are needed to liberate the CBM, thus reducing the number of well sites and access roads. Since considerable amounts of waste water are generated, issues arise regarding its disposal. The West Virginia DEP reviews applications for water discharged and issues permits for the efficient and economic disposal of water. Air quality benefits can arise due to the substitution of cleaner burning methane for other dirtier fuels.[2]

[20] West Virginia Surface Owners' Rights Association, "About “Coal Bed Methane”,"
[21] US Energy Information Administration, "Coalbed Methane Basics," (2012).

Table 12: Comparison of coal bed methane and conventional gas reservoir characteristics

Characteristic	Conventional	CBM
Gas Generation	Gas is generated in the source rock and then migrates into the reservoir.	Gas is generated and trapped within the coal.
Structure	Randomly-spaced fractures	Uniformly spaced cleats
Gas Storage Mechanism	Compression	Adsorption
Production Performance	Gas Rate starts high then declines. Little or no water initially. GWR decreases with time.	Gas rate increases with time then declines. Initial production is mainly water. GWR increases with time

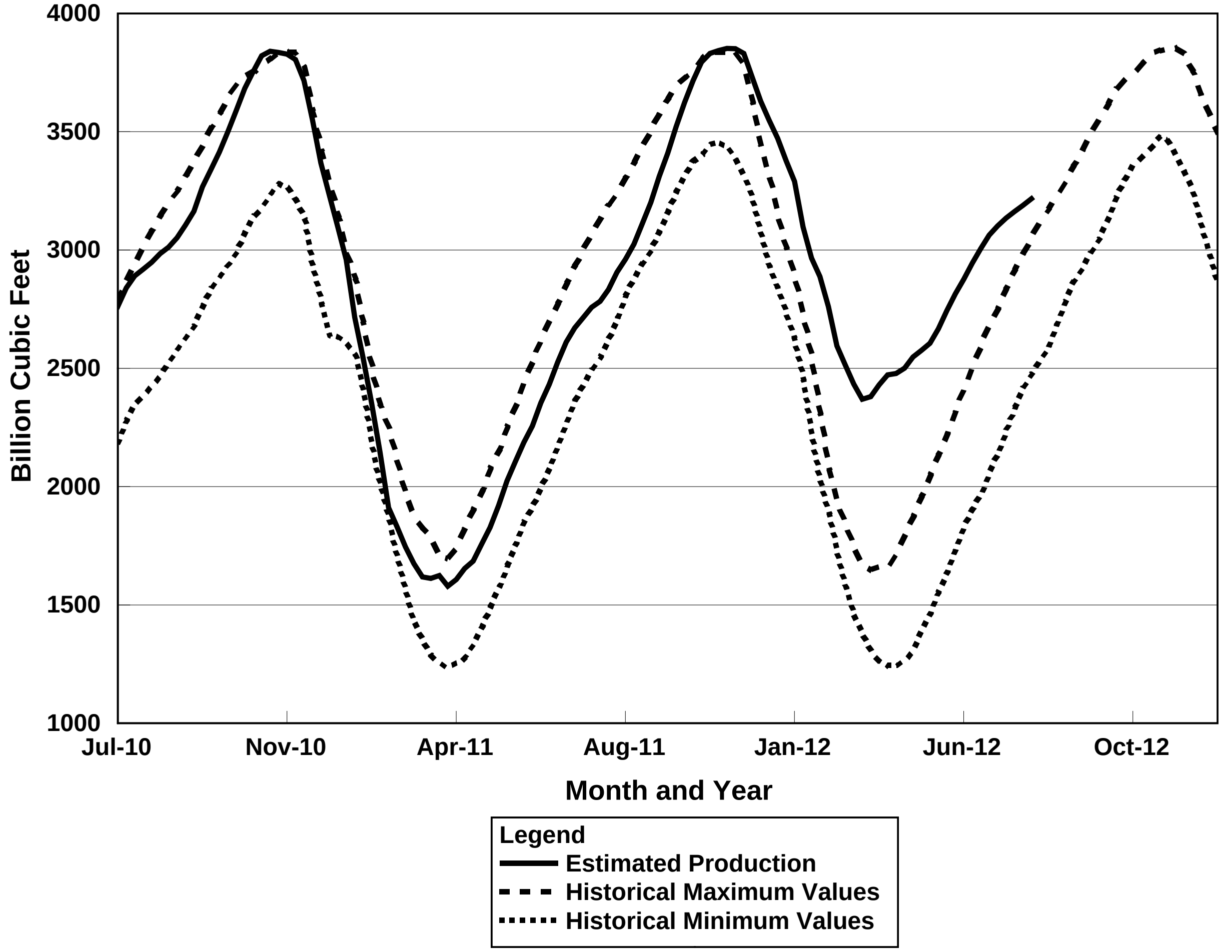
Source: Aminian, K. *Coalbed Methane - Fundamental Concepts*. Morgantown, WV: Petroleum & Natural Gas Engineering Department West Virginia University.

Within West Virginia CBM wells are concentrated in Monongalia, Marion, Wetzel, Marshall, McDowell, Logan, Wyoming, Raleigh, and Boone counties. West Virginia CBM production was 28 billion cubic feet in 2008 and 31 billion cubic feet in 2009, the latest years available from EIA.[22]

Increased production of CBM could pose a problem of insufficient storage. Shown in Figure 12 is a graph of underground natural gas storage capacity for the lower 48 states in the United States. The range between the maximum and minimum lines represents the range between the historical minimum and maximum values for the weekly series from 2007 to 2011. Current production and recent past storage have reached maximum capacity in the months leading up to the winter months. As of January 2012, production began to exceed historical maximums and is this trend is likely to continue. If production continues to increase, construction of new underground storage capacity will be necessary to make use of the excess CBM.

[22] US Energy Information Administration, "West Virginia Coalbed Methane Proved Reserves, Reserves Changes, and Production," (2012).

Figure 12: Working gas in underground storage compared with historical range, 2010-2012



Source: US Energy Information Administration

3.5.3 Coal to liquids

One use of coal entails converting it to a liquid fuel that can be used as an alternative to petroleum. The major methods involve either direct or indirect coal liquefaction. In the direct method coal is dissolved in a solvent under high pressure and temperature for further processing. Indirect liquefaction converts the coal into a gas through proven Fischer-Tropsch or advanced gasification technology processes for further refinement into clean and high quality liquid fuels such as diesel and naphtha. Internationally the leading country with coal liquefaction is South Africa, where Sasol converts coal into a variety of transportation fuels. Current capacity of these operations is over 160,000 barrels per day.

There are many advantages to use of coal as a feedstock according to the National Mining Association.[23]

- Improves national and economic security by lessening dependence on foreign oil.
- Uses domestic resources and produces more jobs for Americans.
- Provides positive influence on U.S. balance of trade and economy.
- Provides environmental benefits, including cleaner fuels that reduce nitrogen oxide and particulate emissions, enabling use of higher efficiency engines.
- Is capable of capturing carbon dioxide (CO2) emissions and serving as a bridge to a hydrogen fuel future through polygeneration (linking multiple types of plants into one, such as co-production of liquid fuels, electricity, hydrogen, etc., embodied in FutureGen initiative).
- Provides geographic diversity of domestic refining capacity.

These plants are very capital intensive and the economics of financing depend upon the spread between the price of coal and the downstream products. Volatility in energy prices, coupled with the projected 30 year financing required for plant construction and operation have restricted the commercial development of CTL plants in the United States. EIA estimates coal-to-liquids production in 2010 as zero but their forecast has coal to liquids increasing to 38 million short tons by 2025.[24]

One exception has been the Adams Fork Energy Plant developed by TransGas Development Systems LLC in Mingo County, West Virginia.[25] This plant is projected to cost $4 billion and would convert 7,500 tons of coal per day to 18,000 barrels of gasoline and 300 barrels of liquidized petroleum gas or propane. The plant has been issued air permits by the West Virginia Department of Environmental Protection and started site preparation work. The developers expect to begin major construction in the first quarter 2013.

A recent study in 2009 identified opportunities for long-term geologic storage of CO_2 associated with the generation of coal to liquids at a plant within West Virginia. [26] This study identified the large amount of CO_2 storage available within West Virginia's oil and gas fields, deep coal seams and saline aquifers. Enhanced oil or natural gas recovery through CO_2 injections are business opportunities that should be studied. The U.S. Department of energy is now focused on enhanced oil recovery through CO_2 as opposed to CO_2 storage.

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[23] National Mining Association, "*Liquid Fuels from U.S. Coal*." http://www.nma.org/pdf/liquid_coal_fuels_100505.pdf (accessed 7/30/2012, 2012).
[24] "EIA - Annual Energy Outlook 2012." http://www.eia.gov/forecasts/aeo/ (accessed 7/25/2012, 2012).
[25] Pam Kasey, "TransGas Coal-to-Liquids Plant Construction Expected Q1 2013," The State Journal, http://www.statejournal.com/story/18768936/transgas-coal-to-liquids-plant-construction-expected-q1-2013 (accessed 7/30/2012, 2012).
[26] Timothy R. Carr, Evan Fedorko and Frank LaFone, West Virginia Carbon Capture and Storage Opportunities Associated with Potential Locations for Coal-to-Liquid Facilities (Morgantown, WV: West Virginia Carbon Sequestration,[2009]).

3.6 Key observations

- Coal has been and will continue to be a major contributor to the West Virginia economy, both in terms of jobs, incomes, tax revenues, and gross state product. Coal will remain very important to West Virginia.
- The national and state outlook for coal, however, calls for declines in West Virginia coal production and demand, particularly as it relates to thermal coal. As will be discussed in a later section, low natural gas prices are eroding coal's role in electric power generation.
- Metallurgical coal exports in international markets will continue to be an important, and possibly growing part of the coal industry.
- Opportunities for coal to liquids industrial development should continue but will be dependent upon the spread between coal and the resulting product produced as well as the availability of long-term financing for the significant capital investments required for these products.
- New markets for coal through waste coal development, coal bed methane, and coal to liquids need to be encouraged.
- CO_2 storage should be considered as a new business opportunity, particularly as it relates to enhanced oil and natural gas production.
- National environmental policy will play a critical role in the selection of coal versus other fuel sources for the electric generation industry.

4 Natural Gas and Oil

Oil and natural gas were discovered in West Virginia long before anyone recognized their value or potential. Reports of "burning spring" outflows on the Little Kanawha, Kanawha, and Big Sandy rivers date back to the time of the early settlers. Harvesting of West Virginia's oil and gas reserves was not thought of until the early 1800s when drilling for salt began in the area. Miners first accidentally struck gas in a salt well in Charleston in 1815. As more and more oil and gas was discovered by salt miners, the Greater Kanawha Valley region became a pioneer of oil discovery, on both the drilling and commercial sale fronts.[27]

Burning Springs, WV, was the site of the first well drilled specifically for oil extraction in West Virginia. In 1859, the Rathbone brothers, originally salt miners from Parkersburg, WV, drilled an oil well that produced 200 barrels of oil per day. Shortly thereafter, the brothers developed a second well that produced 1,200 barrels per day. By 1961, a town had sprung up in the area and was lit entirely by natural gas. This technology spread to other areas of the state and beyond. This marked the beginning of natural gas development in West Virginia. The oil produced in the Burning Springs oil field was shipped by river into Parkersburg. From there, the oil was moved by rail or river to other cities, causing Parkersburg to grow into a chief oil shipping hub.[28]

While Burning Springs was only one of two oil fields in the nation before the Civil War, by 1876 there were 292 wells in West Virginia alone, producing roughly 900 barrels per day. Another notable oil field, known as Volcano, was discovered in 1860 and was very active between 1865 and 1870. It was here that the "endless wire" method of pumping oil was invented in 1874. This method allowed one motor to extract oil from up to 40 wells at a time. Volcano was also the site of West Virginia's first oil pipeline in 1879, which ran from the Volcano oil field to Parkersburg, WV.[29]

Oil production decreased in West Virginia between 1879 and 1889. Oil seekers were unable to dig deeper wells because the soft rock they encountered after a certain depth would crumble into the well and prevent further extraction. In 1889, iron pipes were introduced and allowed deeper drilling by preventing well cave-ins. Deeper drilling allowed the discovery of deeper oil reserves, and thus the oil fields of Doll's Run, Eureka, Mannington, and Sistersville came into play.[30] West Virginia's oil industry reached its peak production level in 1900 at 16 million barrels in one year. Thereafter, the decline in oil production was met by an increase in natural gas development.

4.1 Natural gas industry overview[31]

Natural gas is a colorless, odorless, and tasteless gas used to produce electricity, steel, glass, paper, clothing, and a variety of other products.[32] In the United States, more than half of the homes use natural

[27] WV Geological and Economic Survey, "History of West Virginia Oil and Gas Industry," (2012).
[28] Ibid.
[29] Ibid.
[30] Ibid.
[31] This section is abbreviated from a larger BBER report.(Higginbotham and others 2010, 56)
[32] Natural gas consists of hydrocarbon gases including methane, ethane, propane, butane, carbon dioxide, oxygen, nitrogen, hydrogen sulphide and rare gases.

gas as their main heating fuel. The nation's major sectors responsible for natural gas consumption in 2011 included:[33]

- Electric power sector at 7.6 trillion cubic feet[34] (Tcf) or 34% of US consumption
- Industrial sector at 6.7 Tcf or 30% of US consumption
- Residential sector at 4.7 Tcf or 21% of US consumption
- Commercial sector at 3.1 Tcf or 14% of US consumption

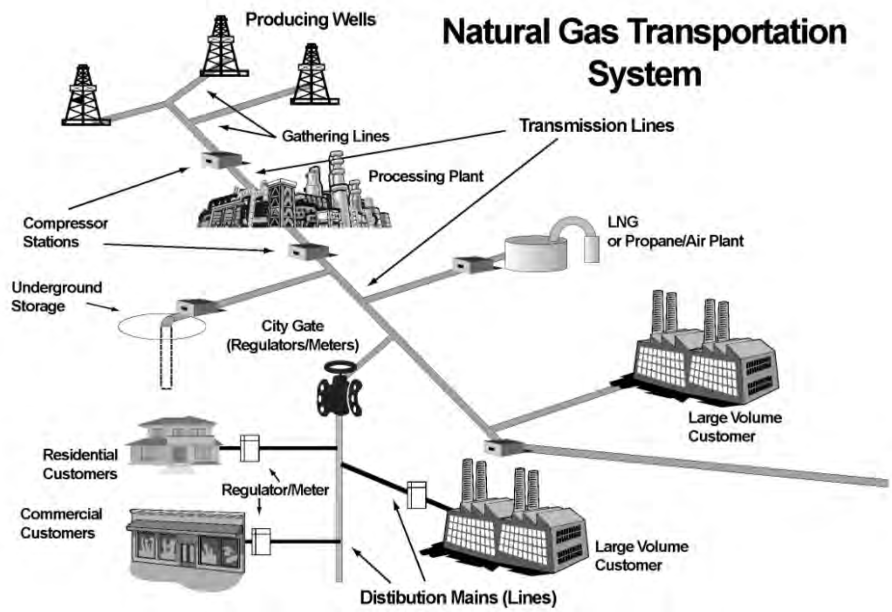
The remaining US consumers of natural gas in 2011 included oil and gas industry operations, vehicle fuel, and pipeline and distribution use.

The process of finding, developing, and preparing natural gas for consumption is quite extensive, expensive and complex. Seismic surveys use echoes to determine the location of natural gas on land and off-shore. Once an area has been deemed promising from a geological perspective, the drilling process begins. As natural gas is found within the deposits of rock formations through the drilling process, it is transported by pipelines to the ultimate consumer.

Transporting natural gas and making it viable for consumers involves many steps (Figure 13). Raw natural gas is gathered in low pressure pipelines and moved from the wellhead to a processing plant or the interconnection with a larger mainline pipeline. Natural gas liquids and impurities, such as liquid hydrocarbons and non-hydrocarbon gases, are separated from the natural gas stream near the site of the well or at processing plants. Natural gas is then transported from the producing area to market areas through wide-diameter, high-pressure interstate and intrastate pipelines. Compressor stations are strategically located throughout the transmission pipeline system to keep the natural gas flowing forward. In low demand times during the year, natural gas is stored in facilities created from depleted oil, natural gas, or aquifer reservoirs or salt caverns. When demand for natural gas increases, such as in the winter months, stored natural gas is delivered back into the mainline pipeline system. Distribution companies take natural gas from the high-pressure mainline system, reduce the pressure to levels suitable for residential and commercial use, and transport it through smaller pipelines called mains. Natural gas is then directly routed to homes and industrial facilities through very small pipelines called services.

[33] US Energy Information Administration, "US Natural Gas Consumption by End Use," (2012).
[34] A trillion cubic feet (Tcf) is one billion Mcf (1,000 cubic feet) and is enough natural gas to heat 15 million homes for one year, generate 100 billion kilowatt hours of electricity or fuel 12 million natural gas-fired vehicles for one year.

Figure 13: The natural gas industry process



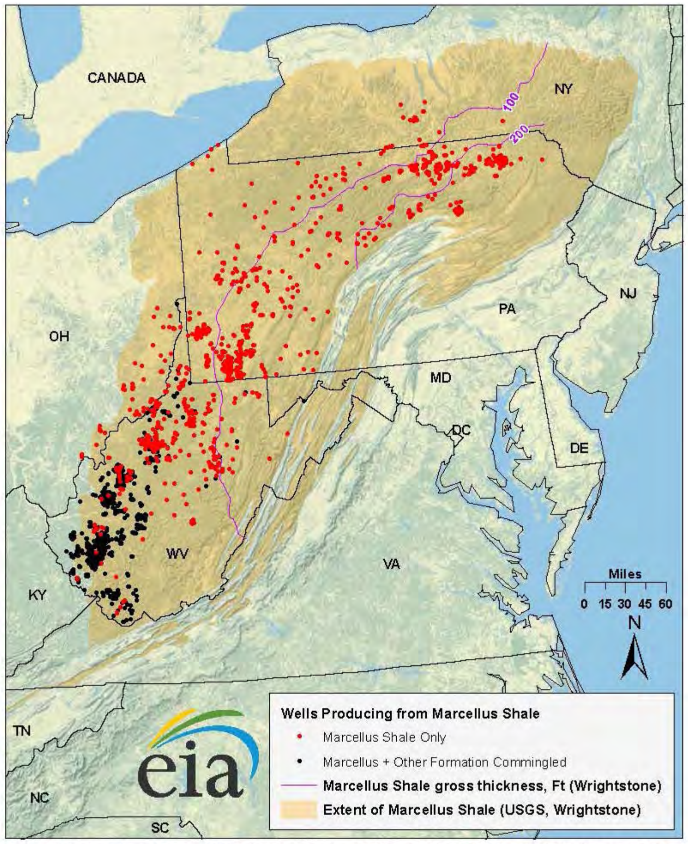
Source: Chesapeake Energy

4.2 The Marcellus Shale changed West Virginia's natural gas industry

Marcellus Shale production of natural gas has become a very important contributor to West Virginia's energy future. As Figure 14 shows, Marcellus Shale can be found beneath the vast majority of the state's territory. Marcellus Shale reserves intermingle with other types of formations such as Utica and Devonian shales.[35]

[35] US Energy Information Administration, *Marcellus Shale Play, Appalachian Basin*US Energy Information Administration, 2011).

Figure 14: Marcellus Shale gas play, Appalachian Basin

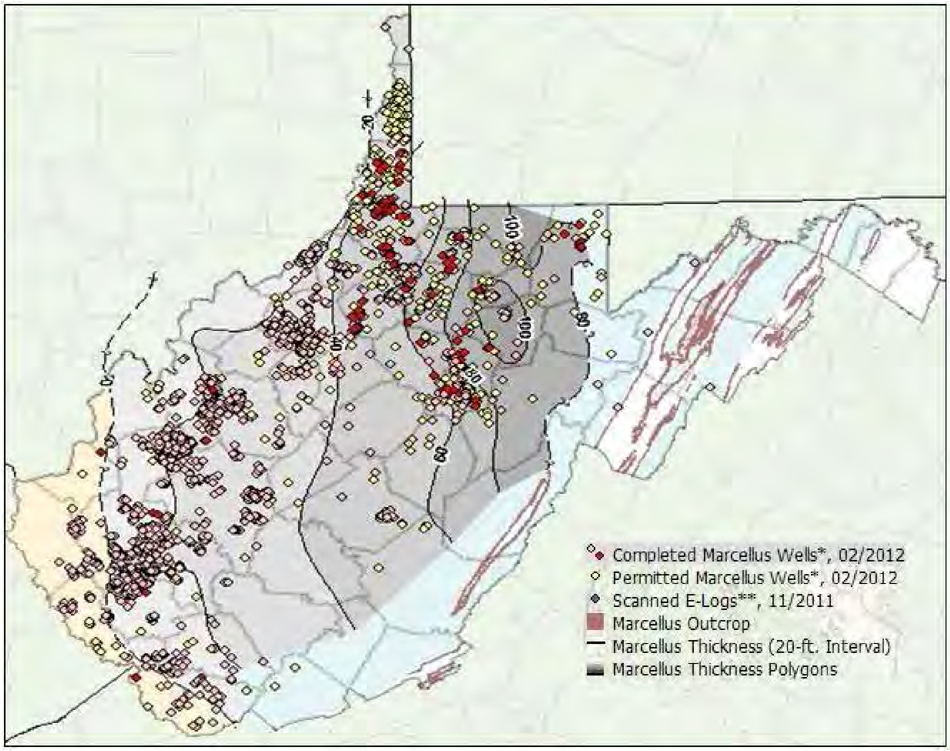


Source: US Energy Information Administration based on data from WVGES, PA DCNR, OH DGS, NY DEC, VA DMME, USGS, Wrightstone (2009). Only wells completed after 1-1-2003 are shown. Updated June 1, 2011

Figure 15 displays completed and permitted Marcellus wells as of February 2012, as well as the thickness of the Marcellus shale across the state. At the time this map was downloaded from the West Virginia Geological and Economic Survey (WVGES) website, the agency was receiving reports of new Marcellus Shale well discoveries. WVGES suspects that the limits of the Marcellus shale thicknesses drawn in this map are conservative depictions. More accurate information will become available as the claims are investigated.[36]

[36] WV Geological and Economic Survey, *Geology of the Marcellus Shale*West Virginia Geological and Economic Survey, 2012).

Figure 15: Marcellus Shale thickness and wells in West Virginia, February 2012



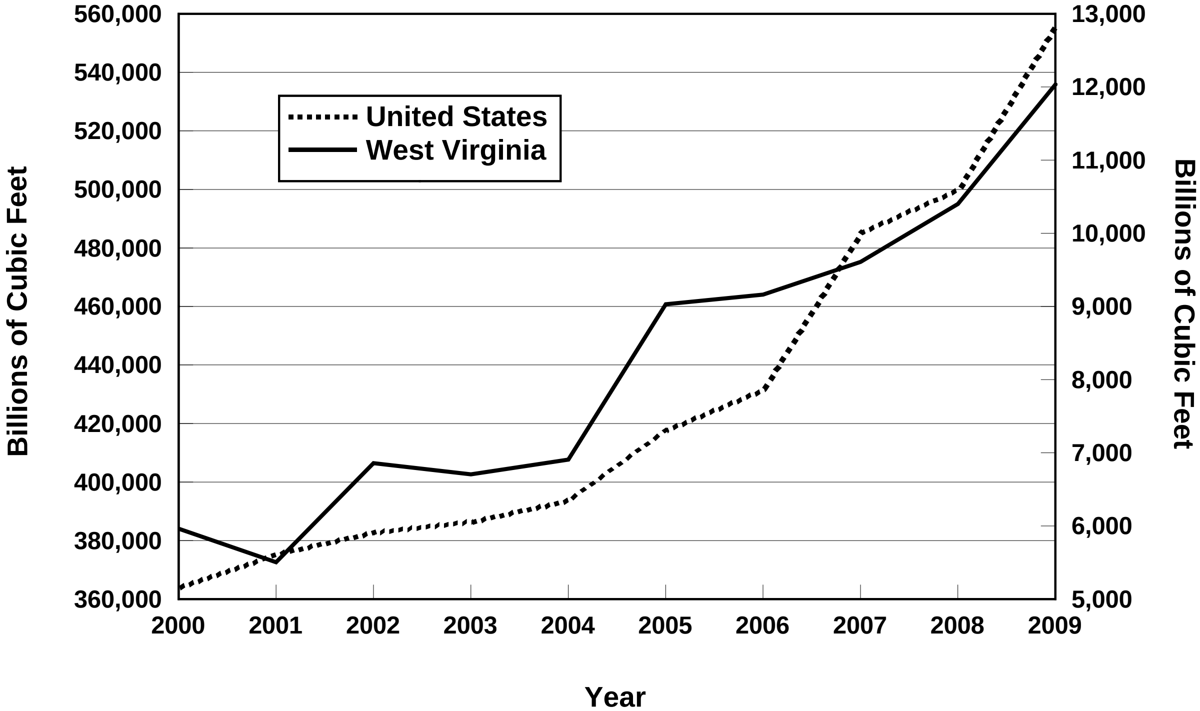
Source: West Virginia Geological and Economic Survey, Marcellus Shale Mapping System

4.3 Natural gas reserves

The proved natural gas reserves trends from 2000 to 2009 for the United States and West Virginia are shown in Figure 16. Proved reserves in West Virginia tended to be more volatile over the time-period than those of the nation. The state experienced several sharp increases and decreases between 2000 and 2005, whereas the nation experienced a steadier increase at an increasing rate. West Virginia's proved natural gas reserves were lowest in 2001, at 5,503 billion cubic feet, but by 2009 had increased to 12,036 billion cubic feet (Bcf). National growth in reserves between 2000 and 2009 amounted to 192,451 Bcf.[37]

[37] US Energy Information Administration, "Natural Gas Reserves Summary as of Dec. 31," (2012).

Figure 16: Proved natural gas reserves, 2000-2009



Source: US Energy Information Administration

Table 13 divides US and West Virginia natural gas reserves by type and also shows West Virginia's share of the national figure. Dry gas is defined as the gas remaining after lease, field, and/or plant separation; it is also known as consumer-grade natural gas. Wet gas is a combination of hydrocarbon compounds and small quantities of non-hydrocarbons in a gas form or in a solution with crude oil. West Virginia's portion of the nation's dry natural gas reserves has increased significantly since 2000, growing from 1.63 percent of US reserves to 2.18 percent in 2009. The state's share of national wet gas reserves has also increased, though incrementally less than dry gas shares, moving from 1.64 percent in 2000 to 2.15 percent in 2009. Overall, between 2000 and 2009, West Virginia's share of national natural gas reserves increased by 0.52 percentage points.[38,39]

[38] Ibid.

[39] Percentage calculations in this paragraph are the work of the author, not the US EIA.

Table 13: Proved natural gas reserves by type, 2000-2009

Proved Reserves, Billion Cubic Feet	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
US Dry Natural Gas	177,427	183,460	186,946	189,044	192,513	204,385	211,085	237,726	244,656	272,509
West Virginia Dry Natural Gas	2,900	2,678	3,360	3,306	3,397	4,459	4,509	4,729	5,136	5,946
WV % Share Dry NG	1.63	1.46	1.80	1.75	1.76	2.18	2.14	1.99	2.10	2.18
US Wet Natural Gas	186,510	191,743	195,561	197,145	201,200	213,308	220,416	247,789	255,035	283,879
West Virginia Wet Natural Gas	3,062	2,825	3,498	3,399	3,509	4,572	4,654	4,881	5,266	6,090
WV % Share Wet NG	1.64	1.47	1.79	1.72	1.74	2.14	2.11	1.97	2.06	2.15
US Total NG Proved Reserves	363,937	375,203	382,507	386,189	393,713	417,693	431,501	485,515	499,691	556,388
WV Total NG Proved Reserves	5,962	5,503	6,858	6,705	6,906	9,031	9,163	9,610	10,402	12,036
WV % Share Total NG	1.64	1.47	1.79	1.74	1.75	2.16	2.12	1.98	2.08	2.16
Proved Reserves, Million Barrels										
US Natural Gas Plant Liquids	8,345	7,993	7,994	7,459	7,928	8,165	8,472	9,143	9,275	(N/A)
West Virginia Natural Gas Plant Liquids	105	106	99	68	85	85	110	115	100	(N/A)
WV % Share NG Plant Liquids	1.26	1.33	1.24	0.91	1.07	1.04	1.30	1.26	1.08	(N/A)

Note: Percentages are the calculations of the author, not the US EIA.

Source: US Energy Information Administration, “Natural Gas Reserves Summary as of Dec.31.”

4.4 West Virginia natural gas production and prices

Between 1906 and 1917, West Virginia was the nation’s leading producer of gas, but the industry saw a decline in production until 1934. After that period of decelerated production, the West Virginia natural gas industry resumed its positive growth until 1970.[40] Production declined until 1983, reaching a low of 130,000 million cubic feet (MMcf), but has been rising slowly since then, with especially high production in 2000, with over 264,000 MMcf .

West Virginia production was only 1,000 MMcf greater in 2010 than it was in 2000 (Table 14). Production declined from 2000 to 2003, but began rebounding in 2004, surpassing its 2000 levels in 2009. State production in 2010, the most recent available data, was 265,174 MMcf.[41]

Table 14 also offers a side-by-side comparison of natural gas proved reserves, production, and consumption in West Virginia from 2001 to 2011. Proved reserves significantly outweighed production in the state. In 2000, production was 4.4 percent of proved reserves, the highest it would be between that

[40] (WV Geological and Economic Survey 2004).
[41] US Energy Information Administration, "Natural GasWellhead and Marketed Production," (2012).

year and 2009. The following year this figure decreased to 3.5 percent and would continue to decline to its lowest point, 2.2 percent, in 2009. Production of natural gas in West Virginia exceeded consumption by between 179,148 MMcf and 258,555 MMcf over the ten-year period for which data was available for both measurements. Consumption reached 4.5 percent of production in 2002 and 2003, but that ratio decreased, reaching a low point of 2.4 percent in 2009, before rising to 2.5 percent the following year.[42,43]

Table 14: West Virginia natural gas production,consumption, and proved reserves, 2000-2011

Year	Proved Reserves (Bcf)	Production (MMcf)	Consumption (MMcf)
2000	5,962	264,139	(N/A)
2001	5,503	191,889	8,491
2002	6,858	190,249	8,575
2003	6,705	187,723	8,525
2004	6,906	197,217	8,185
2005	9,031	221,108	7,536
2006	9,163	225,530	7,125
2007	9,610	231,184	7,359
2008	10,402	244,880	7,040
2009	12,036	264,436	6,290
2010	(N/A)	265,174	6,619
2011	(N/A)	(N/A)	6,988

(N/A) Information not available. Source: US Energy Information Administration.

Table 15 shows natural gas marketed production in West Virginia and surrounding states: Kentucky, Maryland, Ohio, Pennsylvania, and Virginia. Through 2008, West Virginia produced the largest quantity of natural gas of the six states. Pennsylvania surpassed West Virginia in production during 2009 and 2010; however, West Virginia remained the second-largest producer of the six states.[44]

[42] US Energy Information Administration, "Natural Gas Data," (2012).
[43] Percentage calculations in this paragraph are the work of the author, not the US Energy Information Administration.
[44] US Energy Information Administration, *Natural GasWellhead and Marketed Production*

Table 15: Natural gas marketed production (MMcf) in select states, 2000-2010

Year	Kentucky	Maryland	Ohio	Pennsylvania	Virginia	West Virginia
2000	81,545	34	105,125	150,000	71,545	264,139
2001	81,723	32	100,107	130,853	71,543	191,889
2002	88,259	22	103,158	157,800	76,915	190,249
2003	87,608	48	93,641	159,827	143,644	187,723
2004	94,259	34	90,476	197,217	85,508	197,217
2005	92,795	46	83,523	168,501	88,610	221,108
2006	95,320	48	86,315	175,950	103,027	225,530
2007	95,437	35	88,095	182,277	112,057	231,184
2008	114,116	28	84,858	198,295	128,454	244,880
2009	113,300	43	88,824	273,869	140,738	264,436
2010	135,330	43	78,122	572,902	147,255	265,174

Source: US Energy Information Administration, "Natural Gas Wellhead Value and Marketed Production".

Since 2000, citygate natural gas prices have varied notably in West Virginia and the United States. [45] Figure 17 shows citygate prices on a monthly basis. These prices peaked in the second half of 2008, reaching a level of $13.97 per thousand cubic feet in July of that year for West Virginia, which was slightly higher than the national price. Other peak state prices occurred in December 2001 ($10.14) and August to October 2005 ($13.49). Peak national prices were, on average, lower than West Virginia levels, at $8.91 in January 2001, $12.16 in October 2005, and $12.48 in July 2008. As of April 2012, state prices were as low as $4.60, which was higher than the national average. On average, citygate natural gas prices in West Virginia were higher than those of the nation between 2000 and 2012.[46]

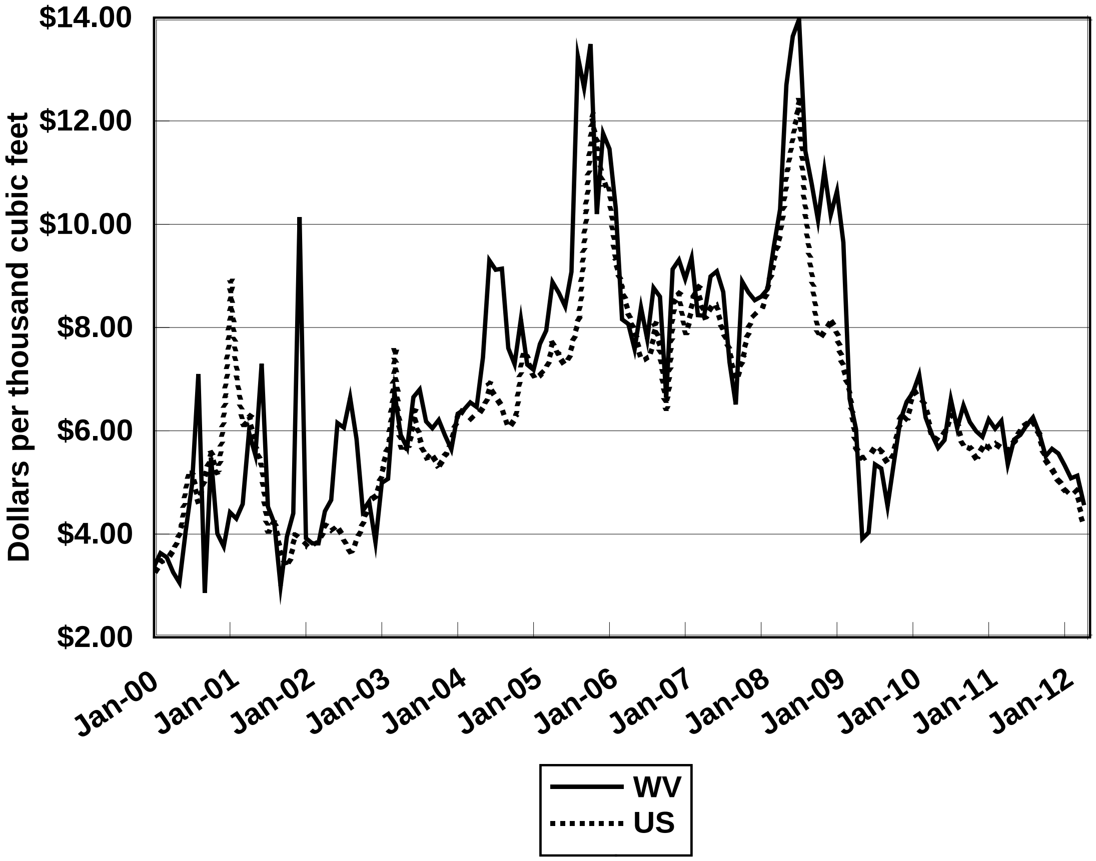
In general natural gas prices, whether citygate or Henry Hub, have historically shown a great deal of volatility. [47] Outside of the spot and futures price, individual midstream and pipeline companies may post prices representing premiums or discount to nationally traded contracts depending on the supply and demand situation within the regional market. The development of Marcellus natural gas production is beginning to affect the spread (difference) between Henry Hub and prices at the Columbia Appalachia (TCO Appalachia) trading point in southwest Pennsylvania.[48] The historic price difference between the TCO Appalachian and Henry Hub natural price was positive until June 2012 and then turned negative due to the significant increase in Marcellus gas production.

As the production increases in the Marcellus and Utica shales, the US natural gas market will change dramatically. Regional price differentials and levels, particularly in the US Northeast, will continue to decline. Natural gas imports will be reduced and as will be seen later, incentives will exist for increasing

[45] Citygate prices at determined at the point when a distributing gas utility receives gas from a natural gas pipeline or transmission system.
[46] US Energy Information Administration, "Natural Gas Prices," (2012).
[47] Henry Hub natural gas prices reflect the spot and futures prices of natural gas as traded on the CME NYMEX futures exchange. In addition, Nymex also has a New York City gate spot price and other natural gas contracts along with crude oil and refined petroleum products. Each contract traded as a reference point for the physical exchange of the commodity detailed in the contract.
[48] US Energy Information Administration, "Spot Natural Gas Prices at Marcellus Trading Point Reflect Pipeline Constraints - Today in Energy -," (2012).

LNG exports to overseas markets, particularly in Japan. This will occur through additional installation of natural gas processing and pipeline capacity.[49]

Figure 17: Monthly citygate natural gas prices, Jan 2000-April 2012



Source: US Energy Information Administration

The EIA Annual Energy Outlook provides forecasts of natural gas prices to 2035. Figure 18 shows its forecast of natural gas prices at the wellhead (nominal dollars per Mcf) through 2035. Figure 19 converts these prices to 2010 dollars. In both cases the long term forecast shows an upward trend in prices from current levels.

[49] Ibid.

Figure 18: Natural gas at the wellhead forecast prices (nominal dollars per Mcf), 2009-2035

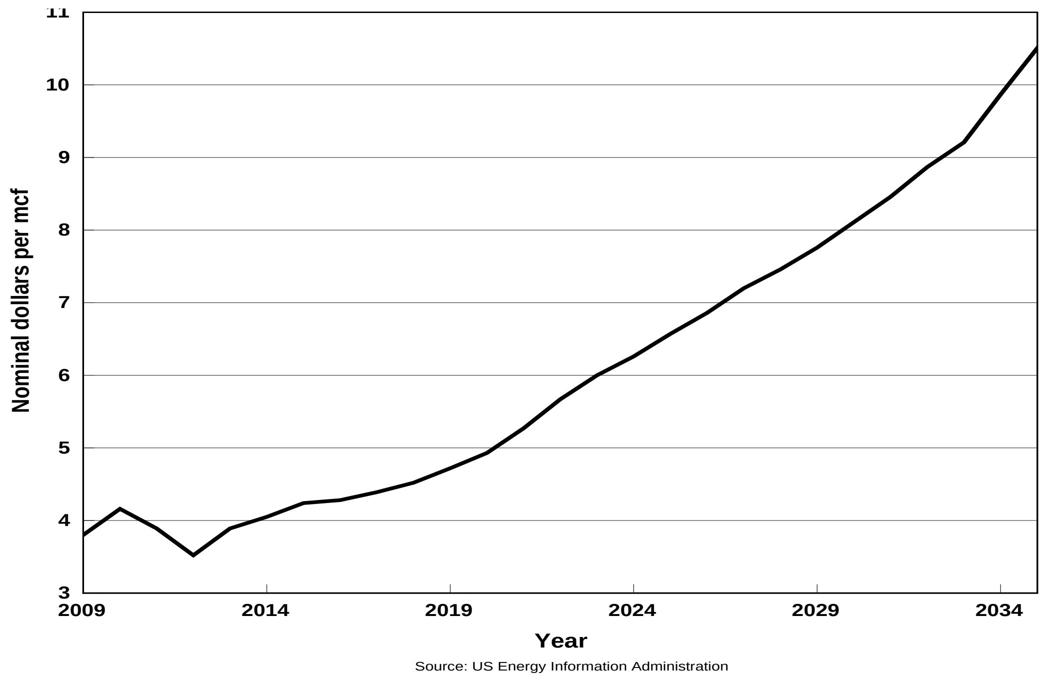
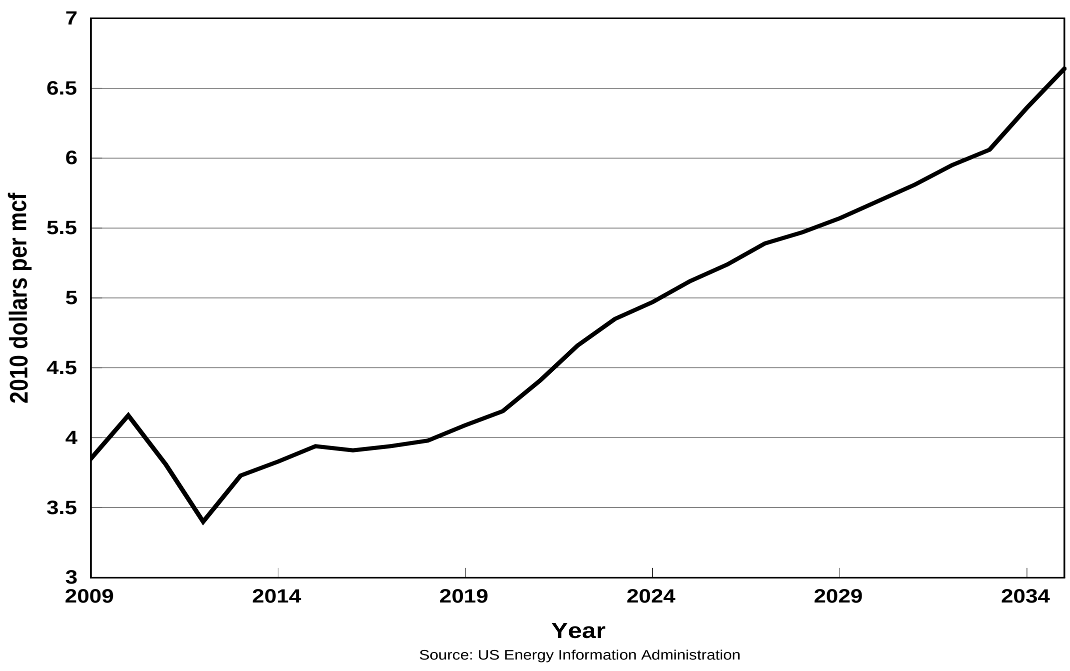


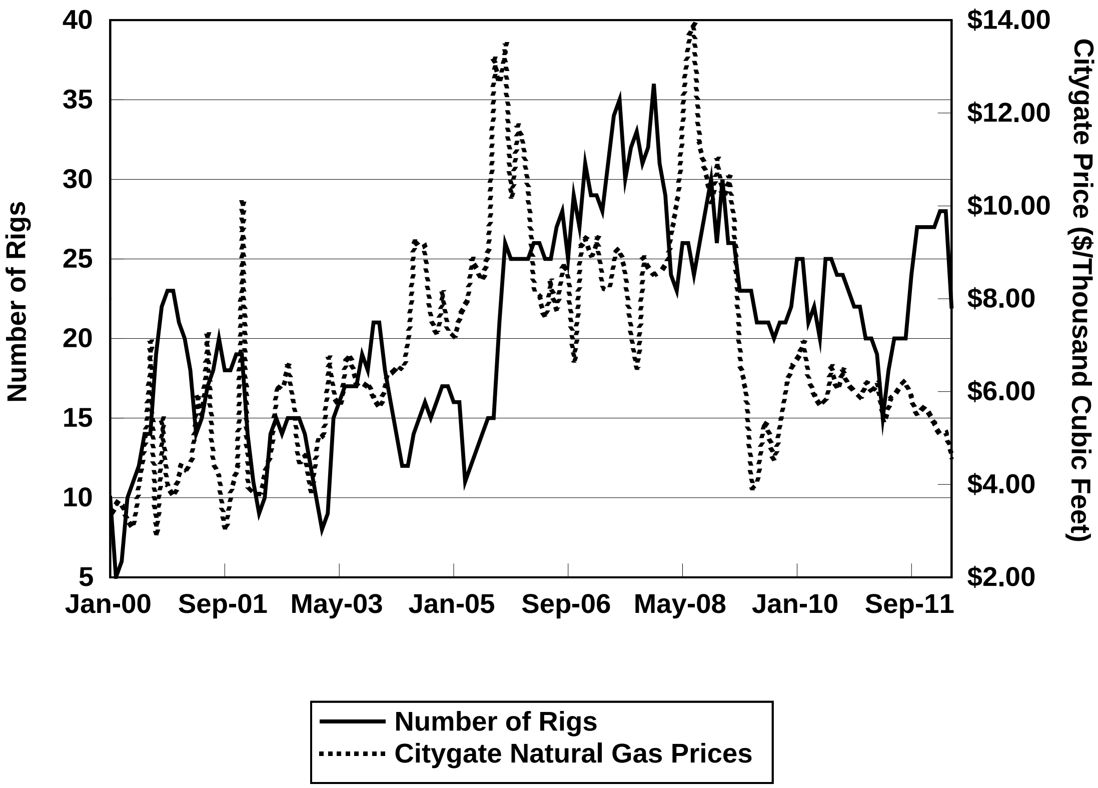
Figure 19: Natural gas at the wellhead forecast prices (2010 dollars per Mcf), 2009-2035



4.5 West Virginia drilling rigs

Figure 20 maps the number of natural gas rigs in West Virginia against the state citygate natural gas prices from 2000 to 2012. The state had the least amount of rigs in February 2000 with only 5 rigs. This coincided with some of the lowest prices for natural gas over the twelve-year period. Rig counts increased after the early months of 2000, but began to fall again after December of that year. The number of rigs and citygate natural gas prices fluctuated dramatically—though not in alignment with one another—over the time frame, with rig counts increasing significantly in mid-2005 and peaking at 36 rigs in December 2007. A downward trend in natural gas rigs and prices began thereafter, reaching a low point in April 2011, before rebounding to 25 rigs in June 2012 despite a falling trend in prices.[50]

Figure 20: Number of rigs and citygate natural gas prices in West Virginia, 2000-2012



Source: Baker Hughes and US Energy Information Administration

4.6 West Virginia natural gas employment trends

Natural gas industries provide many employment opportunities for West Virginian. Table 16 and Figure 21 show state employment in seven different NAICS-defined natural gas-related activities between 2001 and 2011. Though it provided fewer than 1,300 jobs in 2001, support activities for oil and gas operations employed the most individuals of the listed industries after 2007, and had 3,765 employees as of 2011. Oil and gas extraction employed nearly 2,200 people by 2011, followed by oil and gas pipeline and related structures construction with 1,918 employees. Employment in the pipeline transportation of natural gas and natural gas distribution industries experienced overall decreases during the 11-year period.

[50] Baker Hughes, "Rigs by State - Current & Historical," (2012).

Employment in oil and gas field machinery and equipment manufacturing has consistently supplied the least amount of employment of the seven sub-industries, though data is not available after 2009. Workforce West Virginia also had a limited amount of data for drilling oil and gas wells employment.[51]

Excluded from this data are the various ancillary jobs that have been generated from the growth in the natural gas industry associated with the development of the Marcellus shale within West Virginia during the past decade and continuing to the present. For example, the total jobs created (direct, indirect and induced) in 2009 was estimated at 7,600.[52]

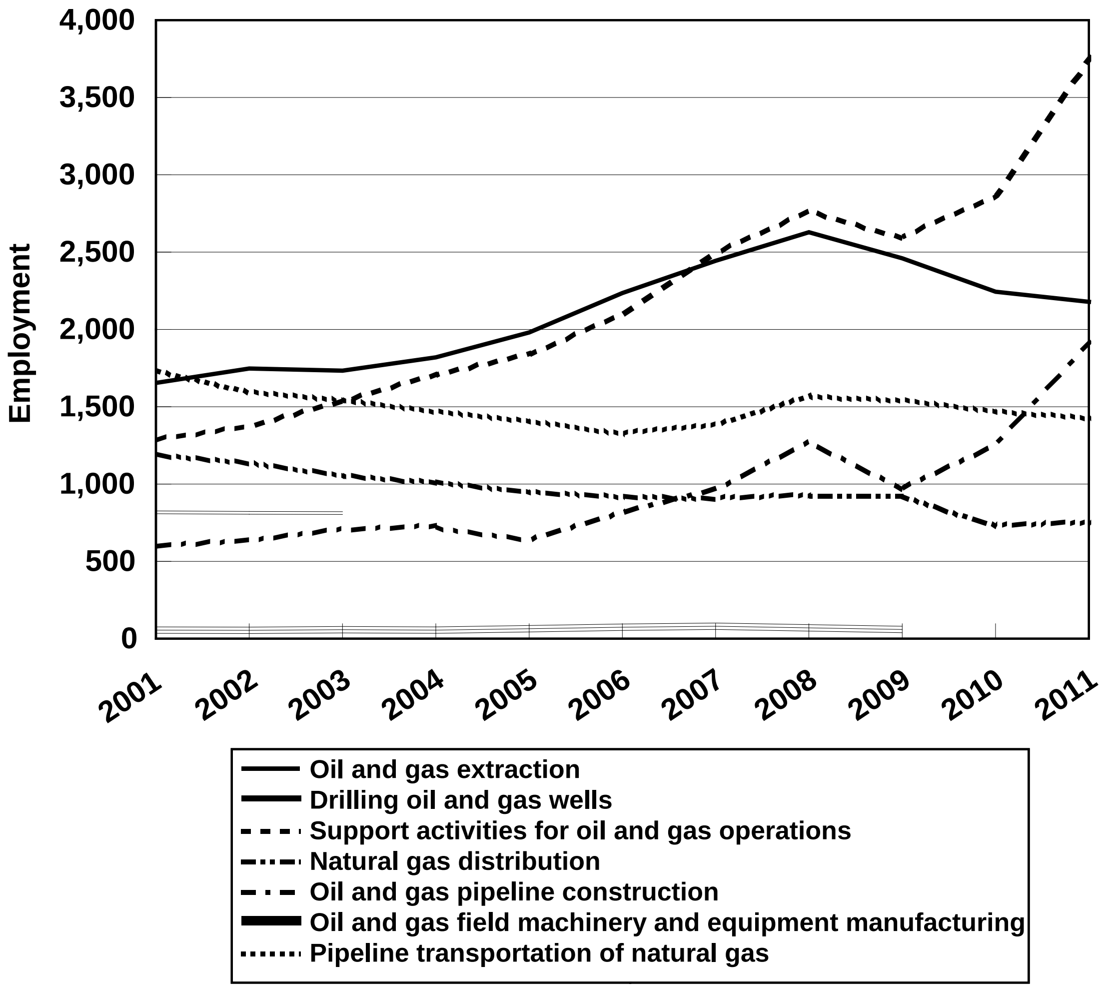
Table 16: West Virginia employment by NAICS industry, 2001-2011

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Oil and gas extraction	1,654	1,747	1,733	1,819	1,980	2,236	2,444	2,629	2,460	2,244	2,179
Drilling oil and gas wells	821	818	816	(N/D)	(N/D)	(N/D)	(N/D)	(N/D)	(N/D)	(N/D)	(N/D)
Support activities for oil and gas operations	1,289	1,370	1,540	1,705	1,841	2,099	2,496	2,773	2,608	2,865	3,765
Natural gas distribution	1,198	1,140	1,059	1,023	961	928	917	923	926	737	751
Oil and gas pipeline construction	601	638	711	727	640	826	965	1,276	983	1,257	1,918
Oil and gas field machinery and equipment manufacturing	60	59	63	60	69	79	85	(N/D)	64	(N/D)	(N/D)
Pipeline transportation of natural gas	1,738	1,600	1,549	1,483	1,419	1,334	1,387	1,571	1,551	1,473	1,437

(N/D) Non-disclosure. Source: Workforce West Virginia.

[51] Workforce West Virginia, "Wage Data," (2012).
[52] Amy Higginbotham et al., *The Economic Impact of the Natural Gas Industry and the Marcellus Shale Development in West Virginia in 2009*Bureau of Business and Economic Research, West Virginia University, 2010), 56.

Figure 21: West Virginia employment by industry, 2001-2011



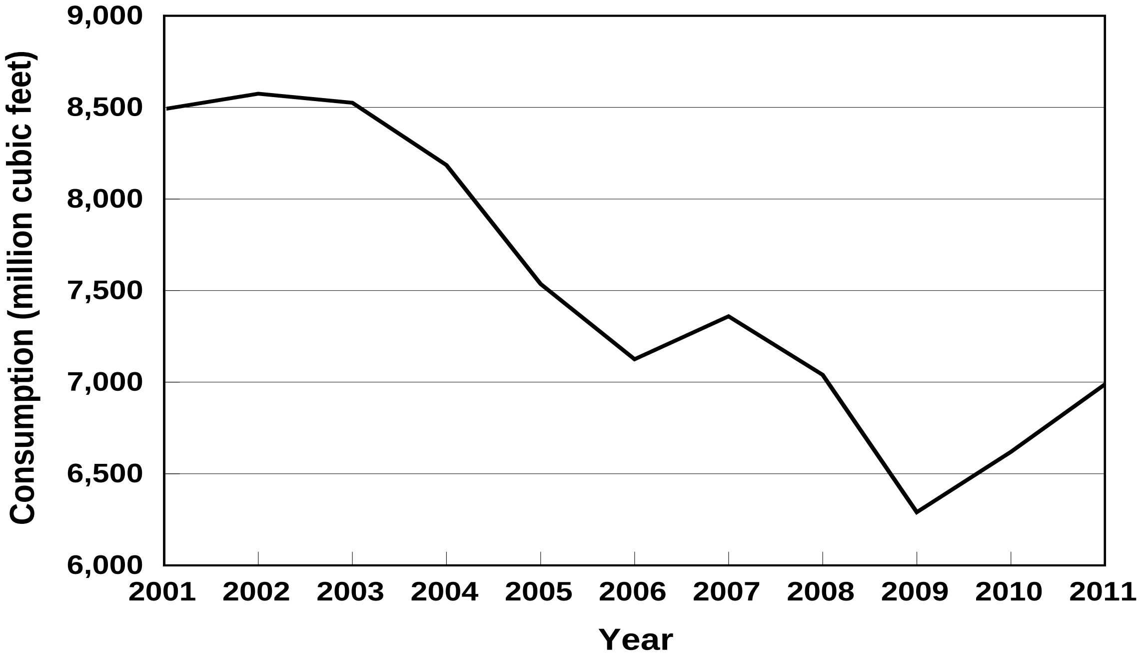
Source: Workforce West Virginia

4.7 Consumption and value added opportunities associated with natural gas

Consumption of natural gas in West Virginia experienced an overall decline between 2001 and 2011, as shown in Figure 22. In 2001, state natural gas consumption was recorded at just less than 8,500 MMcf and peaked the following year at 8,575 MMcf. Over the next four years, consumption decreased to 7,125 MMcf in 2006. Despite an increase in 2007, consumption continued to fall at an increasing rate, reaching a low point of 6,290 MMcf annually in 2009. Since then, consumption has been increasing, and was 6,988 MMcf in 2011, the most recent year data was available.[53]

[53] US Energy Information Administration, "Natural Gas Delivered to Consumption in West Virginia (Including Vehicle Fuel)," (2012).

Figure 22: West Virginia annual natural gas consumption, 2001-2011



Source: US Energy Information Administration

4.7.1 Natural gas as a transportation fuel

As oil prices rise along with environmental concerns, the need for an alternate fuel vehicle becomes more pressing. One of the best options available to meet the country's growing demand for a substitute for gasoline and diesel is natural gas vehicles (NGVs). NGVs can be light-duty (sedans, vans, and small trucks), medium-duty (large passenger vehicles such as buses, shuttle vans, and large trucks), or heavy-duty (large freight-hauling vehicles), though the technology is currently most commonly used for large fleet vehicles that travel long distances.

These vehicles run on either compressed natural gas (CNG) or liquefied natural gas (LNG). Light-duty NGVs use CNG, which requires more storage space than gasoline, so these vehicles tend to have smaller trunk spaces and need to refuel more often than their gasoline or diesel-fueled counterparts. Medium- and heavy-duty vehicles can run off either type of natural gas fuel, but LNG requires less space than CNG and therefore supports longer travel distances. CNG is less expensive to produce and store than LNG because the liquefied form must be cooled and stored in cryogenic tanks.[54] It is anticipated that most fueling stations that come to the area will supply CNG.

In addition to vehicles that run solely on natural gas, known as "dedicated" vehicles, some systems are able to run on natural gas or gasoline. These vehicles are called "dual-fuel" or "bi-fuel" systems. Rather than buying a new dedicated NGV, there is also the option of converting an existing vehicle to run on natural gas by retrofitting equipment that will allow the vehicle to process the different fuel. CNG can be used in certain vehicles that have been converted to run on both natural gas and gasoline. The national organization Natural Gas Vehicles for America (NGVA) asserts that the conversion of a light-duty

[54] Christopher R. Knittel, *Leveling the Playing Field for Natural Gas in Transportation*,[2012].

vehicle would cost between $12,000 and $18,000, depending on the amount of fuel capacity requested by the customer. Approved conversion kits for heavy-duty vehicles (over 14,000 lbs.) are scarce, though as there is growing interest in that market more systems may be expected in the future.[55]

The Honda Civic GX is currently the only passenger NGV in the US market, according to NGVA, and is significantly more expensive in purchase price and maintenance than its hybrid or original counterparts. The demand for light-duty NGVs is not growing very quickly, and due to economies of scale, vehicle production costs will not decrease until more units are sold. On the other hand, General Motors, Ford, and Chrysler have said they will build several thousand medium-duty pickup trucks and vans this year that will run on bi-fuel systems to meet the growing demand for NGVs in the natural gas exploration and production industries. [56]

While there are roughly 12 million natural gas vehicles in operation around the world, only 110,000 to 120,000 of them are found in the United States. Between 25,000 and 30,000 of these are light-duty vehicles used as government or private fleets, while medium-duty vehicles, primarily shuttle vans and work trucks, make up around 20,000 of this number.[57] As of 2010, fewer than 40,000 heavy-duty NGVs were on US roads—that accounted for only 0.4 percent of all heavy-duty vehicles in the nation. Less than 1,000 heavy-duty NGVs were sold in 2010, and natural gas represented only 0.3 percent of fuel consumed by heavy-duty vehicles.[58]

The reasons for increasing NGV usage are many. With the recent discoveries of large domestic natural gas reserves (see Table 13), the United States could decrease its dependence on foreign oil and thereby reduce the trade deficit and US economic vulnerability to oil shocks. In addition, as oil prices rise, natural gas is remaining relatively inexpensive—in fact at the end of 2011, oil was trading at a premium five times higher than natural gas (see Figure 23). From an environmental perspective, using natural gas instead of other fossil fuels reduces emissions of greenhouse gases (GHGs) and health problems associated with them. While natural gas also bears fewer negative externalities than gasoline usage, petroleum fueling is the status quo and the market will require policy interference if it is to reach an efficient balance between the two fuels.[59]

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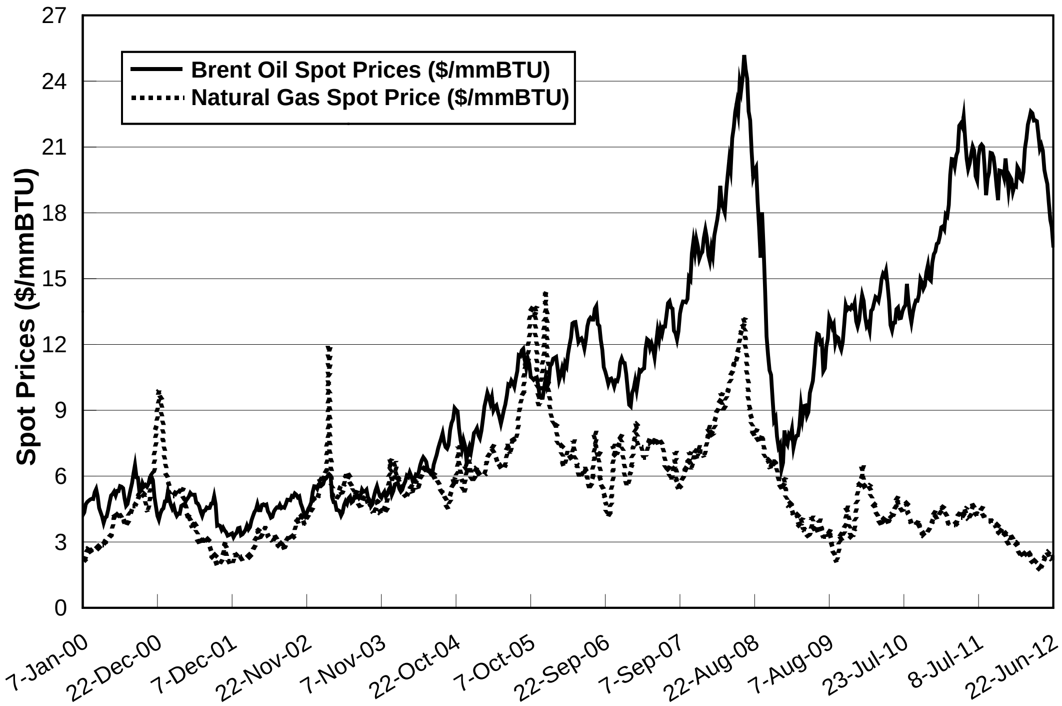
[55] Natural Gas Vehicles for America, *Fact Sheet: Converting Light-Duty Vehicles to Natural Gas* (Washington, D.C.: Natural Gas Vehicles for America, 2011).
[56] Tom Fowler, "America, Start Your Natural Gas-Engines," (2012)
[57] Stephen Yborra, "The Compelling Case for Natural Gas Vehicles (NGV)" Feb. 16, 2012, 2012).
[58] US Energy Information Administration, *Annual Energy Outlook 2012*
[59] Knittel, *Leveling the Playing Field for Natural Gas in Transportation*

Figure 23: Weekly oil and natural gas spot prices, 2000-2012 ($/MMBtu) [60]



Source: US Energy Information Administration

The private benefits of switching from a gasoline-powered vehicle to an NGV must also be taken into consideration. When comparing the Honda Civic CNG and gasoline models, the vehicles' combined city and highway fuel economies are equal at 31 mpg, and though the CNG model stores significantly less fuel, it produces 18 percent fewer CO_2 emissions. Also, due to the low price of natural gas compared to gasoline, savings on fuel outweigh the extra cost of an NGV. The lifetime savings from purchasing a NGV rather than a traditional gasoline vehicle are estimated to be about $2,000 in the case of a 30 mpg sedan and over $116,800 for a 5 mpg heavy-duty truck.[61]

One of the obstacles to widespread light-duty NGV use is the high cost of production, and therefore the high sales price. A CNG-fueled vehicle costs so much more than its gasoline-fueled predecessor that it can take over nine years for the car to pay for itself through fuel savings. However, many companies are currently working on design changes that will lower production costs and entice more buyers. Some of these design changes include making lighter, higher-capacity fuel tanks made from alternative materials.[62]

[60] One may note that midway through October 2005, oil prices exceed natural gas prices per unit of energy. This trend continues without exception through June 2012. The natural gas spot price data for this figure were collected directly from the US EIA in dollars per million British thermal units ($/mmBTU) form. The Brent oil spot price data was gathered from the EIA in $/barrel form and converted to $/mmBTU by the authors. For a ratio of oil and natural gas prices per unit of energy, please see Figure 1 in (Knittel 2012).

[61] For a more in depth cost-benefit analysis of buying an NGV rather than a conventional gasoline vehicle, see Table 2 in (Knittel 2012).

[62] (Fowler 2012).

Natural gas vehicles require a fueling infrastructure to service the vehicles. When it comes to fueling NGVs, there are several different options for fill-up stations. Some stations can be used by members of the public with personal vehicles, while others are restricted to private fleet-use only. Some private stations allow public users to fill-up at their pumps, but of the 1,100 natural gas stations in the nation, over half are used only by fleet vehicles and are not open to the public. Furthermore, many of these stations are located in one state: California. Compared to the 157,000 public gasoline stations in the United States (2010), NGV fueling stations are very scarce.[63]

Natural gas fueling stations may also carry either CNG or LNG. CNG stations have either fast-fill technology or time-fill technology. The fast-fill option is typical of retail stations that attract light-duty vehicles that need to fill-up often. Because the fuel is provided as a gas and not a liquid, a significant amount of new infrastructure would need to be added to retrieve the natural gas from a local utility line, compress it and store it so that it will transfer to the vehicle quickly, and finally dispense it into the vehicle. The equipment needed for each fueling "pump" would be about the size of a regular parking space. Time-fill CNG stations are primarily used by fleets that have a central refueling station and time available to fill their large tanks overnight, or by private drivers with a home fueling station. The CNG at these stations is delivered at a lower pressure, so though it takes more time to fill-up the fuel is pumped directly from the compressor, eliminating the extra storage space required at fast-fill stations.[64]

LNG stations can be mobile, containerized, or customized. The mobile stations are carried by a tanker truck with metering and dispensing capabilities. Containerized stations, also known as starter stations, include a storage tank and dispensing, metering, and containment equipment. Custom LNG fueling stations have larger storage capacities that are suited to a fleet's needs. Because the natural gas at an LNG station is a liquid, the fueling infrastructure is much like that of gasoline or diesel. However, protective clothing is required while fueling due to the dangerously cold nature of the liquid form.[65]

Installing CNG capacity to an existing gas station can cost around $500,000, if the original station has access to natural gas pipelines. Despite high costs new CNG fueling stations are beginning to emerge. Love's Travel Stops & Country Stores, a company from Oklahoma City, has partnered with Chesapeake Energy and will open 10 new retail outlets with CNG pumps during the summer months of 2012. This spring, another company, Kwik Trip Inc., also opened its first of several CNG fueling stations aimed at personal NGV divers in La Crosse, WI.[66]

In-home fueling stations are available for private NGV owners that require only close proximity to an electrical outlet and access to a natural gas line. These systems take about six hours to fill a tank and cost around $4,000 before installation charges. In an effort to make in-home fill-stations more attractive, Atlanta Gas Light Company is offering to install the system for free when a customer agrees to a five-year lease of the equipment at $60 per month.[67]

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[63] (US Energy Information Administration 2012b; US Energy Information Administration 2012d).
[64] US Alternative Fuels Data Center, "Compressed Natural Gas Fueling Stations," (2012).
[65] US Alternative Fuels Data Center, "Natural Gas Fueling Infrastructure Development," (2012).
[66] Fowler, *America, Start Your Natural Gas-Engines*
[67] Ibid.

While the upfront costs for fueling infrastructure can act as significant deterrents to potential investors, the federal government has created a number of grants, programs and other incentives that make pursuing natural gas transport options worthwhile:[68]

- Advanced Energy Research Project Grants
- Advanced Technology Vehicle (ATV) Manufacturing Incentives
- Alternative Fuel Tax Exemption
- Improved Energy Technology Loans

Federal legislation is also in place that affects alternative fuel vehicles and infrastructure development:

- Aftermarket Alternative Fuel Vehicle (AFV) Conversions
- Vehicle Acquisition and Fuel Use Requirements for Federal Fleets, Private and Local Government Fleets, and State and Alternative Fuel Provider Fleets
- Vehicle Fuel Economy and Greenhouse Gas Emissions Standards

An increasing number of federal programs are being set in place to encourage and inform about the possibilities for natural gas transportation in the United States:

- Air Pollution Control Program
- Alternative Transportation in Parks and Public Lands Program
- Clean Cities
- Clean Fuels Grant Program
- Congestion Mitigation and Air Quality (CMAQ) Improvement Program
- National Clean Diesel Campaign (NCDC)
- Transit Investments for Greenhouse Gas and Energy Reduction (TIGGER) Program
- Voluntary Airport Low Emission (VALE) Program

Existing incentives for natural gas vehicle (and NGV infrastructure) owners in West Virginia include the AFV Tax Credit and the Alternative Fuel Infrastructure Tax Credit. The AFV Tax Credit is available for up to $7,500 or $25,000—depending on the weight of the vehicle in question—and applies to a converted vehicle or a new original that runs on either a dedicated or bi-fuel system. This credit is due to sunset on December 31, 2021. The infrastructure tax credit, scheduled to sunset on the same day as the AFV credit, benefits “taxpayers who construct or purchase and install qualified alternative fueling infrastructure.” The credit is for up to $10,000 for a home fueling station and $250,000 for a private fueling station; but is available up to $312,500 if the station serves the public, granted that the tax credit does not exceed construction costs.[69]

In addition, any county in West Virginia that uses one or more school buses that run on CNG is entitled to reimbursement from the state Department of Education. This payment is ten percent of the costs of maintenance, operation, etc. of the CNG school bus.[70] Also, there is a Provision for Establishment of Alternative Fuel Vehicle (AFV) Acquisition Requirements, which states that the state “Department of Administration may require that up to 75 percent of a state agency’s fleet consist of AFVs.” This

[68] US Alternative Fuels Data Center, "Federal Incentives and Laws for Natural Gas," (2012).
[69] *Alternative-Fuel Motor Vehicles Tax Credit,* Public Law 11-6D, (2011): 1.
[70] *Public School Support, Foundation Allowance for Transportation Cost,* Public Law 18-9A-7, (2011b): .

provision can be waived if undertaking the process and maintaining such a fleet would be unreasonably expensive when compared to conventional vehicle or fuel use. It also excludes law enforcement, emergency, school buses, and several other distinctions of agency or vehicle class.[71]

Despite the above incentives for vehicle owners and infrastructure constructors, legislative measures exist in West Virginia that are harmful to further progress with the NGV industry. Currently, the Alternative Fuel Production Subsidy Prohibition prevents political subdivisions from offering incentives or subsidies to producers of alternate fuels, excepting some coal-based liquid fuels.[72]

Other states, however, are moving forward with plans to make CNG and LNG fueling stations more readily available by following a “hub and spoke” model that will ensure fueling infrastructure is in place on major transportation corridors. Texas has a plan to connect its major cities, while California, Nevada, Arizona, and Utah are working on an interstate web to connect six significant transportation hubs. Closer to home, Pennsylvania is developing a plan for a Clean Transportation Corridor that is intended to supply CNG and LNG on routes between Pittsburgh, Harrisburg, Scranton, and Philadelphia.[73]

On June 19, 2012, West Virginia Governor Earl Ray Tomblin signed an executive order that created a Natural Gas Vehicle Task Force. This task force—consisting of current members of the state government and civilian members with relevant industry experience, all appointed by the governor—will “assess the feasibility of transitioning the state’s vehicle fleet to natural gas as a fuel source and developing an infrastructure to support compressed natural gas vehicles,” according to a press release from the Office of the Governor. The task force’s research will include a cost analysis of converting gasoline- or diesel-fueled vehicles to run on natural gas, the potential for a state-operated system of public natural gas fueling station, and possible partnerships with industry producers, developers, and manufacturers that would lead to expansion of the fueling infrastructure and investment in natural gas fuel opportunities.[74] In July, the governor also announced that the 2013 Appalachian Basin NGV Expo & Conference will be held in Charleston, WV, in May.[75]

A discussion paper published by the Brookings Institute suggests a number of infrastructure-, vehicle-, and fuel-based policy changes or implementations that would promote the expansion of natural gas usage in transportation. The author proposes pricing CNG at marginal cost for the retailer; forming an industry consortium to ensure LNG fuel at reasonable prices along major interstate routes; set a date by which a certain percentage of all new vehicles must be dual-fuel systems; create subsidies for NGVs due to their low negative externalities; and also to make the retrofitting certification process less expensive and more widespread. The paper offers several other suggestions and a cost/benefit analysis of each of its proposals.[76]

Another alternative to gasoline and diesel is currently being explored: propane. Propane, or liquefied petroleum gas (LPG), has been used to power propane vehicles for decades, and is a clean-burning, high-

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[71] *Use of Alternative Fuels in State-Owned Vehicles*, Public Law 5A-2A, (2011c): .
[72] *Intergovernmental Relations, Prohibition of Subsidies Or Incentive Payments; and Eligible Investment for Industrialization Revitalization*, Public Law 8-27A-3 and 11-13S-3D, (2011a): .
[73] US Energy Information Administration, *Annual Energy Outlook 2012*
[74] Office of the Governor Earl Ray Tomblin, "Governor Tomblin Signs Executive Order Establishing the Natural Gas Vehicle Task Force," (2012).
[75] Office of the Governor Earl Ray Tomblin, "Governor Tomblin Announces Appalachian Basin Natural Gas Vehicle Expo & Conference," (2012).
[76] Knittel, *Leveling the Playing Field for Natural Gas in Transportation*

energy fuel that accounts for only a fraction of a percent of transportation fuel used today. While relatively inexpensive, propane has a lower energy by unit rating than gasoline or CNG—it takes more fuel to drive the same distance. There are currently about 270,000 propane vehicles in use in the nation. Many of these are fleet vehicles. Because propane burns cleanly, engine life in a propane vehicle is often double that of a similar gasoline-powered machine.[77]

The fueling infrastructure for propane is similar to that of gasoline and diesel, and because production, storage, and bulk distribution capabilities for the fuel are already widespread across the United States, only the individual dispensing equipment needs to be purchased or constructed in many places. The cost for the storage tank, pump, and dispenser combined can range between $37,000 and $175,000. Retailers with existing refill capabilities for small tanks (used for gas grills, mowers, etc.) can upgrade relatively easily to accommodate vehicle fueling. Propane fueling infrastructure and vehicle development often fall under the same federal and state legislation, programs, and incentives for alternate fuel vehicles as NGVs and natural gas fueling infrastructure.[78]

As oil supplies decline and prices rise, it is imperative to start looking at alternative fueling methods for transportation. Natural gas should be high on the list of options, due to the large domestic reserves recently discovered. There are many benefits to developing NGVs, whether they are private or public, economic or environmental. However, without fueling infrastructure, drivers are unlikely to purchase NGVs; without a consumer-base, retailers are unlikely to carry CNG or LNG. In order to encourage widespread use of NGVs and the accompanying infrastructure, policy changes must be enacted that will allow both sides of the industry (consumers and producers) to thrive with diminished risk of losing their investment.

4.7.2 Liquefied natural gas for export

While natural gas is being transported or stored throughout the US for consumers, it is also being liquefied to be stored and transported to other countries. Liquefied natural gas is natural gas that has been cooled to -260ºF. It is approximately 600 times smaller by volume than the gaseous form and can be loaded onto takers to be transported outside of the country. Liquefied natural gas, once transported, is returned to a gaseous form for use by residential, commercial, and industrial consumers at its ultimate destination.

Dominion received approval in July 2012 from the DOE for a license to use its Cove Point facility in Maryland to export LNG overseas and has begun the FERC Pre-filling Process. The projected in-service date for the Dominion Cove Point LNG terminal for export would be March 2017. Once operational, the use of Dominion’s pipelines will extend West Virginia natural gas supplies to an additional market.

4.7.3 Other value-added opportunities from natural gas

Natural gas at the well is categorized as either ‘dry’ or ‘wet’ depending upon the amount of other hydrocarbons present besides methane. The other hydrocarbons present include ethane, propane, and butane, among others. Most gas will need to be processed at a natural gas processing and fractionating plant prior to delivery to pipelines for transport to the ultimate consumers. With the Marcellus Shale development additional supplies of gas are being supplied to existing plants, necessitating the development of new natural gas processing and fractionation facilities.

[77] US Alternative Fuels Data Center, "Propane," (2012).
[78] Ibid.

Dominion has announced a $500 million construction project along the Ohio River at Natrium, West Virginia, that can process upwards of 200 MMcf per day and fractionate 36,000 barrels of natural gas liquids per day.[79] This plant is projected to be in service by December 2012 and may be expanded in a second phase if sufficient additional producer commitments are secured. This plant addition complements other natural gas liquids processing plants in the state and will primarily produce ethane, propane and butane.

The future development of the Marcellus Shale plays within West Virginia will result in significant amounts of ethane, propane and other hydrocarbons being delivered to markets, primarily out of state at this point. To capitalize on these opportunities Governor Tomblin created the West Virginia Marcellus to Manufacturing Task Force in 2011 with the following goals:

- Analyze the feasibility of converting ethane to ethylene in West Virginia including available sites for ethane crackers.
- Locate and analyze existing infrastructure including pipelines and storage facilities.
- Identify potential companies specializing in the construction and operation of ethane crackers.
- Identify companies with capital and other resources to invest in the natural gas, ethane conversion and revitalization of the state's chemical and manufacturing industries.
- Formulate a comprehensive Marcellus to Manufacturing Action Plan.

One outcome was the passage of HB 4086 during the 2012 Session that was signed into law by Governor Tomblin. This bill provided a reduction in personal property taxes for a company that invests at lead $2 billion in building an ethane cracker in West Virginia.

Aither Chemicals has announced its plan to build an ethane cracker in the Kanawha Valley while other firms are also considering locations within West Virginia. If one or more ethane crackers are located in the state, the economic impacts could be considerable. According to a 2011 study by the American Chemistry Council, the ongoing development of new petrochemical production resulting from a world-class ethylene cracker and affiliated polyethylene and other downstream derivative plants could be upwards of over 12,000 jobs annually.[80]

4.8 Natural gas pipelines

The US natural gas pipeline network is a sprawling interconnected transmission and distribution grid that can transport natural gas to and from locations across the nation. The pipeline and grid system is comprised of more than 210 natural gas pipeline systems composed of more than 305,000 miles of interstate and intrastate transmission pipelines. Roughly 1,400 compressor stations maintain pressure on the pipeline network and assure continuous forward movement of the gas to more than 11,000 delivery points, 5,000 receipt points, and 1,400 interconnection points that provide for the transfer of natural gas throughout the United States. Running underneath the pipeline network are 400 underground natural gas storage facilities. There are also 49 locations where natural gas can be imported and exported via pipelines including eight LNG (liquefied natural gas) import facilities and 100 LNG peaking facilities.[81]

[79] Dominion, "Dominion News," (2012).
[80] American Chemistry Council, *Shale Gas and New Petrochemicals Investment in West Virginia*,[September 2011].
[81] Electricity Administration Association, "About US Natural Gas Pipelines," (2012).

Currently twenty natural gas pipelines are operational within the Northeast region.[82]These interstate pipelines transport natural gas to intrastate natural gas pipelines, local distribution companies throughout the region, industrial firms, and increasingly natural gas fired electric power generation facilities.

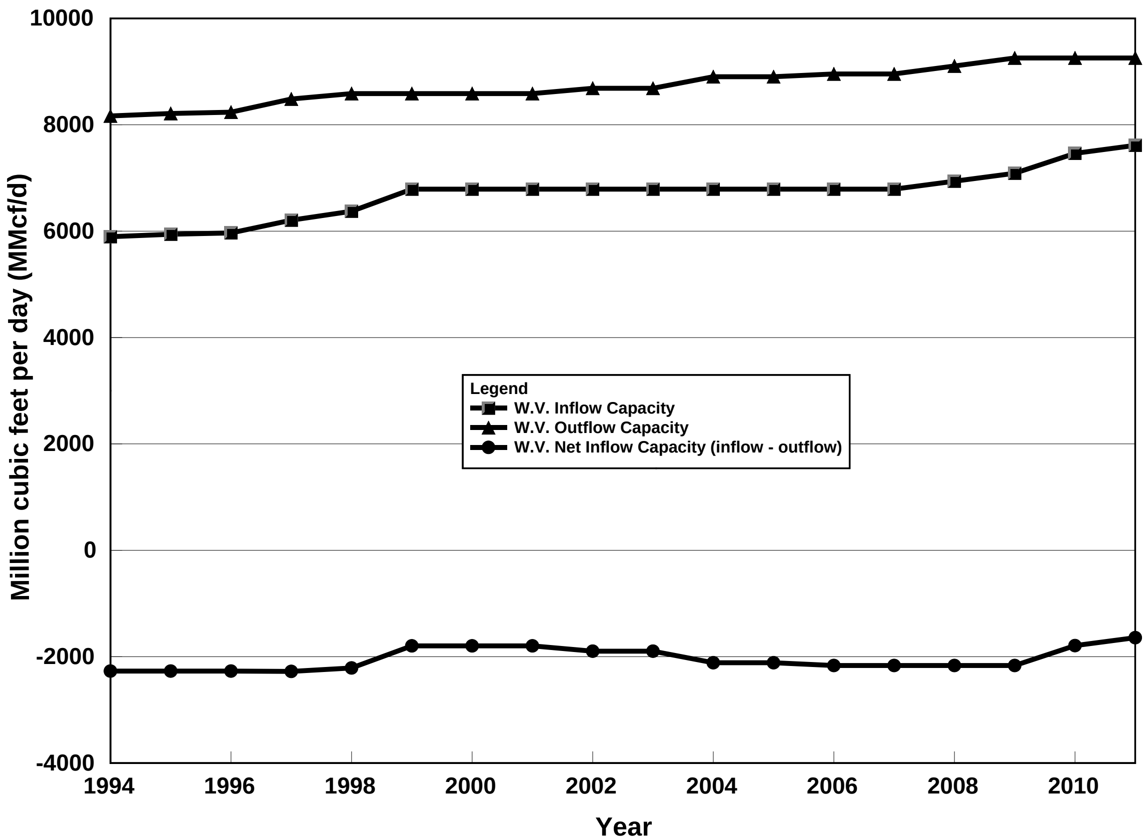
The Northeast region pipeline system and local distribution centers have access to supplies from several major domestic natural gas producing areas and from Canada. Domestically produced natural gas flows into the Northeast region from the southeast into Virginia and West Virginia. From the Midwest it flows into West Virginia and Pennsylvania. Imports from Canada enter the region primarily through New York, Maine, and New Hampshire.

The largest interstate natural gas pipeline system in the Northeast region is operated by the Columbia Gas Transmission Company with a daily capacity of 9.4 bcf (billion cubic feet) per day. Columbia's pipeline network provides regional service to the states of Maryland, New Jersey, New York, Pennsylvania, Virginia, and West Virginia, but also extends into the Ohio in the Midwest region and Kentucky and North Carolina in the Southeast region.

In addition to those that transport natural gas into the region, several smaller interstate natural gas companies operate totally within the Northeast region. These pipelines were developed to transport local production to regional markets. One of these systems is operated by Equitrans Inc. (0.1 bcf/day), serving West Virginia and Pennsylvania. The areas of West Virginia and Pennsylvania were once the Northeast region and the nation's largest natural gas producing area and, consequently, have many local gathering, distribution, and storage interconnections.[83]

[82] The Northeast region is comprised of Connecticut, Delaware, Massachusetts, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Virginia and West Virginia.
[83] Electricity Administration Association, "Natural Gas Pipelines in the Northeast Region," (2012).

Figure 24: West Virginia natural gas state-to-state transmission capacity, 1994-2011



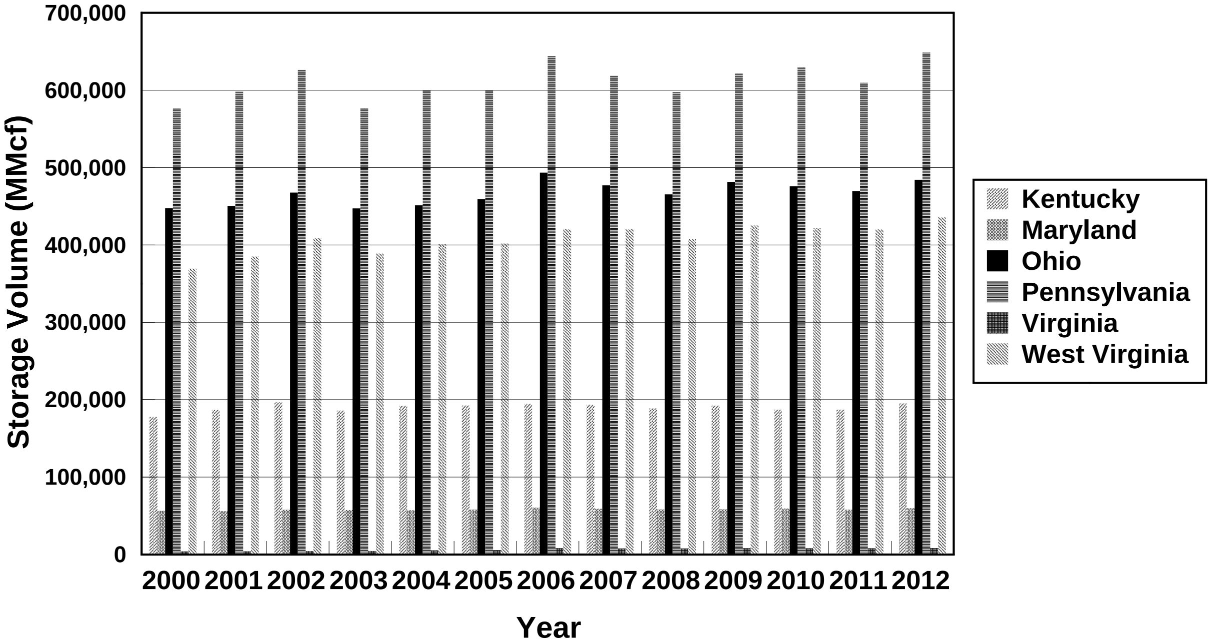
Source: U.S. Energy Information Administration

4.9 Storage of natural gas

Figure 25 displays underground natural gas storage volume in Kentucky, Maryland, Ohio, Pennsylvania, Virginia, and West Virginia. At 435,670 MMcf feet in 2012, West Virginia's storage volume was the third largest of the states listed above. Pennsylvania has the largest capacity (648,699 MMcf), followed by Ohio (484,228 MMcf). Kentucky and Maryland have significantly smaller storage capacities, and Virginia can store only a fraction of what West Virginia is able to hold, with only 8,186 MMcf capacity. Between 2000 and 2012, West Virginia's storage volume increased by over 66,000 MMcf, while Pennsylvania's capacity increased by just over 72,000 MMcf, and Ohio's storage volume grew by 36,616 MMcf. The other states experienced much less storage capacity growth over the same time period.[84]

[84] US Energy Information Administration, "Underground Natural Gas Storage by all Operators," (2012).

Figure 25: Annual average natural gas underground storage volume (Mcf) of select states, 2000-2012



Source: US Energy Information Administration

National underground storage volume is listed along with the same select states in Table 17 includes those states and the nation. In 2000, West Virginia represented 5.9 percent of US storage capacity, while Pennsylvania had 9.3 percent and Ohio had 7.2 percent. Kentucky, Maryland, and Virginia all had portions of national underground storage volume that were less than 1.9 percent.[85] By 2012, West Virginia, Kentucky, and Virginia's shares of national storage capacity had increased minimally, while Pennsylvania, Ohio and Maryland saw declining shares of national natural gas storage volume.[86]

[85] Percentage calculations in this paragraph are the work of the author, not the US Energy Information Administration.
[86] Ibid.

Table 17: Annual Average Natural Gas Underground Storage Volume (MMcf) of Select States, 2000-April 2012

Year	Kentucky	Maryland	Ohio	Pennsylvania	Virginia	West Virginia	US
2000	177,661	56,288	447,612	576,602	3,910	369,341	6,210,104
2001	186,717	55,774	450,624	598,361	4,126	385,062	6,335,558
2002	196,629	57,835	467,731	626,455	4,345	409,127	6,715,545
2003	185,823	57,248	447,234	576,665	4,421	388,867	6,256,805
2004	191,931	57,174	451,346	599,821	5,263	400,933	6,460,054
2005	192,380	58,004	459,423	600,002	5,542	401,819	6,492,884
2006	194,809	60,476	493,449	644,299	8,047	420,817	6,860,307
2007	193,482	59,160	477,015	619,177	7,767	420,602	6,837,505
2008	188,646	58,204	465,402	597,431	7,660	407,325	6,592,182
2009	192,368	58,315	481,516	621,825	8,039	425,138	7,052,343
2010	187,069	59,337	475,993	629,697	7,969	421,438	7,052,461
2011	187,140	57,919	469,772	609,680	7,931	420,059	7,008,084
2012	195,142	59,678	484,228	648,699	8,186	435,670	7,309,614

Source: US Energy Information Administration, Data Table "Underground Natural Gas Storage by All Operators"

4.10 Oil

It is generally believed that over thousands of years, the remains of animals and plants were covered by layers of mud, sand, and silt that formed into sedentary rock. Geologic heat and the pressure of the overlying rock turned the biomass into a hydrocarbon-rich liquid that we call crude oil. Pressure underground eventually forced it into porous rock strata called reservoirs. There are also deposits of hydrocarbon-saturated sands and shale where geologic conditions have not been sufficient to turn the hydrocarbons into liquid.

Wells are drilled into oil reservoirs to extract the crude oil. When the reservoirs are first drilled, the pressure underground provides a “natural lift” to force the oil to the surface. The “natural lift” method is sufficient for a while until the natural pressure dissipates. Once the pressure has dissipated the oil must be pumped out using “artificial lift” created by mechanical pumps powered by gas or electricity. The previous methods are generally referred to as “primary” extraction methods and over time become less effective and “secondary” methods must be used. A common secondary method is “waterflood” injection of water into the reservoir to increase pressure and force the oil to the drilled shaft or “wellbore.” Eventually the secondary extraction methods become less effective and “tertiary” methods must be used to increase the oil’s flow characteristics. These methods include injecting steam, carbon dioxide, and other gases or chemicals into the reservoir. In the United States primary extraction methods account for less than 40% of daily oil production, secondary methods account for half, and tertiary methods cover the remaining 10%. Following extraction, the crude oil is sent to refineries where it is processed.[87]

Another more recent technological advance in oil production has been the use of horizontal drilling into oil shale deposits. Horizontal drilling is combined with multi-staged hydraulic fracturing to create

[87] Consumer Energy Report via EIA. "Crude Formation and Production." Consumer Energy Report, accessed 8/3, 2012, http://www.consumerenergyreport.com/research/crude-oil/crude-formation-and-production/.

permeable flow paths from wellbores into shale units.[88].Horizontal drilling allows for multiple wells to be tapped from one drilling pad, whereas traditional vertical drilling allows for only one well to be drilled from pad site.

Originally built in 1972 by Quaker State, the refinery at Newell, WV was acquired by a new firm Ergon – West Virginia Inc. (EWV) in 1997. The Newell refinery utilizes high-pressure hydro treating technology to produce highly refined paraffinic specialty products and fuels from local Appalachian grade crude oil. EWV currently has the capacity to produce 20,000 barrels of crude oil per day which represents 0.1% of total US production. EWV processes 100% Appalachian grade paraffinic crude oils, particularly Pennsylvania grade gathered from approximately 40,000 facilities throughout Ohio, Pennsylvania, West Virginia, Kentucky, and New York.

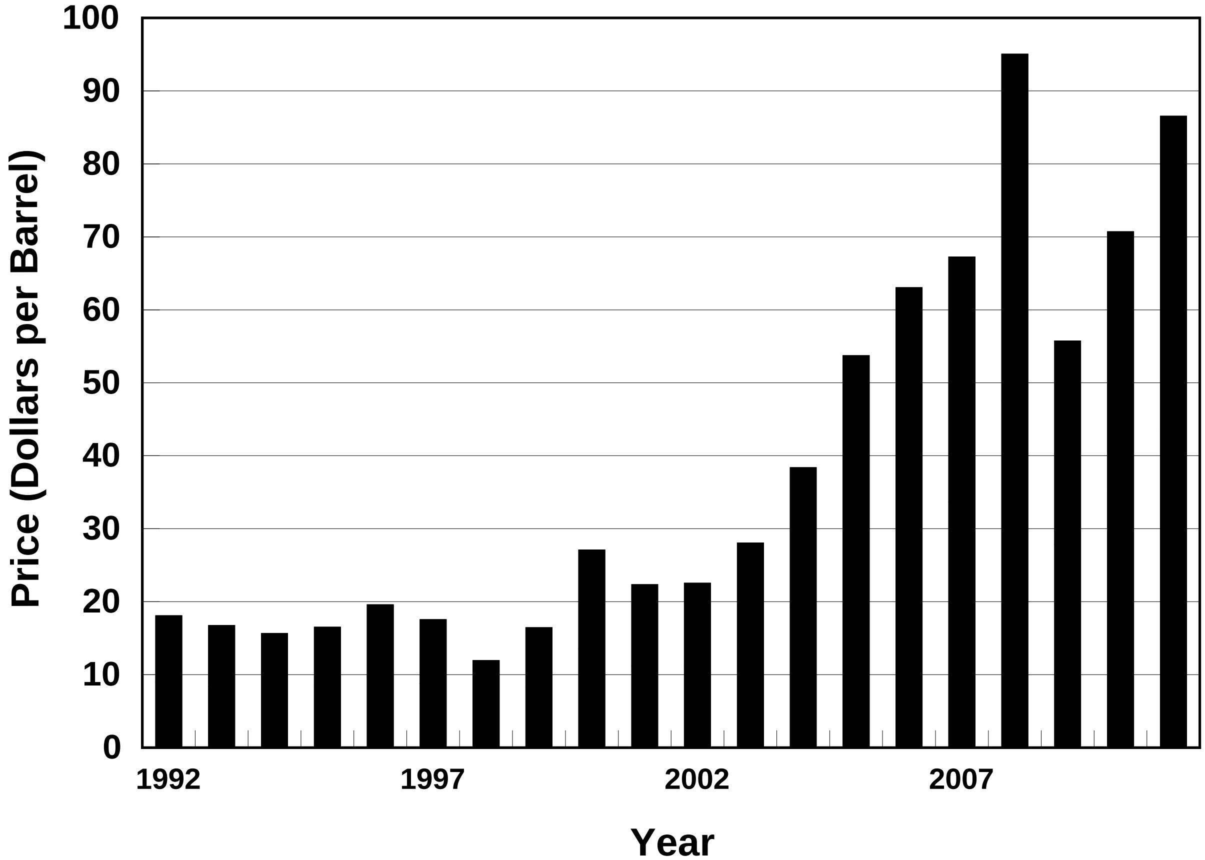
Crude refined at EWV produces a very high yield of paraffinic specialty products when compared with other types of crude oil processed by paraffinic competitors. Initially the crude is handled by Ergon Oil Purchasing and is then transferred by truck or pipeline to gathering centers in Ohio and Pennsylvania before moving on to the refinery via barge, truck, and pipeline.

After the refining process, the ultra-low sulfur fuel products are sold at the refinery rack or by barge within EWV’s regional market. The process and base oils refined by EWV are used in a wide variety of applications, including compounding motor oils, gear oils, greases, pharmaceutical and agricultural spray oils, food grade applications, and in high-temperature rubber applications.

As of 2009 West Virginia had 19 million barrels of crude oil reserves or about 0.1% of total US reserves and 3,965 crude oil producing wells or about 0.8% of the US total. Petroleum fired electricity generation facilities generated 10 thousand MWh of power during the month of April 2012. Figure 26-Figure 28 provide information on historical West Virginia crude oil prices, reserves, and production.

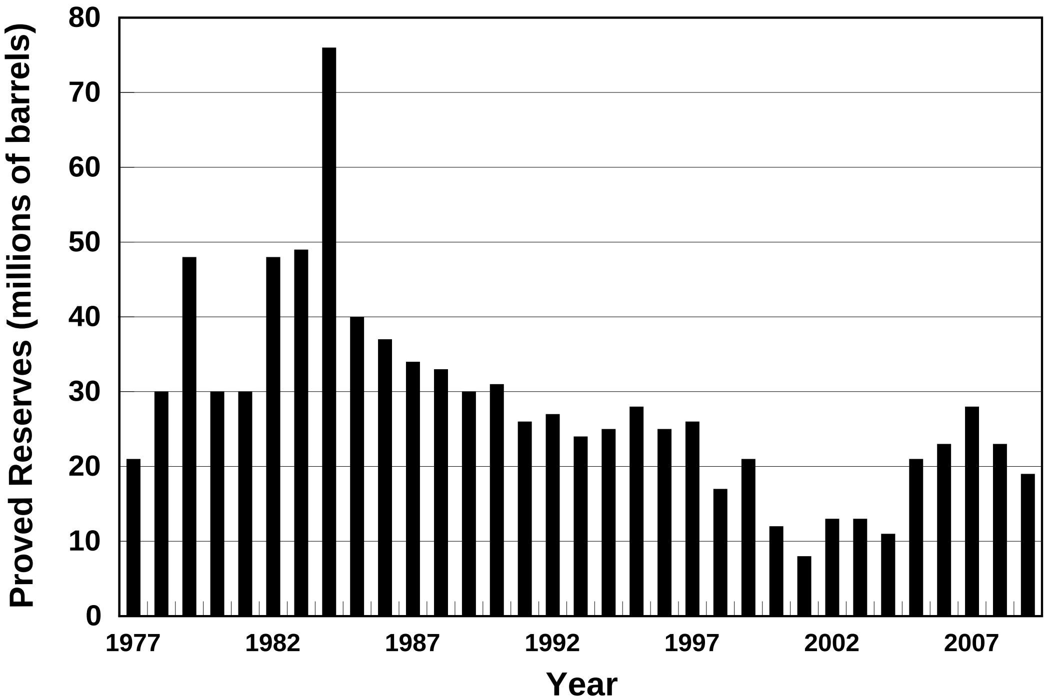
[88] Ohio Department of Natural Resources. "Marcellus and Utica Shales Data." Ohio Department of Natural Resources, accessed 8/7, 2012, http://www.dnr.state.oh.us/tabid/23014/default.aspx.

Figure 26: West Virginia annual crude oil first purchase price, 1992-2011



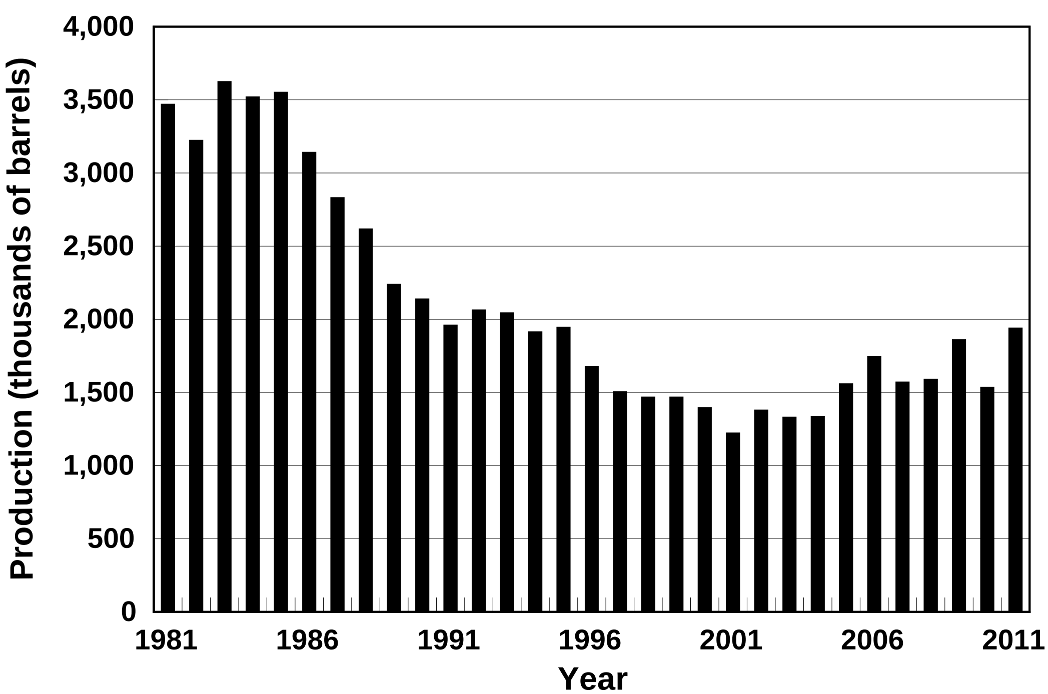
Source: US Energy Information Administration

Figure 27: West Virginia crude oil proved reserves, 1977-2009



Source: US Energy Information Administration

Figure 28: Annual West Virginia field production of crude oil, 1981-2011



Source: US Energy Information Administration

4.10.1 The future of oil shale

There is considerable uncertainty regarding the ultimate size of recoverable shale gas and shale oil resources. Since most shale gas and shale oil wells are still in their infancy, their long-term productivity is untested. Consequently, the amount of long-term production and the estimates of their ultimate recovery potential of oil and gas are uncertain. In emerging shale plays, production has been largely confined to those areas known as “sweet spots” that have the highest known production rates for the play. “Sweet spots” are the portions of the formation referred to as the “active area,” while the remaining portion of the formation that has seen little or no drilling activity is referred to as the “undeveloped area.” If the production rates for the sweet spots are used to infer the productive potential of entire shale plays, then their production potential will probably be understated. Many shale spots are so large (e.g., the Marcellus shale) that only portions have been extensively production tested.[89] While little shale oil has been produced from the Marcellus shale, many rigs have migrated to Ohio to develop the Utica shale, which has significant potential for oil along with ‘wet’ gas. The greatest oil shale development today is in the Bakken shale formation, particularly in North Dakota. Oil production in this state now ranks the state as the third leading oil producing state in the United States.

The United States has been a net importer of oil for more than 50 years, and today still imports a significant portion of its liquid hydrocarbon needs. The US Department of Energy (DOE) projects that US imports may double to 19.8 million barrels of oil per day by 2025. By then imports will exceed 70 percent or demand with the vast majority coming from the Organization of Petroleum Exporting Countries (OPEC). As imports rise, America’s vulnerability to price shocks, disruptions and shortages will also increase.

The OPEC embargoes in the 1970s provide an historic lesson and offer insight to the potential impacts of petroleum shortages. Although temporary, the shortages of the 1970’s drove oil prices higher, and led to high inflation, high unemployment and high interest rates almost simultaneously. These adverse effects can be expected in the future if the US once again experiences a supply shock.

US options for producing more liquid fuels are effectively limited to unconventional fossil energy sources, namely liquids from oil shale, coal and tar sand. The world’s conventional oil resources total 2.7 trillion barrels while North America’s unconventional resources total 3.7 trillion barrels. North America’s resources base of unconventional oil exceeds the world’s remaining conventional oil by nearly 40 percent.[90] Future production of US oil shale reserves could help maintain price stability in gasoline prices due to the increased supply from oil shale and oil sands.

[89] EIA. Review of Emerging Resources: US Shale Gas and Shale Oil Plays. Washington, DC: EIA, 2011.
[90] Office of Deputy Assistant Secretary for Petroleum Reserves. Strategic Significance of America’s Oil Shale Resource. Washington, D.C.: Office of Naval Petroleum and Oil Shale Reserves, 2004.

4.11 Key observations

- The continued development of the Marcellus shale formation will lead to significant additions to natural gas reserves and subsequent production.
- Wellhead prices of natural gas should rebound from recent low levels but Marcellus gas may trade at a discount to Henry Hub until additional processing, pipeline and end-user demand has been generated Future natural gas prices should be less volatile and, on average, tend to be relatively lower than prices experience in the early part of this century.
- Natural gas midstream processing is essential for realization of production potential.
- Natural gas storage capacity is reaching its limit much earlier in the year so development of more storage may be essential to allow for increased production.
- Natural gas liquids production provides significant opportunities for value added industry such as ethane crackers
- Introduction of LNG and CNG transportation vehicles and conversion of existing fleet, coupled with dedicated fueling stations, will increase the demand for natural gas.

5 Nuclear

Nuclear power is the source for 20 percent of the total electricity supply in the US[91] At the present time there are 31 states with at least one commercial nuclear reactor, with most located east of the Mississippi River to take advantage of water resources. All states surrounding West Virginia, except for Ohio, have nuclear power generation facilities.

Recent announcement by USEC Inc. of the American Centrifuge Demonstration, LLC, project in Piketon, Ohio, may result in job opportunities for West Virginians residing either in close proximity to the plant or working at West Virginia firms manufacturing parts for the plant.[92] This plant is designed to construct and operate centrifuge machines that can be used in the enrichment of uranium used in nuclear reactors.

West Virginia code (§16-27A-2) has a limited ban on the construction of nuclear power plants within West Virginia. No nuclear power plant, nuclear factor or nuclear electric power generating plant may be constructed or initiated until the West Virginia Public Service Commission has approved the application for this facility under the provisions outlined in West Virginia code. As a result nuclear power is not an option for consideration in the time period 2013-2017.

5.1 Key observations

- Nuclear Power will not be an option without a change in West Virginia code

[91] US Energy Information Administration, "What is the Status of the U.S. Nuclear Industry?" (2012q)
[92] http://www.usec.com/american-centrifuge

6 Electric Power

6.1 Overview of US electric power industry

In recent years the United States has experiences dramatic changes in the market for electric power. The 2008 recession reduced demand for electricity significantly from a peak of 3,766 TWh in 2007 to a low of 3,597 TWh two years later. The national market has mostly rebounded, but demand in West Virginia, which was 32 TWh in 2010, is still off its peak of 34 TWh in 2008. (See

Figure 29).

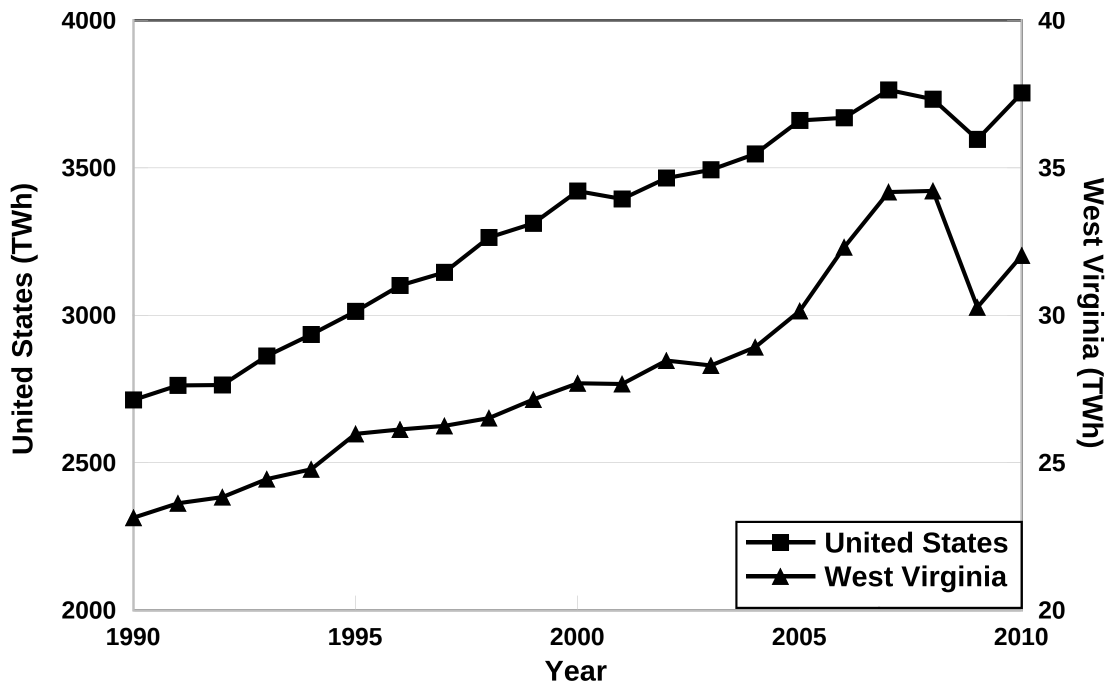
The sources of fuel for power generation have also shifted substantially in the last five years (See Figure 30). So far in 2012, coal's share of national power generation has averaged 35 percent. In April 2012, the share of electricity generation from natural gas rose to 32 percent, almost identical to the share from coal, a first in the nation's history. Generation from natural gas has risen primarily because of historically low natural gas prices due to increases in supply from shale gas production (see

Figure 31).[93] The EIA projects that the high natural gas generation levels will be short lived, however. Demand for natural gas at electric power generators is expected to fall over the next six months to a year as natural gas prices rise. This rise in natural gas versus coal will start to tilt economic dispatch back to coal at the margin. But natural gas will continue to provide a growing share of generation over the next 25 years as the overall demand for electricity increases, as will renewable sources, which are estimated to rise to 15 percent of generation by 2035.[94]

[93] US Energy Information Administration, "Electricity Monthly Update," (2012).

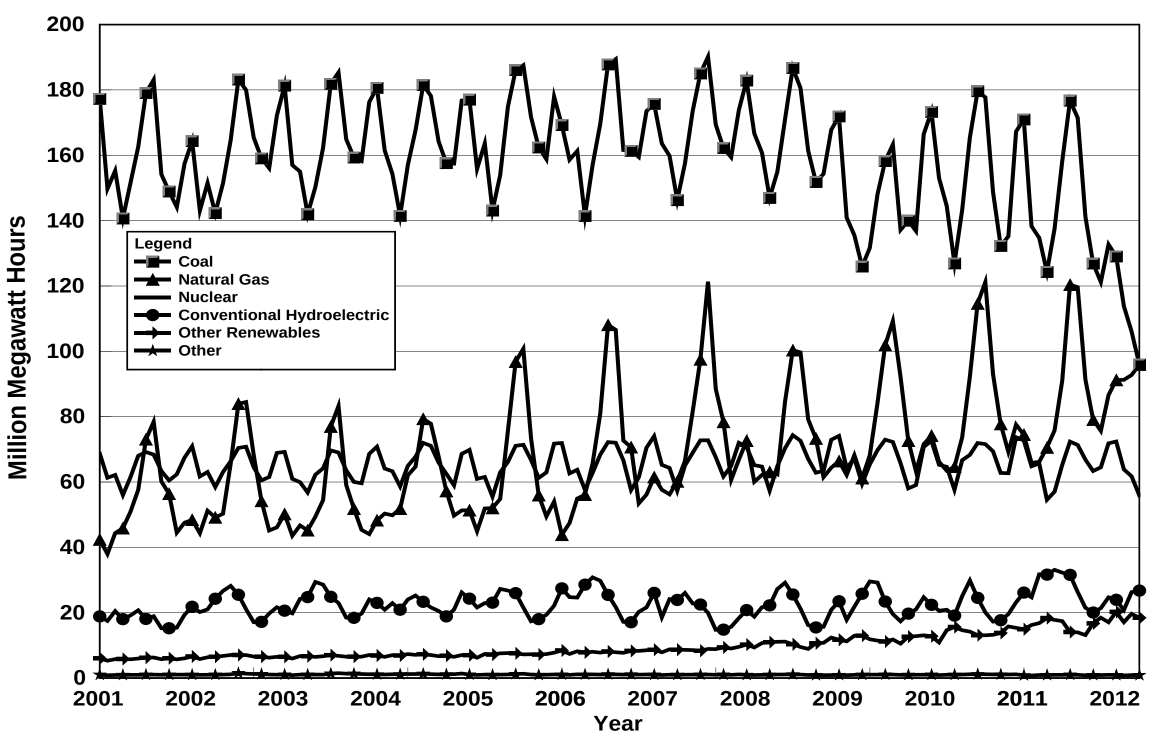
[94] US Energy Information Administration, "Fuel used in Electricity Generation is Projected to Shift Over the Next 25 Years," (2012).

Figure 29: US and West Virginia electricity sales 1990-2010



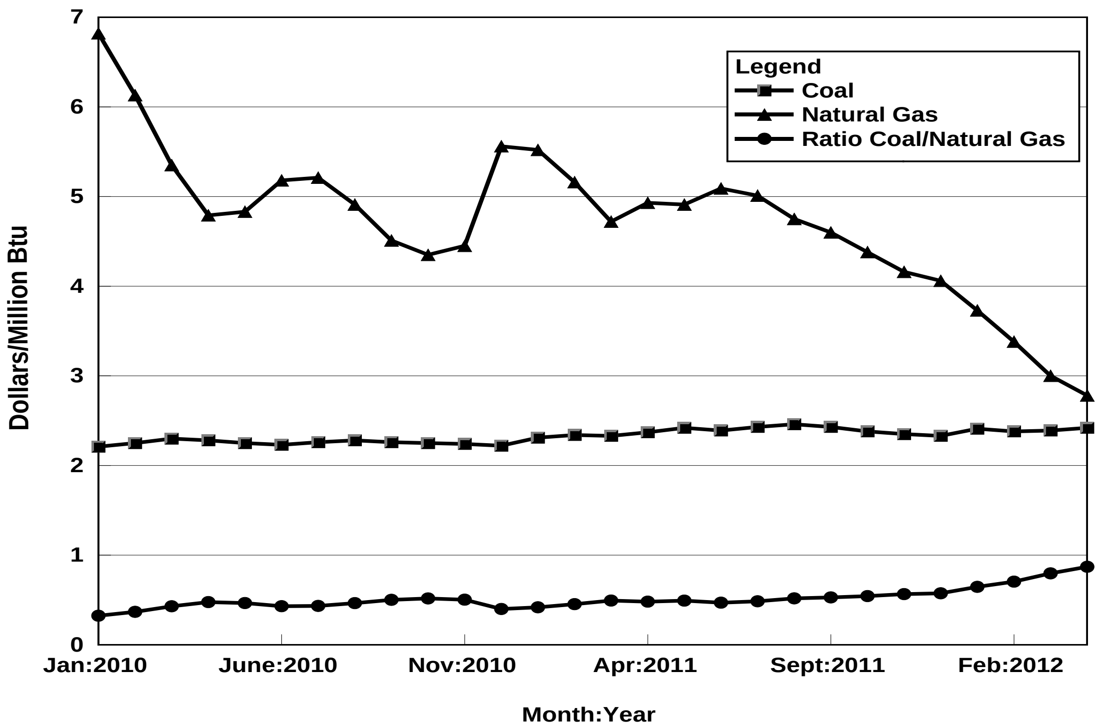
Source: US Energy Information Administration, Electric Power Annual

Figure 30: US Monthly net power generation January 2001 - April 2012



Source: US Energy Information Administration

Figure 31: Average cost of coal and natural gas for electricity generation



Source: US Energy Information Administration

6.2 Overview of fossil fuel electric power generation in West Virginia

West Virginia is largely a regulated utility market with 54 percent of electric power generation plants under regulation as utilities, representing 71 percent of capacity. The rest of the capacity comes from the state's seven independent power producers and four industrial producers. The state's utilities fall into the North American Electric Reliability Corporation's (NERC) Reliability First Corporation region, and are centrally dispatched through the PJM Interconnection. All power is dispatched on a lowest-marginal-cost basis.

West Virginia consumers receive the majority of their power generation from coal, though coal's share has slightly fallen in recent years. In 2012, coal's market share fell to 94 percent on average, down from an average of 97-98 percent over the last two decades. The majority of the drop is attributable to renewable sources. Hydroelectric increased to 2.9 percent from 1.9 percent a year earlier; wind rose to 2.5 percent of West Virginia's generation so far this year, up from 1.4 percent in 2011.[95] Table 18 lists the fossil fuel power plants, which range from 2900 MW capacity at the Appalachian Power John E. Amos plant to 5.6 MW at the Union Carbide South plant.

[95] US Energy Information Administration, "Electric Power Monthly," (2012).

Table 18: West Virginia Power Plants Listed by Fuel and Capacity[96]

Utility	Plant Name	County	Energy Source	Net Summer Capacity
Appalachian Power	John E Amos	Putnam	Coal	2900
Allegheny Energy	FirstEnergy Harrison Power Station	Harrison	Coal	1954
Virginia Electric & Power	Mt Storm	Grant	Coal, Jet Fuel	1602
Ohio Power	Mitchell	Marshall	Coal	1560
Appalachian Power	Mountaineer	Mason	Coal	1300
Allegheny Energy	FirstEnergy Pleasants Power Station	Pleasants	Coal	1288
Monongahela Power	FirstEnergy Fort Martin Power Station	Monongalia	Coal	1107
Appalachian Power	Philip Sporn	Mason	Coal	1020
GenPower	Longview Power LLC	Monongalia	Coal	700
Ohio Power	Kammer	Marshall	Coal	600
Appalachian Power	Ceredo Generating Station	Wayne	Natural Gas	450
Appalachian Power	Kanawha River	Kanawha	Coal	400
Big Sandy Peaker Plant	Big Sandy Peaker Plant	Wayne	Natural Gas	300
Pleasants Energy	Pleasants Energy LLC	Pleasants	Natural Gas	288
Monongahela Power	FirstEnergy Albright	Preston	Coal	283
Monongahela Power	FirstEnergy Willow Island	Pleasants	Coal	235
Monongahela Power	FirstEnergy Rivesville	Marion	Coal	125
PPG Industries	PPG Natrium Plant	Marshall	Coal	123
American Bituminous Power	Grant Town Power Plant	Marion	Waste Coal	80
Virginia Electric & Power	North Branch	Grant	Waste Coal	74
Morgantown Energy Associates	Morgantown Energy Facility	Monongalia	Waste Coal	50
WVA Manufacturing	Alloy Steam Station	Fayette	Coal	38
Bayer CropScience	Bayer CropScience Institute Plant	Kanawha	Coal	12.6
Union Carbide	Union Carbide South Charleston	Kanawha	Natural Gas	5.6

Source: US Energy Information Administration; author calculations[97]

[96] Only plants that generated from fossil fuel sources are listed in this table.
[97] US Energy Information Administration, "Form EIA-860 Detailed Data," (2012).

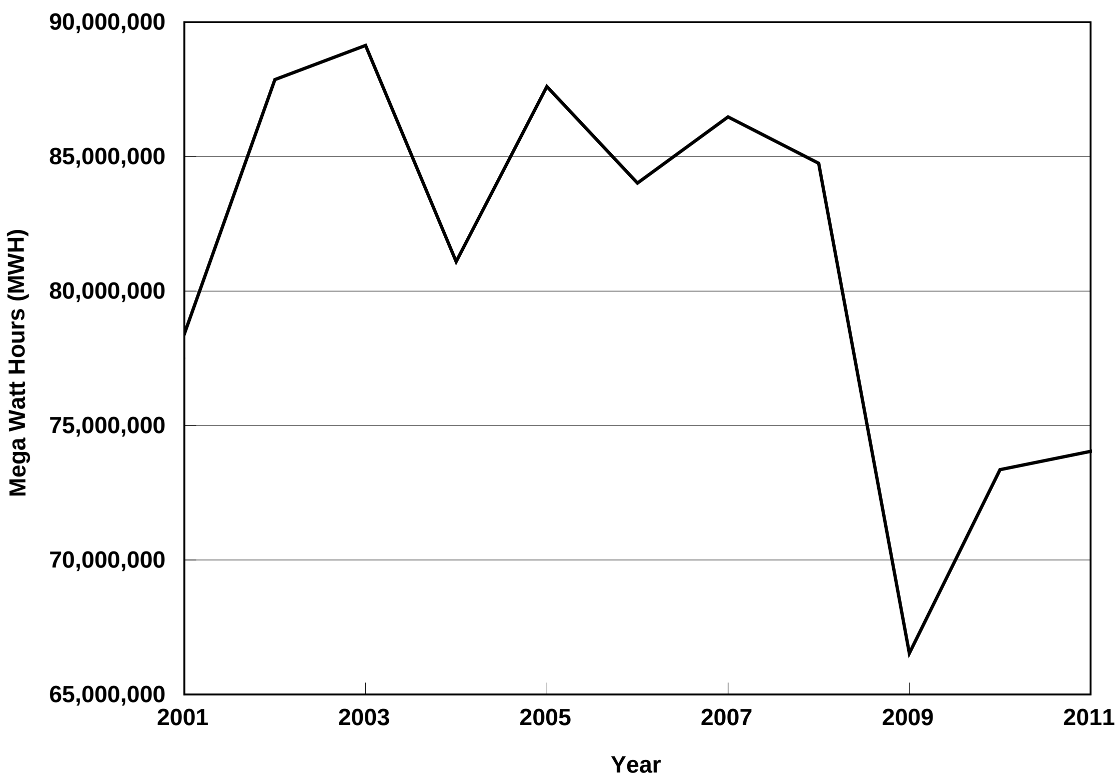
6.3 Trends in coal generation

Coal-fired power generation faces serious adverse market conditions in the short term. Coal plants are running at low capacity factors compared with recent history, mostly due to changes in relative prices between coal and natural gas. Coal stockpiles are also high, indicating the potential for lower sales over the near term. Over the longer term, a significant amount of coal capacity is set to retire with little prospect for replacement, and coal is set to lose market share to natural gas and renewables.

6.3.1 Capacity factors are declining

In April, AEP announced that its coal plants ran at less than half capacity in the first quarter of 2012, compared to a 61 percent capacity factor in the first quarter last year.[98] This mirrors overall trends for coal plants across the state as natural gas takes a larger share of electricity generation. Capacity factors are not yet available for 2011, but as Figure 32 indicates power plants in West Virginia have reduced their generation significantly since 2008.

Figure 32: West Virginia power plant net generation (MWH), 2001-2011



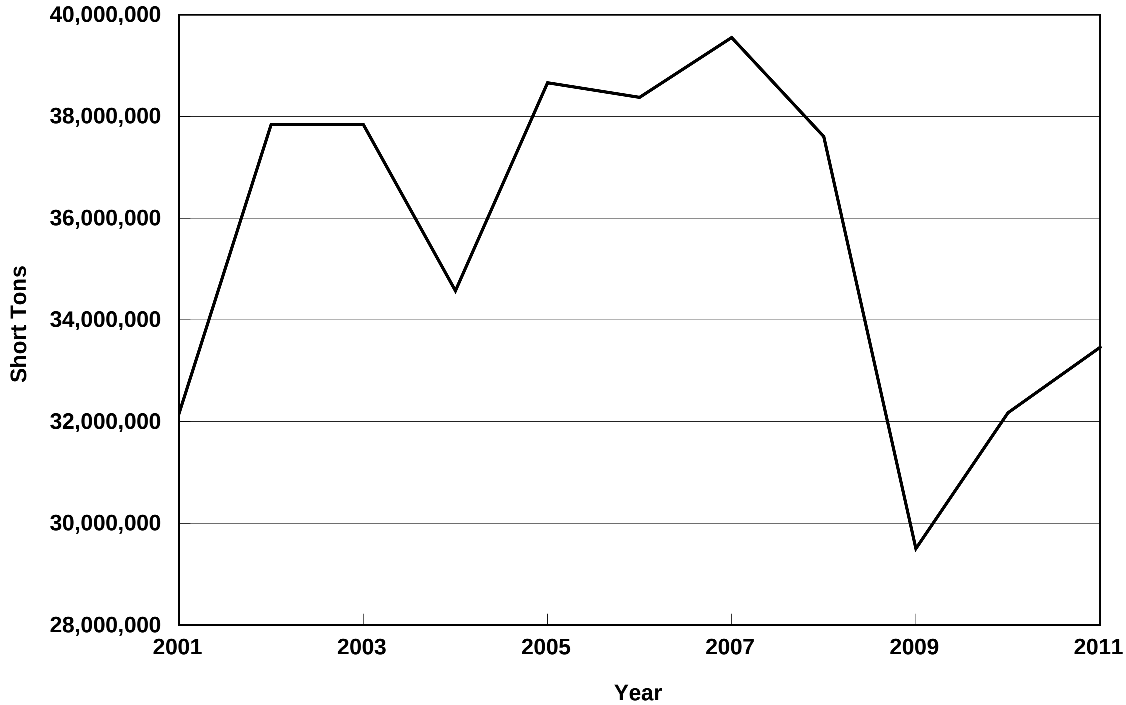
Source: US Energy Information Administration

6.3.2 Coal stockpiles are increasing

Coal consumption follows the trend of lower generation. As Figure 33 indicates, coal consumption has risen somewhat in the past two years after falling off significantly in 2009. But consumption is still 15 percent lower than its peak in 2007.

[98] Pam Kasey, "AEP Eastern Coal Plants Now Running Less than Half the Time," (2012)

Figure 33: West Virginia power plant fuel consumption quantity 2001-2011



Source: US Energy Information Administration

The drop in coal consumption sent coal stockpiles higher in the first quarter of 2012.[99] Coal stores in March 2012 were almost 18 percent above the level in 2011, and represent 91 days of burn time, more than 25 percent above the previous year.

The rise in coal stores has caused some power plants to refuse additional coal orders, or shift orders to later dates. Duke Energy has bought out existing contracts in order to keep from having to buy a new coal, and GenOn used force majeure to stop shipments, claiming they had no space left to store the coal.

6.3.3 Plant closures have been announced

The EIA announced in July that approximately 27 GW of coal capacity would be retired in the next five years.[100] Of that approximately 2.5 GW will be in West Virginia. These retirements are among the largest in the nation's history. The EIA cited several reasons for the retirements, including slow electricity demand, the relative prices of natural gas vs. coal, aging coal-fired generation, and environmental and other compliance costs. Over the longer term, the EIA projects that 49 GW of coal capacity will be retired nationwide by 2035, to be replaced with only 1.7 GW of new unplanned capacity. [101]

Citing new EPA rules,[102] FirstEnergy and American Electric Power (AEP) have announced plans to retire a combined 2,290 MW of older coal-fired power capacity based in West Virginia.[103] The companies said

[99] US Energy Information Administration, "Coal Stockpiles Above Five-Year Range in First Quarter of 2012," (2012).
[100] US Energy Information Administration, *Electricity Monthly Update*
[101] US Energy Information Administration, *Annual Energy Outlook 2012*,[2012c].
[102] See Environmental policies and implications for the electric power sector, page 7.
[103] FirstEnergy, "FirstEnergy, Citing Impact of Environmental Regulations, Will Retire Three Coal-Fired Power Plants in West Virginia," (2012).; American Electric Power, "AEP Notifies Reliability Organizations of Planned Plant Retirements," (2012).

in news releases that the EPA's Mercury and Air Toxics Standards (MATS) necessitate retiring the plants. These actions will have a significant impact on power production and employment in West Virginia. FirstEnergy estimates that 105 employees at the plants will be affected; AEP didn't release employment figures for the plants to be closed. FirstEnergy also announced that transmission system upgrades will be required to enhance system reliability as the power plants are shut down.[104]

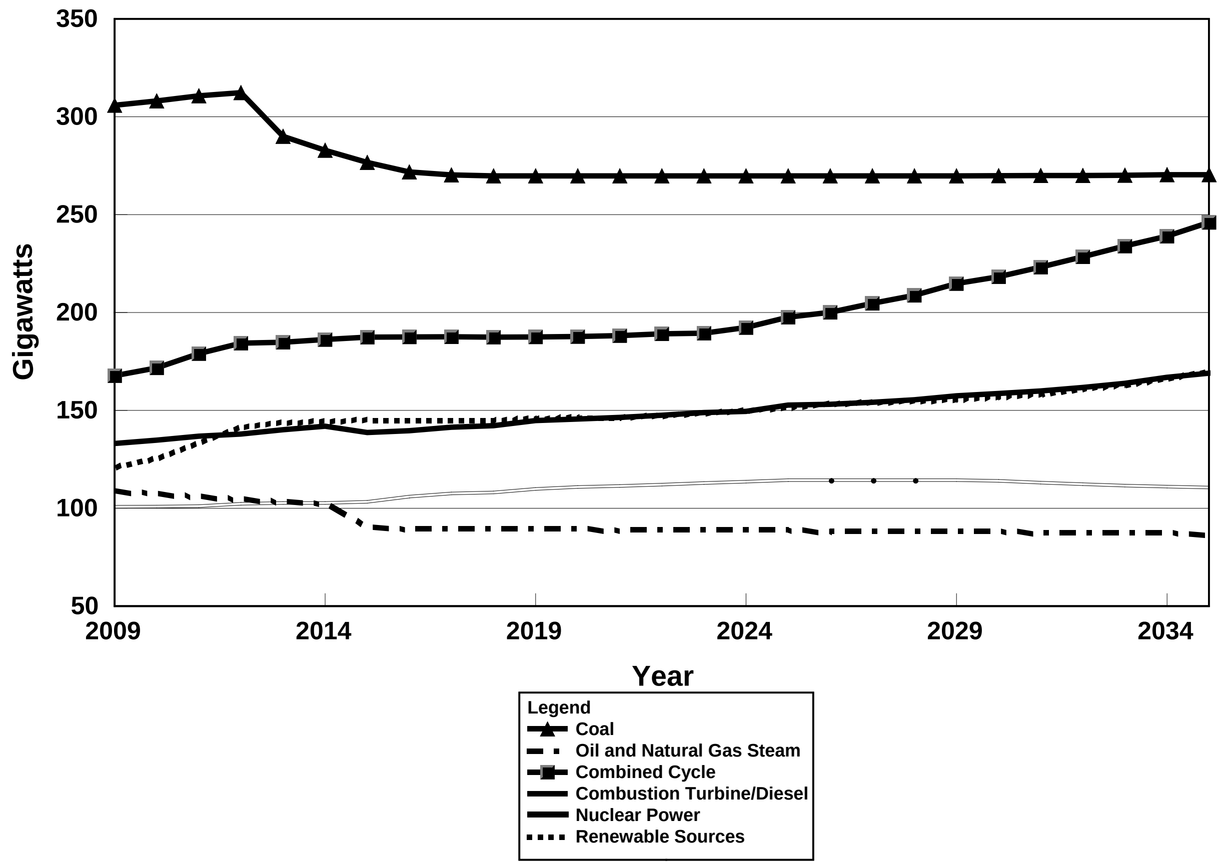
6.3.4 New generating capacity moving to natural gas

The decision to build new generating capacity is based primarily on capital and operating costs, including transmission costs. Coal, nuclear and renewables are very capital-intensive, while natural gas combined cycle plants have low capital costs, but higher operating costs. The total cost over the lifespan of the plant is typically described using levelized electricity costs. The EIA estimates that through 2035 levelized costs for new power plants, excluding subsidies, will be significantly lower for natural gas plants than for other types of generation. This leads the EIA to predict that natural gas plants will constitute the substantial majority of new capacity additions over that time frame.

In the EIA's reference case no new unplanned coal capacity is added until 2017; a total of 1.7GW is added by 2035. This is in addition to 9.3 GW of planned capacity increases. Coal continues to provide the largest share of electricity generation in 2035, but its share drops to 39 percent in 2020 from 45 percent in 2010.[105] Natural gas combined cycle capacity is expected to gain a total of about 65 GW by 2035, providing 28 percent of total generation by 2035. Figure 34 shows projected net summer capacity by type of fuel from 2009-2035.

[104] FirstEnergy, "FirstEnergy Announces "Energizing the Future" Initiative to Ensure Transmission System Reliability," (2012).
[105] US Energy Information Administration, *Annual Energy Outlook 2012* p. 87

Figure 34: Projected net summer capacity by fuel type, 2009-2035



6.4 Environmental policies and implications for the electric power sector

West Virginia's utilities operate in an ever-changing regulatory environment. This section outlines new policies and plant closures that could affect the market for power in the state.

6.4.1 Carbon emissions rule

In March 2012, The EPA issued new proposed rules to limit carbon emissions from electric utilities. [106] The rules stem from a June 2012 decision by the US Appeals Court upholding the EPA's power to regulate greenhouse gas emissions.[107] The rules would prevent new power plants constructed after the rule goes into effect from emitting more than 1,000 pounds of CO_2 per MWh of generation, a level determined to match the emissions from natural gas combined cycle (NGCC) plants. Coal technologies currently in use would not be able to meet the EPA standard, though the agency states that Carbon Capture Storage (CCS) plants would meet the standard with little difficulty. Certain types of super-efficient plants that currently do not meet the standard initially could potentially use a 30-year average emission standard that

[106] US Environmental Protection Agency, "Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units," (2012).
[107] US Environmental Protection Agency, "US Court of Appeals - D.C. Circuit Upholds EPA's Actions to Reduce Greenhouse Gases Under the Clean Air Act," (2012).

would allow coal plants to emit more in the first few years of use and then cut back later on as carbon capture technology advances and becomes less expensive.

The EPA estimates that the new rule will not have a significant economic impact through 2020. [108] This finding is due primarily to the agency's determination of the current economic environment for coal. Low natural gas prices have made NGCC plants less expensive than coal on a levelized cost per MWh basis. Thus the EPA estimates that no new coal capacity without federally supported CCS is likely to be built through 2020 whether the rule goes into effect or not. The EPA estimates that natural gas prices would have to rise to $10/MMBtu before coal will again become competitive for electricity generation. The EPA's report also indicates that because it expects most new capacity to come from natural gas, the new standard will do little to change greenhouse gas emissions for the near future. Nevertheless, the EPA states that a cost-benefit analysis shows that the rules do provide benefits by encouraging cleaner generation trends.

The new carbon rules proposed by EPA mean no non-CCS coal-fired power plants will be able to be built going forward, according to a 2012 report from Bloomberg Government.[109] The average emission rate for coal plants is 1,937 pounds of CO_2 per MWh, putting coal plants well above the EPA's new standard. By comparison, the average NGCC plant emits 790 pounds of CO_2 per MWh. And CCS coal plants are unlikely to be cost-competitive with natural gas without significant subsidies by the federal government. This will lead to replacement of older coal plants with other types of generation, most likely natural gas combined cycle. The study also posits that the new rules might trickle down to existing plants if they undergo significant modification, which normally requires plants to meet new-source performance standards as they upgrade. The new rules specifically exempt existing sources, however. Table 19 shows CO_2 Emissions and cost-related capture and storage for different technologies.

[108] US Environmental Protection Agency, Regulatory Impact Analysis for the Proposed Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units,[2012b].
[109] Rob Barnett, The Twilight of Coal-Fired Power,[2012].

Table 19: CO_2 emissions and cost-related capture/storage for different technologies

Coal-Fired Electricity Generating Unit (EGU) Technology	40-yr. BusBar Cost without carbon price ($/MWh)	40-yr. BusBar Cost Including carbon price ($/MWh)	CO_2 Emission Rate (lb/MWh)
Subcritical PC-fired (standard)	101	136	1940
Supercritical Pulverized Coal (PC) fired 830 MW	97	133	1880
Subcritical Circulating Fluidized Bed (CFB) Boiler	108	145	2020
Supercritical CFB Boiler	108	144	1960
Integrated Gasification Combined Cycle (IGCC) Plant	128	162	1860
Ultra-supercritical PC-fired	98	133	1860
Supercritical PC-fired with Carbon Capture and Storage (CCS)	135	139	220

Source: EPA Available and Emerging Technologies for Reducing Greenhouse Gas Emissions from Coal-Fired Electric Generating Units.(US Environmental Protection Agency 2010)

6.4.2 Mercury and air toxics standards (MATS)

The EPA finalized new mercury and air toxics standards in February 2012. The new MATS rules require emissions reductions of heavy metals, including mercury, arsenic, chromium, and nickel; and acid gases, including hydrochloric acid and hydrofluoric acid.[110] The EPA estimates that approximately 1,400 generating units will be affected by the action, though the EPA is currently reconsidering the standards for technical reasons and expects to be completed by March 2013.

6.5 Carbon reduction technologies

Faced with increasing pressure to reduce carbon emissions, power plants have been looking for ways to cut carbon from both coal-fired and natural gas power plants. The primary line of research has been CCS, which directly reduces carbon by capturing it before it enters the atmosphere. Power plants have also pursued more efficient combustion techniques, such as supercritical boilers and oxy-combustion.

6.5.1 Carbon capture and storage

Carbon Capture and Storage is the common name for the process of capturing a portion of a utility's CO_2 emissions and storing it, generally in underground geologic formations, to prevent its release into the atmosphere.[111] CO_2 captured in this way is generally liquefied and stored in deep wells where the gas remains under high enough pressure to maintain its liquid state indefinitely. CCS offers one of the primary ways of significantly reducing greenhouse gas emissions from coal-based power generation. CCS

[110] US Environmental Protection Agency, "Mercury and Air Toxics Standards (MATS)," (2012).
[111] US Congressional Budget Office, *Federal Efforts to Reduce the Cost of Capturing and Storing Carbon Dioxide*,[2012].

has also been proposed for natural gas combined cycle (NGCC) plants, but the majority of research has emphasized applications in coal power generation.

Carbon can be captured both before and after combustion of coal.[112] Pre-combustion approaches to CCS are usually performed through coal gasification, where the carbon is separated from the gas stream prior to combustion. Since most coal plants currently in operation are more traditional pulverized coal combustion plants, much research has focused on post-combustion strategies for capturing CO_2. Absorbent materials are applied to the output stream of power plants, while allowing the remainder of emissions to pass through. The carbon is then removed from the absorbent materials and stored.

6.5.1.1 Storage

One of the major considerations with CCS is finding locations to store captured CO_2. The most efficient geologic storage is at depths greater than 2400-2600 feet, where pressures are high enough to maintain CO_2 in a supercritical fluid state.[113] A 2009 study on carbon capture and storage found that West Virginia has enough geologic storage potential to last several decades at the state's current levels of CO_2 output. Potential sites include deep coal seams, saline aquifers and oil and gas fields, which have the added benefit of increasing oil recovery. The report concludes that more study is needed, but all indications point to the fact that West Virginia provides excellent potential for CO_2 storage sites, but it may require coordination with neighboring states.

Storage of captured carbon represents a significant portion of the long-term costs for CCS, according to a report from the West Virginia Carbon Dioxide Sequestration Working Group.[114] Cost estimates for sequestration range from $5 to $10 per ton of CO_2, with additional costs of approximately $25 million for site characterization.

6.5.1.2 Economic viability of CCS

Despite progress on CCS technology, a Congressional Budget Office report concludes that coal plants using CCS are unlikely to be built in the near future without government subsidies.[115] Power produced using CCS technology is significantly more expensive than traditional methods, potentially increasing the cost of coal-based power by 76 percent. New proposed environmental regulations all but require CCS for new coal plants, but competition from natural gas will likely lead to few coal plants being built in the near future.

Currently there are six large-scale CCS power plants planned to open in the next five years.[116] Located in Illinois, California, Mississippi, and Texas, the plants total 2.2 GW of generation. In West Virginia, AEP has a demonstration plant in New Haven that uses chilled ammonia process to capture carbon.[117] This pilot project ended in 2011 after capturing 37,000 metric tons of CO_2.

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[112] Ibid.
[113] Timothy R. Carr, Evan Fedorko and Frank LaFone, *West Virginia Carbon Capture and Storage Opportunities Associated with Potential Locations for Coal-to-Liquid Facilities*,[2009].
[114] WV Carbon Dioxide Sequestration Working Group, *Report to the Legislature: Findings and Recommendations with Respect to the Development and Widespread Deployment of Carbon Dioxide Sequestration Throughout West Virginia*,[2011].
[115] US Congressional Budget Office, *Federal Efforts to Reduce the Cost of Capturing and Storing Carbon Dioxide*
[116] Ibid.
[117] American Electric Power, "Carbon Capture and Storage," (2012).

6.5.1.3 Markets for captured CO_2

Though power production from CCS can increase costs significantly, those costs can be mitigated with new revenue sources from selling CO_2 for Enhanced Oil Recovery (EOR). A 2012 study by the National Coal Council found that EOR has the potential to increase the recoverable oil reserves in the United States by 67 billion barrels, but it will require large amounts of CO_2 to inject into existing wells.[118] In the study's ideal case, CCS would offset 100GW of capacity over 20 years, producing enough liquid CO_2 to recover an additional 4 million barrels per day of petroleum. The study also states that CO_2 captured from coal plants could be used to produce substitute natural gas, as well other chemicals.

CO_2 is in high demand for EOR operations across the country, as low supplies of CO_2 are constraining EOR production efforts.[119] But it remains to be seen whether CCS can produce liquid CO_2 at a cost-effective price for EOR. A recent NETL report concluded that EOR can be viable at an oil price of $85 per barrel and a price of $40 per metric ton of CO_2.[120] The study states that the $40 CO_2 price would represent a cost of $12 per barrel of oil. Under these assumptions, NETL estimates an additional 67 billion barrels of oil could be recovered nationwide, including 1.3 billion barrels of oil in Appalachia. Oil reservoirs could store 45 billion metric tons of CO_2. The report did not estimate if a $40 per metric ton price would offset the additional cost of CCS installation at existing or future power plants. Transportation to oil recovery sites would add additional cost, as it requires new pipelines to transport the liquefied CO_2. Oil reservoirs do offer a low-cost storage option for captured CO_2 that could be permitted and used relatively quickly.

6.5.2 Increased combustion efficiency

While CCS provides a way to extract carbon from a power plant's emission stream, new technologies have also been adopted to increase combustion efficiency in order to reduce carbon emissions directly. Two of the most promising are Advanced Super Critical Boilers and Oxy-combustion.

6.5.2.1 Advanced Super Critical Boilers

Advanced super-critical boilers operate at extremely high pressure and heat to improve the boiler's efficiency,[121] thus reducing emissions. Supercritical boilers operate at pressures above 705 degrees Fahrenheit and 3,212 psi, which is the point at which water enters a supercritical state where steam and liquid water achieve the same density. Supercritical boilers can increase efficiency of a plant to between 40-42 percent up from 36-38 percent for a subcritical plant. Ultra-supercritical plants that operate at pressures over 4,400 psi can reach thermodynamic efficiency of 48 percent. New materials developed primarily in Europe and Japan show promise in reaching the pressures and temperatures needed for ultra-supercritical efficiency.

Approximately 400 supercritical boilers are in operation around the world.[122] In early 2011, the Longview Power Plant in Maidsville began operation with a new type of advanced supercritical boiler that was the

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[118] Richard A. Bajura et al., *Harnessing Coal's Carbon Content to Advance the Economy, Environment, and Energy Security*,[2012].
[119] Ibid.
[120] Vello A. Kuuskraa, Tyler Van Leeuwen and Matt Wallace, *Improving Domestic Energy Security and Lowering CO2 Emissions with "Next Generation" CO2-Enhanced Oil Recovery (CO2-EOR)*,[2011].
[121] US National Energy Technology Laboratory, "Coal-Fired Power Plants (CFPPs): Supercritical and Ultra Supercritical Boilers," (2012).
[122] Ibid.

first of its kind in the world. The new boiler increases efficiency to approximately 41 percent,[123] making it among the least emitting power plants in the country.

6.5.2.2 Oxy-combustion CO_2 control

Oxy-combustion is a method of generation that injects purified oxygen into the combustion process in order to increase efficiency.[124] The process also produces a highly concentrated CO_2 stream, which is more suitable for carbon capture and storage than traditional pulverized coal methods. Oxy-combustion is still largely experimental, and requires low-cost supplies of oxygen in order to become economically viable.

The National Energy Technology Laboratory is funding several experimental and pilot projects related to oxy-combustion.[125] Alstom Power in Connecticut has a contract to develop concept designs for retrofitting existing generators for oxy-combustion. The project conducted several pilot-level tests of the technology with a variety of coal types. Reaction Engineering International, based in Utah, is conducting tests to gather data on how oxy-combustion will affect the performance of power plants. None of the projects under way are in West Virginia.

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[123] Stephen J. Goidich, Richard J. Docherty and Kenneth P. Melzer, "World 1st in West Virginia: Longview Supercritical Benson Vertical PC Boiler," (2012)
[124] US National Energy Technology Laboratory, "Coal-Fired Power Plants (CFPPs): Oxy-Fuel Combustion," (2012).
[125] US National Energy Technology Laboratory, "Innovations for Existing Plants: Oxy-Combustion CO₂Control," (2012).

6.6 Key observations

- Demand for coal-powered generation has fallen significantly as a result of both the recession and competition with natural gas. In April 2012, the share of electricity generation from natural gas rose to 32 percent, almost identical to the share from coal, a first in the nation's history. Coal continues to provide the largest share of electricity generation in the longer term, but its share drops to 39 percent in 2020 from 45 percent in 2010.
- The EIA announced in July that approximately 27 GW of coal capacity would be retired in the next five years, with approximately 2.5 GW of that in West Virginia. Levelized costs for new power plants will be significantly lower for natural gas plants than for other types of generation. This leads the EIA to predict that natural gas plants will constitute the substantial majority of new capacity additions over that time frame.
- A proposed EPA rule would prevent new power plants from emitting more than 1,000 pounds of CO_2 per MWh of generation. Coal technologies currently in use would not be able to meet the EPA standard, though the agency states that CCS plants would meet the standard with little difficulty. A Bloomberg Government report states that if the regulations are enacted no non-CCS coal-fired power plants will be able to be built going forward.
- Despite progress on CCS technology, a CBO report concludes that coal plants using CCS are unlikely to be built in the near future without government subsidies. Power produced using CCS technology is significantly more expensive than traditional methods, potentially increasing the cost of coal-based power by 76 percent.

7 Hydrogen Fuels

7.1 Introduction

Hydrogen comprises a small but growing part of the nation's energy infrastructure, with uses in transportation, electric power and material handling, among others. Hydrogen is not a major part of West Virginia's infrastructure, but it has the potential to utilize the state's coal and natural gas resources in a number of different ways.

Hydrogen is a colorless, odorless gas that has been viewed as having great potential as an emission-free fuel source. [126] Unbonded hydrogen is rarely found in Earth's atmosphere, so in order to use it to produce energy it needs to be extracted from another source, typically water or methane. The hydrogen can then be recombined with oxygen, usually in a fuel cell, to release its energy, producing only water as a byproduct. Because it has to be split from water or other sources, however, hydrogen is generally considered to be an energy carrier rather than a generation mechanism. [127]

7.2 Hydrogen production

Hydrogen can be produced in a number of different ways, with electrolysis of water and steam methane reforming among the most prominent. Approximately 9 million metric tons of hydrogen were produced in the United States in 2011, enough to power between 36 and 41 million fuel-cell electric vehicles.[128] Most hydrogen is produced for in-house use at factories or refineries, with approximately 36 percent sold on the market. Market-sold hydrogen supply increased by 77 percent between 2009 and 2011, and is projected to rise another 41 percent by 2016.

Hydrogen production costs remain high compared with fossil fuel prices, but have come down more than 30 percent since 2005.[129] As of 2008, production costs ranged from $1.21 per kilogram (kg) for hydrogen from coal gasification to $7.26 derived from distributed wind power.[130] One kg of hydrogen is considered roughly equal to the power of one gallon of gasoline in transportation fuel.[131] Fuel cell costs have come down by approximately 80 percent since 2002, falling to $49 per kW, which is on track to meet the per kW price of gasoline engines within the next few years.[132]

7.2.1 West Virginia

As on the national level, the market for hydrogen remains small in West Virginia, though there is less data available for the state than the nation. The most recent direct study of the hydrogen market by the BBER was in 2003.[133] The BBER surveyed firms and individuals involved in production, consumption and delivery of hydrogen to determine the status of hydrogen usage in the state. The low response rate of 2.6 percent, and the survey responses indicate that West Virginia has a limited hydrogen infrastructure. The state's hydrogen consumers include the aerospace and chemical industries.

[126] US Alternative Fuels Data Center, "Hydrogen Basics," (2012).
[127] US Energy Information Administration, "Energy Technologies on the Horizon," (2012).
[128] Fred Joseck, "DOE Hydrogen and Fuel Cells Program Record," (2012).
[129] Breakthrough Technologies Institute, *2010 Fuel Cell Technologies Market Report*,[2011].
[130] US Energy Information Administration, "The Impact of Increased use of Hydrogen on Petroleum Consumption and Carbon Dioxide Emissions," (2012).
[131] US Alternative Fuels Data Center, *Hydrogen Basics*
[132] Breakthrough Technologies Institute, *2010 Fuel Cell Technologies Market Report*
[133] Armando Alzate and Tom S. Witt, *Hydrogen Infrastructure in West Virginia 2002*,[2003].

West Virginia is well positioned to take advantage of a hydrogen economy on the production side. Four of the seven respondents in the BBER survey produced hydrogen, which indicates West Virginia may become an important supplier of hydrogen to the world market. The largest amount of hydrogen production comes from steam methane reforming, which would allow use of West Virginia's natural gas resources. And production of hydrogen from coal gasification is currently the least expensive way to produce hydrogen, with costs from gasification in a carbon-capture and sequestration plants also cost-competitive at $1.82 per kg.[134]

7.2.2 FutureGen

One potential benefit of a hydrogen economy for West Virginia is that production of the fuel often requires significant amounts of electricity. In an effort to produce emission-free hydrogen, the DOE announced in 2003 that it was creating the FutureGen project, which was designed to build the first commercial-scale carbon capture and sequestration coal plant in the country. The plant would have produced both electricity and hydrogen fuel, but because of hydrogen market uncertainty, FutureGen was canceled in 2008.[135] The DOE announced in 2010 that it would bring back the project under the designation FutureGen 2.0,[136] though in a much reduced form. The new project plans to renovate an existing coal plant to produce energy using oxy-combustion technology and capturing 90 percent of CO_2 emissions. The new facility will not produce hydrogen, however.

7.3 Primary markets

7.3.1 Transportation

Transportation remains the primary expected use of hydrogen fuel cell technology, though the technology is still largely experimental. The Energy Information Agency estimates that there were 421 hydrogen-powered vehicles on the road in 2010, up from 357 in 2009.[137] The data do not specify in which state the vehicles are located. The number of hydrogen vehicles is significantly lower than those powered by other alternative fuels, including ethanol, propane, electricity, and compressed natural gas. Hydrogen fuel consumption in the transportation sector remains small. The EIA estimates that 152,000 gallons of gasoline equivalent were used in 2010, compared with 134 billion gallons of gasoline consumed by cars in that same year.[138]

One of the most significant barriers to widespread use of hydrogen-powered vehicles is the lack of refueling infrastructure. According to the DOE's Alternative Fuels Data Center (AFDC), only 56 hydrogen refueling stations exist in the country. The majority of these stations are private refueling stations for fleet vehicles. Only five are open to the public, all of which are located in the vicinity of Los Angeles and Palm Springs.[139]

West Virginia had one hydrogen refueling station at Yeager Airport in Charleston.[140] This station is being moved to a site near West Virginia University's Morgantown campus. According to William A. Davis,

[134] US Energy Information Administration, *The Impact of Increased use of Hydrogen on Petroleum Consumption and Carbon Dioxide Emissions*
[135] US Department of Energy, "DOE Announces Restructured FutureGen Approach to Demonstrate Carbon Capture and Storage Technology at Multiple Clean Coal Plants," (2012).
[136] US Department of Energy, "Secretary Chu Announces FutureGen 2.0," (2012).
[137] US Energy Information Administration, "Independent Statistics and Analysis," (2012).
[138] US Energy Information Administration, "How Much Gasoline does the United States Consume?" (2012).
[139] US Alternative Fuels Data Center, "Hydrogen Fueling Station Locations," (2012).
[140] National Alternative Fuels Training Consortium, "WVU's National Alternative Fuels Training Consortium Receives $1.15 Million to Develop West Virginia's Second Hydrogen Production/Fueling Station," (2012).

assistant director – operations for the National Alternative Fuels Training Consortium (NAFTC),[141] in 2010, the NAFTC received a $1.15 million grant from the US DOE's National Energy Technology Laboratory (NETL) to build the station. Davis said that the university is currently taking bids and expects to begin construction in August 2012. The NAFTC also plans to acquire five hydrogen-fueled vehicles that will use the fueling station.

7.3.2 Electricity generation

Hydrogen does not play a large role in electricity generation currently. Nationally, 0.06% of electricity 2011 was generated by fuels in the other category, of which hydrogen is a part.[142] In West Virginia, no electricity generation came from the other fuels category. At the end of 2011, 625 hydrogen-powered electricity generation systems had been deployed nationwide, more than triple the year before, but still small relative to generation from fossil sources.

Hydrogen fuel cells have been used as backup power in case of power outages.[143] This usage is particularly prevalent in the telecommunications industry where hydrogen fuel cells have been used to provide emergency power for cell-phone towers in remote locations that are difficult to refuel. In this guise, hydrogen fuel cells are competitors with batteries.

7.3.3 Material handling

Hydrogen fuel cells are also in use powering forklifts in locations where combustible fuels are not feasible, such as indoor factories.[144] Fuel cell forklifts often have greater power than battery-operated lifts, and can operate for longer periods over multiple shifts without recharging. Fuel costs are higher for fuel cells than for batteries, however, falling in the range of $7 to $8 per working shift as compared with between $1.50 and $2 per shift for batteries. Sales volumes of hydrogen-powered forklifts reached between 150 and 200 units per year in 2010.

7.4 Public policies to support hydrogen

The federal government has more than 25 programs and incentives to support adoption of and research into hydrogen fuel cells.[145] Among the most prominent are: the Hydrogen Fuel Infrastructure Tax Credit, which provides a tax credit up to 30 percent of the cost of fueling stations; and the Fuel Cell Motor Vehicle Tax Credit, which provides a tax credit of up to $4,000 toward the purchase of a fuel-cell vehicle. The federal government also has requirements for government purchase of alternative fuel vehicles, as well as electric and hybrid vehicles. A number of other programs not specifically directed at fuel cells also have supports for hydrogen adoption.

West Virginia has its own Alternative Fuel Vehicle Tax Credit and a tax credit for alternative fuel infrastructure, both of which include hydrogen among the allowed fuels. West Virginia also has subsidies for alternative fuel buses, and procurement of alternative fuel vehicles by government agencies. Hydrogen fuel cells are also one of the eligible fuels in West Virginia's Alternative and Renewable Energy Portfolio Standard.[146]

[141] William A. Davis, Update on WVU's hydrogen fueling station, July 19, 2012, 2012.
[142] US Energy Information Administration, "Annual Electric Utility Data – EIA-906/920/923 Data File," (2012).
[143] David L. Greene, K. G. Duleep and Girish Upreti, "Status and Outlook for the US Non-Automotive Fuel Cell Industry: Impacts of Government Policies and Assessment of Future Opportunities," (2012).
[144] Ibid.
[145] US Alternative Fuels Data Center, "Federal Incentives and Laws for Hydrogen Fuel Cells," (2012).
[146] Database of State Incentives for Renewable Energy, "West Virginia Alternative and Renewable Energy Portfolio Standard," (2012).

7.5 Future research

Hydrogen energy is still very much an evolving technology, with an active research agenda on the federal and state levels.[147] The federal government continues to fund research to improve hydrogen fuel technology, both to reduce costs and increase efficiency of hydrogen fuels. The US DOE's Fuel Cell Technologies Program aims to reduce the cost of hydrogen for transportation purposes to between $2 and $4 per gallon of gasoline equivalent (approximately one kg of hydrogen). The program also plans to fund research into better ways to store and transport hydrogen to improve delivery of the fuel.

Aside from research into better technologies, the DOE is also examining ways to provide education and institutional change to improve the environment for hydrogen adoption.[148] The program's goals include setting national standards for safety of hydrogen storage and use, creating and distributing educational materials, and furthering adoption in early hydrogen markets as a way of pushing wider adoption of hydrogen technologies.

7.6 Key observations

- The primary markets for hydrogen include transportation and material handling. Electricity generation is a small market, mostly limited to providing backup power.
- Hydrogen production costs remain high compared with fossil fuel prices, ranging from $1.21 per kg (roughly equivalent to one gallon of gasoline) for hydrogen from coal gasification to $7.26 for distributed wind power.
- The federal and state governments provide numerous subsidies for hydrogen production and deployment, both on the supply and demand side of the market. The federal government also supports a variety of research into hydrogen fuels and fuel cell technologies.
- West Virginia has the potential to become a significant producer of hydrogen, especially if IGCC power plants facilities become more prevalent. However, hydrogen has little potential for widespread adoption in the next five years, and thus the state is unlikely to generate a significant amount during the frame of this report.
- A hydrogen fueling station at West Virginia University is set to begin construction this summer, adding another hydrogen node on the national refueling system.; however, this potential will most likely be limited to fleet cars in the near future.

[147] US Department of Energy, "Fuel Cell Technologies Program: Fuel Cell Technologies Program Multi-Year Research, Development and Demonstration Plan," (2012).
[148] US Department of Energy, *Secretary Chu Announces FutureGen 2.0*

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FINAL REPORT

Renewable Energy Policy

Opportunities for West Virginia

Prepared for:

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MARSHALL UNIVERSITY
CENTER FOR BUSINESS AND ECONOMIC RESEARCH

Renewable Energy Policy

Opportunities for West Virginia

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Disclaimer:

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List of Abbreviations

AD-Anaerobic Digestion
B&O- Business and Occupation
CHP- Combined Heat and Power
EGS- Enhanced Geothermal System
EIA- Energy Information Administration
EISA2007- Energy Independence and Security Act of 2007
FERC- Federal Energy Regulatory Commission
GHG- Greenhouse Gas Emissions
LCOE- Levelized Cost of Electricity
LFG- Landfill Gas
LMOP- Landfill Methane Outreach Program
MSW- Municipal Solid Waste
MWh- Megawatt Hours
NRC- National Research Council
OSDI- Optimum Solar Deployment Index
PBI- Production-based Incentives
PSSP- Public school Support Program
PV- Photovoltaic
RECs- Renewable Energy Credits
REPG- Renewable Energy Portfolio Goal
RFS2- Renewable Fuel Standard
RPS- Renewable Portfolio Standard
SACP- Solar Alternative Compliance Payment
SMU- Southern Methodist University
SREC- Solar Renewable Energy Credits
SRWC- Short Rotation Woody Crops
TAD- Thermophilic Anaerobic Digestion
UVIG- Utility Variable-Generation Integration Group
W-T-E- Waste-to-Energy
WVDOA- West Virginia Department of Agriculture
WVPSC- West Virginia Public Service Commission
WVSU- West Virginia State University

Executive Summary:
Renewable Energy Policy Outlook for West Virginia

Purpose of the Report

The purpose of this report is to outline the future role of renewable energy in West Virginia. This is accomplished by a set of reports which discuss each of the renewable sources: Wind, Solar, Biomass, Hydropower and Geothermal. Each section includes a discussion of the characteristics of the fuel, the positive and negative aspects of its deployment and its current use in West Virginia. A thorough discussion of how energy efficiency can become an even more important part of the West Virginia energy mix is also included in a separate report. Each section provides conclusions which can be included in the *Five Year West Virginia State Energy Plan 2013-2017.*

The West Virginia "*Alternative and Renewable Energy Portfolio Standard*" provides that utilities must obtain 25 percent of the energy they generate from alternative and renewable sources. This report evaluates all of the possible renewable fuels which can be employed to meet the requirement of the *Standard*. When the *Standard* was adopted there were two objectives: to promote "energy independence and to meet environmental concerns." Since its adoption the energy environment has changed which requires a rethinking of what the most effective and least costly ways to the State's consumers and the State budget for the fulfillment of the *Standard.*

Thirty other states have standards with the same objective. These states have adopted a variety of public policies to promote alternate and renewable fuel usage. Included are tax exemptions or reductions for property taxes, reimbursements to consumers for purchase of energy efficient appliances, incentives for fleet vehicles to use alternative fuels, production incentives to electricity generators who use renewable or alternate fuels either to install the needed infrastructure for utilization or the direct use the desired fuel. In addition states provide grants, loans and loan guarantees related to capital investment related to the development of renewable and alternate energy.

West Virginia has implemented some of these incentives as detailed in the report. These incentives have not been adopted with an overarching view as to how the objectives of the *Standard* are to be achieved. This report calls for careful consideration of the desirability and effectiveness of these incentives. West Virginia is unique in both its available energy resources and the demands placed on those resources. It is hoped that this report will provide the background for public policy decisions which recognize that uniqueness.

The report is the contribution of the Center for Business and Economic Research at Marshall University and is a companion to a report on fossil fuels, electricity and nuclear power prepared by the Bureau of Business and Economic Research at West Virginia University. Funding for the project has been provided by the West Virginia Division of Energy.

Overall Conclusions

Based on the research conducted in this report there are overall conclusions which apply to renewable energy as it is included in the *West Virginia State Energy Plan 2013-2017:*

- None of alternative or renewable energy sources considered in this report is likely to provide fuel or electricity at a lower cost than currently is supplied by traditional sources. Environmental restrictions or fees at the federal level may alter this situation and increase the ability of alternate and renewable fuels to compete. Over the next five years the WV Department of Energy should remain conscious of any regulatory developments which would increase the competitiveness of these resources.
- The speed of transition away from current fuels can be increased only if the State is willing to subsidize these alternatives or to allow for rate increases to cover the increased costs. Neither option is recommended due to high costs and the uncertain level of fossil fuel displacement that variable resources such as wind and solar can provide.
- While not fully developed in this report there is a need for monitoring of potential transportation difficulties relating to all types of fuels and the electricity generated from them in the State. Particular emphasis should be placed on the ability of the transmission grid to accommodate any additional electricity which might be potentially come available in the next five years. While this does not currently appear to be an issue, monitoring by the Public Service Commission is appropriate.
- Environmental concerns regarding alternative and renewable fuels should be fully addressed over the next five years. Information from this investigation should be used to determine what legislative or regulatory action, if any, is desirable. This consideration should be completed prior to any policy changes.

Biomass

Conclusions

- There is little likelihood that ethanol production from corn will occur in the State due to the need for corn ethanol plants to be near significant sources of supply. Corn is not a major crop in terms of total production in West Virginia
- There is very limited potential for development of biodiesel as an industry in West Virginia. Biodiesel was manufactured only at the AC&S facility in Nitro, West Virginia which could operate a three (3) million gallon a year batch plant. Production of soybeans in the State is insufficient to supply a major biodiesel facility. If the biodiesel industry were to develop most of the feedstock would have to be imported from out-of-state providing less economic impact than development using other fuels.
- Considering the extent of forestation in West Virginia, expanded study of the use of woody biomass as a fuel should be explored.
- There is a possibility that ethanol from switchgrass may have some limited potential in the State. However, the need for a production facility in the state and the amount of alcohol fuel which can be produced locally will inhibit its development.

- *A donax* is another biofuel requiring advanced research before widespread use is likely. Considering the availability in West Virginia of reclaimed mine land and other marginal soil in West Virginia, technological developments should be monitored. As is the case with all biofuels there will be a need to locate a refinery nearby if the potential is to be developed.
- While it does not appear that population densities in West Virginia are sufficient for WTE projects to be feasible, the success of facilities elsewhere is worthy of future investigation. The possibility of forming regional authorities around the State's population centers to construct these facilities is an option for consideration as this is the only way such facilities could become feasible.
- Energy from LFG merits only limited consideration. Currently there is one WTE landfill operating in the State and a handful of others are considering such expansion. Contacts with operators of the other landfills indicate that most fills are not likely to pursue such development within the next five years.

Solar

Conclusions

- Solar energy is not as strong in WV as in many other states, although WV's insolation is better than most states to the north. Due to grid integration issues, solar energy may not help conserve fossil resources, particularly coal resources, as much as predicted.
- Distributed solar energy allows security of electricity supply, but to maintain round-the-clock security a facility must still be connected to the grid and able to consume power from grid whenever desired. If a consumer retains that ability some <u>firm</u> external supply must be immediately on-hand at night, and for cloudy days.
- Self-generation of electricity is a price hedge, although at an uncertain level, and is more effective with higher electricity rates. Thus, the near-term expansion of solar capacity in the State is not certain to yield savings on electricity expenditures. Funding solar systems through utility rate increases obscures the real price of avoided electricity purchases.
- Assigning the costs of solar energy to ratepayers reduces disposable income of all ratepayers, but especially those who do not invest in solar systems.
- The primary economic benefits of solar generation would come from the applicable state and local taxes: sales, property, and B&O. Ironically, because a primary way to make solar projects competitive is to exempt them from all or some of these common taxes, the main financial benefits are removed.
- Development of an SREC market in the state assigns the role of market maker to the State Legislature, a position that some would argue is inappropriate for a governing body.
- There are benefits to getting experience with an emerging technology such as PV systems. Individuals and households who install PV systems will come to understand the attributes of the technology and can participate in future adoption as technology improves. Local installers also develop valuable capacity regarding utilization of the resource.
- Solar panel efficiency is expected to increase but will improve more beyond the five-year timeframe evaluated for this report. In addition, beyond the five-year timeframe, grid integration solutions including demand response programs and smart-grid applications

will be more widespread, allowing the potential benefits of solar to be more fully captured.

Wind

Conclusions

- Wind energy is a relatively small energy resource in West Virginia. The quantity of wind that is estimated to be available to be developed on private land is smaller than what has to date already been developed or is under consideration.
- Due to the relatively high cost of developing wind in the region, the installation of wind in West Virginia is driven by Federal incentives. The extension of the federal PTC for wind-powered electricity production will determine future development efforts.
- West Virginia's wind resources are good compared to other onshore resources in the Eastern United States but are not as strong as in the Midwest. This reduces the likelihood that State resources will be developed in the absence of the PTC.
- The primary economic benefits of developing wind energy are lease payments made to landowners and property taxes paid to county governments. The state has very few wind-related manufacturing component suppliers. A small, but growing employment base exists to supply turbine maintenance services.
- Siting of wind facilities is very difficult. The permit application process is lengthy and requires extensive documentation. The siting process is largely similar to that experienced by other power plant developers. However, wind facilities possess several unique attributes that make them quite different than conventional power plants. Nonetheless, any evaluation of the efficiency of the permitting process would have to take all types of power plants into consideration, not just wind facilities.
- There are unresolved efficiency issues related to grid integration of wind electricity that can be at least partly resolved by adopting a series of recommendations related to turbine control, real-time grid operations, reserve utilization protocols, demand response and wind forecasting. However, such implementation will take time and may never be perfect solutions. In the meantime, the ability of wind energy to offset fossil emissions is less than its output due to the need to maintain oversupply of generation capability. More needs to be understood about this issue in terms of accomplishing policy objectives.

Hydropower

Conclusions

Small scale hydropower does not appear to have significant potential for the State. But there are instances in which small scale hydro may play a role. These would be primarily in direct use situations for providing power to a specific user such as a small factory, public building, recreational facility or isolated community.

Geothermal

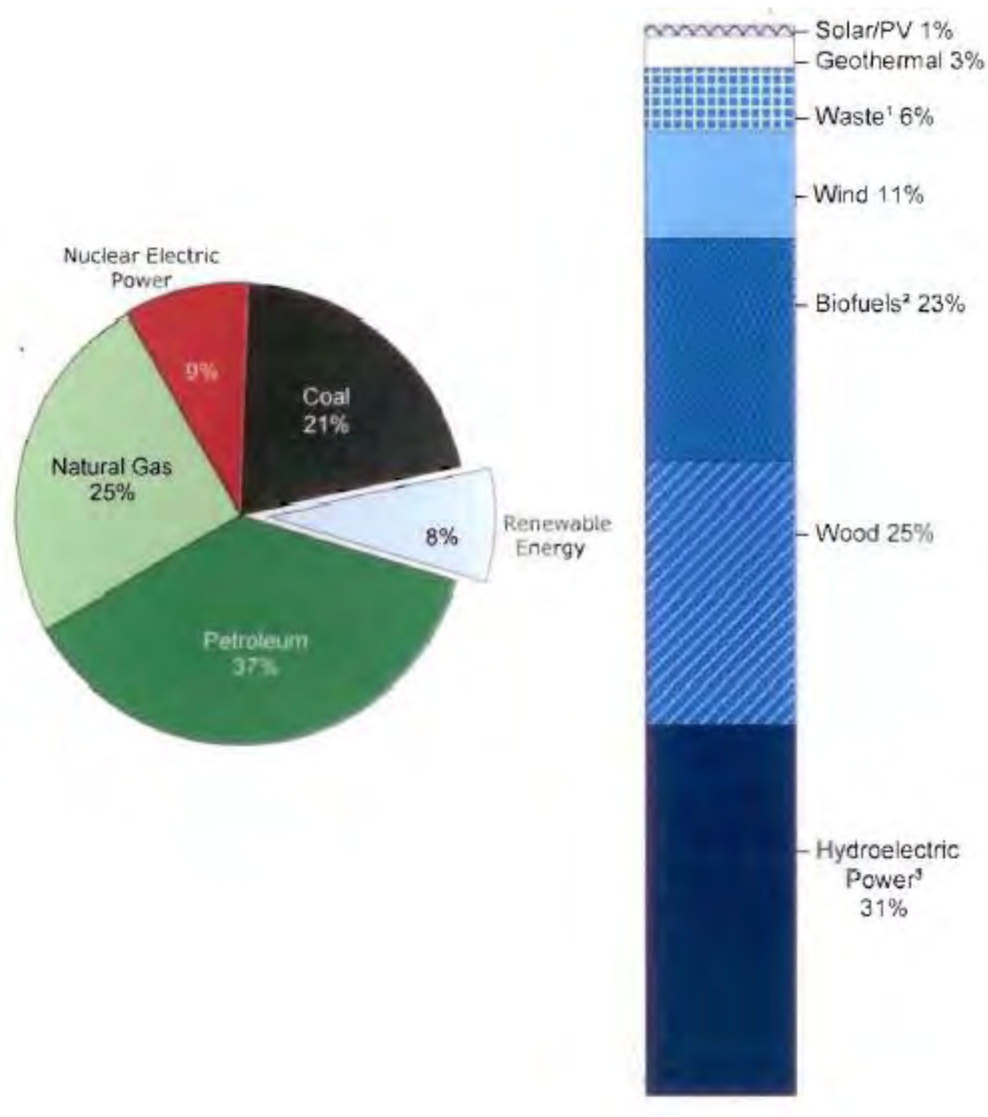
Conclusions

- The generation potential of the geothermal resource in West Virginia is not as great as in other areas of the US, but that should not be construed to mean it would not have an impact. At nearly 31 GW of current estimated generation potential at 14 percent recovery, the State's geothermal resource could match a significant portion of electricity generation in West Virginia.
- Geothermal energy has been proven to provide consistent base load power through the constant loop of the input/output wells at generating facilities due to the fact that the temperature does not fluctuate. The reliability of geothermal systems in West Virginia would produce a secure supply of electricity from a renewable resource.
- Although a large amount of capital is required to establish a geothermal system, the local and state economy would likely benefit from the increase in job demand. Further study would be needed to analyze the potential benefit of developing this resource in this area.
- There is potential for EGS resources to contribute to the West Virginia alternative energy requirement and diversify the source of electricity generation in the State. However, successful development of geothermal resources in West Virginia will not produce immediate benefits. Due to continued improvement of geothermal development technology, establishing a new EGS power plant in this area would be costly at this time and is unlikely to be feasible in the short-term.
- The expansion of EGS demonstration would depend on funding from the U.S. Department of Energy. If the US DOE were to develop a solicitation for a demonstration site in the eastern U.S. WV would be a candidate for such a project.

I. Overview of Renewable Energy

Renewable energy is the U.S. and world's fastest growing source of marketed energy.[1] For 2010 (the last year for complete data) renewable energy accounted for 8 percent of total primary U.S. energy consumption as shown in Figure 1.

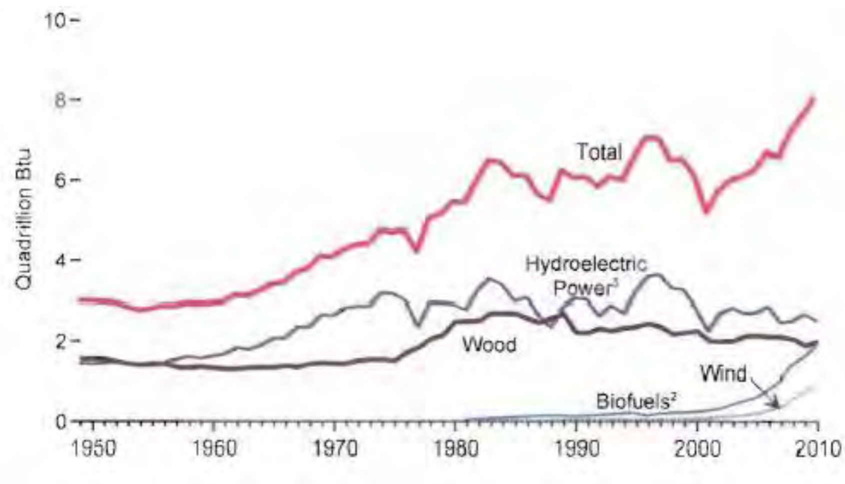
Figure 1: U.S. Renewable Energy as Share of Total Primary Energy Consumption, 2010



But this does not recognize the significant growth over the past few decades. As Figure 2 demonstrates the growth in renewable energy consumption has accelerated. In recent years this has been principally due to the growth in consumption of biofuels and wind.[2]

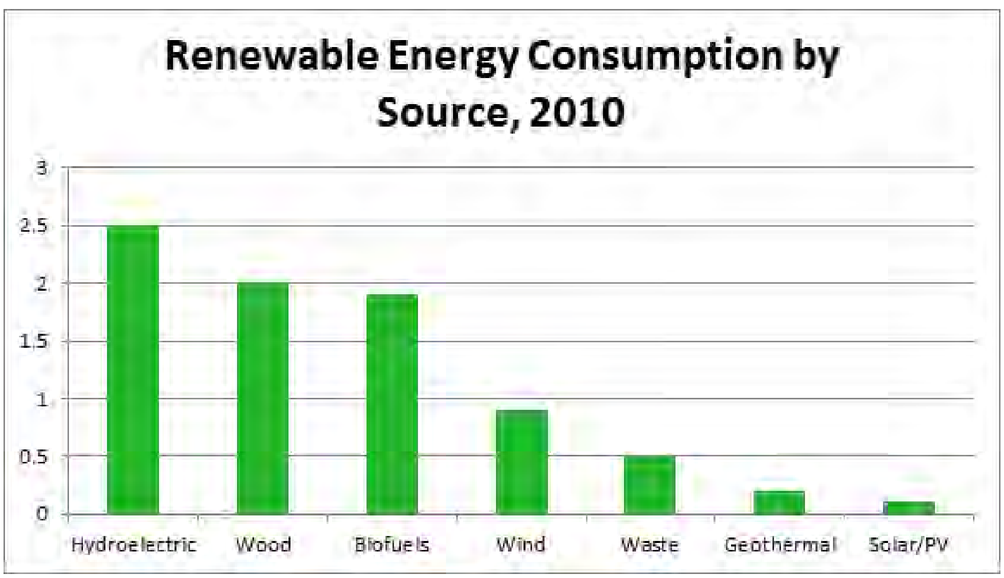
[1] U.S. Energy Information Administration, *Annual Energy Outlook 2012*, 75.
[2] See Appendix A in Biofuels for complete data.

Figure 2: Renewable Energy Total Consumption and Major Sources, 1949 to 2010



The actual amount of energy consumption from each renewable is is provided by Figure 3 which indicates the current dominance of hydroelectric power. If all sources of biomass are combined (wood, biofuels, waste) then biomass is the leading source of renewable energy consumption.

Figure 3: Renewable Energy Consumption by Source, 2010



EIA predicts that over the next 25 years the trend is to continue worldwide with wind and biofuels being the primary contributors to overall renewable consumption.

Figure 4: World Renewable Electricity Generation by Source, forecasted to 2035

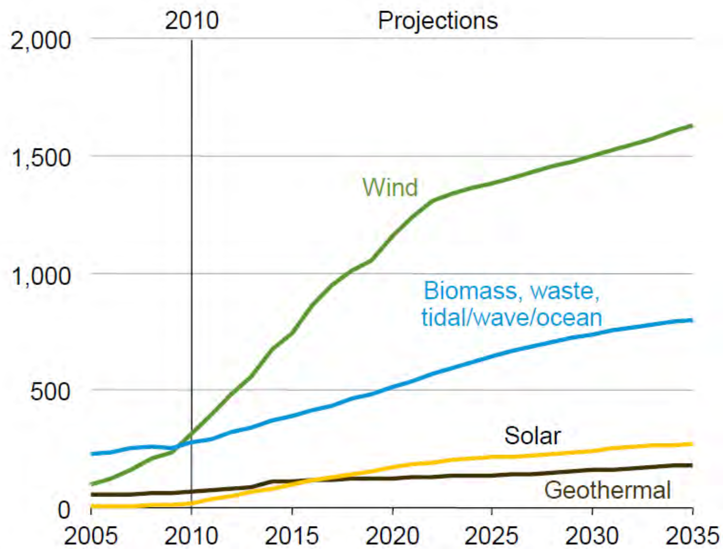
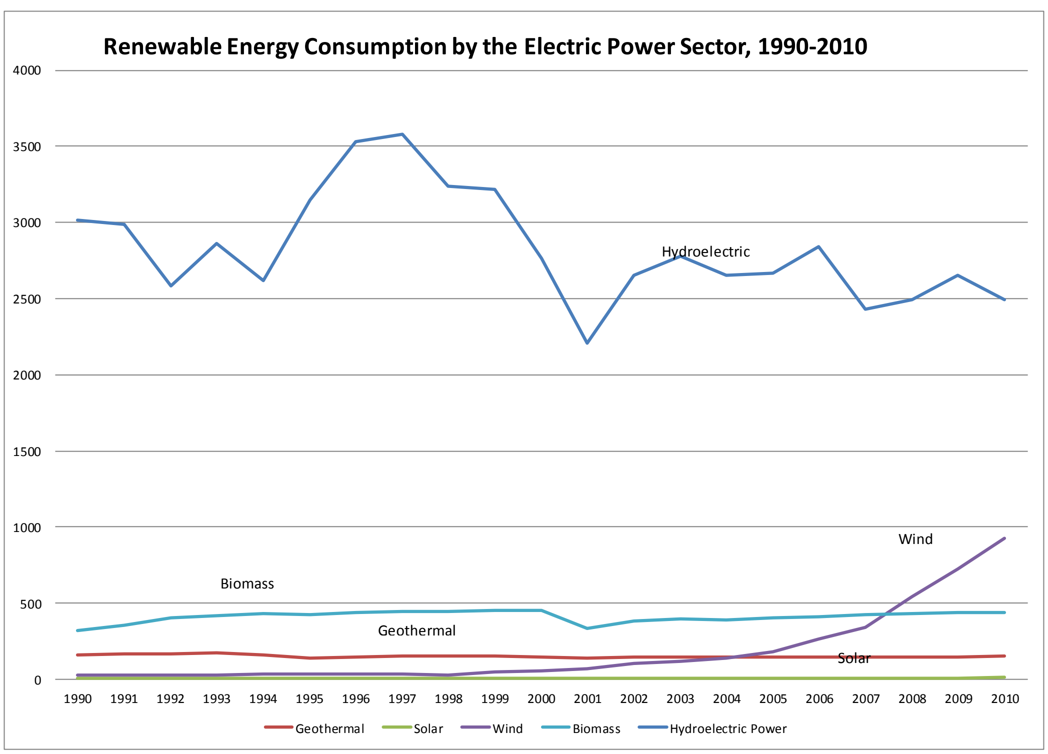


Figure 5 illustrates the composition of renewable energy consumed by the electric power sector for a period of 20 years. Hydroelectric power dominated during this time period, although the amount of wind generation increased sharply, particularly between 2004 and 2010.

Figure 5: Renewable Energy Consumption by the Electric Power Sector, 1990-2010



A. Renewable Energy in West Virginia and the Region

In West Virginia consumption of renewable fuels totaled 41.3 TBtu in 2010. This was eight percent of total energy consumption in the state of 738.9 TBtu.[3] Of this amount 34.7 TBtu is coming from biofuels (mostly ethanol used in transportation sector).

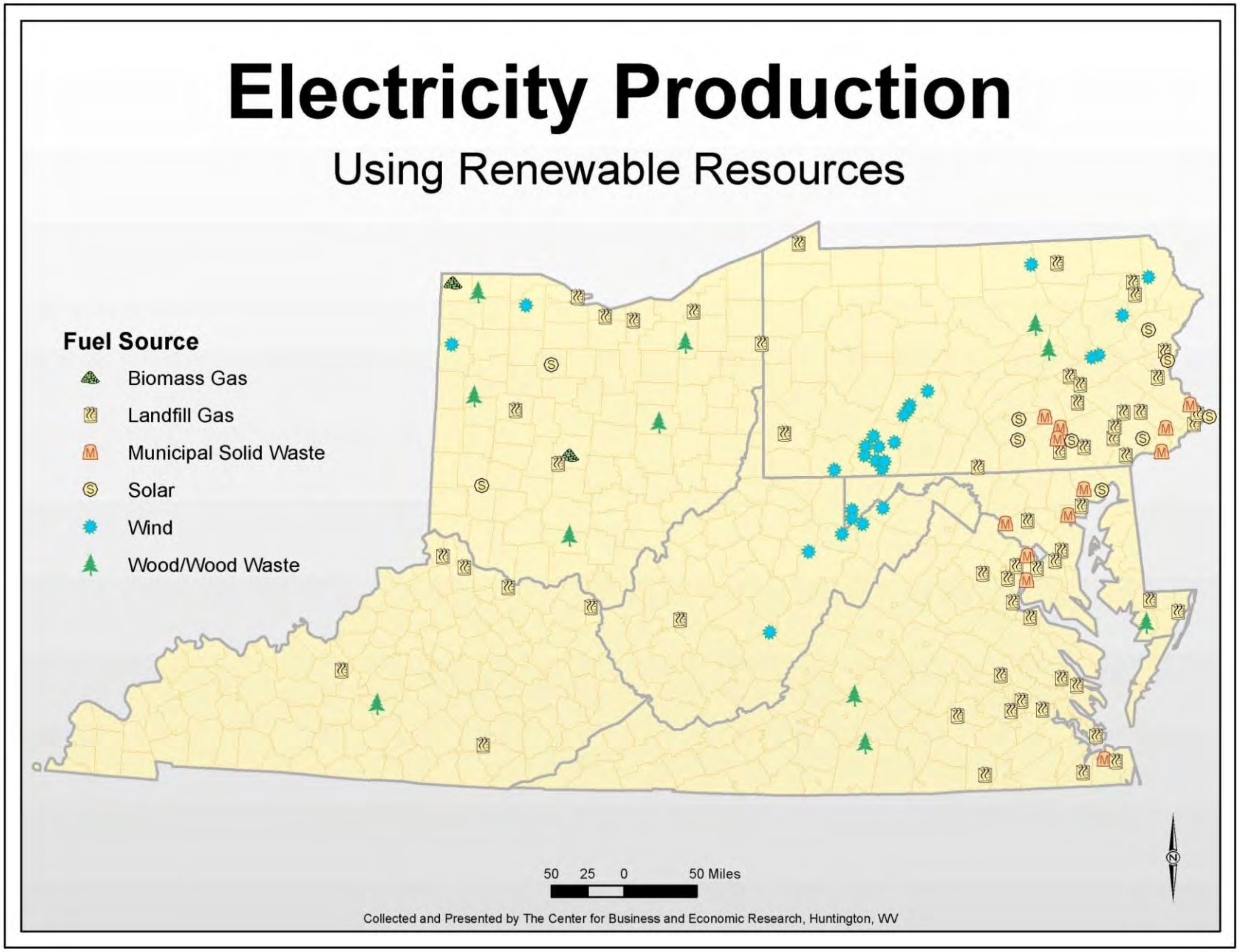
The purpose of this report is to outline the future role of renewable energy in West Virginia. This is accomplished by a set of reports which discuss each of the renewable sources: Wind, Solar, Biomass, Hydropower and Geothermal. Each section includes a discussion of the characteristics of the fuel, the positive and negative aspects of its deployment and its current use in West Virginia. A thorough discussion of how energy efficiency can become an even more important part of the West Virginia energy mix is also included in a separate report.

The purpose of each section is to provide conclusions and policy recommendations which can be included in the *Five Year West Virginia State Energy Plan 2013-2017.* The report is the contribution of the Center for Business and Economic Research at Marshall University and is a companion to a report on fossil fuels, electricity and nuclear power prepared by the Bureau of Business and Economic Research at West Virginia University.

To illustrate the extent of electricity generation already being produced from renewable resources, Figure 6 provides a map showing the location of power plants in the region that utilize renewable energy.

[3] U.S. Energy Information Administration, “Energy Consumption Overview”.

Figure 6: Map of Renewable Energy Electricity Generation Facilities



II. Biomass Energy

Biomass produces energy from three sources: wood, waste and alcohol fuels.[4] Wood produces energy from wood harvested as fuel and wood waste streams which includes pulping liquor or "black liquor" from the paper industry which is the largest source of wood energy. Waste energy includes: municipal solid waste (MSW), manufacturing waste and landfill gas. Waste is the second largest source of biomass energy. The greatest source of biomass energy is alcohol fuels, primarily ethanol followed by biodiesel.[5]

Biomass as a source of fuel has been discussed and researched since the oil embargo of the 1970's. The growing use of imported petroleum and environmental concerns of continued use of fossil fuels have continued and accentuated the inquiry. Turning to energy produced from biomass has been viewed as a means of meeting the nation's need for energy independence and environmental improvement.[6] This paper highlights the major sources of biomass energy and the public policy in West Virginia regarding their use. Conclusions regarding the prospects for each biofuel are also presented for inclusion in the West Virginia Five Year Energy Plan 2013-2017.

A. Growth in Biomass Energy Production and Consumption

There has been a significant increase in the production and consumption of biomass in the United States. Total biomass production in 1973 was 1,259 TBtu. This was 35 percent of total renewable energy produced. By 2011 production had increase to 4,483 TBtu which was 49 percent of all renewable energy production in the U.S. This growth was primarily in the production of biofuels which did not appear on the tabulations until 1985 at 93 TBtu and totaled 2,033 TBtu in 2011.[7]

Appendix A provides a breakdown of consumption by type of biomass type: wood, waste and biofuels. Wood and bio-fuels are by far the main consumption components with nearly identical statistics in 2010 (1967 TBtu and 1933 TBtu respectively). These two constitute 90 percent of all biomass consumption. Wood and biofuels account for 43 percent of all renewable energy consumed in the U.S. Non-hydro renewables (primarily wind and biomass) and natural gas are anticipated to be the two fastest growing sources of energy production in the U.S. over the next quarter century.[8]

[4] U.S. Energy Information Administration, *Renewable and Alternative Fuels*.
[5] U.S. Energy Information Administration, *Renewable Energy Annual 2009.*
[6] National Renewable Energy Laboratory, "Biomass Energy Basics".
[7] U.S. Energy Information Administration, *Outlook 2012: Early Release*.
[8] Ibid

B. Biofuels

1. Growth of Biofuels

Use of biofuels is expected to grow between 2011 and 2035 by 2.8 percent a year with most of the growth due to the new Federal Renewable Fuel Standard (RFS2) for transportation fuels and renewable portfolio standards (RPS) implemented in the states for electrical generation.[9] The production of biofuels envisioned in the Energy Independence and Security Act of 2007 (EISA2007) has fallen well short of meeting the Renewable Fuel Standards for 2022. EISA called for 36 billion gallons of biofuel to be produced by that date. Corn based ethanol was limited to 15 billion gallons with cellulosic ethanol and biodiesel were to contribute a minimum of 16 billion and 5 billion respectively.[10]

These standards will not be met and the Environmental Protection Agency has substantially reduced the cellulosic biofuels mandate.[11] The cellulosic standard reductions over the past three years have been cut from 100, 250 and 500 million to only 8 million for 2012. Due to financial and technological reasons, cellulosic biofuel capacity has been very slow to develop. On the distribution side there are liability problems from misfueling and inadequate infrastructure. Although the EPA has now allowed blending up to E15, dealers are being reluctant to offer the blend.[12]

In considering government policy for biomass, the conclusions reached by the National Research Council (NRC) apply to all types of biofuels discussed in this paper. The NRC investigated the possibility and problems associated with meeting the RFS2. Their primary conclusions were:

- Without major technological advances, the federal mandates for biofuels are unlikely to be fulfilled
- Biofuels are unlikely to become cost-competitive with petroleum based fuels unless there are sustained high oil prices (near or above $191), technological breakthroughs and/or mandated high costs of using carbon based fuels due to government policy.
- Using biofuels may not be an effective policy for reducing greenhouse gases emissions (GHG) depending on how they are produced and what land use changes occur in the their production.
- Without major increases in crop yields the additional cropland required for bio-fuel production will create competition for land use, raise cropland prices increasing the cost of food and feed production
- Achieving goals for bio-fuel production will require increased federal budget outlays for payments, grants, loans and loan guarantee plus forgoing tax revenue due to biofuel credits.
- The environmental effects of increased bio-fuel production depend on feedstock type, management practices, and conversion yields

[9] Ibid
[10] U.S. Energy Information Administration, *Annual Energy Outlook 2012*, 97.
[11] Ibid
[12] National Research Council, *Renewable fuel standard*.

- The primary barrier to increased bio-fuel use is the high cost of producing cellulosic bio-fuels when compared to conventional fuels.[13]

Similar issues were raised by the U.S. General Accounting Office[14] in their report to Congress.

2. Ethanol as a fuel

Ethanol is produced with the expectation that it substitute for petroleum-based gasoline. Ninety-nine (99) percent of all gasoline consumed in the U.S. in 2011 contained some ethanol.[15] Most of this consumption consists of a 10 percent mixture of ethanol with gasoline (E10). Due to EPA regulations, cars and light trucks built after 2007 must have engines capable of using an E15 mixture. E85 is consumed primarily in the Midwestern states where the majority of the corn feedstock is grown.[16]

Although 98 percent of ethanol used in the U.S. is produced from corn[17], sorghum and barley have also found limited usage. Other potential sources for ethanol production which are being used, explored or tested are:[18]

- Potato skins
- Rice
- Sugar cane (used extensively in other nations such as Brazil)
- Sugar beets
- Yard waste
- Forest residue
- Switch grass and other woody crops.

While none of these are extensively used in the U.S. they do contain the sugars needed for ethanol production. Further research is moving forward to determine if the entire corn plant (Stover) can be converted to ethanol and not just the grain.

There is continued controversy (including among major government agencies) regarding the impact of corn ethanol on crop production for human consumption and the impact on prices for foodstuffs. According to industry sources corn used in ethanol production required 40 percent of the U.S. corn crop in 2011.[19] Governors in two states have already requested the EPA to grant relief from the mandate for the use of ethanol citing rising feed prices.[20]

HR.1687 "Open Fuel Standard Act of 2011" would require by 2017, that 95 percent of all passenger and light truck vehicles are manufactured as to run on fuels which are not petroleum based. The bill specifically calls for these vehicles to use E85 or M85 fuels, fuel cells, or plug-in

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[13] Ibid
[14] U.S. Government Accountability Office, *Potential effects and challenges*.
[15] U.S. Energy Information Administration, "Ethanol and Biodiesel".
[16] U.S. Government Accountability Office, *Potential effects and challenges*.
[17] Ibid, p.17
[18] U.S. Energy Information Administration, "Ethanol and Biodiesel".
[19] Renewable Fuels Association, "Accelerating industry innovation".
[20] Abbott, C., "Two States Ask".

electric vehicles. Use of natural gas as a fuel is allowed as is biodiesel. The bill has not emerged from Subcommittee. Similar legislation was introduced in the Senate but remains in Committee.

3. Environmental effects of ethanol

The research on the environmental impacts of ethanol production and consumption is not conclusive.[21] Data from the U.S. Department of Energy contends:

- Ethanol produced from corn results in a 20 percent reduction in GHGs compared to gasoline and is fully biodegradable. This percentage increases to 85 percent for cellulosic ethanol
- Ethanol delivers one third more energy than is used to produce it[22]

Critics[23] claim the research supporting these findings is incorrect and does not consider the full "life cycle" effects of the chemicals and energy used in the production of ethanol. Other negative comments include:

- Land conversion from forest and/or pasture increases GHG and leads to deforestation
- Water supply is adversely impacted:
  - Pollution of water quality due to chemical runoff from crop production
  - Significant diversion of water from other uses to produce ethanol
- Higher food prices
- Reduced miles per gallon

All of these adverse impacts are reduced when corn is replaced with the "second generation" fuels such as switchgrass and other cellulosic feed stocks.[24]

Switchgrass has received considerable attention as the most desirable of the "second generation" ethanol fuels. Using switchgrass is advanced as being carbon neutral, capable of growing on marginal lands, producing high yields, needing little fertilizer and capable of being continually renewed.[25] The potential for switchgrass has been heightened with recent discovery of using genetic engineering to produce a higher grade of alcohol than ethanol from switchgrass without corn ethanol's negative features.[26] This has been accomplished by introducing e-coli bacteria which digests the cellulose fibers significantly reducing the cost of switchgrass as a fuel.[27] Introducing a corn gene into switchgrass doubles its yield and further improves conversion into fuel.[28]

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[21] US Governmental Accountability Office, *Potential effects and challenges*, 133-146; National Research Council, R*enewable fuel standard*.
[22] U.S. Department of Energy, "Ethanol myths and facts".
[23] The World Bank, *Biofuels*.
[24] National Research Council, *Renewable Fuel Standard*.
[25] Oak Ridge National Laboratory, "Biofuels from switchgrass" and Wright, *Historical perspective*.
[26] Schwartz, "Researchers produce gasoline-like fuel".
[27] Yarris, *Transportation fuels*.
[28] Chuck et.al, "Overexpression".

4. Ethanol in West Virginia

Currently all gasoline sold in West Virginia is E10. There are no State incentives for the use or expansion of ethanol on the books. While there is national attention to increase the blending of ethanol so far there has not been any movement in that direction in the State to require increased blending.

C. Biodiesel as a Fuel

Most large trucks, buses and tractors use diesel fuel for a variety of reasons.[29] Any engine which can use petroleum based diesel can switch to a 5 percent blend (B5) of biodiesel without modification. Either used by itself or in blends with petroleum based diesel, biodiesel is growing in popularity not only in the U.S. but in other nations as well.

In the U.S. biodiesel production has expanded from 10 million gallons in 2001 to 229 million gallons in 2010. This was a drop from the 316 million the year before and was due to the expiration of the federal biodiesel tax credit. The credit returned in 2011. Along with demand for exports and the RFS, consumption soared to 772 million gallons last year.[30]

The most popular blend of biodiesel is 80 percent petroleum and 20 percent biodiesel (B20). Most petroleum based diesel fuels include at least 2 to 5 percent biodiesel as it has greater lubricating qualities and prolongs engine life. But pure biodiesel and blends are sensitive to cold weather and require a different type of anti-freeze. Pure biodiesel also has detergent qualities which rule out its use in many vehicles, particularly older ones, as it leads to deterioration in hoses and couplings. Blends do not have this problem.[31]

Biodiesel is primarily produced from soybean oil in the U.S[32] totaling 65 percent of all biodiesel production.[33] Other feed stocks used are:

- Rapeseed and sunflower oil (Europe)
- Palm oil (Asia)
- Vegetable oils
- Tallow and other animal fats
- Restaurant waste
- Trap grease

1. Biodiesel and the Environment

Biodiesel has definite advantages over petroleum based diesel fuel.[34] It is non-toxic and biodegradable plus producing fewer emissions such as carbon monoxide, sulfur dioxide,

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[29] U.S. Energy Information Administration, “Biodiesel performance”.
[30] U.S. Energy Information Administration, “Use of biodiesel”.
[31] Ibid.
[32] U.S. Energy Information Administration “Transportation Sector”.
[33] US Governmental Accountability Office, *Potential effects and challenges*, p 21.
[34] U.S. Energy Information Administration, “Biodiesel and the Environment”.

hydrocarbons (including CO_2) and particulates than petroleum based fuels. But there is a slight increase over petroleum based diesel in emissions of nitrogen oxides.

Since biodiesel is produced from plant matter (particularly soybean oil and palm oil in the US), it is considered carbon neutral as the vegetation absorbs the carbon produced when converted into fuel and the plant regrown. But in underdeveloped nations clear cutting of forests and other natural vegetation have been removed and not replanted to produce feedstock. In these cases the negative effects of biodiesel are believed to outweigh the positive.

2. Biodiesel in West Virginia

Biodiesel use in West Virginia has been encouraged by a requirement in the State's Public School Support Program (PSSP) which provides an additional allowance for districts that use alternative fuels.[35] For those districts, "An additional allowance of 10% of the actual expenditures for operations, maintenance and contracted services, exclusive of salaries, for that portion of the bus fleet that uses alternative fuels."[36] For fiscal year 2011-12, about 250,000 gallons was used by the 48 (out of 55) districts which availed themselves of the option.[37] The additional cost to the PSSP was around $1million.

There is currently no biodiesel being produced in the State due to economic considerations.[38] School districts use B5 but what they use is produced out of state and conveyed to the districts from local distributors. Prior to this B100 was purchased out of state and then "splash blended" at the terminal with conventional diesel to produce B5. Refineries are now producing B5 which has eliminated the blending process.

The cost of B100 is between $4-5 a gallon.[39] With the rack cost of diesel around $2 using biodiesel increases the cost of a gallon of B5 by 10 to 12.5 cents compared to petroleum based diesel. The benefits to users relate to the greater lubricating properties of B5 and the enhanced environmental effects. These have not been quantified, so the use of biodiesel must be supported on grounds other than reduced costs.

D. Woody Biomass

Woody biomass consists of wood and wood wastes primarily bark, sawdust, wood chips, wood scrap (slash) and paper mill residues.[40] Four percent of energy used in the U.S. comes from biomass and 45 percent of that from wood resulting in woody biomass producing slightly less that 2 percent of total U.S. energy production.[41] Woody biomass comes from several sources[42]

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[35] Office of School Finance, *Public School Support Program.*
[36] Ibid, 4.
[37] Data from Shew, Ben, Office of Finance, West Virginia Department of Education, May 15, 2012.
[38] Cordle, Interview by Calvin Kent.
[39] Ibid
[40] U.S. Energy Information Administration, "Renewable biomass".
[41] U.S. Energy Information Administration, "Biomass".
[42] Ashton, "Woody biomass basics".

- Forest operation residues such as branches, tree tops, and stumps
- Wood products residue from sawdust and scraps from manufacturing facilities
- Urban waste wood and yard waste from landscaping, utility line maintenance and storm damage

While woody biomass can be converted to transportation fuels this is unlikely to expand significantly in the future. Because of the cost of building refineries and transporting the fuel, there are no commercial woody biomass refineries in U.S. production[43] although there are several small scale, mostly experimental, plants.[44] The costs of using woody biomass are in excess of the expense of using alternative renewables, so even in a carbon constrained world use of woody biomass is unlikely for transportation. Among the problems for using woody biomass as a fuel are:[45]

- Lack of reliable supply
- Poor and mixed quality
- Bulk, high moisture content and low energy value
- High cost of collecting, harvesting, storing and transporting.

Currently the greatest use of woody biomass (70 percent of total use) is in the commercial sector of the economy primarily at pulp and paper mills plus lumbering facilities using combined heat and/or power (CHP) produced from residues.[46] Almost all of this consumption occurs on-site. If surplus electricity is generated it usually is provided off-grid for direct consumption.

There is potential for continued use of woody biomass in the production of electricity. In 2010 189 TBtu was generated from woody biofuels[47] which is less than 1 percent of total U.S. electric power generation. In electric generation for the grid, wood is usually co-fired with coal. This can be accomplished with only minor adjustments, if any, to existing plant technologies.[48] For wood to electricity to expand there must be a dependable source available which can be transported at low cost (usually less than 75 miles distance from the plant). The problems of using wood as a fuel in electric generation are the same as for using it in transportation. Plus there is concern that using forest waste will harm the natural forest ecology.[49]

There has been success in Europe in burning wood pellets in co-fired electric plants using wood grown in the United States.[50] The wood, including residues, is compressed into pellets which assists in drying it and then shipped. In Europe it is considered to be carbon neutral so reduces the problems of compliance with European environmental standards.

One study of the potential use of wood as a fuel for electric generation concluded:

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[43] White, *Woody Biomass for Bioenergy*.
[44] Bevitt, "Cellulosic Biofuel Predictions".
[45] White, *Woody Biomass for Bioenergy*.
[46] Stowe, "Woody Biomass Power Industry".
[47] U.S. Energy Information Administration, "Renewable Energy Consumption".
[48] White, *Woody Biomass for Bioenergy*.
[49] US Governmental Accountability Office, *Potential effects and challenges*.
[50] Dorminey, "US Biomass: Where do all the wood pellets go?"

- The high cost of moving wood from place of harvest to place of use meant that electric plants would be small and dispersed (40-50 MW). Plants generally would have to be no more than 75 minutes one-way trip from power plant
- These small plants would not experience the economies of scale of larger plants which would mean they would be higher kWh producers
- Plants of this size are only justified if they are subsidized or their use is required under a RNP.[51]

This research indicates that these smaller plants may be most feasible if used for both electrical generation and direct use as district heating. To insure a reliable source of wood chips it may be necessary for loggers to be supplied with special equipment to be used in collecting slash during their logging operations further increasing the cost of using these wood-to-wire plants.

Wood pellets as a source for distributed heating is showing growth in the U.S. Wood is one of the oldest sources for home heat. To avoid the environmental problems associated with burning wood, the new generation of high-efficiency stoves, fireplaces and fireplace inserts certified by the EPA should be used. Since some cities have outlawed the use of wood burning stoves, local ordinances should be checked for those living in urban areas.[52]

1. Short Rotation Wood Crops (SRWC)

There has been interest in growing Short Rotation Wood Crops (SRWC) specifically for fuel. SRWC are fast growing tree species that can be planted at minimum cost and repeatedly harvested.[53] Among the candidates currently being researched are loblolly pine, eucalyptus, poplar, willow, cottonwood, sweetgum and sycamore.[54]

While there is still genetic engineering research ongoing directed to lowering the cost, SRWC has been successful as a fuel source in other countries and U.S. states are considering it as a means of rural development in heavily forested areas.[55] SRWC are usually grown on a plantation system near the electrical plant which will use them thereby reducing transportation costs.

2. Arundo Donax

A "cousin" to switchgrass and bamboo also has received increasing interest as a bio-fuel in electrical generation: Arundo donax (also known as *A donax*, giant reed, wild cane, Spanish cane and Carrizo).[56] There is activity growing *A donax* in West Virginia on abandoned mine land.[57] There are advantages claimed for using *A donax* over coal, petroleum, corn, soy beans or other woody biomass:

- High yield compared to other woody crops

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[51] Timmons et al., *Energy from Forest Biomass*.
[52] U.S. Department of Energy, "Wood and Pellet Heating".
[53] Langholtz, Carter and Rockwood, *Economic Feasibility*.
[54] Hinchee et al., "Short-rotation Woody Crops".
[55] Texas Comptroller on Public Accounts, *Energy Report*.
[56] eNotes, *Arundo donax*.
[57] Kuykendall, "Biomass Industry".

- Low maintenance (tillage, fertilization) except adequate rainfall
- Survives on low-fertility soils
- Cannot be used for food and is not consumed by animals
- Yields multiple harvests each year[58]

On the other hand *A donax* is viewed as an “invasive” or “noxious” weed in several states (CA[59], FL[60], GA,[61] plus TX, AZ, MD, VA[62]), Enthusiasts contend that the environmental problems can be managed and are the result of human error.[63]

Despite the environmental problems created by *A donax*, plans are afoot in Oregon where PGE is committed to eliminating coal at its Boardman plant which supplies 15 percent of the OR’s electric demand and using *A donax* as a fuel.[64] BGE in GA also plans to build an electric plant using *A donax.*[65]

3. Bio-Oil

For over a decade **Bio-oil** has been discussed as a means of using woody biomass as a substitute for fuel oil in residential, commercial, industrial and electrical applications.[66] Bio-oil, also called pyrolysis oil, results from rapid condensation of vapors produced by “cooking” wood by-products in an oxygen starved environment.[67] The quantity and quality of bio-oil produced varies considerably based upon the methods used, so it is difficult to reach definite conclusions about bio-oil potential without being specific regarding these methods.[68]

Major producers of bio-oil in the U.S. and Canada lists the following virtues of using bio-oil: [69]

- Considered to be carbon neutral with emissions of other pollutants (SOX, NOX) equal or less than fossil fuels which allows its use to earn carbon credits
- Produced from wood-wastes and agricultural wastes
- Is a renewable feedstock material
- Can be used as a single source fuel or in combination with other fuels
- Does not require a new distribution system
- Appropriate to be used in the production of hydrogen gas or syngas

The problems in using bio-oil have been identified as: [70]

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58 Daquila, “The Power in Plants”.
59 Ambrose and Rundel, *Nutrient Loading*.
60 Odero et.al., *Giant Reed for Biofuel*.
61 Anderson. et.al., “Final report on Arundo donax”.
62 Daquila, “The Power in Plants”.
63 Biomass Gas & Electric, “Bioenergy Crop”.
64 Meyers, “Boardman’s Next Life”.
65 Daquila, “The Power in Plants”.
66 Easterly, *Assessment of Bio-oil*.
67 Sustainable Energy Research Center, *Bio-oil*.
68 Mohan, Pittman, and Steele. “Pyrolysis of Wood/Biomass,” 848-889.
69 Dynamotive, “Dynamotive Bio-oil”.
70 Easterly, *Assessment of Bio-oil*.

- Lower energy content than conventional liquid fuels
- Higher acidity than fossil fuels which leads to corrosion in storage and distribution facilities
- High moisture content.
- High oxygen content
- Does not blend well with conventional fuels

Bio-oil is currently in limited commercial use but research is continuing[71] with government support in the U.S. and Canada.[72]

E. Municipal Solid Waste (MSW)

Energy recovered from waste results from conversion of non-recyclable waste into heat or electricity. Methods used for conversion include direct combustion, gasification, pyrolization, anaerobic digestion and landfill gas (LFG) recovery. The common name for all these processes is "Waste-to-Energy" (WTE).[73]

Recycling of waste accounts for 34 percent of the total waste generated in the U.S. in 2010. Per capita this amounts to 1.51 pounds per day. WTE has grown steadily in the past half century increasing from less than 10 percent of MSM in 1980 to the current figure.[74]

1. Waste to Energy by Incineration

Burning of MSW for energy has existed since the 1880's. In 2010 there were 86 WTE facilities in 25 states primarily in the Northeast. These facilities can produce 2,720 megawatts of power by processing 28 million tons of waste each year.[75] The EPA claims WTE produces electricity at 4 cents per kWh. The GAO places the cost at 7.5 cents.

There are several reasons as to why WTE has not expanded more quickly.[76]

- Capital costs. The cost of building a WTE facility ranges from $100 to $300 million. This makes WTE non-competitive with landfills in areas which are not densely populated.
- Need for dense populations to generate sufficient waste. Countries with dense populations in Europe, Japan and India have made extensive use of WTE, but those population densities do not exist in West Virginia.
- Problems with long term contracts (30 years+). WTE facilities require long payback periods and a constant and consistent supply of waste. In places where waste is collected by private carters, it is difficult to get long term commitments.

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[71] Evans, "Bio-oil Upgrade". Brown et. al. *Producing Bio-oil*. Garcia-Perez et al "Fuel Properties".
[72] Center for Research and Innovation in the Bio-Economy. "Wood Waste to Transport Fuel". Lane, "DOE to award up to $15M".
[73] U.S. Environmental Protection Agency, "Energy Recovery".
[74] U.S. Environmental Protection Agency, *Municipal Solid Waste*.
[75] U.S. Environmental Protection Agency, "Energy Recovery".
[76] U.S. Environment Protection Agency, "Energy Recovery". U.S. Government Accountability Office, *Natural Resources*.

- Public opposition to incineration. Until the Clean Air Act of 1970 MTE facilities were significant polluters. Since then federal and state regulations have significantly reduced the problem but opposition under NIMBY remains. CO_2 from WTE is not counted as GHG emissions (except landfill gas) as it is considered as part of the "natural carbon cycle." This has created opposition from some environmental groups.
- Problems from disposal of fly ash. 15-25 percent of the waste used in electrical generation remains as fly ash which has to be disposed in specially created landfills which are difficult to site and expensive to build.

a. WTE in Central Pennsylvania

The situation in Central Pennsylvania illustrates both the potential and problems with using WTE. Both York[77] and Lancaster[78] Counties operate WTE successfully converting burnable waste into electricity which is used to power the recovery facilities with remaining power being sold to the grid on long term contracts. Neither facility is tax supported. Both receive revenue from tipping fees, sale of ash and primarily sale of electricity. Both receive waste from outside their immediate jurisdictions including entities in New Jersey and Maryland.

The success in York and Lancaster is due to: [79]

- Sufficient population to support an adequate and consistent supply of waste.
- Long term contracts with governments outside their jurisdictions for the supply of waste.
- Long term contracts with electric distribution companies for the sale of electricity.
- Management by public authorities isolated from political pressures.
- Quality operation by private contractors.
- "Green Credits" for waste conversion.

The WTE facility in Harrisburg has not been financially successful and has been cited as one of the causes of that city's recent bankruptcy[80]. Recent investigations indicate the failure to be the result of mismanagement, corruption and political favoritism.[81] The Lancaster authority is currently in the process of purchasing the Harrisburg facility out of bankruptcy.[82] It is doing so to utilize the excess capacity in the Harrisburg facility as an alternative to building an additional plant in Lancaster. While the purchase cannot be consummated until after the bankruptcy proceeding is finalized, the current purchase price is $124 million.

2. Landfill Gas (LFG)

Landfill gas (LFG) is the major source of MSW used either directly as a boiler fuel or indirectly in electrical generation.[83] According to the U.S. EPA, 54 percent of all MSW is deposited in

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[77] York County Solid Waste Authority, *About us.*
[78] Lancaster County Solid Waste Management Authority, *Renewable Energy: Overview*.
[79] Warner, Interview by Calvin Kent.
[80] Varghese, Bathon, and Sandler, "Harrisburg Files for Bankruptcy".
[81] Malawskey, "Financial Mismanagement".
[82] Gletter, *Why the Authority Wants to Buy the Harrisburg Incinerator*.
[83] U.S. Environmental Protection Agency, "Project Development Handbook".

landfills. These landfills are the second largest human-caused source of methane emission in the nation. As a contributor to global warming methane is 20 times as potent as is CO_2. Using this gas rather than flaring it or allowing it to leak into the atmosphere, is viewed as one of the best ways to reduce the impact of humans on global climate change.[84]

a. Use of Landfill Gas to Generate Electricity

Across the U.S. 2/3rds of the LFG projects are used to generate electricity while the rest are in direct use. Electric generation employs gas turbines or internal combustion engines which can range in size from1 MG to 250kW. LFG is also used in cogeneration projects for electrical generation.[85]

Direct use is most likely successful when the user is within 5 miles of the landfill (some have been as far as 10 miles).[86] There are several cases where large industrial facilities have made direct use of LFG, but smaller projects include firing brick kilns, supplying pipeline quality gas, fueling garbage trucks, and heating for farm applications.[87]

The first step in estimating if a LFG project is viable is to establish if the site will produce sufficient methane to support the project. The criteria used by the EPA includes whether the landfill:[88]

- Contains at least 1 million tons of MSW
- Has a depth of 50 feet or more
- Is open or recently closed
- Receives at least 25 inches of rainfall annually.

A further consideration is the quality of the gas. LFG is a varying quality and must be cleaned of impurities and subject to dehumidification, particulate filtration and compression prior to usage. Improved technology has reduced this problem and LFG is now used in some instances with little or no further processing.[89]

b. Landfill Gas in West Virginia

There are currently 576 LFG plants operating in the US[90] with one in West Virginia: City of Charleston. A second site has plans to develop for power generation: J. P. Mascaro & Sons in Wetzel County. A third site, Berkeley County Solid Waste Authority, closed in 2003. Two other landfills have plans to possibly start electrical production within 2-3 years. The EPA lists nine

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[84] Ibid, 1.2 -1.9.
[85] U.S. Environmental Protection Agency, “Project Development Handbook”, 1-5.
[86] Ibid, 1-6.
[87] U.S. Environmental Protection Agency, “LFG Energy Project Profiles”.
[88] U.S. Environmental Protection Agency, “Project Development Handbook”, 1-12.
[89] Ibid, 1-1.
[90] U.S. Environmental Protection Agency, “Landfill methane outreach program”.

other West Virginia sites as "candidates" for LFG usage and an additional 11 as having "potential".[91]

An unpublished survey by the Marshall University Center for Business and Economic Research in 2012 of all private and public landfill operators in the State found that most are not yet ready to install flaring structures due to cost and an insufficient supply of methane. If flaring is not mandated or is cost prohibitive, than the additional capital costs of using landfill gas for electrical generation makes this expansion unrealistic. The cost of installing WTE facilities would lead to increases in tipping fees which are likely to be passed on to consumers.

All landfills are required to place monies into several escrow accounts to cover mandatory expenditures such as maintenance and closure. While the use of some of these funds might be available for covering the costs of the infrastructure for electrical generation this is not the purpose of these funds but an operator could petition the WV Public Service Commission to release funds for that purpose. Although this has been a recommended strategy to expand LFG to energy production[92] none have done so to date.[93]

F. Poultry Litter

The use of poultry litter as a fuel is being researched in the State. The poultry industry in West Virginia is concerned with energy as a production cost. Most of the industry relies on propane to heat its houses, a fuel that has increased in price in recent years. Although meat is the industry's primary product, poultry litter and bedding is a secondary product or co-product of many farms due to its nutrient content. Use of litter as an energy resource is uncommon, but limited potential exists.

There are several methods of extracting energy from broiler litter. The primary techniques are: anaerobic digestion (AD) and pyrolysis which includes gasification, and direct combustion.[94] There are research projects underway in the State on alternative uses of litter including generation of energy.

1. Anaerobic Digestion

The Bioplex project at West Virginia State University (WVSU) is an early thermophilic anaerobic digester (TAD) demonstration unit operating on broiler litter. This pilot plant has been continuously operating on chicken litter since 2003; the results derived from its research suggest this technology being feasible as a waste control and potentially as energy source on the farm. In 2007 Brinson Farm in Mississippi became the first on-farm TAD unit installed to operate solely on broiler litter.[95] The facility also generates electricity.

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[91] U.S. Environmental Protection Agency, "Landfill and LFG Energy Project Database".
[92] Hansen et al, *Prospects for Landfill Gas-to-Energy Projects in WV*.
[93] Information supplied by Steve Kaz of the Utilities Division of the WV Public Service Commission
[94] Martin, *Options for Using Poultry Litter*.
[95] Arora, *New Frontier for Anaerobic Digestion*.

The main research focus of the Bioplex digester program at WVSU has been: (1) to study the effect of temperature control strategy, frequency of feeding and organic overloads on digester performance.[96] The university has developed its own computer control software for the pilot plant based on real-time feedback of pH, temperature, and biogas composition and production. Reduction in pathogens during digestion is an important feature of the system. Various experiments evaluate pathogen kill over time and demonstrate that the material remaining after known incubation times is not viable.

WVSU has also proposed recommended practices for the use of digested poultry-litter solids and liquids as replacements for commercial fertilizers using test crops to demonstrate nutrient management practices when land-applying combinations of digested, poultry-litter liquids and solids. Due to the high cost of producing energy from the digester, the focus of the research has historically been pathogens and fertilizer products. A 2005 report from WVSU states: "Methane gas production from anaerobic digestion of animal manures is still not sufficient to justify construction of capital intensive regional digesters, even when natural gas prices were at $12 per 1000 cubic feet."[97]

WVSU also operates a "plug flow" digester, which is more suited for odor control but is less often used to generate electricity or other byproducts. Plug flow digesters are smaller and less expensive than anaerobic digesters, and the output of the digester is a more flowable material. This type of system may be more suited to small and medium-sized farms when faced with the requirement to utilize all their litter on-farm.[98]

2. Gasification

The Frye Farm gasification plant in Hardy County, WV utilizes up to 5,300 tons of broiler litter per year, with full capacity of 1,200 pounds per hour. Replacing propane costs was only one component of the project. As compared to propane heaters, this system reduced moisture in farm poultry houses, thereby reducing the concentration of ammonia in the air which improved bird health.[99]

3. Pyrolysis

A mobile Virginia Cooperative Extension and Virginia Tech University sponsored demonstration pyrolysis unit in Rockingham County, Virginia can process up to 5,500 tons of litter per year. The system is designed to produce slow release fertilizer (bio-char), bio-oil for use as heating oil, and biogas that can be used to heat poultry houses. The process is considered "fast pyrolysis" and operates at a temperature of 400 to 450 degrees Celsius. Because the unit is mobile it can be transported from farm to farm as needed.[100]

[96] West Virginia State University, *Bioplex*.
[97] Ibid.
[98] Correspondence with John Bombadier of West Virginia State University, July 15, 2010.
[99] Correspondence with Mike McGolden of Coaltec, Inc, February 15, 2008.
[100] Carbon-negative Network, "BioEnergy Planet".

4. Incineration

Incineration is the most commercially available and lowest-cost method of producing energy from poultry litter. It allows removal of large quantities of poultry litter in a centralized location and can utilize a combination of various types of biomass. A long-proposed incineration plant in Salisbury, MD is being revived in part due to new a State law that specifically allows such electricity to comply with its renewable portfolio standard. The proposed combined-heat-and-power biomass boiler operation will create 70,000 pounds per hour of steam for an adjacent Perdue Agribusiness complex using a combination of poultry litter, layer hen manure, wood chips and other local biomass.[101]

Each of the four methods of converting broiler litter has its own benefits. However, because of its current value as a fertilizer, broiler litter is unlikely to become a suitable resource for energy production unless environmental regulations restrict its use as a fertilizer. Even then, litter is likely to require a large subsidy in order to be developed.

Demand for litter as a fuel may have to compete with the market for treated litter, which may possess superior economics compared to development for energy[102]. Treated litter products retain some nutrient value and could eventually become more marketable as a fertilizer. If EPA regulations remove litter as an income stream for growers, many farms may be faced with a dual problem of excess litter and reduced revenue. In this event, providing an incentive to utilize litter in the growing operation may be more logical.

State financial incentives specifically for poultry litter are rare. Most incentives are directed toward the energy conversion technology or animal waste in general. Anaerobic digestion is included as a qualifying portfolio standard technology in several regional states including West Virginia, Delaware, Maryland and Pennsylvania although the type of waste that is digested is not specified. In May 2012 the Maryland legislature enacted a bill allowing thermal energy associated with biomass systems that primarily use animal waste to qualify as Tier I resources under the State RPS. AD is also available for corporate tax credits taken against electricity produced in Maryland. In Pennsylvania, AD is eligible for grants and loans through the State Alternative Energy Investment Fund. AD was included as a local option under Ohio's Special Energy Improvement Districts legislation, a low-interest loan program, although the program was suspended[103].

Due to the markets that already exist for broiler litter, the use of chicken litter as energy feedstock is not a viable option in the next five years. If environmental regulations become more stringent alternative uses of litter including energy may become more viable. Even in the presence of greater environmental restrictions on the use of litter, developing poultry litter to produce energy may not be the best use. The markets for other litter products, primarily the fertilizer market, may prove more feasible.

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[101] Geiver, "Poultry-litter-to-energy".
[102] Risch, *Evaluation of Opportunities*.
[103] Database of State Incentives for Renewables & Efficiency, S*olar Policy Guide*.

G. Biomass and Biofuels Policy in West Virginia

The West Virginia "Alternative and Renewable Energy Portfolio Standard"[104] stipulates that utilities must obtain 25 percent of their energy resources by 2025 from alternative and renewable resources. Appropriate biomass sources include: landfill gas, biomass, municipal solid waste, biodiesel and anaerobic digestion[105]. As of 2009, renewable energy produced in West Virginia amount to 35.6 TBtu with an insignificant amount coming from biomass and biofuels.[106]

Other than using biomass as a means of meeting the State's Renewable Portfolio Standard and the incentive for schools to use biodiesel, there are no specific laws, regulations, tax credits, subsidies or other incentives for use of biomass in the State.[107] There are provisions for use of alternate fuels in vehicles and transportation, but these apply only to fuels such as natural gas, propane, electricity, hydrogen, and coal-derived liquid fuels but not biomass.

Figure 7 describes programs offered to encourage use of biomass in surrounding states.

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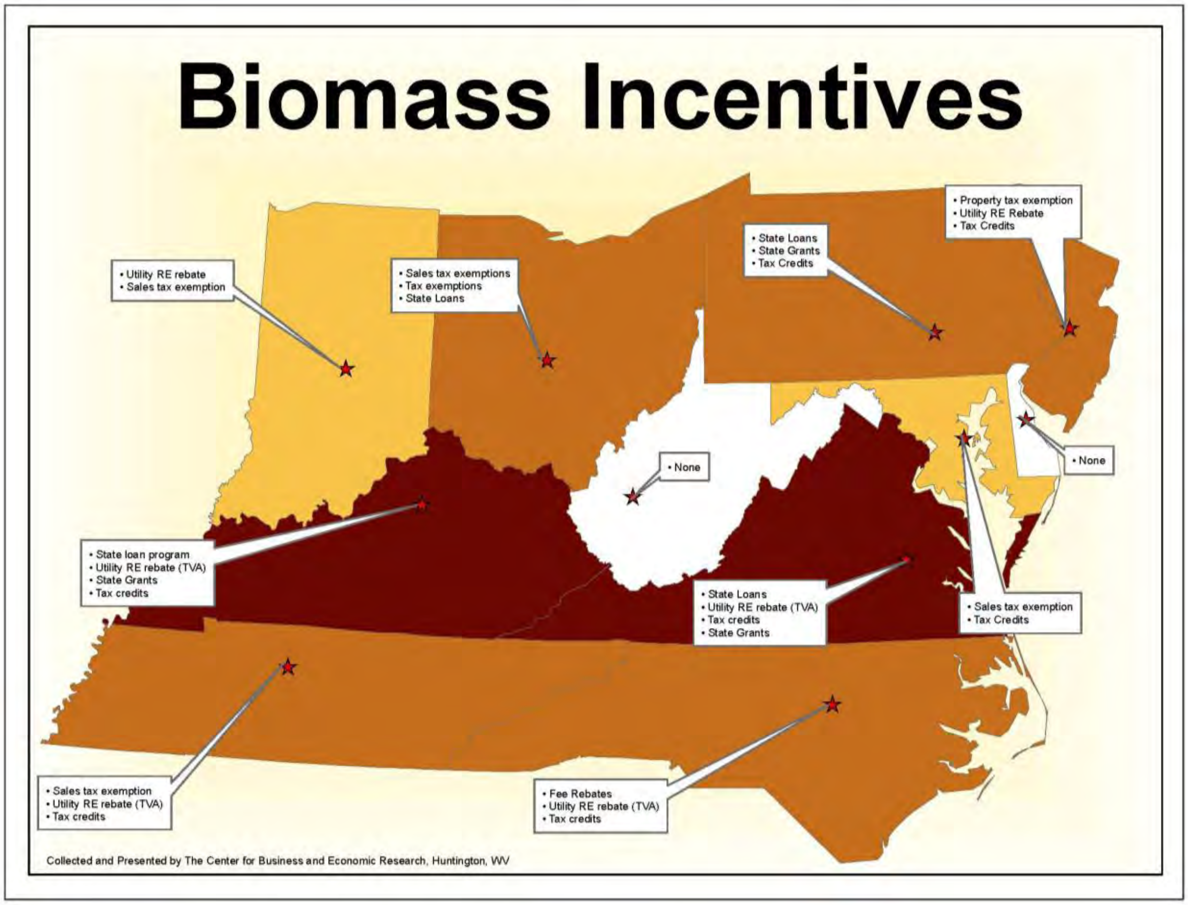
[104] W.Va. Code 24-2F-1 *et.seg.* and SB 350 June 11, 2010
[105] W.VA Code 24-2F-3(13)
[106] U.S. Energy Information Administration, "Data System".
[107] Alternate Fuels and Advanced Vehicles Data Center, "West Virginia Incentives and Laws".

Figure 7: Map of Regional Biomass Incentives



East Coast states have a variety of incentives for the production and distribution of bio-fuels.[108]

- (Uncapped) Producer Production Incentives are provided to producers primarily in the form of tax credits and reimbursements for the percentages of capital costs of the project with no monetary limit (IN, MA, OH). Ohio provides payments to ethanol producers up 50 percent of invested capital in ethanol plants. This program expires tax year 2013.
- (Capped) Producer Production Incentives are the same as above, but the amount of the credit or reimbursement is capped at a dollar amount (IL, IN, KY, MD, MS, PA, TN, VA) which varies based on the fuel stock and type of facility. Kentucky provides an income tax credit to biodiesel producers of $1 per gallon with a statewide cap of $1.5. Million. Maryland provides a 20 cent per gallon subsidy for ethanol or biodiesel made from soybean oil and a 5 cent per gallon subsidy if made from other small grains. Virginia provides a grant of 10 cents per gallon for biofuels sold in the state.
- Government Renewable-Fuel Vehicle Purchase Mandates provide for the state to discount or reimburse for the cost of obtaining renewable fueled vehicles (IN).

[108] Koplow, *Biofuels-at what Cost*.

- Grants, Subsidized Credit and Tax Concessions related to capital investment includes loans, loan guarantees and tax credits to increase renewable fuel plant development projects for new or existing facilities (DL, IL, IN, KY, NJ, NY, NC, PA). Both Kentucky and Pennsylvania have made small grants for ethanol and biodiesel facilities.
- Government-Funded Research, Development, Demonstration Projects and Market Promotion encompass grants and rebates for biofuel research and demonstration projects (DL, IL, NY). Illinois and New York have programs to fund research related to ethanol and biodiesel production with an emphasis on cellulosic ethanol.
- Consumption Subsidies provides rebates for state and local governments and private consumers who purchase alternative fuels (MD, NJ, NY, NC). Maryland has a 50 percent rebate of the incremental cost of purchasing blended biodiesel.
- Subsidies for Infra-structure Related to Biofuel Distribution provide grants, tax credits and cost reimbursements for the installation costs of biofuel infrastructure (IL, IN, KY, MA, NJ, NC, OH, TN). Ohio's program provides a $5,000 grant for facilities to handle E85 and $15,000 grant for B20 infrastructure.
- Subsidies to Biofuel Consuming Capital including tax credits for the purchase of alternative fueled vehicles and/or mandates requiring the purchase of these (GA, IL, WV). West Virginia has a $3,750 tax credit to be taken over three years for E85 infrastructure.
- Support for the Production of Feedstocks/Renewable Fuel Mandates refer to expedited permits for biofuel plants and mandates or goals for state and local government use of renewable fuels (IL, NJ, NY, NC, OH, VA, MD, WV). The Ohio program mandates the purchase of vehicles in the state fleet to be able to drive on E85 while Virginia's program only encourages state fleets to use biodiesel when available.

H. Conclusions

Based on the above analysis, there are possible conclusions to be drawn regarding renewable biomass energy policy under the State's Energy Plan for the upcoming five years.

- There is little likelihood that ethanol production from corn will occur in the State due to the need for corn ethanol plants to be near significant sources of supply. Corn is not a major crop in terms of total production in West Virginia.[109]
- There is very limited potential for development of biodiesel as an industry in West Virginia. Biodiesel was manufactured only at the AC&S facility in Nitro West Virginia which could operate a three (3) million gallon a year batch plant.[110] Production of soybeans in the State is insufficient to supply a major bio-diesel facility.[111] If the biodiesel industry were to develop most of the feedstock would have to be imported from out-of-state providing less economic impact than development using other fuels. Currently there is only one biodiesel distribution center in West Virginia at Inwood on I-81 south of Martinsburg. Encouraging use of biodiesel has environmental benefits but these have not been quantified.

[109] Hanshaw, *Biomass and Ethanol Production*.
[110] US Energy Information Administration, "Table 4 Biodiesel Producers".
[111] Hanshaw, *Biomass and Ethanol Production*.

- Considering the extent of forestation in West Virginia, study of the use of woody biomass as a fuel should be explored particularly as a source of home heating. The U.S. Forest Service in 2010 claimed West Virginia is one of only a few states which have heavy forestation which has not prepared an evaluation of biomass availability and utilization as an energy source.[112] A 2007 report does discuss the use of wood as a fuel and indicates the processes which could be used to reduce the cost of using wood as a co-generator with coal at West Virginia generating plants.[113] But the report indicated that using coal was not cost-effective when compared to conventional fuels given current technology.
- There is a possibility that ethanol from switchgrass may have some limited potential in the State. But the need for a production facility in the state and the amount of alcohol fuel which can be produced locally will inhibit its development.
- *A donax* is another bio-fuel which requires advanced research before its widespread use is likely. Considering the availability in West Virginia of reclaimed mine land and other marginal soil in West Virginia, technological developments should be monitored. As is the case with all biofuels there will be a need to locate a bio-refinery nearby if the potential is to be developed.
- While it does not appear that population densities in West Virginia are insufficient for WTE projects to be feasible, the success of facilities elsewhere is worthy of future investigation. The possibility of forming regional authorities around the State's population centers to construct these facilities is an option for consideration as is the only way such facilities could become feasible. This would require special legislation.
- Energy from LFG, merits only limited consideration. Currently there are only two WTE landfills operating in the State. Contacts with operators of the other landfills indicate little possibility that development is likely to occur within the next five years.

[112] U.S. Forest Service, *State Woody Biomass Utilization*.
[113] Wang, Grushecky, and McNeel, *Biomass Resources,* 65-68.

III. **Overview of Solar Energy in the US and WV Energy Picture**

Solar-powered electricity production is still small relative to total production and consumption in the U.S. However, solar generating capacity has grown sharply in recent years. As of 2011, there were approximately 2,500 MW of photovoltaic (PV) capacity installed in the United States.[114] In 2010, annual global PV module shipments exceeded 17,000 MW, a 120% increase over 2009 although going forward research suggests that the growth rate could subside to a forecasted 14% growth in 2011 and 20% in 2012.[115] Much of this recent growth was driven by stable federal incentives, largely tax credits and cash grants provided through stimulus funding which were concentrated in the year 2010.[116]

As expected, states with higher insolation produce larger quantities of electricity from this resource than does West Virginia. Table 1 below provides a comparison of average annual solar insolation for select cities, demonstrating the variation in intensity by geography.[117]

Table 1: Average Annual Solar Insolation

Area	**kWh/m²/day**		**Area**	**kWh/m²/day**
Daggett, CA	6.51		Philadelphia, PA	4.75
Las Vegas, NV	6.31		Charleston, WV	4.55
Flagstaff, AZ	5.91		Cleveland, OH	4.31
Austin, TX	5.24		Boston, MA	4.23
Atlanta, GA	5.03		Seattle, WA	3.67

[1]PV Watts

An index called the Optimum Solar Deployment Index (OSDI) ranks each of the 50 states by several factors that make installation of solar capacity desirable. These factors are the level of insolation, the amount of economic activity that would be created by the facility, the cost per watt to install the facility, the price of electricity in the state and the carbon dioxide that the solar-generated electricity might offset based on the generation mix in that state. The OSDI ranks West Virginia 24th out of 50, presumed to be due largely to the current carbon-heavy generation mix, even though the state's solar insolation is only ranked 8 out of 50, with 50 being the best. If only costs and insolation are considered West Virginia is ranked 29th. If only price and CO^2 savings are considered West Virginia is ranked 35th. Based on these rankings it is concluded that the optimal location for solar deployment is in the western U.S., which should be most heavily developed for its solar resources.[118]

A. Utilization Trends

Demand for solar energy systems in the United States is concentrated in the West, with California being the largest market with 28 percent of installed capacity in 2010.[119] In the eastern

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114 National Renewable Energy Laboratory, *Solar Technologies*.
115 Electric Power Research Institute, "Technology Guide".
116 Sherwood, *Solar Market Trends.*
117 National Renewable Energy laboratory, *PVwatts*.
118 Croucher, "Optimal Deployment".
119 Sherwood, *Solar Market Trends*.

U.S., states with solar mandates have seen considerable growth in installations. Regionally these include the states of Pennsylvania, Ohio, North Carolina, New Jersey, New York, Maryland and Delaware as well as the District of Columbia.

A study of State-level solar installation for the time period of 2000 to 2008 concluded that states with higher levels of installations have not just better solar resources in common.[120] States with higher levels of solar deployment tend to have the following characteristics:

- larger populations
- higher average incomes
- higher electricity or natural gas prices
- a need to import more energy
- better solar resources
- a more liberal citizenry.

Figure 8 compares installed solar capacity for select regional states as of the end of 2011. At the time, West Virginia had about 750 KW of grid-connect PV capacity. If 2012 additions and off-grid installations were included these numbers would be larger. Some overlap between utility-scale and net-metered capacity may occur.

Figure 8: Utility-Scale and "Behind the Meter" PV Capacity for Select States as of 2011

State	Utility-Scale Capacity (MW)	Total Net-Metered Capacity across All Sectors (MW)[121]	# of Net Metering Customers across All Sectors
Delaware	12.5	14.1	919
Indiana	0	1.32	238
Kentucky	0	1.14	208
Maryland	4.4	36.92	2,456
New Jersey	146.6	441.4	12,907
North Carolina	59.4	3.72	261
Ohio	22.9	19.33	899
Pennsylvania	25	137.1	6,408
Tennessee	0	0.4	17
Virginia	0	6.55	992
West Virginia	0	0.75	151

SOURCE: US Energy Information Administration, Forms 860 & 861.

1. Solar renewable energy credits

Solar renewable energy credits (SRECs) have come to play a very important role in the demand for and utilization of solar energy. SRECs are state-specific markets for electricity generated by solar energy and are tied to state mandates that solar energy comprise a portion of renewable portfolio standards. Typically, one SREC is issued for each MWh of electricity generated from a

[120] Sarzynski, *Solar Incentive Programs*.
[121] These are lower bound estimates based on existing electric power industry survey data at the end of 2011.

solar electric system. The price of an SREC is tied to the rate required to be paid for non-compliance, a solar alternative compliance payment (SACP), and the existence of a SACP. Another important factor is whether the state SREC market is open or closed to systems installed outside of the state.

Regional states with SREC markets are New Jersey, Pennsylvania, Delaware, the District of Columbia[122], Maryland and Ohio. The State of North Carolina has a solar mandate but has no alternative compliance payment requirement and thus has no real market for SRECs.[123] Most of these states are closed to participation by outside systems. Ohio allows participation by bordering states only at an amount equal to 50 percent of the solar set-aside. Pennsylvania is the only state whose SREC market is currently open to all states within the PJM region.[124]

Table 2 shows the range of SREC prices for various states over the last two to three years. As SACP levels are set to decline over time, the prices for SRECs decline as well.

Table 2: Range of Prices for Regional SREC Markets as of June 2012 ($/MWh)

STATE	2012/2013 Compliant?	2012	2011	2010	Market Open To
Delaware	Yes/No	$40-$60	$60 to $260	$200 to $300	DE only
The District	No/No	$240-300	$20 to $325	$250 to $405	DC only
Maryland	No/No	$170 to $218	$175 to $320	$320 to $390	MD only
New Jersey	Yes/Yes	$155 to $245	$550 to $670	$640 to $660	NJ only
Ohio	Yes/Yes	$30 to $285	$30 to $400	$290 to $400	IN, MI OH, PA, WV
Pennsylvania	Yes/Yes	$16 to $20	$10 to $250	$200 to $310	DC, DE IL, MD, NC, NJ, OH, PA, VA, WV

[1] SRECTrade

[2] Flett Exchange.

It has been stated that, in the case of Pennsylvania, market inclusiveness combined with lack of a firm SACP level has caused an oversupply of SRECs and suppressed prices. The Pennsylvania SACP is 200% of the average market value of SRECs sold in that energy year and is not disclosed until six months after the close of the energy year.[125] New Jersey, on the other hand, has pre-set prices for SACPs. State legislatures are responsible for setting SACPs and some states adjust portfolio goals in an effort to keep prices high and avoid volatility.

[122] Only out-of-state systems registered prior to 1/31/2011 can continue to sell SRECs in the DC market.
[123] SRECTrade, “North Carolina SREC Market”.
[124] Flett, *Exchange.*
[125] Ibid.

2. Trends in prices

The price of solar PV modules has declined steadily over the last 30 years, falling to nearly $2 per watt in 2010 from $23 per watt in 1980[126]. The cost of installed systems has fallen from about $11 per watt in 2001 to around $7 per watt in 2010 for "behind-the-meter" or utility customer-connected systems.[127] Larger installations tend to be less expensive per watt than smaller installations due to economies of scale and volume discounts.

The supply of solar panels manufactured in Asia has been one driver of reduced systems costs for consumers in the U.S. In 2010, 59 percent of all PV cells were produced in China and Taiwan.[128] In 2011, low-priced panels induced a "dumping war" of solar manufacturing products between the US and China when the U.S. Department of Commerce stated that is was considering countervailing import duties against Chinese PV module producers, a move that benefited manufacturers in Taiwan.[129] According the Solar Energy Industries Association U.S. solar PV manufacturers produced 1,100 MW of panels in 2010, nearly double that of 2009.[130]

Most solar PV installations are residential. As of 2010, more than 139,000 of 154,000 PV installations connected to the grid were residential.[131] Utility-scale solar systems have also been installed in greater numbers in recent years and dwarf residential and average non-residential systems in size. As of the end of 2011, most of the 225 utility-scale systems (as reported by the Energy Information Administration) are located in the southwest and Florida but 95 are located in the Eastern U.S. outside of Florida.[132] Additional projects are in the development stage.

Other industry trends include the increasing size of a solar system both for residential and non-residential installations. For residential installations the average system size increased from around 3 kW in 2001 to nearly 6 kW in 2010. The average non-residential system increased from around 30 kW in 2001 to 80 kW in 2010.[133]

3. Cost of Production

In terms of an annualized cost per MWh of electricity produced, the levelized cost of electricity (LCOE) produced from solar systems has declined but remains high compared to other resources. Figure 9 shows Energy Information Administration (EIA) estimates of LCOE for new power plants to be brought on line in 2016, including solar and other types of facilities.[134]

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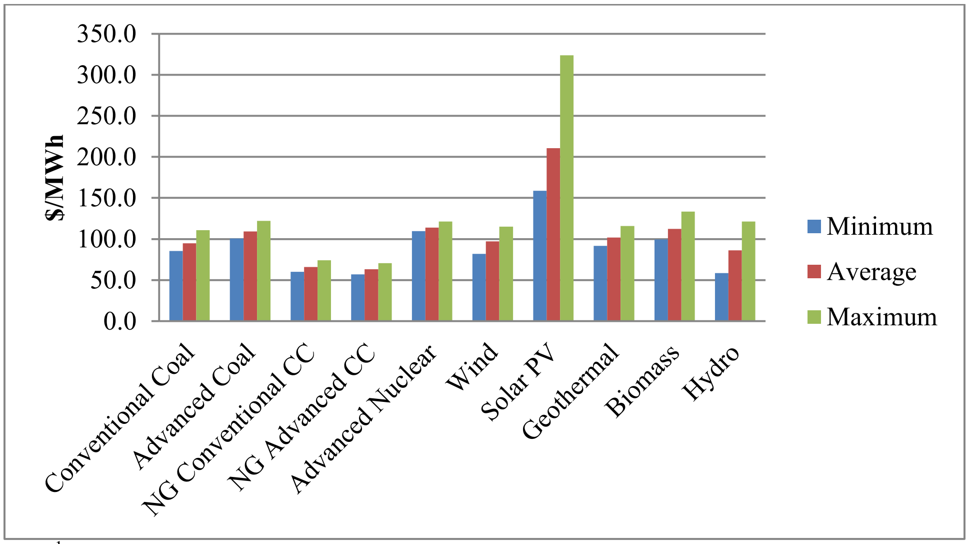
[126] National Renewable Energy Laboratory, *Solar Technologies*.
[127] Ibid
[128] Ibid.
[129] PVTech, "Taiwan PV Producers".
[130] National Renewable Energy Laboratory, *Solar Technologies*
[131] Sherwood, *Solar Market Trends*.
[132] US EIA Form 861.
[133] Sherwood, *Solar Market Trends*.
[134] LCOE figures include overnight capital costs, fuel costs, fixed and variable O&M costs, financing costs and assumed utilization rate for each plant type.

Figure 9: Estimated Levelized Cost of New Generation Power Plants[135]



[1] U.S. Energy Information Administration

State and federal tax incentives are not included in the above figures. Federal incentives have had a significant impact on the level of solar installations over the last few years. Such incentives lower these costs by subsidizing a portion of capital or by allowing a portion of capital costs to be deducted from taxes owed. The Emergency Economic Stabilization Act of 2008 removed the investment tax credit cap for both residential and commercial systems, extended it to 2016 and also made utilities eligible for the credit.[136] This incentive allows individuals and corporations, including utilities, to receive an uncapped tax credit equal to 30 percent of the cost of the PV system.

4. Competitive Position

The current state of solar electricity production is well-summarized by the following quote from the Managing Editor of Renewable Energy Focus. "The key factor for now in determining the potential returns and thus cost-competitiveness of solar PV from an investor's view is the level and life-span of public subsidy available to it in any give location."[137]

The cost of electricity based on the cost to generate a unit of electricity is not the only important aspect of the resource. The issue of grid integration is also very important, and one that makes achieving the avoided emission goals of deploying solar energy less possible. Because insolation is variable, a solar-powered system does not offset conventional generation all the time or even at a constant rate when it is generating. Conventional generation must still be made available to serve electricity load whenever solar resources are not available, e.g. at night and when it is too cloudy to generate. While peak solar energy output corresponds somewhat closely with increasing load during much of the year, approximately 10am to 3pm, the ultimate peak load

[135] "NG" refers to "natural gas-fired plants" and "CC" refers to "combined cycle."
[136] National Renewable Energy Laboratory, *Solar Technologies*.
[137] Rajgor, "Real Cost of Renewable Energy".

occurs earlier or later in the day when insolation is much less. In a 2008 study, Carnegie Mellon University concluded that solar PV systems have a larger magnitude of power output fluctuation than wind energy and that the costs of large scale solar PV integration are thus likely to be larger than those of wind.[138]

The National Renewable Energy Laboratory hosted a workshop on utility-scale PV integration in 2009. The primary lesson learned was that more data was needed in order to fully understand the impact of solar variability on system operations, particularly with attention paid to the impact on real-time power quality.[139]

Thus, a grid-connected solar facility's ability to offset conventional generation and reduce emission from fossil fuels is not one to one because system resources must still be committed. This is evidenced by the presentation of utility requests to recover the costs of providing stand-by power to customers with net-metered systems. The Commonwealth of Virginia allows utilities to impose "stand-by charges" on net-metered systems larger than 10 kW, including expedited processing by the Virginia State Corporation Commission for such requests.[140] While the fossil emissions avoided by solar facilities is certainly greater than zero on an annual basis it is also unlikely that every MWh of solar-generated electricity can offset the emissions generated by the system in producing one MWh.

5. Future Prospects

The trend of declining capital costs is not expected to continue. Current module prices are said to be nearly too low to sustain manufacturing and there is excess supply in the market.[141] As many federal and State financial incentives are disappearing or diminishing, the affordability of solar systems is not likely to improve in the near-term.

Considerable resources are being devoted to understanding and improving the grid integration issue. Among these are the National Renewable Energy Laboratory's Energy Systems Integration effort[142] and stakeholder groups such as the Utility Variable-Generation Integration Group (UVIG) - formerly the Utility Wind Integration Group - a consortium of utilities, grid operators and regulators devoted to accelerating the integration of variable resources into utility power systems.[143] The results of the next few years of research will more clearly reveal the opportunities to efficiently deploy technology to capture solar energy. In terms of the PV systems that would be deployed in West Virginia, newer generation modules with higher efficiencies are being developed. However, due to lower insolation it is more expensive to capture solar energy in places like West Virginia and these systems are also less able to induce significant emissions reductions.

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[138] Apt and Curtright, *The Spectrum of Power*.
[139] National Renewable Energy Laboratory, *Utility Scale*.
[140] Pierobon, *Renewable Mandates*.
[141] Botha, Interview with PV Insider.
[142] National Renewable Energy Laboratory, *Energy Systems Integration*.
[143] Utility Wind Integration Group, *About*.

B. **West Virginia Law Relating to Solar Energy**

1. Legislation/Regulation

Solar energy is specifically listed as a resource eligible to participate in net metering arrangements per the WV Public Service Commission.[144] There are no special provisions applicable to solar energy required of the WV PSC outside of interconnections standards that apply to all net metering projects.

Solar energy is also listed as an eligible resource to comply with the State Alternative and Renewable Portfolio Act.[145] The Act includes no mandated share of generation that must be supplied with solar.

West Virginia passed legislation protecting solar access rights. H.B. 2740 restricts housing associations from prohibiting solar energy systems on homes, although housing association members may vote to establish or remove such restrictions.[146]

2. Tax Policy

Under WV Code §11-13Z-1 the State provides a $2000 personal income tax credit for households that install solar energy systems. The credit applies to residential systems that: 1) generate electricity; 2) heat or cool a structure; or, 3) provide hot water for use in the structure or to provide solar process heat. Swimming pools, hot tubs or any other energy storage medium that has a function other than storage are not covered unless the system used to provide hot water derives at least fifty percent of its energy to heat or cool from the sun. As currently worded, the credit does not apply to systems installed after July 1, 2013.[147]

C. **Policy Options**

1. Portfolio standards/Solar Mandates

The primary state-level incentives used to induce solar installations are solar set-asides, also known as solar carve-outs. Regional states with solar set-asides mandate that solar energy comprise a set portion, often two percent, of the state's renewable portfolio standard. This amount is made mandatory through setting of alternative compliance payments that a utility must pay if they do not meet the state target. SRECs represent the value of the compliance payment, which is set by state legislatures.

2. Rules and regulations

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[144] West Virginia Public Service Commission, *General Order*.
[145] WV Code §24-2F
[146] Database of State Incentives for Renewables & Efficiency, *Solar Rights*.
[147] WV Code §11-13Z-3

State-level regulation of solar energy is largely limited to the utility portfolio standard requirements discussed above. Some states have siting rules that affect solar facilities, but such rules primarily ensure that siting can occur and are in the form of access rights, easements or siting standards. Siting regulations are more common in states with solar mandates. For example, New Jersey has a law allowing solar-powered electricity production as a permitted use in qualified industrial zones. The State of Maryland provides a solar access easement to preserve the exposure of solar energy devices to the sun.[148]

3. Taxation

Several states have developed ways to encourage solar installations through exemption from various taxes including: sales tax, income tax (like that currently allowed in WV), property tax, etc. Presently, solar panel purchases in West Virginia are subject to the State sales tax. Solar panels themselves are not officially exempt from local property taxes, although since most installations are relatively new it is unlikely that property appraisers have included the panels in valuation.[149]

As there are no utility-scale solar facilities in West Virginia the question of what rate to tax such generation has not been raised and it is assumed that solar-powered electricity would be taxed at the same rate as non-wind generation. The property tax exemption that currently applies to utility-scale wind generating equipment in WV also does not apply to solar equipment.

Other states have put in place incentives designed to recruit solar equipment manufacturers. The State of Virginia offers a direct payment of $0.75 per watt of panels sold.[150]

4. Other incentives

States have also instituted low cost loan and grant programs to promote adoption of solar energy systems. Such programs are heavy on paperwork, inefficient and arguably inappropriate for state governments to undertake. Some state grant funds may now be greatly reduced as many were largely ARRA-funded. In West Virginia, most consumers will not be willing to enter into a loan agreement for a solar electricity system with the payback they would receive as borrowing money simply increases the cost of a system.

Most states in the region have chosen to fund solar by passing costs along to all electricity customers via their utility. Given the recent utility rate increases imposed on West Virginia ratepayers it is unlikely that the PSC CAD and other rate case interveners would support such surcharges.

The following graphic shows the types of incentives that are available to develop solar resources in regional states. Local or non-profit incentives are not included. West Virginia has fewer incentives for solar energy than most of the nearby states. However, West Virginia is one of only

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[148] Database of State Incentives for Renewables & Efficiency, S*olar Policy Guide*
[149] Sherald, Interview by Christine Risch.
[150] Database of State Incentives for Renewables & Efficiency, *Solar Manufacturing Incentive*.

three states in the region that have a personal income tax exemption option for installing solar systems.

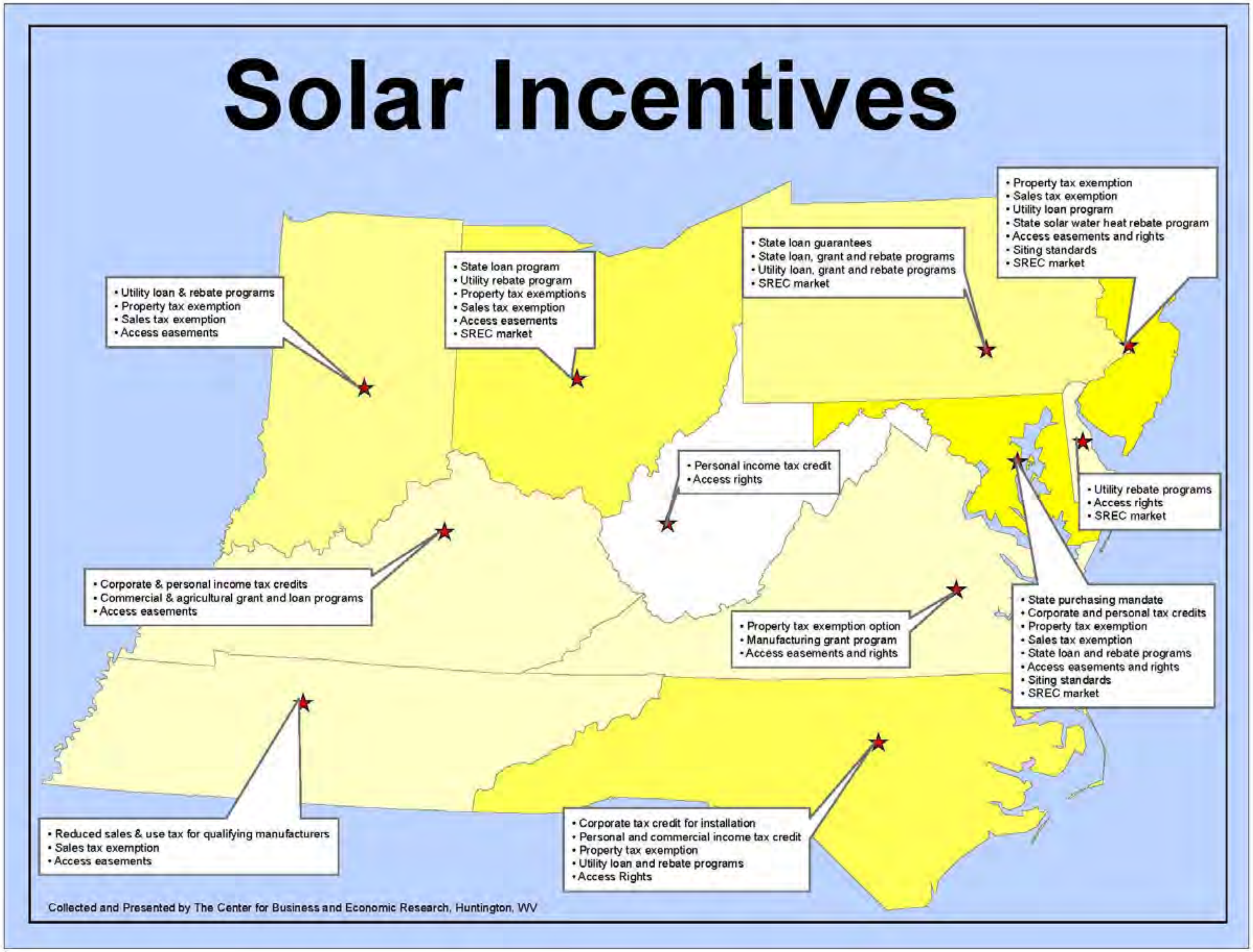

Figure 10: Map of Solar Incentives by State and Type

D. **Conclusions**

The research has made the following conclusions in terms of the objectives of the Energy Opportunities Document.

- Solar energy is not as strong in WV as in many other states, although WV's insolation is better than most states to the north. Due to grid integration issues, solar energy may not help conserve fossil resources, particularly coal resources, as much as predicted.
- Distributed solar energy allows security of electricity supply, to an extent, but to maintain round-the-clock security a facility must still be connected to the grid and able to consume power from grid whenever desired. If a consumer retains that ability some <u>firm</u> external supply must be immediately on-hand at night, and for cloudy days.
- Self-generation of electricity is a price hedge, although at an uncertain level, and is more effective with higher electricity rates. Thus, the near-term expansion of solar capacity in the State is not certain to yield savings on electricity expenditures. Funding solar systems through utility rate increases obscures the real price of avoided electricity purchases.
- Assigning the costs of solar energy to ratepayers reduces disposable income of all ratepayers, but especially those who do not invest in solar systems.
- The primary economic benefits of solar generation would come from the applicable state and local taxes: sales, property, and B&O. Ironically, because a primary way to make solar projects competitive is to exempt them from all or some of these common taxes, the main financial benefits are removed.
- Development of an SREC market in the state assigns the role of market maker to the State Legislature, a position that some would argue is inappropriate for a governing body.
- There are benefits to getting experience with an emerging technology such as PV systems. Individuals and households who install PV systems will come to understand the attributes of the technology and can participate in future adoption as technology improves. Local installers also develop valuable capacity regarding utilization of the resource and interconnection in general.
- Solar panel efficiency is expected to increase but will improve more beyond the five-year timeframe evaluated for this report. In addition, beyond the five-year timeframe, grid integration solutions including demand response programs and smart-grid applications will be more widespread, allowing the potential benefits of solar to be more fully captured.

IV. Overview of Wind Energy in the US and WV Energy Picture

As of the end of 2010, total installed wind capacity in the U.S. stood at around 40 GW. The year of maximum wind capacity installation was 2009, when 10 GW was added[151]. Recent forecasts of global wind power development project a doubling of installed capacity between 2010 and 2014[152] although the actual level of installation will depend heavily on federal incentives.

In 2010 new wind power projects contributed about 25 percent of new nameplate capacity added to the U.S. electrical grid[153]. Wind installations tend to be higher in the mid-west wind corridor, where output per turbine is higher. Among the U.S. states, Texas leads in installed wind capacity with 10.7 GW. Iowa with 4.4 GW and California with 4.2 GW have the second and third largest capacity.

Wind energy provided 2.9 percent of electricity generated in the U.S. in 2011, up from 2.3 percent in 2010[154]. In states with high wind resources wind provides a larger share of electricity. In South Dakota for example, wind generated more than 22 percent of all electricity produced in the state in 2011, while in West Virginia wind generated just over one percent of electricity produced in the state.[155] Table 4 provides a list of regional states with installed wind capacity, national ranking in terms of capacity and percent of in-state electricity generation for each state comparing 2011 and 2010 output.

Table 3: Installed Wind Capacity and Generation in Regional States as of End of 2011

State	Installed Capacity	State Rank in 2011	% of In-State MWh in 2010	% of In-State MWh in 2011
Delaware	2 MW	37th	0.05%	0.04%[156]
Illinois	2.7 GW	4th	2.21%	3.15%
Indiana	1.3 GW	13th	2.34%	2.72%
Maryland	120 MW	28th	0.00%	0.76%
New Jersey	7.5 MW	36th	0.02%	0.02%
New York	1.4 GW	12th	1.90%	2.06%
Ohio	112 MW	29th	0.01%	0.13%
Pennsylvania	789 MW	15th	0.81%	0.86%
West Virginia	583.5 MW	20th	1.16%	1.39%

[1] Wind Powering America
[2] AWEA
[3] EIA

[151] AWEA, *Industry Statistics*.
[152] Electric Power Research Institute, "Technology Guide".
[153] National Renewable Energy Laboratory, *Wind Technologies*.
[154] U.S. Energy Information Administration, "Electric Power Monthly".
[155] Ibid
[156] Data not published. Percentage is based on the same output as in 2010.

A. National Utilization Trends

Over the last few years a continuing industry trend has been toward larger average nameplate capacity, hub height, and rotor diameter of installed wind turbines[157]. Some of the reason for this is to serve lower-wind-speed sites, which require larger rotor diameters to be feasible. Larger sized turbines have contributed to higher capacity utilization of wind facilities as higher wind speeds can be accessed with taller towers. Average capacity factors have declined somewhat in recent years due to the need to curtail wind output in some electricity markets and development of lower-quality wind in some areas[158].

The use of recommended processes to more efficiently integrate wind energy into the electricity transmission system is expanding. Ubiquitous recommendations such as consolidated balancing areas, expansion of forecasting, and intra-hour scheduling are being implemented more broadly. The FERC recently mandated that transmission providers offer 15-minute transmission scheduling[159].

Contrary to solar panel supply, wind component supply has trended toward U.S. production rather than away. It is reported that nine of the eleven largest wind turbine manufacturers in the U.S. market had one or more manufacturing facilities in the United States in 2010.[160]

B. Utilization in West Virginia

West Virginia currently has five operating wind facilities with a combined nameplate capacity of 583.5 MW. These facilities are

- Florida Power and Light's 66 MW Mountaineer facility in Tucker County
- Shell Wind Energy/Dominion/Nedpower's 264 MW Mount Storm facility in Grant County
- Invenergy's 100.5 MW Beech Ridge facility in Greenbrier County
- AES Corp.'s 98 MW Laurel Mountain facility in Barbour/Randolph County
- US Wind Force's 55 MW Pinnacle facility in Mineral County

Two additional projects have been permitted but are not yet operational, while others are still in early stages of development. Siting a wind facility is a long process. It has been stated that it is just as hard to site a wind plant as it is to site a conventional power plant[161].

West Virginia's potentially developable resources are small by some estimates. Early estimates of the total potential for wind energy resources in WV, including federal or State lands, was 10,780 MW. Excluding most resources on federal or State lands, and counting only resources with an estimated gross capacity factor of at least 30 percent at 80 meters, the most recent

157 National Renewable Energy Laboratory, *Clean Energy*.
158 National Renewable Energy Laboratory, *Wind Technologies*.
159 Federal Energy Regulatory Commission, "Final Rule".
160 National Renewable Energy Laboratory, *Wind Technologies*.
161 TeleNomic Research, *Potential Economic Impact*.

statewide estimate is 1,883 MW, a reduction from earlier estimates of 3,800 MW.[162]As the State currently has 584 MW of operating wind capacity there is an additional 1,300 MW that could be developed on private lands. Of this remainder, at least 600 MW worth of projects is known to have been under assessment or permitted. Thus, it is possible that only 700 MW remains as developable without seeking access to public lands. Wind projects have been sited on federal lands in other states but not in the region surrounding West Virginia.

1. Trends in prices

Wind turbine prices doubled between 2002 and 2008, and then fell through most of 2011. Since mid-2011 prices have been rising, largely in response to a demand increase tied to expiration of the federal grant program.[163] Total installed costs are a function of turbine capital costs as well as development costs, interconnection costs and construction costs and are expected to decline somewhat in the near-term as turbine prices are expected to decline.[164]

2. Cost of Production

In terms of an annualized cost per MWh of electricity produced, the LCOE produced from a wind facility ranges from around $60/MWh for onshore systems with high-quality wind to about $152/MWh for offshore systems.[165] High quality wind resources, such as those found throughout much of the Midwest, are able to produce electricity at a cost that is competitive with conventional coal-fired electricity. Regionally, West Virginia is an Eastern state and prices for wind energy produced in the region - based on a sample of purchase power agreements - are higher than average but not as high as in California.[166]

3. Competitive Position

As with solar energy, the cost of electricity based on the cost to generate a unit of electricity is not the only important aspect of the resource. The federal PTC is a primary driver for installing wind generation. In the absence of this subsidy only the highest quality wind sites are likely to be competitive with conventional generation. Wind resources in the Midwest are superior to the resources available in West Virginia and other onshore sites in the Eastern U.S. On average, West Virginia's best wind resources are in the range of 7.5 to 8.0 meters per second at an altitude of 80 meters while the best wind resources in the Midwest are in the range of 9.0 to 9.5 meters per second[167]. Wind resources in the Midwest are also more ubiquitous.

The issue of grid integration is also very important for the competitive position of wind energy. The question of the cost of integrating wind is one of economics and efficiency. A review of

[162] Office of Energy Efficiency and Renewable Energy, *West Virginia 80 Meter Wind Map*.
[163] Lawrence Berkeley National Laboratory, *Wind Turbine Prices.*
[164] National Renewable Energy Laboratory, *Cost of Wind*
[165] National Renewable Energy Laboratory, *Cost of Wind*; Electric Power Research Institute, "Technolog Guide".
[166] National Renewable Energy Laboratory, *Cost of Wind*
[167] Office of Energy Efficiency and Renewable Energy, *West Virginia 80 Meter Wind Map*.

various estimates of the cost of wind integration concluded that the cost could be as high as 18 percent of the nameplate capacity of wind in terms of the systems reserves needed to cover the variability of wind.[168] This needed reserve is not constant however, as wind is an element of weather and changes with seasons and throughout the day. This complicates the ability to calculate the avoided burning of fossil fuels and emissions allowed by substituting wind for other types of generation.

The costs of grid integration are more and more frequently being assigned directly to wind facilities. To date, such assignment is regional, e.g. Bonneville Power Authority, but could eventually become national in scope if some of FERC's recent proposals become law. Such policies increase the costs of wind generation and make it less competitive.

4. Future Prospects

At the national level, considerable resources are being devoted to understanding and improving the grid integration issue. Among these are the National Renewable Energy Laboratory's Energy Systems Integration effort[169] and stakeholder groups such as the Utility Variable-Generation Integration Group (UVIG) - formerly the Utility Wind Integration Group - a consortium of utilities, grid operators and regulators devoted to accelerating the integration of variable resources into utility power systems.[170] The results of the next few years of research will more clearly reveal the opportunities to deploy technology to capture wind energy in a way that ensures efficient use of resources.

Several of the best areas for wind in West Virginia have already been developed. Development in other prime areas has been stalled due to complications related to permitting and financing. As it is very difficult to site a wind facility on public land, the availability of windy locations that are candidates to host a wind facility is few in the State.

The combination of the PTC, the region's close proximity to large electricity demand centers and existing transmission access has to date made West Virginia's wind resources attractive to development. However, the State's wind resources are unlikely to be further developed without the Federal PTC due to the relatively high cost of development in the region.

C. **West Virginia Law Relating to Wind Energy**

1. Legislation/Regulation

Wind energy is specifically listed as a resource eligible to participate in net metering arrangements per the WV Public Service Commission[171]. There are no special provisions

[168] National Renewable Energy Laboratory, *Wind Technologies*.
[169] National Renewable Energy Laboratory, *Energy Systems Integration*.
[170] Utility Wind Integration Group, *About*.
[171] WV Public Service Commission, "General Order".

applicable to wind energy required of the WV PSC outside of interconnections standards that apply to all net metering projects. Wind energy is also listed as an eligible resource to comply with the State Alternative and Renewable Portfolio Act[172].

2. Tax Policy

Wind energy systems have two special taxation policies in the State found under WV Code §11-6A-5a and WV Code §11-13-2o. Both of these policies provide tax rates for wind that are lower than for conventional generating equipment.

Wind turbines and towers are classified as emissions control technology and are eligible to be taxed at salvage value. The equipment that counts as part of the "wind turbine and tower" is explicitly listed in the State Code. The rest of the plant is not accorded salvage value. This policy allows up to 79 percent of the total value of the facility to receive this designation[173].

Wind systems also have a special Business & Occupation (B&O) tax rate levied against generating capacity. WV Code §11-13-2o specifies that wind facilities are to be taxed based on 12 percent of the "official capability" of the unit, while other types of generators are taxed at 40 percent[174].

3. Siting Policy

Elements of a permit application to site a wind facility include: economic impact, environmental impact, wildlife impacts, views had impacts, cultural impact, noise impact, shadow flicker, historical preservation, construction impacts, and public health impacts e.g. setbacks from roads, homes or property lines, as well as general construction permits. State law requires wind developers seeking a siting permit to file copies of the results of spring and fall avian migration studies including lighting studies and risk assessments. This requirement is unique to wind facilities[175]. Other siting requirements are the same as what is required of any type of power plant.

Because commercial-scale wind facilities are relatively new in the State, and because each facility that has been sited is unique in terms of size and location, developers have had varied experiences with the permitting process.

D. **Policy Options**

The development of wind energy is encouraged via various policy mechanisms in surrounding states. Most states in the region have more types of incentives available relative to what West Virginia offers.

[172] WV Code §24-2F
[173] WV Code §11-6A-5a
[174] WV Code §11-13-2o
[175] West Virginia Public Service Commission, "Rules Governing Siting Certificates".

1. Portfolio standards

No states in the region dictate that wind energy be used to meet a certain percentage of their RPS. However, wind is eligible to meet requirements in all states with an RPS.

2. Renewable Energy Credits

Renewable energy credits (RECs) are based on state compliance markets and reflect the avoided alternative compliance payment that a utility would be required to pay if they did not procure qualifying renewable generation to meet the State RPS. Generic RECs are priced much lower than solar RECs. Although RECs can be acquired using several types of renewable resources, wind energy is the most common new resource deployed to meet an RPS due to its relatively low cost and widespread availability.

3. Rules and regulations

State-level regulation of wind energy is largely related to siting policy. However, in the Eastern U.S. most siting is determined by local governments although a few states set guidelines for how localities can restrict development. West Virginia is one exception, with siting decisions for all power plants made centrally by the Public Service Commission (WVPSC). The State of Virginia has enacted broad guidelines for how localities can create ordinances that impact the siting of wind turbines. These guidelines state that such ordinances must: 1) be consistent with the Commonwealth Energy Policy; 2) provide reasonable criteria for siting, while protecting the locality and promoting wind and solar development; and, 3) establish reasonable requirements for noise limitations, buffer areas, setbacks, and facility decommissioning.[176] The State of Delaware has a law prohibiting unreasonable restriction on the installation of residential wind energy systems and defines how restrictive local regulations may be.[177]

4. Taxation

Several states in the region, including Maryland, Pennsylvania, and Indiana exempt wind turbines entirely from property tax. Others states, including West Virginia and Tennessee, allow partial exemption. Income tax credits taken against purchase of a wind energy system is allowed in several states and can apply to all types of taxpayers, e.g. Maryland, or may be exclusive to households, e.g. North Carolina, or corporate entities, e.g. Kentucky. Other common tax-related incentives include exclusion of equipment purchases from sales and use tax.

5. Other incentives

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[176] Database of State Incentives for Renewables & Efficiency, *Wind Ordinances*.
[177] Database of State Incentives for Renewables & Efficiency, *Wind Access and Permitting*.

Several states in the region offer some type of loan, rebate and/or grant programs that apply to wind energy systems. In some states utility programs may also include grant, loan and rebate programs that cover purchase of wind energy systems and may exist instead of state programs, e.g. Tennessee and Ohio, or in addition to state programs, e.g. New Jersey and Virginia. Some programs are available only to certain sectors, i.e. residential or commercial, while others are available to all entities.

Additional incentives that are available to subsidize the cost of wind energy are production-based incentives (PBI), where the owner of a wind turbine or facility can receive payments based on electricity generation. Utilities are authorized to make PBI payments to system owners and in turn receive the associated RECs which are then used for RPS compliance. PBI payments can be received by any entity that owns a grid-connected wind turbine.

The following graphic shows the types of incentives that are available to develop wind resources in regional states. Local or non-profit incentives are not included.

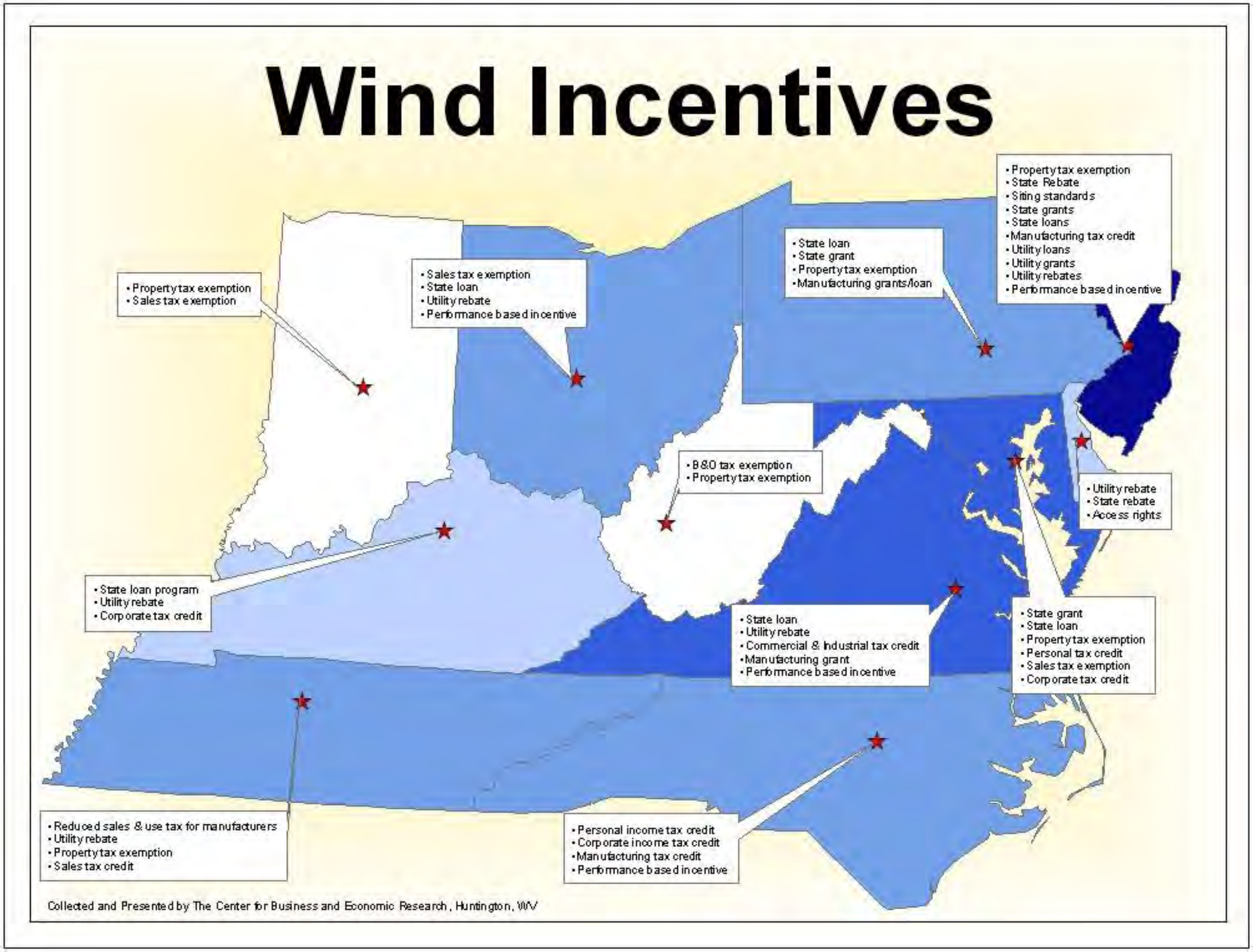

Figure 11: Map of Wind Incentives by State and Type

E. **Conclusions**

The research has made the following conclusions in terms of the objectives of the Energy Opportunities Document.

- At one percent of total electricity generation, wind energy is a relatively small energy resource in West Virginia. The quantity of wind that is estimated to be available to be developed on private land is smaller than what has to date already been developed or is under consideration.
- Due to the relatively high cost of developing wind in the region, the installation of wind in West Virginia is driven by Federal incentives. The extension of the federal PTC for wind-powered electricity production will determine future development efforts.
- West Virginia's wind resources are good compared to many other onshore resources in the Eastern United States but are not as strong as in the Midwest. This reduces the likelihood that State resources will be developed in the absence of the PTC.
- The primary economic benefits of developing wind energy are lease payments made to landowners and property taxes paid to county governments. A small, but growing employment base exists to supply turbine maintenance services. The state has very few wind-related manufacturing component suppliers.
- Siting of wind facilities is very difficult. The permit application process is lengthy and requires extensive documentation. The siting process is largely similar to that experienced by other power plant developers, although wind facilities possess several unique attributes that make them quite different than conventional power plants. Nonetheless, any evaluation of the efficiency of the permitting process would have to take all types of power plants into consideration, not just wind facilities.
- There are unresolved efficiency issues related to grid integration of wind electricity that can be at least partly resolved by adopting a series of recommendations related to turbine control, real-time grid operations, reserve utilization protocols, demand response and wind forecasting. However, such implementation will take time and may never be perfect solutions. In the meantime, the ability of wind energy to offset fossil emissions is less than its output due to the need to maintain oversupply of generation capability. More needs to be understood about this issue in terms of accomplishing policy objectives.

V. Overview of Hydropower

Hydropower is the nation's oldest source of electric energy used in manufacturing with the first hydroelectric plant installed in Wisconsin in 1882.[178] Although its share has been declining in recent years, hydropower is the largest source of renewable energy in the US accounting for 31 percent of all renewable energy in 2009[179] predominantly in the Western US. Considerable attention has been given to off-shore hydro generation which is not applicable to WV.

Advocates of expanded use of hydropower cite that it produces no GHG emissions, is reliable and has the ability to "load follow" which permits the immediate adjustment in generation responding to consumer demand.[180] But hydropower is not entirely benign. The operation of large hydropower installations at times leads to periodic flooding with the undesirable impacts of harming fish, invertebrates, amphibians and other aquatic life during periods of extremely low flow.[181]

A. Hydropower in WV

In West Virginia hydropower accounted for 1,645,927 thousand kilowatt hours of renewable net generating. This represents 68 percent of all renewable generation in the state for 2009.[182] The existing hydro power facilities in West Virginia are presented in Table 5:[183]

Table 4: Hydropower Facilities in West Virginia

Name	Location	Capacity
Summersville Dam	Gauley River	80 MW
Winfield Dam	Kanawha River	28.8 MW
London/Marmet Dam	Kanawha River	14.76 MW
Lake-Lynn Dam	Monongahela River	51.2 MW
Hawks Nest Dam	New River	69 MW
Belleville Dam	Ohio River	42 MW
New Martinsville Dam	Ohio River	35.72 MW
Dam No. 4	Potomac River	1.9 MW
Dam No. 5	Potomac River	1.21 MW
Millville Dam	Shenandoah River	2.84 MW

There have been three major hydro projects either completed or underway in the State:[184]

- An upgrade by Brookfield Renewable Power at Glenn Farris which will generate 38,000 MWh which would provide power to 4,500 users

[178] Practical Action, *Small-scale Hydro Power*.
[179] United State Energy Information Administration, *Renewable Energy Annual 2009*.
[180] US Fish and Wildlife Service, *Hydropower*.
[181] Ibid.
[182] United State Energy Information Administration, *Renewable Energy Annual 2009*.
[183] Public Service Commission of West Virginia, "Resource Planning Assessment".
[184] WV Department of Commerce, *Hydro Energy*.

- The Hawks Nest 102 megawatt plant is undergoing extensive upgrades during a 20 year capital investment program
- The New Martinsville 36 megawatt plant produces enough power for 49,000 households supplying both the City and the grid.

Over a decade ago it was estimated that there were 37 sites in West Virginia with the potential for hydropower generation. Estimates ranged from 1,149 to 1,924 megawatts of additional generation. While most of these sites already had dams located on them they were not equipped with generation capabilities. These sites were located on the Kanawha, Monongahela, Ohio and Potomac Rivers.[185]

Hydropower is well developed at existing sites in West Virginia and construction at additional dams has received federal preliminary permits from FERC as noted in Table 6.[186]

Table 5: Approved Preliminary Hydropower Projects in West Virginia

Name	Location	Capacity
Glen Ferris Dam	New River	38 MW
Willow Island Dam	Ohio River	35 MW
Sutton Dam	Elk River	12 MW
R.D. Bailey Dam	Guyandotte River	7.8 MW
Hildebrand Dam	Monongahela River	20 MW
Morgantown Dam	Monongahela River	15 MW
Opekiska Dam	Monongahela River	10 MW
Pike Island Dam	Ohio River	49.5 MW
New Cumberland Dam	Ohio River	36 MW
Tygart Dam	Tygart River	29 MW
Stonewall Jackson Dam	West Fork River	0.3 MW
Mount Storm pumped storage	Maysville, WV	450 MW

[1] West Virginia Public Service Commission

B. Small Scale Hydropower

Recent years have seen worldwide interest in small scale hydro power.[187] In the US small hydro is defined as a system having up to 10 MW of capacity. Small hydro is further broken down into mini hydro with less than 1,000 kW and micro hydro with less than 100kW generating capacity. The latter is feasible for smaller communities, families or small enterprises.[188] Small hydro does not make use of reservoirs but takes moving water a uses it to rotate a power a generator. Usually this is a “run of the river” installation which is most efficient in hilly sites.

The available power from a small hydro system depends of the “flow” or volume of water and the “head” or vertical drop. A head of at least two feet is required, but the higher the head the greater the amount of electricity generated and the lower the cost of the project. Adequate flow is

[185] Conner, Francfort, and Rinehart, *Hydropower Resource Assessment*.
[186] Public Service Commission of West Virginia, “Resource Planning Assessment”, 8-9.
[187] Irish Hydro Power Association, *Small Scale Hydroelectricity*.
[188] National Renewable Energy Laboratory, *Small Hydropower Systems*.

related to the height of the head, but generally at least 2 gallons per minute will be required.[189] For these reasons small scale hydro is not practical in most locations.[190]

While "off-the-shelf" generators are available the cost of small scale hydro is not competitive with other sources of electric power.[191] But small scale hydropower is competitive with other renewable options such as solar and wind. When it is possible to sell power to the grid the cost is further reduced. Advocates of small scale hydro indicate that the higher initial costs are offset by the lower costs of maintenance and the long life of the installation (up to 50 years) if well maintained.[192]

As is the case with all alternative and renewable energy sources there are pros and cons to small scale hydro deployment:[193]

- Advantages
    - Efficient. With the low head and low flow requirements there are numerous locations where small scale hydro can be efficiently installed
    - Reliable. Generation potential must be calculated at the lowest level of stream flow to determine its reliability. Since the flow is dependable at that level the problem of peaking is eliminated.
    - No reservoir. Since small scale hydro operates without a reservoir on a run-of-the-river there are lower costs and almost no environmental problems than with other forms of renewable energy
    - Cost effective. Technological advances have produced low cost "water-to-wire" systems. Installation costs and maintenance is low meaning the cost of electricity is competitive with conventional sources in less developed nations. (This is not applicable for West Virginia)
    - Serves isolated areas. Small scale hydro is used extensively in areas where access to the grid is not available. Due to its low cost many rural areas in other nations have used it as a substitute for power from the grid. (This is not applicable for West Virginia)
    - Grid integration. Where allowed excess power can be sold to the grid which reduces the cost of the installation.
    - No GHG emissions. Small hydro using running water produces no air pollution.
- Disadvantages
    - Site suitability. Not all stream sites are usable. Dependable flow rate and drop are required. Also the distance from the stream to the user or the grid can be a negative.
    - Expansion. Since capacity is determined at low flow it will be difficult to expand capacity if demand increases.

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[189] Ibid. The formula for determining the electrical output from a small hydro facility is Watts=head[(feet) x flow (gpm)]/10

[190] NoOutage.com, *Hydroelectric information*.

[191] Practical Action, *Small-scale Hydro Power*.

[192] Energy Savings Trust, *Hydroelectricity*.

[193] Alternative Energy News, *Micro Hydro*.

- Seasonable power. During high stream flow periods more power is available but cannot be relied upon during the entire year which reduces small hydro usability unless back-up power from the grid is available.
- Environment impacts. While the environment impacts are less than other sources of power, most states require an impact plan prior to licensure. But a portion of the stream flow is diverted and there may be an impact on aquatic life particularly in low flow periods.

C. Regulatory Considerations

There are also regulatory considerations. Small scale hydro will require state and often federal permits. The Federal Energy Regulatory Commission (FERC) will have jurisdiction over any hydro facility which meets the following qualifications: [194]

- Is on a navigable waterway
- Will effect interstate commerce (if the system is connected to a regional electric transmission grid)
- The project is on federal land
- If water used is from a federal dam

The second of these may apply to small scale hydro if its surplus power is sold back to the grid.

In most states permission is required from the state department of natural resources, fish and wildlife agency, environmental protection agency or similar regulatory body. There may be further legal issues regarding water rights held by downstream users.[195] These legal complications increase both the cost as well as the time of installing small scale hydro.

D. Current Incentives for Hydro Power Installations

In terms of financial incentives for hydroelectric facilities are not as commonly allowed technologies compared to wind and solar. Advocates of small scale hydro request that the federal and state governments should provide the same incentives given to other forms of alternative and renewable energy.[196] In particular they seek identical access to the grid for surplus power production, tax credits, exemptions from or reductions in property and/or sales taxes in addition to installation subsidies or rebates. Some of these are available in other locations.

Hydropower is a resource eligible to comply with State portfolio standards in most states in the region. It is eligible to receive performance-based credits or RECs in parts of Ohio (FirstEnergy) and is eligible for the feed-in tariff in parts of Indiana.

[194] Federal Energy Regulatory Commission, “Licensing”.
[195] NoOutage.com, *Hydroelectric information*.
[196] National Hydropower Association, “Supply Chain Snapshot”.

Hydroelectric facilities are sometimes listed as eligible for exemption from property tax, as in Indiana, Ohio and New Jersey, or exemption from sales tax, as in Indiana. Some states, including Maryland and North Carolina, allow purchases of hydroelectric generating equipment to quality for income tax credits. Tennessee and Virginia include hydroelectric equipment in the list of eligible technologies to receive manufacturing-related incentives. In the region, only Pennsylvania explicitly lists hydropower as being eligible for utility and state grant and loan programs.

There are no specific incentives for hydropower in West Virginia. Figure 12 shows incentives for which hydro is eligible in regional states.

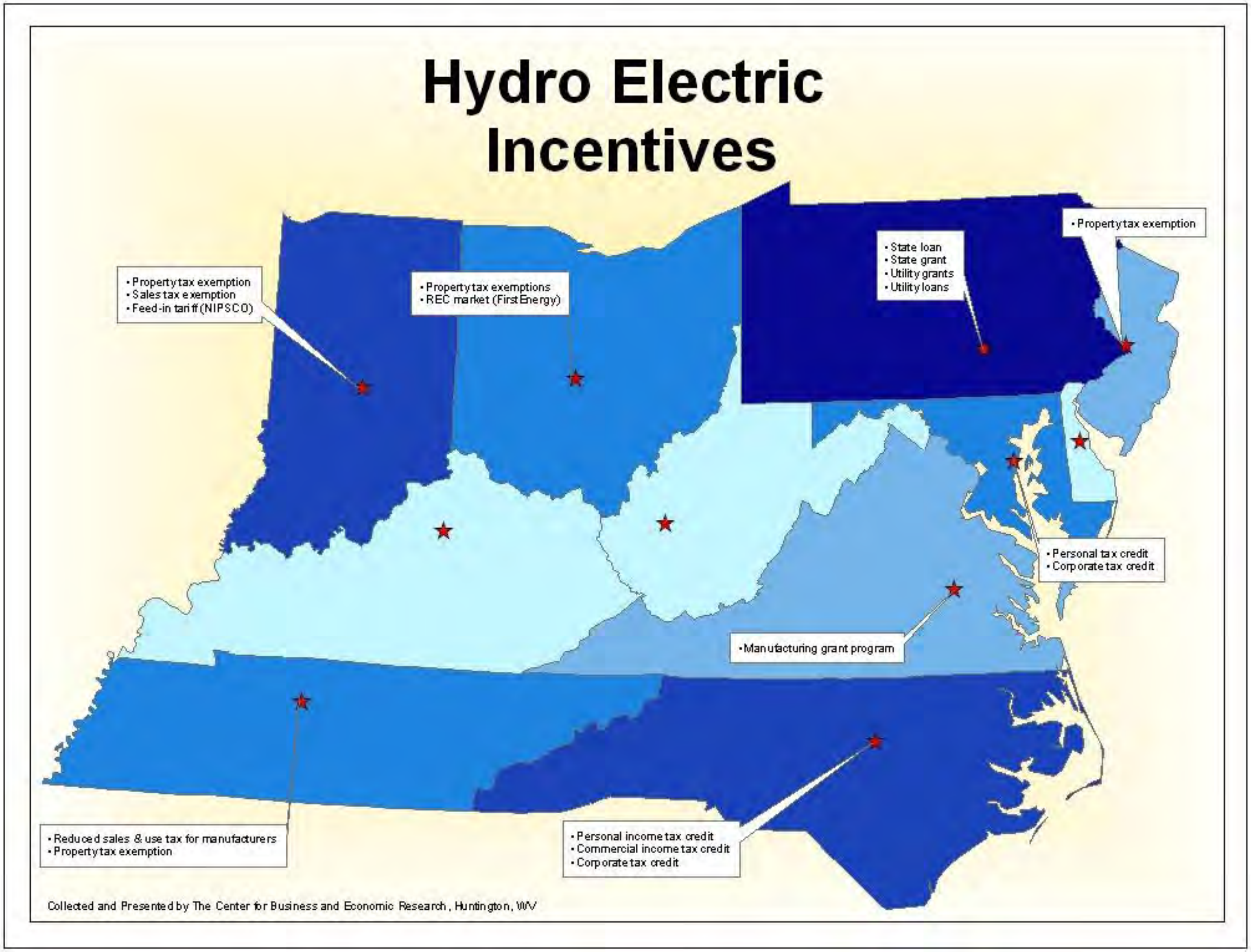

Figure 12: Map of Incentives for Hydro Power by State and Type

E. **Conclusions**

- Small scale hydropower does not appear to have significant potential for the State. But there are instances in which small scale hydro may play a role. These would be primarily in direct use situations for providing power to a specific user such as a small factory, public building, recreational facility or isolated community.

- In other nations small scale hydro has been a very successful strategy for the attraction of manufacturing business to an area. But with the State already well connected to the grid the advantage would only be if the cost of direct use was lower than power off the grid. This assumes that sufficient dependable power would be available.

VI. Overview of Geothermal Energy and the Current State of the Resource in West Virginia

Geothermal energy is harvested through two main methods: conventional and enhanced geothermal systems. Because conventional geothermal systems require attributes[197] not available in West Virginia, an enhanced geothermal system (EGS) would be required for renewable energy production via this source. The use of geothermal energy could benefit West Virginia and advance the State's energy resources on both an economic and environmental level. Development of such resources in West Virginia would promote economic development through job creation for site research, drilling of EGS wells and establishing power plants in the most ideal locations in the State.

The generation of electricity through geothermal resources, compared to fossil fuel-based power plants, emits fewer toxic emissions (including nitrous oxide, hydrogen sulfide and sulfur dioxide). Further, geothermal energy has been shown to provide consistent base load power, making this resource useful in providing stable supply of electricity, particularly at peak hours.[198]

Although harnessing the geothermal resource for electricity production is not a new concept, the functional implementation of such a system has largely gained momentum in recent years. The Southern Methodist University (SMU) Geothermal Laboratory estimated that nearly 3,000 GW of electricity could be generated nationwide through geothermal production at 14 percent recovery.[199] Of that total, the geothermal energy production potential in West Virginia was estimated to be approximately 30.8 GW at 14 percent recovery.

United States-based geothermal systems are most prevalent in the western states. SMU estimated that Texas had the largest (293.5 GW) and Nevada had the second largest (288.3 GW) production potential at 14 percent recovery.[200] In West Virginia, the greatest geothermal potential lies in the northeastern portion of the State.

In terms of net generation, electricity produced from geothermal resources has varied by state in the last year. Hawaii's net generation of electricity from geothermal increased by 21 percent from May 2011 to May 2012.[201] Utah experienced the largest drop (4 percent) from 25,000 MWh to 24,000 MWh over all sectors. Net electricity generation from geothermal in the five states with measurable geothermal energy production is provided in the following table. Note that both electric utilities and independent power producers represent the electric power sector.

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[197] Conventional geothermal systems require natural geothermal reservoirs (pockets of water heated by the Earth) which are common in the western US but are not found in West Virginia.
[198] MIT, *Future of Geothermal Energy.*
[199] Google, *Googol of Heat.*
[200] Ibid
[201] U.S. Energy Information Administration, "Net Generation from Geothermal".

Table 6: Net Generation from Geothermal Resource

	All Sectors			Electric Utilities			Independent Power Producers		
	May 2012	May 2011	Percent Change	May 2012	May 2011	Percent Change	May 2012	May 2011	Percent Change
Hawaii	23	19	21.05%	--	--	0.00%	23	19	21.05%
Nevada	239	230	3.91%	--	--	0.00%	239	230	3.91%
Idaho	8	8	0.00%	--	--	0.00%	8	8	0.00%
California	1,144	1,156	-1.04%	73	71	2.82%	1,071	1,084	-1.20%
Utah	24	25	-4.00%	23	25	-8.00%	NM	NM	0.00%

[1] Energy Information Administration
[2] Net generation data in thousand MWh.
[3] "NM" represents "not meaningful."

By extension, consumption of geothermal energy in the United States has increased in recent years from 181 trillion BTU in 2005 to 200 trillion BTU in 2009.[202]

A. Competitive Position

It is difficult, considering that the advancement of geothermal power plants in the United States and worldwide is still in early development stages, to determine a solid cost estimate for the geothermal potential in West Virginia. The State's geothermal resource exists in much deeper depths than in the western states (in some cases by as much as 3 to 4 km) which would likely result in higher costs. Holding this caveat in consideration, guidance can be drawn from other states with higher geothermal temperatures at more shallow depths to compare the cost of developing geothermal energy.

The levelized energy cost of EGS operations can vary based on a number of factors, including site specifics (such as well depth, flow rates and temperature of the resource) and capital costs. One study estimated the LEC for six mature EGS operations with an 80 kg/s production rate. The lowest and highest LECs were estimated at 3.9 and 8.8 ¢/kWh, respectively.[203] By comparison, costs at The Geysers geothermal power plant in California are estimated between 3 and 3.5 ¢/kWh.[204]

Compared to other fuel resources, conventional geothermal[205] energy is fairly cost competitive, although costs vary regionally.[206] On average, the levelized cost of geothermal energy was estimated to be $101.70 per MWh for new generation resources coming online in the year

[202] United State Energy Information Administration, *Renewable Energy Annual 2009*
[203] MIT, *Future of Geothermal Energy.*
[204] Office of Energy Efficiency and Renewable Energy, "Geothermal FAQs".
[205] Please note: the following cost comparisons between geothermal and other fuel resources consider conventional geothermal only. Cost comparison of EGS with other fuel resources may vary.
[206] U.S. Energy Information Administration "Levelized Cost".

2016.[207] When compared to new generation of other fuel resources coming online at the same time, such as conventional coal ($94.80 per MWh) and natural gas conventional combined cycle ($66.10 per MWh), geothermal energy costs are higher. However, when compared to biomass ($112.50 per MWh), advanced nuclear ($113.90 per MWh) and solar photovoltaic ($210.70 per MWh) suggest geothermal energy is much more cost competitive.[208] It is expected that the cost of producing geothermal energy will decrease as research and development, exploration, drilling and other technologies improve.

B. **West Virginia Law Relating to the Resource**

1. Legislation/Regulation

Geothermal energy is listed as one of the eligible renewable energy resources[209] under the Alternative and Renewable Energy Portfolio Act. There are no additional legislative conditions placed on the development or regulation of electricity generated by geothermal sources in West Virginia at this time.

Geothermal electric is listed among the eligible renewable technologies acceptable to reach the 25 percent renewable portfolio standard (RPS) goal in West Virginia.[210]

At this time, West Virginia does not offer financial incentives for the development of geothermal electric.[211] However, AEP Appalachian Power in West Virginia does provide a Utility Rebate Program up to $150,000 per account per year for geothermal heat pumps used in the commercial and industrial sectors.[212]

2. Tax Policy

No tax policies currently exist specifically for geothermal energy production in West Virginia.

C. **Policy Options**

Along with more conventional renewable energy sources—such as wind, solar and biomass—geothermal energy is considered an eligible renewable technology in many state renewable portfolio standards (RPS). Of the 34[213] states (including the District of Columbia) with RPS goals as of April 2009, 28 include geothermal energy as an eligible technology. States with more prevalent geothermal presence, such as California, Idaho and Nevada, have integrated more

[207] Ibid
[208] Ibid
[209] West Virginia Code §24-2F-3(13)(E).
[210] Database of State Incentives for Renewables & Efficiency, *Solar Rights*.
[211] Ibid
[212] Ibid
[213] U.S. Environmental Protection Agency, *Effective Policy.* PS goals in five of these states—North Dakota, South Dakota, Utah, Virginia and Vermont—are not mandatory as of 2009.

incentives and regulations for this technology. However, as geothermal systems are presently uncommon in this area of the eastern US, the incidence of such regulations and incentives become more generalized. For the best comparison, policy options for states surrounding West Virginia are examined.

1. Portfolio Standards

Four[214] of the five states surrounding West Virginia have implemented RPS or voluntary renewable energy portfolio goals (REPG) policy. Compared to West Virginia's alternative portfolio standard of 25 percent by 2025, Maryland has the highest goal of 20 percent by 2022 and Ohio has the lowest (12.5 percent by 2024).[215] Virginia is the sole voluntary REPG of this selection. In all cases, geothermal electric is an eligible renewable technology.

2. Rules and Regulations

Because of the lack of EGS prevalence in this area of the eastern US, very few legislative regulations related to geothermal drilling currently exist. In most cases, states are more likely to have established policy regulating direct-use geothermal and geothermal heat pumps than commercial-scale EGS development.

Maryland, Ohio and Virginia all impose interconnection standard policies on several renewable technologies, including geothermal electric. The capacity limit is set at 20 MW in Ohio and Virginia and 10 MW in Maryland per state statutes.[216]

Maryland,[217] Ohio[218] and Virginia[219] each require a permit to drill a geothermal well. The State of Maryland requires a subsequent bond under the Maryland Geothermal Resources Act. Further, Virginia imposes legislative regulations under the Virginia Geothermal Resource Conservation Act to both aid in the development of and protect the State's geothermal resources.[220]

3. Taxation

Few tax laws regarding geothermal development have been imposed in this area. Maryland requires that geothermal systems used for heating and cooling in a building (such as a geothermal heat pump) be assessed at the same value as a conventional heating and cooling system.[221] The sale of geothermal equipment—defined as the in-ground technology used to heat and cool in a geothermal system—is exempted in Maryland.[222]

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[214] Kentucky is the only of the five states without an RPS/REPG in place.
[215] Database of State Incentives for Renewables & Efficiency, *Solar Rights*.
[216] Ibid
[217] Annotated Code of Maryland: Environment §5-601 et. seq.
[218] Ohio Revised Code §1509.221.
[219] Code of Virginia §32.1-176.4.
[220] Code of Virginia §45.1-179.1 et. seq.
[221] Annotated Code of Maryland: Tax-Property §8-240.
[222] Annotated Code of Maryland: Tax-General §11-230.

4. Other Incentives

Along with other renewable technologies—such as solar thermal electric, PV, wind and hydroelectric—geothermal electric is eligible for a net metering incentive in Virginia.[223] The capacity limit is 500 kW for non-residential and 20 kW for residential. In addition, Ohio Revised Code allows a provision for municipalities to establish a low-cost alternative energy revolving loan program for assistance in installing geothermal energy projects.[224]

Pennsylvania provides the Geothermal Loan Program as part of the Keystone HELP Residential Energy Efficiency incentive program for geothermal heat pump installation. Pennsylvania residents making improvements on owner-occupied dwellings are eligible for up to $15,000 at 4.99 percent interest on a 3, 5 or 10-year term.[225]

D. **Conclusions**

The following conclusions have resulted from the research on geothermal energy in West Virginia in terms of the potential short-term impact of State policy related to geothermal energy.

- The generation potential of the geothermal resource in West Virginia is not as great as in other areas of the US, but that should not be construed to mean it would not have an impact. At nearly 31 GW of current estimated generation potential at 14 percent recovery, the State's geothermal resource could match a significant portion of electricity generation in West Virginia.
- Geothermal energy has been proven to provide consistent base load power through the constant loop of the input/output wells at generating facilities due to the fact that the temperature does not fluctuate. The reliability of geothermal systems in West Virginia would produce a secure supply of electricity from a renewable resource.
- Although a large amount of capital is required to establish a geothermal system, the local and state economy would likely benefit from the increase in job demand. Further study would be needed to analyze the potential benefit of developing this resource in this area.
- There is potential for EGS resources to contribute to the West Virginia alternative energy requirement and diversify the source of electricity generation in the State. However, successful development of geothermal resources in West Virginia will not produce immediate benefits. Due to continued improvement of geothermal development technology, establishing a new EGS power plant in this area would be costly at this time and is unlikely to be feasible in the short-term.

[223] Database of State Incentives for Renewables & Efficiency, *Solar Rights*.
[224] Ohio Revised Code §717.25(B)(1).
[225] Keystone HELP, "Geothermal Loans".

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List of Abbreviations Used

ACEEE- American Council for an Energy-Efficient Economy
ACP- Alternative Compliance Payments
AEP- American Electric Power
AMO- Advanced Manufacturing Office
ApCo- Appalachian Power Company
ARC- Appalachian Regional Commission
ARRA- American Recovery and Reinvestment Act
ASHRAE- American Society of Heating, Refrigeration, and Air-conditioning Engineers
BCAP- Building Codes Assistance Project
C&I- Commercial and Industrial
CFL- Compact Fluorescent Light Bulb
CHP- Combined Heat and Power
DHBC- Department of Housing, Buildings and Construction
DR- Demand Response
DSM- Demand Side Management
EE- Energy Efficiency
EERE- office of Energy Efficiency and Renewable Energy
EERS- Energy Efficiency Resource standard
EESA- Energy Efficiency Standards Act
EM&V- Evaluation, Measurement and Verification
FE- First Energy
FERC- Federal Energy Regulatory Commission
GHGs- Greenhouse Gases
GOEO- Governor's Office of Economic Opportunity
HVAC- Heating, Ventilating, and Air Conditioning
IAC- Industrial Assessment Center
IBC- International Building Code
ICC- International Code Council
IEBC- International Existing Building Code
IECC- International Energy Conservation Code
IFC- International Fire Code
IOF-WV- Industries of the Future- West Virginia
IOUs- Investor-Owned Utilities
IRC- International Residential Code
ITP- Industrial Technologies Program
KBC- Kentucky Building Code
KEEPS- Kentucky Energy Efficiency Program for Schools
KW- Kilowatt
KWh- Kilowatt Hours
LIHEAP- Low Income Energy & Heating Assistance Program
LRAM- Lost Revenue Adjustment Mechanism
M&V- Measurement and Verification
MBTU- Million British Thermal Units
Mcf- Million Cubic Feet
MEP- Manufacturing Extension Partnership
MWh- Megawatt Hours
NFPA- National Fire Protection Association
NTGR- Net-to-gross-ratio
OBC- Ohio Building Code
OMB- Office of Management and Budget
PACT- Program Administrator Cost Test
PCT- Participant Cost Test
RCO –Residential Code of Ohio
REEF- Revenue-neutral Energy Efficiency Feebates
RIM- Ratepayer Impact Measure
SBC- System Benefits Charge
SCT- Societal Cost Test
SEF- Sustainable Energy Fund
SFV- Straight Fixed Variable
T&D- Transmission and Distribution
TRC- Total Resource Cost Test
USDOE- United States Department of Energy
WAP- Weatherization Assistance Program
WVDOE- West Virginia Division of Energy
WVMEP- West Virginia Manufacturing Extension Partnership
WVU- West Virginia University

Energy Efficiency Policy: Opportunities for West Virginia

Executive Summary

Energy Efficiency (EE) is a term that encompasses multiple levels of meaning. At its simplest level, the term can be understood as "the process of doing more with less." EE is not energy conservation, which implies that one reduces or goes without a service in an effort to save energy. As an energy resource, adoption of EE can lead to overall energy demand reduction without requiring any additional actions by consumers or resource providers. EE is often achieved because of innovations in technology and better management of resources. In West Virginia, there are several actions that can be taken to make existing EE efforts more effective. This is the primary focus of this analysis.

EE should be considered a high priority resource within the West Virginia energy portfolio. Of the 13 Appalachian states, West Virginia is a leading state within the group with the second highest residential energy consumption per household. In rankings of state-level energy efficiency efforts in the region, WV comes in near the bottom. This indicates that others states have characteristics that lead to lower consumption, such as more urban populations with more people per household and more incentives to deploy efficiency programs due to higher electricity costs. EE can help alleviate the impacts of increasing energy demand and rising electricity rates if it is done cost-effectively.

Utility programs are a primary way to deploy energy efficiency initiatives. State policy and state-sponsored workshops and training provide a foundation on which to institutionalize attention to EE. Third-party administrators can also manage very effective EE initiatives, although utility programs are more common due to existing demand-supply relationships and knowledge of consumption patterns. Presently the two state utility programs, offered through Appalachian Power and First Energy, constitute the largest state-level funding for EE efforts at nearly $8 million per year. These efforts are new, having been initiated in 2011, and the programs are younger and less inclusive than similar utility programs in neighboring states.

Energy efficiency programs can confer substantial benefits to utilities and end-users when program implementation and maintenance is more cost-effective than increasing supply of energy. Future increases in investment costs can similarly be avoided for transmission and distribution infrastructure. Although demand response is not typically considered to be energy efficiency, effective EE programs also contribute to a decrease in peak demand due to the decrease in overall demand.

States play an important role in promoting EE through building energy codes. WV has made strides by adopting some of the more recent standards. However, with the exception of public buildings, ensuring code compliance is largely voluntary throughout the State and adoption thus has limited effectiveness. Enacting current and enforceable building energy codes is a vital component of sound EE policy. Structures built to outdated design and construction standards have higher energy consumption. States with the greatest prioritization of EE maintain updated building energy code standards.

In WV industrial EE has been largely supported through federal funding. Various initiatives undertaken in partnership with West Virginia University, and supported by the West Virginia Division of Energy have induced significant levels of energy savings at many manufacturing facilities throughout the state.

Quantifying energy savings and establishing baseline levels of consumption by which program effectiveness can be evaluated is a key aspect to ensuring the efficacy of EE programs. Program evaluation measures the success of utility initiatives in terms of gross versus net energy savings, taking into account variables that would have occurred without the influence of the program. Both gross and net savings are used in evaluation of regional utility programs.

Different sectors of the economy have different energy needs and usage schedules and are able to take advantage of different elements of EE programs. Furthermore, while the current utility programs are administered by electric utilities, the energy saving actions induced by the programs also translate into lower natural gas consumption for households that use gas for space and water heating. Emissions reductions and water savings are ancillary environmental benefits.

I. Introduction to Energy Efficiency

Energy Efficiency (EE) is a term that encompasses multiple levels of meaning. At its simplest level, the term can be understood as "the process of doing more with less."[1] From a more complex view, EE is a valuable resource derived from actions and behavior of customers whose reduced demand can lead to energy cost savings benefits for the entire system. When treated as an energy resource, adoption of EE can lead to overall energy demand reduction without requiring any additional actions by consumers or resource providers.[2] EE is often achieved because of innovations in technology, better management of resources, and improved economic conditions.[3]

Demand response (DR) is a practice related to EE but not synonymous with it. DR involves altering the consumption patterns of consumers of energy over time through long-term price changes or through incentive payments designed to induce smaller levels of electricity use during times of peak prices or peak usage.[4] DR is further distinguished from EE because it is often labeled a "dispatchable" resource. That is, it is a resource that can reduce its demand for electricity when instructed.[5] Most DR programs in effect today are event-driven in that they are designed to curtail or shift loads for short periods of time when called by the grid operator.[6] In contrast, EE involves implementing practices and technologies that permanently reduce levels of energy use and demand at any time.

EE should also not be equated with energy conservation. Conservation implies that one reduces or goes without a service in an effort to save energy. Efficiency efforts differ in that they allow consumers of energy to achieve the same or an increasing level of output but with a decreasing level of energy inputs. However, elimination of wasteful energy practices through conservation and load management via DR represent policies related to EE.

Collectively, energy efficiency, energy conservation, and demand response describe the practice of demand side management (DSM) because they involve managing consumer behavior in terms of the application and processes of energy usage. The focus of this study will be on policy and practices related to EE.

A. Energy Efficiency as a Least-cost Resource

Increasing generation capacity and transmission and distribution (T&D) capabilities has been the traditional approach for meeting increased energy demand. However, the resources utilized in building new power plants and expanding T&D are often more expensive than resources needed to fund efficiency measures.[7] Americans spend approximately $215 billion/year on the production of electricity at a price of 6 to 12 cents per kilowatt hour. Investments in efficiency only amount to approximately $2.6 billion/year at a cost of around 3 cents per kilowatt hour

[1] Center for Sustainable Energy, "Define efficiency".
[2] Nexant, "Capacity Markets".
[3] World Energy Council, "Around the World".
[4] U.S. Department of Energy, "Demand Response".
[5] Nexant, "Capacity Markets".
[6] Goldman et al., "Coordination of Energy".
[7] Blank and Gegax, "Shared Savings".

saved. Furthermore, natural gas efficiency costs $1 to $2 per thousand cubic feet (Mcf) saved compared with $6 to $8 per Mcf supplied.[8]

Energy efficiency is often the least-cost resource. An Environment Northeast study on the economic impact of EE in New England estimates the savings potential for investments in electric and natural gas efficiency at the program level. Their analysis concludes that for every dollar invested in electric energy efficiency, $4.70 in participant savings is generated, and for every dollar invested in natural gas energy efficiency $3.60 in participant savings is generated.[9] In Ohio, research projects that the implementation of residential energy efficiency measures could result in a levelized[10] cost of saved energy of $0.029 $/kWh during the period 2009-2025.[11] Similarly, energy efficiency was also identified as the most-cost effective resource[12] for energy savings in terms of electricity generation in North Carolina.[13] It is also important to note that over the next twenty years the Southern Region[14], of which WV is included, has the greatest potential for energy efficiency savings in absolute terms.[15]

Although efficiency as an energy option is often more cost-effective than traditional supply-side power generation, many states view efficiency and related programs as not only cost-effective alternatives, but also as an opportunity to foster future economic growth and curtail environmental degradation.[16] EE programs confer substantial benefits to utilities and end-users, the wider economy and the environment when program implementation and maintenance is more cost-effective than traditional methods for energy generation.

B. Utility and Ratepayer Benefits

A primary benefit of EE for utilities and ratepayers is the avoidance of capacity-related costs. A long-term, sustained reduction in aggregate system capacity requirements is achieved when efficiency gains are made. Increases in power rates from utilities are often attributed to large investments in capital expenditures which are made to keep pace with the increasing levels of energy demand.[17] If an increase in the demand for energy is decelerated through EE initiatives, utilities will purchase and build less power generating infrastructure. The reduction in capacity investment translates from lower fixed costs for utilities to fewer price increases for consumers over the long-run.[18]

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[8] Environment Northeast 2009, "Economic Growth".
[9] Ibid
[10] The levelized annual cost per kWh of an energy efficiency program is the levelized annual discounted payment amount for each year in the life of the program divided by the annual kWh saved
[11] ACEEE, "Shaping Ohio".
[12] EE was compared with other resources used for achieving cost savings including wind, biomass, natural gas combined cycle, pulverized coal, nuclear, and coal IGCC.
[13] ACEEE 2010, "North Carolina's Energy Future".
[14] According to the EPRI study, the Southern Region includes West Virginia, Kentucky, Virginia, North Carolina, South Carolina, Tennessee, Georgia, Alabama, Mississippi, Florida, Arkansas, Louisiana, Oklahoma, and Texas.
[15] EPRI 2009, "Achievable Potential".
[16] Grueneich, "Lecture 10".
[17] Edison Electric Institute, "Rising Electricity Costs".
[18] U.S. Department of Energy, "Demand Response".

Effective EE programs can also contribute to a deceleration in peak demand growth due to the decrease in overall demand. As less energy is consumed overall, utilities may have less need to utilize their least cost-effective sources of power generation such as older plants which are primarily employed to account for periods of peak load.[19] The increased reliance on newer, more efficient facilities leads to lower marginal costs of production for utilities over the short-run. This factor along with smaller consumption levels inherent with energy efficient technologies and practices can lead to a decrease in utility customers' bills over the short-term as well.[20]

Future increases in investment costs can similarly be postponed or avoided for transmission and distribution (T&D) infrastructure. Other things equal, vertically integrated generators and other T&D firms can invest less in T&D capabilities if EE is effective and consumption decreases.[21] Infrastructure will depreciate at a slower rate in real terms, and this leads to further decreases in T&D expenditures as energy passes more cost-effectively through the supply chain. These cost savings can be passed along to the end-users as well.

C. Economic Benefits

In terms of economy-wide impact, implementation of EE programs is closely linked with job creation. EPRI states that employment can increase "directly due to program expenditures and staffing requirements, and indirectly because program participants have additional disposable income as a result of lower energy bills."[22] Residential sector participants may foster economic growth through purchasing more goods and services, while commercial sector participants are able to designate funds previously used for energy towards hiring and business infrastructure.[23]

It is also important to note that indirect household and commercial spending may be substantial for EE-related goods and services. Energy customers who may not have been inclined to purchase upgraded equipment, appliances or EE services will engage in such activities if they see the additional spending as a viable investment. Therefore, local spending on the technologies and raw materials used in EE will increase proportionately with the number of participants in EE programs.[24] Lighting, appliances, HVAC installation services, and energy auditing are examples of EE-related goods and services which would benefit from an enhanced scope of EE programs. Although purchases may be induced by subsidization initially, these purchasing practices will become the norm once a comprehensive, enduring EE program is established within the state.

Other indirect economic effects are also notable. Savings in operational security and capacity lower the likelihood that forced outages will occur, and thus lower the financial impact on commercial and residential customers who may typically suffer productivity losses during outage periods.[25] Furthermore, work environments may be improved through enhancing lighting quality which reduces eyestrain for workers. Low-income customers represent another sector who could garner substantial financial benefits from program participation. As homes become more

[19] Ibid
[20] Environment Northeast, "Economic Growth".
[21] U.S. Department of Energy, "Demand Response".
[22] EPRI, "Guidebook".
[23] Ibid
[24] Environment Northeast, "Economic Growth".
[25] U.S. Department of Energy, "Demand Response".

efficient and bills reduced, the ability to make payments may increase, leading to "reductions in bad debt, terminations, forced mobility, and collection costs."[26] Additionally, a state's relative position in terms of economic competitiveness and trade on a domestic and even global level can ultimately increase with comprehensive EE programs.[27] EE advocates believe that when energy-related costs decrease, the state becomes a more attractive sphere of investment for commercial entities.[28]

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Participants in EE initiatives generate economic benefits through increased spending of disposable income as decreased energy-related costs and consumption result in lower energy bills. There is less certainty surrounding the correlation between EE and energy prices, however. Therefore, the issue of whether lower energy prices are a contributing factor to decreased energy costs is still unresolved. The prevailing notion within the energy community is that greater reliance on EE will put downward pressure on energy prices and demand.[29][30] A countervailing perspective suggests that EE programs force prices upward as utilities are forced to increase base rates to compensate for the effect demand reduction has on coverage of fixed costs.[31] However, decreases in peak demand can also reduce utilities' power supply costs and reduce the need for new generation capacity. To an extent, these factors offset the need to compensate for fixed costs in rate cases as growth in fixed costs decline in the long-run.[32]

D. Environmental Benefits

Energy savings directly impact the environment because of the reduction of fossil-based resources used in utilities' generation mixes. By reducing the amount of carbon-emitting fuels at the generational level, less greenhouse gases (GHGs) are emitted into the atmosphere. These avoided emissions are directly related to the savings acquired through adoption of practices like EE. The exact amount and mix of reduced GHG emissions depends on when the energy savings take place. EPRI notes:

> *At different times of the day, depending on the electric load, different fuels are used to meet customers' demand. Utility models show the type of fuel being 'dispatched' at each hour of the day. Most energy efficiency programs reduce energy use on the margin and impact 'load following' generation plants. Base load plants are less likely to be impacted by energy efficiency programs.*[33]

Therefore, the quantity of GHGs avoided depends on the nature of the carbon-emitting fuel used as a primary source in utilities' generation mixes.

[26] EPRI, "Guidebook".
[27] Environment Northeast, "Economic Growth".
[28] ACEEE, "Shaping Ohio".
[29] Wood, "Estimating the Impact".
[30] EPRI, "Achievable Potential".
[31] American Public Power Association, "Revenue Requirements".
[32] Ibid
[33] EPRI, "Guidebook".

Water savings are another ancillary environmental benefit. As EE programs become more developed, appliance standards and incentives for water pumps, low-flow showerheads, faucet aerators, and other water-conserving technologies also become more prevalent. Energy Star, for instance, endorses energy-efficient appliances that reduce the use of domestic hot water because of the reduced energy usage required to heat water. Therefore, a derived benefit is that water conservation has been established as a relevant by-product of EE initiatives.[34]

E. Quantifying Avoided Costs and Non-energy Benefits

There is much inconsistency among states regarding how ratepayer-funded energy efficiency programs are evaluated.[35] One thing that is consistent is that all states use "utility system avoided costs" as the primary benefit quantified in program benefit-cost tests.[36] Many of the benefits previously discussed qualify as avoided costs because they are derived from an energy savings value, which often take into consideration what would have happened had the energy not been saved.

The difference between states lies in how avoided costs are defined. The results of a survey of state public service commissions performed by the American Council for an Energy-Efficient Economy (ACEEE) found that 12 states define avoided costs as fixed values based on the avoided next power plant. Another 12 define them based on market prices and 11 states base them on average or marginal system costs. The large majority of states (82 percent) include a value for avoided transmission and distribution costs.[37]

In most cases, avoided costs are defined for individual utilities as opposed to state-wide areas. This is simpler than calculating state-level costs because avoided costs are a function of a utility's generation mix. The two main categories of avoided costs are energy-related and capacity-related. Energy-related avoided costs are the costs of the marginal inputs that would have been used to produce the saved energy; these include cost of commodities, variable O&M, system losses, and may include other non-energy benefits such as reduced air emissions and water usage. Capacity-related avoided costs are capital investments in actual power plants, any purchase of capacity or capacity services, transmission and distribution lines and associated infrastructure. Environmental benefits such as reduced air emissions and avoiding the need for new transmission lines and power plants are a third category of benefits that are frequently included in avoided costs.[38]

No state considers all categories of costs. The correct level of inclusion depends on the state and available resources. Calculation of avoided costs can be short-term or long-term; if long-term, the avoided cost may be larger due to inclusion of more capacity-related variables. The long-term rate impact will depend on the level of fixed capital costs included in the avoided costs to value the energy savings.[39]

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[34] Jackson, "Hidden Benefit".
[35] Kushler, Nowak and White, "National Survey".
[36] Ibid
[37] Ibid
[38] National Action Plan for Energy Efficiency, "Cost Effectiveness".
[39] Ibid

F. Focus on EE in West Virginia

West Virginia has fallen behind its regional counterparts in terms of addressing its energy consumption through EE policy. Climate and other weather-related incidents act as key drivers for energy consumption and these factors vary among states with distinct physical geographic characteristics. It is important to note how West Virginia compares with regional states in terms of consumption and how EE policies reflect state efforts at mitigating load growth.

Table 1 indicates per household consumption figures and relative rankings for the ARC states:

Table 1: Household Energy Consumption in ARC States (2010)

ARC State	Delivered Energy to Residential Sector (MMBTUs)	Number of Households	Consumption per household (MMBTUs)	Rank
Alabama	177,612,000	1,883,791	94.28	11
Georgia	371,763,000	3,585,584	103.68	6
Kentucky	178,972,000	1,719,965	104.06	5
Maryland	219,108,000	2,156,411	101.61	8
Mississippi	109,133,000	1,115,768	97.81	10
New York	771,996,000	7,317,755	105.50	4
North Carolina	341,142,000	3,745,155	91.09	12
Ohio	534,456,000	4,603,435	116.10	1
Pennsylvania	552,369,000	5,018,904	110.06	3
South Carolina	157,338,000	1,801,181	87.35	13
Tennessee	254,474,000	2,493,552	102.05	7
Virginia	306,953,000	3,056,058	100.44	9
West Virginia	86,062,000	763,831	112.67	2
United States	11,527,426,000	116,716,292	98.76	NA

[1] U.S. Census Bureau 2010 Census and Energy Information Administration 2010 State Energy Profiles
[2] MMBTUs signify Million British Thermal Units.

Of the thirteen Appalachian states as defined by the Appalachian Regional Commission (ARC), West Virginia has the second highest residential energy consumption per household with the average household consuming 112.67 MMBTUs per year. This figure is 14.08% above the national average of 98.76 MMBTUs. Ohio is the only regional state to exceed West Virginia in terms of per household consumption with 116.10 MMBTUs of energy consumed per household annually. Pennsylvania ranks third with 110.06 MMBTUs consumed annually per household.

The three states with the least per household energy consumption among the ARC states are South Carolina, North Carolina, and Alabama. South Carolina's annual per household consumption of just 87.35MMBTUs is the least among ARC states. North Carolina has the second lowest annual per household energy consumption with 91.09 MMBTUs, and Alabama, the third lowest, has a per household consumption of 94.28 MMBTUs per year. These three states also had a greater average number of persons per household than WV which means they were able to utilize less energy resources even though they had more people on average in a household.

Table 2 examines residential energy consumption further by taking into account the population of occupied housing units within ARC states and other relevant data:

Table 2: Per Capita Energy Consumption in ARC States and Related Data (2010)

ARC State	Delivered Energy to Residential Sector (MMBTUs)	Population in occupied housing units	Consumption Per Capita in Occupied Housing Units	Rank	Avg. Household Size (persons)	Population Density (Per Square Mile)
Alabama	177,612,000	4,663,920	38.08	10	2.48	94.4
Georgia	371,763,000	9,434,454	39.40	8	2.63	168.4
Kentucky	178,972,000	4,213,497	42.48	4	2.45	109.9
Maryland	219,108,000	5,635,177	38.88	9	2.61	174.8
Mississippi	109,133,000	2,875,333	37.95	11	2.58	63.2
New York	771,996,000	18,792,424	41.08	6	2.57	411.2
North Carolina	341,142,000	9,278,237	36.77	12	2.48	191.1
Ohio	534,456,000	11,230,238	47.59	2	2.44	282.3
Pennsylvania	552,369,000	12,276,266	44.99	3	2.45	283.9
South Carolina	157,338,000	4,486,210	35.07	13	2.49	153.9
Tennessee	254,474,000	6,192,633	41.09	5	2.48	153.9
Virginia	306,953,000	7,761,190	39.55	7	2.54	202.6
West Virginia	86,062,000	1,803,612	47.72	1	2.36	77.1
United States	11,527,426,000	300,758,215	38.33	NA	2.58	87.4

[1] U.S. Census Bureau 2010 Census and Energy Information Administration 2010 State Energy Profiles
[2] MMBTUs signify Million British Thermal Units.

WV's higher levels of consumption can be partially explained when the household variable is examined in greater depth. Beyond weather-related factors, other variables affect overall consumption levels faced by residents within a state. For instance, WV is more rural in terms of population composition than other states like NY and MD that are more urban. In states with greater population density, residents may be more apt to live in apartments and complexes that comprise less square footage than a typical house. As noted in Table 2, West Virginia has the second lowest population density of the ARC states. Additionally, West Virginia's average household size of 2.36 persons is smaller than all the other ARC states and significantly smaller than the national average of 2.58 persons.[40] Thus, more energy is required per person to maintain a household. In fact, when the household population is taken into consideration, West Virginia has the highest residential energy consumption per capita of all ARC states.

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[40] U.S. Census Bureau, "2010 Census".

Despite all of the various factors affecting consumption and interpretations for why various states have higher or lower levels, the idea behind efficiency is to mitigate load growth by implementing policies that curtail consumer demand for energy. Not only did most states in the ARC have less per household and per capita consumption than WV, but they also ranked substantially higher than WV in terms of best energy efficient practices according to a national EE scorecard produced by the ACEEE. New York is one of the leading states in terms of EE practices with a scorecard ranking it 3rd out of 50, while Maryland is also a top tier state with an overall national ranking of 10th. Pennsylvania is a middle tier state according to the scorecard with a ranking of 25. Although these states had similar levels of consumption compared with WV, they are taking steps toward mitigating load growth through enacting EE policies that help their state more cost-effectively meet energy demand. On the other hand, states with lower levels of consumption such as Mississippi, Alabama, North Carolina and South Carolina have comparable or even lower rankings for EE policy. These states may not deem it necessary or urgent to enact policies when their demand for energy is already lower than the rest of the U.S. However, West Virginia has both high consumption levels and unfavorable policy for utilizing EE as a resource.

Although West Virginia has attempted to implement some measures of EE into the scope of its energy policy, it still falls behind most of the ARC states and the nation with its EE scorecard ranking of 44.[41] The low score can be contributed to the fact that West Virginia failed to realize incremental energy savings during the period in which the study was conducted.[42] The factors affecting the state's ability to save are related to the variety of efficiency programs implemented, efficiency budgets, energy savings targets, performance incentives for utilities, building energy codes, state initiatives, appliance efficiency standards, and other aspects of EE policy which will be examined further.

Table 3 shows the ACEEE scorecard ranking of the 13 ARC states:

[41] ACEEE, "Scorecard".

[42] In the 2011 scorecard, various data components were utilized from different years which resulted in data lag for inclusion of existing WV Utility programs. The scorecard utilized 2010 Program budget data for electricity and natural gas programs, 2009 electricity savings data from programs, and 2011 policy (Energy efficiency resource standards) and regulatory status of decoupling/performance incentives. Utilities and other program administrators do not report the data consistently and quickly enough on 2011 program budgets and energy savings to use in the 2011 Scorecard. This is the reason WV was not assessed as having utility energy efficiency programs.

Table 3: ACEEE Scorecard Ranking of ARC States

ARC State	Ranking
Alabama	43
Georgia	36
Kentucky	37
Maryland	10
Mississippi	49
New York	3
North Carolina	27
Ohio	24
Pennsylvania	25
South Carolina	46
Tennessee	30
Virginia	34
West Virginia	44

[1] American Council for an Energy-efficient Economy

West Virginia's last tier status in the scorecard rankings emphasizes the opportunity for the state to focus on EE as a key aspect of its overall energy policy. Other states have taken significant measures to improve their relative and overall standing with regards to EE policy. These measures have led to other states surpassing West Virginia in terms of the scope of their EE policy and the overall effectiveness. Although the previous examples illuminated issues related to residential energy consumption, comprehensive EE policy spans all sectors and requires multiple component programs which are addressed in the next section.

II. Components of Programs

Energy efficiency programs can be broken down into multiple classes based on the types of programs implemented and the energy use sector targeted. In this report, EE programs are described in terms of three different sectors: residential, commercial and industrial. The characteristics and relevant data related to each sector will be described, and the various programs that can be implemented in each sector will be discussed. However, before an examination of each sector is undertaken, it is important to first understand some relevant EE program elements. Prescriptive verses non-prescriptive programs and low-interest loans are two topics to be examined as a precursor to the discussion of EE in the different energy sectors.

A. Prescriptive vs. Non-prescriptive Program Elements

Two distinct approaches towards achieving efficiency outcomes are typical in most EE programs. The prescriptive approach refers to facilitating the adoption of new EE technologies by offering incentives for specific measures with predefined rebates or discounts.[43] Incentives may be paid directly to the customer or to the vendor. For instance, some rebate processes

[43] Xcel Energy, "Efficiency Programs".

require customers to fill out rebate forms to receive cash back on EE-related purchases. Other processes involve rebates being paid directly to vendors, and this approach allows the discounted price of EE-related goods to be more easily visible to customers within the retail location. Rebates, in general, provide trade partners with a promotional tool for EE in the marketplace.[44] Under this approach, consumers of energy are offered such incentives on technologies that meet prescribed efficiency standards in terms of lighting, HVAC, motors, building envelope, refrigeration, and other equipment.[45] A prescriptive program is typically designed to simplify the process by not requiring formal applications or pre-approval before the average user can adopt the most common energy saving measures.[46]

Generally, non-prescriptive EE programs are considered to be customizable initiatives that address more complex energy savings issues. They allow for rebates for commercial and industrial customers whose needs may not fall under the standard prescriptive measures. Examples of non-prescriptive programs include retrofitting, day lighting, building shell and glazing, free cooling, and any other measures, equipment, or technologies not covered under a prescriptive program.[47] For instance, new construction of commercial buildings may qualify for energy design assistance to ensure the building is constructed in the most energy-efficient manner. Non-prescriptive programs must typically undergo a cost/benefit analysis in order to evaluate the potential effectiveness of the initiative.[48] For example, DTE Energy commercial and industrial customers with proposals for custom efficiency projects must submit to a Total Resource Cost test to determine whether the cost-effectiveness of the efficiency measure warrants implementation.[49]

It is important to note that prescriptive and custom programs show a high level of consistency in terms of their mutual offerings within the contexts of EE programs. Both types of programs are typically offered in tandem with one another as coordination of measures, incentive levels and processing, qualification and technical standards, and other aspects of implementation and evaluation overlap.[50] Currently, no EE programs in the ApCo service territory offer non-prescriptive rebates.[51]

B. Low-interest Loan Programs

Low-interest loan programs offer loans at lower than market interest rates to customers seeking efficiency improvements. They can be administered by utilities or by third party agencies. Typically, the entity administering the efficiency program will buy down the interest rates offered from participating banks and offer a lower rate to its customer. It is common for the loan to be structured so the payback can be made mainly through the energy savings that are achieved with the efficiency investment. The Clean and Efficient Energy Program notes that more than 150 energy efficiency financing programs within the country adhere to this payback structure.

[44] Ibid
[45] NEEP, "Best Practices".
[46] DTE Energy, "Energy Optimization".
[47] Rahe, "CORE Electric".
[48] Ibid
[49] U.S. Department of Energy, "DTE Energy".
[50] DTE Energy, "Energy Optimization"
[51] Fawcett, "Interview by Sean Pauley".

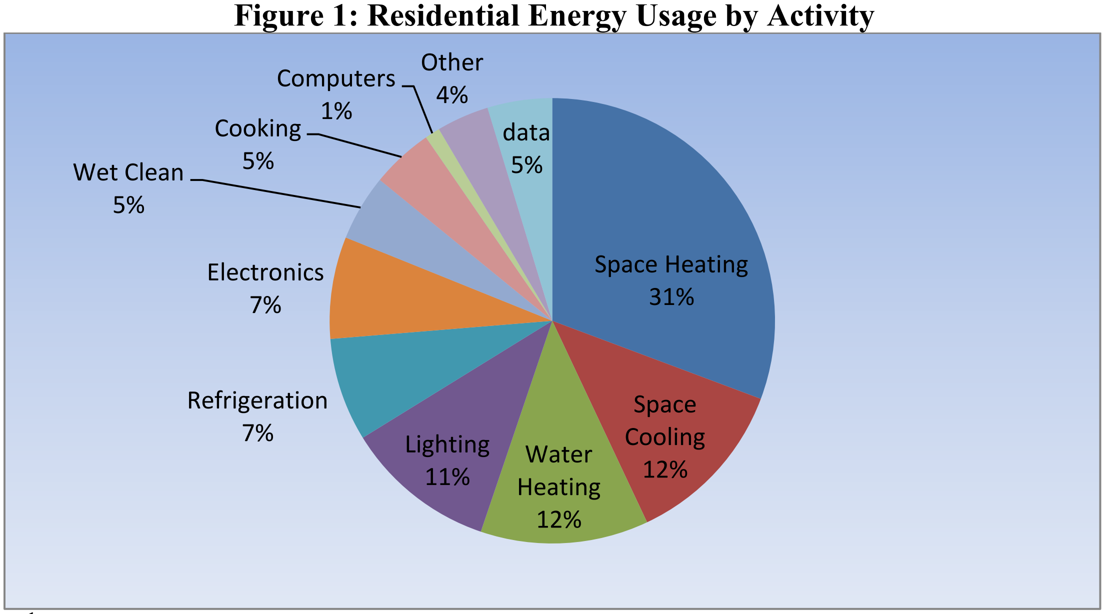
These programs do not offer one-size-fits-all solutions, and they operate with varying levels of success. However, it is important to note that low-interest loans function best when they are offered in conjunction with home audit programs.[52]

C. Residential Sector

With more than 100 million households, the residential sector in the United States uses nearly 25% of total energy consumed.[53] More specifically, the residential sector accounts for 37% of electricity consumption nationwide.[54] Furthermore, it accounts for 21% of natural gas consumption nationwide.[55] Households use energy for a variety of purposes such as heating and cooling their homes, heating water, lighting and operating a wide array of appliances such as refrigerators, stoves, televisions, and computers. Initiatives incentivizing use of energy-efficient lighting, high-efficient appliances, programmable thermostats, improved insulation, and building codes offer great opportunities in the residential sector to substantially reduce energy use.

Space heating is the activity that encompasses the largest amount of residential energy usage, accounting for 31% of the primary energy use in a typical household. Space cooling and water heating account for approximately the same proportion of use at around 12% and lighting accounts for roughly 11% of use. Figure 1 illustrates the proportion of energy usage by all activities relevant to the residential sector:

Figure 1: Residential Energy Usage by Activity



[1] Energy Information Administration and U.S. Department of Energy's EERE

[2] Data category in figure represents 1 quad of energy (5%) that is a statistical adjustment by the EIA to reconcile two divergent data source

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[52] CEEP, "Low-interest".

[53] ACEEE, "Homes and Appliances".

[54] Energy Information Administration, "Electricity Explained".

[55] Energy Information Administration, "Natural Gas Consumption".

1. *Residential HVAC Programs*

In order to maximize their effectiveness, residential EE programs should be designed to take into account the activities which contribute to the greatest amount of energy consumption. Heating, ventilating, and air conditioning (HVAC) is one area emphasized within residential EE programs because it addresses the major activities of heating and cooling. HVAC represents the "mechanical systems that provide thermal comfort and air quality in indoor spaces."[56] Certain prescriptive measures are often adopted that offer residential customers rebates for purchasing energy-efficient equipment related to HVAC. Purchase of efficient heat pumps, boilers, furnaces, water heaters, air conditioners and even maintenance are just a few examples of HVAC equipment-related incentives. Appalachian Power Company (ApCo) offers such a program where heat pumps, water heater insulation jackets, and HVAC tune-ups are all eligible for rebates for residential households.[57]

2. *Residential Lighting Programs*

Lighting initiatives incentivizing the purchase and installation of compact fluorescent light bulbs (CFL) are also a common offering in residential EE programs. More than 70% of the fixtures in the residential sector that can hold CFLs remain unfilled. In states without established CFL programs, 90% of potential remains.[58] Additionally, the U.S. Department of Energy notes that 35% of electricity used for lighting purposes could be saved by switching from incandescent to CFL technology.

Typically, such programs encourage the sale and installation of CFLs through rebates or discounts on products. EE administrators and government agencies work directly with retailers to negotiate reduced prices through buying down the cost of the CFLs. In most cases, there are no coupons or forms necessary for customers to complete their purchase of the CFLs as the prices advertised within the store reflect the marked-down, subsidized price. This model is often seen as more effective method for offering rebates to customers as it uses market-oriented pricing and convenient purchasing as inducements to customers. Furthermore, the buydown process has proven to move higher volumes of products at a lower overall program cost.[59]

This form of a residential lighting program operates as an effective incentive because all parties involved benefit. Retailers have a lessened administrative burden because there is no longer a need for rebate applications and forms. Retailers, manufacturers, and utilities can collaborate through a mutual effort to market their products. Utilities are able to benefit by having a large volume of CFLs installed which reduces their overall system load. Also, energy customers receive savings in the form of price reduction of CFLs and lower energy bills.[60]

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[56] ACEEE, "Heating".
[57] Appalachian Power Company, "Residential Rebates".
[58] U.S. Department of Energy, "Market Profile".
[59] Kates and Bonanno, "Residential Market".
[60] Ibid

ApCo has taken advantage of this model with their SMART Lighting Program. They currently work with participating retailers like Wal-Mart, Home Depot, Lowes, and Sam's Club in West Virginia to offer instant rebates on qualified Energy Star CFL purchases. All ApCo/AEP residential electric customers in West Virginia are eligible for program participation, but there is a 12-bulb purchase limit per household. When CFLs are purchased with "big box retailers and home centers" the discounted price is reflected at the point of purchase. ApCo notes that the qualifying discounted bulbs will be priced "at least $1 less than the normal price at participating retail locations".[61] FirstEnergy, another relevant WV energy company, has established lighting efficiency programs within their power companies, Mon Power and Potomac Edison. However, these lighting incentives are currently only available to commercial customers.[62] These programs are described in greater detail in later sections describing WV utility rebate programs.

3. Residential Appliance Programs

Other EE programs designed for the residential sector also include elements that promote energy-efficient appliances. The increased usage of appliances and consumer electronics has led to greater electricity demand in recent years. Since 1985, the number of households in the U.S. utilizing a dishwasher has risen approximately 45%. Similarly, the number of households with personal computers has risen 170% since 1992.[63] Typical household appliances that require efficiency standards or receive efficiency rebates within EE programs include general cooking appliances, furnaces, washers and dryers, refrigerators, fans, ventilation, and more.[64]

Minimum efficiency standards for residential appliances are considered one of the most successful ways state and the federal governments have attempted to facilitate energy savings. Appliance efficiency standards ban the manufacturing and import or sale of appliances less efficient than the minimum requirements. These standards result in saved energy, but their adoption also has the added benefits of pollution reduction, improved electrical grid performance, and cost savings to consumers.[65]

In 2010, West Virginia adopted an appliance efficiency rebate program based on a federal initiative that gave rebates for Energy Star appliances which would replace residents' older, inefficient appliances. The West Virginia program was enacted on June 17, 2010 and it ended on August 24, 2011. Eligible products included within the program were refrigerators, freezers, clothes washers, dishwashers, and room air conditioners. Rebates of $25 to $100 were offered and were contingent upon proof of proper recycling of old appliances. Total program funding was approximately $1.7 million.[66]

[61] Appalachian Power Company, "Smart Lighting".
[62] FirstEnergy, "Save Energy".
[63] Office of Energy Efficiency and Renewable Energy, "Efficiency Trends".
[64] ACEEE, "Homes and Appliances".
[65] ACEEE, "Appliance Efficiency".
[66] Office of Energy Efficiency and Renewable Energy, "West Virginia".

4. Residential Low-Income Programs

Another component of residential EE is low-income programs. Low-income families are particularly susceptible to variable energy costs, and these programs offer cost-effective solutions oriented towards these customers. Eligible families must typically meet some income requirement such as being a certain percentage under a State median income figure or being eligible for other low-income government programs such as food stamps, temporary assistance to needy families, Medicare, public housing, and others.[67] Programs consist of standard EE improvements that result in lower energy costs, improved comfort, and reduced energy usage. Typical measures included in a low-income program include replacing air conditioning and heating systems, maintenance of heating and cooling systems, replacing leaky ducts, installing additional insulation, replacing water heaters, weather stripping, sealing doors and windows, and other measures.[68]

Low-income programs are evaluated based on the energy savings achieved for households involved in the program. These assessments draw a comparison between energy savings or bill reductions with annual program expenditures to determine whether it is cost-effective. Non-energy benefits of low-income residential EE can also accrue to various stakeholders. These benefits include higher property values, improved community appearance, local job creation, lower school and work absenteeism, and potentially lower expenses on government or utility energy subsidies. These non-energy indirect benefits are typically noted by policy makers as a reason for justifying expenditures on these types of programs. However, they are not typically taken into account under most frameworks for program evaluation.[69]

D. Commercial Sector

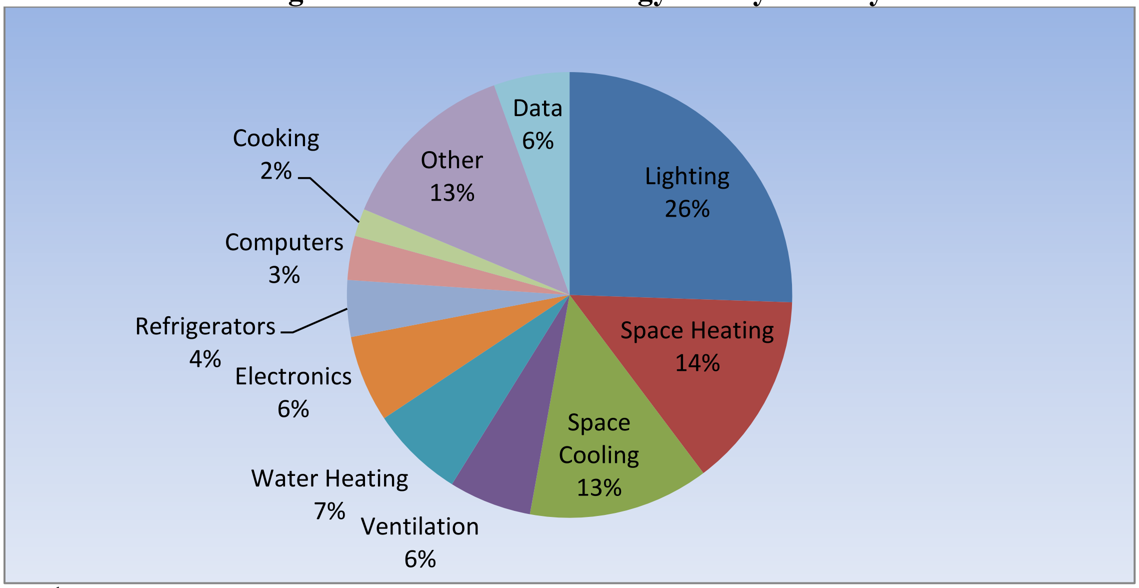
Commercial buildings account for approximately 19% of total energy usage in the United States. Office and retail buildings represent two-thirds of the total commercial energy usage, and half of the total is accounted for by applications such as heating and lighting.[70] This sector is responsible for 34 percent of electricity consumption.[71] Furthermore, it accounts for 14 percent of natural gas consumption nationwide.[72] Common applications of energy usage in this sector are space heating, water heating, air conditioning, lighting, cooking, and running various types of electronic equipment. Initiatives that incentivize the use of energy-efficient lighting, heating and cooling, and adherence to building codes are all relevant to successful implementation of EE in the commercial sector.

Lighting accounts for the greatest portion of commercial energy usage with 26% of the total. Space heating accounts for 14% of total usage, and space cooling accounts for 13% of total usage. Other activities such as water heating, ventilation, and electronics account for fairly

[67] The Electric Company, “Low Income”.
[68] GRU, “Low Income”.
[69] Heffner and Campbell, “co-benefits”.
[70] ACEEE, “Commercial Sector”.
[71] Energy Information Administration, “Electricity Explained”.
[72] Energy Information Administration, “Natural Gas Consumption”.

substantial amounts of energy usage in the commercial sector as well. Figure 2 depicts the proportion of energy usage by all activities relevant to the commercial sector:

Figure 2: Commercial Energy Use by Activity



[1] Energy Information Administration and U.S. Department of Energy's EERE
[2] Data category in figure represents 1 quad of energy (6%) that is a statistical adjustment by the EIA to reconcile two divergent data sources

1. Commercial Lighting Programs

Energy-efficient lighting programs in the commercial sector represent a great opportunity for savings due to the great portion of usage they represent. Commercial lighting is distinct from residential lighting due to the variation in applications of usage. Whereas residential lighting is used "indoors and out to provide ambient light and meet task-specific lighting needs, for decorative purposes, and to provide security", commercial lighting includes "indoor ambient, task, and decorative lighting, street and area lighting, traffic signals, and sign and billboard lighting, among others."[73] The principal technologies being utilized with commercial lighting applications include solid state lighting such as advanced fluorescent and high-discharge intensity systems.[74]

In general, commercial lighting initiatives address efficiency in lighting applications for small businesses whose energy consumption levels meet a given criteria. Programs frequently offer free energy assessments and a portion of the cost for the recommended upgrades as incentives. Lighting upgrades could include replacing current fluorescent fixtures with high-efficiency lamps and ballasts, and changing incandescent to compact fluorescent lights. Another common practice is to upgrade exit signs with LED technology.[75] Often times, these programs utilize outside contractors to fulfill the lighting retrofits needed by businesses. Benefits cited by

[73] ACEEE, "Lighting".
[74] Ibid
[75] NYSEG, "Small Business".

commercial lighting upgrades are lower operating costs due to reduced energy bills and improved working conditions due to the superior quality of the lighting.[76]

2. Commercial HVAC Programs

High-efficiency HVAC provides the same heating and cooling capabilities as standard devices but utilize different components and controls that increase efficiency. Upgraded components such as motors on fans and pumps, and high-efficiency chillers enable these devices to outperform standard equipment. High-efficiency chillers, for instance, can reduce energy consumption by 20% compared with standard-efficiency equivalents.[77] Measures taken to improve efficiency of heating and cooling collectively address nearly one-fourth of energy usage for typical commercial applications.[78] Typical commercial programs offer incentives for upgrading existing systems to meet new standards or for purchasing new high-efficiency systems. Customers purchasing new HVAC systems may be "building managers, developers or contractors who are either replacing failed existing units or who are constructing new spaces."[79]

Typically, administrators of these programs use contractors to facilitate the energy-efficiency upgrades needed by customers. The contractors collaborate with the customer on type of system, price, and installation details. After the project is completed, rebate applications and invoices are required to be eligible for qualifying rebates. On-site verification is also a general step needed to insure efficiency improvements were made.[80] In general, in order to facilitate successful commercial HVAC incentives programs, administrators should minimize the steps and requirements necessary for HVAC distributors and suppliers. These actors will participate in the programs if it is easy for them to engage in the project. Also, HVAC programs should be implemented with a long-term scope. If programs are only funded or enacted for one to two years it will be difficult to achieve results and most distributors and suppliers will not be interested in partnering with the program.[81]

E. Industrial Sector

The industrial sector accounts for approximately one-third of total end-use energy consumption in the United States, which is the most of any sector.[82] The industrial sector accounts for approximately 26 percent of electricity consumption domestically.[83] It also accounts for 30 percent of natural gas consumption nationwide.[84] High frequency applications for energy usage in this sector include process heat and cooling and powering machinery. Facility heating, air conditioning, and lighting are also relevant applications to this sector.[85]In general, the industrial sector encompasses various segments such as "manufacturing, mining, construction, energy-

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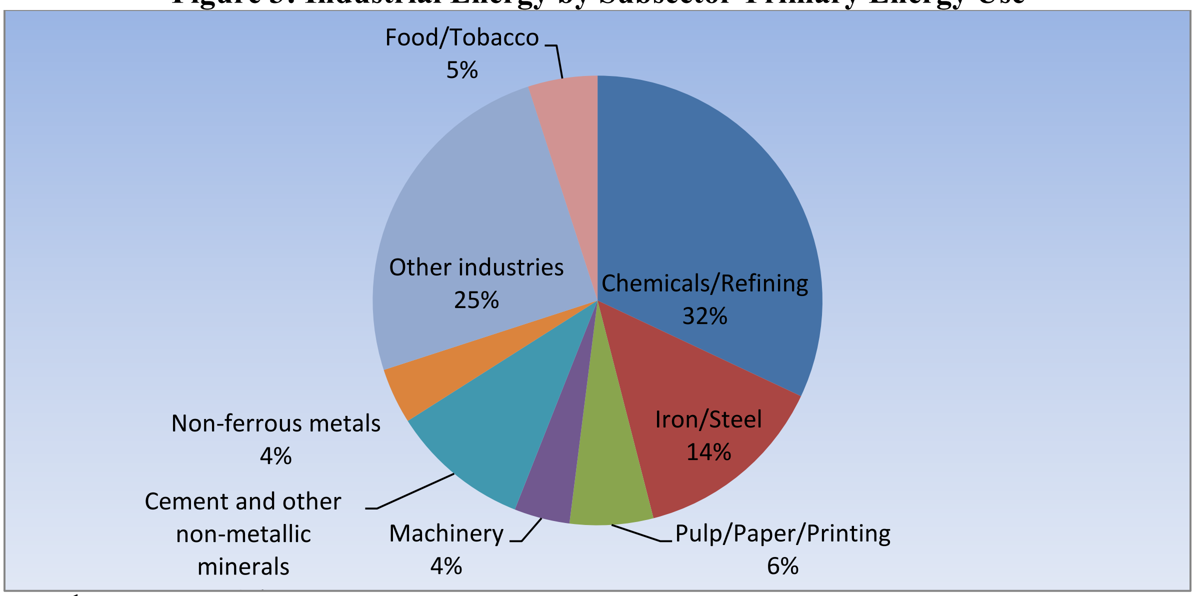
[76] Environment Northeast, "Economic Growth".
[77] Southwest Energy Efficiency, "Guide".
[78] Office of Energy Efficiency and Renewable Energy, "efficiency trends".
[79] Linn, Patenaude and Stasack, "Swimming Upstream".
[80] GoodCents, "Commercial HVAC".
[81] Linn, Patenaude and Stasack, "Swimming Upstream".
[82] ACEEE, "Industrial Sector".
[83] Energy Information Administration, "Electricity Explained".
[84] Energy Information Administration, "Natural Gas Consumption".
[85] Environment Northeast, "State and Utility Administered".

intensive processes, and other operations that ultimately convert raw materials into finished products."[86] The deployment of EE initiatives within this sector varies and is unique from practices associated with other sectors. It not only involves assessing the impact of EE on reduced energy consumption but also on carbon emissions. Most industries are incentivized to engage in EE programs because of the return on investment provided to shareholders and the positive effect it has on fulfillment of regulatory compliance requirements for emissions standards.[87]

The industrial energy sector is defined more specifically into various subsectors that account for different levels of energy consumption. The Chemicals/refinery subsector accounts for approximately 32% of final primary energy use within the industrial sector. Iron/steel segments account for 14%, and cement and other non-metallic materials represent 10% of usage. Figure 3 depicts final energy use by industrial subsector:

Figure 3: Industrial Energy by Subsector-Primary Energy Use



[1] Technology Action Plan

1. *Industrial Energy Audits*

In order to identify the various opportunities for industrial energy efficiency, industrial customers often receive a professional energy audit. This energy assessment can be provided at no cost for eligible[88] small and medium-sized manufacturers by U.S. DOE Industrial Assessment Centers (IAC). The centers are located in 24 universities around the country, and teams work with manufacturers to identify opportunities to "improve productivity, reduce waste, and save energy."[89] The audits are conducted by university faculty and upper-level/graduate students.

[86] Technology Action Plan, "Industrial Sector".
[87] ACEEE, "Industrial Energy Efficiency Programs".
[88] Eligibility for assessments is dependent on various factors such as number of employees, location, gross revenues, annual energy costs, and more. For more information about eligibility, see http://www1.eere.energy.gov/manufacturing/tech_deployment/iacs.html
[89] Office of Energy Efficiency and Renewable Energy, "Industrial Assessment Centers".

According to the EERE, of the 15,000 IAC assessments which have been conducted, the average annual savings for the manufacturers audited amounts to $55,000.

West Virginia University operates the IAC within the state. This program has led to a total of 2.38 trillion Btus saved on an annual basis. The WVU IAC has also saved a total of $18.2 million since its inception with an average payback period of less than 2 years for firms implementing the recommended efficiency measures.[90] IACs represent a key opportunity for efficiency in the industrial sector because they help manufacturers become more aware of the energy-intensive processes in their operations and provide specific, cost-effective recommendations for implementing EE practices.

Industrial firms can opt-out of paying for the State's utility EE programs if they show they are participating in their own efficiency efforts, including implementing practices recommended in IAC or other industrial assessments.[91] This state policy approved by the WV Public Service Commission allows customers with demand in excess of 1MW to opt-out of state EE and DR programs. They are not held responsible for any cost recovery measures associated with State programs if they certify they are taking their own measures to adopt energy efficient practices.[92]

2. Waste Heat Recovery

One area especially pertinent to the industrial sector that offers opportunities for energy-efficiency is waste heat recovery. Waste heat is defined as "the energy associated with waste streams of air, exhaust gases, and/or liquids that leave the boundaries of an industrial facility and enter the environment."[93] Generally, this source of heat is not utilized in the process or for any other purpose within the facility. In fact, 20-50% of industrial energy input is lost as waste heat in the form of hot exhaust gases, cooling water, and heat lost from hot equipment surfaces and heated products.[94] Fossil fuel-fired furnaces, boilers, and process heating equipment represent the primary sources of waste heat in industrial facilities. Approximately 9% of energy used in industrial applications could be substituted by effective practices in waste heat recovery.[95] The key distinction between waste heat recovery and other energy recycling processes is that manufacturers utilize the excess heat already being emitted rather than providing all of the energy at the beginning of the process.[96]

Beyond the energy and environmental benefits, implementation of waste heat recovery practices can lead to substantial economic benefits for plants as well. The significant energy savings resulting from higher-efficiency in process heating applications leads to decreased energy costs. This may come in the form of reduced fuel consumption and/or electricity use and also fewer

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[90] Office of Energy Efficiency and Renewable Energy, "Extends the Reach".
[91] Other assessment opportunities exist for industrial customers in the state. These assessments provide similar services to IACs but may be applicable to different classes of industrial customers or with varying levels of incentives. The various industrial assessments offered in WV are outlined further in the section titled "EE Programs in West Virginia".
[92] West Virginia Public Service Commission, "Petition".
[93] Arzbaecher, Fouche and Parmenter, "Industrial Waste Heat Recovery".
[94] BCS, Incorporated, "Waste Heat Recovery".
[95] Arzbaecher, Fouche and Parmenter, "Industrial Waste Heat Recovery".
[96] Recycled Energy Development, "Understanding Combined Heat and Power".

carbon dioxide emissions. For instance, Steel of West Virginia in Huntington was able to reduce its natural gas consumption from 1,000,000 MCF annually to 800,000 MCF annually by adopting energy efficient practices including waste heat recovery.[97] Furthermore, thermal conversion devices used by plants such as boilers and furnaces can be reduced in terms of size and capacity requirements once waste heat recovery is implemented. Another potential benefit is increased productivity as more efficient practices lead to elimination of bottlenecks in industrial processes.[98]

3. *Combined Heat and Power*

In the traditional system of power production, up to 67% of energy can be lost as waste heat during generation, while an additional 3% of energy is abandoned through transmission line losses.[99] ACEEE notes that “recent advances in electricity-efficient, cost-effective generation technologies—in particular advanced combustion turbines and reciprocating engines—have allowed for new configurations of systems that combine heat and power production.”[100] Combined Heat and Power (CHP), also known as cogeneration, is an efficient, clean, and reliable approach to generating electricity and heat energy from a single fuel source. Facilities such as manufacturing firms and other large institutions can generate energy on site through cogeneration and recycle waste heat into electricity and useful steam which can be used to heat buildings and aid industrial processes. Today’s CHP systems can operate at an efficiency as high as 80%, while conventional methods of producing heat and power separately have a typical combined efficiency of 45%.[101]

a. CHP Policies

State policy can foster an environment where CHP deployment is encouraged and streamlined for industrial actors and other relevant entities pursuing cogeneration initiatives within their facilities. Interconnection standards, net-metering policies, emissions regulations, resource standards, financial incentives, and utility rates for standby power all have an impact on the level of CHP deployment within a region.

In general, standards that establish specific guidelines for the interconnection of CHP systems are an important factor for encouraging CHP. The ACEEE notes that having “multiple tiers of interconnection is important to CHP deployment because smaller systems offer a faster- and often cheaper- path toward interconnection compared with larger systems.”[102] Furthermore, interconnection standards with higher size limits are preferred by CHP developers, as are applicability of standards to all utilities, not just investor-owned utilities.[103]

Standby rates are charges imposed by utilities when a distributed generation system experiences a scheduled or emergency outage and must depend on power purchased from the grid. Standby

[97] Duke, “Steel of West Virginia”.
[98] Office of Energy Efficiency and Renewable Energy, “Unlock Energy Savings”.
[99] Recycled Energy Development, “Understanding Combined Heat and Power”.
[100] ACEEE, “Combined Heat”.
[101] Ibid
[102] ACEEE, “Scorecard”.
[103] Ibid

rates are broken down into two separate components: energy charges based on actual energy provided to the CHP system; and demand charges which recover the utility's cost of providing capacity to meet the peak demand of the facility using the CHP system.[104] Regulators approve demand charges on the assumption that utilities must maintain capacity equivalent to a CHP facility's peak demand in the case of an outage.[105] However, this perspective only recognizes the costs to the utility of an unlikely emergency outage of the CHP system and does not acknowledge the underlying benefits of efficient distributed generation. Such benefits include reduced grid congestion and deferment of more expensive capacity-related investments.[106] Rates weighted towards energy charges rather than demand charges are preferable for the promotion of CHP installation and retention.[107]

Although net metering is most commonly applied to renewable energy systems, it is also relevant to CHP systems, including smaller systems under 1 to 2 MW. When CHP is included as an eligible net metering distributed technology, CHP system owners can receive credit (most often at a utility's avoided cost) for excess power produced on site.[108] This provides an incentive for system owners to install the most cost-effective, efficient CHP technologies in their facilities. Other applicable net metering policies include eligibility for all customer classes and the ability for system owners to indefinitely carry over excess generation at a utility's retail rate.[109]

Considering the effect of CHP when evaluating a facility's output-based emissions is also a vital criterion for effective policy. Many states have enacted emissions regulations on generators based on calculation of the level of emissions resulting from a given level of fuel input into a system. However, for CHP systems, electricity and useful thermal output are generated from one fuel input. If policies do not account for the additional output created from combining heat and power systems, they ignore the avoided emissions associated with the more efficient system and discourage facilities who are regulated on emissions criteria from utilizing CHP technologies.[110]

Resource standards such as EERS and RPS can also play a role in facilitating CHP use to a greater extent. These standards define a specific targeted level of EE or renewable resources that must contribute to a state or a specific utility's overall generation capacity. When CHP is listed as an eligible technology within a standard, an incentive is created to promote CHP as a system resource. Often, programs and financial incentives are put in place to facilitate the promotion of technologies eligible within the standards.[111]

Financial incentives such as tax credits, grants, bonds, rebates and loan programs are often employed within state policies encouraging the growth of CHP development. Tax credits against business and real estate taxes are often the most common measures taken and are often more permanent structures than grants or bonds.[112] States with favorable policies tend to have a

[104] ACEEE, "Scorecard".
[105] ACEEE, "Standby Rates".
[106] U.S. Environmental Protection Agency, "Partnership".
[107] ACEEE, "Standby Rates".
[108] ACEEE, "Scorecard".
[109] Ibid
[110] U.S. Environmental Protection Agency, "Handbook".
[111] ACEEE, "Scorecard".
[112] Ibid

mixture of incentives available to encourage CHP deployment. Policies available to all CHP systems are preferable, but it is important to note that some states promote CHP through lead by example government programs, biomass CHP program incentives, and strong utility CHP incentives.[113]

b. *Other Barriers to CHP Deployment*

Although the potential for CHP is widely known by developers and supporters, there are economic and political barriers which make it difficult for states to deploy CHP on a wide scale. Certain barriers can be removed through policies, while others result from general economic realities and historical business and regulatory practices.

The difference between the cost of fuel required to power a CHP system and the cost of purchasing power from the grid in the absence of a CHP system is termed "spark spread".[114] Poor spark spread indicates that cogeneration may not be as economically viable in a state because access to cheap electricity makes projects less cost-effective. Volatility in deregulated markets for key fuel inputs like natural gas also has potential to affect the spark spread within a region. Poor spark spread cannot be directly addressed with policy enactments, and in most cases financial incentives may be ineffective. In an ACEEE study, it was noted that stakeholders from various states said it could still be economically unviable to develop CHP even if the system was given to them for free. Access to cheap electricity rates and the cost of fuel alone can make CHP projects uneconomic to build and run.[115]

Another barrier to deployment is the lack of access for distributed generators to markets for excess power. There is often a mismatch between a facility's electric load and the electric output provided by a CHP system. In order to fully maximize the return on investment for a system, developers wish to have access to markets where this excess power can be sold. However, even in states with appropriate interconnection standards, CHP developers may only be able to sell their power at a utility's avoided cost or at wholesale rates.[116] Most CHP developers favor policies that would allow them to sell their power at higher, negotiated rates to facilities with whom they contract.[117] A new rule[118] enacted in New Jersey allows an entity to sell electricity to any facility to which it is already selling thermal energy services. This rule allows CHP systems to access existing electricity infrastructure to transport any power sold, and area utilities are only permitted to charge a standard transportation rate.

Another potential barrier to implementing CHP technologies in facilities is the aversion to perceived risk and longer payback periods. CHP competes with other capital investments for priority within a business. These investments must be justifiable to company or facility administrators on an economic basis. A payback period for a typical CHP project ranges from 4 to 6 years, while most developers and supporters note that a payback of one year or less is

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[113] Ibid
[114] ACEEE, "Challenges".
[115] Ibid
[116] U.S. Environmental Protection Agency, "Project Development".
[117] ACEEE, "Challenges".
[118] Amendments to New Jersey bills P.L.1999, c.23, and P.L.1997, c.162, see: http://www.districtenergy.org/assets/pdfs/2010CampConf/New-Jersey-Cogeneration-Bill-12.3.09.pdf

typically required by most facilities for EE-related projects.[119] A CHP project with a 4-year payback may have been viewed favorable in previous years, but the recessionary nature of the economy in recent years has caused decision makers to be more risk averse in terms of tying up capital.

State regulatory commissions can help develop incentives for utilities to be more open to CHP in their service area. For example, alternative regulatory structures can be established that delink utility revenues from volume of electricity sold. Regulatory roles could also include directing public funds toward establishing programs and incentives targeted for CHP development and congruent with other EE programs.

c. *Regional Comparison of CHP Policies and Barriers*

CHP policies and barriers to deployment differ among states. It is important to look at how the CHP market varies between West Virginia and the surrounding region. West Virginia and its bordering states of Kentucky, Maryland, Ohio, Pennsylvania and Virginia will be examined in terms of the favorability[120] of their CHP market.

West Virginia's market for CHP is deemed as unfavorable. From 2005-2010, there were 3 new CHP sites built which generated an additional capacity of 0.6 MW.[121] The primary barrier to deployment for CHP is considered to be the poor spark spread due to the availability of cheap power generated from the state's abundance of coal resources.[122] West Virginia's interconnection standards include CHP as an eligible technology and were recently updated in 2010 to include two levels of review and a system capacity limit of 2 MW.[123] Net metering policy was also updated concurrently with interconnection standards and CHP is considered an eligible technology under net metering standards.[124] Standby rates are not considered to be major factors for discouraging CHP as both utilities operating in the state have rates deemed as "neutral" to CHP.[125] West Virginia currently has no output-based emission standards which would affect the market for CHP.[126] However, the State has established standards within an Alternative and Renewable Energy Portfolio which allows CHP to be counted as an eligible renewable resource towards meeting the goal.[127] West Virginia has no financial incentives in place for CHP.[128]

Kentucky's market for CHP is deemed unfavorable. From 2005-2010, no new CHP sites were developed.[129] The primary barrier to CHP deployment is poor spark spread due to the abundance

[119] Ibid
[120] The basis for deeming the favorability of CHP markets is supported by an ACEEE study of the challenges facing CHP developers and supporters within states. The study assesses the favorability of CHP markets by taking into account new CHP development, capacity, policies and barriers.
[121] ACEEE, "Challenges".
[122] Ibid
[123] WV Public Service Commission General Order 258 & 258.1.
[124] U.S. Environmental Protection Agency, "WV Net Metering Standards".
[125] ACEEE, "West Virginia Clean Distributed Generation".
[126] Ibid
[127] W. Va. Code and §24-2F-1 et seq.
[128] ACEEE, "West Virginia Clean Distributed Generation".
[129] ACEEE, "Challenges".

of cheap, coal-powered electricity within the state.[130] In terms of policy, Kentucky's interconnection and net metering standards are only applicable to CHP systems fueled by biomass and biogas.[131] Standby rates set by utilities are deemed as neutral to unfavorable for CHP depending on the utility. Old Dominion power establishes standby service at the customer's regular rate which is considered to be neutral to CHP development, while Louisville Gas & Electric Co. establishes standby rates based primarily on demand which is considered to be unfavorable for CHP development.[132] Furthermore, Kentucky does not have either portfolio standards or emissions standards which would encourage or discourage CHP development in the state. The only financial incentives applicable to the State are the tax incentives established under the 2007 Incentives for Energy Independence Act which provide businesses and individuals with incentives for pursuing EE and renewable-powered projects. Only biomass-powered CHP would be eligible under these incentives and would require a minimum capacity of 1 MW.[133]

Maryland's market for CHP is considered to be favorable in terms of market growth. From 2005-2010, two new CHP sites were built in the state, but they accounted for a new CHP capacity of 7 MW over the five year period.[134] The biggest barrier to CHP deployment has been interconnection and net metering standards. However, a new interconnection standard effective in 2009 established four distinct tiers of interconnection for systems up to 10 MW in size.[135] In Maryland, an expansion of net metering standards would be needed to better serve large CHP installations as only micro-CHP systems (less than 30 KW in capacity) are eligible.[136] Standby rates set by utilities in Maryland are considered to be neutral towards affecting CHP development.[137] Furthermore, there are no output-based emission standards in the state which could affect perception of CHP.[138] A standard affecting CHP does exist in terms of the state's renewable energy portfolio. In 2011, the state expanded its definition of tier 1 renewable resources to include waste-to-energy systems. Effected utilities are required to meet 6.4% of their 2012 retail sales and 18% of 2022 sales with tier 1 renewable resources which include CHP technologies.[139] The Maryland Clean Energy Production Tax Credit is one state financial incentive applicable to CHP. This tax credit offers $0.85 per kWh, and the maximum incentive limit is $2.5 million over a five year time period. However, the credit is only available for CHP systems powered by renewable fuels such as biomass.[140]

Ohio's market for CHP is deemed as unfavorable although many policies in place are amenable to development. From 2005-2010, there were 8 new CHP sites developed generating 94.6 MW in new capacity.[141] The greatest barrier to development in the state is interconnection practices.[142]

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[130] Ibid
[131] ACEEE, "Kentucky Clean Distributed Generation".
[132] Ibid
[133] Ibid
[134] ACEEE, "Challenges".
[135] Code of Maryland 20.50.09
[136] Md. Public Utility Companies Code § 7-306; HB 1057
[137] ACEEE, "Maryland Clean Distributed Generation".
[138] Ibid
[139] Maryland Senate Bill 690
[140] ACEEE, "Maryland Clean Distributed Generation".
[141] ACEEE, "Challenges".
[142] Ibid

Despite new standards for interconnection which make CHP an eligible technology, the process for interconnection has been considered "unduly burdensome or expensive".[143] In an effort to streamline the process, a 2007 standard was designed to separate interconnection into three tiers depending on the size of the distributed generator. The largest classification is eligible for interconnection up to a capacity of 20 MW.[144] However, even if interconnection were to be amenable for developers because of such policy, standby rates are still seen as an impediment to CHP because power companies in the state base such rates entirely on demand charges.[145] Furthermore, net metering standards do not include CHP as an eligible technology within the state.[146] In terms of emissions standards, CHP is included in Ohio's Nitrogen Oxide budget trading program as an eligible allowance for energy efficiency and renewable energy set-asides.[147] CHP systems installed after 1997 are also counted as an eligible resource within Ohio's Alternative Energy Resource Standard.[148] The state also offers two distinct financial incentives in which CHP qualifies. The Ohio Air Quality Development Authority provides assistance in the form of tax incentives for EE technologies such as CHP that contribute to the mitigation of air pollution and contaminants.[149] CHP projects greater than 250 kW in size can also be eligible for property tax exemptions within the state through the Ohio Qualified Energy Property Tax Exemption.[150]

Pennsylvania's market for CHP is deemed as somewhat favorable on the basis of good regulations, rising electricity prices, and new goals for EE. From 2005-2010, 25 new CHP sites were developed generating 80.9 MW in new CHP capacity.[151] There are no substantial barriers to deployment in the state, but perceived risks and financial aversion due to high up-front costs remain a challenge for larger projects.[152] CHP is included within the state's interconnection standards which cover four distinct tiers of interconnection, up to what is effectively 5 MW in size.[153] Net metering standards were expanded in Pennsylvania in 2007 and include CHP as a primary technology. Investor-owned utilities must offer net metering to residential customers that generate electricity with systems up to 50 kilowatts (kW) in capacity; nonresidential customers with systems up to three megawatts (MW) in capacity; and other customers with systems greater than 3 MW but no more than 5 MW who make their systems available to the grid during emergencies.[154] Utility standby rates in the state are seen as neutral because utilities offer a balanced approach towards demand and energy use charges.[155] There are no output-based emission regulations in the state.[156] Pennsylvania's Alternative Energy Portfolio Standard was enacted in 2004 and revised in 2007. The portfolio classifies resources into three distinct tiers of which CHP is included in the tier two classification. The standard requires that 18% of electricity

[143] Ohio Revised Code 4901:1-22-02.
[144] Ibid
[145] ACEEE, "Ohio Clean Distributed Generation".
[146] U.S. Environmental Protection Agency, "Ohio Net Metering Standards".
[147] Ohio Administrative Code 3745-14
[148] Ohio State Bill 221
[149] ACEEE, "Ohio Clean Distributed Generation".
[150] Ibid
[151] ACEEE, "Challenges".
[152] Ibid
[153] Pennsylvania Administrative Code Title 52, Chapter 75, Subchapter C
[154] U.S. Environmental Protection Agency, "Pennsylvania Net Metering Standards".
[155] ACEEE, "Pennsylvania Clean Distributed Generation".
[156] Ibid

be generated through alternative sources by 2020, where tier two resources such as CHP must contribute to 10% of the cumulative goal.[157] The Alternative and Clean Energy Program offers support for alternative energy and clean energy projects in the form of loans, grants and loan guarantees. Energy systems derived from waste energy qualify for such assistance.[158]

Virginia's market for CHP development is deemed as unfavorable. From 2005-2010, the state deployed three small CHP projects which generated new CHP capacity of 0.1 MW.[159] The biggest barrier to deployment is considered to be poor spark spread although utility practices and lack of markets access also affect CHP markets in Virginia.[160] An interconnection standard was established in 2009 that allows for three tiers of interconnection ranging from systems as small as 500 kW to those 20 MW.[161] As there are no specified fuels or technologies and none that are specifically precluded in the standard, CHP would be considered eligible. Virginia's net metering policy is only applicable to those systems up to 500 kW and powered by renewable fuels.[162] Standby rates are considered unfavorable in Virginia because the state's major utilities provide standby service for CHP systems using rates designed with high demand charges.[163] Virginia has established a set-aside for EE within current emissions budgets.[164] However, the state does not have any portfolio standard established under which CHP is eligible.[165] In terms of financial incentives, the Virginia Commonwealth's Energy Leasing Program offers 12 to 15-year terms for energy projects (including CHP) with a minimum cost of $100,000.[166]

Table 4 summarizes the policies and barriers of the states previously discussed:

[157] DSIRE, "Pennsylvania Alternative".
[158] ACEEE, "Pennsylvania Clean Distributed Generation".
[159] ACEEE, "Challenges".
[160] Ibid
[161] VA Code § 56-578
[162] U.S. Environmental Protection Agency, "Virginia Net Metering Standards".
[163] ACEEE, "Virginia Clean Distributed Generation".
[164] U.S. Environmental Protection Agency, "VA CAIR EE and RE Set-Aside".
[165] ACEEE, "Virginia Clean Distributed Generation".
[166] Ibid

Table 4: Regional Comparison of CHP Policy

State	Interconnection Standards	Standby Rates	Net Metering	Output-Based Emissions	Portfolio Standards	Financial Incentives	Primary Barrier
Kentucky	CHP Eligible; biomass-powered only (up to 30 kw)	Neutral/ Unfavorable	CHP Eligible; biomass-powered, system cap (30 kW)	No Standards	No Standards	Biomass-powered CHP; min capacity 1 MW	Poor Spark Spread
Maryland	CHP Eligible (four tiers); capacity limit- 10 MW	Neutral	CHP Eligible; Micro CHP, system cap (30kW)	No Standards	CHP eligible as tier one renewable in state RPS	Clean Energy Production Tax Credit: Biomass-powered CHP	Interconnection and Net Metering Standards
Ohio	CHP Eligible (3 tiers); capacity limit- 20MW	Unfavorable	CHP Not Eligible	CHP eligible in Nox budget trading program	CHP eligible in AERS	Tax incentives for air quality improvement; property tax exemptions	Interconnection Process
Pennsylvania	CHP Eligible (4 tiers); capacity limit- 5 MW	Neutral	CHP Eligible; capacity limits vary by sector, system cap (5MW)	No Standards	CHP as Tier two Resource in AEPS	CHP eligible for financial assistance in Alt. and Clean Energy Program	Financial Aversion
Virginia	CHP Eligible (3 tiers); capacity limit- 20MW	Unfavorable	CHP Eligible; Renewable-powered systems, system cap (500 kW)	EE set asides in existing emissions budgets	No Standards	CHP eligible for financial assistance in VA Energy Leasing Program	Poor Spark Spread
West Virginia	CHP Eligible (two tiers); capacity limit- 2MW	Neutral	CHP Eligible; capacity limits vary by sector, system cap (2MW)	No Standards	CHP eligible renewable in ARES	No Incentives	Poor Spark Spread

Although West Virginia policy on CHP is not the most encouraging in terms of capacity limits and financial incentive offerings, other states in the region such as Ohio and Virginia may have comparable or even more unfavorable policies in terms of CHP deployment. Although enhancing capacity limits for interconnection and net metering standards may offer a path towards greater expansion of CHP, other barriers such as poor spark spread can affect CHP's level of deployment even if all of the right policies are in place. The economics of coal-powered electricity and uncertainty in natural gas markets makes it less viable for CHP developers to invest heavily in the state. Financial incentives could help promote the growth of CHP development if they were offered at a level able to offset this risk. However, it is important to reiterate that even in other regional states like Ohio and Virginia where an abundance of cheaper coal-powered electricity is also prevalent, financial incentives have not been effective enough to make their states' CHP markets favorable. An in-depth examination of such barriers to deployment along with the net effect of new policies would be required before further incentivizing CHP technologies.

III. EE Program Delivery

The administration and maintenance of energy efficiency programs can have a major impact on the success of program delivery. Various administrative models have been adopted to serve as a means for successful deployment of cost-effective EE. Programs can be delivered via utilities, third party independent agencies, and through state-administered programs. Regardless of the structure of delivery, effective EE initiatives require three fundamental pillars to ensure program success: clarity, consistency, and consensus.[167]

Clarity refers to the idea that the program has stated purpose at every level of deployment which includes appropriate goal-setting and evaluation metrics. Clarity of an EE program is founded in the policy justifications for pursuing EE which appear in legislative texts and regulatory mandates.

Consistency refers to how a program evolves over time and the degree by which changes in goals, design, and scope affect the program's results. Changes should not be made frequently to such factors as the program can risk becoming ineffective with a constantly changing mandate. This makes it difficult for continued public and political support as targeted efficiency results are never achieved.

Consensus refers to the level of agreement reached by key stakeholders with regards to program design, evaluation methods, and regulatory performance. Successful EE programs with greater energy savings often result from a broader consensus among key stakeholders.

A. Utility Administration

Under a utility-administered approach, planning, development, implementation, management, and assessment of EE program effectiveness are the responsibility of the utility. Other agencies

[167] Sedano, "Who Should Deliver".

or commissions may also oversee elements of the planning process and evaluate the effectiveness of utility-administered EE once implemented.[168] There are also approaches where utilities are charged with administering the program but formal management exists outside the utility typically through an external service commission or via joint agency coordination.[169] There tends to be no main distinctions in administration of electric and gas energy efficiency programs. In fact, to capture the positive benefits of economies of scope, the increasing trend is toward integration of electric and gas EE program delivery which reduces transaction costs and allows for more customizable services for customers.[170]

Regardless of the level of utility control and integration of programs, most states (41 of 50) see this form of administration as a viable option. This is logical as utilities are the entity with the greatest contact with customers. They are knowledgeable about the customer's energy usage and have already established a relationship with the customer which enables them to exploit current communication channels as promotional tools for programs.[171] Another benefit of utility administration has to do with the existing staff, infrastructure, and networks utilities already possess in the industry. Once a utility has developed a knowledgeable staff, a network of professional contacts in the energy services and distribution community, and the capabilities to deploy energy efficiency technologies it makes switching costs to another administrator that much greater.[172]

Another benefit of having utility administration of EE programs is that utilities can more easily incorporate EE into their long-run strategic plans for resource acquisition and capital investment.[173] However, it should be noted that utilities have both long and short- run incentives to increase their volume of energy sales due to the increase in profits which results. This idea is referred to as the "throughput incentive." The notion relates to the link between sales and revenue which exists for a regulated utility. Implementation of EE within the utilities business strategy would most likely be contradictory to the firm's goals unless regulatory policies like revenue adjustment mechanisms are established within the legal framework of the industry.[174] When this obstacle is overcome, utilities stand out as a key player in the industry equipped with the relevant resources and capabilities to deploy EE.

However, utilities are still held accountable for their efforts in EE if they are chosen as the administrator of the program. Generally, state commissions or governing boards oversee the activities of utilities with regards to administering an EE program. They often require documents and reports on the activities program implementers engage in to achieve energy efficiency goals. Despite the fact that program funds remain under the financial administration of utilities, there have still been issues where monies have been raided in state appropriations processes. This can be avoided if EE costs are embedded within the regulated rates rather than including them as a separate fee on ratepayer's energy bills.[175]

[168] Goldman, "Program Administration".
[169] Sedano, "Who Should Deliver".
[170] Barbose, Goldman and Schlegal, "Shifting Landscape".
[171] Munns, "Trend Analysis".
[172] Sedano, "Who Should Deliver".
[173] Munns, "Trend Anaysis".
[174] Sedano, "Who Should Deliver".
[175] Ibid

B. Third-Party Administration

Under a third-party administrative approach, the responsibilities of EE program delivery are transferred to an independent agency that may coordinate with utilities and government but is separate from those entities. Often times, public benefit funds are established and used as a medium by which monies collected from customer charges can be transferred from utilities to these entities in order to support the administration and execution of the EE-related programs.[176] The third party agency typically operates from a broader scope than that of a utility-administered model because the entity spans across an entire region or state. The independent agency is more apt to conform to broad, statewide energy goals and maintain consistency with EE policy objectives. This is due to the fact that their organizational success is not derived from energy sales but from energy savings.[177]

The key benefit of third-party administration is that energy efficiency goals are the only focus of the organization. Because the rate base would not be an issue, an independent agency would not be induced to grow sales volume or favor supply-side capacity as a utility would.[178] Managerial cultures under utilities may reward performance related to supply-side solutions but diminish the work done by those in favor of EE policies. An independent administration would eliminate this climate of conflict as employees serving in the organization would be motivated by similar goals: enhancing energy efficiency and achieving savings.[179]

It is also important to note that the cost of implementation of EE programs may be lower under third-party administration. The recovery of lost margins would not be an issue as it would be under a utility-administered program. Also, there would be no need for additional funding to back incentive structures as is needed for utilities that operate under the throughput incentive.[180] Another key benefit to note is that independent administrators are often efficient because they operate a portfolio of programs under one organizational structure. In a utility-administered model various programs may be offered by one of the many utilities operating within a state. Each utility would have different programs and a different method of implementation and evaluation. Adoption of a third party independent model would ensure that all programs were under the umbrella of one administration, and there would therefore be uniformity across the gamut of programs offered within a state.[181]

Another relevant factor to examine is the transition costs in switching to a third-party agency. This is especially relevant to WV as adopting a statewide and independent nongovernmental organization to facilitate EE would require transitioning from the already-established utility-administered structure. One factor to consider is the startup costs related to creating an entity. Prior to collecting revenues garnered from charges to a customer base, outside financing would have to be arranged to support initial costs. Also, it is important that clear protocols are adopted that allow for the smooth transitioning of existing utility programs to the new entity. Policy

[176] Center for Climate and Energy Solutions, "Public Benefits Funds".
[177] Sedano, "Who Should Deliver".
[178] Munns, "Trend Analysis".
[179] Sedano, "Who Should Deliver".
[180] Ibid
[181] Munns, "Trend Analysis".

makers need to establish procedures for transition and enforce them when there is delay of implementation that cannot be justified. Finally, customer awareness during a transition stage is important, and customer specific project information from a previous administrator should be provided to the new administrator.[182]

C. State Administration

State governments can play various roles with regards to administration of EE programs. They can act as overseers who regulate and monitor the actions of utilities or third party agencies or they can directly assert control over programs through establishing plans and budgets. State administers of EE are attuned to statutory goals and can focus their program on accomplishing specific targets and goals related to energy savings. Also, it is generally advisable that state-run agencies be exempt from state procurement rules to enable them the flexibility needed to successfully manage EE programs. However, the trend in EE program administration is growing away from state administration due to various historical issues.[183]

When state agencies directly administer EE programs various issues can arise which could hinder the program's effectiveness. States have historically acted as regulators of utilities who insure administrators are providing quality service to ratepayers. However, when state agencies begin to oversee broader issues such as program planning, implementation, and effectiveness, their regulatory capacity is diminished.[184] Also, with governmental control over the program's budget and resources, there is the risk that the revenue funded from ratepayers to sponsor EE initiatives could be misappropriated for other political purposes.[185] Another issue with state administration of EE programs relates to staffing.[186] The state may not be able to employ or dedicate the best staff towards EE initiatives with limited funding. The incentive also exists to divert staff from EE initiatives to other governmental matters.

Overall, exclusive state administration is not recommended as an efficient delivery method for EE programs. However, a hybrid approach that allocates resources based on function offers a viable means by which multiple actors, including state agencies, can play a role in fostering EE. Some participants in the debate argue that consumer education and low-income programs should be administered by a third party administrator or the state, while individualized programs, dependent on service territory and customer class, should be left to the utilities.[187] However, if a hybrid approach is not feasible, the utility administration and third-party administration of EE are generally accepted as the most effective methods of program delivery.

D. Federal Administration of EE

The federal government is also a key administrator of EE on a national level. The US Department of Energy has developed the office of Energy Efficiency and Renewable Energy (EERE) to act as the entity responsible for the administration and implementation of EE-related

[182] Sedano, "Who Should Deliver".
[183] Ibid
[184] Blumstein, Goldman and Barbose, "Who Should Administer".
[185] Sedano, "Who Should Deliver".
[186] Blumstein, Goldman and Barbose, "Who Should Administer".
[187] Sedano, "Who Should Deliver".

initiatives. The EERE is responsible for developing initiatives that raise awareness of EE, coordinating initiatives towards meeting specific goals, and establishing and managing programs.[188] For instance, the EERE has established the Weatherization Assistance Program (WAP) which offers energy efficient home upgrades to low-income families in an effort to permanently reduce their energy bills. Under this program, the U.S. Department of Energy (USDOE) provides funding to states and other entities that are responsible for program management. From there, these regional entities provide the funds to a network of local agencies, non-profit organizations, and local governments who administer the programs.[189]

The EERE initially developed the Industrial Technologies Program (ITP) as the leading federal program with the mandate of increasing U.S. industrial energy efficiency. The ITP partnered with industry to "research, develop, and deploy innovative technologies that companies can use to improve their energy productivity, reduce carbon emissions, and gain a competitive edge."[190] Since industrial productivity accounts for nearly one-third of total energy consumption and 12% of GDP in the United States, the federal government sees it as a necessary action to stimulate EE within an industrial context.[191] More recently, ITP has been renamed as the Advanced Manufacturing Office (AMO) although the mandate has remained relatively similar. Through the AMO, industrial plants can access thousands of rebates, grants, loans, assessments and other incentives for implementation of energy efficient materials, technologies, and practices.

IV. State Initiatives

The following section outlines key initiatives that can be implemented at the state level to further EE as an energy resource in the state. A principle area of discussion surrounds the level of energy usage resulting from design and construction standards for buildings. Building energy codes and compliance with those codes are two areas that should be addressed to facilitate EE as a prioritized resource within the West Virginia energy portfolio.

A. Building Energy Codes

Buildings account for 40 percent of energy consumption and 70 percent of electricity consumption in the nation.[192] Adopting and enforcing updated building energy codes is vital to improving efficiency in the state. Building codes represent a key asset to any successful energy policy because "they create easy-to-understand minimum requirements for all new construction" and establish baseline measures by which performance can be evaluated.[193] Two types of building energy codes are discussed: residential and commercial.

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188 Office of Energy Efficiency and Renewable Energy, "The Office of EERE".
189 EERE, "Weatherization".
190 Office of Energy Efficiency and Renewable Energy, "Industrial Technologies Program".
191 Ibid
192 NASEO, "Building Energy Codes".
193 Ibid

1. *Residential Building Energy Codes*

The International Energy Conservation Code (IECC) is the most commonly used standard for residential buildings. The IECC was first published in 2000, and there have been subsequent publications in 2003, 2006, 2009, and 2012. The code establishes minimum design and construction standards for energy-efficient buildings in the residential sector. It sets standards of minimum thermal performance for buildings, walls, ceilings, floors/foundations, and windows. It also sets efficiency standards for lighting, mechanical and power systems in homes.

The IECC model has been adopted by various state and local governments throughout the United States.[194] The West Virginia State Fire Marshall has promulgated the adoption of 2009 IECC standards as an update to the 2003 code already in place.[195] Such a change could produce substantial energy savings for the State as the current residential building code offers a less stringent path for new home construction compared with other states that had adopted 2006 IECC standards and moved toward 2009 standards.[196] For instance, the transition from more rigid IECC 2006 standards to IECC 2009 standards was estimated to be a 12-15% improvement in energy efficiency.[197] It was also concluded that Ohio's adoption of the 2009 code would lead to immediate savings for households with respect to lower energy and construction costs. Savings were related to stricter requirements for windows and insulation as well as better duct sealing which results in smaller HVAC equipment.[198] Although the State Fire Marshall has promulgated the adoption of IECC 2009, it still must undergo a legislative rulemaking process before it can be adopted. The 2012 IECC code has been published, but the Home Builders Association of West Virginia[199] is in favor of only moving toward the 2009 standards.[200]

Certain states adopt IECC standards directly, while others develop residential codes based on IECC standards but with state-specific amendments. Table 5 provides data pertaining to the adoption and enforcement of the residential building energy codes of ARC states:

[194] Turner, "Energy Management Handbook".
[195] OCEAN, "IECC Update".
[196] ICF International, "Energy and Cost Savings".
[197] Cole, "Increased Inspections".
[198] MEEA, "Benefits to Ohio".
[199] The Homebuilders Association of WV has become a principal interest group relevant to the building code adoption process. Their level of approval for adoption is based on the effects codes have on increasing building design and construction costs. As codes become more stringent, buildings may become more expensive to construct. However, home builders cannot typically justify the costs of greater efficiency measures because they do not add value to the buildings during most formal appraisal processes.
[200] Bragg, Interview by Sean Pauley.

Table 5: IECC Residential Code Adoption in ARC States

ARC State	Residential Building Energy Code (IECC Equivalent)	Level of Adoption	Level of Enforcement
Alabama	N/A	Local	Local
Georgia	IECC 2009	Statewide	Local
Kentucky	IECC 2006	Statewide	Division of Building Codes Enforcement/ Local
Maryland	IECC 2012	Statewide	Local
Mississippi	N/A	Local	Local
New York	IECC 2009	Statewide	Department of State/ Local
North Carolina	IECC 2009	Statewide	Department of Insurance/ Local
Ohio	IECC 2009	Statewide	Board of Building Standards/ Local
Pennsylvania	IECC 2009	Statewide	Local/Dept. of Labor and Industry/ Third Party
South Carolina	IECC 2006	Statewide	Local
Tennessee	IECC 2006	Statewide	State Fire Marshall
Virginia	IECC 2009	Statewide	Local
West Virginia	IECC 2003	Statewide	Local

[1] International Code Council & U.S. Department of Energy's Office of EERE

[2] To maintain uniformity for comparative purposes, code information is based on states' relative IECC equivalent

2. Commercial Building Energy Codes

Building codes are also a relevant element for addressing EE within the commercial sector. The American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) is a building technology society that publishes standards concerned with design and maintenance of indoor environments.[201] ASHRAE address the energy-efficiency requirements for the "design, materials, and equipment used in nearly all new construction, additions, renovations, and construction techniques."[202] Their standards and guidelines are considered the national model for energy codes and are especially relevant to the commercial sector.[203] Implementation of ASHRAE code leads to reduced energy consumption, building owner cost savings, and reduced CO_2 emissions. Standards are updated on a triennial basis through development, review, and making additions to the standard.[204]

[201] ASHRAE, "Standards and Guidelines".

[202] Office of Energy Efficiency and Renewable Energy, "Building Energy Codes".

[203] The IECC also provides guidance for energy efficient design of commercial buildings. These guidelines are outlined in Ch.5 of the code. However, the IECC also calls out the adoption of ASHRAE standards for new commercial construction. Because ASHRAE is a more commonly used standard and is referenced within the IECC as a viable source for commercial guidance, we defer discussion of commercial building energy codes to ASHRAE standards. However, it should be noted that either standard, ch.5 of IECC or ASHRAE 90.1 can be adopted depending on the choice of the building designer and contractor.

[204] Office of Energy Efficiency and Renewable Energy, "Building Energy Codes".

ASHRAE 90.1 is a specific standard that has been adopted by many states and local entities. Although West Virginia's adoption of the 2003 IECC references ASHRAE 90.1 2001, the state is yet to adopt the ASHRAE 90.1 2007 or 2010 standards already published.[205] The US DOE notes, "the West Virginia Legislature passed companion bills directing the State Fire Commission to promulgate rules adding the 2009 IECC and ASHRAE 90.1-2007 to the state building code."[206] Therefore, pending successful movement through the legislative process, WV's commercial code would be updated to ASHRAE 90.1 2007. Governor Tomblin signed a bill on April 2, 2012 which required all state-funded construction to comply with IECC 2009 and ASHRAE 90.1 2007 effective July 1, 2012.[207]

Certain states adopt ASHRAE standards directly, while others may develop building codes or other distinctly-named codes based on ASHRAE or IECC standards but with state-specific amendments. Table 6 shows the level of adoption and enforcement for state building energy codes in the commercial sector:

Table 6: ASHRAE 90.1 Commercial Code Adoption in ARC States

ARC State	Commercial Building Energy Code (ASHRAE 90.1 equivalent)	Level of Adoption	Level of Enforcement
Alabama	N/A	Local	Local
Georgia	ASHRAE 90.1-2007	Statewide	Local
Kentucky	ASHRAE 90.1-2007	Statewide	Division of Building Codes Enforcement/ Local
Maryland	ASHRAE 90.1-2010	Statewide	Local
Mississippi	N/A	Local	Local
New York	ASHRAE 90.1-2007	Statewide	Department of State/ Local
North Carolina	ASHRAE 90.1-2007	Statewide	Department of Insurance/ Local
Ohio	ASHRAE 90.1-2007	Statewide	Board of Building Standards/ Local
Pennsylvania	ASHRAE 90.1-2007	Statewide	Dept. of Labor and Industry/ Local
South Carolina	ASHRAE 90.1-2004	Statewide	Local
Tennessee	ASHRAE 90.1-2004	Statewide	State Fire Marshall
Virginia	ASHRAE 90.1-2007	Statewide	Local
West Virginia	ASHRAE 90.1-2001	Statewide	Local

[1] Online Code Environment & Advocacy Network & U.S. Department of Energy's Office of EERE
[2] To maintain uniformity for comparative purposes, code information is based on states' ASHRAE equivalent.
[3] In Pennsylvania, municipalities have the right to either opt-in or opt-out of building code enforcement at local level. 95% of counties opt-in and provide local enforcement. The Department of Labor and Industry is responsible for code enforcement for commercial buildings in opt-out counties.

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[205] Ibid
[206] Office of Energy Efficiency and Renewable Energy, "Status of State Energy Codes".
[207] OCEAN, "IECC Update".

B. Building Energy Code Compliance and Enforcement

Although building energy codes are stressed as a key means toward enhancing EE policy and providing future energy savings through increased building standards, compliance with codes is an even more important factor. In most states, efforts to improve code compliance through training, outreach, implementation support, and enforcement are severely underfunded. Estimates put compliance in some states to be as low as 50 percent.[208] This causes most new and renovated buildings to consume more energy than they should, and billions of dollars in savings are missed.

There has been an increase in awareness of compliance efforts with the passing of the American Recovery and Reinvestment Act of 2009 (ARRA). In order to receive stimulus funding, Governors' offices of the 50 states and District of Columbia pledged to meet code stringency requirements (IECC 2009 and ASHRAE 90.1 2007) and to create plans for achieving 90 percent code compliance within an eight year timeframe.[209] Increasing the emphasis on compliance could have drastic effects on the level of energy savings as some research suggests every dollar spent on building energy code compliance yields six dollars in energy savings.[210]

Although building energy codes may be in effect at a statewide level, states typically delegate enforcement authority to local jurisdictions. The extent by which local authorities are required to enforce energy codes varies widely, with some states making it voluntary. Personnel and budget limitations are often noted as the key challenges for local enforcement.[211] Code officials often oversee both commercial and residential structures and are charged with enforcement of multiple codes beyond just the energy codes. In a 2008 Building Codes Assistance Project (BCAP) study, respondents (code officials) noted that energy codes were generally considered to be less important than other codes, and because of this, officials may neglect building energy codes when faced with budgetary constraints and deadlines.[212]

The BCAP also study stressed the importance of education and training of code officials as a primary way to increase compliance. The study found that although more than 80% of code officials received training at least once a year, nearly all officials desired further code training. Both the quantity and the quality of training materials code officials need improvement. Misuriello et al. notes:

> *Instead of simply covering the content of the code, training should include guidance on how to meet requirements, how to demonstrate compliance, and how to inspect for compliance. Increasing the amount of state-specific training will also be useful for both code officials and code users.*

Having a qualified staff with adequate training is also a way to ensure that compliance efforts are streamlined and cost-effective. As codes are constantly updated, it is important that staff stay current by having relevant training and certification. Legislative officials can promote

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[208] Institute for Market Transformation, "Code Compliance".
[209] Misuriello, et al., "Lessons Learned".
[210] Institute for Market Transformation, "Code Compliance".
[211] Misuriello, et al., "Lessons Learned".
[212] Building Codes Assistance Project, "Usability and Compliance".

compliance efforts by providing funding for training and cost reimbursement for officials seeking certification requirements.[213]

In general, it is recommended that policymakers take the following steps when a high level of compliance is sought[214]:

- Enhance, or at least, maintain existing building department budgets
- Express political support for rigid and uniform enforcement of building standards
- Encourage elected officials and utilities to increase funding of compliance efforts
- Support code officials, designers, and builders through training initiatives
- Increase public awareness on the value of standards in building energy codes.

1. Code Compliance and Enforcement in West Virginia

Although WV's current IECC and ASHRAE adoption is effective statewide, local jurisdictions must adopt the statewide requirements to enforce them at the local level.[215] Therefore, the building energy code is enforced on a voluntary basis in counties and municipalities where a code official is employed within those jurisdictions. Compliance at a state level is contingent upon cost considerations to employ enough staff to facilitate inspections and assessments of building standards. The State Fire Commission promulgates energy building code adoption, but their principle area of review and enforcement concern compliance with fire codes not building energy codes. This misalignment of policy promulgation and compliance is viewed as a critical factor preventing the State of West Virginia from fully benefiting from EE policy.

The WV State Fire Commission establishes the rules and standards which are deemed necessary for the "safeguarding of life and property and to ensure compliance with the minimum standards of safe construction of all structures erected or renovated throughout this state."[216] However, their mandate as an entity with overarching authority in rule proposals for the entire state building code creates an organizational structure with a conflicting, narrowly-focused mission and limited enforcement capacity.

For example, the state building code includes standards prescribed by various entities including the National Fire Protection Association (NFPA) and the International Code Council (ICC) with reference to a wide array of areas such as fire safety, energy efficiency, plumbing, electric, mechanical aspects, fuel gas, property maintenance and more. The majority of these topic areas are covered through the adoption of codes published by the ICC. However, references to fire prevention and safety within adopted ICC publications, such as the International Building Code (IBC) and the International Existing Building Code (IEBC), are omitted and supplanted with NFPA standards outlined in the State Fire Code. Furthermore, whenever an aspect of the State Building Code is in conflict with an aspect of the State Fire Code, the Fire Commission gives precedence to the fire code.[217]

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213 Institute for Market Transformation, "Compliance Strategies".
214 Institute for Market Transformation, "Policy Makers Fact Sheet".
215 W.V. Code §29-3-5b.
216 W.V. Legislative Rules Title 87 Series 4
217 W.V. Legislative Rules Title 87 Series 4

These factors lead to a conflict in enforcement because fire marshals are predisposed to give preference to NFPA codes.[218] The portfolio of codes published by the ICC includes a code called the International Fire Code (IFC). The IFC prescribes standards on fire prevention and safety similar to the standards prescribed in the NFPA codes which WV has adopted. Because the state has already enacted a near comprehensive code set published by the ICC, supplanting the NFPA codes with the IFC would create greater uniformity for State Building Code standards. This would prevent the fire commission from having to give precedence to one code over another because the entire set of codes would be consistent and complimentary.

However, the NFPA standards have been an established standard within the State for many years. Fire marshals and other enforcing agents are familiar with its requirements and may be hesitant to change standards after such a long history of adoption. The intellectual capital lost from replacing the current fire code would require retraining officials on the new standards. This could be a complex undertaking given budgetary constraints and human resource allocation which could affect the speed of the new adoption.

These conflicting standards and practices do not indicate the fire commission is intentionally neglecting energy codes in their compliance and enforcement efforts, but that their legislative mandate requires them to give priority to other issues before energy efficiency. After all, their mission is defined as "to provide, through leadership, the best possible fire prevention and life safety for our citizens by legislation, education, training, standards and resource allocation."[219] Although legislation requires that local jurisdictions enforce building energy codes, this structure still leaves EE initiatives without a permanent representative voice on the commission.

As EE becomes a more relevant aspect to our energy resource portfolio, there will need to be actors and organizations that champion it within the code process. The WV code[220] stipulates that the commission has the

> *authority to establish advisory boards as it deems appropriate to encourage representative participation in subsequent rule-making from groups or individuals with an interest in any aspect of the State Building Code or related construction or renovation practices.*

However, the specific language, "as it deems appropriate", does not make the appointment of advisory boards mandatory but voluntary based on the judgment of the commission. Such an advisory board or even an ex oficio member of the commission could act as a relevant voice for building energy code adoption and enforcement in the short-term. This actor would ensure that policies promulgated at the commission were up to date and consistent with the general EE policies promoted at the state level.

The capacity to enforce energy codes like the IECC and others is further limited due to the lack of deployment of code officials on the local level. Most municipalities and counties have decided

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218 W.V. Legislative Rules Title 87 Series 1
219 West Virginia State Fire Commission, "Code Adoption".
220 W.V. Code §29-3-5b.

not to ensure compliance with state building codes due to budgetary constraints and the voluntary nature of enforcement. Of the 232 municipalities in West Virginia, only 38 have adopted the State building code. Of the 55 counties in the state, only Greenbrier, Jefferson, Harrison, Berkeley, Hampshire, Fayette, Raleigh, and McDowell counties have adopted the state building code.[221] Enforcement is further complicated because compliance of energy building codes in state-funded construction initiatives such as public schools and other state and federal buildings may be handled by individual agencies responsible for operations and maintenance of government buildings. Based on the lack of capacity, uniformity and continuity in building energy code enforcement in WV, it is important to look to a state with a similar history of enforcement issues as an example for potential improvement.

2. A Kentucky Case Study

Kentucky offers a relevant example of a structure for code compliance and enforcement that can be more effective through specialization and a multi-level approach. The Kentucky Department of Housing, Buildings and Construction (DHBC) enforce statewide standards for building construction. The DHBC "ensures fire and life safety in existing buildings; licenses/certifies plumbers, electricians, boiler contractors, sprinkler and/or fire alarm contractors and building inspectors."[222] Housed within the DHBC are four divisions: Division of Building Code Enforcement, Division of Heating, Ventilation, and Air Conditioning, Division of Plumbing, and Division of Fire Prevention (Office of the State Fire Marshal).

The Division of Building Code Enforcement is the principal entity charged with code enforcement for new construction, major renovation, and change of use in buildings. The Division's scope and authority is clearly delineated and aligned with their mission:

> *The building codes section is responsible for reviewing, approving and inspection of buildings and structures that are under the applicability of the Kentucky Building Code (KBC) and other referenced standards. This service is done though reviewing and approving of the construction documents and follow-up field inspections to ensure that the building is constructed in accordance with the approved construction document.*[223]

Referenced standards within Kentucky codes include those relevant to the energy-efficient design and construction of new buildings. Code officials in Kentucky adhere to the Kentucky Building code to ensure commercial building energy compliance is at 2009 IECC standards. The Kentucky Residential Code has recently been updated from IECC 2006 to IECC 2009 standards for new residential construction effective October 1, 2012.

Kentucky's multi-level approach refers to how jurisdiction responsibilities are shared between state and local government. The Kentucky Building Code (KBC)[224] outlines which entities are responsible for the examination and approval of plans and specifications and the inspections

[221] West Virginia Fire Commission, "Code Adoption".
[222] Kentucky Department of Housing, Buildings and Construction, "Department".
[223] Kentucky Division of Building Code Enforcement, "Building Codes".
[224] 2007 Kentucky Building Code Chapter 1 Section 104

necessary to determine compliance for buildings. For instance, local code officials employed by municipal or county government building departments are responsible for code enforcement in assembly occupancies, business occupancies, churches, factory or industrial occupancies, mercantile occupancies, and residential, storage, or utility occupancies. Code enforcement in assembly occupancies, business occupancies, educational, high-hazard or institutional occupancies, factory or industrial occupancies, industrialized building systems, mercantile occupancies, state-owned buildings, and any other buildings fall under the Division of Building Code Enforcement's state jurisdiction.

Jurisdictions where overlap occurs are distinguished by the overall load occupancy. Local jurisdictions manage compliance in overlapping jurisdictions where capacity is less than 100 persons, while the state jurisdiction manages compliance of those with a capacity in excess of 100 persons. Municipalities within the state can also apply for expanded jurisdiction which grants them authority to oversee compliance in all occupancies including those with capacity in excess of 100 persons. However, in municipalities with expanded jurisdiction, the Division still maintains exclusive jurisdiction in occupancies solely enforced by the State.[225]

The KBC[226] requires all local jurisdictions to provide at least one certified building inspector. However, due to budgetary constraints of smaller municipalities where code enforcement does not warrant the cost of employing an official, this aspect of the building code is rarely enforced.[227] Building code officials can enter into contracts with multiple local governments with oversight from the DHBC. This allows those municipalities with smaller populations and less building infrastructure to divide the duties and costs of one code official among multiple local governments.[228] All construction projects, except single-family dwellings, in jurisdictions without a local building inspection program, shall be submitted to the Division of Building Codes Enforcement for review and approval prior to the start of a construction project.[229] In general, funding for the Division and local building departments is provided by a plan review and inspection fee schedule as prescribed in section 121 of the KBC.

In Kentucky, the Office of the State Fire Marshal is a separate division called the Division of Fire Prevention within the DHBC. They retain traditional duties and responsibilities[230] related to eliminating and reducing the potential of loss by fire or other hazards. For instance, the State Fire Marshal performs general inspections of existing buildings to ensure compliance with state fire and life safety codes. They enforce codes such as the 2006 NFPA 1 Fire Prevention Code and other NFPA codes. They are also responsible for plan review, permitting, licensing and renewal certification of underground and above ground storage tanks. Licensing contractors for fire protection systems and certifying private fire alarm and sprinkler inspectors are also under the purview of the Fire Marshal.[231] Training on fire codes and technical assistance to local fire officials are also a part of the Division of Fire Prevention's mandate, among other duties.[232]

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[225] Kentucky Division of Building Codes Enforcement, "Jurisdiction Programs".
[226] 2007 Kentucky Building Code Chapter 1 Section 103.4
[227] McNees, Interview by Sean Pauley.
[228] Ibid
[229] Kentucky Division of Building Code Enforcement, "Building Codes".
[230] Kentucky Revised Statutes Chapter 227 Section .220
[231] Kentucky State Fire Marshal, "General Inspection".
[232] Ibid

This example shows how Kentucky has delineated the boundaries of responsibility between building code and fire code officials by making each responsible for only the codes that pertain to their principal mission. By specializing in particular code areas it ensures promulgation and training in recent codes are a top priority. However, there is little value in updating to recent code publications when adherence to the standards that save energy are not certain. This coherent structure of enforcement makes the building energy standards and others effective by guaranteeing compliance with each set of codes.

V. Utility Initiatives

This section addresses the various aspects of EE which will necessitate utility involvement. Utilities have already been noted as important actors for the successful implementation of EE programs. Establishing savings standards and lost revenue recovery are two areas where policy can affect the success of utility engagement in programs.

A. Setting Targeted Energy Savings Goals

The effectiveness of EE policy may improve with use of mandated energy savings goals. Under this structure, a legislative or regulatory requirement is established which sets a target for energy savings via efficiency initiatives within a given timeframe. These targets are often termed Energy Efficiency Resource Standards (EERS), and the general trend has been to shift away from budgetary requirements towards more emphasis on savings[233] requirements.[234]

The key concern is whether setting binding targets is an important factor for an effective EE initiative. According to a report conducted by the ACEEE, "having a strong legislative requirement" is the second highest rated factor for current importance in EE, and it will be the top factor for progress in EE for the future.[235] Targeted savings levels often help a program achieve greater savings than they would have without the policy enactment.[236] A similar conclusion is reached by a U.S. DOE study that states when a binding goal is implemented with specific, measurable targets utilities and other entities responsible for EE will often surpass initial savings requirements.[237] A study conducted by Resources for the Future notes that it is important to design an EERS or utility-specific goals with incentives for those entities responsible for deploying the efficiency initiatives. The incentives can be based on a reward for achieving a desired savings target or a monetary penalty for not successfully reaching established goals. A hybrid approach of rewarding and penalizing can also be used, but the key is to design a measurable and verifiable standard by which progress can be based.[238] Established targets

[233] Savings are typically expressed as a percentage of total utility sales but can also be expressed as a specific amount of savings of an energy resource.
[234] York, Kushler and White, "State Goals".
[235] Ibid
[236] Sciortino, et al., "Progress report".
[237] Glatt and Schwentker, "Resource Standards Anaylsis".
[238] Palmer, et al., "Energy Savings".

reinforce the idea that EE is a utility resource that can be quantified, and this makes planning for utility system loads and resource needs an easier task.[239]

Savings targets typically take the form of requiring a certain percentage reduction of sales or sales growth of electricity and natural gas. Some states require annual reduction goals, while others require cumulative savings targets be met within a long-term timeframe. Other states use interim goals in combination with cumulative goals to ensure adequate progress is made throughout the established timeframe. The ACEEE defines three distinct policy approaches toward setting binding, long-term savings targets for utility efficiency programs.[240] One approach is to mandate a statewide EERS which is set by state legislators and codified by regulatory bodies which requires all eligible utilities to meet a deemed level of savings. A second approach is more customized in that it requires utility commissions to establish specific annual and long-term goals tailored to each utility. A third approach is to include EE as an eligible, quantifiable resource within a state RPS. This approach is milder in that it does not measure EE savings on an annual basis but rather within a cumulative assessment of the overall impact of alternative energy. West Virginia policy is most closely related to the third approach.

The Alternative and Renewable Energy Portfolio Act of 2009[241] establishes goals for WV investor-owned utilities (IOUs) in reducing reliance on traditional forms of energy generation. The legislation requires that IOUs with more than 30,000 residential customers supply 25% of retail sales from applicable alternative and renewable energy sources by 2025.[242] Under the statute, demand-side responses and EE initiatives are eligible for credits to count towards meeting the standard if initiatives are certified by the WV Public Service Commission. However, there is no mandated portion of EE that must contribute to the fulfillment of the savings target, and this is why WV is considered as having a non-binding efficiency goal.[243] In 2011, the West Virginia State Legislature proposed adoption of a statewide binding EERS, but the bill did not pass in the House Judiciary Committee.[244] However, in order to elevate the importance of EE as a unique utility resource, approval of legislation tying EE to specific, measureable targets may be necessary rather than maintaining EE as an eligible resource within a broader renewable policy.

EE program savings standards and goals are established by state legislatures and state utility regulators depending on how programs are mandated within each state. The Federal Energy Regulatory Commission (FERC) notes that there are 22 states in the U.S. with EERS and 9 states with non-binding efficiency goals as of September 2009. Table 7 shows the EERS and efficiency goals established by other states with mandated and voluntary energy savings targets:

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[239] Sciortino, et al., "Progress Report".
[240] Sciortino, et al., "Progress Report".
[241] WV Code §24-2F
[242] The legislation also establishes goals at other set intervals prior to 2025. From 2015-2019, 10% of retails sales should be generated from these alternative and renewable sources.
[243] DSIRE, "West Virginia Incentives".
[244] ACEEE, "West Virginia Utility Policies".

Table 7: Examples of EERS and EE Goals by State

State	Type	Goals
Arizona	EERS	22% cumulative savings by 2020; peak credits
Arkansas	Non-binding EE Goal	0.75% electric savings by 2012
California	EERS	Save 1,500 MW, 7,000 GWh; reduce peak 1,537 MW: 2010-2012
Colorado	EERS	Save 3,984 GWh, 2012-2020; reduce peak 5% by 2018
Connecticut	EERS	1.5% annual savings, 2008-11
Delaware	EERS	Cut electricity use and peak 15% from 2007 by 2015
Florida	Non-binding EE Goal	3.5% savings; summer and winter peak reduction by 2019
Hawaii	EERS	4,300 GWh electricity reduction (40% of 2007 sales) by 2030
Iowa	EERS	1.5% annual, 5.4% cumulative savings by 2020
Illinois	EERS	2% energy reduction by 2015; 1.1% from 2008 peak by 2018
Indiana	EERS	2% annual electricity savings by 2019
Massachusetts	EERS	2.4% annual electric savings by 2012
Maine	Non-binding EE Goal	30% electric sales reduction and 100 MW peak by 2013
Maryland*	EERS	15% per capita energy reduction and peak demand by 2015
Michigan	EERS	1% annual savings by 2012
Minnesota	EERS	1.5% annual savings to 2015
Nevada	EERS	0.6% annual savings (~5%) to 2015; EE to 25% of RPS
New Mexico	EERS	10% electric savings by 2020
New York*	EERS	15% reduction from projected electric use by 2015
North Carolina*	EERS	EE up to 25% of RPS to 2011
Ohio*	EERS	22% energy savings by 2025; 7% peak reduction by 2018
Oklahoma	Non-binding EE Goal	EE to 25% of renewable goal
Oregon	Non-binding EE Goal	1% annual savings, 2013-14
Pennsylvania*	EERS	3% cut from projected electric use and 4.5% peak by 2013
Rhode Island	EERS	Cut consumption 10% by 2022
Texas	Non-binding EE Goal	Reduce 30% annual growth; 0.4% winter and summer peaks beginning 2013
Virginia*	Non-binding EE Goal	Reduce electric use 10% by 2022
Vermont	Non-binding EE Goal	~6.75% cumulative savings, 2009-11; summer and winter peak reduction targets
Washington	EERS	All cost-effective conservation (~10%) by 2025
West Virginia*	Non-binding EE Goal	EE & DR earn credits in Alternative & Renewable Energy std.
Wisconsin	EERS	1.5% electric savings and peak reduction by 2014

[1] Table adapted from Federal Energy Regulatory Commission
[2] States with asterisk represent ARC States

The EERS approach is a relatively new model in the energy industry. West Virginia has taken an initial step by including EE within its alternative and renewable energy standard. A resource standard can ensure EE programs reach a targeted savings level each year and would allow EE to be viewed as a more viable resource in the state's energy portfolio. This is based on the notion that the future impact of EERS will most likely be substantial as many experts in energy believe it will be “a leading policy tool used to secure large utility-sector energy efficiency accomplishments in the future.”[245]

B. Utility Recovery Policies

Analyzing the ways EE can impact a utilities established revenue levels is a pertinent issue because it directly relates to aligning energy supply and demand. Cost recovery mechanisms affect the motivations of key actors in terms of their disposition to fully engage in EE programs. This portion of the report focuses on utility incentives and disincentives with regards to implementing EE programs. Potential mechanisms for lost revenue and cost recovery are identified and evaluated, and a comparison of various states’ policies for recovery is also made.

1. Decoupling as a Lost-revenue Recovery Mechanism

Revenue decoupling is considered to be a key mechanism relevant to neutralizing a utility’s disincentive to support energy efficiency programs.[246] Decoupling removes the link between a utility’s sales and the volume of energy that is actually generated or distributed. When utilities operate based on the revenues established through rate cases, there is an incentive to increase sales of energy between rate cases because of the positive effect it may have on their profitability. This is typically referred to as the throughput incentive. When there is an incentive to increase sales of energy, there is a disincentive to promote energy efficiency.

With demand fluctuations due to changes in ratepayers’ consumption habits, a utility could receive either greater than or less than expected revenues between rate cases. Theoretically, a utility’s overall revenue would decrease between rate cases if EE programs were effective and ratepayers reduced their overall energy consumption. However, during initial phases of EE program implementation, the adoption levels may be not be large enough to have an impact on a utility’s overall revenue generation. Although some ratepayers would adopt the practices and technologies at an early stage, the utility could still potentially increase sales as other consumers continue normal consumption patterns. Revenue over-recovery could also result following a base rate increase. If utilities seek to increase rates on the basis of decreased consumption levels, subsequent periods between rate cases could result in over-recovery if the forecasted consumption levels overcompensate for the effect of EE adoption. Alternative revenue adjustment mechanisms (discussed further in the next section) can help adjust for cases where demand diminishes or mild weather conditions persist. However, often these policies only address situations where established revenues are not met, and they do not remove the incentive for increased energy sales.

Decoupling true up plans “use periodical, mechanistic true ups (adjustments) to cause actual revenue to track more closely the revenue sanctioned by the regulator”.[247] This type of decoupling adjusts for both possible scenarios by giving customers a credit when established revenue levels are exceeded or by adding a surcharge to customer accounts when established revenue levels are not met. True ups can be made monthly, quarterly, or annually and can be

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[245] York, Kushler and White, “State Goals”.
[246] ACEEE, “Decoupling Utility Profits”.
[247] Lowry, Getachew and Makos, “Commonwealth Edison”.

applied selectively to certain customer classes. By removing the incentive to increase sales, the utilities can secure revenues while still promoting EE policy. Customers are also incentivized to engage in EE initiatives due to the savings that results with their decreased consumption.[248] Arkansas, California, Idaho, Indiana, Maryland, Massachusetts, Michigan, New Jersey, New York, North Carolina, Oregon, Vermont, Virginia, and Washington are examples of states who have implemented pilot decoupling true up programs and went on to approve decoupling as a more permanent fixture of their overall rate-making policies.[249]

Decoupling offers two alternative ways for rates to be set: deferral decoupling and current period decoupling. With deferral decoupling, the utility uses a balance account to hold any over or under collected revenue. The positive or negative balance can be distributed in subsequent periods as eligible revenue to the utility or the customer in the form of lower or higher per-unit prices. With current period decoupling, there is no balance account as rates are adjusted each billing cycle to insure the utility collects their allotted revenue. With this form of rate adjustment the utility would divide the allowed revenue levels (established in the last rate case) by actual units of consumption to determine the per unit price of electricity.[250]

Decoupling initiatives are not free from criticism. Customers in one consumer class may be forced to absorb the impact of demand downturns by another class.[251] For instance, a reduction in demand by the industrial sector could lead to a situation where overall revenues for the generating company fall short of expected levels. This would cause residential and commercial customers to have to subsidize the shortfall through increased customer bills on their part as well. In order to allocate the usage more efficiently, the demand and required revenue levels should be broken down into customer classes so one sector is not subsidizing another.

Another disadvantage is that decoupling reduces the responsiveness of the utility to market functions. The utility faces a lessened degree of financial risk because the reduced energy consumption will not adversely affect revenues. However, their operating costs may be reduced with decreased strain on system capital, and established revenues should be adjusted to reflect this change in the utilities' cost structure.[252]

Utilities also run the risk of losing industrial customers if they adopt decoupling policies that threaten their terms of service. Large volume customers could adopt self-generation capabilities or move their operations to alternative services areas. This could result in a decreased load in the region and possibly be a detriment to the local economy.[253] West Virginia has already taken measures to insure retention of large-scale energy consumers through allowing an opt-out policy for industrial customers who do not wish to engage in EE programs.

Finally, and importantly, decoupling weakens the price signal for reduced energy usage. It is possible that in the short-run ratepayers could see a slight increase in the per-unit cost of energy

[248] Center for Climate and Energy Solutions, "Decoupling in Detail".
[249] Lowry, Getachew and Makos, "Commonwealth Edison
[250] National Renewable Energy Laboratory, "Decoupling Policies".
[251] Lowry, Getachew and Makos, "Commonwealth Edison".
[252] Lowry, Getachew and Makos, "Commonwealth Edison".
[253] Ibid

with decoupling policies. Since a utility's revenue requirement remains fixed, each kWh will have to cover a greater portion of the cost of service and will be subsequently priced higher. Although this increase may be relatively small considering the system-wide benefits related to EE, it could still be perceived negatively. Consumers who participate in EE initiatives should experience less volatility and lower bills as they consume less energy due to implementing EE measures. However, those customers who do not initially engage in EE could see higher bills as they consume a similar volume but initially pay higher per-unit costs. This could be of particular concern to low-income customers least able to respond to changes in bills. On the other hand, it could be perceived as an incentive to encourage those not participating to adopt the relevant EE measures. However, if utility fixed costs decrease due to EE and subsequent rate cases adjust for this, per-unit costs will then reflect decreased revenue requirements.[254]

2. *Alternative Recovery Mechanisms*

Alternative mechanisms beyond true up style decoupling also exist which act as viable methods for lost-revenue and cost recovery for EE program implementers:

Straight Fixed Variable (SFV) pricing is an approach to rate design that uses variable charges to recover short run system costs. Utilities recover lost revenues through "moving fixed costs previously recovered through usage charges to customers or some kind of reservation charges that vary with expected future usage."[255] By aligning fixed costs more closely with fixed charges, it allows the utility to recover fixed costs without relying on sales volume.[256] Therefore, SFV pricing causes long-term rates to correlate more closely to fixed costs rather than energy demand.[257] However, customers' benefits to conservation are diminished because the charges absorbed to recover equipment, plants, and other capital expenditures remain fixed. The customers who consume the least amount of energy will see less benefit in their energy conservation as variable usage charges are low. This approach could be useful for EE programs in the long-term if growth in fixed costs decrease as there is a lessened need for expanded capacity. However, SFV pricing could weaken customer incentives to fully engage in EE programs in the short-run due to the negligible effect implementation of EE technology and practices would have on lowering customer bills. SFV is used by gas utilities in four states: Georgia, Missouri, North Dakota, and Oklahoma. There are no states using SFV to recover electric utility costs.[258]

Lost-Revenue Adjustment Mechanisms (LRAM) are an adjustment system that allows utilities to be compensated for the under-recovered revenues which result from energy savings of EE programs. Typically, an evaluation is needed to quantify the energy savings directly attributable to the program in order to establish the amount of sales foregone. This figure is then multiplied by an established amount of fixed cost per kWh to determine the amount of additional revenue the utility is entitled to collect. Customer bills often include a rate adjustment in the form of a

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[254] National Association of Regulatory Utility Commissioners, "Decoupling".
[255] Lowry, Getachew and Makos, "Commonwealth Edison".
[256] Center for Climate and Energy Solutions, "Decoupling in Detail".
[257] National Action Plan for Energy Efficiency, "Customer Incentives".
[258] AEP, "Straight Fixed Variable".

rider to compensate utilities for the under-recovered amount.[259] LRAMs are not needed in states where EE programs are independently administered. When LRAMs are utilized, they tend to have high administrative costs due to their reliance on evaluations to produce savings estimates.[260] Also, this system does not take into account utility over-recovery when actual revenues exceed the established revenues. Therefore, the throughput incentive is not addressed, and the incentive for utilities to increase sales of energy remains.[261] Arizona, Arkansas, Georgia, Kentucky, Louisiana, Montana, Nevada, New Mexico, North Carolina, Ohio, Virginia, and Wyoming all have initiated LRAM mechanisms for electric utilities within their states.[262]

DSM Performance Incentives adjust rates mechanistically to "strengthen utility incentives to develop large, efficient programs."[263] While decoupling removes a utility's disincentive in engaging in EE, it is not designed to incentivize EE practices.[264] Some DSM incentives mechanisms reward or penalize based on differences between targeted values and a utility's actual values for key performance indicators, while others share a portion of estimated program savings. Another feature of most DSM mechanisms involves capitalizing a portion of EE expenses so shareholders receive a return on investment for utility-sponsored EE programs. DSM performance incentives are not intended to recover lost revenues but to act as a way to "mitigate financial attrition."[265] However, it is important to note that decoupling and DSM performance incentives are not mutually exclusive. Many proponents believe that offering the two mechanisms jointly provide for a sound policy for lost revenue recovery. Arizona, California, Colorado, Connecticut, Georgia, Hawaii, Kentucky, Massachusetts, Michigan, Minnesota, New Hampshire, New Mexico, Ohio, Oklahoma, North Carolina, Rhode Island, South Carolina, South Dakota, Texas, and Wisconsin are states who offer electric utilities incentives meeting DSM performance criteria.[266]

Revenue-neutral Energy Efficiency Feebates (REEF) offers another viable means for cost recovery within EE programs. Under this arrangement, a limit is set on the level of energy that can be consumed by customers. If a customer's consumption goes beyond the allotted amount, a fee will be assessed based on their overage.[267] Targeted usage levels are often set based on meeting specific policy goals. Potential REEF targets include on peak usage, off peak usage, and demand. However, a common method for establishing a size and design of the fees is to base them on the long -term marginal costs or avoidable costs in the individual cases.[268] More than one fee can be assessed depending on the goals of the energy conservation initiatives. Customers who do not exceed their consumption levels will receive a rebate which is funded by the fees paid by customers who went over their limits. A disadvantage of feebates is that they could be considered as a tax on energy customers who consume more than others. Also, by setting a limit on consumption, the energy initiative would be limiting the liberties of customers. The fees and

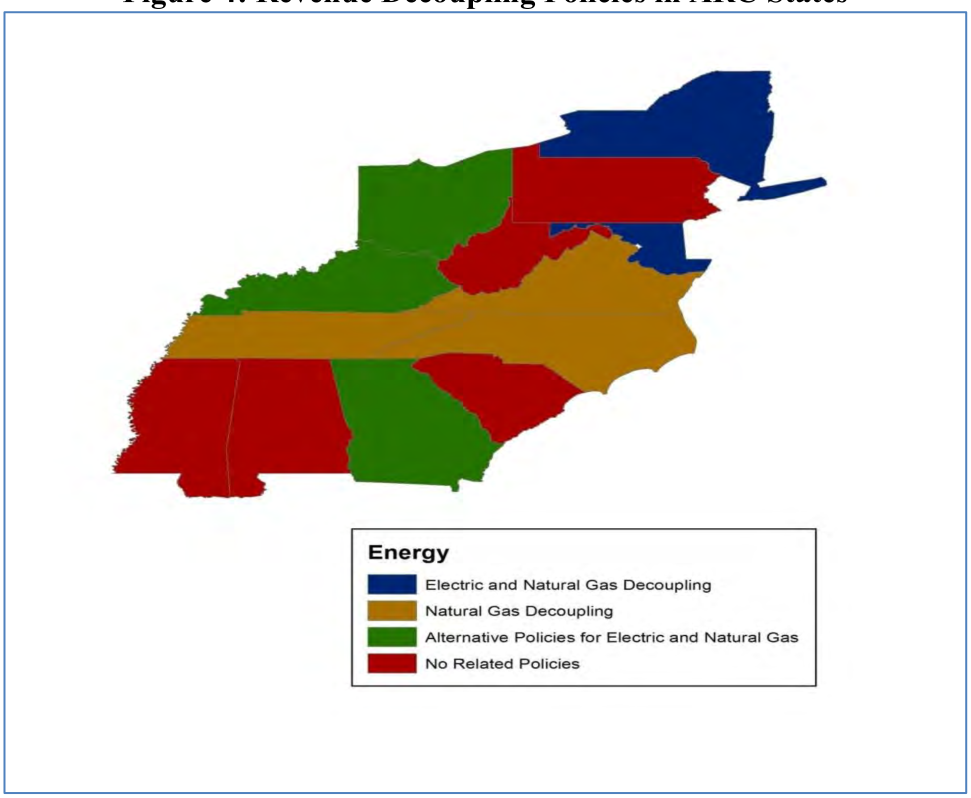
[259] Hayes, et al., "Balancing Interests".
[260] Lowry, Getachew and Makos, "Commonwealth Edison".
[261] Center for Climate and Energy Solutions, "Decoupling in Detail".
[262] Hayes, et al., "Balancing Interests".
[263] Lowry, Getachew and Makos, "Commonwealth Edison".
[264] National Association of Regulatory Utility Commissioners, "Decoupling".
[265] Lowry, Getachew and Makos, "Commonwealth Edison".
[266] Ibid
[267] Center for Climate and Energy Solutions, "Decoupling in Detail".
[268] Boonin, "A Rate Design"

rebates would have to be structured around energy usage by classes with consumers of a comparable size and consumption level (i.e. commercial, schools, residential, etc.). Most research has shown that in order for the feebates to be effective in controlling consumption the fees must be set at a high rate in order to discourage consumption.[269] Currently, no states have adopted policies establishing REEF. However, it is important to note that implementing REEF is typically discussed in tandem with SFV initiatives as the two mechanisms are complimentary.[270]

C. State Policies on Lost-revenue and Cost Recovery

Of the thirteen states considered to be within the Appalachian region as identified by the ARC, Maryland and New York are the only two states that have adopted decoupling for both natural gas and electric utilities in an effort to address revenue recovery issues. Three states have enacted decoupling mechanisms for addressing lost revenue recovery for their gas utilities but not for the electric utilities. These states include Tennessee, North Carolina and Virginia. Ohio, Kentucky, and Georgia are three states who have alternative cost-recovery mechanisms in place for their natural gas and electric utilities. West Virginia is among the five states that have not enacted any policy towards addressing lost revenues by utilities. The other states within the classification are Alabama, South Carolina, Mississippi and Pennsylvania.[271] Figure 4 illustrates revenue decoupling policies enacted in ARC States:

Figure 4: Revenue Decoupling Policies in ARC States



[1] Energy Information Administration

[269] Boonin, "Revenue Neutral"
[270] Boonin, "A Rate Design".
[271] Energy Information Administration, "Decoupling Treatment".

VI. EE Program Evaluation

Transforming EE into a viable energy resource for the State necessitates validation of the effectiveness of EE programs. Policy makers, utilities, ratepayers and other stakeholders are interested in evaluating whether program benefits outweigh their costs. Such evaluation is used to justify the retention of existing programs and potential expansion of programs into other areas. Legislative bodies and regulatory agencies desire third party verification of program results, process transparency, and clear, measurable objectives that are consistent with public goals when overseeing EE implementation. Utilities have a strong interest in accurate verification of program effectiveness because it provides the evidence needed to allow for program cost recovery and lost revenues. Furthermore, ratepayers are more likely to support their investment in programs when they see EE initiatives are resulting in lower energy bills.

Evaluation confirms or disproves the effectiveness of EE initiatives through real time and/or retrospective assessments of the performance and implementation of a program. It is important to note the distinction between evaluation and measurement and verification (M&V). M&V refers to data collection, monitoring, and analysis used to calculate gross energy and demand savings from individual sites or projects. The two terms are often combined into one concept labeled Evaluation, Measurement and Verification (EM&V) when referencing analysis of EE activities. Generally, the difference between evaluation and M&V is that the former is more broadly associated with programs and the latter relates directly to individual projects or facilities. M&V can be a subset of a program impact evaluation which is discussed in later sections.[272]

A. Benefits of EE Evaluations

Evaluation of the impacts of EE programs is a vital component to any utility-sector EE policy.[273] Benefits of evaluation often take the form of intellectual capital gained on the functionality and efficacy of programs. According to the Electric Power Research Institute, successful EE evaluations lead to various benefits:

- Evaluation measures what progress programs have made towards accomplishing stated goals through quantifying its effects and determining its impact.
- Evaluation leads to determination and/or adjustment of goals to conform to revised performance estimates for current and future programs
- Evaluation proves whether the model for program design functioned as expected
- Evaluation highlights the value of promoting EE as the lowest cost approach to energy reduction
- Evaluation identifies whether EE programs are meeting regulatory requirements.

Therefore, a key aspect of program evaluation is the identification of areas of improvement that can make EE initiatives more effective. The well-known maxim, "things that are measured tend

[272] National Action Plan for Energy Efficiency, "Impact Evaluation Guide".
[273] Kushler, Nowak and White, "National Survey".

to improve", is highly applicable in the case of EE. Specific improvements that can be made based on the outcome of evaluations include[274]:

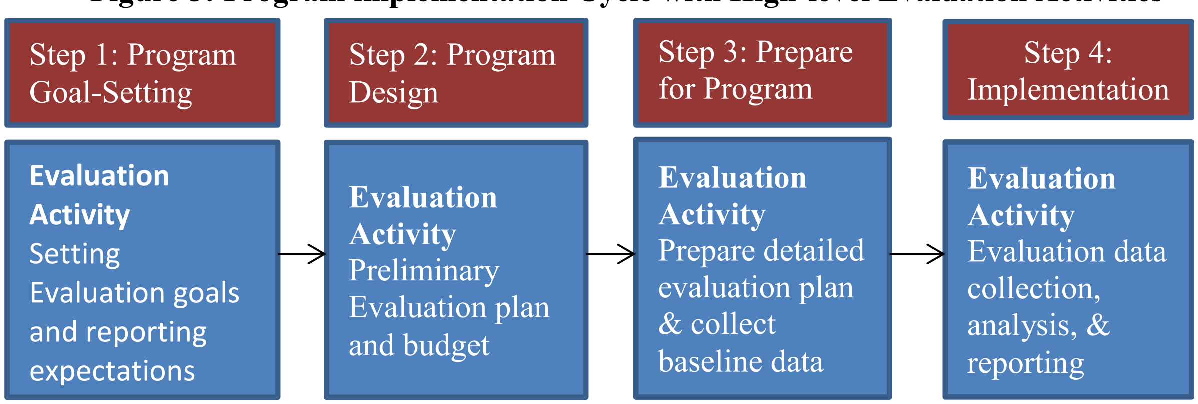
- Reestablishing regulatory performance metrics
- Adopting improvements and new strategies for program delivery
- Adapting programs to meet evolving market conditions
- Modifying incentive criteria
- Conforming service packages to promote desired market activity
- Capturing economies of scope through program integration
- Improving program design and administrative processes

Furthermore, evaluation leads to more accountable practices within EE programs. The reliability of efficiency as a resource can be determined through metrics and process assessments that identify internal and external uses of program resources. By identifying which program elements are most and least effective, officials are held accountable for their approach towards program implementation.[275]

B. Evaluation Planning

In traditional models of EE program design, evaluation began following the implementation process, and there was no interaction with program planning or design. In recent years, there has been a shift towards integrating evaluation with the design and planning process so that the programs produce more substantial evaluation findings on the basis of the improved information provided by implementers.[276] This early coordination allows evaluation processes to support implementation throughout the phases of the program. Figure 5 shows the relationship between program activities and evaluation activities during various steps of the program cycle:

Figure 5: Program implementation Cycle with High-level Evaluation Activities



[1] National Action Plan for Energy Efficiency

It is important to note that program goals, regulations, evaluation quality expectations, uses of results, and other factors can vary across regions and program portfolios. Therefore, the depth of

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[274] EPRI, 'Guidebook".
[275] National Action Plan for Energy Efficiency, "Impact Evaluation Guide".
[276] EPRI, "Guidebook".

integration between evaluation and implementation planning will also vary. However, there are key evaluation planning issues that should be addressed regardless of the level of early coordination between the two activities. The National Action Plan for Energy Efficiency defines seven key areas:

- Defining evaluation goals and scale such as deciding which program benefits to evaluate.
- Setting a time frame for evaluation and reporting expectations.
- Setting a spatial boundary[277] for evaluation
- Defining a program baseline, baseline adjustments, and data collection requirements.
- Establishing a budget in the context of expectations for the quality of reported results.
- Selecting impact approaches for calculating gross and net savings and avoided emissions.
- Selecting the individual or organization that will conduct the evaluation.

Although all seven areas are aspects of planning necessary for successful evaluations, defining data requirements is most important, especially when quantifiable results are needed. For example, it is necessary to consider at the outset what data should be tracked in order to verify the results of initiatives launched. If a commercial lighting program is undertaken, then measures need to be established to acquire related data such as pre- and post- wattage and hours of use. Beyond programmatic data, a solid evaluation will also require the analysis of the impact of external events such as weather, demographic composition, and behavioral patterns. During the evaluation planning phase, securing such raw data needs to be considered as a vital part of establishing program baselines and possible adjustments.[278]

By planning evaluation activities early in the program cycle and integrating them with other processes, implementers are provided with timely feedback. This allows them to take corrective actions for existing programs and make recommendations for the design of future programs. Programs change over time to reflect more accurate design and planning processes on the basis of accurate and relevant information garnered from previous experiences. Therefore, program evolution is not only dependent on shifting policy goals, but also on the effectiveness of past initiatives.[279] When policy and program objectives are identified during the evaluation processes, it allows for more accurate assessment of program performance, and this may give rise to program expansion if results demonstrate attained objectives.

C. Types of EE Program Evaluations

The three most common evaluative methods taken to measure the effectiveness of EE programs are impact evaluations, process evaluations, and market effects evaluations. These classes of evaluations are deemed "ex post" because they analyze what has already happened. However, each assessment is different because they measure a distinct component of program performance.

Impact evaluations are quantitative in nature because they determine a program's impacts through measuring the amount of energy and demand saved as well as the levels of indirect benefits. Specific methodologies are established to quantify how much energy consumption (i.e.

[277] Spatial boundary refers to what energy uses, emission sources, data collection, etc., the analyses will include
[278] National Action Plan for Energy Efficiency, "Impact Evaluation Guide".
[279] Gilligan, "Program Planning Workbook".

(MWh) was avoided and how much demand (KW) was deferred through program influence. Indirect benefits such as avoided GHG emissions, improved health, enhanced energy security, job creation, more efficient T&D, and water savings are also calculated or taken into account through the completion of impact evaluations.[280] In addition, impact evaluations also provide information related to the analysis of a program's cost effectiveness.[281]

Process evaluations examine program delivery, including design and implementation, in an effort to identify bottlenecks, inefficiencies, constraints, and potential improvements. Issues commonly inspected are administration, promotional practices, delivery methods, incentive levels, market barriers, and data tracking. Process evaluations "revolve around the execution of a series of interviews, surveys, and document reviews in order to assess the performance of the energy efficiency program in question."[282] These evaluations take into account all relevant actors throughout the process including utility staff, trade allies, implementers and ratepayers. Identifying appropriate opportunities for process improvements during evaluation is essential to continual program enhancement.[283]

Market effects evaluations are designed to estimate a program's influence on future EE projects because of changes in the marketplace for energy technologies. The evaluations are most relevant to programs with an emphasis on developing and transforming the energy market to conform to EE as a resource.[284] An example of such a study would be an examination of the increased availability of energy-efficient HVAC units following the implementation of a rebate program within a utility's service territory.[285]

The primary focus of this report will be to understand the components and objectives associated with an impact evaluation. These studies directly quantify energy and capacity (demand) savings. However, the three types of evaluations mentioned are not mutually exclusive, and there are benefits in undertaking multiple studies simultaneously. In fact, aspects of process evaluation and market effects evaluations are often integrated either implicitly or explicitly within impact evaluation studies.

D. Objectives of an Impact Evaluation

A principal challenge inherent with evaluation of EE programs is measuring a non-existent resource. The term "savings" cannot be directly measured since it refers to the absence of energy or demand. Specifically savings refers to the reduced level of energy use or demand following the installation of energy-efficient technologies.[286] Energy savings, for instance, would be calculated by measuring the difference between the actual post-installation energy consumption and what energy consumption would have occurred during the same period had the efficiency measures not been installed.[287] The latter denotes a baseline energy use which is often just the

[280] EPRI, "Guidebook".
[281] National Action Plan for Energy Efficiency, "Impact Evaluation Guide".
[282] EPRI, "Guidebook".
[283] National Action Plan for Energy Efficiency, "Impact Evaluation Guide".
[284] Ibid
[285] EPRI, "Guidebook".
[286] Ibid
[287] National Action Plan for Energy Efficiency, "Impact Evaluation Guide".

pre-installation level. However, adjustments can be made to this approach to take into account conditions like weather, production, usage, square footage, and occupancy that exist following the EE technology upgrade.[288] More simply put, the role of an impact evaluation is to estimate what would have been consumed over a given time frame but was not.

The National Action Plan for Energy Efficiency notes that it is most relevant to conduct impact studies when evaluation objectives are based on three criteria:

- Determining, quantifying, and documenting energy and demand savings and avoided emissions that are directly attributable to EE program impact
- Conducting a cost-benefit analysis to determine program cost effectiveness
- Apprising current and future program administrators of the savings actually achieved from specific measures or program strategies

By quantifying the impact of EE programs, the above objectives can be met. Not all aspects of an impact study will be relevant to all EE programs. Program implementers must determine which criteria are most important to measure given the scope, interests of stakeholders and cost considerations.

E. Components of an Impact Evaluation

The process of calculating energy and demand savings via an impact evaluation can be broken down into four key components:

- Estimation of gross energy and demand savings including adjustments to key external factors not attributable to the program
- Estimation of net energy and demand savings via adjusting gross savings for variances in application, usage, and behavior
- Calculation of avoided emissions based on net energy savings
- Additional co-benefits are determined as appropriate

Typically, evaluations are formally structured around annual reporting cycles so that the above steps can be viewed as an annual process.[289]

Estimation of gross savings is determined through calculating the change in energy use or demand by program participants before and after their participation in the program.[290] This component of change should reflect the elimination of some portion of prior energy use after implementation of an EE program. It is typically expressed in terms of kWh of energy saved. Gross impact savings can be determined through various approaches such as measurement and verification, deemed savings, or large scale data analysis. However, it is important to make corrections for external factors beyond the scope of the initiative or control of the ratepayer when estimating gross savings. Factors can include adjustments for variances in installation rates,

[288] EPRI, "Guidebook".
[289] National Action Plan for Energy Efficiency, "Impact Evaluation Guide".
[290] Kaufman and Palmer, "Program Evaluations".

failure rates, baseline assumptions, leakage[291], weather, building hours and occupancy levels, and production levels in industrial facilities. Adjustments are made to "align energy use in the pre- and post-program time periods to the same set of conditions in order to neither understate nor overstate the impact of the program."[292] The equation used to estimate gross savings is:

[Adjusted] Gross savings = (baseline use) - (reporting period use) ± [adjustments]

Net energy savings refers to the total change in load or consumption that can be attributed directly to program efforts. It takes into account variables that would have occurred without the influence of the program.[293] Variables that can substantially change the realized savings include free ridership, spillover, and rebound effects. Free ridership refers to program participants who would have purchased EE upgrades on their own even in the absence of a program. Net savings cannot take into account such customers because they would have made the desired change without the inducement, and the program's impact is irrelevant to their behavior.[294] Spillover is the adoption of EE measures by participants and non-participants who are influenced by the program but "do not claim financial or technical assistance for additional installations of measures supported by the program."[295] Rebound effects describe "changes in consumer behavior resulting from the installation of energy efficiency measures that diminish expected energy savings associated with the original installation."[296] An example would be the increased use of an HVAC unit because of the reduced cost associated with the EE technology. As the effects of free riders, spillover and the rebound effect are difficult to quantify, a variety of approaches are used to estimate these effects. Self-reporting surveys, qualitative choice models, econometrics, and stipulated net-to-gross ratios are some methods used by evaluators to determine the effects of the aforementioned variances.[297] The National Action Plan for Energy Efficiency defines a standard net-to-gross ratio (NTGR) as follows:

NTGR= (1- Free ridership + Spillover)

Appraising the levels of non-energy benefits also represent key drivers behind successful evaluation studies. An example of a non-energy benefit derived from EE is the avoidance of air emissions such as Greenhouse Gases. By reducing generation or capacity growth, the level of carbon-related fuel used for generation is also reduced. Therefore, the emissions that would have been associated with those generation resources are not expended.[298] Similar to the calculation of energy savings, determination of reduced air emissions must take into account a baseline factor. Evaluators are charged with comparing levels of actual emissions following the implementation of an efficiency program with an estimate of the level of emissions that would have occurred

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[291] Leakage refers the diversion of impact for EE incentives to areas outside of the service territory. For example a customer may purchase a subsidized CFL in one location and transport it to another area. Sales data suggests a local savings impact because of the purchase, but energy savings are actually being accrued in another locale.
[292] EPRI, "Guidebook".
[293] Barnes, "EERE guide".
[294] EPRI, "Guidebook".
[295] National Action Plan for Energy Efficiency, "Impact Evaluation Guide".
[296] EPRI, "Guidebook".
[297] Ibid
[298] Ibid

absent the program.[299] In terms of quantifying the impact of emissions avoidance, EPRI notes that various approaches can be taken:

> *Some states have created a conservation 'advantage' by increasing all avoided cost annually by a fixed percentage (usually 10 percent). Others have attempted to place a value on carbon reductions in their cost-benefit tests. Not doing anything attributes zero value on environmental benefits*.

Placing a specific value on carbon reductions can be achieved through two approaches: the emission factor approach and the scenario analysis approach.[300] It is important to note that the exact values and mix of reduced GHG emissions also depends on when the energy savings takes place since generators use an assortment of fuels to meet customer demand at different times of the day. Approaches used to calculate reduction values should take into account such demand load variables.

Co-benefits represent the fourth component of an impact evaluation study. Co-benefits refer to other categories of benefits that may be derived from EE programs. They include such factors as improved health, enhanced energy security, job creation, avoided T&D capital costs and line losses, and even better payment behavior and debt reduction for low-income customers.[301] A subcategory of EE co-benefits are participant non-energy benefits like water savings, comfort and safety, reduced operation and maintenance costs, reduced eyestrain due to improved lighting quality, and potentially higher resale values associated with EE upgrades. Generally, the most important types of benefits should be quantified when conducting impact evaluations for cost-effectiveness purposes. A wide range of practices from economic modeling to simple assessment of historical trends can be used to quantify co-benefits. However, participant non-energy benefits are usually listed rather than quantified due to the lack of agreed upon methodology for quantifying them and due to their high associated costs as well.[302]

F. Evaluation Costs

A relevant aspect of evaluation of EE programs is determining the level of resources dedicated to the evaluation process. In general, state regulatory agencies are charged with defining the proportion of program budgets allocated to evaluation costs. Some jurisdictions allocate around 2-3% of estimated savings to cover costs of evaluations. Smaller percentages of allocated funds yield results with a greater level of uncertainty and lack of program-specific detail.[303] Other entities allocating a greater percentage (2-5%) cite greater detail and accuracy, reduced uncertainty, enhanced validation of programs, increased revenue recovery for utilities, higher program performance, more reliable demand projections, and other factors as key benefits

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[299] National Action Plan for Energy Efficiency, "Impact Evaluation Guide".
[300] The specific framework for calculating emission avoidance through either approach is beyond the scope of this report. However, it is important to highlight what best practices are utilized for future reference when impact evaluation studies may be considered.
[301] EPRI, "Guidebook".
[302] National Action Plan for Energy Efficiency, "Impact Evaluation Guide".
[303] EPRI, "Guidebook".

derived from greater investment in the evaluation process. On the upper end of the spectrum, entities have allocated as much as 8 percent of program budgets toward evaluation purposes.[304]

Many factors affect the costs of evaluations such as the type of evaluation chosen, the scope of the information requirement, and the validity required for the information results.[305] Evaluation should be prioritized by identifying the program elements with the largest savings potential for the least amount of cost. When the most effective programs are given priority in the evaluation process, it ensures the greatest cost recovery for the utility and provides the most convincing validation of the overall efficacy of EE programs for regulators and the public. EPRI summarizes the nature of evaluation costs by distinguishing between consumption and demand data requirements:

> *In general, programs that attempt to suppress overall energy use are easier to evaluate because gaining information on total energy consumption of users is easier to obtain than information about when they use energy. The latter information is necessary if the measure's purpose is to reduce or shift demand away from periods of peak usage. In short, evaluating programs that measure demand will be more costly than those measuring energy uses.*

Ultimately, an optimal evaluation will balance evaluation costs with the value of the evaluation information while minimizing uncertainty.[306]

G. Cost-Effectiveness

EE program cost-effectiveness is measured by comparing the benefits of an investment in EE with its associated costs. A program should be considered cost-effective when the benefits exceed the costs. However, it should be noted that the perspective of whether an EE program is beneficial depends on what stakeholder is being considered. Various actors such as EE program participants, the EE program administrator, non-participating ratepayers, and the general society have different viewpoints and all should be considered when EE is assessed. Another relevant factor is to determine which key benefits and costs should be included in the evaluation. For instance, does the analysis take into account avoided energy use, EE incentives, avoided and/or deferred capacity investment, avoided and /or deferred T&D investment, and environmental impacts among others? The baseline against which the costs and benefits are measured is another important consideration. Had there been no investment in EE programs what would have been the net result? Furthermore, cost-effectiveness tests are influenced by factors such as discount rates, non-energy benefits, GHG emissions, established goals, and many other areas. All these factors should be taken into consideration in order to facilitate an accurate and thorough cost-effective analysis.[307]

Multiple tests exist to determine the cost-effectiveness of EE programs. The National Action Plan for Energy Efficiency identifies five distinct tests as most relevant: participant cost test

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[304] Ibid
[305] Barnes, "EERE Guide".
[306] National Action Plan for Energy Efficiency 2007
[307] National Action Plan for Energy Efficiency, "Best Practices".

(PCT), program administrator cost test (PACT), ratepayer impact measure test (RIM), total resource cost test (TRC), and the societal cost test (SCT). Each test has its own distinct advantages and disadvantages. The PCT is concerned with the overall welfare of participants as a result of the program, but it does not consider the impact the program will have on utilities. The PACT analyzes how utilities (often the program administrators) will be affected in terms of revenue requirements. However, it does not take into account the impact on customers. The RIM test is similar to the PACT in terms of addressing cost-effectiveness from a utility perspective. However, it addresses whether rates will increase as a result of the program. The TRC test is a commonly used measure which includes all the costs and benefits to the utilities and its ratepayers as a whole. In general, this test should address the issue of whether it is cheaper to meet energy demand by conserving energy through efficiency or by supplying it through enhanced generation capacity. The SCT is similar in scope to the TRC but it includes the effects of externalities.[308]

It is important to note that cost-effectiveness analysis requires quantifiable information on gross savings, net savings, emissions avoidance, and other potentially measurable co-benefits. Therefore, cost-effectiveness tests and impact evaluations are mutually inclusive. Furthermore, use of cost-effectiveness test requires the monetization of the most important types of benefits and costs. Valuing costs and benefits in monetary terms is necessary to facilitate a comparison of whether program benefits outweigh its costs.[309]

There is no single best test used to identify the cost-effectiveness of EE.[310] A comprehensive approach that utilizes all major tests is most effective because it takes into account the impacts associated with EE from all vantage points. However, it is noted that if jurisdictions seek increased levels of EE implementation, the PACT may be the most useful to emphasize as it "compares energy efficiency as a utility investment on a par with other resources".[311] Various jurisdictions calculate and define savings differently, use different savings and baseline values, vary in their assessment of uncertainty, and apply different forms of independent review. Because of this, the credibility of EE cost-effectiveness can be negatively affected as meaningful comparisons become more difficult to achieve. In order to overcome this downfall, it is important the entities charged with the evaluation, measurement and verification of energy savings stress an increase in the "accuracy and transparency of reported savings by improving the accuracy of measuring and verifying savings, and standardizing the reporting of energy savings."[312]

H. Approaches to EE Program Evaluation among ARC States

Regulation of retail electric and natural gas utilities has historically been the responsibility assigned to governing agencies in individual states. A result of this structure is that each state has

[308] EPRI, "Guidebook".
[309] National Action Plan for Energy Efficiency, "Impat Evaluation Guide".
[310] Although no single test is definitively used as a determinant of effectiveness, industry best practices use some general rules of thumb to insure program continuity. For example, programs should always pass the PCT or else it will not be attractive to customers. Similarly, programs that pass the RIM and TRC test should be implemented because they represent a cheaper solution than the supply-side alternatives.
[311] National Action Plan for Energy Efficiency, "Best Practices".
[312] Woolf and Oshie, "Working Group".

adopted its own approach to not only implementing various EE programs, but also evaluating them. The inconsistencies in approaches to evaluation cover a wide array of topics such as differences in legal framework, administration, methodologies, and assumptions. Because of this lack of uniformity some have called for a national standard in terms of EE evaluation so comparisons can be more meaningful among different states' programs.[313]

However, this does not mean that evaluations and cost-effectiveness tests are not valid in their justification for retention of elimination of EE programs. It simply points out the difficulty in making comparisons of effectiveness across state borders. It can still be useful though to examine the methods used by various states in terms of evaluation practices. States with greater experience and more robust programs may offer exceptional insight into evaluation practices. After all, their practices are resulting in expansive EE policy and a contributing factor most certainly would be having successful evaluations which prove a program's overall efficacy.

In a survey conducted by ACEEE where 44 states were asked about their evaluation policies and practices, the wide spread diversity of evaluation practices were confirmed. In terms of which entities administered the evaluation function, the results showed that 37% of respondents employ a utility administration, 36% employ administration by the regulatory agency or a combination of the regulatory agency and the utility, and 27% rely on administration by another government body or a third-party entity. The study did show some conformity in terms of who actually conducts the evaluations. 79% of respondents utilize independent consultants or contractors, while only 21% use utility or government staff.[314]

Furthermore, the ACEEE study showed differences in terms of the legal foundation for evaluations. 45% of states have legislative mandates, 45% rely solely on orders from regulatory bodies, and 10% reported no framework for mandating an evaluation.

Finally, the ways states approach quantifying benefits and using them in cost-effectiveness tests also varies. 26% of respondents reported quantifying savings through gross savings, 53% used net savings, and 21% used a combination of both.[315] Furthermore, the survey showed that most states used one or more of the five standard cost-effectiveness tests previously mentioned. The primary test used for decision-making purposed was less variable with 71% of states using the TRC test, 15% using the SCT, 12% using the PACT, and 2% (one state) using the RIM test.

Although these general trends present useful information in terms of evaluation practices, it is also beneficial to examine the individual practices of states that are most similar to West Virginia. The following table examines the practices of the surveyed ARC States with regards to 6 key variables related to evaluation:

[313] Kushler, "Programs by the States".
[314] Kushler, Nowak and White, "National Survey".
[315] Ibid

Table 8: Summary of Surveyed ARC States Evaluation Policies & Practices

ARC State	Administration of Evaluation	Legal Framework for Evaluation	Report Gross or Net program savings or Both?	Adjust for Effects of Free Riders?	Adjust for effects of Free-Drivers/ Spillover?	Primary Cost-effectiveness Test
Georgia	NA	NA	Both	NA	NA	NA
Kentucky	Utilities	Reg.	Gross	No	No	TRC
Maryland	Utilities/ PUC	Leg./ Reg.	Gross	No	No	TRC
New York	Utilities/ NYSERDA	Reg.	Net	Yes	Yes	TRC
North Carolina	Utilities	Reg.	Net	Yes	No	TRC
Ohio	Utilities/ PUC	Reg.	Gross	No	No	TRC
Pennsylvania	PUC	Leg./ Reg.	Gross	No	No	TRC
South Carolina	PUC/SCORS	Leg./ Reg.	NA	NA	NA	NA
Tennessee	TVA	NA	Both	Yes	Yes	TRC
Virginia	PUC	Leg.	Net	Yes	Yes	RIM

[1] Kushler, Nowak and White. "National Survey".

[2] Abbreviations used in table: NA- Not Available; PUC- Public Utility Commission; NYSERDA- New York State Energy and Research Development Authority; SCORS- South Carolina Office of Regulatory Staff; TVA- Tennessee Valley Authority; Reg.- Regulatory mandate; Leg.- Legislative Mandate; TRC- Total Resource Cost test; RIM-Ratepayer Impact Test.

VII. EE Programs in West Virginia

EE already has a presence in various aspects of state policy. Although it is recognized that there is significant room for advancement for EE policy in West Virginia, it is important to acknowledge those areas where the state has already taken strides. Rebate programs, EE promotion and training, low-income assistance, and industrial initiatives are all actions that have been taken in WV to encourage EE.

A. State Utility Rebate Programs

There are three existing utility rebate programs in West Virginia. Two of the programs are facilitated by AEP, and one program is facilitated by FirstEnergy[316]:

AEP and its subsidiaries, ApCo and Wheeling Power, provide residential electric customers in West Virginia with incentives to engage in measures that improve EE within their household. The EE improvements are funded through the ApCo HomeSmart Program. The program began on March 11, 2011, and it applies to household improvements in lighting, heat pumps, insulation, HVAC maintenance, and other EE technologies. Measures can be installed by a licensed contractor participating in the program, or they can be installed by the customer and inspected at

[316] This evaluation excludes comment on electric cooperatives in the state because consumption resulting from their distribution comprises such a small portion of the state's total consumption. Nearly all consumption in the state is derived from power generated and distributed by West Virginia's two major utilities.

a later date. Following completion of the work, inspection, and submission of necessary documentation, a rebate check will be sent to customer in under 45 days.[317]

Another key element of ApCo's residential program design is the home energy audit/retrofit which allows customers the opportunity for a free in-home energy assessment. ApCo has contracted with GoodCents, an energy consulting company, to examine customers' homes, produce an audit report, and install low-cost efficiency improvements. Improvements that can be performed along with the audit are installation of up to six compact fluorescent light bulbs, aerators for kitchen and bathroom, up to three low-flow showerheads, LED nightlights, two water heater temperature adjustments, water heater pipe insulation, refrigerator thermometer, refrigerator coil cleaning brush, and basic air sealing.[318] As of July 24, 2012, the program had contributed to approximately 3,000 home audits.[319]

ApCo also provides EE incentives to non-residential electric energy customers through their Commercial and Industrial (C&I) Prescriptive Program. This program began on March 11, 2011.[320] Eligible participants include commercial and industrial electric customers who pay into the EE and DR cost recovery riders. The projects must "involve a new facility improvement that results in a permanent reduction in electrical energy usage", and "any measures installed at a facility must be sustainable and provide 100% of the energy benefits as stated in the Application for a period of at least five years or for the life of the product.[321] Applicable EE technologies include lighting, lighting controls/sensors, chillers , heat pumps, central air conditioners, programmable thermostats, motor VFDs, led exit signs, commercial refrigeration equipment, and LED lighting.[322] Initiatives can be installed by a participating contractor in the program network or can be self-installed. However, self-installation measures taken in excess of $1000 in rebate value are subject to inspection, and all applications with a rebate value of $20,000 are automatically inspected.[323] Once the work has been completed, inspected, and all required documents submitted, a rebate check is sent to the customer within 45 days.[324]

FirstEnergy's utilities, Mon Power and Potomac Edison, also have a utility program within the state that offers incentives for adoption of EE technologies. The Business Lighting Incentive Program was designed in accordance with the WV Public Service Commission's December 30, 2011 order[325] directing the companies to begin offering EE initiatives to commercial customers. Eligible participants include commercial, industrial, and government customers of Mon Power and Potomac Edison. The incentive program is scheduled to last either until December 31, 2014 or when program funds run out.[326] The program provides a performance-based rebate for energy efficient lighting equipment and controls that save energy. The incentives are based on kWh

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[317] DSIRE, "West Virginia Incentives".
[318] Appalachian Power Company, "Home Energy Audit".
[319] Fawcett, interview by Christine Risch and Sean Pauley.
[320] DSIRE, "Commercial and Industrial Rebate".
[321] Appalachian Power Company, "C&I Prescriptive Plan".
[322] DSIRE, "Commercial and Industrial Rebate".
[323] Appalachian Power Company, "Prescriptive Program".
[324] DSIRE, "Commercial and Industrial Rebate".
[325] See WV PSC Case 11-0452-E-P-T
[326] First Energy, "Frequently Asked"

saved and are independent of what lighting products or technologies are implemented.[327] The program offers participants an incentive of $0.05/kWh of first year savings. Both existing buildings and new construction projects are eligible for incentives, but "all equipment must be code compliant and in accordance with FirstEnergy Standards."[328]

B. Efforts to Promote Efficiency by the West Virginia Division of Energy

The WVDOE has played a role in fostering EE efforts in the state through initiating specific programs and facilitating available funding. For instance, the DOE has sponsored residential and commercial energy code training in an effort to keep architects, engineers, code officials, and contractors up to date with current codes. They have prepared trainees on residential codes by sponsoring seminars that highlight the distinction between the IECC 2003 and IECC 2009 .They have also initiated training on the commercial side by supporting training events for architects, engineers and contractors on the ASHRAE 90.1 2007 standards which will be required for all new state-funded construction. These initiatives have been supported through a combination of state and SEP-carryover funds.[329]

The WVDOE has also advocated for new efficiency opportunities in governmental facilities through use of Energy Star tools like the Portfolio Manager. During the FY 2011-12 program year, WVDOE promoted Portfolio Manager to all of the state agencies and units of local government funded with ARRA dollars. As a result, eight West Virginia towns provided data on government-operated buildings, and more than 200 buildings in West Virginia received ARRA support for energy efficiency and renewable energy upgrades. Furthermore, the DOE's sponsorship of the Portfolio Manager service has assisted West Virginia county school systems in increasing their awareness of energy use and efficiency. This assistance includes $40,000 in stripper-M funds for Portfolio Manager training for school administrators, Portfolio Manager assessments, and student training in building energy audits.[330]

WVDOE will also provide five grants up to $10,000 to West Virginia communities planning commercial or residential energy efficiency programs. Competitive grant selection criteria will include projected level of community involvement, expertise of local organizations and local match. Points will be awarded for collaboration with the community's electric or natural gas utility, partnership with community and technical colleges and local businesses including commercial or residential building contractors. Communities may use the funds for energy assessments or education activities. No funds will be spent on equipment. Applications will be accepted from Oct. 1-Dec. 31, 2012, with program activities occurring from Jan. 1-Sept. 30, 2013. The program will be supported with $50,000 from SEP funds.[331]

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[327] Ibid
[328] DSIRE, "First Energy (Mon Power and Potomac Edison).
[329] West Virginia Division of Energy, "Buildings".
[330] Ibid
[331] Ibid

C. Low-income Weatherization Assistance Program

The West Virginia Governor's Office of Economic Opportunity (GOEO) manages the state's WAP program. GOEO has established contracts with 12 regional agencies that employ trained weatherization crews to install energy efficiency and conservation measures in low-income homes based on energy audits and diagnostic testing. Examples of such improvements include "installing insulation, reducing air-infiltration, performing heating and cooling tune-ups and modifications, and when appropriate, replacing heating units for energy efficiency and safety."[332] Applicants meet basic eligibility requirements when their annual gross income from all sources is at 200% of the Office of Management and Budget's (OMB) poverty guidelines for a given family size and if they have previously received cash assistance payments under Title IV of XVI of the Social Security Act during the preceding twelve months.[333] The U.S. DOE-sponsored program was funded through 2011 by specific federal backing from the ARRA. USDOE appropriations, Low Income Energy & Heating Assistance Program (LIHEAP) fuel assistance funds, and utility partnership funding are all continuing contributing sources for the low-income WAP. By utilizing these varied funding sources, the program had weatherized more than 3,300 WV low-income homes by December 2010.[334]

D. Relevant Federal and State Industrial EE Initiatives in WV

West Virginia was one of the 12 states awarded federal funding for the Save Energy Now program in 2009. The state received $9 million in funding to deliver industrial energy efficiency programs within the regional project area of West Virginia, southwestern Pennsylvania, eastern Ohio, central and eastern Tennessee, central and eastern Kentucky, and south western Virginia. The resources granted were eligible to be used in such activities as "energy assessments, training in ITP software tools, technology demonstrations, and energy management certification pilot programs."[335] West Virginia University (WVU) is responsible for overall project management and coordination. WVU also conducts energy assessments in West Virginia and eastern Ohio, while they contract with EE partners to fulfill the energy assessment obligations in other regional states.[336] As of March 2011, 12 enhanced energy assessments have been delivered throughout the region, resulting in the identification of potential energy savings of 2,035,333(MMBtu/yr) and financial savings of $15,801,361 per year.[337]

The WV project team is responsible for developing a comprehensive package of services that includes energy assessments via the IACs and energy management technical resources. For instance, an internet-based knowledge center is being planned to provide specific information to plants concerning the results of their assessment and educational resources pertaining to energy efficiency improvements. The team is also developing a Regional Industrial Energy Efficiency Marketing and Outreach Center to "promote the participation in the Regional Partnership, showcase success stories, provide information to the media, and serve as the central point of

[332] West Virginia Governor's Office of Economic Opportunity, "Weatherization".
[333] Ibid
[334] Ibid
[335] Advanced Manufacturing Office, "Software Tools".
[336] Cullen, Crowe, et al., "Save Now".
[337] Ibid

contact for inquiries about industrial energy efficiency tools, services, and resources."[338] The development of a sustainable energy management system is also a relevant part of the Save Energy Now mandate.

The Manufacturing Extension Partnership (MEP) is another federally-funded source that aids industrial manufacturers in their EE efforts. MEP acts as a non-profit organization to consult small and medium-sized manufacturers on issues related to "lean manufacturing, strategic management, quality initiatives and systems, growth planning, HR and environmental issues among others."[339].The organization operates as a nationwide network with programs in each state funded from the U.S. Department of Commerce. The West Virginia Manufacturing Extension Partnership (WVMEP) is located in Morgantown. It offers a service package for the industrial sector titled E3 which is aimed at utilizing "specific tools to address process, energy, and environmental issues."[340] The E3 service delivers comprehensive assessments which identify opportunities to reduce energy bills, cut waste, and improve process efficiency. The WVDOE partners with this program by providing $30,000 from SEP funds which are used in performing the carbon footprint evaluations relevant to the environmental assessments.[341]

It is important to note that West Virginia also has a federally-funded, state-administered program titled Industries of the Future-West Virginia (IOF-WV) that offers full plant assessments at manufacturing facilities within the state. In 1997, West Virginia became the first state to launch a state-IOF program.[342] The key distinction between the IOF-WV program and the IACs previously discussed is that the IOF program provides a no-cost assessment to industrial manufacturers who do not meet the energy expenditure criteria established under the IAC programs.[343] The WVDOE contracts with WVU's IAC to complete the assessments. The WVDOE plans to continue this partnership by providing a total annual budgeted amount of $50,000 in stripper-M funds to meet a goal of 10 annual assessments.[344] From its inception in 1997 to 2011, the IOF-WV program has facilitated research and development projects, assessments, and workshops related to industrial EE. Over the years, the program has consulted over 250 companies, trained over 500 people in EE best practices, and produced more than $18.4 million annually in energy savings.[345]

VIII. Comparison of WV Utility Rebate Incentives

West Virginia's only form of financial incentives for implementation of EE in the state comes in the form of utility rebate programs. Other neighboring states such as Ohio, Pennsylvania, and Maryland have utility rebate programs offered by the same utilities as West Virginia. Those utilities are American Electric Power (AEP) and FirstEnergy. It is important to note how West Virginia's programs compare to similar programs offered by the same utilities in different states

338 Office of Energy Efficiency and Renewable Energy, "Regional Assessment".
339 Source Authority, "Manufacturing Extension Partnerships".
340 WVEMP, "E3".
341 West Virginia Division of Energy, "Industry".
342 Irwin, "Industries of the Future".
343 National Research Center for Coal and Energy, "Assessment Programs".
344 West Virginia Division of Energy, "Industry".
345 Cullen, "National Recognition".

A. Maryland

FirstEnergy's (FE) Potomac Edison power company operates a residential EE program in the state of Maryland as well. The program is geared towards offering residential electric customers incentives for upgrading their appliances and HVAC equipment to more energy efficient technologies. Eligible EE technologies include clothes washers, refrigerators, dehumidifiers, lighting, heat pumps, central air conditioners, duct/air sealing, building insulation, comprehensive measures/whole building, room air conditioners, appliance recycling, and electronically commutated motors.[346] All appliances are limited to one rebate per customer per year except for room air conditioning units which are eligible for 3 units per customer.[347] Customers upgrading building insulation are eligible for rebates of 15% of the cost.[348] The FE program in Maryland offers incentives for a wider array of EE technologies than the WV ApCo residential program. Residential programs in both states offer free installation of lighting and other similar upgrades through an in-home energy audit. Through Maryland's FE Quick Home Energy Check-up an energy auditor will evaluate a home's efficiency and can install upgrades such as CFLs, faucet aerators, and low-flow showerheads.[349]

The Potomac Edison Commercial and Industrial Efficiency Rebate Program is available to FE electric customers in the Maryland service territory. Commercial, industrial, governmental, and non-profit customers are eligible for rebate incentives related to EE equipment upgrades. Authorized rebates include lighting, controls, sensors, traffic signals, exit signs, heat pumps, air conditioners, chillers, variable frequency drives, food service equipment and other non-prescriptive measures. Custom projects must meet a minimum energy savings target of 50,000 kWh/yr, while custom buildings must meet a minimum energy savings goal of 20,000 kWh/yr.[350] Similar to the FE residential program, the FE commercial rebate initiative in Maryland is more expansive than similar WV AEP and FE programs in terms of rebate offerings. This FE program also differs from WV's ApCo and FE programs in that energy audits are made available to commercial customers. Potomac Edison offers a no-cost assessment to commercial customers with an annual demand of 60 KW or less.[351]

B. Ohio

AEP's Ohio Electric Residential Energy Efficiency Rebate Program is similar to West Virginia's AEP (ApCo) residential program in that in-home energy assessments and audits are used as distinct means to identify and implement energy savings measures in residential customers' homes. The Ohio program does not include these measures as free initiatives, however. The energy assessment costs $25 but includes approximately $100 of energy saving equipment installed by a qualified auditor. This includes installation of up to 12 CFLs, two low-flow faucet aerators, one low-flow shower head, one LED night light, 5' of pipe wrap and a programmable thermostat.[352] The in-home energy audit is a more comprehensive assessment which includes the

[346] DSIRE, "First Energy (Potomac Edison)".
[347] JACO Environmental, "Rebate Program".
[348] DSIRE, "First Energy (Potomac Edison)".
[349] Potomac Edison, "Energy Check-up".
[350] DSIRE, "First Energy (Potomac Edison)".
[351] energysaveMD, "Audit Program".
[352] DSIRE, "AEP Ohio (Electric)".

same services as the energy assessment in addition to comprehensive diagnostic tests such as a blower door test to discover air infiltration and a combustion efficiency test to measure appliances. This service costs $50 dollars for AEP's Ohio residential customers.[353] Similar to West Virginia, a number of efficiency technologies are available for rebates for residents once they are made aware of the possible efficiency upgrades. However, the Ohio rebate program includes a more comprehensive list of available technologies. AEP Ohio also has a residential energy efficiency incentive for gas-powered residences with similar provisions to that of the AEP electric incentives.[354]

AEP's Ohio Commercial Energy Efficiency Rebate Program is applicable to all non-residential sectors and includes incentives to upgrade to more energy efficient lighting in facilities. Nonresidential customers must apply for preapproval to insure funds availability. Eligible projects include screw-in compact fluorescents, hardwired compact fluorescents, conversion of T12 to T8 lamps, LED fixtures and lamps, LED exit sign retrofits, and lighting occupancy sensors among others.[355] For small businesses with annual consumption less than 200,000 k/Wh, AEP also provides rebates for recommended equipment, retrofits, occupancy sensors, refrigeration controls and other technologies following the results of an energy assessment.[356] West Virginia's C&I program offers similar technologies and lighting retrofit options. However, the lighting initiative within AEP's Ohio program contains a higher maximum incentive level than West Virginia's program. In Ohio, the lighting incentive is generally 50% of the project cost or $300,000.[357] In West Virginia, a similar incentive has a $150,000 cap per account per year.[358] Also, it is important to note that relevant sectors for West Virginia's program are commercial and industrial only. Ohio's program is relevant to all nonresidential sectors which include commercial and industrial, but also nonprofit, schools, local government, state government, federal government, and institutional organizations.[359]

The FE Ohio Commercial Energy Efficiency Program offer rebates for the installation of certain EE improvements for commercial, industrial, nonprofit, schools, local government, state government, agricultural, and institutional customers. Incentives help cover the cost of energy efficiency upgrades involving HVAC equipment, commercial cooking equipment, motors, variable frequency drives, lighting measures, and custom measures.[360] The FE High-Efficiency Audit Program offers partial rebates to commercial customers for completion of facility audits to identify feasible energy saving measures[361] The West Virginia program offered by FirstEnergy is applicable to the same nonresidential sectors, but the eligible technologies are related to lighting measures only. The Ohio program requires preapproval due to the variety of measures available to nonresidential customers, while the WV program is prescriptive with a maximum incentive of $0.05/kWh of first year savings for lighting applications.

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[353] AEP Ohio, "In-home Energy Programs".
[354] DSIRE, "AEP Ohio (Gas)".
[355] DSIRE, "AEP Ohio, Commercial Energy".
[356] AEP Ohio, "Express Program".
[357] AEP Ohio, "Incentives for Common Energy".
[358] Appalachian Power Company, "C&I Prescriptive Program".
[359] DSIRE, "AEP Ohio, Commercial Energy".
[360] Ibid
[361] FirstEnergy, "Audit Program".

C. Pennsylvania

FE's utility company, West Pennsylvania Power, offers a Residential EE rebate program with incentives for adoption of various efficiency technologies. Eligible efficiency technologies include washers, dryers, dish washers, CFL bulbs, room ac units, water heaters, central AC units, heat pumps, programmable thermostats and other appliances.[362] Most incentives have a limit of one rebate per customer per year except for room AC units which have a maximum incentive of 2 per customer.[363] Similar to the program offered to ApCo's WV residential customers, an in-home energy audit including installation of $50 of EE improvement products is available to residential customers of West Penn Power. However, the West Penn program applies a $50 fee for the cost of audit, whereas the WV program includes the audit and energy saving measures as complementary.[364]

The West Pennsylvania Power Commercial and Industrial Energy Efficiency Rebate Program offers various rebates to eligible customers adopting EE measures and equipment. Qualifying technologies include lighting, lighting controls/sensors, chillers, heat pumps, central air conditioners, custom/others pending approval, and led exit signs.[365] The program also allows for non-prescriptive measures to be installed upon approval from program administrators and passing of a Total Resource Cost test.[366] The ApCo program offers similar incentives for commercial and industrial customers. However, the West Penn program offers the incentives to a broader range of applicants including nonprofits, schools, local and state governments and other institutions.[367] Furthermore, the FE commercial program offered in WV is less comprehensive in terms of the scope of efficiency offerings. The WV program limits rebates to lighting initiatives, while the West Penn program offers incentives in most segments of EE improvements.

FirstEnergy operates another residential EE rebate program for its Pennsylvania Electric Company, Metropolitan Edison Company, and Pennsylvania Power Company. Qualifying technologies include washers, refrigerators, dehumidifiers, water heaters, lighting, heat pumps, central and room air conditioners, programmable thermostats, weatherization, windows, comprehensive measures/whole building, custom measures, and personal computing equipment.[368] These Pennsylvania FE programs facilitate a home energy audit program with installation of EE upgrades as well. The audit is $50 to FE residential customers, and it includes the installation of up to $50 of energy-saving products.[369] Another interesting aspect of this FE rebate program is the Appliance Turn In component. This aspect allows customers to recycle their old refrigerator/freezer and/or air conditioning unit in order to receive a $50 and $25 check, respectively. A contracted company will pick up the appliances from the customers' homes.[370] Compared to the WV ApCo and FE residential programs, the Pennsylvania FE program is more comprehensive in terms of the scope of rebates offered. Also, the WV program does not offer

[362] DSIRE, "First Energy (West Penn Power)".
[363] JACO Environmental, "Appliance Turn-in Program".
[364] FirstEnergy, "Walk Through Energy Audit Program".
[365] DSIRE, "First Energy (West Penn Power)".
[366] EnergysavePA, "Custom Incentive Program".
[367] DSIRE, "First Energy (West Penn Power)".
[368] DSIRE, "FirstEnergy (MetEdison, Penelec, Penn Power)".
[369] FirstEnergy, "Walk Through Energy Audit Program".
[370] JACO Environmental, "Appliance Turn-in Program".

any appliance turn in component to customers. However, the home energy audit for Pennsylvania's FirstEnergy companies is fee-based for customers, while the ApCo audit is free of charge to residential customers.

The FirstEnergy Commercial and Industrial program for the Pennsylvania Electric Company, Metropolitan Edison Company, and Pennsylvania Power Company is similar in scope to the program offered by the West Penn power company. The program offers EE incentives to sectors with commercial, industrial, government, schools, and institutional applications. Qualifying technologies include washers, refrigerators, water heaters, lighting, lighting controls/sensors, chillers, heat pumps, central air conditioners, motors, motor VFDs, custom measures pending approval, LED exit signs, vending machine controls, commercial refrigeration equipment, personal computing equipment, food service equipment, audit program, and LED Lighting.[371] This FirstEnergy utility rebate program offers a wider array of eligible technologies than what is offered through the WV ApCo and FE Potomac Edison programs. Similar to the West Penn program, this initiative allows for non-prescriptive incentives for commercial customers. The West Virginia programs available to commercial customers offer prescriptive rebates only. Table 9 summarizes the eligibility of various categories of incentives for each of the regional utilities:

Table 9: Summary of Regional Utility Rebate Eligibility

		Eligible Efficiency Technology Rebates							
Utility Program	**State**	**HVAC**	**App.**	**Light**	**Weath.**	**Non-pre**	**Mnt.**	**Maj Renov.**	**Audit**
FE (P. Edison) Res.	MD	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes (No Cost)
FE (P. Edison) C&I	MD	Yes	Yes	Yes	No	Yes	No	Yes	Yes (No Cost)
AEP Ohio Res.	OH	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes (Fee-based)
AEP Ohio Com.	OH	Yes	Yes	Yes	No	Yes	No	Yes	Yes (No Cost)
FE Ohio Com.	OH	Yes	Yes	Yes	No	Yes	No	Yes	Yes (Partial cost)
FE (W Penn) Res.	PA	Yes	Yes	Yes	Yes	No	Yes	No	Yes (Partial Cost)
FE (W Penn) C&I	PA	Yes	No	Yes	No	Yes	Yes	Yes	Yes (No Cost)
FE (M. Edison) Res.	PA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes (Partial cost)
FE (M. Edison) C&I	PA	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes (Partial cost)
AEP (ApCo) Res.	WV	Yes	No	Yes	Yes	No	Yes	No	Yes (No Cost)
AEP (ApCo) C&I	WV	Yes	Yes	Yes	No	No	No	No	No
FE (P. Edison[2]) Com.	WV	No	No	Yes	No	No	No	No	No

[1] HVAC= Heating Ventilation and Air Conditioning-related; App. =Appliances (i.e. dishwashers, clothes washers, refrigerators, freezers, etc.); Weath. =Weatherization measures (i.e. duct/air insulation or building insulation); Non-pre= non-prescriptive or custom incentives; Mnt. = Maintenance (i.e. HVAC tune-up); Maj Renov. = Major renovation/whole building; Audit: "Fee-based" indicates total consumer cost burden, while "partial" indicates a consumer bearing only a portion of cost of incentive because of availability of partial rebate.
[2] The rebates offered to First Energy Potomac Edison customers in West Virginia are the same rebates offered to First Energy Mon Power customers. For this reason, Mon Power's eligible rebates are not listed in the table.

[371] DSIRE 2012, "FirstEnergy (MetEdison, Penelec, Penn Power)".

IX. A Regional Comparison of EE Initiatives

West Virginia's placement among other states in terms of their EE program development has been noted in many cases already. However, a closer look will now be given to comparing[372] the scope of WV's programs to other ARC states. Points of comparison will be made in terms of financial incentives such as tax incentives, rebate programs, grant programs, and loan programs applicable to residential, commercial and industrial sectors. Additionally, the rules, regulations, and policies for EE will also be examined regionally from a comparative perspective. It is important to note that local initiatives are excluded in the summation.

A. West Virginia

Of the various opportunities for financial incentives in EE, West Virginia has only adopted one area of incentives: rebate programs. Specifically, the state has three utility rebate programs that are operated by Appalachian Power and FirstEnergy.

In terms of rules, regulations, and policies for EE, West Virginia has adopted building energy standards for public buildings that comply with IECC 2009 referencing ASHRAE 90.1 2007. The statewide adoption for construction of private residential and commercial buildings is consistent with IECC 2003 and ASHRAE 90.1 2001 standards, respectively.

B. Alabama

In Alabama there are eight utility rebate programs related to the adoption of EE technologies. The state has eight EE loan programs: six are sponsored by utilities and two are sponsored by the state government.

New Alabama State buildings must comply with standards as prescribed in the IECC 2006 building code. Effective October of 2012, construction of new residential buildings must comply with 2009 International Residential Code (IRC)[373] standards with some amendments, and construction of new commercial buildings must comply with 2009 IECC standards.

C. Georgia

The Clean Energy Tax Credit in Georgia is the one tax incentive related to EE adoption in Georgia. The state hosts 20 utility rebate programs and 8 loan programs relevant to EE technologies. Of the eight loan programs, one is sponsored at the state level and the remaining seven are utility-sponsored.

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[372] Sources of comparison are derived principally from information gathered from the DSIRE Summary tables. See http://www.dsireusa.org/summarytables/finee.cfm & http://www.dsireusa.org/summarytables/rrpee.cfm

[373] IRC is a code published by the International Code Council that establishes residential standards in terms of building, plumbing, mechanical, fuel gas and electrical requirements for one- and two-family dwellings in one code.

Georgia public building standards are upheld to achieving efficiency standards 30% above ASHRAE 90.1 2004. Residential standards are based on IECC 2009, and commercial buildings must meet ASHRAE 90.1 2007 as referenced in IECC 2009.

D. Kentucky

There are two EE tax incentives in the Commonwealth of Kentucky. They are called "Energy Efficiency Tax Credits" and are applicable to both personal and income taxes. Furthermore, Kentucky hosts 23 rebate programs: 22 are utility-sponsored and one is state-sponsored. There is one EE grant program under Kentucky's Office of Agricultural Policy which applies to both the commercial and agricultural sector. In addition, there are five loan programs related to EE in Kentucky of which three are utility-sponsored and two are state-sponsored.

Kentucky maintains two energy standards for public buildings. One standard is applicable to general public buildings, and it requires that construction and major renovation meet building certifications depending on a life-cycle cost analysis. The Kentucky Energy Efficiency Program for Schools (KEEPS) is a voluntary standard and is applicable specifically to construction and major renovations in public schools. The program encourages schools to report energy use reduction and energy savings. It also provides assistance to school districts that renovate or construct new buildings and choose to adopt EE technologies. The building code established for non-government buildings in Kentucky is based on the adoption of IECC 2006 and IECC 2009 standards for residential and commercial applications, respectively.

E. Maryland

There are three tax incentives in the state of Maryland related to EE. One incentive is a sales tax holiday related to the purchase of EE technologies. The other two are property tax credits[374] related to the construction and/or renovation of high performance buildings and the installation of energy conservation devices. Maryland also has 18 rebate programs for efficiency of which 17 are utility-sponsored and one is state-sponsored. Eight EE loan programs also exist at the state-level.

Maryland had initially established minimum efficiency appliance standards in 2004 with their Energy Efficiency Standards Act (EESA). However, despite subsequent amendments and additions, Federal guidelines for appliance standards have since preempted state-issued standards. In terms of energy standards for public buildings, Maryland previously required energy use reduction in state buildings of 5% by 2009 and 10% by 2010 relative to a 2005 baseline, Similarly, LEED[375] Silver or a comparable rating was required for new state construction, renovations, and new schools that receive state funding. Maryland is the only state

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[374] It should be noted that the property tax credits for EE are applicable statewide but adopted on a local level based on Maryland's opt-in and opt-out policy for county enforcement.

[375] Developed by the U.S. Green Building Council (USGBC), Leadership in Energy and Environmental Design (LEED) is a framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions. LEED certification provides independent, third-party verification that a building, home or community was designed and built using strategies aimed at achieving high performance in key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

in the ARC to have already adopted IECC 2012 and ASHRAE 90.1 2010 standards for residential and commercial buildings.

F. Mississippi

Within the state of Mississippi there are 12 utility rebate programs related to EE. There are also two utility-sponsored loan programs applicable to the residential sector. A state-sponsored loan program for commercial and industrial energy consumers is also available in Mississippi.

Standards related to the building energy code in Mississippi are implemented on a voluntary basis within the residential and commercial sectors. ASHRAE 90.1-1975 is the voluntary code within both sectors. However, the code is mandatory for public buildings, state-owned buildings, and high-rise buildings constructed within the state.

G. New York

The state of New York has a property tax incentive related to energy conservation improvements on residential property. The incentive is a property tax exemption, and it applies to 100% of the value added to the residence by the improvement. In terms of rebate programs, New York has 42 which are related to EE. Seven are state-sponsored rebate programs, while 35 are utility programs. New York has also implemented three state loan programs and three state grant programs concerning the adoption of EE measures within residential, commercial, industrial, low-income, and other relevant sectors.

New York has appliance efficiency standards for consumer audio and video products and digital television adapters. Furthermore, energy-consuming equipment used in state buildings must adhere to EnergyStar specifications. Construction of new state buildings and substantial renovations must meet LEED guidelines in New York. However, the general building code for residential and commercial buildings follows standards of IECC 2009 and ASHRAE 90.1 2007, respectively. New York also supports energy efficiency education, outreach, research and development, and low-income energy assistance though a system benefits charge (SBC) program. The state's six investor-owned electric utilities support the program through collection of a surcharge on utility customers' bills.

H. North Carolina

There is one tax incentive for adoption of EE technologies in North Carolina. The state offers a 100% sales tax exemption for qualifying Energy Star appliances during a one-day "sales tax holiday" that occurs annually. North Carolina's rebate programs are substantial in that they have 26 utility-sponsored and 2 state-sponsored rebate programs. There are also eight EE loan programs implemented within the state. Seven are utility loan programs and one is a state loan initiative that grants cities and counties the right to establish revolving loan programs to finance renewable energy and energy efficiency projects that are permanently affixed to residential, commercial or other real property.

Construction of new state buildings in North Carolina must surpass energy building code standards as defined in ASHRAE 90.1 2004 by 30%. Major renovations of public buildings must exceed the same code by 20%. The IRC 2009 and IECC 2009 are the basis for the state-developed 2012 North Carolina Energy Conservation Code which applies to both residential and commercial sectors.

I. Ohio

Ohio has no tax incentives in place to promote EE adoption within the state. However, there are 25 utility rebate programs offered by a variety of utilities and applicable to all sectors. There are also five loan programs offered in Ohio that promote EE initiatives, two state-sponsored and three utility-sponsored.

Ohio has various rules related to energy standards for public buildings. All new public school construction must achieve LEED Silver certification, with a goal of gold certification. Other public buildings meeting a certain size requirement will undergo a necessary life-cycle cost analysis and energy consumption analysis prior to construction. Furthermore, Ohio requires that State institutions of higher education develop efficiency guidelines for capital improvement projects and leasing of buildings.

In terms of general building energy code standards, Ohio has developed two codes, the 2011 Residential Code of Ohio (RCO) and the 2011 Ohio Building Code (OBC). The 2011 RCO is based on the 2009 IECC and 2009 IRC standards, and it will become effective beginning 2013. The 2011 OBC is Ohio's commercial code, and it is based on standards established within the 2009 IBC, 2009 IECC, and ASHRAE 90.1 2007.

Ohio's Advanced Energy Fund is a public benefits fund used to provide grants for EE and renewable projects to different economic sectors. Previously the fund was supported by a uniform fee placed on customers of the state's investor-owned utilities. However, the collection of these fees expired at the end of 2010, and additional funds are now only accrued based on the imposition of alternative compliance payments.[376]

J. Pennsylvania

There are 15 utility rebate programs in effect in Pennsylvania which relate to the adoption of EE measures and technologies. One utility also sponsors an EE loan program in the commonwealth, while the other five EE loan programs are enacted at the state-level. Pennsylvania also maintains four state-sponsored grant programs relevant to the adoption of EE.

Executive order 2004-12 requires state agencies to develop energy conservation methods for new construction and building renovations consistent with the oversight and coordination from the state's Department of General Services. Pennsylvania's general building energy code for the residential sector is the 2009 Uniform Construction Code. It is based on standards established by the 2009 IECC, but alternative compliance paths are offered through the 2009 IRC and 2009

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[376] Alternative Compliance Payments (ACPs) are penalties imposed on investor-owned utilities and retail suppliers within the state for not meeting specified benchmarks in terms of energy efficiency and renewable standards.

Pennsylvania Alternative Residential Energy Provisions. On the commercial side, the 2009 Uniform Construction Code also applies. Standards are based on IECC 2009 referencing ASHRAE 90.1 2007. In Pennsylvania, Sustainable Energy Funds (SEFs) have been developed on a regional basis. These funds act as public benefits programs to promote the development of sustainable and renewable energy. They are maintained by utilities within the state through the utilities' distribution rates.

K. South Carolina

There are two tax incentives offered in the state of South Carolina related to the adoption of EE. One is a personal income tax credit offered to residential sector to incentivize consumers to purchase energy efficient manufactured homes. The other is a 100% sales tax exemption on energy efficient manufactured homes purchased in the state between July 1, 2009 and July 1, 2019. In addition, the state has 18 EE rebate programs which are sponsored at the utility level. There are also four utility loan programs along with one loan program sponsored by the state which act as incentives for implementation of EE measures.

South Carolina has also implemented energy standards for public buildings which require that all major facility projects in the state must be designed, constructed, and receive at least two globes using the Green Globes[377] Rating System or receive the LEED Silver standard. For the building energy code for residential and commercial sectors, South Carolina has implemented IECC 2006 standards.

L. Tennessee

In Tennessee there are 14 utility rebate programs relevant to implementing EE initiatives in residential, commercial, and industrial sectors. There was one state-sponsored grant program that addressed EE initiatives within public schools, but it expired in June of 2010. There are a total of five EE loan programs in Tennessee. Three are administered at a utility level, and two are administered on a state level.

Although there are no specific building standards for public building construction in Tennessee, there are requirements related to purchase of equipment used by state agencies within public buildings. Tennessee requires that all State agencies purchase EnergyStar qualified equipment, appliances, lighting, and heating and cooling systems. The building code for new residential and commercial construction in the state is set at IECC 2006 standards.

M. Virginia

Virginia offers three tax incentives for EE. A personal income tax deduction of 20% of the sales tax paid by an individual for the purchase of a qualifying EnergyStar appliance is available until July 2012. Within the Commonwealth, there is also a four-day sales tax holiday where qualifying EnergyStar products can be purchased with a 100% sales and use tax exemption. Furthermore, a

[377] Green Globes is a building environmental design and management tool. It delivers an online assessment protocol, rating system and guidance for green building design, operation and management. It provides market recognition of a building's environmental attributes through third-party verification.

property tax incentive is offered to all sectors with buildings that exceed the statewide building code energy efficiency standards by 30% or that meet other criteria such as LEED and other certifications. This state incentive enables local jurisdictions to assess the property tax of such energy efficient buildings at a lower rate. Virginia also hosts 11 utility-sponsored rebate programs which apply to EE technologies. There is also one utility-sponsored EE loan program and two state-sponsored EE loan programs.

Virginia has also enacted requirements for public building energy standards. It is required that new buildings and major renovations be built to LEED Silver or Green Globes Two Globes Standards. Furthermore, agencies and institutions are instructed to purchase or lease EnergyStar-rated appliances and equipment. For residential and commercial building energy standards the IECC 2009 rules are mandatory statewide.

Table 10 and Table 11 summarize the scope of financial incentives and rules, regulations, and policies for each ARC State:

Table 10: Summary of EE Financial Incentives for ARC states

ARC State	EE Tax Incentives				EE Programs		
	Personal Tax	Corporate tax	Sales Tax	Property Tax	Rebate	Grant	Loan
Alabama	N/A	N/A	N/A	N/A	8U	N/A	2S; 6U
Georgia	N/A	1S	N/A	N/A	20U	N/A	1S; 7U
Kentucky	1S	1S	N/A	N/A	1S; 22U	1S	2S; 2U
Maryland	N/A	N/A	1S	2S	1S; 17U	N/A	8S
Mississippi	N/A	N/A	N/A	N/A	12U	N/A	1S; 2U
New York	N/A	N/A	N/A	1S	7S; 35U	3S	3S
North Carolina	N/A	N/A	1S	N/A	2S; 26U	N/A	2S; 7U
Ohio	N/A	N/A	N/A	N/A	25U	N/A	3S; 2U
Pennsylvania	N/A	N/A	N/A	N/A	15U	4S	5S; 1U
South Carolina	1S	N/A	1S	N/A	18U	N/A	1S; 4U
Tennessee	N/A	N/A	N/A	N/A	14U	1S	2S; 3U
Virginia	1S	N/A	1S	1S	11U	N/A	2S; 1U
West Virginia	N/A	N/A	N/A	N/A	3U	N/A	N/A

[1] DSIRE Financial Incentives for Energy Efficiency
[2] S= State-sponsored initiative; U= Utility-sponsored initiative; N/A= Not Applicable

Table 11: Summary of EE Rules, Regulations, and Policies for ARC States

ARC State	Appliance/Equipment Efficiency Standards	Energy Standards for Public Buildings	Public benefits Funds
Alabama	1S	IECC 2006	N/A
Georgia	N/A	30% above ASHRAE 90.1-2004	N/A
Kentucky	N/A	Life-cycle cost analysis/KEEPS	N/A
Maryland	1S	Energy use reduction goals/ LEED	N/A
Mississippi	N/A	ASHRAE 90.1-1975	N/A
New York	1S	LEED Guidelines	1S
North Carolina	N/A	30% above ASHRAE 90.1-2004	N/A
Ohio	N/A	life-cycle analysis/LEED (schools)	1S
Pennsylvania	N/A	Executive order 2004-12	1S
South Carolina	N/A	LEED Silver or Green Globes 2 globes	N/A
Tennessee	N/A	No public building standards; Energy Star equipment purchases	N/A
Virginia	N/A	LEED Silver or Green Globes 2 globes	N/A
West Virginia	N/A	ASHRAE 90.1-2007	N/A

[1] DSIRE Rules, Regulations, & Policies for Energy Efficiency
[2] S= State-sponsored initiative; N/A= Not Applicable
[3] Although discussed within this section, the General building energy codes are not listed in the tables as they are already summarized in Table 4 and Table 5 under the building code sections previously discussed.

X. Conclusions

EE should be considered a high priority resource within the West Virginia energy portfolio. EE programs can help alleviate the impacts of increasing energy demand, rising electricity rates, and above-average per capita energy consumption in West Virginia. There are also substantial ratepayer, utility, economic, and environmental benefits derived from greater reliance on EE as an energy resource. Additionally, EE complements traditional forms of generation by allowing utilities to use their generation assets more cost-effectively. The following outlines various conclusions reached about EE in terms of the objectives of the Energy Opportunities Document and its relative importance in West Virginia:

- Above average household energy consumption and lack of expansive programs increases the potential for West Virginia to reap substantial energy savings via enhanced EE policy
- Saving energy through EE is a more cost-effective option than traditional means of power generation. By reducing a utility's reliance on capacity expansion to meet greater energy demand, EE allows use of a least cost resource.
- Utility programs in West Virginia are less extensive than similar programs in surrounding states. Of the two utilities offering programs in WV, the ApCo residential and commercial program is more comprehensive.

- Methods for quantifying benefits and "avoided costs" vary by state and make direct utility program comparisons difficult.
- Utility administration of EE programs is regarded as the most effective approach for program administration given appropriate decoupling and/or incentive policies remove the throughput incentive. Utilities have the greatest level of interaction with customers, and they can more easily incorporate EE into their long-term integrated resource planning. Third party administration is seen as another viable means for program delivery because independent agencies do not face regulatory incentives discouraging the promotion of EE.
- Effective utility EE programs should reduce a utility's overall revenue between rate cases due to the decrease in energy consumption resulting from greater adoption of efficiency technologies and practices. Utility under-recovery of revenue may be adjusted by decoupling and other recovery adjustment mechanisms. True-up decoupling is unique from other mechanisms because it provides a framework that insures customers are reimbursed if utility over-recovery should take place.
- Establishing binding energy savings goals through EERS can help a program achieve greater savings than in the absence of a legislative mandate. Specific, measurable goals provide a standard by which progress can be based and reinforce the notion of EE as a quantifiable energy resource.
- Updating building energy codes is a vital component to a sound EE policy. Both residential and non-residential structures account for large proportions of energy use due to outdated design and construction standards. States with the greatest prioritization of EE maintain updated building energy code standards.
- Adoption of a consistent family of building codes enhances uniformity and streamline enforcement processes
- The nature of code promulgation in WV does not automatically lend to adopting the most recent and effective codes for building energy efficiency. The State Fire Commission proposes a series of codes for adoption but there is little opportunity within the commission to champion the causes of EE. Although some members of the commission are proponents of building energy codes, the principal mission of the commission is the adoption of a set of codes related to fire prevention and lifestyle safety.
- There is a high degree of discontinuity in terms of the enforcement of building energy codes within the state. The current structure misaligns the responsibilities of the promulgating agency with its mission since the enforceability of the series of codes adopted under their authority is limited mainly to fire codes. Limited local enforcement also makes updating building energy codes more of a symbolic act rather than a practical measure. Enforcing building energy code compliance of state-funded construction is also discontinuous as no specific entity has overarching authority to oversee all public building construction.
- Training on updated standards and practices is one of the most effective ways to sell EE to architects, engineers, and building owners. Courses and presentations from regional code experts are effective ways to communicate the benefits of building energy codes.
- Municipalities in the FirstEnergy service territory may receive the most benefit from EE community grants because there is no residential program or substantial commercial program where ratepayers can be educated on EE or receive an energy audit.

- State-administered industrial programs like the WVMEP E3 service and the IOFWV program are important because they offer consulting opportunities and energy assessments to small and mid-sized industrial firms who may not meet the eligibility requirements for IAC assessments.
- Quantifying energy benefits and establishing baseline levels of consumption by which program effectiveness can be evaluated is a key aspect to ensuring the efficacy of both state and utility EE programs.

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Public Hearing Speakers — Huntington

Name: Regan Quinn
Hometown: Charleston, WV
Organization:
Title:
Date:

Thank you for the opportunity to comment on the WV Department of Energy Five Year Plan.

While there are many excellent features of the Plan, such as the provision for a K-12 School Building Energy Program, and the encouragement of industrial energy efficiency, I am sorry to see there is little explicit acknowledgment of the risk of global climate instability caused by sustained and increasing CO2 emissions.

I recently viewed the newest version of the "Inconvenient Truth" slide show, and saw images of jet wheels sunk into melted tarmac, and heat buckled railroad ties from this summer's extraordinary heat wave; images illustrating the unexpected fragility of the country's infrastructure in the face of increasingly severe ~~heat waves~~. temperatures This is in contrast to this summer's broad-based failure of the Midwest corn crop due to heat and drought. Drought is a predicted outcome in global warming scenarios. In either case, these are not normal events and they are just the beginning. Inevitably, the physical properties of green house gases assure that with a continued upward course of CO2 emissions, global warming will worsen.

A Union of Concerned Scientists report has stated, "Many of the changes to the world around us are unfolding faster than scientists projected just a few years ago... indeed we may be very close already to triggering natural amplification mechanisms that could cause irreversible change with catastrophic consequences"[1]

Therefore, I would ask that the Plan acknowledge the grave and immediate risks presented by global climate instability due to man-made green house gases, and attempt a quantitative assessment of the potential for each of the elements of the Plan to reduce carbon emissions. Such assessment could eventually permit prioritizing state investment in accordance with the CO2 reduction efficacy of each program.

This might mean less emphasis be placed on coal but the outlook for coal has been dimmed anyway for economic reasons. See the August 14, 2012 Charleston Gazette editorial "Future? Coal mining outlook" and the Union of Concerned Scientists Report "A Risky Proposition: The Financial Hazards of New Investments in Coal Plants"[2]. There have been no successful commercial trials of carbon capture[3],

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[1] From Union of Concerned Scientists report, "A Risky Proposition The Financial Hazards of New Investments in Coal Plants" at page 2, quoting NAS, and NRC sources respectively.

[2] "Coal is a dead man walkin". Reported quote of Deutsche Bank chief Kevin Parker, UCS report supra at page 37.

although the Weizmann Institute in Israel has experimentally succeeded in using solar power to chemically transform the CO2 from coal combustion to hydrogen and carbon monoxide, both of which can be used as fuel sources according to the investigators[4].

Major renewable energy technologies have the potential to produce many times the current US power demand[5]. The Plan acknowledges that, "solar energy represents conceivably the single largest source of energy" (p 24). Because of the urgency of the climate instability problem, it is probably inadvisable to wait for the 5-10 years estimated before solar is as cheap as fossil fuel[6], a course the Plan appears to suggest. Financing options to encourage earlier adoption of solar and other renewable technologies should be addressed in the Plan. Ted Boettner's concept of a permanent trust fund for economic diversification is an excellent one. Similar trust funds have been successfully established elsewhere. Wyoming was the fourth state to establish such a fund, around 1974, and the fund is now worth $5 billion[7]. Regarding more short-term financing options, could the Plan express reasons why the State of WV should not take advantage of two billion dollars in federal funding available for energy efficiency and renewables projects via Qualified Energy Conservation Bonds issued under the Better Buildings Challenge[8]?

In relation to the School Building Energy Program, articulated in the Plan: it would be nice to see as a medium or long term goal the construction of net-zero school buildings. Such highly energy efficient buildings use no more energy than they produce via on-site renewable geothermal, wind and photovoltaics. Such buildings have reduced operating costs and can be constructed for less than a conventional school building costs, when energy savings are factored in. Examples include the Richardsville Elementary School in Warren County Kentucky The facts re this school are that a state grant for $3 million helped pay for PV panels, and the projected savings over the next ten years, thanks to energy efficiency and PV, is $8.6 million.

Thank you for your kind reception of these comments.

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[3] UCS report supra at page { }

[4] Story at Weizmann Institute of Science website re the NewCO2Fuels Ltd venture in Australia.

[5] UCS report supra. at page 9.

[6] UCS report supra. at page 10.

[7] Personal communication Jeremy Richardson of UCS.

[8] DOE announcement June 26, 2012 "Obama Administration Announces Major Steps Forward to Advance Energy Efficiency Efforts, Improve Access to Low-Cost Financing for States and Local Communities"

Name: Helen Gibbins
Hometown:
Organization: League of Women Voters of West Virginia
Title:
Date:

LWV LEAGUE OF WOMEN VOTERS

LEAGUE OF WOMEN VOTERS OF WEST VIRGINIA

September 5, 2012

To: West Virginia Division of Energy

From: League of Women Voters of West Virginia
President - Susan Watkins, susanwatkins@suddenlink.net
Presenter – Helen Gibbins, gibbins@frontier.com

Re: Comments on West Virginia's 5-Year Energy Plan

The League of Women Voters supports energy programs that achieve the following goals;

1) Helping our householders and businesses access their energy needs at reasonable costs; and 2) Lessening harmful impacts on the environmental costs to our water, air, land, and natural biota and climate change.

ENERGY EFFICIENCY

We believe that Energy Efficiency is a principal formula for achieving these goals. For this reason we support the Energy Efficiency Study's recommendations, especially as it has to do with updating energy efficient building codes and enforcement of the codes. In addition we favor

1) Adopting another rebate program for West Virginia customers.

2) Improving the program that upgrades more efficient heating and cooling for low-income households.

3) Promoting waste heat recovery and co-generation. Besides saving energy co-generation encourages the establishment of new businesses.

4) Passing **binding** energy efficiency goals on utilities.

5) Setting a mandatory energy standard on utilities will produce cost savings to homes and businesses.

RENEWABLE ENERGY RESOURCES

The League of Women Voters supports West Virginia increasing its reliance on renewable resources for generating energy.

1) Biomass

When researching the use of growing plants for conversion to fuels, West Virginia must not even consider Arundo donax because it is a highly invasive plant. West Virginia does not need another invasive plants to struggle with. Switch grass might be useful because it is a native grass, has deep roots, can be grown on marginal lands, and is a perennial plant.

The use of forest floor litter for energy should be evaluated thoroughly. Forest litter is essential to the health of the biota of forests and provides the nutrients for the next generation of trees.

2) Solar

West Virginia should extend its income tax credits to households that install solar energy systems. WV should also consider extending tax exemptions to the sales and local taxes. Unless the income tax credits are extended, they will expire in July, 2013.

The League also agrees with the Study that suggests the state monitor "options to effectively integrate wind and solar resources into the grid."

3) Wind -

All of the PSC's siting requirements must be strictly enforced. Recent research has found ways to minimize the killing of bats and birds. These methods must be required of our already established windmills as well as new ones.

4) Geothermal

The League agrees with the study that the development of geothermal energy in West Virginia should be studied along with possibly establishing demonstration sites.

FOSSIL FUELS.

It is predicted that easy-to-mine coal is becoming less available and natural gas production is increasing. For many years there have been discussions on how to replace the income from depleted fossil fuels. The League believes that West Virginia should study the benefits of establishing a permanent tax on the extraction of fossil fuels with the income to be used to create a fund for diversified economic development and for replacing future tax losses from coal production.

Methane should be used as a fuel rather than be allowed to escape from coal mines and natural gas wells.

We oppose the promotion of converting coal to gas. It is expensive and deleterious to the environment.

Thank you for allowing us to make comments on the Energy Plan.

Name: Robin Wilson
Hometown:
Organization: WV 350 Reversing Climate Change
Title:
Date:

I really am deeply concerned about finding a way to work together for a healthy economy and to reverse climate change. I was part of the PSC taskforce that worked on energy. Kelly Bragg and Terry Stafford were also part of that. Last summer our family was able to put up a self-installed solar power unit. I'm a little more knowledgeable about the solar part. I'll talk more about that later. Basically we have 3 megawatt hours of credit with Mon Power. So it's a very exciting project for me. I'm optimistic that future generations will look back at the hard work we've done, all of us, to make the transition to energy independence as well as the standard for renewable energy. It's going to be a huge task but we can do it. Partly because the need is to take into account __ climate change issue. It's a hard thing to weigh in because it's a highly politicized issue. But I think we should try to find a way to bring everybody on board on that one. So basically in terms of the 5-year energy plan, I think it would benefit if it was more proactive. There was a kind of feeling when I was reading the fossil fuel part that carbon taxes are on the way and we should probably get ready, but I think we could be much more proactive than that. My feeling is that we could use the characteristics of self-reliance and integrated energy design to make us ahead of the curve instead of waiting for these carbon taxes. West Virginians have a tradition of building our own homes and fixing our own cars and growing our own food. I think these traditions can help with the state's slogan that Mountaineers are always free. Nowadays we can not only do those things, we can generate our own electricity. So I think we need to take in to the whole integrated package here in West Virginia how we can save energy. It deals with every part of our society, even making our own entertainment. We can __ low-carbon alternatives now and we don't have to wait and we don't have to fight the carbon emission rules. Often people feel like it's the role of WV to fight the carbon emission rules, I think if we put our minds to it and work together, we could solve that problem and be an example to the rest of the country. I've been reading this book I really enjoy called Reinventing Fire by the Rocky Mountain Institute. They have lots of ways that you can use renewable energy and energy efficiency to reach a society that's __ on climate change. I think sometimes we don't realize that the people who are trying to discredit making a transition from fossil fuels are really doing a disservice to themselves. It's to all of our benefits and all of our self-interest to try to solve this problem. One sector cannot solve it alone. We need everybody on board. I think the energy plan would be stronger if we had graphs that showed the rise of carbon dioxide. We need to face this issue straight on. So I think we could have graphs that show how carbon dioxide is rising and also the projections for present and future environmental and global warming effects. I think this is important because without this in our energy plan, we can't really do an assessment about where we're going. WV has a strong __ variety of action steps that we can do to reverse carbon dioxide. We have the ability, because we have a large rural population, to work with __ the local food movement, which has a huge impact on energy. That's a huge sector of our energy consumption, goes to our food production. Basically I feel like as Americans we were able to mobilize to fight World War II, to mobilize to end segregation and get a person on the moon, I think we can solve these problems. I think we have sort of a can-do attitude in the US. We could be a leader in the world in finding a way to make not only energy independence but making renewable energy sustainability not only a way that we can pass on the economic opportunity but the environmental possibilities. Those are my prepared remarks. I just wanted to share since we have a little extra time some of my views on the solar issue, since I am an enthusiast on the issue. In order to compare the cost of coal-based power to solar power, you need to weigh in all the externalities of coal. And I'm not against coal miners, it was not anyone's fault, when WV started mining coal like you said in your fossil fuel report, there was no concept of what carbon dioxide would do to climate change. Now we know, and I think that we can weigh in the externalities of coal, not only climate change but health issues and other environmental problems. In terms of the intermittent issue on solar power, Germany and Denmark are great at renewable energy, and they've found a way to deal with that. And one of the easier ways to improve the reliability of it, and Christine pointed out to me, if you use coal power for backup, it's a big problem because a coal power plant can't be shut down and started up. From what I understand with gas power is that isn't such a big problem. So that's one of the things that I think would mitigate the intermittency of solar power, solar and wind power. One of the things that I've researched and I think Marshall University has researched is the electric cars. Since we have a surplus from the electric company. I'm really interested in, at the moment, we're stymied because the cars weren't designed for rural WV. If you look at the Volts and the Nissan Leafs, they're all just a few inches off the ground. I think we can research the possibilities, and WV has some of the best incentives for electric and hydrogen cars in the country, you should mention that in the energy plan and promote that. In terms of my solar power experiment, I have 16 pounds, which is 3.4 kilowatts but it's been more than enough. As I mentioned we have a surplus at the power company, we have credits, and my point is if we could get power to be solar, to the grid, and not just get credit, you'd see economic activity in a rural county like mine, Roane County. We have official 10 percent unemployment, we have an attitude that people can do stuff on their own, there's a real tradition of do-it-yourself. If we had solar power available that people could sell, people would be drawn to finding solutions that would enable it to be cheaper. In our case because we did it, do-it-yourself, it cut the price of solar installation in half. Aside from that, it feels good to switch from being energy consumer to an energy producer. Ours is online and it's fun to check out. As well as the solar power I think we should mention passive solar and solar water heat in our study. Because in Germany they have a system of passive where they've gotten energy use almost down to zero. In terms of combined heat and power which was mentioned earlier in I think it was Denmark, they require all new power plants to use wasted heat. In our system, two thirds of the energy burned from coal comes from wasted heat. As a result it's not a very efficient system. If we could find ways to use that heat __. The other thing I wanted to mention in terms of integrated design , and it was talked about in the Reinventing Fire book, is that once you change one thing it changes everything. If you go down the street and look at the Nissan Leafs, the body has carbon fibers and it's an ultra light car. They doubled the distance the car could go which is 100 miles on a good day, __. So I think it's important to realize that we have a lot of opportunities for doing integrated design. And I thank you all very much.

Name: Maribeth AndersonHometown:
Organization: Chesapeake Energy
Title:
Date:

Maribeth Anderson – From Chesapeake Energy.

I re-read the Energy Plan for the state, written five years ago. The word Shale was not in it, at least not that I could find. And that makes sense – it was written just as the shale gas opportunity was beginning to be felt in the mountain state. Since the last plan was written, West Virginians have learned that we can drill horizontally into the Marcellus Shale, creating prolific natural gas wells in the northern part of the state.

Across the country, newfound natural gas abundance from shale has lead to sustained low prices for a clean-burning, domestic fuel

Chesapeake Energy this morning has six rigs running in West Virginia's Northern Panhandle and in the Southwestern part of Pennsylvania, because of the natural gas liquids to be found there.

Of course, when we drill for natural gas we get methane --- but in the northern panhandle we also get ethane, propane, butane, and other NGL's or natural gas liquids.

Those NGL's can revitalize the chemical and manufacturing industry – because the new supplies of cheap shale gas are an important feedstock.

The American Chemistry Council put out a study, based on what it called a hypothetical but realistic 25% increase in ethane production, and from that it found 17-thousand new jobs inside the chemical industry, and 395-thousand new jobs in support of the chemical industry. A 32-billion dollar increase in chemical production, all because of the cheap shale gas.

It's why the West Virginia Manufacturers association is keeping a close eye on this resource. They held a "Marcellus to Manufacturing" conference this past spring, to bring together the best minds on this question of how to use the shale gas resource, to benefit manufacturing in west Virginia.

In the power generation sector, we are fortunate to have two fuels right here that can be used for electricity, and both should be part of the state's energy plan for power generation. Diversity in the fuel mix protects consumers and benefits power providers.

Abundant, affordable, domestic energy is here to stay and West Virginians are well positioned to benefit, particularly in terms of the chemical and manufacturing sectors. Other speakers from my company will speak in more depth at other sessions about natural gas in the transportation sector, the potential for research and development, and environmental benefits.

Name: Dustin White
Hometown:
Organization: Ohio Valley Environmental Coalition
Title:
Date:

Thank you for the opportunity to speak. I'll keep it short just to wrap it up. I'm Dustin White speaking on behalf of the Ohio Valley Environmental Coalition based in Huntington WV. First of all let me say that we are in agreement with the energy efficiency plan for the state. In addition we endorse all the recommendations of Energy Efficient WV. However, we do not understand the continued lack of leadership in developing and utilizing all sectors of truly renewable energy for public and economic stimulation. For example, WV could be making use of renewable energy technology in public buildings to serve as an example for the general public. It is simply not true that these renewable technologies are not available. WV falls short where other states and countries are excelling. Even China now has investments in renewables as part of its economic stimulus strategy. The use of all renewables together with other energy generation should be part of our state's energy production as a whole and not looked at singularly as energy solutions. Please refer to our written comments for ideas on how renewables can be developed. Thank you.

Name: Diane Bady
Hometown:
Organization: Ohio Valley Environmental Coalition
Title:
Date:

I'm Diane Bady, also representing the Ohio Valley Environmental Coalition. As Dustin pointed out, our organization strongly supports the recommendations of Energy Efficient West Virginia. And I just want to read several of those. We strongly endorse all the recommendations of the energy efficiency section of the proposed WV state energy plan. Thank you. Those are really good. Specifically we support the idea of an energy efficiency resource standard, to set long term goals in energy savings. We urge the plan to recommend integrated resource planning as a strategy to ensure utilities invest in all cost-effective energy efficiency and ensure that our utilities are making investment decisions in the long-term public interest. Along with the organization Energy Efficient WV, we're disappointed that the energy plan did not include any recommendations to support the development of co-generation or combined heat and power. There's potential for improvements in efficiency by capturing waste heat of industrial processes to create electricity. Other states have much stronger policies in place to allow co-generation facilities a long-term contract for their electricity production. Thank you.

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September 5, 2012

On behalf of the Ohio Valley Environmental Coalition (OVEC) based in Huntington, WV, we agree with the Energy Efficiency section of the purposed West Virginia State Energy Plan. Energy efficiency is often underutilized and over looked as a valuable stepping stone for cleaner energy. Energy efficiency measures would be financially beneficial to the public at large if broadly implemented. The state must follow through with this section of the plan in order to ensure a sustainable market in energy efficiency services and to require utilities to invest in cost-effective energy efficiency with continued public interest in mind.

In addition. OVEC endorses all recommendations of Energy Efficient West Virginia regarding this proposed state energy plan.

However, we are disappointed that there seems to be little interest in development of truly renewable energy sources within the state. We feel that West Virginia has the potential to begin the development of these resources. Often, cost is cited as the reason for not persuing these resources when many other states are advancing far beyond the state of West Virginia on renewable energy production. Even other countries seem to be advancing where West Virginia falls short. China now has investment in renewable energy as part of its economic stimulus strategy and leads the way in both use and manufacturing of renewable techniques.

With the right leadership and progressive renewable energy policies, West Virginia too could strive to be a leader in renewables and could pave the way for both public and private use that will provide local jobs and stimulate the economy.

OVEC has recommendations in several areas of the renewable sector. While the proposed WV Energy Plan states that renewable technologies are not easily available, the examples of other states shows that this is just not true.

Solar: West Virginia should provide more support in the growth of solar energy within the state, including development of new solar technology that would make use of solar more affordable and effective for individual use. An Op-Ed in the July 23rd edition of the Charleston Gazette by Bill Howley speaks of how solar energy can be utilized in such a way. This type of distributed solar energy could be used in public buildings, including schools. Even a few schools with a solar array connected to a battery storage system could provide strong examples for the public of the feasibility of this type of truly renewable energy

Geothermal: We encourage the state to thoroughly study the possibility of use of deep geo-

thermal energy sources in eastern West Virginia, and seek more federal funding and involvement for such feasibility research. The state should also support the development of conventional geothermal use in public buildings. Again, even a few public buildings or new school buildings which include conventional geothermal in their energy mix could set a positive example for the public.
OVEC has members who have successfully incorporated conventional geothermal in their home energy systems.

Community scale wind energy: We encourage the state to examine the feasibility of smaller community scale wind energy. Research has shown that this type of wind energy, as compared to large scale corporate wind, keeps jobs and profits within the state. The organization Windustry, based in Minneapolis, has worked to encourage the development of numerous community scale wind farms throughout the Midwest (windustry.org)

Biomass: State planners need to review reports from a West Virginia University sponsored conference of forest-products based biomass energy. This conference, held two or three years ago in Morgantown, included detailed research reports by WVU experts which showed that large scale bio-mass facilities are not sustainable over the long term. Liquidation of state forests for short term energy is unacceptable. We encourage the state to provide resources for Sally Shepard's initiative of growing and harvesting miscanthus for bio-mass production as highlighted in a June 14th, 2012 article in the Charleston Daily Mail.
It is our understanding that the technology has been developed for closed loop biomass facilities that limit the production of pollutants.

In conclusion, the state of West Virginia must encourage the development of truly renewable energy sources as other states have already done. We deeply appreciate the good recommendations in this plan for growth in Energy Efficiency, and ask that all of the recommendations of Energy Efficient West Virginia be implemented as well.

There must be use of all resources available and energy efficiency together for the benefit of the state, not only for improvement in energy consumption, but also for economic stimulus. There are already West Virginia companies that provide renewable energy services now, for example, Mountain View Solar. The use of combined resources should be studied as a whole, not individually, as is the case in this proposed state energy plan.

We Need Reliability in the Power Grid

excerpted from a July 23 *Charleston Gazette* op-ed by Bill Howley

During the recent power blackout tens of thousands of West Virginians practiced what electricity experts call "distributed generation," the production of electricity in small generating units close to where power is used.

The one thing we learned from the blackout is that if you can produce your own power, you don't have to depend on the power companies to send it to you over their deteriorating distribution system.

Most people think of power production as something they only do in emergencies, so they buy gasoline generators. These generators are noisy, produce toxic fumes, are expensive to run and depend on a fuel that is often in short supply exactly when you need it most. Once the emergency is over, the generator goes back in the garage and doesn't provide any value until the next blackout.

There is another way that is quiet, economical and will produce electricity for your home when the blackout is over. A solar panel array connected to a battery storage system, if it is sized properly, will get you through a week or more of no grid power with no noise, little or no fuel cost and no fumes. These kinds of systems are now affordable for most middle-income families.

These systems would be affordable to even more West Virginians if the Legislature and the Public Service Commission provided the kinds of incentives and renewable energy credits that most other states have adopted. Instead, in 2009, Gov. Joe Manchin and the Legislature passed an Alternative and Renewable Energy Portfolio Standard law that effectively blocks any support to homeowners with solar power systems.

If you think a solar power system is too expensive for your family or business, factor in how much the 2012 blackout cost you, along with the December 2009 blackout. Then factor in how much your electric rates have been going up in recent years, and how much more they'll rise to pay for emergency repairs from this new outage. Because your solar panels produce electricity every day (even on cloudy days), they will cut your electric bill all year long.

If you used a generator to produce electricity during the blackout, you know how reliable it is. Now you can begin to build on the expertise you gained from that experience and build yourself a smarter system. There are a number of solar power installers around our state. Contact them and get a cost estimate for the kind of system you want.

If you want to start with a backup system, you need a battery bank, but you don't need to create a system that will power your whole house. Identify exactly how much power you absolutely need in a blackout and build a system that will meet those needs. Let emergency planning be your starting point. You can always add panels later.

Many people don't have good sun exposure on their properties. If West Virginia's utility regulators were focused on real reliability, they would have supported small community power generation sharing using what are called "microgrids." Microgrids work great in urban areas where homes and businesses are closer together. Neighbors invest together in building a solar panel array in the location with the best sun exposure and share the power through computerized "smart grid" switching. During blackouts, the microgrid can be isolated from the larger grid and power stored in batteries can be shared.

So far, West Virginia political leaders have stood back and watched as our state's electrical system deteriorates from lack of investment by our out-of-state electric companies, and electric rates spiral upwards, paying for nothing but more and more frequent emergency repairs. They have made no effort to support the development of real reliability using community-based electricity.

If you want real reliability in your electrical system, don't wait around for politicians. Do your homework and design a home- or business-based system that doesn't depend on failed state leadership or power companies that won't invest in our state's obsolete grid. Then hire West Virginia businesses and West Virginia workers to make it happen.

Howley, is chairman of the Steering Committee of the Coalition for Reliable Power and writes at The Power Line, the View from Calhoun County and the Coalition for Reliable Power, web sites about electricity policy issues.

State solar power installers include PIMBY or MTV Solar or Alterra Renewable Energy (do an Internet search to find contact information for these companies). You will be surprised at how affordable your own system will be. You will have reliable electricity, and your "backup" system will produce power every day of the year. (Yes, solar panels produce power on cloudy days, too.)

EEWV

**Talking Points for the WV Division of Energy
State Energy Plan 2013-2017**

You can read the State Energy Plan and submit comments on the proposed State Energy Plan on-line at http://www.wvcommerce.org/energy/energyplan/comments/default.aspx **by close of business on September 7th.**

Mail comments to: 2013 West Virginia State Energy Plan
90 MacCorkle Ave SW
South Charleston, WV 25303

Email comments to: EnergyPlanComments@wv.gov

- I strongly endorse all of the recommendations of the Energy Efficiency section of the proposed West Virginia State Energy Plan.
- Specifically, I support the idea of an Energy Efficiency Resource Standard (EERS) to set long-term goals in energy savings. I agree that such a policy would spur greater utility investment in efficiency, would ensure a long-term market in energy efficiency services, and reinforce the concept of energy efficiency as a resource.
- Energy efficiency is a low-cost and underutilized resource for West Virginia. Utility-funded energy efficiency programs in WV are weaker than many programs in surrounding states, including programs offered by other AEP and FirstEnergy companies.
- I urge the Plan to recommend integrated resource planning as a strategy to ensure utilities invest in all cost-effective energy efficiency and ensure that our utilities are making investment decisions in the long-term public interest. IRP has been adopted by more than half of the United States and would require our utilities to submit long-term plans explaining how they will best meet future electric demand at the lowest cost.
- IRP would evaluate supply-side and demand-side resources, such as energy efficiency, on an equal footing and would show how much utilities should invest in energy efficiency as a resource.
- The Division of Energy should support transparent evaluation of all energy alternatives including gas plants, coal plants, renewable energy, co-generation and demand-side resources such as energy efficiency, conservation and demand response to meet the electric capacity needs of our state.
- I am disappointed that the Energy Plan did not include any policy recommendations to support the development of co-generation, or combined heat and power. There is potential for significant improvements in efficiency by capturing waste heat from industrial processes to create electricity. Other states have much stronger policies in place to allow co-generation facilities a long-term contract for their electricity production.
- The Division of Energy's decision to commission this report in three separate parts by Marshall University and West Virginia University demonstrates that West Virginia does not yet value the potential of integrated resource planning. It also means that resource options like co-generation (combined heat and power) fall through the cracks.

EXAMPLES of other states

Ohio Valley Environmental Coalition

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The West Virginia Energy Expansion Fund Act

September 2010

Renewable energy is now the primary energy investment vehicle:

-In the recession year of 2010, $200 billion was invested worldwide in renewable energy expansion, an increase of 30% over the previous year (*Wall Street Journal*, 2010).

-For the first time in the US, that same renewable energy investment has surpassed traditional fossil fuel investment (for the past two years in a row) (Ren21, 2010).

-In the US, renewable energy accounted for the majority of newly installed electricity production in 2009 (CESA, 2010).

-In the US, solar energy has grown by an average of 60% every year of the past decade (Ren21, 2010).

-Over the last five years, wind energy has grown 27% annually, and is the fastest growing source of electricity in America (Ren21, 2010).

WV has significant untapped capacity in the renewable energy sector:

-Not including solar energy and energy efficiency savings, WV has almost 5,000 MW of renewable energy capacity in just wind, biomass and hydropower, enough to power every residence in WV (WV Division of Energy, US Department of Energy)

Energy Expansion Funds (often called Clean Energy Funds) have a proven track record of performance in 20 states:

-Energy Enhancement Funds (EEFs) or Clean Energy Funds invested $1.9 billion across 20 states in the past decade, which leveraged $10.1 billion in additional funds in the same period (leveraging $5 for every $1 of state investment) (CESA, 2010).

-EEF states have committed over $4 billion in the coming decade (CESA, 2010).

-In OR, energy efficiency programs administered under the EEF four dollars are saved for every one dollar invested in energy efficiency (Energy Trust of Oregon, 2010).

-In NJ, over 4,000 solar installations have been stimulated by the EEF, saving solar owners an estimated $1.1 million annually (NJCEP, 2010).

-The Oregon EEF created 2,300 new jobs in the past decade, which has stimulated $7.6 million in additional wages and $11 million in new business income (Energy Trust of Oregon, 2010).

-The Oregon fund has over 1,500 private contractor affiliates that have implemented the EEF programs at over 300,000 residential, commercial, industrial, agricultural and public sites, achieving $65 million in energy savings in 2009 alone (Energy Trust of Oregon, 2010).

-Between 2002 and 2026, the Wisconsin fund is anticipated to create over 60,000 job years, generate $8 billion in sales for WI businesses, and increase disposable income in WI by over $4 billion (Wisconsin Department of Administration, 2007).

-From 1999-2005, under the NY State EEF, the number of private energy service companies operating in New York State increased from fewer that 10 to over 180 companies (NYSERDA, 2006).

-Illinois's EEF is estimated to generate by 2020 a $7 billion net increase in economic output, a $1.5 billion net increase in personal income, and 43,000 net new jobs, creating 7,800 new jobs by 2012 (University of Illinois, 2005).

-Under the EEF in Massachusetts, over $21 million is saved annually by energy efficiency measures, creating over 2,000 jobs in 2002 alone (MA Division of Energy Resources, 2004).

-Under the New York EEF, 4,900 net jobs were created between 1999 and 2008 (NYSERDA, 2009).

-In 2008 alone, EEFs resulted in the installation of over 12,500 new renewable energy projects (a 13 % increase over the previous year), which will generate 1.2 million megawatt-hours every year of operation (CESA, 2010).

Energy Expansion funds may be administered and utilized in several ways:

-There are several options for what administrative body manages the Fund: 1). pre-existing government agency can administer the fund, such as the Division of Energy, 2). a new, dedicated government agency can administer the funds, (common in the most successful EEFs), 3). an independent non-profit can administer the fund, 4). an electric utility can administer the fund.

-EEF activities are usually a combination of increasing capacity in both renewable energy and energy efficiency.

-EEF funds are typically disbursed by a combination of grants, rebates, loans, industry recruitment, and equity investments.

West Virginia's Energy Expansion Fund can be funded in a variety of ways:

- The single most common funding stream is a **systems benefit charge**, a modest surcharge on power bills based on consumption. These surcharges have been shown to be less than the benefits gained under the EEF, particularly if ratepayers utilize the energy efficiency programs of the EEF. Accordingly, demand for EEF programs are shown to increase as electricity rates increase.

- **Utility mergers** and buyouts have funded EEFs in other states. With a proposed $4.7 billion dollar buyout of Allegheny Power, Ohio-based buyer FirstEnergy is in a position to capitalize WV's Energy Expansion Fund by order of the PSC.

-Future energy development in West Virginia can be funded by the **energy wealth of the present**. In particular, the Worker's Compensation Severance Tax, expected to be fully funded and therefore taken off the books in 2013, is an opportunity to ensure continued investment (of approximately $80 million per annum) in energy infrastructure and jobs well into the future.

Name: Dean Cordle
Hometown:
Organization: WV Public Energy Authority
Title:
Date:

My name is Dean Cordle and I am a member of the WV Public Energy Authority, but I stand before you today as a citizen and an individual that is responsible for a chemical manufacturing facility. First of all the reports are excellent, they are very well supported factually and they are very, very informative. I did note in one of them that our CO_2 emissions, according to the EIA, are supposed to drop by 1% per year per capita, is that a fact? Natural gas is going to lead WV and the chemical industry out of the economic morass that we're in right now. On the renewable side, my company is responsible for operating the first renewable transportation fuel production facility in the state of WV. To this day it's still is the only one. Right now it's a __ because of the economic realities of running a biodiesel production facility. The facts are the materials don't exist here in the state of WV. The manufacturing costs were just too high. Which also was supported by a federal mandate which gave a dollar a gallon tax credit for every gallon of biodiesel produced. You simply cannot run a business when it's supported by a government subsidy like that. So there are economic realities when you're talking about renewables and how much they cost our __. But I believe the state of WV is on the right track, the energy efficiency aspect of what we're talking about here today was very well-written, and I think we stand to gain the most by implementing some of the recommendations in the document. What we can do as citizens is contact our legislature to get the standards adopted and passed and develop a program where we actually have enforcement not just oversight of these energy efficiency goals. I think we can really help all West Virginians if we do that. Thank you.

Public Hearing Speakers — Morgantown

Name: Jim Sconyers
Hometown:
Organization: WV Energy Savers
Title: President
Date:

We distribute free compact fluorescent light bulbs or CFLs, to low income northern WV citizens. This enables these folks to participate in energy conservation, while saving money on their electric bills. WV Energy Savers does its work because of the total absence of residential homeowner efficiency and conservation programs provided by our electric utility here in northern WV. Let me give you an example. When I shop in Maryland, I live near the state line, I can buy deeply discounted CFLs for about one dollar each. Why? Because the bulbs are subsidized by First Energy's Maryland power company, Potomac Edison. But when I come home to northern WV, I'm out of luck. There are no discounted bulbs for sale. Why? Because again, First Energy's WV power company, Mon Power, refuses to offer these consumer discounts. First Energy in WV apparently would rather burn coal than encourage conservation and efficiency. Clearly, First Energy, like most electric companies, sees the light when it feels the heat. Maryland legislators and regulators require First Energy to offer efficiency and conservation options to customers. West Virginia's legislators and regulators do not. Efficiency and conservation are what's called the "low-hanging fruit" of energy saving. They're cheap, clean and fast. WV's regulators must demand all electric utility decisions concerning rates and more must embrace robust efficiency and conservation plans. One additional comment I'd like to make, is how disappointed I am in these presentations today, which basically summarize trends rather than establishing meaningful serious policy and seem to be basically business as usual. I understand we can submit written comments today? Thank you.

Comments on the West Virginia Energy Plan
Morgantown 9/6/2012

Submitted by
Jim Sconyers, President
WV Energy Savers
304.698.9628 jimscon@gmail.com

My name is Jim Sconyers. I'm president of WV Energy Savers. We distribute free compact fluorescent light (CFL) bulbs to low income northern West Virginia citizens. This enables these folks to participate in energy conservation while saving money on their electric bills.

WV Energy Savers does its work because of the total absence of residential, homeowner efficiency and conservation programs provided by our electric utility.

Let me give you an example.

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But when I come home to northern West Virginia I'm out of luck. There are no discounted bulbs for sale. Why? Because First Energy's West Virginia power company, Mon Power, refuses to offer these consumer discounts. First Energy in West Virginia apparently would rather burn coal than encourage conservation and efficiency.

Clearly, First Energy, like most electric companies, sees the light when it feels the heat. Maryland legislators require First Energy to offer efficiency and conservation options to customers. West Virginia's do not.

Efficiency and conservation are the "low hanging fruit" of energy saving. They are cheap, clean, and fast. West Virginia regulators must demand that all electric utility decisions concerning rates and more must embrace robust efficiency and conservation plans.

Name: Cathy Kunkel
Hometown:
Organization: Energy Efficient WV
Title:
Date:

We're a statewide group promoting energy efficiency across all sectors of the state. I would urge the Division of Energy to implement the recommendations of the energy efficiency section of the draft plan. Particularly we strongly support the idea of an energy efficiency resource standard to the long-term targets for energy efficiency savings by our utilities. Experience in other states shows that this is an important driver of utility-funded efficiency programs. For example, in Pennsylvania utilities were required through their energy efficient resource standard to achieve savings of 1% of sales over two years. In Ohio, utilities were required to save 0.8 percent over two years. For comparison, in West Virginia, First Energy is only required to save 0.5% over five years, which is a target that the utility itself proposed. So I think adopting an energy efficiency resource standard is an important way to make sure that our utilities are offering a similar level of incentives in savings as they do in other states where they operate. We were also disappointed to see that the energy efficiency plan does not include recommendations supporting cogeneration or combining power although the report did note the benefits of cogeneration. There are a lot of advantages there including reduced line losses and grid stability benefits from distributed generation. It's a very efficient use of fossil fuels, up to 80% efficiency from re-using waste heat in power generation. It would allow industrial facilities __ compliance with new regulations. And considering that both our utilities have announced they are short on capacity and are looking to acquire additional capacity, now seems like an important time for the Division of Energy to be promoting cogeneration as an efficient use of fossil fuels and a means of increasing the industrial competitiveness in our state. Thank you very much.

Name: Stacy Gloss
Hometown:
Organization: Energy Efficient WV
Title:
Date:

I'm with Energy Efficient WV. Thank you for the opportunity to comment on the draft of WV's 5 year plan. First I strongly urge the Division of Energy to support all of the recommendations of the energy efficiency section of the plan. The plan provides a thorough and well-researched analysis of the status of energy efficiency policies in the senate in WV and surrounding states. I'd like to say that at the outset of this 5 year plan both of the large investor-run utility companies in WV are getting ready for cases at the Public Service Commission to purchase coal-electric generation capacity in spite of the fossil fuels report that says that capacity factors are declining. Coal stockpiles are increasing. Plant closures have been announced. New generating capacity is moving toward natural gas. In light of this WV needs a better plan than what investor-owned utilities are planning themselves. Given that Mon Power is looking to double their base rates, we feel that West Virginians deserve a transparent look at all of the alternatives, not just accepting the utilities' preferred power equipment. Supporting stronger policies for integrated resource planning would evaluate supply status and demand side resources on equal footing together showing how much our utilities should be investing in energy efficiency in our state. Integrated resource planning which has been adapted in more than half of all the United States of the union would require West Virginia's utilities to submit long-term plans to our Public Service Commission, explaining how they can meet future electric demand at the lowest cost. With robust integrated resource planning process, the identification of capacity shortages in that integrated resource plan would trigger requirements for the utility to issue request for proposals for additional capacity, allowing open competition between gas plants, coal plants, co-generation facilities, renewable energy and demand side resources to meet capacity. I'd like to say that

I am personally disappointed with the renewable energy section. I would like to encourage the Division of Energy to reconsider the comments by Dr. Kent about the challenges of transmission and transportation of renewable energy in WV. I would like to point out that there is a great need for WV to explore the ongoing challenges of the electricity transmission and transportation on an existing deteriorating transmission lines. I strongly encourage the recommendations of the energy efficiency section in the state's energy plan, urging the Division of Energy to advocate for the adoption of the energy efficiency resource standards in the next 5 years. We urge the Division of Energy to recommend integrated resource planning as a strategy within the next 5 years for insuring that WV utilities invest in all cost-effective energy efficiency to insure that WV utilities are making investment decisions in the long term public interest. Thank you.

Name: Aaron Sutch
Hometown:
Organization: Mountain Institute
Title:
Date:

I work with the Mountain Institute. The Mountain Institute promotes culture conservation in mountain communities. I am the energy program manager. First of all I would like to emphasize the fact that solar works, unlike the conclusion in the report that solar doesn't work for WV. And I would urge them, the authors of the report, to do a complete economic analysis. Sorely lacking in the report is an economic benefit of, or an analysis of economic benefits of solar. These are specific in 3 categories. First of all the grid benefits. Solar produces during peak demands, when peaking higher cost inefficient resources are constantly used. That's a benefit to the grid. It also benefits during blackouts which we have recently experienced here, and it also provides peak, or excuse me, ancillary services such as voltage support frequency regulation. Those are economic benefits that were not included in the report. Second is rate tier benefits. Solar provides a hedge against volatile fuel prices, we've seen that with the rising fuel costs, here in WV over the last 5 years. Utility rates have risen over 50 percent, that closely tracks the rising costs of fuel. Obviously solar and other renewables do not have that tracking based on that. The last one would be local economic benefits. Solar has been proven to provide twice as many jobs per unit of electricity as traditional fossil fuels. In addition to these jobs it provides communities an opportunity to take control of their energy destiny. So in this analysis I would highly encourage the authors or when they go back and hopefully revise the draft that they do an economic benefit based on some of the more current data that's out there. I would highly recommend the following action steps: a solar carve out of at least 1 percent here in the state of WV, this would help us with an SREC market based on compliance. It would also help move things forward as far as solar capacity which would build jobs out here in the state. Also as the report mentioned I concur with their recommendations to continue the WV tax credit which is 30 percent capped at 2000, and also allow non-utility generators to sell electricity. Non-utility generators could be solar, but it also could be combined heat and power, and other distributed generation sources which have been proven to be more efficient due to less line loss. Line loss currently in the United States is about 6 to 8 percent. Distributed generation, on site generation of electricity, would greatly reduce that and be more efficient. I appreciate the opportunity to comment. Thank you.

Name: James Kotcon
Hometown:
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Title:
Date:

Sierra Club
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Six Issues in the 2013-2017 West Virginia State Energy Plan

1) The **Energy Efficiency Plan** is helpful, but needs to go further. We support recommendations in the Plan for strong building codes, rate decoupling, and an Energy Efficiency Resource Standard, but the Plan should also include Integrated Resource Planning, and support for Combined Power and Heat facilities, as well as Distributed Generation.
2) The **Renewable Energy Plan** is biased and does not prepare West Virginia for the emerging renewable energy industries. The plan should recommend stronger support for renewables such as solar, wind, biomass and geothermal.
3) The **Fossil Fuels Plan** is hopelessly biased and needs to go back to the drawing board. It does not mention climate change, even when discussing pending rules to limit greenhouse gases.
4) We oppose coal-to-liquids facilities because of the high greenhouse gas emissions and excessive costs.
5) We oppose nuclear power because of the high costs and the dangers of radioactive waste disposal.
6) Because of our historic dependence on fossil fuels like coal and gas, the WV-DOE Energy plans need to prepare for a transition to a cleaner energy future.

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SIERRA CLUB
FOUNDED 1892

Sept. 6, 2012

2013 West Virginia State Energy Plan
c/o WV division of Energy
90 MacCorkle Ave SW
South Charleston, WV 25303

Please accept the following comments of the WV Sierra Club on the 2013-2017 WV State Energy Plan. The comments address each of the three studies individually.

Fossil Energy Opportunities for West Virginia (Draft 8-13-2012).

1) There is no mention of the impacts of climate change in the document, in fact, the word "climate" is never mentioned. Are the authors seriously attempting to propose a fossil energy policy for the state without even mentioning climate change? Although a "carbon emissions rule" and "greenhouse gas emissions" are mentioned, the document is devoid of any acknowledgement of why fossil fuel facilities need limits on their carbon emissions, and little direction is offered to the state or the industry on how to address climate change. An energy policy on fossil fuels that fails to address climate change leaves the state and the industry with little direction to address this critical issue. It is as if the BBER authors simply do not accept the reality of climate change, and hope that by refusing to say the words, the reality will go away. Will the WV Division of Energy actually pay taxpayers' dollars for a report so out of touch with reality? Please tell me this is going back to the drawing board.

2) The BBER authors' recommendation on nuclear energy appears to support repeal of the statutory ban on nuclear power plants. They state in their conclusions that "To attract nuclear power generation resources, the legislature must repeal those sections of West Virginia (code) that make those resources unobtainable." The authors apparently do not think it is necessary to repeal basic economic facts. Nuclear power is the most expensive, complex, expensive, dangerous, and expensive method ever devised to boil water. A recent report by John Blackburn, (Professor of Economics and Chancellor of Duke University) concludes that solar power is now cheaper than nuclear energy. Any attempt to saddle West Virginia ratepayers with the costs of a nuclear power plant is nothing more than blatant corporate welfare for utilities and nuclear power companies. The authors claim to be employed as economists, but never once mention the economics of nuclear power generation. This is either deliberate deception or sheer incompetence, and I do not believe these authors are incompetent.

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3) Section 2.6.4. Coal Consumption. The BBER authors use the January 2012 EIA Annual Energy Outlook, but have failed to consider the dramatic shift in energy use just in the last six months since that report was released. The June 2012 Update shows slower growth in energy consumption, and a faster transition away from coal. (http://www.eia.gov/forecasts/aeo/pdf/0383(2012).pdf). Even this is overly conservative. Due to low natural gas prices, coal consumption for electricity generation has dropped precipitously, down 14.7 % in June 2012, compared to one year earlier. The market share for coal dropped to 36 % in June, and went as low as 32 % in February, (http://www.eia.gov/electricity/monthly/) already well below the 38 % that EIA predicted in their Annual Energy Outlook for 2035. What this illustrates is how rapidly the market shifts when a lower-cost source of energy is available. We can realistically expect the cost of gas to go up again, but the cost of renewables keeps coming down. Wind energy is already cheaper than a new coal plant, and when the cost of solar drops below the cost of coal, the shift from coal will be rapid and permanent. In addition, the current cost does not consider the cost of greenhouse gas emissions. In their June 2012 Update, the EIA projects that the market share for coal drops to as little as 4 % by 2035 if a $25/ton cost of carbon emissions is implemented. Finally, the estimates of coal consumption ignore the expected shift from Appalachian coal to sources from the central and western US. Buried in the EIA forecast of an increase in coal consumption by 2035, is the explicit expectation that almost all of that will be in western coal, and that Appalachian coal production will decline precipitously. The BBER authors appear to have ignored all of these factors in section 2.6.4. The report should be revised to acknowledge a significant risk of a dramatic collapse in the West Virginia coal industry, perhaps in as little as five years, and should identify policy recommendations to help West Virginia cope with this dramatic shift in our economy.

4) Section 2.6.5. Renewable fuels. The BBER authors cite the EIA estimate of growth in renewable fuels of 2.8 % per year, but ignore the dramatically higher growth rates that renewables have actually experienced. Solar energy is the most rapidly growing source of electricity, and the market demand continues to expand nation-wide. Will west Virginia prepare for the energy demands of the next generation, or will we remain wedded to a dying industry as the market moves to alternatives?

5) Section 2.7. Per capita energy consumption. The BBER report uses an outdated estimate of the decline in per capita energy consumption. The most recent estimate from the EIA June 2012 Update is 0.6 % per year. Again, will West Virginia keep up, or will we surrender our economic competitiveness as other states increase their energy use efficiency. By using outdated information and faulty assumptions, the BBER authors set us up for poor policy choices that will cost us jobs.

6) Section 2.8. Energy imports. Again, the use of outdated information by the BBER authors results in faulty conclusions. For example, the authors conclude that nuclear energy will represent an increasing proportion of electricity generation, but the EIA forecast calls for the market share from nuclear to remain essentially flat through

2035. The BBER authors suggest that CO2 emissions from electricity will increase 4.9 % by 2035, while the EIA's June 2012 updates shows lower greenhouse gas emissions for all but the most optimistic scenarios.

7) Section 3.6. Key observations. This section dramatically understates the likelihood and extent of the decline in coal production in West Virginia. The statement that "...coal to liquids industrial development should continue..." is completely unsupported by any data whatsoever. Coal-to-liquids technologies are not cost-effective, and have excessive emissions of greenhouse gases, even in comparison to petroleum fuels. The report should be revised to provide a more realistic summary for policy-makers.

8) Section 4.7 identifies various problems and issues associated with development of natural gas as a transportation fuel. It is unfortunate that the BBER authors did not undertake a similar analysis of opportunities with rechargeable electric vehicles, as the fuel cost is even lower than for gas, and use of electric vehicles avoids many of the infrastructure issues needed to implement natural gas as a transportation fuel.

9) Section 8. Short-term Development Goals 2013-2017 Fossil Energy. Several of these recommendations are incorrect, and based on incorrect, or worse, absolutely no data. For example, there is no justification for the state to promote coal-to-liquids facilities (section 8.2). Nor is there any rational justification for promoting natural gas vehicles (section 8.3), except in limited special circumstances where the fleet conversion costs are justified. The conversion of school buses from biodiesel to natural gas is a major step in the wrong direction, as it makes our school systems dependent on unsustainable uses of fossil fuels. Advocacy of retaining fossil fuel generation (section 8.5) ignores the compelling interest in avoiding climate change, an issue that this study completely ignores. And as stated above, repeal of state statutes that currently prohibit nuclear power generation (section 8.6) demonstrates a complete absence of economic analysis by the BBER authors.

Energy Efficiency Policy Outlook for West Virginia

1) The Energy Efficiency plan recommends adopting of strong building codes for energy efficiency, and we support that recommendation.

2) We also support efforts to allow rate decoupling to provide utilities with a financial incentive to promote energy efficiency, as well as an Energy efficiency resource standard with targeted goals for reducing energy consumption.

3) The report should go further to support Integrated Resource Planning by utilities to assure that the lowest long-term cost sources of electricity are established, while also assuring that the true cost of electricity, including the health and environmental impacts, is incorporated in utility planning decisions.

4) The report should also recommend Smart-grid technologies, combined power and heat facilities, and distributed generation, to enhance grid reliability.

Renewable Energy Policy Outlook for West Virginia

Unfortunately, the CBER authors of this report do not demonstrate, nor do they appear to have, any particular expertise in renewable energy technologies or economics. There is evident bias throughout the report that illustrates the authors are captives of the fossil fuel industry, with, at best, very limited knowledge of the rapidly emerging markets in renewable technologies. There does not appear to be any effort for a comprehensive life cycle analysis, or an assessment of the true costs of fuels, nor an awareness of the diverse environmental impacts and benefits associated with various energy sources.

1) The report offers the conclusion that "None of the alternative or renewable energy sources considered in this report is likely to provide fuel or electricity at a lower cost than currently is supplied by traditional resources." Unfortunately, this conclusion appears to represent a pre-existing bias, rather than being based on an objective factual analysis. For example, wind-based electricity is already cheaper than electricity from a new coal-fired power plant. Solar and biofuels also have cost-effective applications. And much of the cost advantage for fossil fuels is actually based on long-running subsidies and structural incentives that help preserve their near-monopoly.

2) The recommendation to emphasize the electric grid ignores the need for, and advantages for, distributed generation, which gives a competitive edge to renewable sources closer to end users.

3) I support the recommendation that "Environmental concerns regarding alternative and renewable fuels should be fully addressed…", as many life cycle costs and the full greenhouse gas emissions potential should be considered. However, this must also apply to extraction and use of fossil fuels in order to avoid creating yet another structural barrier to renewables. Environmental compliance standards for fossil fuels must be at least as stringent as those for renewables, and these must include standards for greenhouse gas emissions.

4) Development of Waste-To-Energy facilities should be done cautiously, as these often have excessive costs and significant air pollution emissions.

5) Energy from Landfill gas must also consider the significant emissions of methane and related greenhouse gases that are produced. Capture of landfill methane is notoriously inefficient, with recent studies suggesting that less than 20 % of the methane generated is captured, and as much as 80 % is lost to the air. To make matters worse, landfill gas facilities generally manage the landfill to maximize methane production by keeping the waste moist, this 80 % loss means that many landfill gas facilities actually generate far more greenhouse gases than they remove, and accelerate the emissions of greenhouse gases to the air. Landfill gas development should not be used to exempt landfills from sound management practices. The preferred management for landfills should be to secure and close the landfill as a dry cell to minimize both water leachate production and methane losses.

6) Methane from in-vessel digesters should be re-examined for application. This technology is already in application in Europe, where collectives of farms grow the biomass in the form of vegetative matter or animal manure which generates methane for power generation, home heating, and small industrial uses. Because the feedstock is more controlled than for municipal waste-to-energy plants, the air pollution emissions are better regulated.

7) The conclusions regarding solar energy completely ignore the greenhouse gas benefits achieved, as well as the benefits of encouraging development of this emerging green industry. At a minimum, the report should acknowledge the climate implications of our current fossil fuel-based energy systems. For example, utility-level subsidies for solar energy provide all ratepayers with benefits from reductions in greenhouse gas emissions. Those who adopt solar technologies, even if subsidized by other utility rate-payers, may still have to bear the costs of climate change from the greenhouse gas emissions of other ratepayers, even though the solar adopters produce no greenhouse gas emissions of their own. The report conclusions are currently presented in a very one-sided fashion and should be re-written to describe both sides of this equation.

8) Overall, these recommendations do little to help West Virginia move into America's fastest growing energy sector. This is largely a prescription for economic stagnation, and allowing West Virginia to be left behind in the emerging energy industries of the future. We can, and must, do better.

9) Figure 12 is already seriously outdated. As described in the recent article by US Energy Secretary Steven Chu, the levelized cost of electricity for solar in 2012 is already below the lower limit projected for 2016 (Nature 488:294-303. Available at: http://www.nature.com/nature/journal/v488/n7411/full/nature11475.html). This illustrates how rapidly the cost of solar energy is coming down. In fact, Emanuel Sachs (MIT) projects that as economies of scale help lower the cost of production, the levelized cost of electricity from solar will drop below that of coal-fired electricity before 2020. West Virginia needs an energy policy that prepares for the day when customers will abandon utilities with large centralized coal-fired power plants because solar is cheaper. As illustrated in Figure 11 of the CBER report, West Virginia is already falling behind our surrounding states in installed solar capacity. The recommendations of the CBER report to do nothing more than to maintain current state policies will lock us into that uncompetitive last-place position.

Thank you for the opportunity to submit these comments. We recommend that the Division of energy provide a revised energy plan that substantially re-writes much of the analysis and recommendations provided in these reports. We ask that tyou work with citizens across the state to help prepare West Virginia for a clean energy future.

Sincerely,

James Kotcon

James Kotcon, Chair
Energy Committee

Name: Cale Irwin
Hometown:
Organization: Industries of the Future
Title:
Date:

Good morning, I'm Carl Irwin, Industries of the Future WV program. We've worked on a study with the Division of Energy on many years on the demand side of energy efficiency. I wanted to briefly share some results from a workshop in Charleston two weeks ago on what you might call supply side energy efficiency. This was a brainstorming session that was part of a DOE funded project. Just to share briefly with you some of the recommendations from that meeting. One was that the law should be changed to enable non-utility generators to sell to selected customers even if they're just down the street or across the road. You have to work with the utilities for there to be ways for utility companies to purchase power at some discount for their __ cost, but on the other hand you don't want the other rate payers' costs to go up. For these non-utility generators there should be a long-term, 8 to 10 year contracts, sales contracts, to give the up-front investor some assurance of recouping their investment and also to provide some stability on prices. It was also suggested at the workshop that the Legislature could pass a study resolution for key stakeholders to convene and develop what might be called a standard offer program which would address these types of recommendations. The group thought it very timely that the state look at something like this. In addition to the turmoil and transition in energy markets, there's a very recent executive order that said that within the next decade up to 40 gigawatts of CHP __ will be the goal __ across the country. Furthermore, Energy, Commerce, EPA, and other agencies are going to be working with states to see these types of implementations. So it's a great time to get on board with what's happening relative to that executive order. From a technical point of view it's unprecedented computer technologies, centers, controls, that can handle multi-sources around the grid. Small sources, a few megawatts. That can be handled, that's still called more grid stuff. Technically that can be done. I won't go through the details but at the workshop there were three instances of potential investment in the state involving biomass, solar and one involving _ recovery. These were projects that were planned but they couldn't progress because of lack of access to committed customers. So the utility law is this initiative. Thank you.

Name: Marion Harless
Hometown:
Organization:
Title:
Date:

I'm Marion Harless of Randolph County, psychologist, wildlife biologist, naturalist, organic grower, bachelor's and master's from West Virginia University. I am concerned, today primarily with, we had two minutes so I might ramble more to the 5 minutes we've been allotted, with the wind portion of the report, of the draft report. There was a listing of the problems associated with sighting and with the transmission of the highly inefficient high voltage power lines that have caused so many disturbances in the state the last few years. Loss of a lot of people's time, energy, money, worry. In the references in the draft report on the wind section I see no references on environmental engineering. I would suggest that the reviewers, workers go to the environmental engineering research at Duke University, University of Colorado, you'll see that these giant wind turbines, industrial wind installations, cause changes in wind patterns and weather patterns. Look at the areas where we have the largest concentration of industrial wind, you'll see we have the largest concentrations of drought in those areas and in the areas that benefit from the weather changes along the path. So look at Nebraska, Colorado, California, Iowa, Texas, __ Texas. These are big changes. They're not just little changes. Little changes at the wind turbines themselves, look at research from Duke University, for example, you'll see that soil temperatures go up, humidity in the soil goes down. This calls for increased irrigation of crops that are grown in the Midwest under the turbines. If we look at public health issues, __ I noticed the other day in the Gazette and elsewhere that hemorrhagic wasting disease in white-tailed deer in WV, there's an outbreak in Clay County this year, I don't know where that's from exactly. Hemorrhagic wasting disease is a mosquito-borne disease, it's a viral disease. Mosquitoes also transmit West Nile disease, we've all seen a big increase in that lately. Another mosquito-borne disease. Mosquitos carry other things like equine encephalitis, there's a big increase in that. You can check these data at the Centers for Disease Control, they have plenty of amounts of information as does the WV Department of Agriculture and DNR. And the more bats we kill, the more small birds we kill, with those giant wind turbines, we can expect to see a huge increase in public health problems. I would like to see the report address the environmental engineering of the public health issues involved with this. You have a long list of problems, there's no detail on those problems, it would be wonderful if everyone who is very encouraged about wind, giant wind turbines, not the small ones, would go to the Public Service Commission, the Department of Environmental Protection, water aspects, and read the voluminous records on all of the cases that have come before those agencies in the last eight years. Thousands and thousands of hours have been spent by WV residents, and I would guess around 2 million dollars of economics involved here, in protest by WV citizens on this giant wind turbine issue. Thank you.

Name: Gary Thompson
Hometown:
Organization:
Title:
Date:

I teach in the Energy program at WVU-Parkersburg. That includes the energy assessment technology program and the solar energy program. Both of these programs were funded by WV state funds about 3 years ago. I'd like to thank you, Director Herholdt, and Kelly Bragg, for your support both financially and morally in helping get those programs started. Those programs were launched three years ago with the intent to provide trained, well-trained energy professionals to fill the green-collar jobs that were going to be needed by West Virginia in the future, which has become the present right now. We are in the process now of graduating those professionals. Unfortunately, we are finding that the jobs at this point are not available. And we believe that the reason for that is really a lack of understanding in terms of homeowners, business owners, as to the advantages, benefits and the value that can be accrued from employing these professionals. In terms of homeowners, we find that there is really not enough understanding of the value and benefits both financially and comfort-wise in terms of providing and developing real energy efficient upgrades to their homes. In terms of business owners, we find that the understanding, the knowledge that hiring an energy professional to help businesses manage their energy consumption will actually save them money on their bottom line. So I am here today to plead that the Division of Energy, in WV public policy, help us as educators educate not just the professionals of the future and the professionals of the present, but also educate the public, homeowners and business owners, as to the value of hiring those energy professionals. Because in the long term, it provides reduced energy consumption, and jobs here in WV, good jobs here in WV. And again, I'd like to thank you for your past support and plead for ongoing support.

Name: Scott Rotruck
Hometown:
Organization: Chesapeake Energy
Title:
Date:

It's good to be here with you. Actually it's very good to be here with everyone. I think it's great that we're having a conversation about an energy plan and a blueprint in WV. It's certainly not something we've been able to do nationally yet. The last time we had an energy plan was way back when Jimmy Carter was president. There was a nuclear engineer at that time, and we were faced with what he called the moral equivalent of war. We thought we were having such a scarcity of energy. Whereas I'll submit to you now, all of our thinking has to be done in a new way. We're in an era of abundance. Part of that is due to the shale revolution that's taking place. But we're going to have to think about these things in new ways. I would also join the other speakers who have all committed to the proposition of energy efficiency. It is important. This country needs to produce with a lot less energy, its units of output. I'm Scott Rotruck, vice-president of Chesapeake Energy. Chesapeake is the second-largest producer of natural gas in the country, we're the 15th largest producer of natural gas liquids in the country, we're the number one driller of horizontal wells in the country. Our own company has taken on the effort of efficiency. We're an energy producer, we're also a user. So therefore we're going to strive to do the best that we can to use less energy per unit of our own output. We're also converting all of our fleet to run on natural gas. We're going to try to run our natural gas rigs on LNG, because it is a preferable fuel to run on. Let me say something about safety. It is important that everything we do on the producer end is done first and foremost with safety in mind. That's safety of folks that work in our operation, our vendors who are there, the communities in which we operate, and efficiency. Efficiency translates into what is environmentally beneficial. Our industry recently has been characterized by great innovation. One of the things that has been talked a great deal about our industry is the use of water, it's actually also one of our best stories. We have learned to recycle and reuse, again harking back to efficiency. As you go about your deliberations on this, think about the other benefits that can be derived. Downstream benefits. The possibility since we have a wet gas window in WV in the Marcellus shale, of taking that natural gas stream, taking the ethane out of it, cracking it into ethylene, and making products out of it. Again I think we need to do things as efficiently as possible. Making things near where they are used with again a drive toward that goal of efficiency. Natural gas, again can be one of the enablers of renewables. There have been plans in the past that a number of associations and organizations have put forth saying that there needs to be a reliable base load power so that renewables can gain ground. I would submit to you that that is natural gas. It is abundant now. The old paradigm of up-and-down fluctuation in price and volume in the market has changed because shales are the kitchens where the natural gas over time was cooked, if you will. Now we're down into that mother load. So there's a __ of reliance we can have now on our product. I just wanted to join with folks this morning and focus on the idea of efficiency, what we can do in contribution to that. We will submit extensive written comments on the plan. Thank you all very much.

Name: Mary Ellen Cassidy
Hometown:
Organization: Wheeling Jesuit University
Title:
Date:

I'm from the Appalachian Institute at Wheeling Jesuit University. I'm with Wheeling's community energy program. The Appalachian Institute for Wheeling's community energy program strongly endorses the recommendations in the energy efficiency section of the state's energy plan. As for energy efficiency program administration, we suggest that energy efficiency programs be delivered with community organizations as a major player. This would be for several reasons. One is that communities are able to deliver programs without the potential conflict of throughput incentive that the utilities now face without decoupling or other similar mechanisms. A second reason is that information from community organizations and well-known people is heard and processed more thoroughly by the community. Anecdotally an example would be, a couple of years ago before our program started, when we talked to people in our community, even with the best efforts of DOE and __, our community had no idea that there were free walk-throughs or giveaways or any of these programs available. A third reason community programs, organizations and individuals should be major players in energy efficiency program administration is that insights from behavioral psychologists have shown that people are often strongly influenced by community social norms and public commitments made within their community and neighborhoods. A second point, we agree that financing assistance including low-interest loans financed through utilities and/or third-parties should particularly incentivize an energy audit upgrade package as recommended in this report. This may avoid the scenario of audits essentially being left at the altar. A third point, we strongly agree that energy efficiency program evaluations and assessments should include the avoided cost and non-energy benefits as described on page 8 and 16 of the report. Anecdotally again, while the average 2 and a half to one return on investments from energy efficiency programs, a report from the Minneapolis community energy programs find that 1,474 home energy upgrades resulted not only in 13.8 million dollar savings for homeowners, but also 4.8 million dollars in work for Minnesota's insulation and heating contractors. Energy efficient jobs for veterans and other unemployed or underemployed workers produce that multiplier effect in local communities and should definitely be included in energy efficiency program assessments. These jobs cannot be outsourced nor are they subjected to global market volatility. A fourth point, we strongly encourage leading by example as described in the report, particularly for public buildings which represent the taxpayers' savings and return on investments. Our fifth point, we strongly encourage additional funding and support for weatherization assistance program jobs. Along with the increase in jobs, this would also address the issue of 30 percent or more of money given for monthly utility bill assistance being lost completely due to poorly sealed homes or inefficient homes. Sixth, we strongly support energy efficient resource standards. Seventh, we urge the Division of Energy to recommend integrated resource planning, in order to insure WV utilities make smart business decisions that consider cost-effective energy efficiency that contribute to WV's long term public interest. I'd also just like to mention that, it was brought up that subsidies are an obstacle and need to be put in place for renewables. But I've seen already heavily subsidies in our current energy system. We've already set as a state a precedent that we're willing to do this for the importance of our energy sector. Last, I would just like to recommend that if possible these hearings be in the evenings or on weekends so that particularly students could participate. This is a great example of how a community comes together and talks about their energy program. If we want to encourage math and science in our schools, this would be a great vehicle to have students come and see how important these studies are and what they can do for their state and their nation and the globe in general. Thank you.

Mary Ellen Cassidy, Appalachian Institute at Wheeling Jesuit University; Community Energy Program
WVDOE 5 year public meeting comment notes: September 6, 2012, 9:00am Erickson Alumni Center, WVU

The Appalachian Institute and Wheeling's Community Energy Program strongly endorse the recommendations of the energy efficiency section of the state's Energy Plan.

1. As for Energy Efficiency program administration, we suggest that EE programs be delivered with community organizations as the leading administer with the option to finance through utility bill savings and/or low interest loans.

a. As mentioned in this report, Community delivered programs do not carry "throughput incentive" conflicts facing some utility programs and are enthusiastic promoters of energy efficiency with the sustainability of their communities as their primary focus. However, partnering with utilities would be a successful hybrid if community organizations addressed the educational and recruiting efforts and utilities offered an on-bill financing option. In this instance, decoupling or similar mechanisms would further support the community/utility hybrid model.

b. Another reason to designate Community Organizations as EE program administrators is that research studies show that information coming from a local trusted organization (vs. utility or state/federal entities) is more likely to be heard, understood and acted upon. For instance, despite the best efforts of AEP and state programs to offer free audits, giveaways and tax incentives, virtually no attendees at our Community Energy meetings over the past year and a half knew anything about these or even what an energy audit is for that matter.

c. Insights from behavioral psychologists have shown that people are strongly influenced by social norms and public commitments made within their community. Community-based strategies can be most effective here in establishing energy efficiency as a social norm and recognizing community leaders.

2. We agree that financing assistance, including low interest loans financed through utilities and/or third parties, should particularly incentivize an energy audit/upgrade-package as recommended by the report. This avoids the scenario of audits essentially being left at the altar.

3. We strongly agree that EE Program evaluations and assessments should include "Avoided Costs and Non-Energy Benefits" such as those listed on pg. 8and 16 of the EE Report such as job creation, growing local wealth and community development. Along with an average 2 ½ to 1 ROI from EE programs, anecdotally, a report on the Minneapolis, MN Community Energy Program finds that 1474 home energy upgrades resulted not only in $13.8 million savings for homeowners, but also $4.8 million in work for Minnesota's insulation and heating contractors. EE Jobs for veterans and other unemployed or underemployed workers produces the multiplier effect in local communities and should be included in EE program assessments. These are jobs that cannot be outsourced nor subjected to global market volatility.

4. We strongly agree with report findings that encourage leading by example, particularly EE programs for public buildings, which represent the taxpayers' savings and returns on investment.

5. We strongly encourage additional funding and support for Weatherization Assistance Program jobs including solutions such as possible public/private work hybrid formats. Along with an increase in jobs, this would also address the issue of 30% or more of the money given for monthly utility bill assistance is currently being lost due to poorly sealed homes or inefficient homes.

6. We strongly support target goals and mandated EERS, as recommended in the report.

7. We urge the WVDOE to recommend integrated resource planning in order to assure West Virginia's utilities make smart business decisions that consider cost-effective energy efficiency and contribute to WV's long-term public interest.

8. The panels' findings stated that renewable energy, particularly solar, is only viable in WV if subsidies are included. However, our state's current energy system is already heavily subsidized setting a precedent that in WV our energy sector is valuable and deserving of support. This support and funding should be available to all proven energy producers to help establish a diversified portfolio that provides a hedge against volatility. Also, with climate change driving the market towards energy efficiency and renewables, it would be great to see WV be in the forefront of this development.

Last, I appreciate the work put into these reports, their availability to the public and the opportunity to learn about the research and the reasoning that led to the stated recommendations. However, I would strongly encourage the WVDOE to hold the public comment meetings in the evenings or weekends and to include more meeting sites. This would allow more interested individuals to learn and voice their concerns. It would also be an exceptional opportunity for WV students to see democracy at work, as well as inspire them to go into math, science and public service fields to build sustainable communities, local, regional and global.

Thank you for this opportunity and we encourage the WVDOE to continue to provide support for community residential and commercial energy programs.

Name: Jim Dean
Hometown:
Organization:
Title:
Date:

Good morning. I'd like to thank you Director Herholdt for the opportunity to comment on the state's 5 draft energy plan today. I'd also like to state that the comments I'm making today and any further written submissions on the draft plan are my personal comments and are not representing my employer. First, I would like to compliment both the Center for Business and Economic Research and Marshall University and the Bureau of Business and Economic Research at West Virginia University for preparing detailed and thoughtful reports based on my first reading of the documents. I agree with the statement in the draft on renewable energy policy that when pursuing the objectives of the Alternative and Renewable Energy Portfolio Standard, "energy independence and to meet environmental concerns" are the main objective, but that the most effective and least costly ways to the state's consumers and the state budget should be utilized. As a lifelong resident of the state, I applaud this thinking. Too often our state and federal government initiatives are implemented with too little thought on overall effectiveness, that is benefits and the costs. It appears that in the draft that the use of biodiesel in the state's Public School Support Program, the PSSP, may, and I emphasize may, be one such initiative. With a one year cost of approximately $1 million dollars with no quantified benefits stated, I strongly concur with the specific recommendation in the draft report and would also suggest that you consider the economic benefit to the state as was done in the case of the recommendation drafted for corn ethanol. Given the fact that 80 percent of West Virginia's energy production is exported, further review of the state's export assistance efforts to WV energy producers should also be reviewed and perhaps strengthened in consultation with the energy producing sectors, with input from them, to receive the maximum benefit. I also strongly agree that that state needs to encourage that the future growth and development of these cornerstone industries, coal, oil, and natural gas, for the benefit of the people of West Virginia and its economy, occurs. The contribution to WV's economy in Table 10: top ten WV export industries ranked by value of commodity exports in 2011 by NAICS code 212- Minerals and Ores is significant with over 50 percent of the contributions. I personally look forward to reading the findings and recommendations of the Governor's task force on using natural gas as a transportation fuel, which may have significant benefit in accomplishing the overall objective of energy independence by offsetting the large amount of petroleum based transportation fuel imported into the state by utilizing what we have. The last comment that I have is that as a state, we should perform a detailed review of the successes and failures of others implementing alternative energy policy around the world to inform our efforts. And I also personally believe that this includes a critical review of the theory that global warming is caused by man-made contributions of CO2 or by natural variability. I point out and I will submit the details on that, __ UK's meta office, and the fact that the models are not predicting accurately the temperature increases for the last 14 years. Thank you for the opportunity to provide these comments today and I wish you luck in sorting out the comments Jeff.

Name: Charlie Burd
Hometown:
Organization: Independent Oil & Gas Association of West Virginia
Title:
Date:

Jeff, if it pleases the panel my name is Charlie Burd, executive director of the Independent Oil & Gas Association of West Virginia. I'm here today, basically, I did not pre-register not knowing if I could be here, but once I was here I decided I needed to step to the podium to congratulate this task force, this committee, for its work. I also was very interested to listen to the other comments, we've got some pretty learned people sitting here in the audience, so their comments are important. It's always good to hear others around the state that you don't get to hear. I'm going to go back 40 years, I worked for Hope Gas. At that time, we were in a gas curtailment in this state. You couldn't get natural gas. It wasn't drilled, it wasn't given to new buildings. We weren't doing any of those things. That was under the Carter administration. In just 40 years what a turnaround we have with this game-changer called the Marcellus shale. That we know now is a source rock for probably all those more shallow rock formations that we've been producing natural gas from for 150 years. We've done that through advanced technology, hard work and maybe some luck. I think that this study that you've put together, these recommendations, address the broad-based scope of every energy source that we have available to us in the state. But it's exciting for me to be part of the oil and gas industry and to have a 14-year-old that has two desires in life: to be a wide receiver for the Mountaineers and he wants to be a petroleum engineer. And I'm happy about that. It's always good, a father likes to see his son step in his footsteps. And how we develop these shales and the downstream benefits we get from it, through propane and butane and now ethane, that we're going to do something with it locally as opposed to just shipping it somewhere else, it's so exciting for this state. The economic benefits, the jobs, the taxes. I'd like to also say, that we in the natural gas industry are very cognizant of the fact that we need a healthy coal industry in this state. Working together, co-firing, co-generation, the other things that we can do to help reduce emissions in our country, that's where we want to be with our coal association. I thank you for this opportunity to say that. Thanks.

Name: Jim Sconyers
Hometown:
Organization: WV Energy Savers
Title: President
Date:

I'd like to add to a comment made by an earlier speaker, James Kotcon from the WV Sierra Club. Another word that I was very, I didn't, I sped read the documents, but another word I didn't see in this so-called energy plan was the word health. And I frankly fail to see how we can be talking about policy, not just history and trends, but policy meaning what we should do, without considering the health impacts of especially our fossil fuel industry. Those impacts are in the air, they're in the water, they're measurable. The number of deaths caused per power plant, you can read it in black and white, the health effects that millions and millions of dollars attributable to fossil fuel pollution in the air, in the water, and how can we have a policy that does not reflect that. Thank you.

Name: Marion Harless
Hometown:
Organization:
Title:
Date:

I just wonder how many people in this room have a solar attic fan? That's 3 more than I've had in the approximately 1200 people that I've asked. Everyone should have one.

Name: John Terry
Hometown:
Organization:
Title:
Date:

Did not speak.

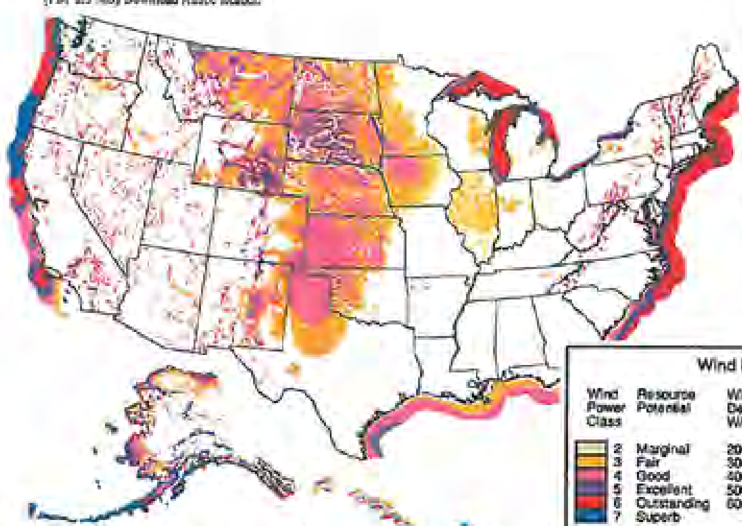
Written Comments
from
John Terry
Rt 1 Box 137T
Montrose, WV
to the
WV Department of Commerce
WEST VIRGINIA ENERGY PLAN
September 2012

Committee Members,

Thank you for this opportunity to comment on the West Virginia Department of Commerce, West Virginia Energy Plan . I have chosen to write this document rather than limit myself to two minutes of comments. I trust that you will give it your full consideration.
I have read some of the Marshall report. I am particularly interested in the Renewable Energy Policy section especially the part pertaining to wind energy in the state of West Virginia. I have a home on three-hundred acres of land in Montrose, Randolph County, WV. Because of my proximity to the wind turbines at AES Laurel Mountain, I have a unique perspective on wind energy production in the Mountain State that few others have. I notice that the Marshall study is a compilation of data gleaned from the reports of others. In this document I intend to present a view of day to day wind farm operations as seen from a mile and a quarter away and then to draw conclusions as well as make suggestions.

On May 19, 2011, Raif Sgrist, President and CEO of Nordex USA Inc., the German wind turbine manufacturer answered a letter to the editor of the Cumberland Times News I had written regarding wind availability in the Allegheny Highlands by saying that his, "Nordex's fleet in the U.S.A. achieves availability greater than 97 percent - the lost time is for planned maintenance and service which keeps it running the other 97 percent of the time and allows us to offer 20-year warranties to our customers." What Mr. Sigrist was saying to me was, in effect, Don't blame the turbines if there's not enough wind to turn them. Earlier in his letter, CEO Sigrist explained that, "... wind does not blow at a high and constant speed" and that "In fact, the economics of the wind industry assume this to be the case." The wind turbines in question are the 20 Nordex turbines on Backbone Mountain at the Maryland, Roth Rock wind project only a few miles north of the West Virginia border and the troubled Florida Power and Light Mountaineer wind facility.

United States — 50-Meter Wind Resource Map
Zoom or print the full U.S. map
(PDF 2.3 MB) Download Adobe Reader.



Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m²	Wind Speed[a] at 50 m m/s	Wind Speed[a] at 50 m mph
2	Marginal	200 - 300	5.6 - 6.4	12.5 - 14.3
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	> 800	> 8.8	> 19.7

[a] Wind speeds are based on a Weibull k value of 2.0

The wind power resource data for this map was produced by TrueWind Solutions using the Mesomap system and historical weather data. It has been validated with available surface data by the National Renewable Energy Laboratory and wind energy meteorological consultants.

NREL
06-JUN-2002 2.1.2
U.S. Department of Energy
National Renewable Energy Laboratory

In the Marshall Center for Business and Economic Research Draft Not for Citation Report the authors mention that the onshore wind resources in other parts of the U.S., especially the Midwest, and offshore are of a higher quality than those found in West Virginia (and I might add the Allegheny Highlands region). This should come as no surprise to anyone who has either spent time viewing a West Virginia wind farm or who has studied the various maps published by the U.S. Department of Energy, the National Renewable Energy Laboratory or the WV Division of Commerce. NOAA publishes a compilation for 276 U.S. cities' based on over fifty years of data. Elkins, WV is the only West Virginia mountain city listed and the home of AES Laurel Mountain. Of the 276 listed cities, only eight have lower annual wind speeds than Elkins.

To those of you reading this who live in Huntington or Charleston where you don't have turbines to study, it may come as a surprise that West Virginia is not a particularly windy place. As I said earlier, my home is in Montrose, WV and every day I see five, six in the winter, of the sixty one wind turbines located at Elkins. When we drive into town, we see all sixty one. This is the AES Laurel Mountain wind farm which went into full operation in July of 2011. AES is a multi billion dollar corporation run, I would suppose by some very intelligent managers. The machinery, GE 1.6 MW turbines, are state of the art and everything about the facility is brand new. There is also no reason to think of AES Laurel Mountain as anything other than typical of a modern wind facility operating in West Virginia.

Since I was among the members of a citizen's group who opposed the wind farm's construction, many people have asked me why it is that the turbines sit idle for hours or days at a time. We know that currently, after reporting an endangered bat kill early this July (coming after a kill of nearly 500 migrating birds less than three months after opening) AES Laurel Mountain has voluntarily shut down during the evening and night time hours when bats might be flying. The bat mortality should come as no surprise as bats are prevalent in the sky every summer evening and, eighteen miles to the north, the Mountaineer wind farm has been killing thousands of bats every year since it's construction in 2002.

As a neighbor of AES Laurel Mountain, the first thing I see after the fog clears each morning is the wind farm, and the last thing, as we pull down the shades in the evening, is the red flashing light on turbine #6 through our bedroom window. In July I, and several others, began logging daily entries on wind farm operation. A simple log of how many of the turbines we could see were and were not operating. In October I began a separate study by measuring the seconds per revolution of the turbine I could see the best. There is nothing unusual about this wind turbine and as far as I have observed, it operated no more or less than the other 60 AES Laurel Mountain machines.

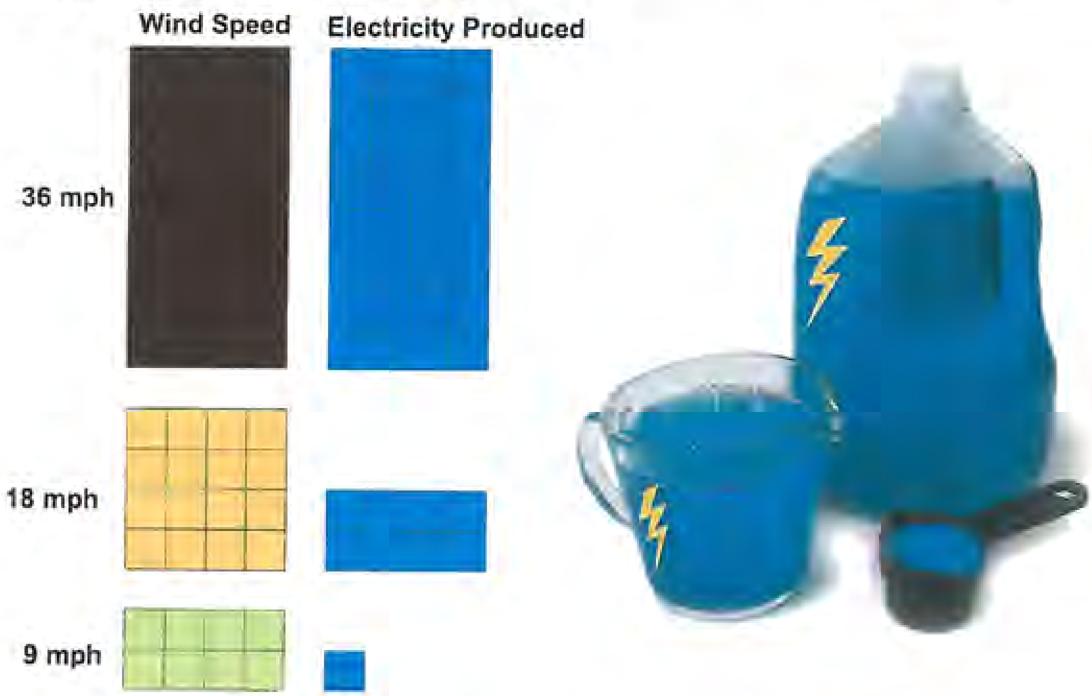
For most of the study period (before the endangered bat kill report) the wind turbines were free to operate at night. I can not see the blade movement at night and have no night time data. However, in most cases, wind speed diminishes after dark as the air cools. In times of dense fog, I cannot see the turbines and therefore, no data can be recorded then. It should be noted that West Virginia is among the foggiest places in the nation. Fog is usually associated with calm, still air.

As a retired educator and photographer, I spend lengths of time away from our West Virginia home, and so do not have data from those times.

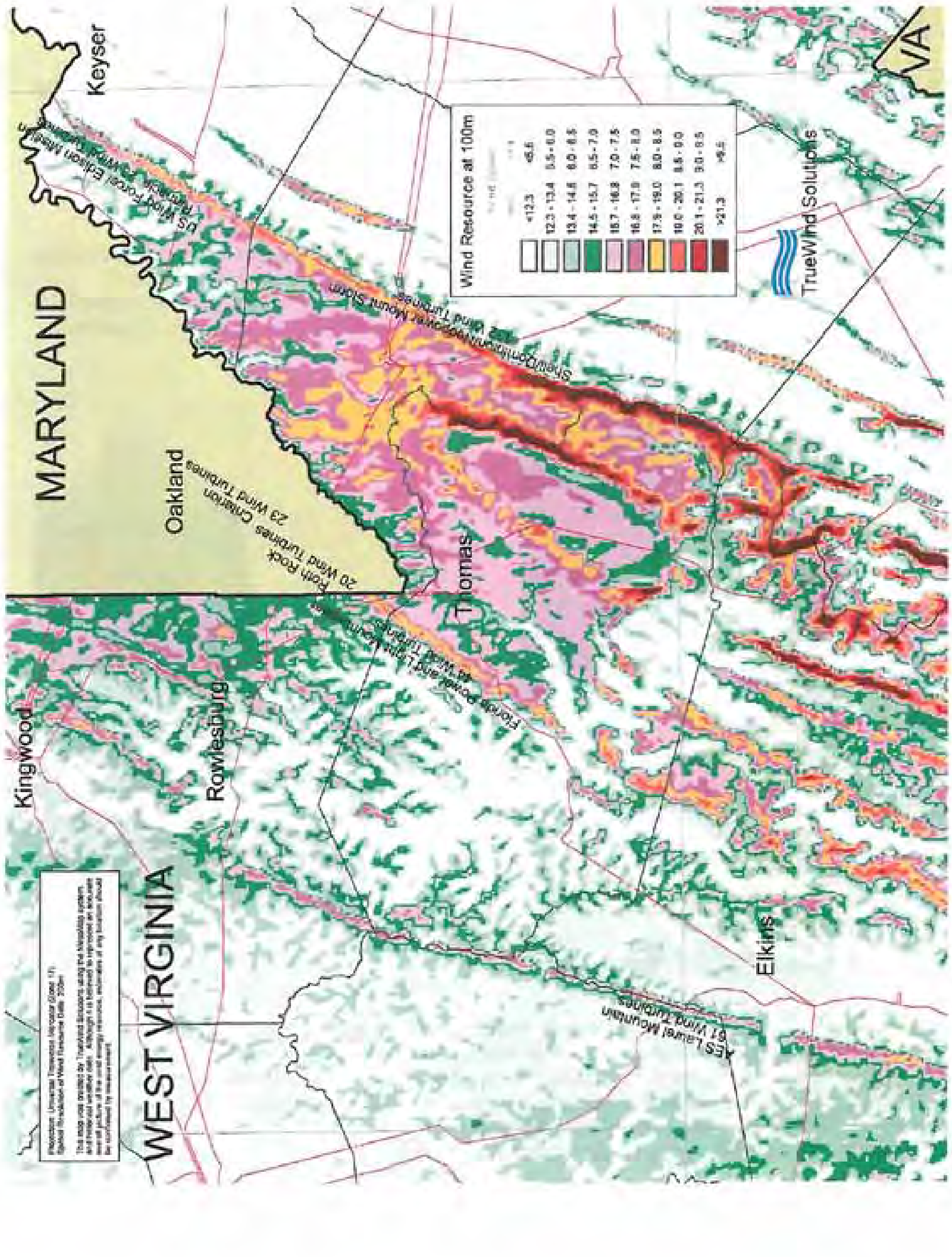
The monthly charts show that, by anyone's definition, AES Laurel Mountain, as an electrical generating facility, has proved to be a failure. The cause could be faulty equipment, poor management, bad luck or lack of sufficient wind energy. My guess is the last.

As you know, wind turbines need wind speeds that are neither too slow or too strong. Watching the turbines, as I do with a stopwatch, you see that the turbines speed up and slow down incessantly, if they are turning at all. Below or above these operational speeds turbines must shut down. It would seem logical to assume that if a turbine had a good wind of 36 MPH and the wind slowed by half to 18 MPH that the electric generation would be halved as well, but that's not the how it works.

Using the example from David Umling's book, Lifestyle Lost, if we imagine the 36 MPH wind as producing a "gallon" of electricity, halving the wind speed would not yield a half gallon of electricity, but rather, a "pint" of electricity. Reducing the wind speed by half again to 9 MPH, well within the operational range of a wind turbine, we have reduced the output to a "quarter of a cup" or 1/64th of the "gallon" of electricity at 36 MPH.



If we take the WV Division of Energy's map and consider the small and sporadic amount of electricity generated at AES Laurel Mountain which is seen as various shades of pink and project the same poor prospects for production to all the other areas of pink on the map, it is evident that there is little purpose in placing wind towers on West Virginian mountain ridges. In this land of many uses - wind energy production is not one of them and does not deserve consideration as a viable source of electricity in this state.


MARYLAND
WEST VIRGINIA
VA
Keyser
Oakland
Thomas
Kingwood
Rowlesburg
Elkins
23 Wind Turbines Criterion
20 Wind Turbines Roth Rock
61 Wind Turbines AES Laurel Mountain
Wind Resource at 100m
TrueWind Solutions

The following pages have charts showing data from observations made within a two hour frame five times every day when at home and the turbines are visible. There is every expectation that wind turbines operate in a similar fashion or slower at night when wind speeds tend to be less. The voluntary shutdown due to the endangered bat does not have an effect on the charts. All values shown below the red dash line indicate the turbine is stopped. Readings were not made where data has not been entered. Readings were made using a stopwatch and an average of 10 revolutions. The RPM range of 10 to 20 is based on the observation that we have never seen the turbine turn faster than 3.36 seconds per revolution (October 19, 2011) or slower than 5.969 seconds per revolution (March 10, 2012). Times when turbines are not turning, 0 RPM, are shown on the charts below red dash line.

John Terry
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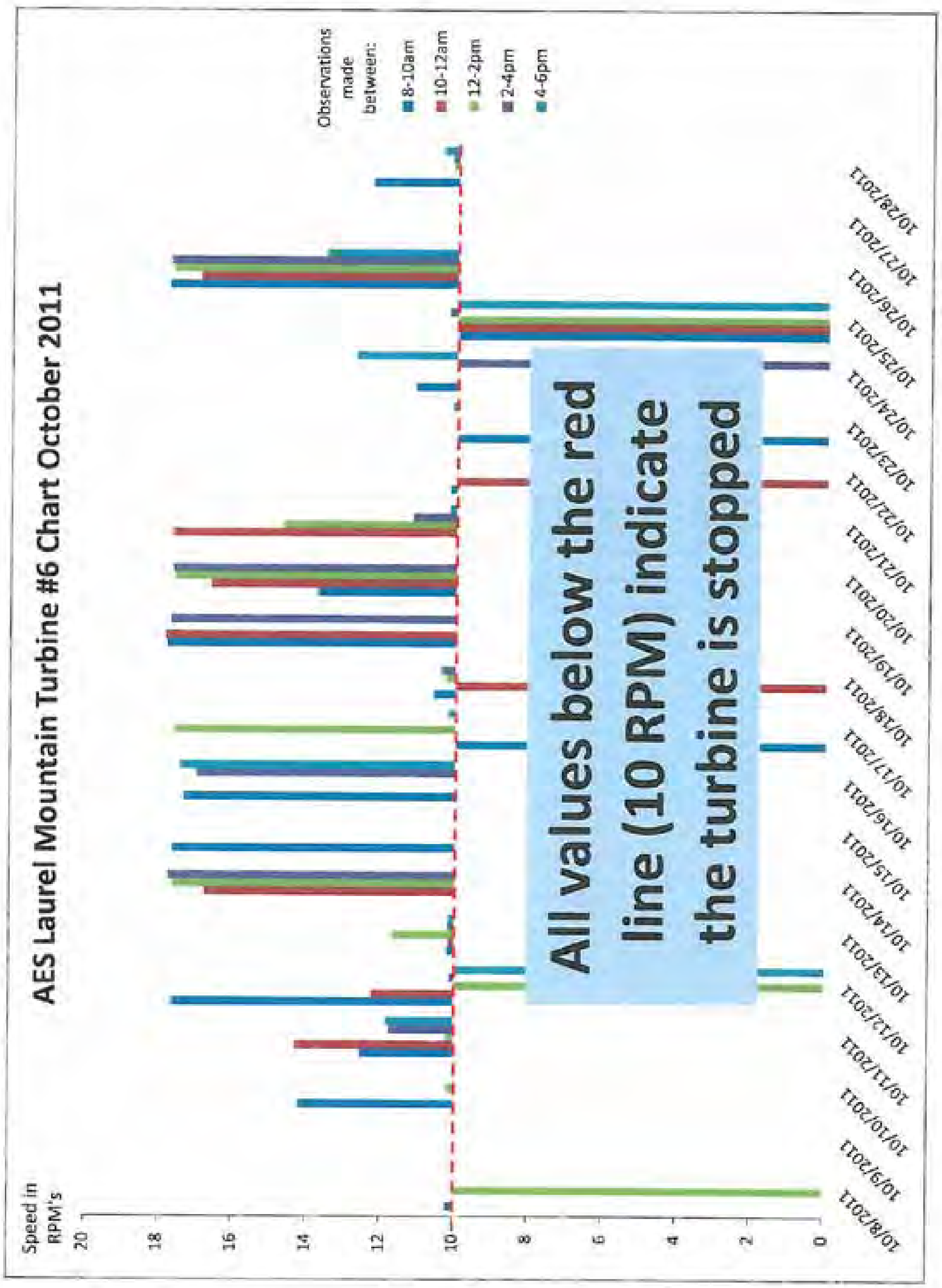
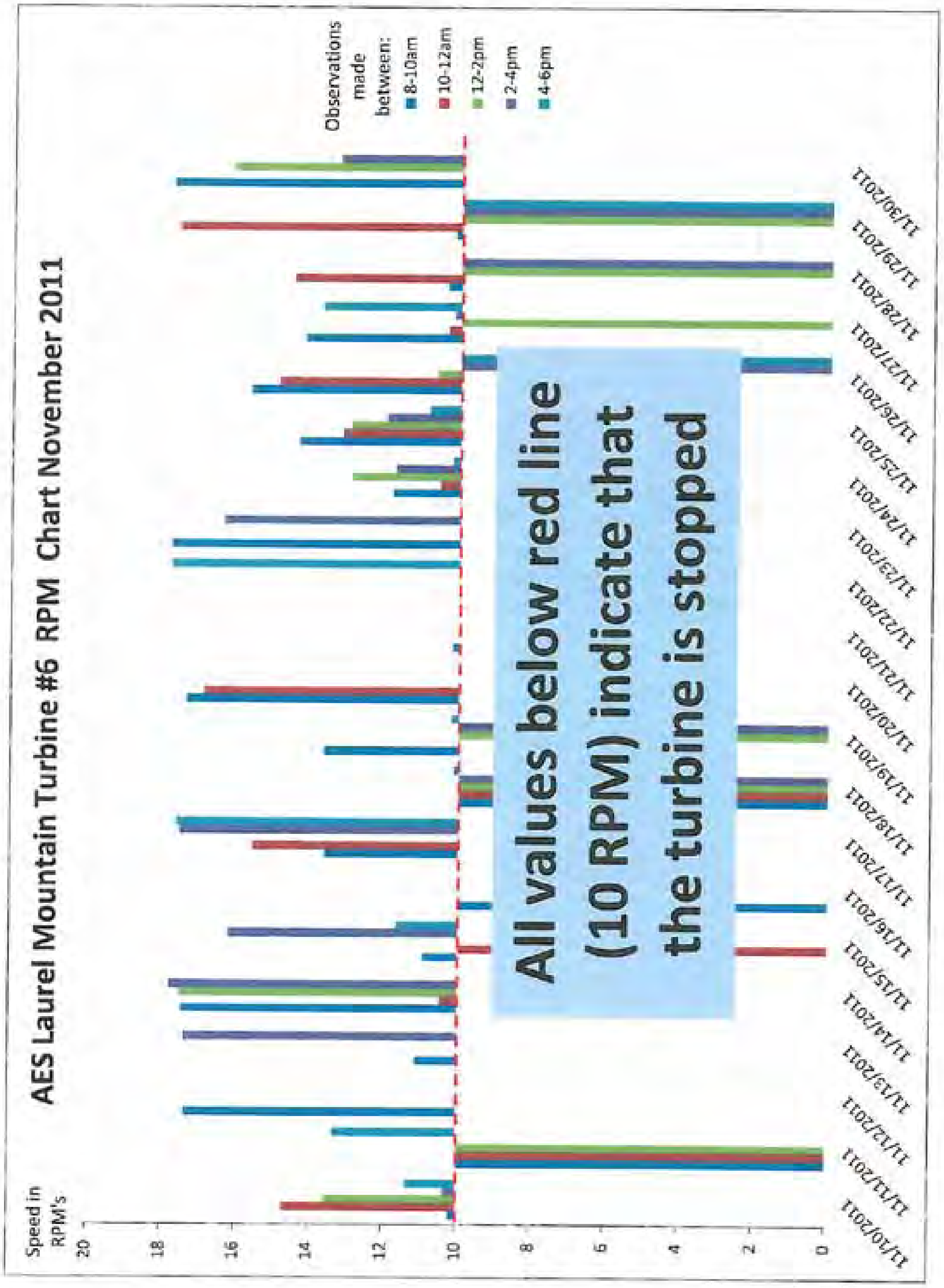

AES Laurel Mountain Turbine #6 Chart October 2011
Speed in RPM's
20
18
16
14
12
10
8
6
4
2
0
Observations made between:
8-10am
10-12am
12-2pm
2-4pm
4-6pm
All values below the red line (10 RPM) indicate the turbine is stopped
10/8/2011
10/9/2011
10/10/2011
10/11/2011
10/12/2011
10/13/2011
10/14/2011
10/15/2011
10/16/2011
10/17/2011
10/18/2011
10/19/2011
10/20/2011
10/21/2011
10/22/2011
10/23/2011
10/24/2011
10/25/2011
10/26/2011
10/27/2011
10/28/2011

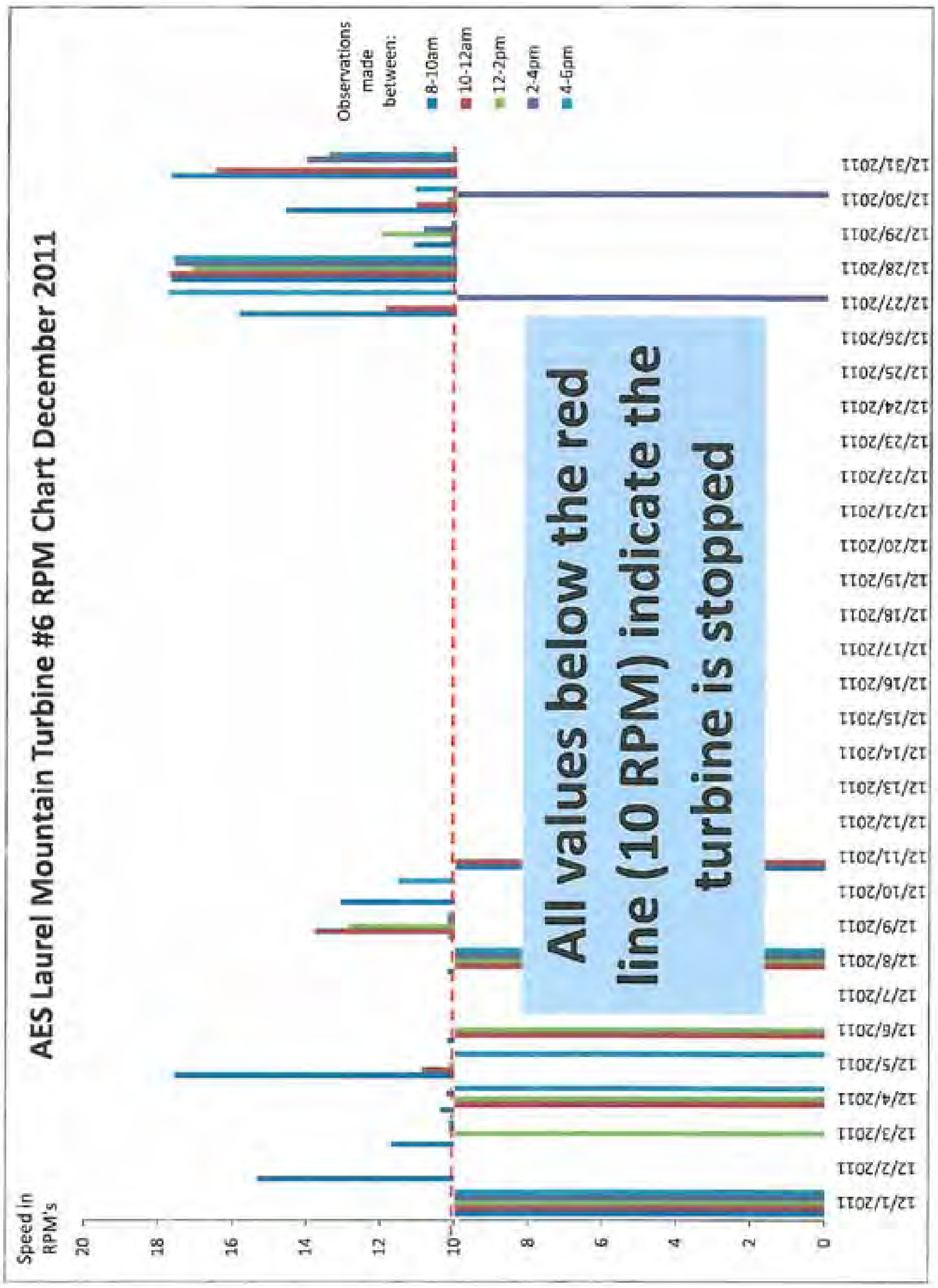
October Data 2011

	8-10am	10-12am	12-2pm	2-4pm	4-6pm
10/8/2011	10.19		0		
10/9/2011					
10/10/2011	14.21		10.19		
10/11/2011	12.55	14.32	10.22	11.76	11.86
10/12/2011	17.64	12.24	0	10.14	0
10/13/2011	10.2	10.16	11.71	10.18	10.17
10/14/2011		16.76	17.64	17.75	
10/15/2011	17.65				
10/16/2011	17.34			17	17.44
10/17/2011	0		17.6		10.2
10/18/2011	10.6	0	10.27	10.38	
10/19/2011	17.8	17.86		17.7	
10/20/2011	13.76	16.62	17.6	17.65	
10/21/2011		17.66	14.73	11.18	10.19
10/22/2011	10.17	0			
10/23/2011	0				10.12
10/24/2011	11.14			0	12.76
10/25/2011	0	0	0	10.21	0
10/26/2011	17.79	16.95	17.69	17.76	13.58
10/27/2011					
10/28/2011	12.33		10.13	10.16	10.41


AES Laurel Mountain Turbine #6 RPM Chart November 2011
Speed in RPM's
20
18
16
14
12
10
8
6
4
2
0
Observations made between:
8-10am
10-12am
12-2pm
2-4pm
4-6pm
All values below red line (10 RPM) indicate that the turbine is stopped
11/10/2011
11/11/2011
11/12/2011
11/13/2011
11/14/2011
11/15/2011
11/16/2011
11/17/2011
11/18/2011
11/19/2011
11/20/2011
11/21/2011
11/22/2011
11/23/2011
11/24/2011
11/25/2011
11/26/2011
11/27/2011
11/28/2011
11/29/2011
11/30/2011

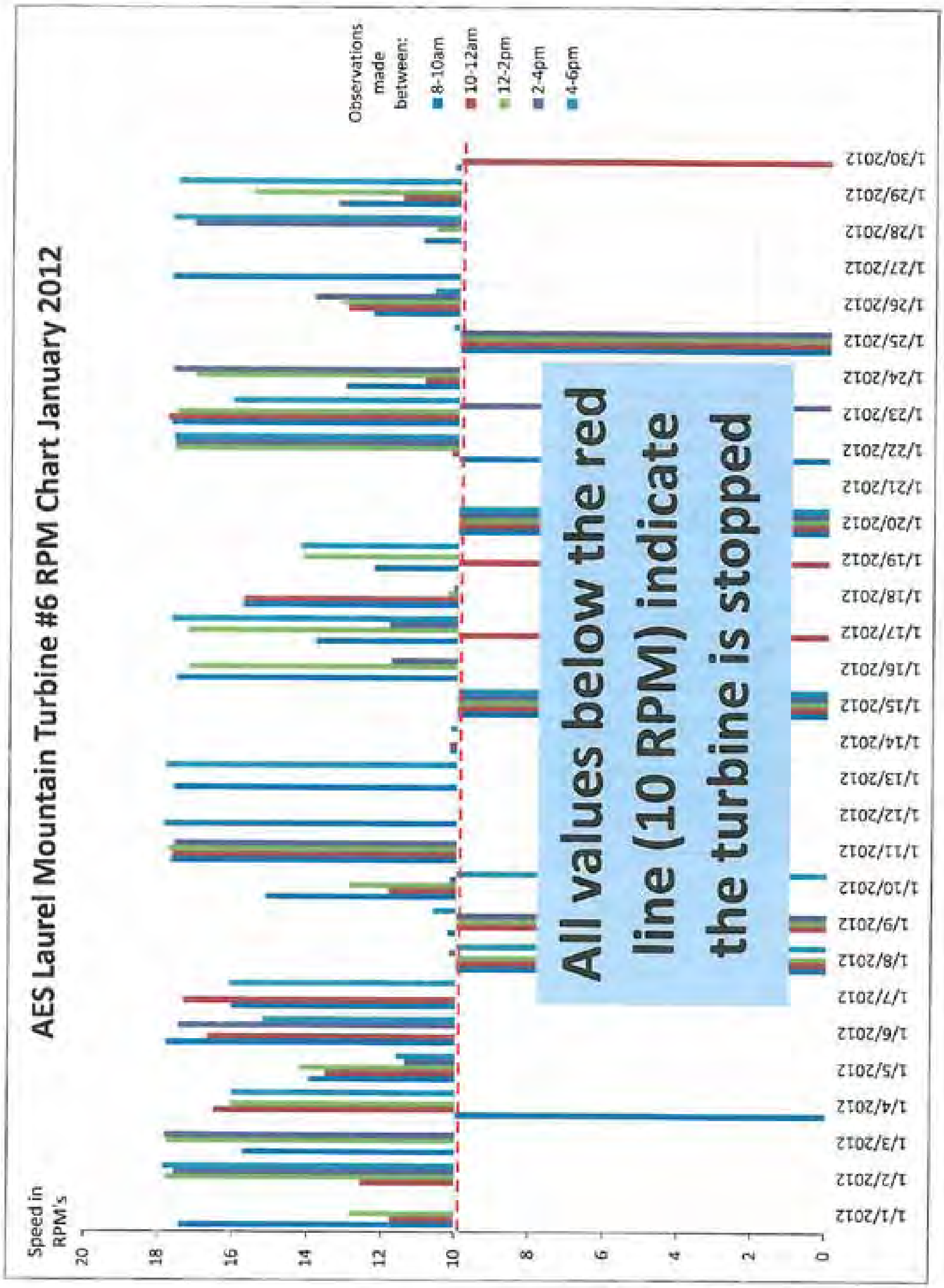
November Data 2011

	8-10am	10-12am	12-2pm	2-4pm	4-6pm
11/10/2011	10.2	14.68	13.56	10.34	11.37
11/11/2011	0	0	0		13.35
11/12/2011	17.36				
11/13/2011	11.14			17.38	
11/14/2011	17.45	10.48	17.52	17.79	
11/15/2011	10.93	0		16.19	11.67
11/16/2011	0				
11/17/2011	13.61	15.56		17.52	17.63
11/18/2011	0	0	0	0	10.12
11/19/2011	13.64		0	0	10.19
11/20/2011	17.38	16.89			
11/21/2011	10.18				
11/22/2011					17.78
11/23/2011	17.78			16.37	
11/24/2011	11.83	10.55	12.93	11.75	10.2
11/25/2011	14.36	13.18	12.97	11.99	10.85
11/26/2011	15.67	14.91	10.64	0	0
11/27/2011	14.21	10.35	0	10.19	13.73
11/28/2011	10.38	14.51	0	0	
11/29/2011	10.18	17.63	0	0	0
11/30/2011	17.81		16.19	13.29	


AES Laurel Mountain Turbine #6 RPM Chart December 2011
Speed in RPM's
20
18
16
14
12
10
8
6
4
2
0
12/1/2011
12/2/2011
12/3/2011
12/4/2011
12/5/2011
12/6/2011
12/7/2011
12/8/2011
12/9/2011
12/10/2011
12/11/2011
12/12/2011
12/13/2011
12/14/2011
12/15/2011
12/16/2011
12/17/2011
12/18/2011
12/19/2011
12/20/2011
12/21/2011
12/22/2011
12/23/2011
12/24/2011
12/25/2011
12/26/2011
12/27/2011
12/28/2011
12/29/2011
12/30/2011
12/31/2011
Observations made between:
8-10am
10-12am
12-2pm
2-4pm
4-6pm
All values below the red line (10 RPM) indicate the turbine is stopped

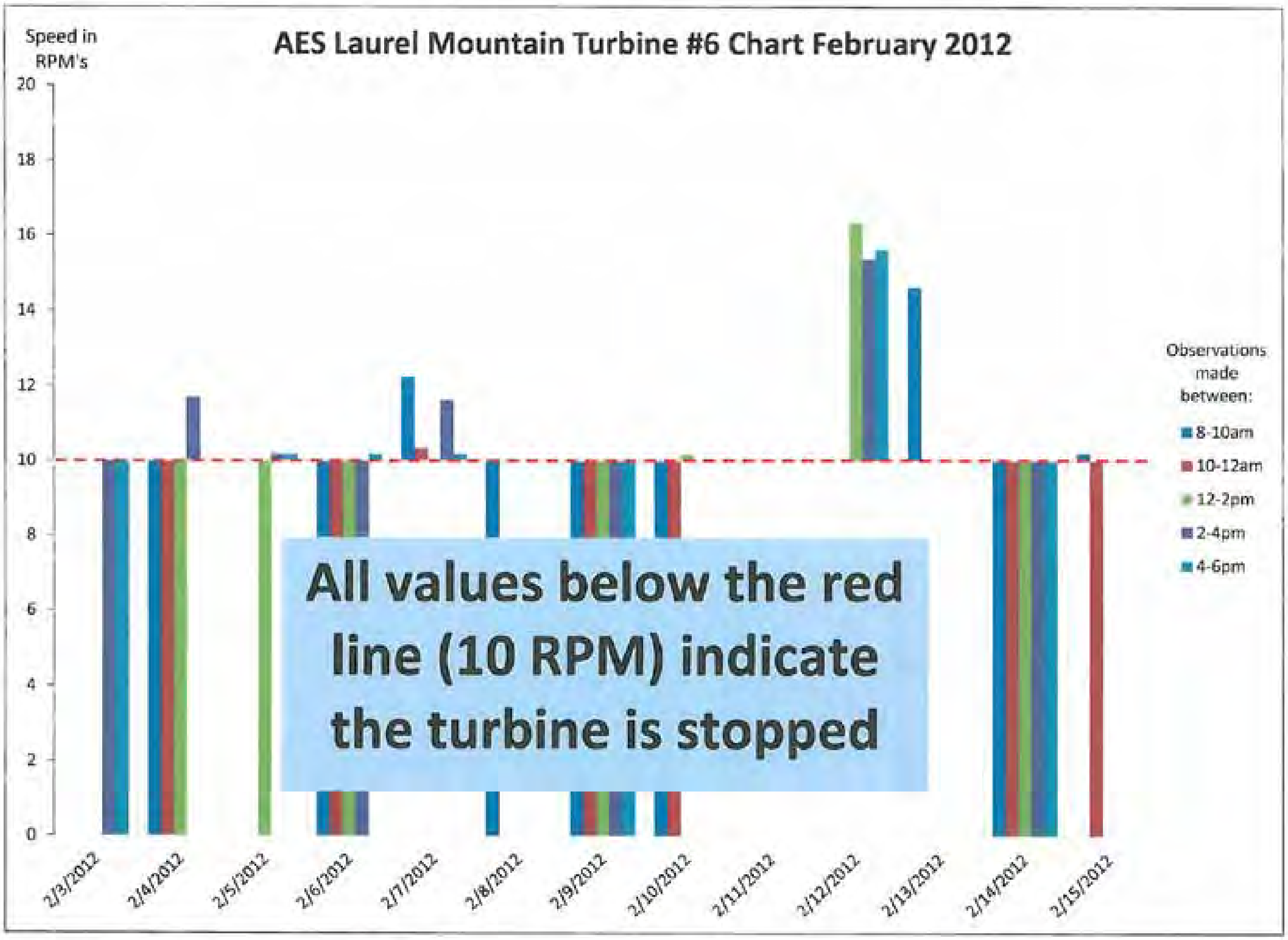
December Data 2011

	8-10am	10-12am	12-2pm	2-4pm	4-6pm
12/1/2011	0	0	0	0	0
12/2/2011	15.33				
12/3/2011	11.7		0	10.14	10.15
12/4/2011	10.37	0	0	10.21	0
12/5/2011	17.57	10.86	10.16		0
12/6/2011	10.19	0	0		
12/7/2011					
12/8/2011	10.19	0	0	0	0
12/9/2011	10.15	13.78	12.89	10.19	10.2
12/10/2011	13.09				11.52
12/11/2011	0	0			
12/27/2011	15.89	11.91		0	17.8
12/28/2011	17.73	17.78	17.19	17.61	17.68
12/29/2011	11.16	10.17	12.04	10.89	10.15
12/30/2011	14.64	11.09	10.27	0	11.13
12/31/2011	17.73	16.52		14.07	13.47


AES Laurel Mountain Turbine #6 RPM Chart January 2012
Speed in RPM's
Observations made between:
8-10am
10-12am
12-2pm
2-4pm
4-6pm
All values below the red line (10 RPM) indicate the turbine is stopped
20
18
16
14
12
10
8
6
4
2
0
1/1/2012
1/2/2012
1/3/2012
1/4/2012
1/5/2012
1/6/2012
1/7/2012
1/8/2012
1/9/2012
1/10/2012
1/11/2012
1/12/2012
1/13/2012
1/14/2012
1/15/2012
1/16/2012
1/17/2012
1/18/2012
1/19/2012
1/20/2012
1/21/2012
1/22/2012
1/23/2012
1/24/2012
1/25/2012
1/26/2012
1/27/2012
1/28/2012
1/29/2012
1/30/2012

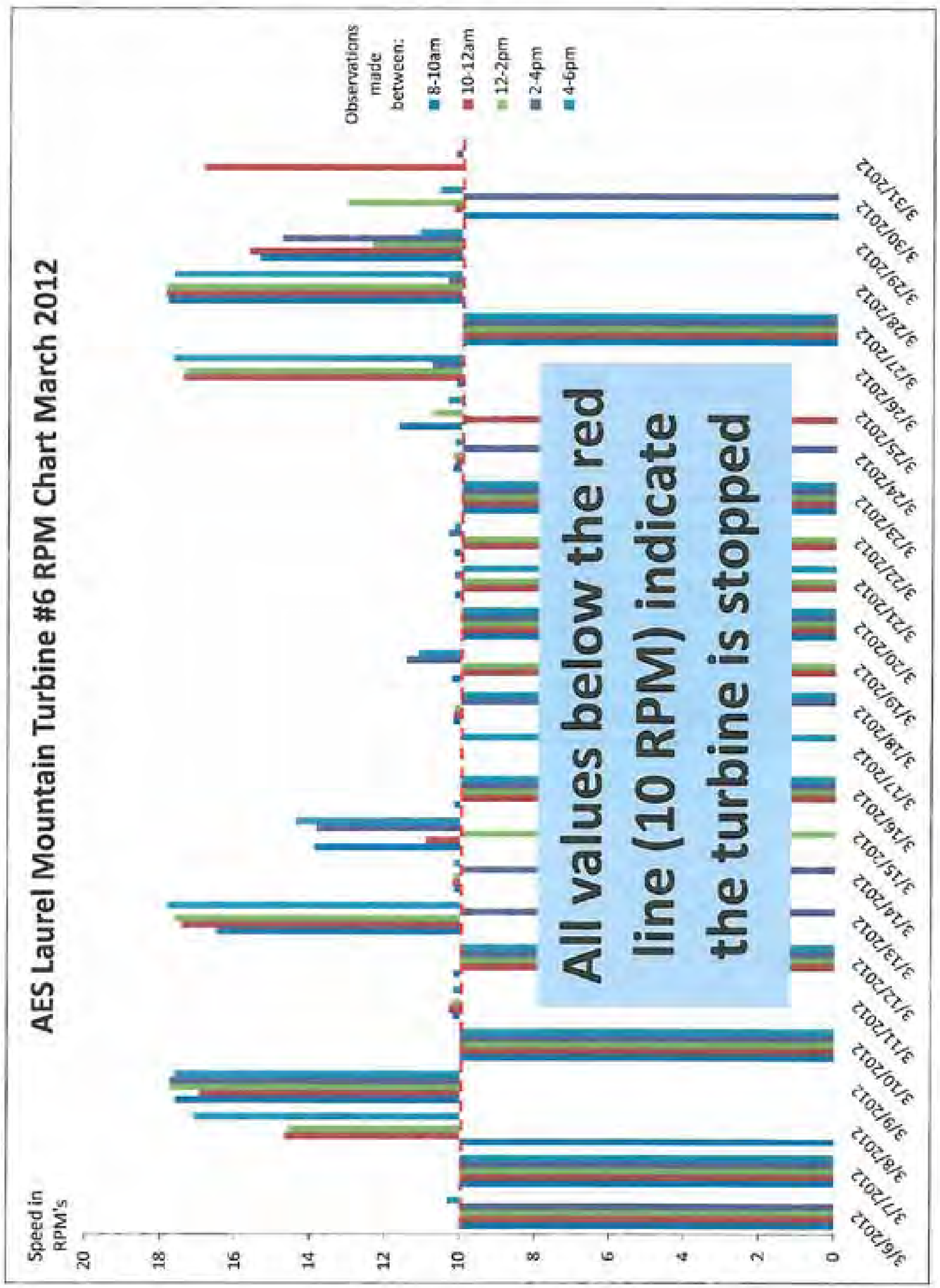
January 2012 Data

	8-10am	10-12am	12-2pm	2-4pm	4-6pm
1/1/2012	17.41	11.76	12.87		
1/2/2012		12.57	17.81	17.58	17.88
1/3/2012	15.74		17.78	17.83	
1/4/2012	0	16.52	16.08		16.03
1/5/2012	13.95	13.54	14.22	11.38	11.61
1/6/2012	17.81	16.71		17.47	15.22
1/7/2012	16.06	17.34			16.14
1/8/2012	0	0	0	10.17	0
1/9/2012	10.23	0	0	0	10.63
1/10/2012	15.16	11.85	12.89	10.17	0
1/11/2012	17.71	17.67	17.79	17.62	
1/12/2012	17.89				
1/13/2012	17.65				17.84
1/14/2012	10.18	10.2			10.17
1/15/2012	0	0	0	0	0
1/16/2012	17.58		17.25	11.8	
1/17/2012	13.84	0	17.3	11.87	17.74
1/18/2012	15.82	15.79	10.28	10.12	
1/19/2012	12.29	0	14.22		14.27
1/20/2012	0	0	0	0	0
1/21/2012					
1/22/2012	0	10.2	17.67	17.66	17.69
1/23/2012	17.78	17.85	17.63	0	16.13
1/24/2012	13.1	10.95	17.14	17.74	
1/25/2012	0	0	0	0	10.19
1/26/2012	12.37	13.03	13.22	13.95	10.7
1/27/2012	17.78				
1/28/2012	11.03		10.67	17.19	17.76
1/29/2012	13.32	11.58	15.63		17.63
1/30/2012	10.17	0			


AES Laurel Mountain Turbine #6 Chart February 2012
Speed in RPM's
20
18
16
14
12
10
8
6
4
2
0
2/3/2012
2/4/2012
2/5/2012
2/6/2012
2/7/2012
2/8/2012
2/9/2012
2/10/2012
2/11/2012
2/12/2012
2/13/2012
2/14/2012
2/15/2012
Observations made between:
8-10am
10-12am
12-2pm
2-4pm
4-6pm
All values below the red line (10 RPM) indicate the turbine is stopped

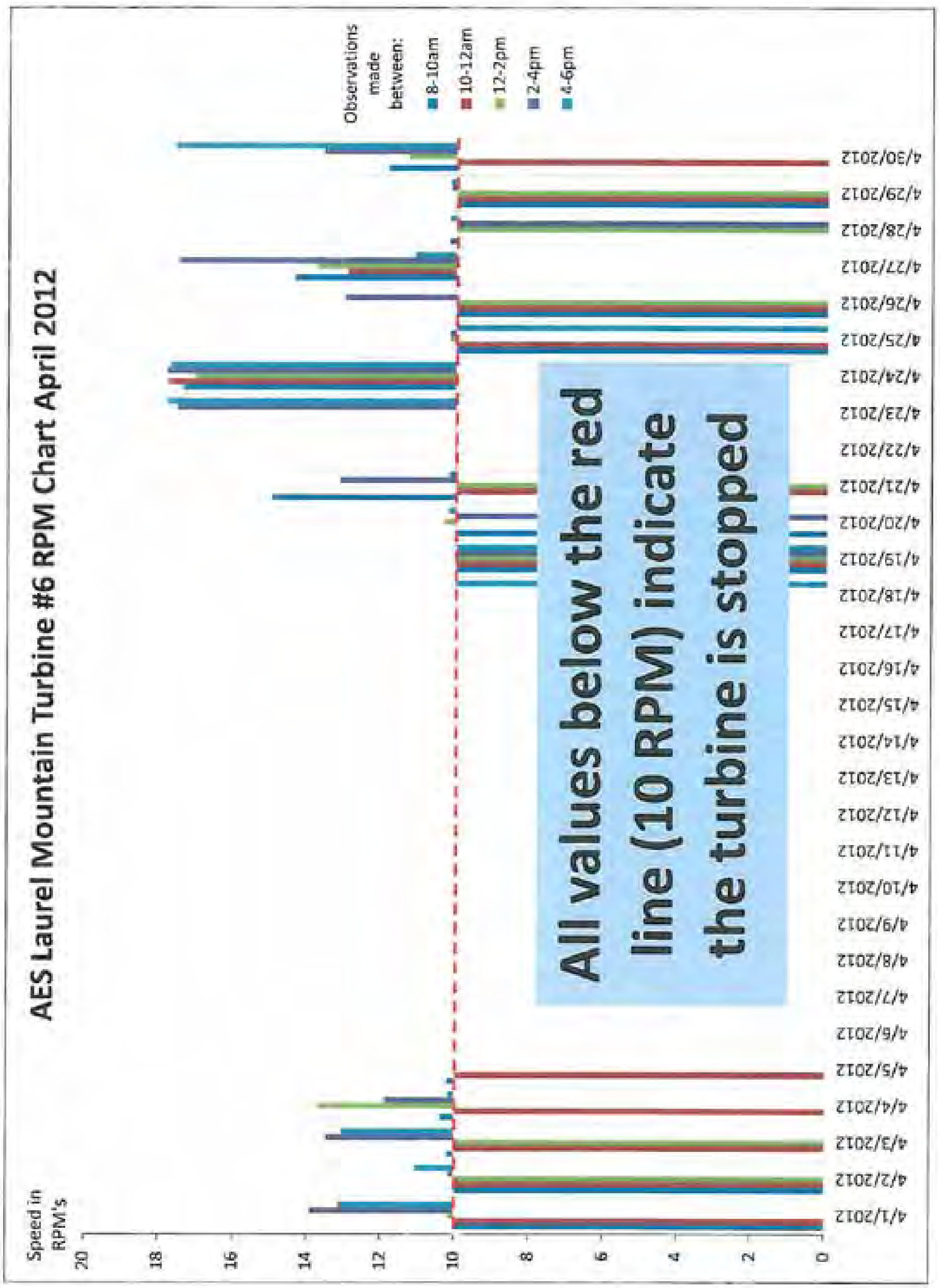
February 2012 Data

	8-10am	10-12am	12-2pm	2-4pm	4-6pm
2/3/2012				0	0
2/4/2012	0	0	0	11.7	
2/5/2012			0	10.18	10.18
2/6/2012	0	0	0	0	10.17
2/7/2012	12.24	10.34		11.63	10.17
2/8/2012	0				
2/9/2012	0	0	0	0	0
2/10/2012	0	0	10.17		
2/11/2012					
2/12/2012			16.35	15.37	15.62
2/13/2012	14.62				
2/14/2012	0	0	0	0	0
2/15/2012	10.19	0			


AES Laurel Mountain Turbine #6 RPM Chart March 2012
Speed in RPM's
20
18
16
14
12
10
8
6
4
2
0
Observations made between:
8-10am
10-12am
12-2pm
2-4pm
4-6pm
All values below the red line (10 RPM) indicate the turbine is stopped
3/6/2012
3/7/2012
3/8/2012
3/9/2012
3/10/2012
3/11/2012
3/12/2012
3/13/2012
3/14/2012
3/15/2012
3/16/2012
3/17/2012
3/18/2012
3/19/2012
3/20/2012
3/21/2012
3/22/2012
3/23/2012
3/24/2012
3/25/2012
3/26/2012
3/27/2012
3/28/2012
3/29/2012
3/30/2012
3/31/2012

March Data 2012

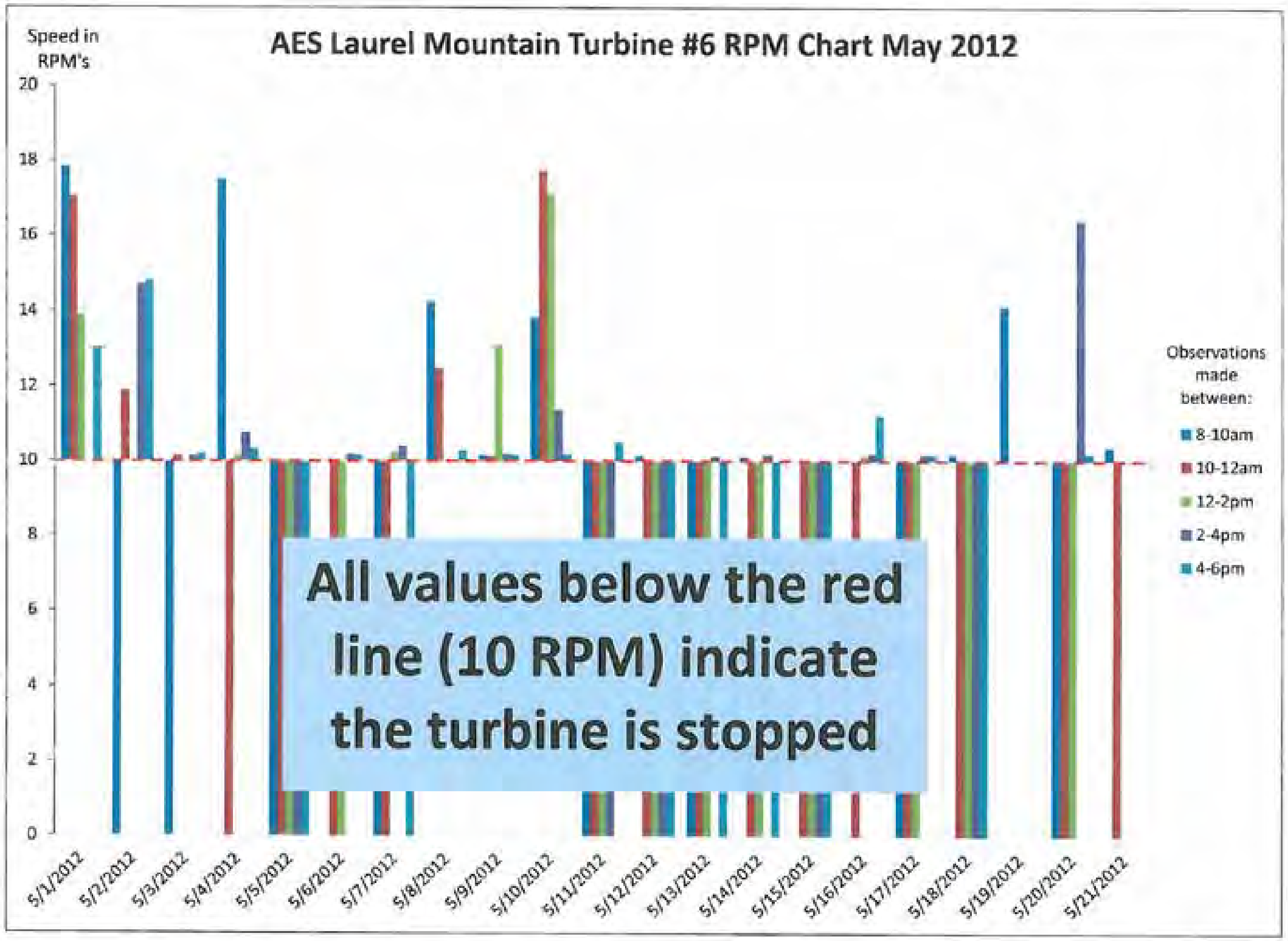
	8-10am	10-12am	12-2pm	2-4pm	4-6pm	
3/6/2012	0	0	0	0	10.32	
3/7/2012	0	0	0	0	0	
3/8/2012	17071	14.67	14.58		17.11	
3/9/2012	17.6	16.97	17.75	17.75	17.63	
3/10/2012	0	0	0	0	0	
3/11/2012	10.19	10.29	10.23		10.18	
3/12/2012	10.17	0	0	0	0	
3/13/2012	16.51	17.45	17.63	0	17.84	
3/14/2012	10.17	10.2	10.18	0	10.18	
3/15/2012	13.9	10.92	0	13.84	14.4	
3/16/2012	10.18	0	0	0	0	
3/17/2012					0	
3/18/2012	10.2	10.19	10.17	0	0	
3/19/2012	10.24	0	0	11.46	11.13	
3/20/2012	0	0	0	0	0	
3/21/2012	10.17	0	0	10.17	0	
3/22/2012	10.2	0	0	10.32	10.18	
3/23/2012	0	0	0	0	0	
3/24/2012	10.23	10.18	10.23	0	10.18	
3/25/2012	11.67	0	10.77		10.36	
3/26/2012	10.14	17.46	17.42	10.79	17.73	
3/27/2012	0	0	0	0	0	
3/28/2012	17.86	17.91	17.91	10.36	17.69	
3/29/2012	15.42	15.69	12.4	14.82	11.14	
3/30/2012	0	10.22	13.1	0	10.59	
3/31/2012		16.9		10.17		



AES Laurel Mountain Turbine #6 RPM Chart April 2012
Speed in RPM's
20
18
16
14
12
10
8
6
4
2
0
4/1/2012
4/2/2012
4/3/2012
4/4/2012
4/5/2012
4/6/2012
4/7/2012
4/8/2012
4/9/2012
4/10/2012
4/11/2012
4/12/2012
4/13/2012
4/14/2012
4/15/2012
4/16/2012
4/17/2012
4/18/2012
4/19/2012
4/20/2012
4/21/2012
4/22/2012
4/23/2012
4/24/2012
4/25/2012
4/26/2012
4/27/2012
4/28/2012
4/29/2012
4/30/2012
Observations made between:
8-10am
10-12am
12-2pm
2-4pm
4-6pm
All values below the red line (10 RPM) indicate the turbine is stopped

April 2012 Data

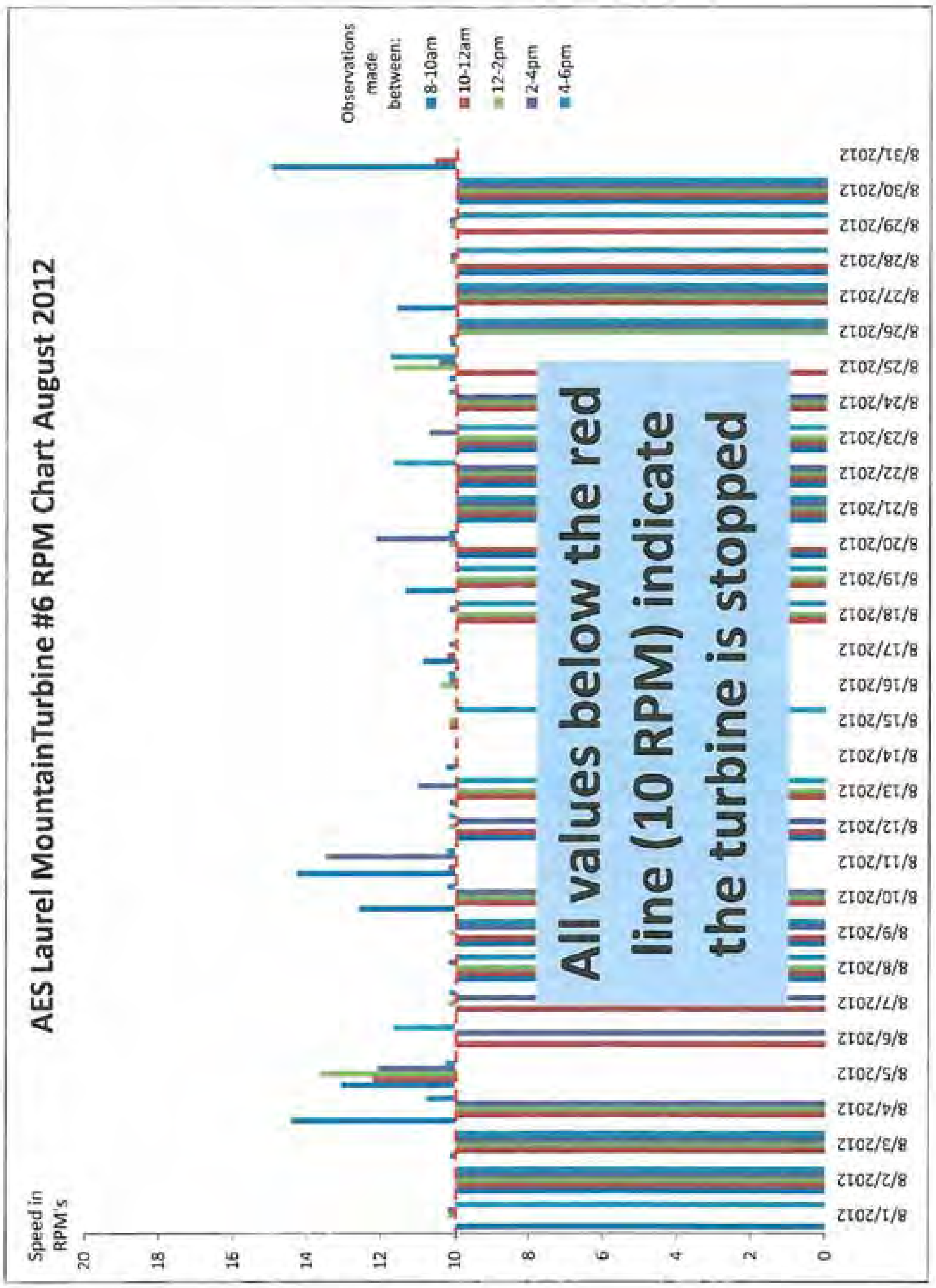
	8-10am	10-12am	12-2pm	2-4pm	4-6pm
4/1/2012	0	0	10.17	13.9	13.16
4/2/2012	0	0	0	10.16	11.06
4/3/2012	10.2	0	0	13.46	13.07
4/4/2012	10.38	0	13.74	11.89	10.17
4/5/2012	10.2	0			
4/18/2012					0
4/19/2012	0	0	0	0	0
4/20/2012	0		10.32	0	10.18
4/21/2012	15	16058	0	13.14	10.18
4/22/2012					
4/23/2012				17.53	17.79
4/24/2012	17.39	17.78	17.06	17.8	17.73
4/25/2012	0	0	10.17	10.16	0
4/26/2012	0	17078	0	13.01	
4/27/2012	14.4	12.94	13.8	17.49	11.13
4/28/2012	10.19		0	0	10.17
4/29/2012	0	0	0	10.12	10.14
4/30/2012	11.86	0	11.31	13.58	17.6



AES Laurel Mountain Turbine #6 RPM Chart May 2012
Speed in RPM's
20
18
16
14
12
10
8
6
4
2
0
5/1/2012
5/2/2012
5/3/2012
5/4/2012
5/5/2012
5/6/2012
5/7/2012
5/8/2012
5/9/2012
5/10/2012
5/11/2012
5/12/2012
5/13/2012
5/14/2012
5/15/2012
5/16/2012
5/17/2012
5/18/2012
5/19/2012
5/20/2012
5/21/2012
Observations made between:
8-10am
10-12am
12-2pm
2-4pm
4-6pm
All values below the red line (10 RPM) indicate the turbine is stopped

May 2012 Data

	8-10am	10-12am	12-2pm	2-4pm	4-6pm
5/1/2012	17.82	17.04	13.92		13.05
5/2/2012	0	11.89		14.71	14.82
5/3/2012	0	10.15		10.14	10.21
5/4/2012	17.5	0	10.17	10.76	10.32
5/5/2012	0	0	0	0	0
5/6/2012		0	0	10.19	10.16
5/7/2012	0	0	10.24	10.4	0
5/8/2012	14.26	12.5			10.28
5/9/2012	10.16	10.15	13.14	10.2	10.17
5/10/2012	13.84	17.75	17.13	11.38	10.19
5/11/2012	0	0	0	0	10.52
5/12/2012	10.16	0	0	0	0
5/13/2012	0	0	0	10.13	0
5/14/2012	10.12	0	0	10.18	0
5/15/2012		0	0	0	0
5/16/2012		0	10.15	10.2	11.22
5/17/2012	0	0	0	10.17	10.19
5/18/2012	10.18	0	0	0	0
5/19/2012	14.14				
5/20/2012	0	0	0	16.41	10.21
5/21/2012	10.37	0			


AES Laurel MountainTurbine #6 RPM Chart August 2012
Speed in RPM's
20
18
16
14
12
10
8
6
4
2
0
8/1/2012
8/2/2012
8/3/2012
8/4/2012
8/5/2012
8/6/2012
8/7/2012
8/8/2012
8/9/2012
8/10/2012
8/11/2012
8/12/2012
8/13/2012
8/14/2012
8/15/2012
8/16/2012
8/17/2012
8/18/2012
8/19/2012
8/20/2012
8/21/2012
8/22/2012
8/23/2012
8/24/2012
8/25/2012
8/26/2012
8/27/2012
8/28/2012
8/29/2012
8/30/2012
8/31/2012
Observations made between:
8-10am
10-12am
12-2pm
2-4pm
4-6pm
All values below the red line (10 RPM) indicate the turbine is stopped

August 2012 Data

	8-10am	10-12am	12-2pm	2-4pm	4-6pm
8/1/2012	0		10.19	10.19	0
8/2/2012	0	0	0	0	0
8/3/2012	10.13	0	0	0	0
8/4/2012	14.43	0	0	0	10.77
8/5/2012	13.07	12.22	13.66	12.08	10.26
8/6/2012		0		0	11.67
8/7/2012		0	10.2	0	10.16
8/8/2012	0	0	0	10.18	0
8/9/2012	0	0	10.18	0	0
8/10/2012	12.6	0	0	0	10.21
8/11/2012	14.28	10.19		13.49	10.26
8/12/2012	0	0	10.18	0	10.2
8/13/2012	10.15	0	0	10.99	0
8/14/2012	10.26				
8/15/2012		10.16	10.18		0
8/16/2012			10.4	10.17	10.2
8/17/2012	10.88	10.23		10.18	
8/18/2012		0	0	10.17	0
8/19/2012	11.35	0	0		0
8/20/2012	0	0	10.19	12.14	10.2
8/21/2012	0	0	0	0	0
8/22/2012	0	0	0	0	11.69
8/23/2012	0	0	0	10.7	0
8/24/2012		0	0	0	10.2
8/25/2012	10.17	0	11.68	10.46	11.76
8/26/2012	10.16	10.18	0	0	0
8/27/2012	11.58	0	0	0	0
8/28/2012	0	0	10.17	10.15	0
8/29/2012		0	10.18	10.17	0
8/30/2012	0	0	0	0	0
8/31/2012	15	10.57			

Public Hearing Speakers — Martinsburg

Name: Grover Duling
Hometown:
Organization: Eastern WV Community and Technical College

My name is Grover Duling. I'm from Eastern WV Community and Technical College in Moorefield WV. Several years ago we had the dream of starting a program to train wind technicians. We saw wind turbines going up in the Mount Storm area, we already had 66 turbines in Tucker County, and we saw plans for additional wind turbines to be installed all around us, north, south, east and west. At this point in time, we have in West Virginia 327 operating wind turbines producing 586 megawatts of energy at their maximum capacity. I'm saying that to say this. Without the Division of Energy, and their support, the training that we have to train local people, who are West Virginians, for West Virginia jobs would not be available today. We have graduates who have come through our 2 year program working on wind farms all around us. And this is what it's all about. As far as our 5-year plan, and working with the Division of Energy, and what we can do to support additional trainings, we plan to look toward doing training in the area of solar energy. Our part of the country, I don't know if yours does or not, but our part of West Virginia has a lot of poultry farms. The roofline on a poultry house is long and a lot of times it faces the southern sky. Southeast and west. In many cases solar energy would be just a natural for that. Our first trainings that we're looking to do in that area would be to educate the local farmers on what the possibilities would be, what the costs would be, and what incentives might be out there to support either solar electric or solar hot water. That's one area of training we're going to get into. We continue to enhance our program for the wind technician training by adding real-life opportunities for those students to be trained on equipment that they will find in the field. Little bench models of wind turbines is great to talk about, we believe as Iowa Lakes Community College, who was the leader for years in wind technician training, we believe that the students need the real-life opportunity. Industry has seen that as well. We have partnered with Dominion Power, and they've provided several grants for us to continue our work, and we want to move forward with renewables as best we can in training in that area. I thank you, Jeff, for your support, the Division of Energy, Christine, we've communicated several times and talked about what we can do, we want your input, and I'm speaking to Jeff and Christine and anyone who would want to call the college, because we want to be as green as we can be. And we want to do the training that's necessary to support what industry and the residents of West Virginia need. Thank you Jeff for your time.

Name: Janet Brosio
Hometown:
Organization: Occupy Martinsburg

I am Janet Brosio with Occupy Martinsburg and also just a concerned citizen. I kind of had a question. Dr. Witt had said that the biggest energy increase will be coming from natural gas in our future. Yet when I was reading last night online in the report, the overview of renewable energy stated that renewable energy is the U.S. and world's fastest-growing source of marketed energy. And the predictions of renewable energy is going to trend upward within the next 25 years. So why is the recommendation for renewable and alternative energies to maintain the current policy within the next 5 years? Jeff answers, the issue with growth of renewables is that it's growing from a smaller number to begin with. So you could have an increase of 15%, and still only end up with 3% overall. Janet says, But why such small, why in the next 5 years are we not going to be looking much? Why are you maintaining? Jeff says, again this is market driven, the renewables have considerable incentives now, they're competing against other fuel sources. Janet says, OK, explain it more to me like I'm a 6 year old, because this is not my forte. I'm just wondering, why are we not doing more? Christine says, if it weren't for the system integration issue, we would find it easier to advocate a more aggressive state policy. First of all, the federal policies are much more generous than almost any state policy with the exception of SREC credits for solar. The state can't do a whole lot with wind energy, the federal production credit is so large and that's the driver. If it weren't for the integration issue which clouds the policy, which is to reduce the burning of fossil fuels, if the answer to that were clearer it would be easier to justify large incentives. Because the recommendations to smooth this integration are not in place or only partially in place, and because the changes from year to year and day to day and season to season, and there is no real standard or answer for how much benefit we're getting with these variable resources. It's hard to make an aggressive policy without knowing that answer. Janet says, so as a regular citizen, how do I go about asking my WV government to give more incentive and encourage more leaning toward renewable and alternative energy? Christine says, in terms of variable reserves, I'm not sure we should subsidize it heavily because we don't know what we're getting from it. It's very complex system integration where you must maintain very high level of reliability for electricity. This is a real-time market. Janet says, I know it's complex, but for the average person to understand it, it has to be broken down if I'm not a person that does this for a living. It needs to be broken down further so that the average person can understand what my WV government is doing to make sustainable energy. Christine says, there will be a lot of reports in the next 2 or 3 years that will help clear this up. Janet says, so we don't really have an answer for that, is that correct, that's just it? Christine says, the answer is not there. Janet says, thank you.

Name: Gail Becker
Hometown:
Organization: Occupy Martinsburg

I'm Gail Becker, Occupy Martinsburg. One question that I wanted to ask, we've been told that coal production is declining and I don't understand with obvious concerns on the state level about coal production declining, why you wouldn't be more serious about reaching out for renewables. We know that you're reaching out for natural gas, but natural gas is also potentially very dangerous if not carefully regulated. Why aren't you reaching out for renewables? Again, we're losing jobs here in the coal industry. Why aren't you helping to create jobs in the renewable industry? That's a question. Jeff says, I understand your question. When the plan was written we had 66 megawatts of wind generation in West Virginia, 66. We now have 580 megawatts. Wind energy has increased dramatically over the last 5 years. Solar capacity was 1 kilowatt or something like that 5 years ago. It's now a little over a thousand kilowatts. There's been dramatic increases in hydro, probably __. There have been dramatic growths of renewable energy in West Virginia over the last 5 years. Gail says, can you put it in terms of how many people these industries are employing in the hydro or the solar industries in West Virginia? Jeff says, again, we're having 10 people provide input. The solar industry is on the agenda, they will certainly be offering comments. I'm sure they will offer their employment figures, on the installers. As Christine referenced, we do not have the manufacturing side of solar in our state. The jobs from solar principally come from the installers. Gail says, OK just one more question. This might be for Christine. She notes that, well I'll just make a statement. She notes that funding solar through utilities, quote "obscures" the real price of __ electricity. I'm quoting, increases. It seems that the quote unquote "real" price, and I'm not going to speak to that, I believe we have a much better speaker back here, Joe Gray. It seems the real price of coal and gas production in terms of environmental damage and health costs have long been obscured in West Virginia and elsewhere. And I would just ask that you find a system that would really equate the cost of fossil fuels to the West Virginia economy and the West Virginia health, OK. Your office seems very concerned about the cost and the real price of solar, yet we're not hearing the real price I don't think of fossil fuels. Thank you very much.

Name: Joe Gray
Hometown:
Organization: Occupy Martinsburg

Good morning, my name is Joe Gray. I'm also with Occupy Martinsburg. I'm a local area resident. My issue is that if people, and this is a general economic issue, but it seems to come home a lot in the energy field, and that is for people to make rational economic decisions about what they're going to purchase, they need to know the true cost of the item they're purchasing. When it comes to energy, it's just notorious that so much of the costs are externalized. Starting with coal extraction, the runoff, the damage to the streams, the coal ash and dust, the damage to lungs and people's health, the mercury that's in the fish, the global pollution and global warming problems, all of these costs are externalized. Therefore it makes the cost of the coal look cheap. This is why people buy coal. This is why people don't buy renewable energy, because renewable energy bears its cost. It does not have all these externals associated with it. So what I'm saying is that we need to make a serious effort to internalize the cost. In the end, each one of the energy sources be representative of its true cost. This way and only this way will people make rational decisions about their choices of energy. My last comment is, I noted in the list of Christine Risch's listings of the benefits of efficiency, that there was nothing about reduction of pollution, environmental pollution, health issues or global warming. All of this associated with cost and energy peak loads and so forth. I would advise please to add those references to the chart. Thank you.

Name: John Christensen
Hometown:
Organization: Mountain View Solar

John Christensen with MTV Solar here locally. I wanted to start off by complimenting you, your agency and all the authors of the report for a job well done. Of course I have some issues with it and I'll be sure to let you know. I appreciate the people that preceded me talking about the internalized costs, that's very important. My background is as a solar energy advocate and government affairs with MTV Solar. Therefore I spend my 60 day session at the Capitol advocating for solar energy and all renewable energy. While I was down there last year, Joe Manchin came up to me and complimented me for my work and expressed his belief that a more diversified energy portfolio is something that West Virginia needs, and something that should be promoted by your agency. Jeff says, I have heard those discussions, yes. John says, it was unsolicited, he came up to me. Even though we have had discussions with him in the past, it was pretty surprising to me. To maintain current policies, I would say that we need to add to it. The solar carve out, which would make the solar energy portfolio standard a catalyst for solar electric installation statewide, with the ultimate goal of attracting a major manufacturing company like Solar World that we work with exclusively. American-made product, 100% of the materials come from America. WV is blessed with glass, silicon and aluminum, which is what it takes to put together a solar panel. Besides the copper, I don't think we have copper. That's about the only thing we don't have. With that, if we had some more incentives, then that would attract a major manufacturer like they do in the gas industry. There's all kinds of incentives, in the coal industry there's all kinds of incentives. You know, we need to level the playing field in order for renewable energy to compete. We are, you know, if we brought in this manufacturing company, it would create thousands of new high-paying jobs statewide. And we could produce as many panels so that we could export them overseas, which currently Solar World does. We are engaged as a company to teach solar electric installation technology to local students here in the Panhandle. With the Blue Ridge CTC, we start next week, it's at no cost to the students in this area, it's just a wonderful opportunity for local folks to learn a new trade and you know, get a job if they're unemployed or underemployed this could lead to a bright future. Talking about the draft plan, it seemed to me as far as renewables are concerned that it had kind of a negative tone throughout, and that's not our experience. Our experience is that this industry is growing tremendously. In table one, it's kind of misleading. It does not even show Germany's low insolation number compared to West Virginia, and how they have the most developed solar industry in the world. They're huge compared to everybody else. Solar is a localized energy source, not to be exported. But to use to support the local distribution generation grid. Figure 7, as far as solar capacity, does not show New Jersey. New Jersey's huge. New Jersey should be in there. It's the leader in our industry. And they have the best SREC market as well. Finally, this just came out, administrator for FERC (Federal Energy Regulatory Commission) says that the nation's electrical future may well belong to distributed generation such as rooftop solar rather than central power stations. And generators far from demand such as public lands, solar and wind. John Wellinghoff is the chairman. He says that the nation's electrical future will benefit by rooftop solar. So these are all good reasons to, for the state to get behind this and promote this budding industry that could provide thousands of high-paying jobs and clean up the environment. Thank you very much.

Name: Ashley Jones
Hometown:
Organization: Mountain View Solar

Hi, my name is Ashley Jones, I'm with Mountain View Solar. I just wanted to discuss one key conclusion about the solar portion of the energy plan, which basically states that West Virginia's solar resource is too weak to support an industry and to conserve our coal resource. West Virginia, as you saw in the presentation, receives about 4 to 5 hours of solar-generated light per day. New Jersey also receives about 4 to 5 hours a day. New Jersey is the second in the nation for most-installed solar, right behind California. Actually in the first quarter of 2012 they installed more solar than any other state in the nation. They have, to date, installed over 850,000 kilowatts of solar, which generates roughly enough power, or enough electricity to power about 10,000 average American homes. In the process they've created about 5,000 jobs in the industry. West Virginia too could see this success. Actually Mountain View Solar has begun to, with several commercial, municipal and residential installs throughout the state. With government support, we could further support and expand the solar industry to create West Virginia jobs, save West Virginians money, all while utilizing this clean and free resource of energy. This can also help us conserve our coal industry and coal resource while insuring a sustainable energy economy for years to come. Thank you.

Name: Colin Williams
Hometown:
Organization: Mountain View Solar

Thank you all very much for the opportunity to comment on this draft report. As we look at the 5-year plan, the conclusions about the decrease in the role of coal as a fuel source for electric generation is exactly why now is the time to create the regulations needed to secure the development of renewables within our state. Solar resources provide for long-term electric generation with no base fuel required. This is one of the pieces of the equation that I think, there was some comment about the real cost of electric generation that's sometimes obscured. Once a solar panel is installed it will produce electricity for literally generations with no added fuel. As an energy exporter, we're able to meet some of our consumption through solar and other renewables. CHP, wind and hydro. This will increase our export capacity. The more energy we're able to export, the more revenue that comes from that and the stronger our state is. Solar is distributed power. It's made where it's needed, generally speaking, which adds stability to the grid. It's very efficient because essentially there's no line loss. This is something that Christine and I heard at a workshop we attended on Standard Offer Programs in Charleston recently. Nationally, 236 billion kilowatt hours of electricity are lost in transmission. That equates to a 24 billion dollar loss. It's enough energy to power the state of California. By deploying rooftop solar, we're able to reduce the amount of energy lost in transmission. Energy rates will continue to go up whether we transition or not, so the argument that the cost is a reason not to do it, is erroneous. The reality is that we have some of the lowest rates in the country and we'll continue to see increase in the rates of electricity regardless of whether or not we begin to transition. WV electric rates are some of the lowest in the nation and will continue to increase. Solar allows consumers to fix the cost of a portion or all of their electricity needs, again for the long-term. This is one of the economic drivers. There's more money in my pocket because I have solar panels on my roof. I pay less to Allegheny Power today than I did a year ago on a monthly basis because I have some production on my home. One of the drivers, as Christine mentioned, were the incentives, tax credits and SREC. At this point, discussing whether an SREC is an appropriate way to fund a solar carve out is putting the cart before the horse. The first step is for the ARPS to be amended to allow for carve outs, specifically solar but also for other distributed generation sources such as CHP, wind and hydro. The other thing that needs to happen legislatively is that the rules need to be changed to allow for the sale of electricity. Yesterday Dr. Carl Irwin presented a report to you in Morgantown that outlined this more specifically and gave examples citing that. But essentially there are plants in this state that would go back online and be generating electricity if they were allowed to sell electricity. This would also be a mechanism that would allow for large-scale solar deployment. Investors would see the economic return necessary to invest in solar deployment in the state of WV. Currently in the US there are over 100,000 people employed in the US solar industry. This shows substantial growth as you identified in 5 years. The solar industry is relatively new in the US, and we've seen substantial growth in an industry at a time when there are 24 million Americans looking for jobs. This is a time of stagnant economic growth, if not decline, yet the solar industry is growing. Largely funded through incentives, state and federal incentives, a small portion through stimulus dollars. But it is a growing industry and it will continue to be. It's over a billion dollar industry and it can play a prominent role in WV's energy future. And that's about it, did I finish on time? Thank you so much, it is an exhaustive report and again I do appreciate you giving us the opportunity to provide input and we certainly hope that you take it to heart and add it to your report. Thank you very much.

Name: Bob Magrath
Hometown:
Organization: Mountain View Solar

I'm Bob Magrath, I'm also here with Mountain View Solar, we're here en masse today. I wanted to cover just a couple of quick areas that are relative to the report. Currently, as the state legislation is written, we are precluded from going ahead and selling electricity directly to an individual or company on whose location we have installed solar as any other renewable energy provider is. We cannot sell that electricity directly to them. Many states have a vehicle called the power purchase agreement. And that power purchase agreement allows an arrangement to be struck between the individual on whose facility the solar is being installed and the installer, such that they can sell the electricity at a rate that is agreed to between the end user and between the installer. I would like the report to be expanded to include an investigation of power purchase agreements as a vehicle to facilitate that, because what I think that could do is it can extend the installation of solar and have an arrangement struck directly between the solar provider and/or any renewable energy provider and the end user. There is a vehicle for the statement, you have to become a registered utility and be regulated by the state. Under the power purchase agreements that exist in other states this is not required. So I'd like that section to be looked at if you would. The second thing is, there's another area of renewable energy that is not addressed in the report called gasification plants, which are beginning to pop in a number of places. And this basically is the burning of trash to generate heat that then drives steam turbines that produces electricity. This is being done up in Canada and some other locations as well. And I think this should be included at least as an area to be investigated, because it has a significant impact not only in the renewable energy source, because trash, like it or not, seems to be a renewable source, and secondly it has a nice environmental impact in that we're disposing of that in a responsible manner, and there are standards around these plants that make sure that they are protecting the environment. But they also have become a source for producing electricity. So if you could take a look at that, that would be appreciated as well. Thank you very much for the opportunity.

Name: Michael McKechnie
Hometown:
Organization: Mountain View Solar

Jeff, thanks for having us here today. We appreciate you having this venue in the Eastern Panhandle. As you know, we've been advocates of solar energy in WV for the last 4 years. Thanks to your help in the Department of Energy, you specifically and Joe Brouse, we seen tremendous growth in solar through your implementation of some of the stimulus money that came through to allow some projects at the Morgan County Courthouse, we've done a wastewater treatment plant in Hurricane, WV, basically, we're finally allowed to say we put solar panels on the DEP office in South Charleston. That was some stimulus money for solar that we really, really liked. Thanks for all the help you've done. Also, the report you put together, I can't imagine how much time it took, we appreciate that. I haven't been through all of it personally but it but have been a lot of effort by Christine and everyone else. Lots of good information in there. We're here to talk about solar energy specifically. From our perspective, we have a small company I own with my brother, a small company here in WV, that used to build houses. If we were still building houses, these folks wouldn't be here. Our parking lot would be empty. And there would be no people working. Instead of that, what we have is 24 full-time people working for us where there used to be zero. That's in the last 3 years. That's a big growth. And like Colin said, in an otherwise really down economy. The energy sector, specifically in solar power. We work in Maryland, Pennsylvania and Virginia. Most of our work is in WV, even though the incentives are much better in MD, OH, and PA. Most of our work is right here in WV because we chose to make it that way here. And with support from the Department of Energy, we've really been able to succeed. A couple highlights: energy efficiency is a tremendously good part of your report. I enjoyed that tremendously. It is the very first place we need to start. A tremendous amount of energy is wasted in our houses and commercial properties. That needs to be fixed immediately. The 2009 code being adopted, we know we tried that a couple of years ago, hopefully we can do it this year with legislative support from this report. That was great. The economic __ is what I want to talk about. Solar creates a tremendous amount of jobs. In all the states that have the SRECs. An SREC, as you know, is an east coast phenomenon, not a west coast. We don't have the _ capacity to generate that here in WV because the ARPS needs to be modified for a carve out, like they have in OH, PA and MD. Those states up on the chart that Christine had, had significantly more solar power than we produced. We have about 1.3 megawatts on grid, _ current study with what we put in. Off the grid there's at least another couple hundred kilowatts that we know _ put in specifically. That's a big number there. The economic driver is not the taxes that you would get from the state or local or B & O tax or property tax. It's the money that comes from the payroll that we spend every week. That's the money. That's the economic driver. We hire people mostly from WV that live and work here. They shop here. They spend their money here and in our communities. We train people all over the state to do that. It's starting to grow. We've seen tremendous growth in Ohio, PA and MD. And we've stagnated here in WV. We've got some good steps forward. 1.2 megawatts compared to 40, 50, 60 or 88 in pa. Here's the difference: if we had that one extra piece of __ carve out in the ARPS, similar to what they have in Ohio, matter of fact identical if we did a half a percent by 2020. We would see significantly more growth , and more companies like ours. We're just building contractors. We're not solar guys. We're contractors that learned how to survive in a down economy. We put things in to people's houses and their businesses. Energy is the hottest topic out there. The fastest growing industry globally, it's the fastest growing energy sector in our country, and WV is behind. We need to improve. We've made some good steps, we'd like to see a few more good steps made. Thanks again for having us here and thanks for being here in the Eastern Panhandle.

Name: Keryn Newman
Hometown:
Organization: Stop Path Shepherdstown

My name is Keryn Newman and I'm a member of Stop PATH WV. I have read the draft energy plan, all 300 or so pages, and I have a very few brief comments. I'd first like to state that I support the formal written comments recommendations regarding the plan submitted by Energy Efficient WV and the Coalition for Reliable Power. I read the fossil section of the plan with great interest and was impressed by its detailed and realistic observations about the present state of coal-fired electric generation resources. However, the recommendations presented at the end of the document do not logically correlate with the observations noted. After adequately presenting the current market for coal-fired generation, including slow demand and the economic realities of natural gas versus coal fuel prices, the recommendations focus on continuing to advocate for fossil fuel generation as an affordable and reliable option for electric consumers. This is pure fantasy. Your own plan tells you so. The plan also mentions that CCS increases the cost of coal-fired generation by 76 percent. That is not economical that the recommendations continue to expend time and resources on a losing proposition. The observations do not logically correspond with the recommendations. American Electric Power and First Energy have recently announced plans to transfer more coal-fired generation assets from their competitive generation subsidiaries into WV's regulated system. So that expensive environmental gas co-firing retrofits needed in these plants will become the financial responsibility of WV's electric consumers. The utilities know that WV will continue to cover up the economic realities of its continued addiction to coal. However, WV's businesses and industries know that it is just getting too expensive to do business in this state, and they're closing their doors. WV's energy plan should recommend integrated resource planning as a tool that will provide the least cost resources and generation diversity that will lower electricity prices and prevent future rate spikes. We can no longer afford to allow the financial wants of out-of-state companies to control our energy plan, raise prices and compromise reliability. I came across a news article last night with the headline, Federal Energy Expert Backing Distributed Generation. Distributed generation seems to have been left out of WV's energy plan. John Wellinghoff, chairman of FERC, said the nation's electrical future may well belong to distributed generation such as rooftop solar rather than central power stations and generators far from demand, and that right now, he'd put his money on distributed resources. WV's energy plan should recommend policies that would encourage the deployment of small-scale distributed generation renewables for increased reliability and price stability. Continued reliance on centralized generation, dependent on only one source of fuel that is becoming increasingly uneconomical, is a head-in-the-sand recipe for economic disaster for the people of WV. We must let go of the past and embrace the future.

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AEP & FE have both recently announced plans to transfer more coal-fired generation assets from their competitive generation subsidiaries into WV's regulated system so that expensive environmental and gas co-firing retrofits needed at these plants will become the financial responsibility of WV's electric consumers. The utilities know West Virginia will continue to cover up the economic realities of its continued addiction to coal. However, WV's businesses and industries know that its just getting too expensive to do business in this state and are closing their doors.

West Virginia's energy plan should recommend integrated resource planning as a tool that will provide the least cost resources and generation diversity that will lower electricity prices and prevent future rate spikes. We can no longer afford to allow the financial wants of out-of-state companies control our energy plan, raise prices and compromise reliability.

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West Virginia's energy plan should recommend policies that would encourage the deployment of small-scale, distributed generation renewables for increased reliability and price stability. Continued reliance on centralized generation, dependent on only one source of fuel that is becoming increasingly uneconomical, is a head-in-the-sand recipe for economic disaster for the people of West Virginia. We must let go of the past and embrace the future.

Name: Allan Tweddle
Hometown:
Organization: WV Public Energy Authority

My name is Allan Tweddle. I was appointed by Governor Manchin to the Public Energy Authority when he revived it because the legislature required him to have a troublemaker on the board, so I've tried to fill that role. The first thing I did was ask the governor, where's the energy plan? As a result, we are now committed to an energy plan. I said, why don't you start a Department of Energy? With Joel Freeman, who was on the board at that time, and Senator Unger, we were able to get an energy department established by the legislature. So I'm very proud of the progress and I admire this young man up here who goes through all sorts of hoops and has to deal with the politics of all the industries and so on. I congratulate you sir on your continued work. I admire you for what you have to do and what you put up with. Now, in the form of full disclosure, I'm an engineer originally born and raised in Ontario. I lived in California for 30 years and was involved in designing solar systems in the mid 70s. So I've been around that energy source, have no connection to it by the way, I'm not a solar advocate. I own my own manufacturing business in which we're going to reduce the carbon footprint of all commercial aircraft. We're looking to locate a plant somewhere and I fully intend to have that plant zero carbon footprint. __ process energy and renewables to run that plant. Why? Because the market is demanding it. The airlines are under mandatory reduction of their carbon footprint in Europe and that's coming elsewhere in the world. Asia is looking at it. So the market trend toward renewable energy and reducing our carbon footprint is very real and serious and I don't know if WV is paying enough attention to that fact. Or to that opportunity. I've read the report, I haven't studied it like I should if I were one of the good professors having to write an exam on it. But I did look at it and I'd like to make a couple of points. First issue, you talk about the economics of coal as if it's just the price of coal. And others have related to this. I suggest that next time you do this study, you take a serious look, maybe even make a trip, to Ontario. Because in 2005, the minister of energy for the province of Ontario, after being advised for 2 years with professors and academia and a detailed study, determined that the price of coal-fired power was higher than the price of renewables. How can he possibly come to that conclusion? For the simple reason that the government of Ontario also has in its budget the power generation cost. They don't even have totatlly independent car? Companies up there __ but they also have this ridiculous idea in Ontario that everybody ought to be covered by health care. So as a result in the Ontario budget they also have to worry about the cost of health care caused by pollution. The study that Ontario did, I really urge you to look at it. It concluded that the province of Ontario was paying too much for coal-fired power because of its economic impact on health care. So they made the decision in 2005 to begin to shut down all the coal-fired power plants for that reason, and the last plant is being shut down as we speak. __ coal in WV. So the health care costs and the environmental costs attributed to coal-fired power has been studied to show that the costs, the real cost of coal, is much higher than you're reporting in your paper. I'm going to take privilege as a member of the board and forget the clock. I really suggest, Christine I respect you dearly, you and I have been on panels together and spoken, you're a very talented lady, and Professor is very talented and has lots of years of experience, it's wonderful to have this kind of talent here. Take another look at the real cost of energy because you made the statement, I'm going to read it down here somewhere, we don't want to complicate the cost of electricity by having some sort of add thing in utility bills. Well what you're talking about is the FIT program, feed in tariffs. It works in Germany, it works in Ontario, it works so successfully that those people are backing up trying to figure out the deal with the success and the problems that's generated. But if you go to Ontario today, which __, you'll see solar panels everywhere. You'll see wind energy everywhere. These people are on a strong path to renewables. But the FIT program, which adds maybe 25 cents to a utility bill, 50 cents whatever it is, has been the incentive that has caused the enormous growth that someone talked about in Germany for solar energy and now in Ontario and other parts of the world. You might ask yourself, why is China spending 2.3 billion dollars on solar research. And you know another country that's spending almost as much if not more than we are, Saudi Arabia. Because the minister of energy said it's the future. So we've got to pay attention. You've already cited the enormous growth of solar and renewable, and I urge you to say let's ride on that train of economic growth.

That's a powerful economic trend. And we could do so much to enjoy it. With incentives for people to buy it, with incentives for people, for manufacturers to be here, and just help it go on, help it continue its phenomenal growth. So I guess that's really all I've got to say, but it is the future, this renewable energy, and all those miners could be re-trained to install solar cells for sure. I don't think that's impossible at all. Again, I thank you Jeff, thank you Christine, and I thank the professors. I have to think of the long-term future and I think a 5-year plan is OK, but think of what's going on beyond, make sure that 5-year plan doesn't put us in a position 6 years from now of being totally behind the curve. I'll shut up.

Public Comments

Name: Todd Web
Hometown: Kenova, WV
Organization:
Title:
Date: Friday, September 14, 2012

I first want to thank everyone involved in moving West Virginia forward on all Energy plans especially alternative, renewable and sustainable sources. In reviewing the current discussions it seems that the most qualified and abundant Energy Source available to West Virginia which would provide an immediate impact on reducing our dependence of fossil fuels and creating jobs has been overlooked.

West Virginia's Forest industry provides jobs in every corner of our state and is already providing alternative energy in the form of Wood Pellet Fuel. Appliances are already available and being used to harness this energy in both residential and commercial settings. If our state's energy plan placed more value in the abundant resource we already have, our state could become the leader and model to reducing our country's carbon foot print while creating meaningful good paying jobs. Wood biomass can be used to provide both heat and power reducing or in some cased eliminating our dependence on fossil fuels. The Appalachian Forests are a verified sustainable resource of which the entire state of West Virginia is a part of. If the law makers reviewing this plan would put wood energy at the top of their list everyone would benefit from their wisdom.

Name: John Ackerly
Hometown: Takoma Park, MD
Organization: Alliance for Green Heat
Title: President
Date: Friday, September 14, 2012

We are often amazed how politicians can overlook the obvious: that wood and pellet stoves are the favorite renewable energy devices in West Virginia, as they are in all other states. As a society, we seem to think that our renewable energy future has to be some new, shiny technology.

We are a renewable energy group based in Maryland that promotes cleaner and higher efficiency stove technology. For rural states, providing incentives for the cleanest and most efficient wood and pellet stoves is the most affordable way to help the most residents. And, it keeps energy dollars not only in the state, but often in the community. And West Virginia has some of nation's top wood pellet producers: Appalachian Wood Pellets, Lignetics and Hamer Pellet Fuel. Those are great, local businesses that would benefit if West Virginia residents heated their homes with more pellets.

We were surprised to that the draft Renewable Energy Policy for West Virginia had substantive discussions about ethanol, biodiesel, chicken litter and other uses of biomass, but nothing about the oldest and most efficient use of it: heating.

A $2,000 wood or pellet stove can achieve 80% efficiency, double or triple the efficiency of a multi-million plant that uses biomass to make electricity.

We also feel that the federal government and state governments, including West Virginia, too readily provide rebates and tax incentives to very wealthy families to install solar often on large homes but exclude the favorite renewable energy device of working families — the wood and pellet stove. A wood or pellet stove can make the same amount of energy in 5 months that the typically array of solar panels make in a year.

The only drawback of wood stoves is that the older ones are too polluting. And the outdoor wood boilers can be too polluting so we do not recommend incentives for them. Giving a tax credit for new wood stoves encourages families to upgrade to a far more efficient stove that uses far less wood. There are no significant environmental drawbacks to pellet stoves.

Residential heating in West Virginia has been transforming in the last 10 years. Heating with electricity is up 28% and as of 2010, 40% of the state heated with electricity. Electric rates are relatively low in West Virginia but still, electricity is usually an expensive way to heat a home and many families could save by using wood and pellets as a primary or secondary heat source. Only 3.8 of residents heat with oil and 4.8 heat with propane, both very expensive fuels.

Maryland just announced a pilot program to give rebates to the cleanest wood and pellet stoves as part of the same program that gives rebates for solar and geothermal. Oregon and Montana also gives a tax credit for certified wood and pellet stoves and Idaho gives a generous tax deduction.

We believe the West Virginia's draft renewable energy plan has a lot of sound advice but it omits a very important use of a very abundant local resource: wood. We would encourage the state to consider a tax credit for the cleanest and most efficient wood and pellet stoves, just as it provides a tax credit for solar.

Name: Chris Haddox
Hometown: Morgantown, WV
Organization: Morgantown Municipal Green Team
Title: Chair
Date: Friday, September 14, 2012

On behalf of the Morgantown Municipal Green Team (MMGT), and with endorsement from the City Manager of Morgantown, let me extend my gratitude for the opportunity to respond to the three DRAFT reports that will ultimately inform the 2012-17 WV State Energy Plan.

The MMGT appreciates the complexities in creating a visionary energy plan for our state and offers the comments following comments from our September 2012 discussion:

The draft plan is, at this point, a collection of three different reports: Fossil Energy Opportunities, Energy Efficiency Outlook and Renewable Energy Outlook. While each separate document includes much good information (data), it is unclear how this data will come together to represent an overall strategy that is in line with an agreed upon long-term vision for the state. Additionally, this individual component approach suffers from the oversight of synergistic opportunities that may be identified and capitalized upon were the subjects of each individual report evaluated in a whole-systems approach. The MMGT requests a separate comment period on the OVERALL DRAFT PLAN that will ultimately result from the compilation of these individual documents.

The reports make mention of Integrated Resource Planning (IRP)—the requirement for utilities to utilize the least-cost resource mix for meeting demand needs. This mix would include incorporating both demand side (consumer energy efficiency gains) and supply side efficiencies (generation). As stated on the

American Council for an Energy Efficient Economy, "IRP provides a common framework for balancing these traditional goals by considering all supply and demand options as potential contributors and selecting an integrated set of least-cost resources that meets expected needs. The result is an opportunity to achieve lower overall costs than might result from considering only supply-side options. Furthermore, the inclusion of demand-side options presents more possibilities for saving fuel and reducing negative environmental impacts than might be possible if only supply-side options were considered. An integrated resource plan should include the full range of resource options, ranging from traditional power plants to more innovative sources of electricity supply such as power purchases, independent power plants, cogeneration, demand-side management (energy efficiency and load management), and renewable energy sources. The MMGT strongly endorses the concept of IRP as being a critical component of the Plan.

The potential for utilizing solar power is under estimated. The MMGT recommends that the plan include a more complete analysis of this sector, considering not only energy reliability/stabilization benefits of this component of distributed generation, but private sector economic benefits as well.

The reports suggest the adoption of more stringent building codes aimed at increasing the energy efficiency of the all sectors of the building stock. The MMGT strongly supports , and endorses this concept. In keeping with the past work of the MMGT, it is recommend that the Plan adopt the most current energy codes with automatic adoption of triennial edits/changes to those codes without such adoption having to go through the legislative process.

Thank you again for the opportunity to comment on the development of the WV State Energy Plan.

Name: Sandra Fallon
Hometown: Morgantown, WV
Organization: Interested, concerned citizen
Title:
Date: Friday, September 14, 2012

The draft documents prepared by WVU and Marshall University provide an excellent starting point for analyzing current and future energy prospects from an economic perspective. However, the economic perspective only addresses a portion of the issue. For a more thorough and sustainable approach to West Virginia's energy future, it is equally important to conduct robust analyses of the environmental and social aspects (including public health) of all forms of energy extraction, production, distribution, and use, i.e. an analysis of the triple bottom line. In addition, an examination of West Virginia's energy future must be made within the context and framework of climate change. This requires a clear discussion, based on sound science, regarding the need to limit carbon emissions, the specific actions required to adequately measure and reduce those emissions, and to what levels West Virginia intends to reduce them. I highly recommend that you include qualified climatologists and other climate change experts in conducting additional examinations and developing a more comprehensive and sustainable energy plan. A few states that have addressed climate change in their energy planning, and that may provide lessons learned, include California, New York, Washington, and Oregon. Thank you for the opportunity to provide comments on the WV State Energy Plan.

Name: Michelle Bloodworth
Hometown:
Organization: America's Natural Gas Alliance (ANGA)
Title: Vice President - State Affairs and Business Development
Date:
Comment

anga

2013 West Virginia State Energy Plan
90 MacCorkle Avenue SW
South Charleston, WV 25303

To Whom It May Concern:

America's Natural Gas Alliance (ANGA) appreciates this opportunity to provide comments on the State of West Virginia's Energy Plan. ANGA is an educational and advocacy organization formed by North America's leading independent natural gas exploration and production companies. ANGA represents 29 of North America's largest independent natural gas exploration and production companies, which are the leading developers of the shale plays now transforming the clean energy landscape. ANGA is dedicated to increasing appreciation for the environmental, economic and national security benefits of clean, abundant, affordable and dependable natural gas. Its members produce approximately 40% of our nation's domestic natural gas supply.

THE ROLE OF NATURAL GAS IN WEST VIRGINIA'S ECONOMIC FUTURE

America's Natural Gas Alliance (ANGA) is working in West Virginia to increase demand for natural gas and educate residents about the substantial economic, job-growth and environmental opportunities that natural gas can provide the Mountain State.

Sitting atop the huge and prolific Marcellus shale play, West Virginia can leverage its position as a manufacturing leader and its network of major interstate pipelines to attract a wide range of industries.

SAFE & RESPONSIBLE DEVELOPMENT

As development continues across the state, ANGA member companies understand that with this opportunity comes the responsibility to be dedicated stewards of local land, air and water. We are committed to helping the communities where we operate understand what natural gas development means for them. Though all energy development comes with some risk, the proven, scientific safeguards and vigilant regulatory oversight that is in place today help to ensure that natural gas continues to be produced safely and responsibly. Communities should not have to choose between advancing their economic interests and safeguarding their natural resources. With responsible natural gas production, West Virginians can advance both priorities together.

POWERING WEST VIRGINIA & OUR NATION

Modern technological achievements, like horizontal drilling, are being coupled with proven development techniques, such as hydraulic fracturing, to unlock a game-changing supply of clean, affordable natural gas that can power West Virginia and our nation for generations to come.

The largest and most immediate opportunity to increase the value and use of natural gas is through power generation. The U.S. Energy Information Administration (EIA) estimates that 223 gigawatts of new generating capacity will be needed between 2009 and 2035 to meet growing electricity demand and offset power plant retirements across the United States.

Already in West Virginia, six older, less efficient, power plants have announced plans to retire currently or within the next few years. These plants represent almost 3,000 megawatts. Converting these plants to run on natural gas, or replacing them with new, high-efficiency natural gas combined-cycle plants, will allow West Virginia to deliver affordable, reliable electricity along with cleaner air.

For new power generation in West Virginia, natural gas plants have attractive life-cycle economics—costing less to build and operating more efficiently than plants relying on other fuels. The price stability that comes with the abundance of domestic natural gas resources, along with the growing trend toward long-term contracts in the industry, further provides both producers and utilities with a stable foundation for West Virginia's energy future. When used in power generation, natural gas produces far less carbon and smog-forming nitrogen oxides than many of its energy counterparts. And, natural gas emits virtually no sulfur dioxide, and no particulate matter or mercury.

A MANUFACTURING RENAISSANCE

The stable price of natural gas, driven by its abundance right here at home, is helping American industries such as steel, plastics and chemicals revitalize their workforces. Many companies that once sent their manufacturing operations offshore in a quest for affordable energy are now choosing to build new plants here in America.

Shell Oil's new ethylene cracker plant, just across the border from West Virginia, is a prime example of how stable natural gas prices are driving manufacturing jobs and innovation. And there are numerous other examples in other states. One is Nucor Corporation, one of America's leading steel producers, which has seen natural gas transform its American operations. In 2004, Nucor was forced to dismantle operations in Louisiana, shipping them overseas in search of cheaper energy. Now, thanks to an abundant supply of cheaper, cleaner Domestic Natural Gas, Nucor has announced a new $750 million facility in Louisiana. Nucor spokeswoman Katherine Miller said, "Affordable American shale gas has completely changed the economics [of domestic operations] for us."

CLEAN ENERGY OPPORTUNITIES AND SAVINGS ACROSS WEST VIRGINIA

There are a number of examples of how abundant (and inexpensive) natural gas is already having a positive effect in West Virginia:

- Mountaineer Gas Company has recently filed to reduce its rates by some 11 percent, thanks to the low natural gas prices occasioned by shale-driven abundance.
- We understand that parties are investigating the potential for a large ethylene plant on the Kanawha River.
- On a smaller scale, the return of affordable and abundant natural gas allowed the Blenko Glass Company in Milton, the nation's only manufacturer of mouth-blown, hand-pressed glass products, to emerge from Chapter 11 bankruptcy to thrive and grow.
- On a conservative basis, using a study produced for ANGA by Navigant Consulting Inc., West Virginia residents and businesses are now saving at least $300 million per year.

NATURAL GAS FOR TRANSPORTATION

West Virginians also can save money and reduce emissions through greater utilization of natural gas in transportation. When used for transportation, natural gas is 25 percent cleaner than traditional vehicle fuels and emits up to 90 percent fewer smog-forming compounds with no mercury.

While many private companies have started converting their fleets to natural gas, the marketplace is looking at states to step forward and stand for U.S. energy security by converting state fleet vehicles to CNG. Governor Tomblin's Natural Gas Vehicle Taskforce has done just that. Initiatives are underway in Kanawha and Harrison counties to work with local governments and businesses to further develop these efforts. West Virginia can encourage fleet conversions and fueling infrastructure through continuing to ensure a level playing field in tax treatment for alternative fuels, vehicles and infrastructure.

JOBS, OPPORTUNITY AND WORKFORCE DEVELOPMENT

ANGA is working with West Virginia universities, technical colleges, government agencies and other groups to explore ways to build out the skilled workforce needed to develop natural gas. These efforts include examining approaches that have been successful in other states like Pennsylvania and Texas, and hosting career fairs, job summits and additional meetings with university administrators to discuss proven programs like Shale NET.

Shale NET, which includes West Virginia Northern Community College, is an industry-approved, standardized curriculum that can be implemented across West Virginia. It is designed to create a multi-state, comprehensive recruitment, training, placement and retention program for six high-priority occupations (derrick operator, rotary drill operator, service unit operator, roustabout, welder/brazer and commercially licensed driver). Because West Virginia is one of the states that is fortunate enough to have direct access to the Marcellus shale, the number of these high-skilled and high-pay jobs keeps growing. Further support of Shale NET is important to ensure that colleges and universities throughout the state embrace the program and make this training available to more West Virginians.

Thank you again for the opportunity to comment on the State's 2013 Energy Plan. We look forward to continuing to work cooperatively with the State on this and other issues.

Sincerely,

Michelle Bloodworth
Vice President
State Affairs and Business Development

Name: W. Chris Shepherd
Hometown: Sissonville, WV
Organization: WVU College of Law/Center for Energy & Sustainable Development
Title: Student
Date: Thursday, September 13, 2012

The draft energy plan's concerted focus on energy efficiency as a valuable energy resource shows true energy leadership that serves the best interests of all West Virginia citizens over the increasingly uncertain long-term. The efficiency component of the draft energy plan is excellent and accurate, particularly in its endorsement of decoupling and of an energy efficiency resource standard. The final energy plan must include those two elements if WV is to remain a true energy leader, rather than become an antiquated, high-cost reminder of an obsolete past.

Despite the draft report's strength in focusing on efficiency as an energy resource, however, Integrated Resource Planning must also be included and endorsed in the final Energy Plan. Only by that mechanism will our state's two utilities be required to truly serve the best interests of their captive customers (West Virginians), in ways that do not result in further 50% rate increases such as we have seen in the past several years. Because integrated resource planning requires that all potential, achievable energy resources be compared equally on a cost basis, our energy state citizens would be assured of an electrical supply that is truly the most efficient way to meet our needs. Instead, due to our extreme and previously unquestioning over-reliance on a single fuel supply, we are now exposed to global commodity markets, and accordingly have fallen out of the top ten for lowest retail electricity rates in the country. While West Virginia is proud to mine her coal to power America, her citizens should not be burdened with the penalty of increasing rates simply because we do not bother to require better generation planning in our electrical utilities.

Had West Virginia been its own energy leader and instituted Integrated Resource Planning, as have 26 other states, we could have prevented the rate hikes of the past. Thankfully, we can prevent them in the future, particularly if Integrated Resource Planning is combined with a decoupling mechanism.

Such a requirement of our utilities to truly serve the best interests of our citizens would reward the most cost-efficient forms of meeting our energy needs. I hope the final Energy Plan recognizes this no-brainer approach to returning to the low electric rates that our hard-working citizens have earned and deserve.

Name: Robin Wilson
Hometown: Spencer, WV
Organization: WV 350 Reversing Climate Change
Title:
Date: Thursday, September 13, 2012

Responses to climate change caused by greenhouse gases such as carbon dioxide and methane should definitely be in our five-year plan. Climate change requires us to mobilize a multifaceted response before we experienced the worst of droughts, floods, and sea level rise. This is a new challenge for us humans, as in the past we could base actions on past experience. For example, not enough food last winter, store more for this winter. To solve the problems of climate change we need to hone our ability to look at the beginning of the problem, which is occurring now, and strategize powerful responses to avert a monumental crisis.

Future generations will thank us for the hard work it took to build a consensus for new carbon reducing policies and practices, for new economic models that incentivize acting for the interest of people and planet before profit, and substituting a consumer society with one rich in community and caring. Denial and business as usual are not options. Either we make proactive solutions or we face unacceptable damage.

Specifically: we can cut back on our energy use, we can use energy much more efficiently, and we can use renewable energy and products mimicking nature with zero waste cycles. Climate solutions also include integrating solutions to population, poverty, and resource depletion. See Reinventing Fire and Full Planet, Empty Plates under resources for details about making these transitions.

On a state policy level, I applaud the Energy Efficient Resource Standards and Least Cost Planning. I would add Portfolio Standards to encourage renewables like solar and wind power. For example, the state of Maryland's standard is 20% renewable power by 2022. These changes would create jobs, improve health, and help reverse climate changes.

On a national or state level we could have fee-bates where people who buy efficient cars are paid a fee from those that buy environmentally damaging ones, which have proven effective.

We have the capabilities for selfless service for the common good, we are capable of highly creative problem solving, and we can make big changes in a short time.

We need all hands on deck. We as Americans mobilized to fight WWII, to end segregation, and to go to the moon. We have the can do spirit needed for a successful sustainable energy transition!

Resource books with details on the above solutions (available on loan from Robin Wilson):
Reinventing Fire: Bold Business Solutions for the New Energy Era by Amory Lovins
Full Planet, Empty Plates by Lester Brown
Everything Under the Sun: Toward a Brighter Future on a Small Blue Planet by David Suzuki
Storms of my Grandchildren by James Hansen
The Transition Handbook: From oil dependency to local resilience by Rob Hopkins
Earth: Making a Life on a Tough New Planet by Bill Mckibben
The Rough Guide to Climate Change: the Symptoms, the Science, the Solutions by Robert Henson
Our Choice: A Plan to Solve the Climate Crisis by Al Gore
The Post Carbon Reader: Managing the 21st Century's Sustainability Crisis Edited by Richard Heinberg
The Weather of our Future: Heat Waves, Extreme Storms, and other Scenes from a Climate-Changed Planet by Heidi Cullen.

Name: Tammy Stafford
Hometown: Charleston, WV
Organization: Appalachian Power
Title: EE Program Coordinator
Date: Thursday, September 13, 2012

Appalachian Power offers the following comments on the draft Energy Efficiency Policy: Outlook for West Virginia recommendations regarding utility efforts:

Establishment of stakeholder working group to provide guidance on EE program elements: Appalachian Power supports stakeholder meetings and has their first meeting scheduled for October.

Implementation of decoupling or a similar mechanism to allow for reasonable recovery of utilities lost revenues resulting from State-mandated EE programs: Appalachian Power supports the recovery of utilities lost revenue through the use of a Lost Revenue Recovery Mechanism rather than Decoupling. Appalachian Power looks forward to participating in future discussions on how to address this challenge.

Establish an Energy Efficiency Resource Standard with targeted goals for producing energy savings via EE programs: Appalachian Power believes that the Public Service Commission is in the best position to determine the appropriate level of ratepayer-funded, utility-sponsored EE considering the unique factors associated with individual utilities, not limited to program achievement and rate impacts. Additionally, Appalachian Power believes that the draft report has not accurately represented residential household consumption patterns.

The Draft Energy Efficiency Policy Outlook for West Virginia asserts that West Virginia has "the highest residential energy consumption per household" by incorrectly including electrical system energy losses in their calculation. To examine household energy consumption, "delivered energy" must be used, as is consistent with the EIA Residential Energy Consumption Survey (RECS). Further, using that general methodology will not yield any important insight as there are several factors, the most obvious being climate, that will greatly overwhelm any state-to-state differences due to efficiency.

Name: Kevin Fooce
Hometown: Point Pleasant, WV
Organization:
Title:
Date: Wednesday, September 12, 2012

While the authors of this report recommend staying the course, I have to ask is that what we really need to do. We can at this time continue to us our natural resources as a primary energy source, but also foster the creation of new production and markets in our state. As a prime example I have been involved with several companies which have been curious about installing solar for a variety of reasons. Some are so they can meet word wide sustainability portfolios in their factories. Other such as Patriot Coal expression of interest in installing solar on some of the old surface mine sites.

With the expansion of our energy portfolio into other markets, we actually start building to our existing workforce. At this time we have several institutions training workers for the solar installation and maintenance fields. This includes both collage and apprenticeship programs such as the ones ran by the International Brotherhood of Electrical Workers and their 6 locals and 4,200 members in WV. We are also utilizing several aluminum extrusion operations and metal fabrication facilities to make the framework which support and hold the solar panels. West Virginia also has a number of solar contractors 7 of which have primary business function as the installation and maintenance of these systems. One of these companies by itself has installed nearly 1 megawatt of capacity. This company by itself may accounts for over 100% of what this report states WV has installed.

A look at some of the maps shown in this report also shows a partial list of items surrounding states are doing to attract and grow their renewable energy markets and create jobs. These same states are seeing increase employment along with reduced long term utility cost for residential/commercial operations and local/state governments. Some institutions such as Ohio University and the University of Maryland are creating programs and installing solar and reducing cost at an alarming rate while our institutions just 100 miles away continue on the path of the last 100 years. One of our states largest utilities actually has a 7 megawatt solar farm less than 100 miles from our border near the city of Columbus Ohio. They also have solar on many of their maintenance facilities in Ohio. A 22 megawatt farm is in the final planning stages within 40 miles of Parkersburg WV but will be located again in Ohio.

With just these examples along with our growing population and the need for good high paying jobs, I ask you can we afford to continue down the dirt road we are on now, or do we need to start building a highway? Do we have a real reason to say no to starting the process to build a new economy and increase the wealth our state needs? Should we wait and let the other build the facilities that train, installs, and manufactures these products, or should we start the process of moving into the 21st century?

What I would recommend is simple; give incentives to the residential market such as increased cap on tax credits for home owners. Give tax credits for building multi-unit dwellings that use renewable energy. Tax credits for businesses that use renewables for power, heating, day lighting, etc. Create a technology transfer program that utilizes our universities to develop the ideas and our business community to produce the products our young scientist and business leaders come up with. Allow our communities to utilize their waste water and trash to produce energy and sell it. Create a program to install solar on the roofs of any and all local, county, and state buildings to reduce the cost of power to the tax payers of the state while increasing our employment base.

We need to start to move ahead and not fall behind. Just last quarter the US installed enough solar to replace a mid-sized power plant. We need to look to the future now, not 30 years from now.

Below is a list of problems just in the solar portion of the renewable energy paper.

1: Page 8 figure 1 shows the amount of renewable energy produced in the US in 2010. It is well worth noting the amount of renewable energy produced in the US in 2011 is now 13% or 5% higher than the chart shows. This is a major increase in just 1 year and show the growth of the industry. http://www.eia.gov/energy_in_brief/renewable_electricity.cfm

2: Page 9 figure #2 notice the sharp increase in the use of renewable resources in the 2000-2010 sectors. With this in mind we can come to a conclusion that renewable energy is a source of jobs and energy we should not ignore.

3: Page 12 Conclusion 3 economic value of solar is less. Economic impacts should be considered on a megawatt per megawatt bases instead of what the state has now. As an example a 1,300 megawatt coal fired power plant employees in the neighborhood of 150 people, transportation of fuel to the plant employees another 15 to 20 and mining of this fuel will employ between 25 to 35 people in a deep mine setting surface mine less. This brings the total number of people employed directly producing electricity and fueling this plant to about 200, or ration of 6.5 megawatts per person employed. Solar on the other hand will require 7 people per megawatt for upkeep and maintenance. Solar in the end when taking into account wages and highest available tax rate revenues (personal income taxes) would be a much better source of income to the state along with decreasing unemployment and welfare programs. This could go a long way in saving the state money.

4: Page 12 Conclusion 4 price hedge. Every long and short term forecast for fuel cost show all sources rising as far as they can project. http://www.blackgoldglobal.net/upload/CLSA%20Nov%2010%20Full_report.pdf
http://www.be.wvu.edu/bber/pdfs/BBER-2011-12.pdf

Page 20 map. Notice we have no solar marked on this map. We do however have several large installation in our state some are notable. Such as a 77kw on the R. C. Byrd Federal Court House in Charleston, 21kw at the Hurricane Waste Water Treatment Plant, several buildings in the WVU system, Morgan County Court House, along with many other institutions.

Page 38 notices the map and WV has no incentives, this means no jobs in this field.

Page 43 Paragraph 1 states in 2011 2,500 megawatts of solar was installed when in fact we had a little more than that installed in 2010, 2011 should actually read we had 4,383 megawatts of large scale solar installed with a possible 3,500 more coming on line in 2012. I used Wikipedia on this one since the authors of this paper seemed to like it. http://en.wikipedia.org/wiki/Solar_power_in_the_United_States

Page 43 Notice that WV has nearly 70% of the potential that the best location listed in the chart has and nearly 87% of the potential cities such as Austin TX has which we would all consider a good location for solar.

Page 44 figure 11 shows WV only had around 660 kW of installed large solar in early 2012. In early 2012 Mountainview solar installed one solar array that is a little over 350kw by itself, the RC Byrd Federal Court House in Charleston has a 77kw array, and the Hurricane Waste Water Treatment Plant has a 21kw array these figures place a question mark on this 660kw figure. http://www.mtvsolar.com/blog.php?id=14&p=&search http://www.wvgazette.com/News/201104041235 http://www.solardock.com/content.php?page=Government&parent=25

Page 44 figure 1 for some reason forgot to also include New Jersey on the list. This state alone has 306 megawatts installed in 2011 with another 132 megawatts expected to be installed in 2012. With installed numbers this puts this one state installed capacity larger than the installed capacity of all others listed in the chart. http://en.wikipedia.org/wiki/Solar_power_in_New_Jersey

Page 44 figure 1 amount of solar in Pennsylvania. The Keystone State has 6,700 of its residents working in the solar jobs sector, second only to California. With 600 state businesses currently working on installing solar energy systems — with and a total of 130 MW of solar energy set to be installed in Pennsylvania by the end of 2011 — expect that number to rise. http://www.getsolar.com/blog/pennsylvania-makes-big-quick-strides-in-solar-energy/14695/

Page 46 2 trending states the price for panels are at $2 and not expected to fall much. A recent price sheet from a major supplier of panels has some listed at $.58 per watt. This is about a 75% decrease over what is quoted. http://www.sunelec.com/

Page 46 Table 3 is a massive disservice to anyone who is getting paid to do this report and should be thrown totally out of this paper. I just did a quick search for Pennsylvania and found several newer facilities with many more that are old news now. http://www.communityenergyinc.com/about-us/press-releases/press-release-detail/article/community-energy-will-build-largest-solar-power-project-in-pa/ http://www.conergy.us/Utility-scale-Solar.aspx 2 farms from this company http://www.earthtechling.com/2012/02/solar-powered-mushroom-farm-pops-up-in-pa/ http://www.earthtechling.com/2010/11/pennsylvania-pretzel-king-goes-solar/

Page 47 figure 12 it is important to note that actual plant investment decisions are affected by the specific technological and regional characteristics of a project, which involve numerous considerations other than the levelized cost of competing technologies. A related factor is the capacity value, which depends on both the existing capacity mix and load characteristics. Policy-related factors, such as investment or production tax credits for specified generation sources, can also impact investment decisions. Finally, although levelized cost calculations are generally made using an assumed set of capital and operating costs, the inherent uncertainty about future fuel prices and future policies, may cause plant owners or investors who finance plants to place a value on portfolio diversification. EIA considers all of these factors in its analyses of technology choice in the electricity sector. When looking at the above facts one cannot simply assume the levelized cost as anything more than one of many items we need to look at when implementing a utility power project. http://www.eia.gov/oiaf/aeo/electricity_generation.html

Page 48 paragraph 1. This is why we need a consistent policy to support and grow all resources regardless of type.

Page 48 paragraph 2. With the use of solar as noted in this paragraph it will not do away with our current energy sources but simply add to the mix. As stated not all power will be reduced by an equivalent amount of another energy source but it will reduce at some rate other than unity.

Page 48 paragraph 2. We need to read the conclusion of the paper instead of a summary of the paper. If PV becomes economically attractive enough to be deployed at large scale, intermittency is likely to be matched with dispatch able power, storage, and/or demand response. It may be argued that the intermittency of solar PV is not an integration issue because wind is also intermittent and has been integrated at scale. In systems with relatively large fractions of wind, control issues are generally solved by fast-ramping assets either within the control area or through an interconnection.13 such compensation has economic costs. Knowledge of the character of the intermittency can be used to minimize the costs. As argued previously for the case of wind, 6 an ensemble of generators, energy storage, and demand response would likely be a more economically efficient solution to match the linear region observed in the power spectrum of PV array output power than a source with a single ramp rate. http://www.clubs.psu.edu/up/math/presentations/Curtright-Apt-08.pdf

Page 48 paragraph 3 real-time power quality has been a problem with the grid since we started using switching power supplies in our electronics and lighting. This problem is now being solved with the next generation of PV inverters on small scale systems.

Page 48 paragraph 4 one to one. What is missed on this topic is no two power sources are ever a one to one ratio on the amount of fuel one will save when bringing on a second source. This has been known for years in the power industry either on generator systems such as large hospitals with a multi generator back-up supply or utilities.

Page 48 Future Prospects has already been answered in Page 46 2 Trending.

Page 49 paragraph 1. Lower insolation has been addressed previously, some of the papers sighted are now more than 5 years old, and considering that so much of the situations in this paper are from 2010 the next few years have now arrived.

Page 52 Figure 13 shows WV is behind the curve and will continue to fall behind all our surrounding states if we do nothing.

Page 54 the reason to expand any resource is to stay competitive and create jobs. Without expanding WV will continue to fall behind surrounding states, loose tax revenue and never gain jobs in new fields so we can diversify our workforce and create a more stable state economy.

Name: Chris Haddox
Hometown: Morgantown, WV
Organization:
Title:
Date Wednesday, September 12, 2012

Thank you for the opportunity to submit my comments on the draft documents that will inform the 2012-17 WV State Energy Plan.

While I find each of the DRAFT documents to contain many piece of valuable information, I feel they are lacking in overall vision. I suppose the Plan will ultimately be some sort of compilation of these DRAFT documents, so it makes commenting on a Plan a bit of a guessing exercise. Considering the three topic areas separately marginalizes the opportunity to find synergies among the topics, in much the same way that a linear approach to the design of a building often leads to eventual problems with the actual construction. It is my hope that there will be opportunities to address this shortcoming and to look at the overall plan in a more holistic fashion. As my area of interest and expertise lies primarily with the built environment, my main commentary on substance is in support of more stringent building codes, names the ICC suite of codes, and more specifically the International Energy Conservation Code. I support the adoption of the 2012 IECC and the automatic adoption of new codes as they are produced on the 3 year cycle. According to the Energy Information Administration and US Census Data, West Virginians use more energy per capita than most other citizens of the United States. Inefficient building stock is a primary driver of the high usage. Demand side efficiency measures are by far the most economical sources of "new" energy and West Virginia should be mining these efficiencies. I also support Integrated Resource Planning as a way to fully identify and prioritize these efficiency opportunities. As economic opportunity seems to be of concern, I would argue that having a State Energy Plan calling for business development related to energy efficient products and materials could be a catalyst for attracting and developing small businesses involved in that particular sector. My utility provider, First Energy, offers many more incentives for becoming more energy efficient to its customers in our neighboring states than it does to West Virginia customers and I feel the State Energy Plan should call on all energy utility providers to be required to first think, and act, in terms of long-term efficiency measures as opposed to focusing on supply side issues. Distributed generation via solar opportunities is given a wash in the draft documents. There are economic opportunities, as well as energy security and stability opportunities with solar that are being overlooked. In addition, the proliferation of small photovoltaic businesses has economic implications that are not fully explored in the draft documents. I am against the notion of CTL as research indicates it is a net energy loser and has an significantly larger carbon footprint than conventional petroleum fuels. In the absence of climate protection policies, I can see where CTL would make sense from a purely economical (cost of fuel) perspective.

As our country recognizes climate issues, but seems flummoxed about how to deal with them, CTL might make short term sense. Long term CTL production, however, is sure to not make sense in light of climate regulations that will most certainly have to be implemented. Thank you. Chris Haddox

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Name: Maryellen York
Hometown: Inwood, WV
Organization:
Title:
Date Wednesday, September 12, 2012

Why doesn't the states' study of renewable energy include micro hydro power? With all the creeks and rivers in the area, if homes along those waterways used micro hydro power, it would be a real help.

Also, I think grid-connected home systems should be allowed to make more than the energy to supply the home and donate the additional energy to Churches and schools. Then, Churches and schools could negotiate for group discounts for their members to have solar, wind or micro-hydro power installed for their constituency. It would be a win-win for everybody but the greedy power companies.

Name: Will Castle
Hometown: Granville, OH
Organization:
Title:
Date Tuesday, September 11, 2012

On page 9 of the Draft Plan, the residential household consumption figures are completely wrong. The numerator includes "losses" associated with the production of electricity and thus greatly inflates household consumption figures. Because producing electricity is only 50% (or worse) thermally efficient, states that use a greater percentage of electricity relative to other fuels will fare worse in this (valueless) comparison, even though households are being equally efficient. This occurs because a large percentage of the population uses electricity to heat their homes (instead of natural gas). This is a question of geography and not something that can be solved with efficiency. Thus, West Virginia has not "fallen behind" other states and households do not use 19% more energy than the average US home - something that on closer inspection should have been obvious to the report's authors. Do not base any policy solely or in part on this fundamental misuse of data.

Name: David Umling
Hometown: New Creek, WV
Organization:
Title:
Date Monday, September 10, 2012

I oppose the development of Industrial Wind Energy to satisfy the State's future energy needs. Industrial wind production is inherently unpredictable and variable over short periods of time. It creates unpredictable instability in energy supplies and cannot serve as supply of reliable or useful electricity. West Virginia needs to depend on reliable electricity and Industrial Wind has not shown that it can meet that demand. Other sources of electricity should be pursued and industrial wind energy should be dismissed. Its environmental impacts on the state's valuable forest resources are too great to justify its use.

Name: Brad Stephens
Hometown: Morgantown, WV
Organization: Allegheny Highlands Alliance
Title: Executive Director
Date Thursday, September 6, 2012

The Allegheny Highlands Alliance, Inc. ("AHA") is a nonprofit organization which seeks to advance public knowledge and understanding of the cultural and environmental significance of the major ridgelines that comprise the Allegheny Highlands, and to preserve and protect areas of particular importance in this region. AHA's membership is comprised of residents of the states of West Virginia, Pennsylvania, Maryland, Virginia and North Carolina. AHA would like to thank the Division of Energy for the opportunity to comment on the draft energy plan.

AHA generally endorses the policies proposed in the document Energy Efficiency Policy Outlook for West Virginia, and concurs with the assessment of this section of the energy plan set forth in the comments submitted by Energy Efficient West Virginia on August 30, 2012. AHA also supports the legislative adoption of integrated resource planning for the state's electric utilities. Although AHA opposes coal mining utilizing mountaintop removal and is greatly concerned about the impacts of Marcellus shale development on the highlands' water resources, the organization understands that coal and gas will continue to play a role in

West Virginia's energy picture, as set forth in Fossil Energy Opportunities for West Virginia.

AHA supports a shift to cleaner energy sources, but not regardless of the social or environmental costs imposed. Thus, because AHA is primarily focused on slowing the proliferation of utility-scale or "industrial" wind energy facilities in the Allegheny Highlands, AHA submits comments narrowly tailored to address the conclusions and recommendations set forth in Chapter IV of the document Renewable Energy Policy Outlook for West Virginia. As a point of clarification, AHA uses the label "industrial wind" to signify the industrialization of our mountain landscapes, which results from the construction of the massive wind turbines used in such projects, as opposed to smaller-scale models utilized by individual households and businesses.

AHA commends the authors of this document for eschewing a repackaging of industry propaganda and instead presenting a largely even-handed assessment of the limitations of wind energy in the broader electricity generation picture. As noted in the report, according to estimates prepared by the U.S. Department of Energy's National Renewable Energy Laboratory, perhaps half of the marketable industrial wind energy capacity on private land in West Virginia has already been utilized. Further, because electric generating units in West Virginia access transmission facilities and participate in wholesale power markets controlled by a regional transmission organization ("RTO"), wind energy's actual contribution to and dependence upon this regional grid system must be considered.

As a federally-sanctioned RTO, PJM Interconnection oversees the high-voltage transmission of electricity and manages a wholesale power market across all or parts of 13 states and the District of Columbia. Under PJM rules, any grid-scale wind facility commencing commercial operation in West Virginia is eligible to participate in the RTO's capacity markets, but only to the extent of 13% of its peak or "nameplate" generating capacity. This figure was derived from historical summer operating data from wind units in PJM, and reflects the mean of all recorded capacity values for those units; therefore, it is an accurate measure of what can be expected going forward for a wind project.

Applying the 13% standard to the approximately 700 MW of remaining wind energy capacity in the state (cited in the report) results in a total "capacity credit" of only 91 MW, which represents only a small fraction of the capacity afforded by any major baseload power plant in West Virginia and only a tiny sliver of the capacity needed to serve native customer load in West Virginia, much less across the entire PJM footprint. Perhaps more importantly, as conceded in the report, the wind resource in West Virginia pales in comparison to the potential in various Midwest states, which, AHA would add, include Illinois and Indiana—two states with a heavy stake in the PJM grid and its associated markets. All of this context should be seriously considered, in addition to the balancing and backup complications induced by the intermittent output of wind facilities, which are discussed in the report.

AHA remains unconvinced that any significant, lasting and positive economic benefits from industrial wind have been realized in the state, particularly given that development threatens to impose negative economic impacts in the form of diminished values of surrounding real estate and reduced appeal of the state's natural areas to tourists. To date, most studies addressing economic impacts of wind energy development have either been commissioned by industry trade groups or have otherwise been unduly biased in favor of results favorable to wind developers.

AHA further disagrees with the report's assessment that siting of wind facilities in the state is "very difficult." It is true that substantial documentation must accompany a wind developer's application to the Public Service Commission ("PSC") for a siting certificate. AHA is aware of only one project application out of many, however, for which the PSC declined to issue a siting certificate. Notably, the PSC's denial of that developer's application was essentially due to critical elements missing from the application, not from the Commission's balancing of competing interests based on the substance of the application. Moreover, regardless of the volume of information presently required by the state's regulatory processes, the PSC lacks the internal expertise necessary to make a serious evaluation of the impacts of wind energy facilities, and no other state agency is required to or otherwise is afforded an opportunity to participate in the siting certificate process.

Based on the above, AHA cannot concur with the report's recommendation that current policies regarding grid-scale wind energy should be maintained. AHA believes serious reforms to the PSC's siting certificate process, and more importantly, the applicable statutory structure, are long overdue. Wind energy enjoys an embarrassment of riches when it comes to subsidies, and the present economic incentives embodied in West Virginia law do not bring us closer to a more stable and efficient energy future.

AHA does agree, though, with the recommendation that results of studies concerning the integration of variable energy resources should be closely monitored. While the organization is skeptical that such studies will produce a "fix" for wind energy's many weaknesses as a source of reliable electricity, the fruits of these efforts may indeed serve to enlighten both policymakers and the state's citizenry as to the technology's limitations.

Finally, AHA urges the Division of Energy to include an honest and critical assessment of industrial wind in the final version of the Energy Plan—one long on substance and free of misleading industry propaganda. Trade group buzz words such as "clean" and "green" appeal superficially to the emotions, but they do not provide the foundation for a meaningful energy strategy for the future. Massive wind turbines on Appalachian ridgetops kill untold numbers of bats and birds every year, blight the splendid viewsheds of the highlands, and diminish the character of rural mountain communities, while doing nothing to offset environmental degradation imposed by other sources of electricity. AHA submits that industrial wind should have no place in West Virginia's energy plan.

Name: Bill Howley
Hometown: Chloe, WV
Organization: Coalition for Reliable Power
Title: Chairman, Steering Committee
Date Thursday, September 6, 2012

The Coalition for Reliable Power is a coalition of citizens, businesses and organizations working together to create an electrical system in West Virginia that is reliable, affordable and sustainable. Because our focus is on our state's electrical system, our comments will focus on this aspect of the 2013 – 2017 Draft Energy Plan.

We were generally encouraged by the energy efficiency analysis and recommendations included in the Draft Plan. Increased energy efficiency, as the Draft Plan states, will continue to be the lowest cost electricity resource throughout the five year plan period. There are substantial opportunities for electricity savings through energy efficiency, because West Virginia is currently among the highest per capita residential energy use states in the US.

Throughout these comments, we will refer to the draft report Fossil Energy Opportunities for West Virginia as "the fossil energy section," the draft report Energy Efficiency Policy Outlook for West Virginia as "the EE section," and the draft report Renewable Energy Policy Outlook for West Virginia as "the renewables section." We will refer to the overall draft of the Division of Energy's 2013 – 2017 Energy Plan as "the Draft Plan."

West Virginia Needs an Integrated Energy Plan. We were disappointed that the Draft Plan was broken into three discreet sections, with no attempt to integrate them into unified policy goals and recommendations.

The true value of having a state energy plan is created only when we identify economic trends and design a comprehensive, flexible plan that allows West Virginia businesses and energy users to respond to change. While it is important to isolate trends and characteristics of different choices, we only create value with an integrated analysis that helps us weigh those choices and make good decisions among them.

West Virginia clearly has had extensive coal and natural gas reserves. These fuels will continue to play a large role in the state's energy future. As the fossil energy section points out, however, fuel based electrical generation is subject to the vagaries of commodity markets and adverse production conditions, and has significant adverse health impacts. Over the past ten years, almost all of the significant increase in electric rates for all West Virginia consumers has been caused either directly by higher coal fuel costs or investment in physical plant designed to reduce dangerous coal exhaust emissions. Since 2007, residential electric rates have risen over 33% for FirstEnergy's West Virginia customers and over 50% for AEP's West Virginia customers. Natural gas is the cheaper fuel at the moment for electrical generation, but price swings are inevitable. Keeping West Virginia's electric power generation tied so closely to the cost of fuel, coal or gas, is not a sensible long term policy goal. There are two sources of electrical power capacity that are not vulnerable to shifting fuel costs, namely renewable generation, particularly photovoltaic and wind power, and gains resulting from increasing energy efficiency. West Virginia needs a flexible and diversified electricity portfolio to provide the diversity and flexibility required to increase the reliability and a lowest cost electrical system for our state.

Integrated resource planning (IRP) is used in twenty six states to build cost-benefit analysis into public service commission processes and state energy policies across the US. IRP requires power companies to identify electricity needs and provide a cost-benefit analysis of all possible means of providing the capacity to meet those needs. As the efficiency section points out, investment in efficiency savings is always the lowest cost source of meeting electrical need, by a significant margin. West Virginia's new Energy Plan should advocate for the immediate implementation of IRP at the West Virginia Public Service Commission.

Renewable Power in West Virginia

The renewables section provides an overview of photovoltaic generation in West Virginia and the surrounding region, but the authors fail to note important aspects of small scale solar power development:

There is passing reference to enhanced system reliability from distributed generation. The fact that the authors give this impact short shrift seems odd in light of the fact that West Virginia has experienced two major collapses of its electrical distribution system in the last three years.

The costs of insuring the reliability of the current centralized generation/distribution system in West Virginia were not analyzed in the Draft Plan. The repair costs for the 2009 and 2012 blackouts will likely total over $100 million. The West Virginia Public Service Commission has already deferred rate recovery for the 2009 costs, resulting in additional rate increases for power company interest costs. It is likely that when utilities submit their repair costs for the 2012 blackout, these costs, plus resulting interest costs, will be deferred as well.

In the WV PSC investigation of the 2009 blackout, Senior PSC Engineer James Ellers testified that West Virginia was one of only sixteen states in the US that had no reliability performance standards for electric utilities. Ellers also testified that while the WV PSC had allowed Allegheny Energy (now merged with FirstEnergy) to raise rates to generate cash flow for distribution system maintenance and repair, by the time of the 2009 blackout, Allegheny had not spent the funds it had collected as promised. Allegheny's subsidiaries subsequently spent the balance of their repair and maintenance account on emergency repairs. The WV PSC is in the process of developing reliability performance standards. In the first order in the case, the Commissioners opined that instituting these standards would lead to more rate increases.

Unless the two Ohio-based companies that own our state's electric utilities make significant investment in rebuilding their fifty year old distribution systems, paid for by further rate increases, West Virginia rate payers will face more and more blackouts from less and less severe weather events. Increased blackout frequency will also place more and more burden of the costs of lost food and business on West Virginians, in addition to the resulting rate increases.

The renewables section also fails to include any calculation of the benefits of increased solar generation to improving public health by reducing various emissions from fossil fuel combustion. The US Environmental Protection Agency lists West Virginia as the state with the highest rate of premature deaths (at 14.7 per 100,000 adults in 2010) from fine particulate matter whose primary source is coal-fired power plants.

There is also no mention in the renewables section of the relatively speedy deployment of small scale solar installations compared with the much longer construction times for gas and coal fired plants. Because PV deployment occurs in very small increments, new capacity can also be calibrated to meet shifts in capacity needs in very short time periods. This relatively rapid scalability of PV power has been demonstrated in a number of states, particularly California and Vermont. Given the recent capacity problems generated by West Virginia subsidiaries of FirstEnergy and AEP, it would seem that our state is in need of the kind of flexibility that small scale solar deployment provides.

In discussing various incentive systems for promoting investment in solar power generation, the renewables section's authors point out that solar carve out and SREC systems require some new administrative overhead. However, the extensive use of these management systems throughout the PJM region indicates that these administrative costs are not a problem in states with a commitment to increasing solar power generation. If simplicity is a goal of policy makers, a number of countries and US localities have demonstrated that a feed in tariff, graduated to phase out as capacity targets are met, is probably the simplest solar incentive system.

The authors of the renewables section used a levelized cost analysis to compare costs of investment in grid scale solar generation with other types of power generation. This analysis must make assumptions about fuel cost trends for fossil source energy. The uncertainty of fuel price trends does not apply to solar power investment, where, once the initial capital investment is made, fuel costs are zero. In the past month, FirstEnergy made the claim that expanding its coal-fired generation capacity in West Virginia will provide long term rate stability, despite the fact that coal is a more expensive fossil fuel choice at the present time. The real long term cost stability of renewable power is not factored into the Draft Plan's comparison on solar power to other power sources. Solar power's zero fuel costs are the ultimate price hedge, particularly when the cost of delivered coal rises 70%, as it did between 2000 and 2009.

Even a small fraction of the hundreds of millions of West Virginia rate payer dollars spent on coal cost increases and equipment to manage coal's health impacts over past ten years, would have provided a significant incentive for homeowners and small businesses to invest in aggressive energy efficiency investments and solar power development. These investments would have provided real long term solutions to fuel cost risk and damage to West Virginians' health caused by current generation technologies.

Levelized generation-only cost comparisons with solar power under-estimate the rate savings in avoided reliability costs, personal savings in healthcare costs and future cost stability hedging benefits provided by distributed solar generation. The Draft Plan should have gone beyond a generation-only comparison in its analysis of renewable power costs and benefits.

The authors of the renewables section correctly spent little time discussing the 2009 Alternative and Renewable Portfolio Standard, because this legislation will have no impact whatsoever on investment in renewable power in West Virginia.

Recent Electrical Industry Trends Ignored in the Draft Plan. The West Virginia electrical system has experienced three major trends over the past five years that receive little or no mention in any of the three sections of the Draft Plan:

Unprecedented consumer rate increases, due primarily to coal price increases and the negative health impacts of burning coal,

Two major collapses of the West Virginia electrical distribution as a result of weather events and reduced investment in maintenance by West Virginia's Ohio-owned electric utilities which indicated the need for costly monitoring of and investment in distribution system performance, and

Recent attempts by both AEP and FirstEnergy to shift the costs of more expensive coal-fired generation capacity into the West Virginia rate base from Ohio, largely as a result of deregulation of Ohio electricity markets.

Coalition for Reliable Power Recommendations Development of a fully integrated planning process that prioritized reliability, flexibility and long term investment in lowest cost power resources, on both the demand and supply sides, should be the basis for any plan for West Virginia's energy future.

The Coalition for Reliable Power makes the following policy recommendations to be included in the 2013 – 2017 Energy Plan:

The Coalition strongly supports the Draft Plan's endorsement and energy efficiency standard for West Virginia. The Coalition also strongly supports the Draft Plan's endorsement of decoupling of base rate cost recovery from electric rate setting to protect utilities from under-recovery of overhead and capital costs from loss of power sales due to efficiency improvements.

The Coalition would like to see support in the 2012 – 2017 Energy Plan for legislation to require the West Virginia Public Service Commission to establish an Integrated Resource Planning process for our state's electric utilities to insure that West Virginia rate payers have access to the lowest cost electricity resources.

The Coalition believes, contrary to the opinions expressed in the Draft Plan, that investment by West Virginia rate payers in a solar power incentive system in West Virginia is justified by the benefits created by diversification of our state's energy portfolio, increases in the speed at which marginal capacity can be ramped up, and the benefits to overall system reliability. The Coalition believes that either a solar carve out and SREC market or a feed in tariff program would be equally appropriate tools for achieving this incentive, if properly designed and implemented.

As the authors of the renewables section pointed out:

"There are benefits to getting experience with an emerging technology such as PV systems. Individuals and households who install PV systems will come to understand the attributes of the technology and can participate in future adoption as technology improves. Local installers also develop valuable capacity regarding utilization of the resource."

These human capital benefits, as well as the new jobs and businesses created, are essential if West Virginia is to remain competitive with innovative efficiency, renewable power and microgrid technologies that are maturing in other states.

Thank you for this opportunity to participate in building West Virginia's energy future.

Submitted by:
Coalition for Reliable Power
Steering Committee:
Bill Howley
Keryn Newman
Patience Wait
John Christensen

Sources:
*U.S. Department of Energy, The Potential Benefits Of Distributed Generation And Rate-Related Issues That May Impede Their Expansion, 2007
*Perez, Zweibal, Hoff, "Solar Power Generation in the U.S.: Too Expensive or a Bargain?" University of Albany/George Washington University, 2011 *Farrell, J., "Democratizing the Electrical Sector" ILSR, 2011 *Ban-Weiss G. et al., "Solar Energy Job Creation in California", University of California at Berkeley.
*M. Wei et al., "Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US" University of California at Berkley *Sawin, Flavin et al. "The American Path to Energy Security" World Watch Institute. Washington DC

Name: Aaron Sutch
Hometown: Morgantown, WV
Organization: The Mountain Institute
Title: Energy Program Manager
Date Thursday, September 6, 2012

Thank you for this opportunity to comment.

I am requesting that the authors of the Draft Report reconsider their characterization of solar energy to accurately reflect current data on its ability to enhance electric grid infrastructure, benefit ratepayers and empower local job creation.

The report's economic analysis of solar energy in West Virginia is very limited and does not take into account the following factors:

SOLAR BENEFITS THE ELECTRIC GRID

Solar produces most during times of peak electricity demand. This obviates the use of less-efficient and more costly peak power plants.

Provides grid security against blackouts and terrorist attacks while improving overall grid reliability

For this reason the U.S. military uses solar in domestic and international operations

Saves on transmission and distribution losses which are typically 8%

SOLAR BENEFITS RATEPAYERS

Provides hedge against rising electricity based on fuel price volatility (WV electric rates have increased by

50% over the last 5 years due to the increasing cost of coal)

Enables private subsidization of electricity generation assets without passing on costs to ratepayers via the guaranteed rate of return that the PSC guarantees investor-owned utilities for expansion of generation assets

Increased grid reliability benefits ratepayers by lessening the instances of blackouts and brownouts which decrease business productivity and threaten family safety

July 2012 blackout left a majority of West Virginians without power for days and even weeks while costing millions and threatening lives

SOLAR CREATES JOBS

Data indicates that solar and other renewables create more jobs per unit than fossil fuel electricity

Solar has the highest incidence of jobs created per unit of energy

The solar industry employs more than 100,000 Americans with numbers increasing every year.

Our neighboring state, Pennsylvania, ranked fourth in the nation last year in solar jobs with nearly 5,000. This is in spite of weaker solar resources than West Virginia

WEST VIRGINIA HAS PLENTY OF SOLAR RESOURCES

West Virginia averages 4-4.5 kWh per square meter of solar resource

This is much more than Germany (the world's leader in solar capacity) and similar to parts of Northern Spain

Slightly better than New Jersey, which is the East Coast leader in solar installations

Sources:
*U.S. Department of Energy, The Potential Benefits Of Distributed Generation And Rate-Related Issues That May Impede Their Expansion, 2007
*Perez, Zweibal, Hoff, "Solar Power Generation in the U.S.: Too Expensive or a Bargain?" University of Albany/George Washington University, 2011 *Farrell, J., "Democratizing the Electrical Sector" ILSR, 2011 *Ban-Weiss G. et al., "Solar Energy Job Creation in California", University of California at Berkeley.
*M. Wei et al., "Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US" University of California at Berkley *Sawin, Flavin et al. "The American Path to Energy Security" World Watch Institute. Washington DC

Name: Richard and Bettina Dennis
Hometown: Morgantown, WV
Organization:
Title:
Date Wednesday, September 5, 2012

Thank you for the opportunity to submit these comments on the WV 2013 energy planning process and the associated reports from Marshall University and West Virginia University. Our comments, seven in total, are submitted below.

The three reports do a very good job of summarizing the current market and business potential of various energy systems including renewable energy, fossil energy, and energy efficiency technologies and approaches.

The Energy Efficiency report is excellent and should be incorporated into a West Virginia State Energy Plan and Policy. Energy efficiency planning and resources management at the power generation utility scale should be strongly encouraged as a tool to bring about lower energy rates for WV citizens. It is strongly recommend that integrated resource planning be used as a strategy to ensure utilities invest in cost-effective energy efficiency technology and ensure that our utilities are making investment decisions in the long-term public interest.

The titles of two of the reports by the Marshal University (MU) CBER are inappropriate. The University CBER does not formulate or publish policy for the state of WV. The titles of these two reports should be changed. CBER can assess business and market potential for energy related technology and supply this information to the state, essentially this is what the reports do, and the titles of these reports should be changed to reflect this content.

The MU CBER on renewable energy at times seems to take so called market making policy as an objectionable tool for shaping markets. This position seems highly biased. Policies that "shape markets" are tools used by policy makers to bring about a vision.

It is unfortunate that sub section (q) of state law SS 5B-2F-2 does not address the support for improving an end-use energy efficiency improvement approach. Energy efficiency end use improvement (demand side efficiency improvement) is well documented to be, by significant margin, the most power full tool for addressing energy related issues; in particular global climate change issues.

The state of WV should conduct a proper energy policy planning process. These reports only address part of this process. Simply put this would be to state a long term vision and a 5-year mission and then conduct a proper assessment of the strengths, weaknesses, opportunities, threats (SWOT) and externalities to bring about this vision through the mission of a 5-year plan. The three reports made available to the public for comment provide a reasonable basis for conducting a SWOT analysis. However more information is still needed with regard to externalities and how the state's energy policy interacts with bordering states, regions and environmental issues.

Nowhere in these reports is the concept of global climate change mentioned as an externality or driving force in energy planning and or policy consideration. This certainly underscores the need for further consideration of externalities and the requirement for additional information as the state embarks on formulating energy policy.

In conclusion we are very pleased that the state of WV is embarking in an energy planning process and seeking public comment. The three reports provide a good basis for conducting further analysis on how to realize a vision for the public good through energy planning. We hope our comments are seriously considered and addressed.

Respectfully,
Richard and Bettina Dennis
197 Upper Cobun Creek Road
Morgantown WV 26508

Name: Carl Irwin
Hometown: Morgantown, WV
Organization: Industries of the Future - West Virginia
Title: Director
Date Wednesday, September 5, 2012

Comments to WVDE – Morgantown, WV – September 6, 2012 Summary Report on U.S. DOE Funded Workshop on State-Level Standard Offer Programs held August 21, 2012 in Charleston, WV The Workshop was a deliverable on a U.S. DOE funded project to investigate the use of a "Standard Offer Program" as a state-level policy tool to:

Increase supply side EE

Promote investment in the state and create jobs

Diversify energy supply

Provide environmental benefits

The time is imminently right for such a program:

Both major utilities in WV are short on generation capacity to meet peak loads

Power generation resources are in transition - natural gas is cheap – fossil energy resources are under environmental pressures

Recent Executive Order to accelerate industrial EE and investment in CHP – goal of 40 GW in a decade. U.S. Departments of Energy, Commerce, Agriculture, and EPA are to provide policy and technical assistance to states

Recent FERC decisions show an interest in promoting DG actions at to the state level

Unprecedented computational power, sensors and controls – i.e., smart grid technologies – can handle integration of numerous distributed small generators into the grid WV is missing out on investment opportunities – 3 examples from the workshop:

A WV company wanted to burn a biomass by-product waste stream to generate heat and power – using 6 MW of about 20MW generated – project did not progress due to lack of commitment for purchase of the excess 14 MW

A WV company has applied to the PSC to invest $19 million in a resource recovery facility at a Berkley Co landfill. The facility would be powered by a solar energy farm to be built near the landfill. State utility regulations currently prevent a power sales agreement between the two parties

Recycled Energy Development (RED) has completed engineering design and financial planning for a waste heat recovery project at WV Manufacturing in Alloy, WV. The project would generate up to 60 MW of clean power, enable plant production to increase by 20%, create jobs, and be an economic boon to southern WV. The project has not gone forward due to lack of access to customers for the power.

Workshop recommendations:

Laws should be changed to enable non-utility generators to sell power to customers or have scenarios where utilities purchase the power at a reasonable cost (i.e., profitable for them while not increasing relative rates for other ratepayers)

Power purchase agreements/contracts should be long term – 8 to 10 years – to create stability not only in long-term prices but also for banks to fund investment

Utilities should be required to issue an RFP for acquiring new generating capacity that may be needed when demand exceeds their own generating capacity

Power prices (excluding any "green" premium pricing or renewable energy credits) should be at or below avoided costs – this makes it legal under PURPA

Could have some type of efficiency goal that power projects must achieve (e.g. 60%) – utilities could achieve this through CHP

Utilize RED and U.S. EPA databases to catalog the best opportunities in WV for WHR and CHP projects.

The WV Legislature should pass a Study Resolution for the WVDE, IOF-WV, or other entity to convene a working group with representatives from utilities, the PSC, the Legislature, industry, and other key stakeholders to draft a SOP for WV that enables third party power projects meeting certain pre-specified conditions to qualify for multi-year power sales contracts.

Name: Regan Quinn
Hometown: Charleston, WV
Organization: Climate Reality Project
Title:
Date Tuesday, September 4, 2012

Thank you for the opportunity to comment on the WV Department of Energy Five Year Plan.

While there are many excellent features of the Plan, such as the provision for a K-12 School Building Energy Program, and the encouragement of industrial energy efficiency, I am sorry to see there is little explicit acknowledgment of the risk of global climate instability caused by sustained and increasing CO2 emissions.

I recently viewed the newest version of the "Inconvenient Truth" slide show, and saw images of jet wheels sunk into melted tarmac, and heat buckled railroad ties from this summer's extraordinary heat wave; images illustrating the unexpected fragility of the country's infrastructure in the face of increasingly severe heat waves. This is in contrast to this summer's broad-based failure of the Midwest corn crop due to heat and drought. Drought is a predicted outcome in global warming scenarios. In either case, these are not normal events and they are just the beginning. Inevitably, the physical properties of green house gases assure that with a continued upward course of CO2 emissions, global warming will worsen.

A Union of Concerned Scientists report has stated, "Many of the changes to the world around us are unfolding faster than scientists projected just a few years ago… indeed we may be very close already to triggering natural amplification mechanisms that could cause irreversible change with catastrophic consequences."

Therefore, I would ask that the Plan acknowledge the grave and immediate risks presented by global climate instability due to man-made green house gases, and attempt a quantitative assessment of the potential for each of the elements of the Plan to reduce carbon emissions. Such assessment could eventually permit prioritizing state investment in accordance with the CO2 reduction efficacy of each program.

This might mean less emphasis be placed on coal but the outlook for coal has been dimmed anyway for economic reasons. See the August 14, 2012 Charleston Gazette editorial "Future? Coal mining outlook" and the Union of Concerned Scientists Report "A Risky Proposition: The Financial Hazards of New Investments in Coal Plants." There have been no successful commercial trials of carbon capture, although the Weizmann Institute in Israel has experimentally succeeded in using concentrated solar energy to chemically transform CO2 from coal combustion to hydrogen and carbon monoxide, both of which can be used as fuel sources according to the investigators.

Major renewable energy technologies have the potential to produce many times the current US power demand. The Plan acknowledges that, "solar energy represents conceivably the single largest source of energy" (p 24). Because of the urgency of the climate instability problem, it is probably inadvisable to wait for the 5-10 years estimated before solar is as cheap as fossil fuel, a course the Plan appears to suggest. Financing options to encourage earlier adoption of solar and other renewable technologies should be addressed in the Plan. Ted Boettner's concept of a permanent trust fund for economic diversification is an excellent one. Similar trust funds have been successfully established elsewhere. Wyoming was the fourth state to establish such a fund, around 1974, and the fund is now worth $5 billion.

Regarding more short-term financing options, could the Plan express reasons why the State of WV should not take advantage of two billion dollars in federal funding available for energy efficiency and renewables projects via Qualified Energy Conservation Bonds issued under the Better Buildings Challenge?

In relation to the School Building Energy Program, articulated in the Plan: it would be nice to see as a medium or long term goal the construction of net-zero school buildings. Such highly energy efficient buildings use no more energy than they produce via on-site renewable geothermal, wind and photovoltaics. Such buildings have reduced operating costs and can be constructed for less than a conventional school building costs, when energy savings are factored in. Examples include the Richardsville Elementary School in Warren County, Kentucky. The facts re this school are that a state grant for $3 million helped pay for PV panels, and the projected savings over the next ten years, thanks to energy efficiency and PV, is $8.6 million.

Thank you for your kind reception of these comments.

Name: Olga Gioilis
Hometown: Sutton , WV
Organization:
Title:
Date Monday, August 30, 2012

I endorse the recommendations to the Energy Efficiency section of the WV Energy Plan. I believe we need to improve our energy use and reduce it efficiently. We need to consider alternative energies and evaluate how to use and integrate them.

Name: Ted Boettner
Hometown: Charleston, WV
Organization: WV Center on Budget and Policy
Title: Executive Director
Date Monday, August 30, 2012

West Virginia stands at a crossroads. We are now facing a natural gas boom similar to that of the coal industry in the last century.

But the experience of 100 years has taught us that shared prosperity and natural resources extraction don't necessarily go hand in hand. Without a plan for the future, we are likely to continue to experience a lack of economic diversity, endless cycles of boom and bust, and poor economic outcomes.

Rather than repeat the past, the West Virginia Center on Budget and Policy asks that the DOE propose to move forward by creating the West Virginia Future Fund, similar to funds created by several other mineral-producing states.

The Future Fund will be created from a portion of natural resources severance taxes and will turn a one-time source of revenue into a permanent source of wealth for our state.

We propose that the principal of such a fund should be untouchable and allowed to grow.

It should be prudently invested and wisely managed so that the income gained will provide an ongoing stream of revenue to meet the challenges of the future and help build a more prosperous and secure economy.

If we do not include a Future Fund in our state's energy plan, than the mineral resources will disappear and the state will be more vulnerable in the future.

Name: Cathy Kunkel and Stacy Gloss
Hometown: Naoma, WV
Organization: Energy Efficient West Virginia
Title: Coordinator
Date Monday, August 29, 2012

Energy Efficient West Virginia is a statewide non-profit coalition dedicated to improving energy efficiency across all sectors in West Virginia. We appreciate the opportunity to comment on the draft of the state's 5-Year Energy Plan.

We strongly endorse all of the recommendations of the Energy Efficiency section of the Plan. The Plan provides a thorough and well-researched analysis of the status of energy efficiency policies and incentives in West Virginia and surrounding states. We concur with the Plan's overall finding that energy efficiency is a low-cost and underutilized energy resource for West Virginia.

With regard to utility energy efficiency policy, the report highlights that West Virginia's utility-funded energy efficiency programs are weaker than many programs in surrounding states, including programs offered by other AEP and FirstEnergy companies. We agree that establishing an Energy Efficiency Resource Standard (EERS) is critical to facilitating the development of stronger programs in West Virginia. By setting interim and long-term goals for energy savings, an EERS would spur greater utility investment in efficiency, ensure a long-term market in energy efficiency services, and reinforce the concept of energy efficiency as a resource.

EEWV further recognizes the need to re-align utility financial incentives to put supply-side and demand-side energy resources on an equal footing. We agree that decoupling offers the best approach to eliminating utilities' financial disincentive to promote energy efficiency.

We also support the Plan's recommendations to ensure that the state adopts up-to-date building energy codes and to provide for more effective enforcement of such codes. As the plan notes, West Virginia lags behind many other Appalachian states in adoption of residential and commercial building energy codes. Promulgating and enforcing up-to-date energy codes is one of the most effective steps that the state can take to promote energy efficiency.

While the Plan does mention the benefits of co-generation, waste heat recovery, and combined heat and power (CHP) in its industrial opportunities section, we are disappointed that recommendations to facilitate the development of such projects were left out of the draft energy Plan. Co-generation, in which the waste heat from electricity generation is used as industrial process heat, is a highly efficient form of power generation. Producing electricity and heat separately has a typical combined efficiency of 45%, whereas co-generation can achieve a combined thermal efficiency of 80%. Nationally, co-generation contributes 9% of electricity capacity; in West Virginia, it is only 2.3%, despite West Virginia's position as an industry-intensive state. Benefits of CHP include the potential to use in-state natural gas resources, increased efficiency of fossil fuel use, and grid stability benefits such as reactive power support and reduced line losses. West Virginia has no policies to encourage co-generation, and at least one large project has stalled due to an inability to guarantee a long-term contract for power sales to the grid. We believe the Division of Energy should play an important role in analyzing the barriers to CHP development in West Virginia and developing policy to promote CHP as a means of enhancing industrial competitiveness and energy efficiency.

More broadly, we are disappointed that the plan does not address the need for integrated resource planning in West Virginia. Integrated resource planning, which has been adopted by more than half of U.S. states, would require West Virginia's utilities to submit long-term plans to the Public Service Commission explaining how they can meet future electric demand at the lowest cost. Crucially, a rigorous integrated resource planning analysis would evaluate supply-side and demand-side resources on an equal footing to show how much our utilities should be investing in energy efficiency.

Currently, both of West Virginia's investor-owned utilities are short on capacity and are proposing to purchase additional coal capacity. Although both utilities claim that their proposal is the lowest-cost option for their customers, there is no integrated resource planning process in place to require a transparent evaluation of alternatives. With a robust IRP process, the identification of capacity shortages in an integrated resource plan should trigger a requirement for the utility to issue an RFP for additional capacity. This would allow for open competition between gas plants, coal plants, renewables, co-generation facilities and demand-side resources to meet the capacity need. Acquiring coal capacity is a significant investment with long-term implications for customer rates, yet our utilities were allowed to develop their proposals without being required to fully evaluate alternatives or issue a formal RFP for additional capacity.

In summary,

1. We strongly endorse the recommendations of the energy efficiency section of the state's Energy Plan, and we urge the Division of Energy to advocate for the adoption of an Energy Efficiency Resource Standard.

2. We urge the Division of Energy to support policies that would lead to greater development of co-generation, or combined heat and power, as a strategy to enhance industrial competitiveness and improve efficiency of fossil fuel use.

3. We urge the Division of Energy to recommend integrated resource planning as a strategy for ensuring that West Virginia's utilities invest in all cost-effective energy efficiency and to ensure that West Virginia's utilities are making investment decisions that are in the long-term public interest.

Name: Mary Ellen Cassidy
Organization: Wheeling Jesuit University
Title: Research Associate and Adjunct Faculty
Date Monday, August 27, 2012

I would like to strongly encourage stronger community incentives for energy efficiency for homes, small businesses and schools. Although there are limited tax incentives, a significant obstacle to energy audits and upgrades for buildings is the upfront costs. Allowing the homeowner and small business to finance upfront costs through their utility bills or other innovative energy performance type contracting. Letting homes and small businesses finance energy efficiency (like larger entities through EPC) without upfront costs would allow more people to enjoy the savings from energy efficiency and also help communities expand construction, HVAC, auditor and create additional job demands. Energy efficiency developed on this community level is a great job creator and develops local wealth in a sustaining environment. Along with financing incentives, I would also strongly encourage our state to ask the PSC to tell utilities to incorporate "least-cost pricing" that has been proven to lower demand and increase efficiency.

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West Virginia
Energy Users
Group

November 5, 2012

WVEUG RESPONSE TO DRAFT WV ENERGY PLAN COMMENTS

The West Virginia Energy Users Group ("WVEUG") offers these initial thoughts and comments in response to the current draft recommendations appearing on the West Virginia Energy Plan homepage. Broadly, the referenced documents address Energy Efficiency ("EE") and Demand Response ("DR"), Renewable Energy, and Fossil Fuel-based Energy issues. Beyond its initial comments here, WVEUG would be eager to continue to provide input as the West Virginia Energy Plan is formulated and developed.

As an overview, WVEUG members are critically engaged in attempting to maintain their economic viability in the manufacturing and industrial business sectors in which they compete. This has been made all the more difficult by electric rate increases in the last few years of well over 50% in West Virginia. As such, it is critical for the West Virginia economy that any initiatives that could increase electric rates be critically evaluated.

In addition, with specific respect to EE/DR, large manufacturing and industrial users have a built-in incentive to use electricity and manage their usage as efficiently as possible. As such, these customers have historically invested in, and continue to invest in, EE/DR measures, and they have made those investments without seeking other ratepayer support, even though these measures likely have provided "system-wide" benefits. In turn, these customers should not also be obligated to fund utility-directed EE/DR programs nor should they be effectively required to subsidize competitors through such funding.

WVEUG supports EE/DR measures offered through utility-driven programs provided that costs for such programs are borne by the rate classes that benefit directly from them and provided that individual large users of electricity are able to opt-out from paying related charges. WVEUG likewise supports economic production of renewable and fossil-fuel based electric generation, so long as it does not increase electric costs for customers, particularly in the current economic environment.

Initial Responses to Energy Efficiency Policy Draft Report:

- Legislative action could resolve the problem of lost revenue recovery and/or revenue decoupling by creating a legislative requirement for utilities to reduce consumption and demand without requiring these extraordinary revenue measures (WVEUG opposes lost revenue recovery and revenue decoupling).
- Absent a legislative mandate (which WVEUG does not advocate), maintaining the current EE and DR policies is the best option for WV industry and manufacturing, given

the ongoing economic conditions and the potential massive outlay of costs necessary to advance broader EE and DR policy goals.

- WVEUG would affirm the finding that industrial and manufacturing entities have a natural economic incentive to pursue EE and DR savings independently from any utility programs, and they have done so as a matter of record for years, without seeking to socialize the cost of such investments.
- Because of the natural investment incentive, large industrial and manufacturing entities (electric loads of 1 MW and greater) should be exempt from participating in voluntary or statutory utility-implemented EE and DR programs.
- To the extent that automatic exemption from participation is not provided, the current ability of industrial and manufacturing entities to "opt-out" from utility-implemented EE and DR programs must be continued.
- Experience in other states indicates that the greatest EE applicability to large industrial and manufacturing entities is found in prescriptive EE and DR measures, which are costly for utilities to implement outside of legislative mandates and funding.
- WVEUG has opposed utility-initiated lost revenue recovery and would continue to do so at the regulatory level. WVEUG would oppose a legislative lost revenue recovery or revenue decoupling mandate.
- Lost revenue recovery does not account for a utility's <u>net</u> revenue position, and the lost revenues experienced by utilities through EE and DR programs are likely more than offset by other <u>net</u> revenue influencing factors.
- Regardless of utilities' best M&V efforts, lost revenues will always be very difficult to confirm to a degree that justifies recovery from ratepayers.
- Because large industrial and manufacturing companies have built-in incentives to independently invest in EE and DR, lost revenue recovery from industrial ratepayers compels subsidization of other ratepayers who have not taken advantage of these opportunities, including potential commercial competitors.
- Lost revenue recovery is "single-issue ratemaking" that does not address possible changes in a utility's cost structure and revenue position in the future. This violates traditionally acceptable ratemaking principles.
- For many of the reasons stated above with respect to lost revenue recovery, WVEUG also opposes "revenue decoupling" measures for EE and DR programs.
- Revenue decoupling also provides utilities with a guaranteed regulatory "test year" level of earnings, which ignores that the appropriate objective of utility ratemaking is permitting the utility <u>the opportunity to earn a fair rate of return</u> on investment, not a guaranteed level of return.
- Revenue decoupling also constitutes "single-issue ratemaking" that does not acknowledge changes in a utility's overall cost structure and revenue position.
- WVEUG concurs with the stated criticisms of revenue decoupling in the report, particularly the findings on the potential impact on prices and the conclusions that decoupling weakens price signals and inhibits market responsiveness.
- WVEUG generally supports DR development and growth; however, any statewide DR programs should not interfere with the ability of individual industrial and manufacturing entities to utilize and benefit from other regionally available DR programs and incentives (<u>e.g.</u>, PJM programs). These programs provide substantial economic benefit to large end-users.

- WV DOE should also consider state incentives for "waste heat recovery" and Combined Heat and Power technology, similar to the recent stalled joint initiative of the US DOE and EPA.
- WVEUG and its individual members have worked with IOF-WV and are generally interested in continuing this relationship.

Initial Responses to Renewable Energy Policy Draft Report:

- WVEUG supports the recommendation to maintain current policies.
- Of the potential options available to WV industry and manufacturing, the possibility of solar self-generation holds some promise; however, WVEUG strongly agrees that, for reasons of continued economic and competitive viability, funding any solar projects through utility rate increases is not recommended.

Initial Responses to Fossil Energy Opportunities Draft Report:

- The continued monitoring and publication of energy production and consumption data can be useful, but it must maintain the confidentiality of individual customer data.
- The current and future economic conditions nationally and in WV have significant impacts on the ability of WV industry and manufacturing to remain in business; thus, any fossil energy policy should carefully consider the cost impact of these entities continuing to do business in WV.
- WVEUG generally supports continued and aggressive development of the Marcellus Shale resources, to include attracting an ethane cracker, and agrees that the development of natural gas electric generation in WV would be beneficial provided that such generation plant capacity is not funded by electric utility ratepayers prior to the point in time when such plant capacity is actually operational and in service.
- WVEUG concurs that it is important to promote increased electric generation capacity in WV so long as it is funded privately or by utility shareholders, not captive ratepayers.
- WVEUG concurs that access to affordable and uninterrupted electric supply is critical to WV manufacturing and industry.

* * *

As noted above, WVEUG would be pleased to continue to provide comments and input to the process in developing the West Virginia Energy Plan. In that regard, please contact Derrick Williamson to coordinate that effort (dwilliamson@spilmanlaw.com; 717.795.2741).

Thank you.

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October 9, 2012

Mr. Jeff Herholdt, Director
West Virginia Division of Energy
1900 Kanawha Blvd., East
Building 6, Room 645
Charleston, WV 25305-0311

Re: West Virginia Energy Plan for 2013-2017

Dear Director Herholdt:

FirstEnergy would like to express its thoughts on the West Virginia Division of Energy's new five year (2013 – 2017) energy plan for the state of West Virginia, including the three West Virginia University and the Marshall University proposed plans for their consideration of the new Energy Policy Plan. FirstEnergy does business in West Virginia primarily under the distribution companies of Monongahela Power Company and The Potomac Edison Company, while it generates electric power under the names of FirstEnergy Generation Company and Monongahela Power Company.

FirstEnergy does not support mandates and subsidies for any particular type of energy program or production. Subsidies and mandates create inefficiencies in the markets which lead to higher costs. It assumes customers cannot make decisions for themselves and more importantly is a tax on the economy and the people.

The company also does not support Marshall University's recommendation on Energy Efficiency. FirstEnergy supports efforts to focus on the development of supply side production and use of these energy forms rather than focusing on policy to develop an electric system that relies on curtailing customers demand to meet requirements. Development of any quantitative standard cannot be made without an extensive process to develop and understand the information, choices and financial implications associated with any Energy Efficiency Resource Standards (EERS).

Energy efficiency programs ultimately will produce higher rates for customers in our view. These additional costs include those associated with developing, implementing and evaluating such programs. Higher rates are charged to all customers (including non-participants) for recovery of costs associated with these programs.

Rate impact measure tests should be performed to determine if energy efficiency programs result in the lowest rates $/kwh and are most efficient for customers versus the availability of other supply side options. For example, energy efficiency as a resource is not equivalent to a generating unit where the asset is dispatchable, measurable and reliable. The market should serve as the driver for energy efficiency participation, not legislative or regulatory mandates. If the price for power is at a level that induces customers to participate in energy efficiency programs, then participation is encouraged and will occur due to market forces, but it should not be mandated. Also, energy efficiency programs should not be administered by the utility but by other entities who are better equipped to follow the needs of the market. Accordingly, FirstEnergy does not support implementation of Energy Efficiency Resource Standards (EERS).

While demand response and energy efficiency are often used as tools for reducing peak consumption, peak pricing and total MWh consumption, and as a result slow the need for new generation assets, we as a nation must be wary of the reliability of these programs and not make ourselves dependent on these programs to the point where grid reliability is threatened. Such programs should only be looked at as a complementary tool to traditional generation as opposed to replacement of electric generation of all fuel types. Additionally, the energy efficiency and demand response that are claimed for the benefit of the electric grid need to be validated as being available and ready to perform before payment is made for these services. In too many cases today, state and federal laws are too quick to promote demand response and energy efficiency, and unscrupulous curtailment service providers can too easily take advantage of laws and regulations, allowing for payments to be made for phantom demand response and energy efficiency programs which in turn not only cost ratepayers, but threaten grid reliability.

More than 20% of FirstEnergy's West Virginia industrial load has elected to opt-out of the Company's West Virginia Energy Efficiency program in the first nine months since it was approved. Additional opt-outs are being processed. This is permitted under the Company's programs approved by the Public Service Commission if the industrial customer has already implemented its own energy efficiency measures and is a sufficiently large consumer of electricity (1 mw of demand and greater). This demonstrates that customers will implement and pay for energy efficiency measures that meet their specific economic criteria on their own without the need for mandated targets and utility-sponsored energy efficiency programs. It also demonstrates that customers are unwilling to subsidize energy efficiency programs for the benefit of others when they have a choice.

West Virginia is different from neighboring states in that the investor-owned electric utilities in West Virginia have voluntarily implemented energy efficiency programs without legislative or regulatory requirements to implement such programs. West Virginia should continue to let these programs develop under the direction of the investor-owned utilities and other stakeholders rather than under legislative or regulatory mandates.

FirstEnergy strongly agrees that should demand response and/or energy efficiency programs be voluntarily implemented by the utilities or mandated by the state, a mechanism must be included to allow the utility to recover the lost revenues resulting from these programs. However, FirstEnergy does not support revenue decoupling. The company opposes revenue decoupling as a lost revenue recovery mechanism. FirstEnergy views lost revenues as an energy efficiency cost that should be recovered together with all other energy efficiency program costs. Decoupling is a ratemaking mechanism designed to remove the link between sales volume and revenues. One effect of decoupling is to remove the disincentive for utilities to pursue energy efficiency by reducing the dependence on volume based sales. A utility's distribution expenses, however, are associated with installing, operating and maintaining infrastructure to accommodate peak demand for electricity. Commercial and industrial customer rates are, in fact, demand based. Residential customers have volume based rates as a proxy for demand.

Revenue decoupling is a much broader approach to this more narrow issue which can lead to recovery of lost sales due to any number of effects including mild weather, loss of customers or major storm outages. Revenue decoupling is not necessarily in the interest of the consumer. It could re-allocate costs from high usage customers to low usage customers or be cost neutral for customers. It also can conflict with efforts to encourage reduced consumption. Utilities should have the option of instituting a decoupling mechanism, but should not be required to decouple. However, the company does support a lost recovery mechanism that is tied directly to the energy reductions caused by the energy efficiency programs.

FirstEnergy believes that the current Renewable Portfolio Standards (RPS) in West Virginia are adequate. While research and development into new resources may be critical to our country's prospering future, such new resources need to also be cost effective and able to compete on their own before they displace current technologies. Subsidies mask the true cost of these resources and cost ratepayers more in the long run either through their utility rates or through higher taxes. Some examples of such subsidies under current law are the investment tax credits for wind and solar projects and the production credits for wind, and customer credits at the federal and state levels.

FirstEnergy believes that the State Energy Plan should note that coal is a vital source of generation and the plants that are abruptly shutting down due to legislative or regulatory mandates, have an overall negative impact on the State of West Virginia. FirstEnergy agrees with the ideals of advanced coal technologies (clean coal); however, the market and competition should dictate its development.

FirstEnergy supports the recommendation to repeal the sections of the West Virginia law that prohibits the development of nuclear power generation in the state. Due to the long lead time, planning and pre-siting studies being done today will pave the future of nuclear development into the 2020's and 2030's. Refreshing these studies can be done if the laws change, but presently laws hostile to nuclear today will mean little interest not only in the near future but possibly for many years to come – even decades. The time to repeal the law is now and not in the future.

In regard to electric transmission, West Virginia should participate in the PJM Planning Process which is inclusive of stakeholders. The current discussion is planning for aging transmission infrastructure across the entire footprint of the Regional Transmission Organization (RTO). West Virginia can participate in those stakeholder discussions or through the Organization of PJM States Inc. (OPSI) to influence related scenario analysis. Streamlining both the siting and the associated environmental permitting process in West Virginia would be helpful for energy resources that may have a short lead time for being placed into service.

I hope you will please take FirstEnergy's statements on the proposed West Virginia Energy Plan 2013-2017 into consideration as the Plan is finalized. If you have questions or would like to discuss any of the material in more detail, we would welcome the opportunity to meet and discuss these issues in greater detail. Should you desire such a discussion, please contact George Blankenship at (724) 244-4427 or Sammy Gray at (304) 345-4695. Thank you for the opportunity to provide comments on the proposed Plan.

Sincerely,

Holly C. Kauffman

Holly C. Kauffman
President, WV Operations

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