Assessment of a 15 Percent Pennsylvania Alternative Energy Portfolio Standard

Final Report - Executive Summary

January 2010

Prepared for

COMMUNITY FOUNDATION FOR THE ALLEGHENIES

Supported by:
Supported by Heinz Endowments and the William Penn Foundation

Black & Veatch Project 165599

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1.0 Executive Summary

Black & Veatch is pleased to provide this assessment of the likely resources needed and impacts of an expanded 15 percent Tier I Alternative Energy Portfolio Standard (AEPS). Black & Veatch estimated the potential impacts of increasing the renewable portion of Pennsylvania's AEPS from the current target of 8 percent to 15 percent by 2026. The 15 percent standard would include a 3 percent set-aside for solar energy. Black & Veatch also estimated the impact of an additional 3 percent requirement for energy from coal plants with carbon capture and sequestration (CCS) technology. CCS is not counted as part of the 15 percent Tier I renewable standard, but would be part of the existing Tier II standard, which would be otherwise unchanged. The study was commissioned by the Community Foundation for the Alleghenies in partnership with Heinz Endowments and the William Penn Foundation.

1.1 2004 AEPS Impacts and Future Requirements

Development of new renewable energy facilities in Pennsylvania was initially slow due to the ramp-up provisions and timing exemptions in the 2004 AEPS. While total renewables did not increase appreciably through 2007, 2008 and 2009 saw an expansion of new projects and new facilities. Roughly 700 MW of new renewable capacity has been installed since 2004, with many more projects in the development stage. Several new renewable energy manufacturing plants have also been developed or expanded since the passage of the original AEPS in 2004, employing hundreds of workers.

1.2 AEPS Resource Assessment

A resource assessment was performed to quantify the technical and near-term potential of wind, solar, biomass, biogas, hydroelectric, coal mine methane, and coal with CCS to supply the Pennsylvania market. Resource estimates were combined with technology characteristics to develop a set of economic supply curves showing the amount of alternative energy available at varying levelized costs. This curve revealed the least-cost energy generation portfolio to meet the expanded AEPS.

The analysis shows that Pennsylvania theoretically has enough long term renewable energy potential to satisfy its entire electrical power needs. This study identified just over 1 million GWh of long term renewable energy technical potential, or nearly seven times the 2007 retail load (152,000 GWh). Most of this potential energy (949,165 GWh) is from relatively high cost solar, while another 43,493 GWh is from coal

with carbon capture and storage. The potential statewide supply by resource is shown in Table 1-1.

Table 1-1. Pennsylvania Renewable Energy Potential.

	Capacity (MW)	Energy (GWh)
Biogas	76	589
Biomass Cofiring	497	3,448
Biomass Direct	24	179
Coal Mine Methane	50	392
Coal with Carbon Capture	6,405	43,493
Hydro	851	3,724
Solar	619,000	949,165
Wind*	9,811	27,143

* Includes 4,504 MW of potential from out of state wind.

Supply curves were developed for each resource and then aggregated to determine the overall mix of technologies best to supply the AEPS requirements. Figure 1-1 shows the resources identified to meet the 2026 AEPS goals without set-asides; Figure 1-2 shows the resources with solar and CCS set-asides. Based on the resource assessment, wind, biomass co-firing, biogas and hydroelectric generation technologies appear to be the most likely mix of cost-effective renewable technologies to be developed under a 15 percent AEPS (Tier I), with wind and biomass co-firing accounting for approximately 80 percent of the total required renewable generation

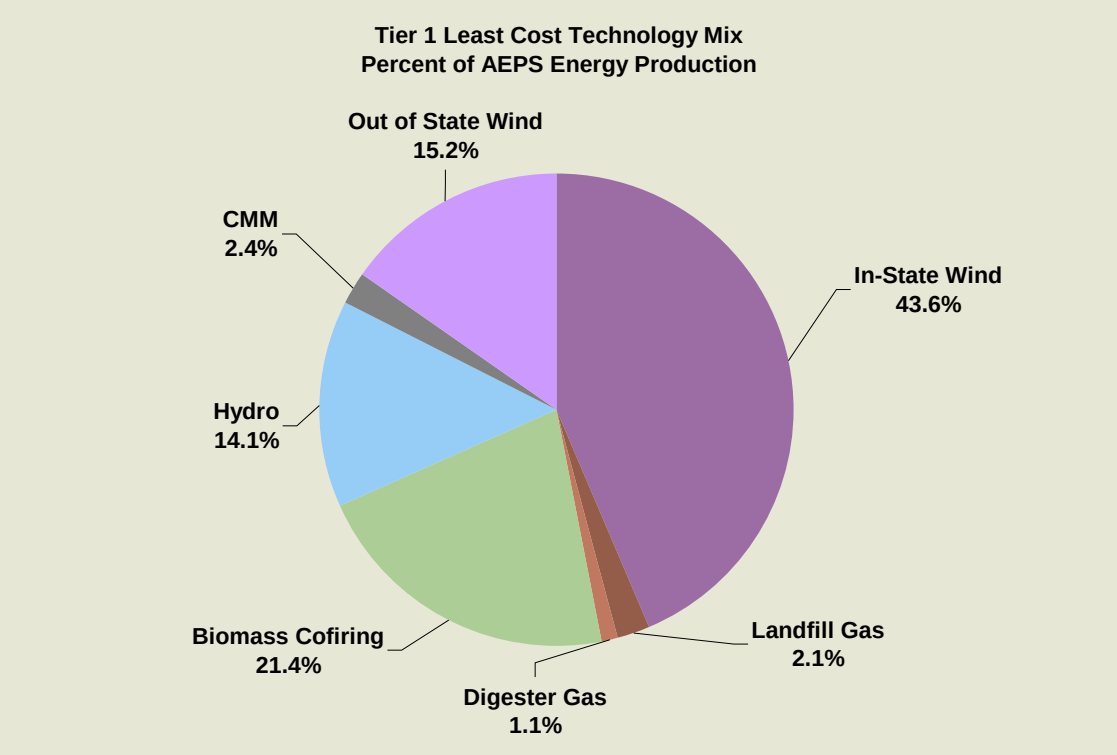

Figure 1-1. Least Cost Technology Mix For Renewable Goals, Without Set-Asides.

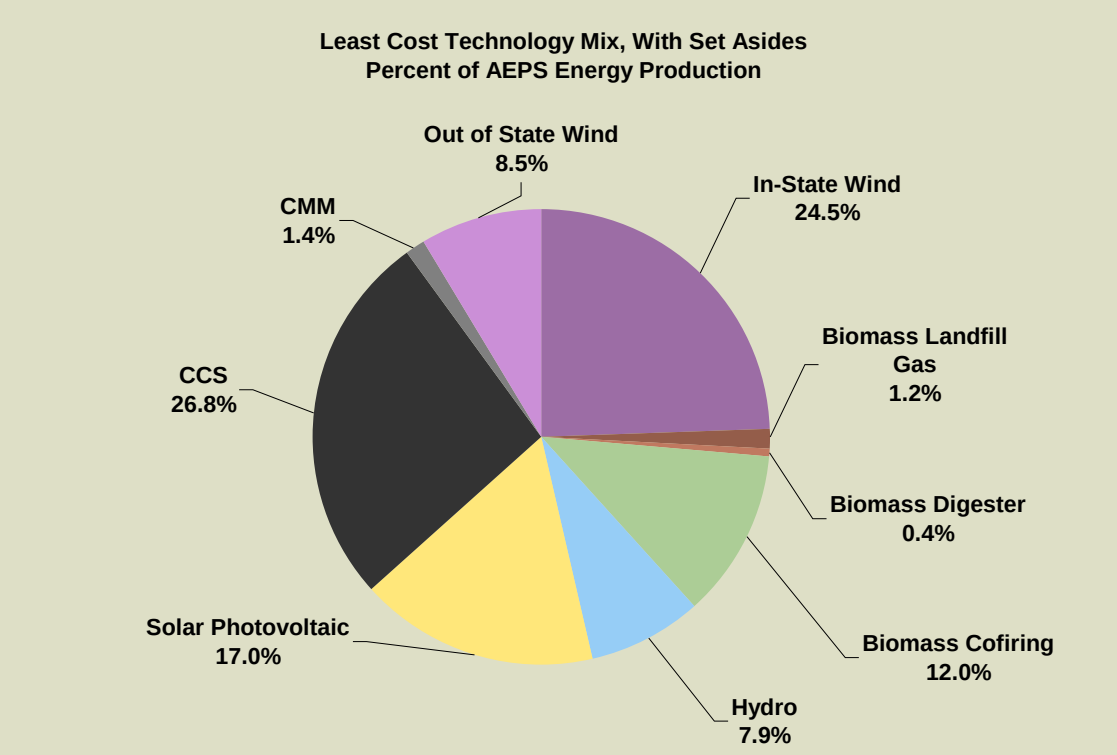

Figure 1-2. Technology Mix For Renewable Goals, With Set-Asides.

1.3 Economic Impact Assessment

The study examines economic development impacts resulting from renewable energy development including job creation, earnings, cost of electricity, natural gas costs, and state economic output. The estimated economic impacts were compared to a "fossil fuel only" (FFO) scenario, in which the generation expansion is met with conventional natural gas and coal technologies.

Evaluating the economics of renewable energy development requires estimation of the resulting economic costs and benefits to Pennsylvania. The primary costs and benefits relevant to this analysis include the cost of electricity, as well as direct and indirect impacts on jobs, income, and economic output.

1.3.1 Cost of Electricity

To estimate the direct impact that the expanded AEPS would have on electricity costs, an economic model was constructed. This involved comparing the cost of generating electricity under the AEPS with the FFO portfolio costs that would be avoided (avoided fuel, O&M costs, CO2 costs, and capacity costs) due to the AEPS.

Annual cost estimates were calculated and compared for the portfolio mixes. In terms of cumulative present value costs over the study period, the AEPS portfolio cost of $6.8 billion is approximately $1.6 billion, or 31 percent higher than the $5.2 billion cumulative present value cost of the fossil fuel only case. Taken in context, the $1.6 billion AEPS premium is small. On a statewide energy consumption basis, $1.6 billion in present value dollars equates to a premium of 0.055 cents/kWh or a 0.6 percent increase over the average 2007 Pennsylvania retail electricity price of 9.08 cents/kWh. Based on an average household monthly electricity consumption of 850 kWh, the AEPS would increase electricity costs per household by about 50 cents per month versus the FFO scenario.[1] Furthermore, this price premium for renewable energy may be offset by the possible price suppression effect of renewable energy in the regional electricity market, valued at a net present value of $3.5 to $6.2 billion over the study period.

1.3.2 Jobs and Economic Output

It has long been recognized that there can be significant socioeconomic impacts associated with new power plant investment. Foremost among these are the associated increases in employment, output, and income which arise in a local or regional economy. For the study of the AEPS, the intent is to estimate the multiplier impacts arising in

[1] This is the present value of the cost increase over all the generation over the entire study term. In reality any increases, if they were passed on in the form of electricity rate increases, would likely be small initially

Pennsylvania due to the construction and operation of an AEPS portfolio, and to compare these impacts with those arising from a fossil fuel only expansion plan. The model chosen for use in the study is the Regional Input-Output Modeling System (RIMS II model), developed and maintained by the US Department of Commerce's Bureau of Economic Analysis.

The cumulative impacts over the planning period are estimated by combining the impacts estimated on a per MW unit basis with the total MW of capacity installed for each portfolio. Table 1-2 compares the total impacts associated with the AEPS and fossil fuel only portfolios. Figure 1-3 shows the total estimated employment impact for each of the technologies.

Table 1-2. Cumulative Job and Output NPV Impacts, AEPS Versus Fossil Fuel Only Case

	Output Impact ($ billions)	Earnings Impact ($ billions)	Employment Impact (Job-years)
AEPS Portfolio	37.5	9.2	211,000
FFO Portfolio	11.3	3.8	82,000
Difference	+ 26.2	+ 5.5	+ 129,000

and would rise towards the end of the study term. However, as described elsewhere in this section, the other benefits of the AEPS may completely offset this direct cost.

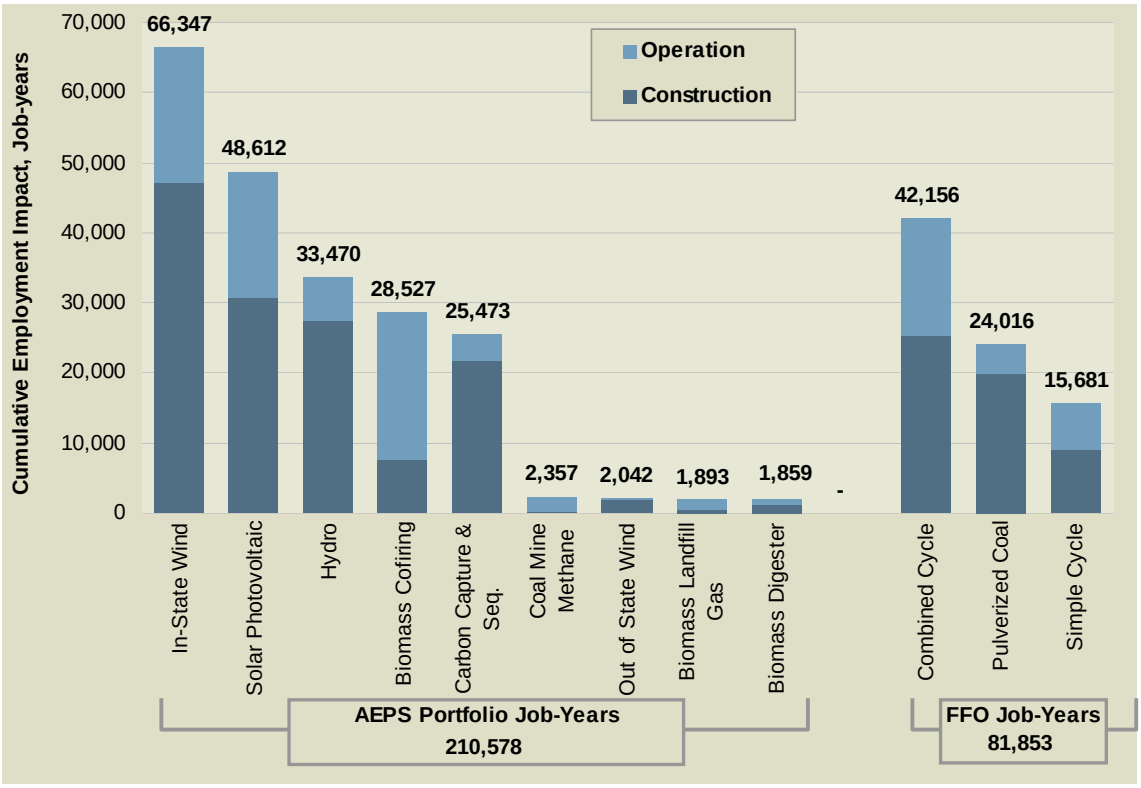

Figure 1-3. Cumulative Employment Impacts by Technology, AEPS and Fossil Fuel Only Cases

Results indicate that the AEPS portfolio has a significantly larger net present value (NPV) impact than does the fossil fuel only scenario. This includes an approximate $26.2 billion advantage in output, a $5.5 billion advantage in earnings, and approximately 129,000 more job-years[2] over the planning period. It is also useful to note that the portfolio's added earnings multiplier impacts would more than offset the cumulative present value direct electricity cost advantage of approximately $1.6 billion from a fossil fuel only case. That is, the additional income earned and expenditures made by Pennsylvanians working in the renewable energy industry more than makes up for the relatively small increase in electricity costs.

1.3.3 Hedging, Commodity Cost Reduction, and Price Suppression

The use of fixed, low marginal cost renewable energy, such as solar or wind, can decrease fossil fuel prices through decreased demand, provide a hedge against fossil fuel price increases, and have a suppression effect on electricity market prices. The most significant of these are reductions in wholesale electric market prices.

[2] A job-year is defined as 2080 hours of employment over a single year.

A study by PJM showed that 15,000 MW of low marginal cost wind in the PJM region could suppress wholesale electricity market prices by $4.50 to $6.00/MWh by 2013. [3] According to PJM, this equates to annual market-wide savings of $3.55 to $4.74 billion versus not having the renewable energy in place. Assuming a similar range applies to the state and would be generally applicable over the study term (after 2012), then the cumulative net present value of the price suppression benefit study could be $3.5 to $6.2 billion compared to the fossil fuel only case.

Notably this savings is much higher than the direct electricity cost impacts identified earlier ($1.6 billion increase for AEPS vs. FFO). Thus it is plausible that the expanded AEPS could result in an overall net reduction in energy prices in Pennsylvania compared to a FFO scenario.

1.3.4 Summary of Economic Impacts

The following are the major findings of this economic impact analysis:

- The projected AEPS portfolio electricity cost of $6.8 billion is $1.6 billion, or 31 percent higher than the $5.2 billion estimate for the FFO scenario on a net present value basis.
- The $1.6 billion higher cost equates to a premium of 0.055 cents/kWh over all electricity sold in Pennsylvania during the study period. This is a 0.6 percent increase over the average 2007 Pennsylvania retail electricity price of 9.08 cents/kWh.
- The AEPS portfolio has a significantly better economic impact than does the FFO scenario including an approximate $26.2 billion advantage in output, a $5.5 billion advantage in earnings, and approximately 129,000 more job-years over the study period.
- The AEPS portfolio may have significant secondary impacts on the regional energy markets, including hedging benefits, reduced fossil fuel prices, and electricity market price suppression effects. In the case of the electricity market price suppression, Black & Veatch estimated the potential benefit over the life of the study to be as much as $3.5 to 6.2 billion compared to the fossil fuel only case. This is significantly larger than the $1.6 billion estimated direct electricity cost increase.

[3] Potential Effects of Proposed Climate Change Policies on PJM's Energy Market. PJM, 2009.