Renewable Energy Policies in the DC Metropolitan Area

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Abstract

The primary objective is to research the Federal government and State policies on renewable energy within the DC Metropolitan Area. This is inclusive of how many homes utilize renewable energy, how many kWh are being sold and at what price, the tax incentives, percentage of energy coming from the electric company, and finally, the government expectation in the years to come as to how much renewable energy is distributed by local utility companies.

Introduction

Fossil Fuel is currently providing more than half of the nations capital's energy supply, according to Tarbell[1]. While supplies are currently abundant, they won't last forever. Oil production is in decline in 33 of the 48 largest oil producing countries, yet energy demand is increasing around the District of Columbia Metropolitan area as the economies grow and nation's capital develop. Abundant energy drives economic development, which in turn creates demand for more energy. Since fossil fuel puts pressure on supply and impacts the environment, natural gas is simultaneuously being used as a hope of replacing Fossil fuel. Getting natural gas to market takes time and investment. But natural gas is a cleaner source of energy than oil or coal, and emits fewer greenhouse gases. As a result, natural gas will only increase in significance. Demand for gas is projected to grow 2.8 % annually through 2025, somewhat faster than demand for oil[2]. However, in attempt to create an environment that is free of greenhouse gases, renewable energy is strongly pursued. Renewable energy refers to energy resources that occur naturally and repeatedly in the environment and can be harnessed for human benefit. Examples of renewable energy systems include solar, wind, and geothermal energy (getting energy from the heat in the earth). These various types of energies can be used to produce electricity without polluting the environment. In the following report, renewable energy policies in the District of Columbia, Virginia, and state of Maryland are presented with the intent that they will encourage community support in adopting clean energy technology on a commercial and residential level.

District of Columbia

Legislation and Implementation

Passed by the District of Columbia City Council and approved by Congress, the District of Columbia's retail electric competition and consumer protection act came into effect as of the 26th of May 2000[3]. Basically, this bill as of January 1st 2001, allows the residents of the District of Columbia to choose an alternative electricity generation supplier. Prior to the above "ACT" passed, the primary supplier of electricity to the residents of the District of Columbia was PEPCO (Potomac Electric Power Company). As a result, residents now have the option to maintain PEPCO as the source of generation or they may choose other sources. The implementation of the above legislation gave birth to **DEREGULATION**.

Deregulation

Deregulation is primarily an event mandated by legislation and public utility commissions which allows customers to purchase electricity from sources other than the regulated source. In the case of the District of Columbia, residents now have the option to choose their supplier or the generation of electricity. In spite of this, delivery of electricity (includes transmission and distribution) will still be the chief responsibility of PEPCO. In other words, PEPCO, regardless of the new changes, is still the local utility company, which ensures the safe deliver and reliability of electricity to the residents of the District of Columbia. As a result of deregulation, the District of Columbia Public Service Commission has certificated twenty-one alternative generation and transmission suppliers[3].

Renewable Energy Portfolio Standard Act of 2004," Bill 15-747[3]

The above bill mandates the following in support of renewable energy:

- Requires the District of Columbia Service Commission to implement a Renewable Energy Portfolio Standard through which a fixed percentage of electric providers supply source would be from renewable energy
- Require that such standards to be met by the accumulation of renewable energy credits
- Require the Commission to adopt regulations governing the application and transfer of credit and implementation of this Act
- Provide for the eligibility of energy from specified sources
- Require electricity suppliers to submit an annual compliance report to the District of Columbia Public Service Commission which demonstrates an electricity suppliers compliance with the Renewable Energy Portfolio Standard or the amount of electricity sales by which the electricity supplier failed to meet the applicable Renewable Energy Portfolio Standard
- Require electricity suppliers to pay compliance fees for failure to comply with the Renewable Energy Portfolio Standard
- Provide for the recovery of fees and costs associated with complying with the Renewable Energy Portfolio Standard
- Establish a Renewable Energy Development Fund to be administered by the District of Columbia Energy Office

- Require the District of Columbia Energy Office to establish and maintain a renewable electricity trading system
- Provide that the District of Columbia Public Service Commission has certain power and authority over electricity suppliers for purposes of this Act
- Require the District of Columbia Public Service Commission to report to the Council each year on the status of implementation of this Act.

Renewable Energy in the District of Columbia

The genesis of deregulation brought about the **RENEWABLE ENERGY PORTFOLIO STANDARD ACT**, enacted as of the 19th of January 2005[3]. This is an agency that promotes cleaner renewable energy sources for the electric production. The District of Columbia mandates that a minimum percentage of renewable energy must come from electric providers with an expectancy of having 11% of electricity from renewable energy source by 2022. This process must, according to the council start by January 1 2007. Examples of renewable energy are:
Solar - Solar energy is energy that comes from the sun. Every day the sun radiates, or sends out, an enormous amount of energy.
Wind- Wind energy describes the process by which the wind is used to generate mechanical power or electricity.
Qualifying biomass- Biomass energy is organic matter where energy from the sunlight is stored in chemical bonds or is derived from plant matter and animal waste products.
Methane- Methane is also a primary constituent of natural gas.
Geothermal- Geothermal energy is heat energy originating deep in the earth's molten interior.
Ocean- relies on changes in ocean water temperature to generate electricity; tidal power, surface wave energy and subsurface current.
Fuel cells- Fuel cells use hydrogen and oxygen, the very molecules of water, to produce electricity with no pollution.
Hydro electric power- Hydroelectric power is the technology of generating electric power from the movement of water through rivers, streams, and tides.

Renewable Energy Electricity Suppliers for the District of Columbia

According to the energy efficiency and renewable energy affirm that at least 50% of customers have the option to purchase renewable electricity directly from their power supplier, and all customers have the option of purchasing Renewable Energy Credits (RECs). Such power is sometimes referred to as "green power" or "clean power."

PEPCO ENERGY SERVICE[4]– They have an option of providing either 51% or 100% of New Wind Energy and Green Electricity.

- **New Wind Energy 100%** is offered at a price of **$0.1365 /kWh**
- **New Wind Energy 51%** is offered at a price of **$0.1288 /kWh**
- **Green Electricity 100%** is offered at a price of **$0.1292 /kWh**
- **Green Electricity 51%** is offered at a price of **$0.1251 /kWh**
- **Green Electricity 10%** is offered at a price of **$0.1216 /kWh**

WASHINGTON GAS ENERGY SERVICES[5], Inc. –

- **Generation & Transmission Price:** 10.89¢ per kiloWatt hour - Residential Rate Schedule
- **Generation & Transmission Price:** 11.29¢ per kiloWatt hour - Residential AE Rate Schedule

Comparison of Generation and Transmission Rate as of February 27, 2006[3]

Company	Feature and Term Offer	Generation & Transmission Rate
PEPCO's Standard Offer Service (SOS) Rates Effective February 8, 2005	Effective February 8, 2005, prices will vary by season, but will be fixed through May 31, 2006	6.66 cents per kwh* - winter (November - May bills); 7.05 cents per kwh - summer (June - October bills) 6.8 cents per kwh - annual average
Pepco Energy Services (PES) – New customers (Price offerings for February 2006)	Price offers change monthly, but whatever price is in the contract will be fixed for 12 months	No price currently available for standard residential service 12.16 cents per kwh - 10% green power 12.51 cents per kwh - 51% green power 12.92 cents per kwh - 100% green power 12.88 cents per kwh - 51% wind 13.65 cents per kwh - 100% wind
Pepco Energy Services (PES) – Renewal Customers (Renewal pricing for customers being renewed in April 2006)	Price offers change monthly, but whatever price is in the contract will be fixed for 12 months	No renewal price available for standard residential service 10.71 cents per kwh -10% green; 11.03 cents per kwh - 51% green; 11.43 cents per kwh - 100% green; 11.34 cents per kwh - 51% wind; 12.03 cents per kwh - 100% wind
Washington Gas Energy Services (WGES) – New Customers	Once contract is signed, price is fixed through May 2007	10.89 cents per kwh - Residential R class - includes 5% wind power; 11.29 cents per kwh - Residential - AE class - includes 5% wind power

Federal Tax Credits for Energy Efficiency[6]

Product Category	Product Type	Tax Credit Specification	Tax Credits
Solar Energy Systems	Solar Water Heating	The system must use solar power to provide at least half of a home's hot water. The credit is not available for expenses for swimming pools or hot tubs. The water must be used in the dwelling and the system must be certified by the Solar Rating and Certification Corporation (SRCC).	30% of cost, up to $2,000
	Photovoltaic Systems	Photovoltaic systems must provide electricity for the residence, and must meet applicable fire and electrical code requirement.	30% of cost, up to $2,000

Net Metering[7]

As of the 10th of February, the District of Columbia's, Public Service Commission incorporated new metering rules, which esteems from the "Retail Electric Competition and Consumer Protection Act."
Net metering is available to both residential and commercial customer generators with renewable energy systems, such as solar, wind and biomass, CHP systems, fuel cells and microturbines. Significant provisions related to the District's new net-metering rules include the following:

- The metering equipment must be capable of measuring the flow of electricity in two directions.
- The maximum capacity of eligible systems is 100 kilowatts.
- Net excess generation (NEG) is credited to customer-generators at full retail rate.
- Utilities must develop a standard net-metering contract subject to review and approval by the PSC.

Break Down of the Renewable of the Renewable Energy Portfolio Act of 2004[8]

Year	Tier One of Renewable Energy Source	Tier Two Renewable Energy Source	Solar Energy
2007	1.5%	2.5%	0.005%
2008	2.0%	2.5%	0.011%
2009	2.5%	2.5%	0.019%
2010	3.0%	2.5%	0.028%
2011	3.5%	2.5%	0.038%
2012	4.0%	2.5%	0.066%
2013	4.5%	2.5%	0.083%
2014	5.0%	2.5%	0.104%
2015	5.5%	2.5%	0.128%
2016	6.0%	2.0%	0.157%
2017	6.5%	1.5%	0.192%
2018	7.0%	1.0%	0.233%
2019	7.5%	0.5%	0.281%
2020	8.5%	0.0%	0.329%
2021	9.5%	0.0%	0.386%
2022	11%	0.0%	0.386%

Tier One renewable source comprises of the following energy sources:

- Solar Energy
- Wind
- Qualifying Biomass
- Methane from decomposition of organic materials
- Geothermal

- Ocean including energy from waves, tides and currents
- Fuel cells

Tier Two renewable source comprises of the following energy sources:

- Hydroelectric power
- Waste to energy

Enforcement of the Law [8]

Under the Renewable Energy Portfolio Standard Act of the District of Columbia, electricity suppliers are mandated to meet the above criteria in the tableau form. However, if they fail to meet outlined criteria from tier one resources they must pay 2.5 cents per kWh, 1 cent per kWh for tier two resources and 30 cent per kWh for solar sources.

Renewable energy policies in Virginia

Renewable and alternative forms of energy hold the potential to provide for greater stability in cost, economic growth within the Commonwealth, and improvements in air and water quality. In the state of Virginia, there have been studies by the Virginia center for coal and energy research (VCCER) about the use of different types of renewable energy in Virginia especially in the transportation and electricity sector.[1] It was found that the following renewable energies; Bio-diesel, Ethanol, Biomass and wind were found to have the greatest potential to provide the greatest benefit at the lowest cost, because of their ability of providing a second market to the farming industry in Virginia, unlike coal, which is Virginia's predominant primary-energy product. Virginia is also a producer of natural gas and of small amounts of petroleum. Several of the state's rivers are harnessed to generate hydroelectric power.[12]

Bio-diesel

Bio-diesel holds the most promise for providing a cost-competitive alternative to regular diesel fuel while concomitantly providing a boost to Virginia's soy farmers. Bio-diesel blends in low concentrations can be used in diesel vehicles without modification and without voiding factory warranties.[9]

Ethanol

Although the energy balance associated with producing ethanol is not as good as with bio-diesel, low concentration blends of ethanol can be offered at comparable prices to gasoline. Additionally, as with bio-diesel, automobiles can use low blends of ethanol without modification.[9]

Biomass

Wood residues and crops grown specifically for energy generation can be used either by themselves or can be combusted with coal in traditional coal power plants. This process, known as co-firing, can produce electricity at relatively low cost without construction of a new facility. Biomass also offers farmers an alternative to cash crops such as tobacco. [9]

Wind

Wind energy is a mature technology that can produce electricity at a cost-competitive level with traditional energy.[9]

The following parameters would be used in evaluating the benefits of these types of renewable energies, cost, environment, energy balance and cross- country industry opportunities.

Cost

For this report, the goal is to identify the technologies that can provide cost competitive alternatives to traditional energy sources. For the transportation sector, cost comparisons are made with gallons of gasoline and diesel fuel. For electricity, cost comparisons are made with kilowatt hours of electricity (kWh). The current average cost for electricity in Virginia is $.07 - $.09 per kWh.[9]

Environment

Although cost is a major factor, the environmental benefits of renewable forms of energy have been a major argument for their development. This report will identify the basic environmental benefits or drawbacks for each form of renewable energy.[9]

Energy Balance

Another criterion for evaluating the various forms of alternative energy is the energy balance, especially for transportation fuels. If it takes more energy to produce a fuel than that fuel can provide, the result is a net energy loss. Although the less energy it takes to produce a fuel the better, the net energy balance is not as important if the primary goal of using an alternative fuel is to achieve energy independence. Liquid fuels are a more desirable form of energy because they can be used in the transportation sector, which is heavily dominated by petroleum.[9]

Cross-Industry Opportunities

A final criterion evaluated in this report is the ability of a renewable resource or technology to provide a synergistic effect on the economy of the Commonwealth. By focusing on strengths already anchored in the state, there is a greater chance for success and widespread adoption of the renewable resource. The different forms of renewable energy reviewed in this report are divided into two categories: transportation fuels and electricity and energy generation. The reason these technologies are divided is to help evaluate how implementation would benefit the citizens of the Commonwealth. Approximately 90% of the energy used in the transportation sector comes from oil. Consequently, providing incentives to develop wind energy would have

no effect on gasoline or diesel prices because wind turbines generate electricity. Although this report focuses on utility scale electricity and energy generation, any discussion on how to save money on transportation fuel, electricity, and energy in general must begin with reviewing the concepts of energy efficiency and conservation, which are universally recognized as the most cost effective means of reducing a homeowner's electricity bill.[9]

Energy Efficiency

Energy efficiency and energy conservation are best explained by understanding the concept that it is far cheaper to save a kilowatt than generate a kilowatt of electricity. Although not technically a form of renewable energy, greater implementation of energy efficient appliances and building design can help reduce the demand on traditional forms of energy and lower costs to all consumers. The level of energy intensity in Virginia, the amount of energy consumed per dollar of gross state product (GSP) was 9.2 BTU/$. This compares with the national average of 10.3 BTU/$ for that year. As a metric of energy efficiency, Virginia is ahead of the national average in terms of leveraging energy use to generate gross state product.
Two of the largest energy efficiency resources in Virginia are commercial and residential buildings. Implementing energy efficient appliances, lighting, heating, and cooling would benefit both the residential and the commercial sectors. One possible tool for encouraging greater implementation of energy efficient design and appliances would be to review the current building codes. Appliances and office equipment account for 70% of all primary energy consumed in U.S. homes. Though minimum standards of energy efficiency for appliances are set at a federal level, the Commonwealth can encourage increased efficiency of these products through incentives and other policies. Current standards have already led to dramatic reductions in energy usage among many of the products, but there are still considerable savings that can be gained. Virginia residents could cumulatively save more than $1,236 million by the year 2020 if higher efficiency standards were adopted for a range of appliances. This would save enough electricity to equal a power plant of 57 MW or enough electricity to power 1,048 homes. Virginia has millions of square feet of building space in state office buildings, hospitals, schools, and libraries. Energy savings of more than 20% are usually achievable by retrofitting these facilities with energy efficiency measures.[9]

Transportation Fuels

A. Bio-diesel

Bio-diesel is a clean burning alternative fuel produced from animal fats or vegetable oils, typically canola or soy. As a transportation fuel, bio-diesel can be used in almost any diesel vehicle with little or no modifications. The most common blends of bio-diesel marketed in the U.S. are B2, B5, B20, and B100. The number in each of the preceding figures represents the percentage of bio-diesel in the fuel blends, with B100 representing a fuel containing 100% bio-diesel.[9]

Cost

The Clean Cities Program, sponsored by the Department of Energy, compiles prices for gasoline, diesel, and alternative fuels across the U.S. The table below represents the cost analysis for bio-diesel in the September 2005 Clean Cities Alternative.[9]

Fuel Price Report:

	B2-5	**B20**	**B100**	**Diesel**
Lower Atlantic	$2.88	$2.92	$3.53	$2.81
National Average	$2.81	$2.91	$3.40	$2.85

The prices represented in the Clean Cities report are based on voluntary submissions by participating localities of actual prices at the pump.[9]

Environment

Bio-diesel offers substantially reduced emissions in several categories of regulated and unregulated pollutants and only a small increase in the emission of nitrogen oxides (NOx).[9]

Energy Balance

One of the most commonly cited reports on the energy balance of bio-diesel is the joint study performed by the U.S. Department of Agriculture (USDA) and the U.S. Department of Energy (DOE). In performing a life-cycle analysis of bio-diesel and petroleum-based diesel, the report concluded that every unit of energy used in making bio-diesel yields 3.2 units of energy.8 Bio-diesel is recognized as having the highest energy balance of any alternative fuel.[9]

Cross-Industry Opportunities

In addition to expanding the already existing bio-diesel production facilities within the state, further support of bio-diesel would provide a secondary market for the farming and agricultural industries in Virginia. Increasing production capabilities in Virginia would provide an opportunity for the state to become a net exporter of bio-diesel. Given the new regulations promulgated by the EPA requiring a significant reduction in the sulfur content of diesel fuel, demand for low-sulfur bio-diesel is expected to grow.[9]

B. Ethanol

Ethanol is similar to bio-diesel in that both are bio-fuels derived from a biomass feedstock. Ethanol, however, is produced from fermenting and distilling crops such as corn, barley, or

wheat. Ethanol is typically blended with gasoline to create E85, which contains 85% ethanol and 15% gasoline. Several automobile manufacturers offer Flexible Fuel Vehicles (FFV) that can run on E85 at the same cost to the consumer. As of 2003 it is estimated that two million FFVs have been sold in the U.S.9 Most of the 150 public refueling stations are located in the Midwest. All vehicles, regardless of designation as an FFV, can run on up to a 10% blend of ethanol without modification.[9]

Cost

The Clean Cities Program, sponsored by the Department of Energy, compiles prices for gasoline, diesel, and alternative fuels across the U.S. The table below represents the cost analysis for E85 in the September 2005 clean Cities Alternative Fuel price report.[9]

	E85	**Gasoline**
Lower Atlantic	$2.50	$2.84
National Average	$2.41	$2.77

Environment

The benefits of ethanol are slightly different from those of bio-diesel. For example, using E85 resulted in a significant decrease in NOx emissions and a slight decrease in carbon monoxide and carbon dioxide. Total hydrocarbon emissions, however, increase.[9]

Energy Balance

In a 2002 update the USDA reported that the energy balance for ethanol production was 1.34.11 Therefore, every one unit of energy invested in producing ethanol from corn would yield 1.34 units of energy.[9]

Cross-Industry Opportunities

Producing ethanol, like bio-diesel, would provide a secondary market for the agricultural industry in Virginia.[9]

Electricity and Energy Generation

A. Wind

From transportation and mechanical needs to generating electricity, wind energy is one of the oldest forms of energy harnessed by societies. The wind industry is currently a billion dollar business in the U.S. and has been the world's fastest growing energy sector. The majority of

installed wind turbines in the U.S. are in Texas and California; locations with good wind resources near large population centers. Virginia has yet to build any utility scale wind turbines or wind farms, but the Highland County Board of Supervisors recently approved locating up to 20 wind turbines along a ridgeline in project. Wind energy can be divided into two main categories: utility-scale and small-scale units. Utility-scale turbines are typically in the range of 750 kW to 2 MW and small-scale turbines are usually less than 10 kW. Aside from the physical size and generating capacity, the main difference between the two categories is the cost of electricity produced and the payback period for a turbine. On the utility-scale level, the technology can be divided into two categories, offshore and onshore. With higher wind resources extending into state waters and the Outer Continental Shelf (OCS), there is considerable potential for offshore winds farms. Although there are offshore wind farms in Europe, there are currently no offshore wind farms in the U.S. and therefore this report only reviews onshore wind energy.[9]

Cost: Utility Onshore

The cost of electricity generated by wind turbines is currently around $.05 per kWh in an area with a good wind resource, which includes the $1.5 per kWh Production Tax Credit.15 At $0.05 per kWh wind energy is cost competitive with traditional sources of electricity, which can range between $0.07 and $0.09 per kWh.[9]

Environment

Environmental critics of onshore wind turbines typically focus on bird or bat kills, which studies show are far less frequent than with other man-made objects. Other related environmental concerns such as noise and light flicker can be mitigated by using appropriate setback requirements. Many of the environmental issues associated with wind turbines are relatively insignificant and often brought to light by opponents more concerned with the visual impact of the turbines. The environmental benefit of generating electricity with wind is the displacement of emissions from coal power plants. Wind turbines produce no air or water pollution over the course of their life span, often reaching 30 years. This obvious benefit of wind energy has been the main driving force of its development and deployment across the U.S.[9]

Cross-Industry Opportunities

In the case of the Highland County Wind farm, estimated tax revenues from the project are expected to be around $250,000 per year.18 In counties such as Highland, with little economic development outside of the farming community, generating tax revenue is a major priority.[9]

B. Biomass

Biomass is a general reference to a resource that is grown in an agricultural manner, typically originating from a crop. The most mature and economical form of biomass energy production is the direct combustion of the biomass material. Biomass systems are typically described as either closed-loop or open-loop. Closed-loop systems use a crop that is grown specifically for combustion, whereas open-loop biomass systems typically take a byproduct or waste biomass product and combust the material to produce energy or electricity. The most promising

application of closed-loop biomass systems involves a technology called co-firing. Co-firing is the process of burning a biomass material with a traditional fuel, such as coal. The VCCER Study contains an in depth discussion of this type of renewable resource and technology.[9]

Cost

The VCCER study projects that biomass could be used as a renewable fuel at a cost of $.10 to $.15 per kWh. If cofiring processes were used in existing coal plants, electricity could be produced for as low as $.05 per kWh[9].

Environment

Biomass as a renewable source of energy has the benefit of being carbon neutral. Combusting biomass to produce electricity does not release any more carbon into the atmosphere than the plant absorbed during its lifetime. Although biomass releases pollutants such as particulate matter, sulfur oxides, and nitrogen oxides, these pollutants are not in the same quantity as with traditional coal power plants. [9]

Energy Balance

Although the net energy balance is positive, biomass has much lower energy intensity than traditional carbon-based fuels. The result is the need for a greater quantity of biomass to produce the same amount of electricity, which results in greater transportation and handling costs.[9]

Cross-Industry Opportunities

Greater implementation of biomass as a fuel has the potential to help farmers in rural areas by providing a secondary market for their crops and waste residue. Additionally, switch grass may be a feasible alternative for many tobacco farmers for use in closed-loop biomass plants.[9]

C. Solar (Photovoltaic)

Solar energy is collected through two different processes: passive and photovoltaic. Passive solar energy encompasses a wide variety of devices and design techniques. Passive solar electricity is not a utility-scale application, but rather used as a tool to improve overall energy efficiency in the heating and cooling of homes and businesses. The typical commercial-scale solar technology, primarily located in the southwest, is a concentrating solar power (CSP) facility. These facilities are not feasible in Virginia due to the moderate solar resource. In addition to passive solar and solar-concentrating applications, solar energy can be converted into direct current (DC) electricity through the use of photovoltaic (PV) cells. A power inverter can convert direct current to alternating current (AC) for typical household electricity demands. When used for powering equipment in remote locations, PV systems include batteries that store electricity for use at night or when the solar resource is low. The primary uses for PV panels are telecommunications, security and lighting systems, water pumps, and load management. There has been significant

investment in PV cells on the federal level, which has resulted in significant increases in efficiency. In recent years, much of the research into PV cells has focused more on producing electricity at a lower cost through cheaper manufacturing processes and cheaper materials as opposed to focusing solely on efficiency. Despite the technical advancements made with PV cells, electricity generated from PV cells, even on a utility scale, is still several times the cost of traditional forms of electricity[9].

Cost

The cost of electricity from PV cells as reported in the VCCER Study ranges between $0.23 to $0.33 per kW/h.[9]

Environment

The environmental benefit of solar energy, regardless of form, is the displacement of emissions from traditional power plants[9].

Cross-Industry Opportunities

Other than the direct employment of manufacturing plants and potential for manufacturing associated components for PV systems, there is little opportunity to involve other industries in Virginia.[9]

D. Hydroelectric

Hydroelectric resources in the Commonwealth are limited because the utility-scale technology requires a large volume of water and a significant drop in elevation to produce electricity. Although the cost of electricity generated from a hydroelectric plant is cost competitive with other carbon-based forms of energy, Virginia has a relatively low potential for future development.24 One barrier to future development is lack of a suitable resource; however, impacts on the environment, cultural resources, scenic attributes, and land rights are all issues that have hindered similar projects across the U.S. The most significant advances in hydroelectric production in Virginia would come from retrofitting current reservoirs with more efficient turbines. The VCCER Study suggests there is the technical potential to gain an additional 200 MW of production capacity over the current 750 MW of installed capacity through retrofitting.[9]

Incentives for the use of alternatives sources of energy in Virginia

1. Solar Photovoltaic Manufacturing Incentive Grant Program

The Solar Photovoltaic Manufacturing Incentive Grant Program, established in 1993, provides an incentive grant for firms that manufacture solar photovoltaic panels in the Commonwealth. Pursuant to § 45.1-392, each manufacturer is eligible for a grant of $0.75 per watt of the rated capacity of panels sold in a calendar year. If a manufacturer commenced eligible sales during calendar year 1995, it is eligible for grants for panels produced during the five years from 1995

through 1999. If it commences eligible sales at any time after December 31, 1995, and sells solar photovoltaic panels it manufactured in Virginia during any of years 1996 through 2001, it is entitled to an annual grant based on the rated capacity of panels sold in the calendar year. No manufacturer may receive grants for more 5 years.[10]

2. Loans for Installation of Energy-Saving Devices

Section 36-55.31:1 requires the Virginia Housing Development Authority to establish a program of loans for financing the purchase and installation of solar or other alternative energy sources, and for insulation, storm windows and doors, which will reduce the reliance on present sources of energy. The improvements may be used in (i) residences occupied by persons or families of low and moderate income and (ii) public or nonprofit buildings or facilities.[10]

3. Property Tax Exemptions for Solar Energy Equipment

Section 58.1-3661 allows local governments to exempt solar energy equipment from local taxation. Exempt equipment includes any solar energy equipment that conserves conventional energy or electricity that would otherwise be used for water heating, space heating or cooling, or other applications. This exemption is authorized by Article X, Section 6 (d) of the Virginia Constitution. [10]

4. Property Tax Exemptions for Energy Generating Equipment

Local governing bodies are authorized by § 58.1-3662 to adopt an ordinance establishing a full or partial property tax exemption for generating equipment installed for the purpose of converting from oil or natural gas to such renewable sources as wood, wood bark, or wood residue, or to another alternate energy source, as well as to coal, for use in manufacturing. This exemption is authorized by Article X, Section 6 (i) of the Virginia Constitution.[10]

5. Virginia Solar Easements Act

The Virginia Solar Easements Act (§ 55-352 et seq.) was established to encourage the use and development of solar energy by establishing criteria for easements established to protect exposure of solar energy equipment, facilities or devices. Instruments creating solar easements shall include such information as the vertical and horizontal angles at which the solar easement extends over the servient property, terms or conditions under which the solar easement is granted, and provisions for compensating the owner of the property subject to the easement.[10]

6. Virginia Solar Energy Center

The Virginia Solar Energy Center, created pursuant to § 45.1-391, has been established to receive non-state funds for purposes related to solar energy, including serving as an information clearinghouse, coordinating programs, and developing education programs.[10]

7. Net Energy Metering/Virginia Electric Utility Restructuring Act

Section 56-594 establishes "net energy metering" as part of Virginia's restructuring program. "Eligible customer-generators," as defined in this section, self-generate electric power using solar, wind or hydro energy. Excess electricity self-generated from these renewable resources over and above household or business use is fed back to the electric grid and netted against the electricity supplied to the household or business by its electric service provider during a twelve-month period. If, at the end of a year, the customer has supplied to the provider more electricity than the customer has consumed, the statute permits arrangements to be made between the parties to compensate the customer for this excess.[10]

8. Generation Disclosures/ Virginia Electric Utility Restructuring Act

Section 56-592 encourages the development of full and fair disclosures concerning the sale of renewable energy by directing the Commission to establish standards governing all generation fuels and emissions information in (i) competitive suppliers' marketing materials, and (ii) electricity customers' billing statements.[10]

9. Subdivision Ordinance Provisions Encouraging Solar Power

Section 15.2-2242 authorizes local governments to include provisions in their subdivision by the sub divider.[10]

10. Exemption for Small Hydroelectric Producers

House Bill 2646 (1999) amended § 56-232 to encourage the development of Virginia's independent hydroelectric industry by exempting from Commission regulation, as public utilities, qualifying small power producers. The exempt producers are those producing electricity by using renewable or nondepletable primary energy sources, with a rated generation capacity of 7.5 megawatts or less, and whose output is not sold to residential customers. Aggregators of such small power producers were also exempted from SCC regulation by this bill.[10]

11. Designation of Coordinating Agency

Section 45.1-390 provides that the Division of Energy, within the Department of Mines, Minerals and Energy, is established to ensure Virginia's commitment to the development of renewable and indigenous energy sources.[10]

12. Virginia Coal and Energy Commission established

The Coal and Energy Commission is directed in its enabling legislation to "endeavor to stimulate, encourage, promote and assist in the development of renewable and alternative energy resources other than petroleum." Section 9-145.1 E provides that the Commission shall endeavor to encourage research designed to further new and more extensive use of the coal as well as alternative and renewable energy resources of the Commonwealth. It is to coordinate its efforts

with those of the Virginia Solar Energy Center and the Virginia Center for Coal and Energy Research.[11]

13. Income Tax Credits for Renewable Energy Source Expenditures (expired)

Sections 58.1-331 and 58.1-431 provided income tax credits for individuals and corporations, respectively, for a percentage of their renewable energy source expenditures, as defined in § 23 of the Internal Revenue Code. Section 23 of the I.R.C., which was established a residential energy tax credit, was repealed in November, 1990. Virginia's tax credit applied to expenditures (excluding labor costs) made between January 1, 1985, and December 31, 1987. The percentage of the expenditures that qualified for the tax credits declined from 20 percent in the first year to 10 percent in the third year. The amount of the credit was capped at $1,000 for qualified renewable energy source expenditure or the tax imposed by this chapter, whichever is less. Credits in excess of tax liability may be carried forward until used.[10]

State Incentives

Alternative Fuel Vehicle (AFV) and Refueling Infrastructure Tax Credit

The Commonwealth of Virginia provides individuals, private entities, and corporations a state tax credit equal to 10% of the amount allowed as a federal tax deduction for clean-fuel vehicles and related refueling property (under Section 179A of the Internal Revenue Code). The tax credit was amended in 1994 to specify that it is for the purchase of clean fuel vehicles that are principally garaged in Virginia and for certain refueling property placed in service in Virginia. (Reference Virginia Code 58.1-438.1)[11]

High Occupancy Vehicle (HOV) Lane Exemption

AFVs displaying the Virginia 'Clean Special Fuels' license plate can use the Virginia HOV lanes, regardless of the number of occupants, until July 1, 2006. Dedicated AFVs and the Toyota Prius, Ford Escape, and Honda Insight and Civic hybrid electric vehicles may qualify. (Reference Virginia Code 33.1-46.2 and 46.2-749.3)[11]

Alternative Fuel Job Creation Tax Credit

There is a job creation tax credit worth $700 per full-time employee for businesses involved with alternative fuels. The credit is allowed in the taxable year in which the job is created and in each of the two succeeding years in which the job is continued. Qualifying businesses include AFV component manufacturers and vehicle conversion companies. This credit is effective for taxable years beginning on or after January 1, 1996, through December 31, 2006. (Reference Virginia Code 58.1-439.1)[11]

State Laws and Regulations

Alternative Fuel Vehicle (AFV) Tax Reduction

Local governments have the option of reducing personal property taxes for AFVs. (Reference Virginia Code 58.1-3506)[11]

Alternative Fuel Vehicle (AFV) and Infrastructure Loans

The Virginia Board of Education may use funds from the state Literary Fund to grant loans to school boards that convert school buses to operate on alternative fuels or construct alternative fuel refueling stations. (Reference Virginia Code 22.1-146)[11]

Alternative Fuels Tax

A tax of $0.16 per gallon is imposed on liquid alternative fuels used in AFVs. Alternatively, an annual license tax of $50.00 per vehicle is imposed on AFVs that are fueled from a private source. (Reference Virginia Code 58.1-2249)[11]

Alternative Fuel License

The following people must obtain a license from the Virginia Department of Motor Vehicles: a provider of an alternative fuel; a bulk user of an alternative fuel; a retailer of an alternative fuel, and; any person who fuels their AFV from a private source that does not pay the special fuels tax described above. (Reference Virginia Code 58.1-2244)[11]

Neighborhood Electric Vehicle (NEV) Access to Roadways

NEVs may not operate at a speed faster than 25 mph and may only be used on roads that have a posted speed limit of less than 35 mph. The vehicle must comply with safety standards contained in Title 49 of the Code of Federal Regulations, section 571.500, meet the standards set forth in Virginia Code 46.2-908.2, and meet the same titling, registration and insurance requirements applicable to passenger cars. (Reference Virginia Code 46.2-100 and 46.2-908.3)[11]

Alternative Fuel Vehicle (AFV) Signs

The Virginia Board of Education may provide by regulation for the display of appropriate signs or other markings on school buses using alternative fuels. Such signs or markings shall identify the vehicle as an AFV and indicate the type of alternative fuel used. (Reference Virginia Code 46.2-1089.1)[11]

Idle Reduction Requirement

County governments are authorized to establish idle reduction measures for buses. Specifically, county governments may prohibit bus engine idling for more than 10 minutes when the bus is parked, left unattended, or stopped for reasons other than traffic or maintenance. Violators shall be subject to a civil penalty not to exceed $50.00, the proceeds from which shall be paid into the county's general fund. The provisions of this section shall not apply to school buses or public transit buses. (Reference Virginia Code 46.2-1224.1)[11]

Utilities/Private Incentives

Natural Gas Technical Assistance and Fuel Rate Reduction

Virginia Natural Gas will provide technical support and training to customers who are interested in starting a natural gas vehicle (NGV) fleet. Virginia Natural Gas offers two special fuel rates specifically for NGVs. The utility has five refueling stations available 24 hours daily with card access to customers.[11]

Maryland Renewable Energies: Incentives, regulations, rules and policies

1 **Net Metering in Maryland**

Incentives Types:	**Net metering**
Renewable Energy Technology:	**Photovoltaic, Wind, Biomass**
Applicable Sectors:	**Commercial, Residential, Schools, Local Government, State Government, Federal Government**
Limit on System Size:	**200kW (500 kW with MD public Service Commission approval)**
Limit on Over All Enrollment:	**34.7 MW (0.2% of state's adjusted peak load for 1998)**
Treat of Net Excess:	**To be determined by MD Service Commission**
Utilities Involved**:**	**All utilities**
Interconnection:	**Yes**

Table 1[13]: Net Metering

The state of Maryland passed a legislation in 1997 that allowed residential customers and schools with qualified solar-energy systems of 80 kilowatts (kW) in capacity to have net metering. Since then, there have been many expansions to this legislation which includes the eligibilities of wind technology in May, 2004, biomass technology in April, 2005, and by raising the maximum

system capacity from 80 kW to 200 kW. The last expansion in April, 2005 also allowed generators of the alternative energy sources to ask the Maryland Public Service Commission (PSC) to grant net metering capacity as large as 500 kW. However, the PSC does have the right to approve or disapprove the 500kW system after its findings on the project due to public safety and reliability requirements and the benefits of the public service.

According to the Maryland Energy Administration, the statewide limit on net-metering capacity is 34.722 megawatts (MW), equal to 0.2% of the state's adjusted peak-load forecast for 1998. The energy administration also have some regulations that required utilities to set up a single, bi-directional meter at a customer's facility, if need be and must offer net metering at no additional cost or increase energy rate. Customers with renewable energy system or systems that satisfy all safety and performance standards may not be required to by utilities to install additional controls, to perform or pay for additional tests, or have to purchase liability increase.
As of present, there is no statewide standard on what to do with the excess generation of electricity as the result of the net metering. However, there are discussions going on between the Maryland State Energy Administration and the PSC to come up with a means of outlining the details of the state's net metering program[13].

2 Solar Energy Grant Program

Incentives Types:	**State rebate program**
Renewable Energy Technology:	**Solar water heat, solar thermal process heat, Photovoltaic**
Applicable Sectors:	**Commercial, Residential, Nonprofit, Local Government**
Amount:	**20%**
Maximum Incentives**:**	**$ 3,000 (residential PV); $5000 (commercial PV); $2000 (solar water heating)**
System Size**:**	**Minimum system size applies**
Program Budget:	**$75000 (second round of funding)**
Ownership of Renewable Energy Credits**:**	**Remind with project owner**

Table 2[14]: Solar Energy Grant Program

- The lesser $2000 or 20% of the cost for solar-heating equipment.
- To be eligible for the funding of the minimum size of a system, the project must meet the requirements of Maryland which is the same as the U.S department of energy's million solar roofs initiative. Those requirements are as follow:
- Solar water-heating systems for residential, school, or public buildings: 20 square feet of collector area (or 1kW equivalent)
- Commercial solar water-heating systems: 40 square feet of collector area (or 2kW equivalent)

- Residential photovoltaic system: 500 watts (0.5 kW); on and off grid systems are eligible
- School, government and church solar electric systems: 1 kW
- Commercial photovoltaic systems: 2 kW
- Solar water-heating collectors must meet the Solar Rating and Certification Corporation's (SRCC) OG-100 certification[14].

3 Wood Heating Fuel Exemption

Incentives Types:	**Sales tax exemption**
Renewable Energy Technology**:**	**Biomass**
Applicable Sectors**:**	**Residential**
Amount:	**100%**

Table 3[15]: Exemptions on wood heating

According to the Maryland code of law (Md. Tax-General Code § 11-207), a person can be exempt from the state sales tax on all wood or "refuse-derived" fuel for heating purposes. This exemption applies to residential use only[15].

4 Montgomery County – Clean Reward Program

Incentives Types**:**	**Local rebate program**
Renewable Energy Technology**:**	**Photovoltaic, Landfill gas, Wind**
Applicable Sectors**:**	**Residential, Commercial**
Rebate Amount:	**Estimated reward equal to county energy tax (currently 0.47¢/ kWh for residents, 1.2¢/kWh for businesses)**
Terms:	**To be determined**

Table 4[16]: Clean Reward Program

The Montgomery county council approved the clean energy program in March 2005. This program provides financial reward to businesses and residents if they buy clean energy. Some of these clean energies include landfill gas, wind and solar. The amount of the reward hasn't been set; however, the program is projected to be a payment equivalent to the energy tax paid by

residents and businesses. The tax paid by businesses at present is 0.47¢ per kilowatt-hour whereas the tax paid by residents is 1.2¢ per kilowatt-hour[16].

5 Solar Access Guidelines

Maryland construction law (Md. Real Property Code § 2-118 et Seq) makes it illegal to restrict installation of solar collection panels. This law said one may not "impose or act to impose unreasonable limitations on the installation of solar collection panels on the roof or exterior walls of improvements". The limitation to this law that, one may not install a solar collection panels on a "historic property that is listed by the MD inventory of historic property or by the MD Register of Historic Properties".[17]

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