Fall 2009

Clean Air Forum

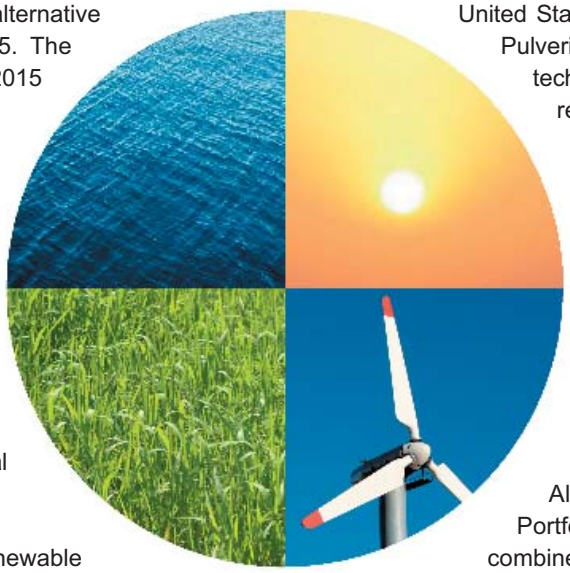
Information on alternative energy from around the state and nation.

Alternative and Renewable Energy Portfolio

Legislation

An important component of Governor Joe Manchin III's legislative agenda in 2009 was a bill to implement an Alternative and Renewable Energy Portfolio. The portfolio requires large utilities selling electricity in West Virginia, such as Allegheny Energy and Appalachian Power, to include alternative and renewable energy sources in their generation mix. West Virginia utilities currently use coal for 99 percent of their electric generation and hydro power for 1 percent. The legislation requires that 25 percent of electric sales in West Virginia be met by alternative and renewable energy sources by 2025. The interim goals are 10 percent of sales by 2015 and 15 percent by 2020.

So why is West Virginia requiring this of its utilities? Roughly 30 states have adopted an energy portfolio. These states feel it is important that their electric utilities bring on new electric generation fuels. Most states use the portfolio to promote the production of renewable energy in their states. Others, such as Pennsylvania, Ohio and Michigan adopted portfolios like West Virginia's that also allow new coal technologies.



Who qualifies?

As the name of the Alternative and Renewable Energy Portfolio implies, a broad array of electric generation technologies can qualify as portfolio fuels. Allowable renewable energy technologies include solar (thermal and photovoltaic), wind, biomass, run-of-river hydro, geothermal energy and fuel cell technology. Natural gas can be used to meet one-tenth of the portfolio requirements. Allowable alternative fuels may also include advanced coal technologies that yield reduced CO_2 emissions, coal bed methane, coal gasification, coal liquefaction, integrated gasification combined cycle systems, waste coal, pressurized fluidized bed systems, ultra-supercritical systems and systems employing carbon sequestration and recycled energy. Greenhouse gas emission reductions or offset projects also qualify as portfolio opportunities. Demand-side initiatives such as peak demand reduction programs or customer energy efficiency programs also qualify for the West Virginia portfolio.

Tracking requirements

The production of qualified electricity is tracked through the issuance of credits. An electric utility is granted one credit for each megawatt-hour (MWh) of electricity generated from an alternative energy source. An electric utility can receive two credits for every MWh of renewable energy generation. Renewable energy generation from a facility located on a reclaimed surface mine site is awarded three credits per MWh.

Roughly 50 percent of the electricity produced in the United States comes from coal-fired power plants. Pulverized coal combustion is the dominant technology in use. With the current concerns regarding the environmental performance of coal, it is important that a cleaner suite of electric generation technologies be pursued. West Virginia's Alternative and Renewable Energy Portfolio advances fossil, renewable and energy efficiency technologies to accomplish this goal.

New and proposed projects

Several fossil and renewable projects now under consideration in West Virginia would qualify for the Alternative and Renewable Energy Portfolio. The 600-MW integrated gasification combined cycle electric generation plant proposed for Mason County by Appalachian Power is a clean coal technology that would qualify. West Virginia currently hosts 330 MW of wind power electricity. Another 626 MW of wind capacity has been permitted. For run-of-river hydro, West Virginia has 264 MW operational. Another 127 MW of hydro power is in the FERC permit stage. These developed and permitted renewable energy projects total 1,347 MW. They could qualify for the West Virginia portfolio if their credits were purchased by West Virginia utilities.

West Virginia is an energy state with diverse energy resources. Energy production and utilization are key components of our economy. The Alternative and Renewable Energy Portfolio will serve to promote clean coal technologies, renewable energy development and customer-based energy efficiency.

By John F. "Jeff" Herholdt, director, WV Division of Energy

An ad hoc publication of the West Virginia Department of Environmental Protection's Division of Air Quality in conjunction with the West Virginia Division of Energy

Net Metering Adds Value to Projects

Net metering is available in 42 states and the District of Columbia, including the state of West Virginia.

Net metering allows West Virginia residents to get credit from their electric utilities for electricity they generate from renewable energy generating sources such as solar, wind, biomass, landfill gas, hydropower or other renewable sources.

According to the West Virginia Public Service Commission, "At its most basic level, net metering is simply permitting the electric customer to allow any excess energy produced on-site beyond its requirements to flow into the electric distribution system, thereby resulting in its meter running backwards from time to time. The customer would be billed only for its 'net' usage as reflected at the time the meter is read."

In West Virginia, residences and small commercial customers can use net metering for units up to 25 kW of generating capacity. For comparison purposes, in Nevada, systems may be up to 80,000 kW; in Indiana, 10 kW.

In West Virginia, each electric utility can provide net metering to 0.1 percent of its total load participation. As the West Virginia Public Service Commission was developing net metering rules, it provided some illustrative data on the maximum levels allowed for each of the state's four largest electric utilities, based upon 2005 peak demands:

- Appalachian Power 3,046 kW
- Monongahela Power 1,719 kW
- Potomac Edison 591 kW
- Wheeling Power 370 kW

Total allowed net metering in West Virginia would equal 5,726 kW or 229 projects at 25 kW each.

Customers who want to use net metering must work with their individual electric utilities, filling out an application and paying an application fee, as well as providing proof of liability insurance. They can receive full retail credit for the energy they produce in excess of use.

For rules regarding net metering at each of the above-named electric utilities, visit their websites and look for information on tariffs:

Appalachian Power
Wheeling Power
www.appalachianpower.com/
Enter "tariffs" in the search window; click on APCO-Rates & Tariffs; select West Virginia; click on the PDF. The net metering information is on Sheet 26-1.

Monongahela Power
Potomac Edison
www.alleghenypower.com/
Go to "Rates and Tariffs;" select company; click on "Net Energy Metering Rider."

ENERGY STAR sales tax holidays continue

West Virginia's first ENERGY STAR sales tax holiday, which ran from September 1-7, 2008, saved West Virginia consumers an approximated $300,000, as they did not have to pay sales tax on purchases of ENERGY STAR-qualified products valued at $2,500 or less.

The average American household spends about $2,000 a year on energy. With ENERGY STAR dishwashers using at least 41 percent less energy, and qualified washing machines saving nearly 7,000 gallons of water a year, the financial and environmental impact of these products makes them attractive to environmentally-conscious consumers.

An ENERGY STAR-qualified product is one that meets the energy efficiency guidelines set by the U. S. Environmental Protection Agency and the U. S. Department of Energy.

The exemption will also be available for West Virginia consumers in 2009 and 2010 beginning on the first day of September at 12:01 a.m. and ending on November 30th at midnight each year on purchases of $5,000 or less per qualified product.

To learn more about the holiday and qualifying products, go to www.state.wv.us/taxrev/taxholiday.html.

Household Solar Photovoltaic Systems

By John Smith and Clarissa Mathews
Shepherd University Institute for Environmental Studies

Solar Photovoltaic Cells

Direct Current (DC) circuit breakers. These devices direct the flow of electricity in the system. When the disconnects are closed, electricity flows to the next phase of the system: the inverters or DC batteries.

DC batteries. If the energy from the system is not being used to power a load, the electricity can be stored in the DC form in batteries. DC power is used to charge the batteries so there is no need to convert the DC into another form. Typically, deep-cycle lead-acid batteries are used. For grid-tied systems (where a backup energy source is available) batteries are not needed.

Inverters. Photovoltaic cells produce a steady DC electrical current. Household appliances in the United States run on alternating current (AC) that follows a sine wave function. Using a mathematical process to create a modified sine wave, inverters convert the DC current into AC current useable by household appliances. Unfortunately, the conversion of DC to AC is not 100 percent efficient; energy losses take place. Today, typical inverters operate at around 70 percent conversion efficiencies. Depending upon the size of the system, more inverters may be required to transform DC to power AC loads.

Charge controller. This device tracks the output of the system and communicates between the batteries, solar panels and any AC loads. The charge controller directs the flow of electricity for the entire system.

AC disconnects. After passing through the inverters, the current travels to the AC disconnects. If the electricity is needed to power AC loads, the disconnects are closed and power is supplied.

Grid-tied photovoltaic system cost breakdown*

Photovoltaic panels: $575 (110W) to $720 (115W) each
Inverter system: $4,100 (inverter, charge controller and disconnects)
Batteries: $600 (825A) each
Cables: $175

* In grid-tied net metering systems, full electronic meters must be replaced with mechanical meters, which can run backward (showing a subtraction of kilowatt hours) at an estimated cost of $450, according to information from Appalachian Power, a unit of American Electric Power. The company also requires a main disconnect unit so that workers can visibly verify that the customer-owned generation system is disconnected, with an installation cost of about $250. The company also requires specification sheets, a one-line diagram of the system, manufacturer information and an application with a fee of $30.

Geothermal Heating Catches on in West Virginia

The mountains of West Virginia provide many renewable energy opportunities. A surprising example exists at high schools in the state's most mountainous counties. High in the Appalachians, Pocahontas and Webster County High Schools have invested in their future by installing geothermal heating systems.

These heating systems use geothermal heat pumps, highly efficient renewable energy technology gaining wide acceptance in residential and commercial applications. Geothermal heat pumps are used for space heating and cooling, as well as water heating. Geothermal heat pump technology concentrates heat that exists naturally in the Earth rather than through the combustion of fossil fuels. This form of heating and cooling is cleaner than combustion with its corresponding pollutants. The technology for this renewable energy relies on the fact that the ground beneath the surface of the Earth remains at a relatively constant temperature throughout the year, warmer than the air above it during the winter and cooler in the summer, very much like a cave or a coal mine. The geothermal heat pump transfers heat stored in the Earth or ground water into a building during the winter or out of the building and back into the ground during the summer. The ground acts as a heat source in winter and as a heat sink in summer.

Webster County High School installed the first major geothermal heat pump system in the state employing a closed loop system *(see photo above).* This project was funded by the West Virginia School Building Authority. This system consists of a 500-ton geothermal heat pump loop of 240 wells, each 307 feet deep, with more than 28 miles of underground piping, all spread under an adjacent football field used for practice drills. The closed loop system utilizes a 20 percent propylene glycol/water solution, and has resulted in reducing the high school's electric costs by nearly 50 percent compared to the previously used HVAC system. The Pocahontas County High School closed loop geothermal system consists of 192 wells, 300 feet deep, with more than 20 miles of underground piping spread under an adjacent parking lot that was built on top. This system uses only around one-third of the energy previously required and also provides energy efficient air conditioning, unavailable at the high school before (information from GeoExchange).

A typical geothermal heating system is composed of three parts: an Earth connection system or loop, a heat pump subsystem and a heat distribution subsystem. The Earth connection system is a system of pipes buried near the building and may be tailored to the site based on available land, soil conditions and climate. This system circulates a fluid, generally a water/anti-freeze mixture, which exchanges heat with the surrounding soil. When used for heating purposes the fluid absorbs heat, and releases heat when used for cooling purposes. The heat pump subsystem concentrates the hot or cool air from the fluid. A heat distribution system uses conventional ductwork. According to the International Ground Source Heat Pump Association, "The ground source heat pump is one of the most efficient residential heating and cooling systems available today, with heating efficiencies 50 to 70 percent higher than other heating systems and cooling efficiencies 20 to 40 percent higher than available air conditioners. That directly translates into savings for you on your utility bills."

Although it makes more sense from a cost-benefit ratio for larger facilities to implement geothermal systems due to their larger floor area, geothermal systems also work in residential applications. A permit engineer in the West Virginia Department of Environmental Protection's Division of Air Quality got interested in geothermal heating and cooling after observing one in action. A local geothermal system installer calculated a six-year payback using current electric rates and taking into account his previous

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Hydrogen as a Fuel . . .
Past, Present and Future

It seems that proponents of wind power and representatives of the coal industry are typically of different mindsets and, some might say, have competing interests. However, it is possible common ground exists for both in the form of hydrogen. This may come as a surprise to some, especially given the fact that hydrogen has been the next big thing for some time now.

Hydrogen as a fuel is much nearer than most people think. There are already available fuel cell electric vehicles that offer the same driving experience as traditional gasoline cars. It is a transparent experience. The price of these vehicles has dropped greatly and will continue to drop as more infrastructure is brought on-line. The only direct emission from a hydrogen fuel cell vehicle is water.

So, how is hydrogen development good for wind? Unfortunately, wind power is currently generated many times in off-peak periods, such as at night. This means that much of the time, wind power is put onto the grid at times where it is not utilized to its fullest potential. Hydrogen represents a readily available way to store the wind power, e.g., by using the off-peak power to hydrolyze water into hydrogen, then by storing hydrogen for use in generating electricity via fuel cells during periods of peak load. Fuel cells represent the third-fastest growing renewable energy sector, behind only biomass and solar power in research development and implementation.

The coal industry also benefits in the development of hydrogen as a fuel. Much conversation has taken place of late regarding "clean coal" and, indeed, recently much federal money has been appropriated for clean coal technology. One of the most developed clean coal technologies that currently exists is in the possible synergy with hydrogen.

West Virginia is the site of the nation's first open architecture hydrogen station.

West Virginia is the site of the nation's first open-architecture hydrogen production and distribution station. This hydrogen dispensing station uses power from coal-fired electricity to break down water to produce hydrogen, which will then be used in vehicles at Yeager Airport and by the West Virginia Air National Guard. This prototype will allow the hydrogen-supporting community to sort out issues related to the production, containment, storage, safety, delivery and durability of hydrogen fuel.

One may question the comparison of air emissions of the displaced gasoline-powered vehicles to the miniscule power plant emissions related to the use of the electricity for the hydrolyzer at Yeager Airport. As the hydrogen fuel will be generated specifically during the off-peak electricity generation times in the middle of the night, there will conceivably be no net air pollution emissions than would otherwise occur.

This is because the reality of coal-fired power generation is that it cannot be switched on and off, so the electricity generated during off peak hours is sometimes wasted.

As coal-fired power generation will maintain its status as a significant force into the foreseeable future, hydrogen derived from electricity as a means to reduce the environmental footprint of the transportation sector makes good sense. It is easier to control pollution from one point source rather than many small mobile sources. Other applications, including gasification, also will enhance the domestic energy portfolio and go a long way toward reducing our dependence on foreign resources. This represents a win-win situation for the American public.

Biomass Gains in Popularity

Once again biomass is a hot topic in West Virginia, in particular wood and wood residue. With passage of the "Alternative and Renewable Energy Portfolio Standard," power plants in West Virginia will look increasingly to renewable sources of fuel. The standard requires a portion of electric sales to be met by alternative and renewable sources in the following amounts: 10 percent by 2015, 15 percent by 2020 and 25 percent by 2025. Monongahela Power Company's Albright Power Plant is one of the first in the state to explore the possibilities of electric generation using biomass as a fuel.

In July 2008, the WVDEP's Division of Air Quality issued a minor source air permit to the Albright Power Plant to allow the co-firing of biomass in its coal-fired units. The permit allows for 60,000 aggregate tons per year of biomass to be co-fired in the steam-generating boilers. The biomass will primarily consist of green sawdust and can be co-fired in each of the boilers, displacing up to 20 percent of the coal by weight. The original biomass handling and feed equipment was installed under a cooperative agreement between the U.S. Department of Energy and Allegheny Energy Supply Company, L.L.C. Mon Power retains the right to combust 100 percent coal. Currently, there is only one boiler set up to receive biomass at the Albright plant and, as power generation has been down, no biomass is currently being used.

West Virginia is the second-leading hardwood growing state in the nation, behind Pennsylvania. West Virginia is the third most heavily forested state in the nation and has a wood products facility in every county. According to www.wvbiomass.org, as recently as 2006, no electricity in the state was being generated from biomass. In contrast, many surrounding states that have had renewable portfolio standards longer than West Virginia are generating electricity from biomass. As of 2006, these border states had the following electricity-generating capacity from biomass: Kentucky - 3.3 MW; Ohio - 7.2 MW; Pennsylvania - 27.5 MW; and Virginia with 103.39 MW of capacity.

There is no doubt that wood and wood residues are plentiful throughout the state. In terms of logging residues alone, it is estimated that there could be "approximately 1,125,000 tons of low quality oak available each year in West Virginia" [WVU's *2006 Annual Wood Utilization Research Report*]. This statistic includes only one species of tree and only one specific type of wood waste. An electricity-generating plant would have to consider the economic feasibility of transportation costs and the cost to process the wood into a suitable fuel.

As the distribution of the state's wood and wood residue resources has been mapped fairly extensively, and as there are only a handful of electric generating utilities (EGUs) that could actually utilize this fuel without a large capital outlay, feasibility studies should be fairly easy to begin. Besides the Albright plant, possible candidates include plants using circulating fluidized bed technology to generate electricity, such as the North Branch Power Station in the Eastern Panhandle, the Grant Town Power Plant in Marion County and the Morgantown Energy Associates facility in Monongalia County. It is also possible that EGUs that have boilers with cyclone-type burners used to burn lesser grades of coal such as the Willow Island, Pleasants and Kammer power plants could utilize sawdust as well. Other EGU boilers may also be able to accommodate co-firing small amounts of wood waste with some modifications.

In addition to power plants, another energy producer has a vested interest in biomass. A coal-to-liquids (CTL) plant would almost certainly have to incorporate biomass in the form of wood residue as a significant feedstock in its process. Biomass can be readily adapted to the gasification process and when co-fired with coal, produces a gas that is higher in hydrogen, which increases the flexibility of what the end products can be. As long as responsible re-planting takes place, wood is a renewable resource. The use of wood residue for energy will result in some net regulated pollutant emissions reduction compared to the fossil fuel it replaces.

With the recent announcement of plans to build a $150 million wood-fired power plant in Mingo County, a company called American Clean Energy is jumping on the biomass bandwagon. The proposed 28 MW plant will be designed to use 400,000 tons of wood waste per year. The facility is expected to start generating electricity before 2012 begins.

Biomass, especially in the form of wood and wood waste, has several factors in its favor that will allow it to take its rightful place in the energy production sector of the future. It is appropriate because it comes from a renewable, sustainable resource base. Its prices have been historically stable and are not linked to global energy markets. Wood is one of West Virginia's greatest natural resources and will be a greater force in the energy production market of the future, further enhancing the state's position as a national energy leader.

Chicken Litter Heats Up

Perched at the edge of the state, Wardensville is a small community of 246 people and, since the spring of 2007, home to a state-of-the-art, energy-producing pilot project. Located on the Frye Poultry Farm, a gasifier produces clean heat from chicken litter: dry, heated air that supplants costly propane as a fuel. It eliminates a troublesome water pollutant, chicken litter, and has an added side benefit: the resultant ash can be beneficial as a soil amendment and/or fertilizer. Relatively new, gasifier technology has been used in other applications with such diverse fuels as nonrecyclable plastic, bark, wood pellets and cow manure. Gasifiers fulfill a number of uses, as the clean heat produced can be run through a heat exchanger or even a turbine.

Propane heats poultry houses throughout the winter. Unfortunately, propane produces a wet heat, which results in high levels of ammonia. Many air exchanges are needed each day, introducing cold air into the system as large flaps on the side of the poultry houses are opened and closed. This air must be reheated, using more propane and resulting in higher gas bills.

At Wardensville, a propane burner fires up the gasifier. The system breaks down carbon chains in the fuel, in this case chicken litter, in the absence of oxygen. This produces a gas, which is captured in a separate chamber, where ambient temperature air is introduced and the gas is combusted. The litter is slowly consumed, leaving only an ash high in phosphorous, potassium and calcium. A computer system coordinates the process and monitors all temperatures, fuel feed rates and air mixture fans.

Funding for this pilot project was provided by the U. S. Department of Agriculture's National Resources Conservation Service (NRCS), and the West Virginia Department of Agriculture.

Many times, far-fetched schemes are proposed to the West Virginia Department of Environmental Protection by outside entities. These schemes often include a process that has been invented where a waste is input on one end resulting in beneficial products with little or no resulting pollution. The chicken litter gasifer, however, is the real deal, and could be one of the answers to our future energy needs that will result in a minimum of air pollution, but a large reduction in the agricultural waste that has plagued the Potomac River Watershed. Coaltec Energy USA and Westwood Energy have come up with a viable solution to solve multiple problems for poultry producers, not the least of which is the sky-rocketing price of energy, in this case, propane.

Using chicken litter beneficially to create a cleaner environment is a plan whose time has come in West Virginia. For more information, please visit www.coaltecenergy.com or www.maxwestenergy.com.

Wind and hydroelectric power in West Virginia

Currently in West Virginia, 330 MW of wind power is operating including Shell Wind Energy/Dominion/Nedpower Mount Storm (264 MW installed), the largest wind project operating in the eastern United States, and Florida Power and Light with 66 MW installed.

In addition, permitted wind projects include 626 MW:

- Invenergy (186 MW permitted)
- West Virginia Wind Force (U.S. Wind Force) (150 MW permitted)
- AES Corporation (Laurel Mountain) (125 MW permitted)
- AES Corporation (New Creek) (165 MW permitted)

Currently, 264 MW of hydroelectric power is operating in West Virginia. Federal Energy Regulatory Commission (FERC) has preliminarily licensed 127 MW more.

Operating hydroelectric plants in West Virginia, totaling 264 MW, include:

- London/Marmet, Kanawha River
- Winfield, Kanawha River
- Millville, Shenandoah River
- Lake Lynn, Monongahela River
- Hawks Nest & Glen Ferris, New River
- Dam No. 4 Hydro Station, Potomac River
- Dam No. 5 Hydro Station, Potomac River
- Racine Lock and Dam, Ohio River
- New Martinsville, Ohio River
- Belleville, Ohio River
- Summersville, Gauley River

Hydroelectric projects that have been preliminarily licensed by the FERC total 127 MW of capacity and include:

- Tygart Dam, Tygart River
- R.D. Bailey Project, Guyandotte River
- Sutton, Elk River
- Jennings Randolph, Potomac River
- Robert C. Byrd, Ohio River
- Opekiska Lock and Dam, Monongahela River
- Hildebrand Lock and Dam, Monongahela River
- Morgantown Lock and Dam, Monongahela River

Geothermal Heating Catches on in West Virginia

Continued from Page 4

monthly average HVAC bill of $128 per month. The engineer also will have the added benefit of free hot water available in the cooling season (April through September).

Digging began in January 2009. Coils of plastic piping full of a water-antifreeze mixture were placed into four trenches dug on the property *(see picture, page 4, bottom right)*. Once the pipe was positioned and laid, the water furnace and ancillary equipment were installed. Then, a new air handler similar to those used for typical heat pumps was installed.

The system was up and running in a matter of three weeks and is currently in operation. As it is a given that electricity costs will continue to increase (natural gas and electricity rate increase requests are pending before the West Virginia Public Service Commission) and with concerns about climate change and the aging electricity grid infrastructure growing, geothermal makes sense more now than ever.

Homeowners who install geothermal heating and cooling systems are now eligible for increased tax incentives under the American Recovery and Reinvestment Act of 2009. Previous legislation offered a one-time tax credit of 30 percent of the total investment for residential ground loop or ground water geothermal heat pump installations, with a maximum credit of $2,000 for a single residence. The new bill, signed into law on February 17, 2009, removes the $2,000 cap and offers homeowners the entire 30 percent tax credit. For more information on all federal tax credits for energy efficiency, go to www.energystar.gov.

By choosing energy efficient appliances and taking steps to optimize the performance of your heating and cooling equipment, you are helping to prevent climate change and promoting cleaner air while enhancing the comfort of your home.

Information for this article was taken in part from the U.S. Department of Energy website, which can be viewed at: http://www1.eere.energy.gov/geothermal/heatpumps.html, as well as from the International Ground Source Heat Pump Association website at: http://www.igshpa.okstate.edu/

Testing, energy efficiency important before installing residential wind or solar

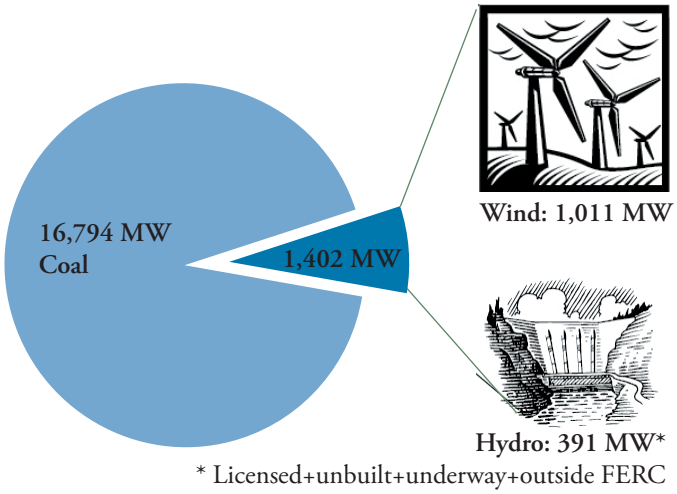
West Virginia residents often contact the Division of Energy about installing renewable energy at their homes or businesses. Before investing, assess the wind quality and speed and solar availability at your site.

Equally as important, make sure your building is as energy efficient as possible, which can reduce the size (likewise, the cost) of any renewable system.

- Change bulbs from incandescent to compact fluorescent
- Add insulation
- Caulk around windows and doors
- Use programmable thermostats to set back heating and cooling temperatures while you are away or sleeping
- Use ENERGY STAR® appliances.

Whether you ultimately decide to purchase a renewable energy system, making your home or business as energy efficient as possible can reduce your energy costs now.

West Virginia existing and potential electric capacity



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