Public Citizen

Renewable Energy
Can Meet Virginia's Needs

People have been presented only a false choice between conventional fossil fuels and nuclear power. Based on the work of governments, universities and other organizations in the United States, Europe and Japan, it is technically and economically feasible for a diverse mix of existing renewable technologies to completely meet Virginia's electricity needs over the coming decades. Virginia has vast renewable resources, which can be harnessed effectively and reliably. This can be done without producing carbon emissions, radioactive waste, or other significant pollution.

Virginia continues to be reliant on coal and nuclear power to generate electricity. In 2003, Virginia's annual electricity consumption totaled about 113.4 million megawatt hours (MWh), 97% of which came from these conventional polluting sources.[1] In order to improve the health of Virginia's communities, reduce the state's impact on climate change and increase energy independence, Virginia must move urgently to make use of its renewable energy resources. According to data from the National Renewable Energy Laboratory (NREL) in a recent 2005 study by the Virginia Center for Coal and Energy Research (VCCER), Virginia's electricity needs can be fully met in the coming decades by renewable energy sources, including wind, solar, advanced hydroelectric power, and geothermal heat pumps.[2]

WIND

Wind is one necessary part of meeting Virginia's energy needs. Virginia's wind resources are classified by the U.S. Department of Energy as "good-to-excellent" and capable of utility-scale energy production.[3] While it has a decent land-based resource, most of Virginia's strongest winds are offshore. Considering only resources less than 20 miles from existing transmission lines, NREL estimates in the VCCER study that Virginia's onshore and offshore wind resources equal about 4091MW.[4] This would generate about 11.9 million MWh annually – over 10% of Virginia's electricity use. Expanding this analysis to include wind resources further than 20 miles from existing transmission (an additional 31661 MW), *NREL finds that Virginia's wind potential comes to over 104.4 million MWh – over 92% of Virginia's total annual electricity consumption.*

In this study, the wind resource data used was screened to eliminate areas that may not be compatible with wind development, such as urban areas, airfields, steep slopes, parks, wetlands, and wildlife refuges. Because these exclusions are conservative, this calculation of Virginia's wind resource is probably a low estimate.[5]

WHERE IS IT LOCATED?

This wind is found across the state, but specific regions of Virginia have more wind than others. Virginia's inland wind resources are concentrated in the Appalachian Mountains all along Virginia's western border, with mostly Class 3 wind speeds, as well as several Class 4 and 5 locations. The remaining majority of Virginia's wind resource is found off the Virginia coast, both in the Chesapeake Bay and Atlantic Ocean, particularly near Norfolk, North Hampton, and Virginia Beach. The coastal region has Class 3, 4, 5, and 6 winds, and the winds more than 10 miles from shore are particularly extensive.[6]

ARE THERE ISSUES WITH WIND DEVELOPMENT?

While the siting of wind turbines has been controversial in some communities, turbines are clean and safe, and have far fewer impacts than other forms of electricity generation. Improved turbine design has virtually eliminated turbine noise, while establishing siting considerations and limiting the number of turbines in one area has reduced concerns about visual effects. Bird and bat migration is being addressed through monitoring, warning signals, and site selection that takes their migratory patterns into account.[7] Much of Virginia's wind is also offshore, meaning turbines would be five to fifty miles from shore – barely visible as specks on the horizon.

SOLAR

The Department of Energy describes the solar resources in Virginia as "good".[8] Solar photovoltaic technology (PV) has improved dramatically in the past thirty years, and the efficiency of PV panels is high enough to meet our needs. Most recently, work by scientists has led to the development of cheap, flexible thin film panels capable of at least 15% efficiency - a significant advancement for the technology.[9] These panels have begun to be produced on a large scale in Germany.[10] In most cases, solar panels can be built on top of or into already-existing constructions, and will not take up any additional land.

In the 2005 study by the Virginia Center for Coal and Energy Research, NREL estimates that photovoltaic solar energy can provide slightly over 13,000 MW in 2005.[11] This would generate 23.7 million MWh annually in Virginia - about 21% of current electricity consumption. This, however, underestimates Virginia's true solar resource. NREL bases its analysis on a study by Navigant Consulting for the Energy Foundation (EF),[12] which actually calculates technical solar PV potential out to 2025.[13] *Using the roof space for 2025, the EF study estimates that 25,225MW of PV solar is possible by that time, which would generate over 46 million MWh – about 41% of Virginia's annual electricity use.*

The VCCR and EF reports also only use available residential and commercial roof space in their analyses, and do not take into account the available space for PV from parking lots, awnings, windows, highway medians, and industrial buildings. Using these surfaces for PV would further increase the amount of potential electricity generated from solar in Virginia.

ADVANCED HYDROELECTRIC

The DOE states that Virginia has a "moderate" potential for hydropower production.[14] In 2002, Virginia produced 868,000 MWh using hydropower (from 757 MW installed capacity).[15] Large conventional dams, however, have caused serious environmental damage.[16] In order to contribute to Virginia's renewable potential, they will have to be retrofitted or taken down, and systems with advanced turbine designs are set up. The Department of Energy estimates that advanced systems which minimize environmental impact can be applied at more than 80% of existing hydropower projects, meaning that current power-producing facilities in Virginia could produce around 700,000 MWh per year.[17] In addition, a DOE resource assessment report found that these hydropower sites could produce an additional 11.7 MW of power, and that 52 other projects in Virginia with already existing dam structures that could be used for hydropower production of 375.8 MW. *This means that in total, advanced hydro systems could provide Virginia with over 1,800,000 MWh per year - about 1.6% of Virginia's annual electricity use.*

GEOTHERMAL

Geothermal heat pumps are systems that use the relatively constant temperature of the earth to heat and cool buildings, reducing the energy typically used for these purposes. *These pumps can be used in Virginia, as well as almost anywhere across the U.S., and can reduce a building's energy use by 30 to 60%. The extensive reduction in energy use would significantly reduce electricity demand, making it easier for renewable energy to meet Virginia's needs.* There are two principle types of geothermal heat pump systems – a vertical loop design and horizontal loop design. The vertical loop system is only a few feet wide, but extends deeper into the ground (350 ft average depth). The horizontal system only extends 12 to 18 ft. underground, but stretches much longer. The type and size of the system required depends on the amount of space available, as well as local geology and soil type.

WHAT ABOUT VARIABILITY AND INTERMITTANCY?

Despite the abilities of renewable technologies and the vastness of the resource, renewable energy is still often depicted as far too variable and inconsistent to meet our energy needs in Virginia. This, however, is incorrect.

Virginia has a diverse renewable resource base, and intermittency can be dealt with effectively. Wind resources along the coast and in the Appalachians could be balanced with solar and advanced hydro facilities throughout the state. Advanced hydro is already capable of producing baseload power, and offshore wind has similar potential. For PV and land-based wind - although it is true that "the sun doesn't always shine and the wind doesn't always blow" - it is possible to harness these sources of energy in a way that substantially reduces the problems of intermittency and variability.

A recent analysis by the International Energy Agency (IEA) - an intergovernmental body of twenty-six countries committed to advancing security of energy supply, economic growth, and environmental sustainability- concluded that *intermittency is not a technical barrier to renewable energy*. To deal with variability and intermittency, IEA recommends distributed generation, links across geographic areas, a diverse mix of technologies harnessing different resources at different times, and the continued development of storage technologies.

Significant advances have already been made. The first three measures alone can allow non-hydro renewable technologies to well exceed 20% of generating capacity by 2020 without impacting grid reliability or stability. In the longer term, storage remains the most significant issue. Presently, the best options for storage are hydroelectric pumped water and compressed air. Hydroelectric pumped storage moves water from lower to higher reservoirs when extra electricity is being produced, and releases it when that energy is needed., Because energy is stored in times of excess generation, pumped storage systems do not compete with hydro generation.[18] Air compression systems work on a similar principle, compressing air and storing it in airtight underground caverns during times of less demand, and releasing it to run turbines when needed. These technologies have undergone significant developments recently, being designed to store energy from wind farms. In the longer term, the production of hydrogen will likely become an important energy storage mechanism.

COST

Despite the perception that renewable technologies continue to be too expensive to consider, wind power at good sites in the U.S. is already significantly cheaper than power would be from new nuclear power plants.[19] Solar is still more expensive, but higher efficiency thin film panels and expanding manufacturing are expected to cause a significant drop in these prices.

Moreover, conventional technologies such as coal and nuclear power have costs that are unaccounted for in our present economic models, such as carbon emissions, air pollution, land and water degradation from mining, the safety and security risks posed by commercial reactors, risks from nuclear weapons proliferation, and the dangerous legacy of radioactive waste. These costs should be accounted for in the price of these technologies before any price comparisons are made.

Also, over the last fifty years, federal support for nuclear power and fossil fuels has far surpassed support for renewable technologies, resulting in unequal technology development and commercialization. According to a report by the Renewable Energy Policy Project (REPP), from 1947 through 1999, direct federal government subsidies totaled $115.07 billion for nuclear power and $5.49 billion for wind and solar.[20] To make up for these problems, states around the U.S. now offer financial incentives for investing in renewable technologies.

For the documents referenced in this fact sheet, please see
http://www.citizen.org/cmep/energy_enviro_nuclear/renewables/articles.cfm?ID=15507

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