The Maryland Renewable Portfolio Standard:

An Assessment of Potential Cost Impacts

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1. Executive Summary

Maryland has an opportunity to join over a dozen other states that have recognized the benefits of adding an increasing amount of renewable resources to the electricity generation supply. Using clean renewables to diversify the resources that drive our electricity system can, at little to no cost, stabilize electricity prices and help to avoid price spikes caused by fluctuating and increasing fossil fuel costs.

This report provides a quantitative assessment of the likely cost impacts if Maryland establishes a requirement for 7.5% of the total electricity generation in 2013 to come from renewable energy resources. The report concludes that this could be achieved at little or no cost, and might even reduce electricity costs in the long run.

Our base case analysis suggests that the RPS might increase retail electric costs by roughly 0.1% to 0.8% from 2006 and 2013. Residential customers' electricity bills would increase by roughly six cents to eighty-two cents per month, with lower impacts in the years after 2013.

However, these costs may be partially or entirely offset by the natural gas demand reduction effect of the RPS. A recent study by the U.S. Energy Information Administration (EIA) found that the retail price impacts of a proposed 10% national RPS would be largely offset by lower gas prices that result from reduced gas use. Our analysis finds that a 2% reduction in PJM natural gas prices as a result of the Maryland RPS would be more than sufficient to offset the cost of the renewable generators, while a 4% reduction would result in *reductions* in retail electricity costs in Maryland.

If natural gas prices turn out to be 25% higher than current forecasts, then the cost of renewable generation relative to conventional generation would be reduced, and the RPS would have almost no impact on retail electric costs. If natural gas prices turn out to be 50% higher, then in the RPS will *reduce* retail electricity costs, beginning in 2009 and continuing many years into the future.

The maximum possible cost of the RPS would occur if the incremental cost of renewable generation reaches the compliance fee level of 2 ¢/kWh in every year of the standard. Under this scenario, the percentage increase in retail electricity costs could be as high as 1.9% by 2013, and then would decline thereafter. Table 1.1 summarizes these results. Our analyses and results are provided in more detail below.

Table 1.1 RPS Cost Impact – Percentage Increase in Retail Electric Costs

	2006	2007	2008	2009	2010	2011	2012	2013
Base Case	0.1	0.1	0.3	0.4	0.5	0.6	0.6	0.8
RPS Reduces Gas Price 2%	0.1	-0.1	-0.1	-0.2	-0.3	-0.4	-0.5	-0.6
RPS Reduces Gas Price 4%	0.1	-0.3	-0.5	-0.8	-1.1	-1.4	-1.7	-2.0
High Gas Price: 25%	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
High Gas Price: 50%	0.0	0.0	0.0	-0.1	-0.1	-0.2	-0.3	-0.4
RPS Premium = 2 ¢/kWh	0.1	0.3	0.6	0.8	1.1	1.3	1.5	1.9

2. Benefits of Renewables and the RPS

Renewable energy technologies provide a sustainable way of meeting energy needs with minimal impact on the environment. Emissions from conventional methods of generating electricity are the cause of numerous health and environmental problems, and mounting evidence of the link between fossil fuel burning activities and climate change underscores the importance of finding alternative means of producing energy. Renewable energy increases fuel diversity and reduces the risks of price volatility while contributing to local economic development.

Unlike fossil fuel-based power plants, which produce harmful air pollutants and large quantities of carbon dioxide, many renewable energy sources generate electricity while releasing zero or relatively minor levels of emissions. Growing concerns over the human health and environmental impacts of conventional electricity generation have sparked interest in renewable energy technologies, several of which rely on free, non-depletable sources of power.

Recent natural gas price volatility emphasizes the need for a diverse portfolio of electricity generating resources. Relying on generation from renewable resources increases fuel diversity and reduces the financial risk of electricity price spikes due to fossil fuel price volatility. A report by the Lawrence Berkeley National Laboratory quantifies the hedge value of renewable energy by equating it with the stability premium for natural gas. The report determined this value to be roughly 0.50 ¢/kWh, or about 14% of the expected wholesale electricity price in Maryland in 2006.[1]

In addition to serving as a hedge against volatile natural gas prices, increasing renewable generation also reduces natural gas demand, which mitigates the cost impacts of renewable energy. A study by the U.S. Energy Information Administration (EIA) found that the retail price impacts of a proposed 10% national RPS would be largely offset by lower gas prices that result from reduced gas use.[2]

Investing in renewable energy technologies is also a way of hedging uncertainty over potential environmental regulations. Should legislation or international agreements pertaining to criteria pollutants and carbon dioxide emissions become more stringent in the future (as they already have in several countries), taking actions to reduce emissions immediately with renewable resources will be far less costly than doing so reactively in the future.

Because several areas in Maryland are in severe non-attainment of EPA's air quality standards, aggressive environmental policies such as the RPS can help the state to secure federal funds. While the RPS may not bring all of these areas into attainment, it would demonstrate positive action to increase the region's air quality, which would facilitate the procurement of federal funds.

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[1] Bolinger, Mark, Ryan Wiser and William Golove. "Quantifying the Value that Wind Power Provides as a Hedge Against Volatile Natural Gas Prices." Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National Laboratory, June 2002. Available at <http://eetd.lbl.gov/EA/EMP>.

[2] EIA 2002. "Impacts of a 10-Percent Renewable Portfolio Standard," February 2002.

Renewable energy can also be a significant source of local economic development. Wind energy, for example, provides more than five times as many jobs per dollar invested as coal or nuclear power.[3] The growth of a robust market for renewables technology will create jobs and enterprises that build, market, and maintain these technologies.

Unfortunately, electric utilities and generation companies usually fail to account for the myriad benefits of renewable energy, preferring conventional sources of electricity for their perceived lower costs of generation. As the restructured electricity industry in Maryland and the PJM region relies more upon market forces to drive the development of new generation facilities, renewable resources are at a significant disadvantage because the market does not account for their many environmental and economic benefits, including but not limited to:

- improved air and water quality;
- low levels of net greenhouse gas emissions;
- hedge against fossil fuel price volatility;
- improved energy security and reliability; and
- local economic development and revenue.

Public policies such as the RPS are needed to help address these market failures and promote electricity resources that are in the best interest of society in general.
The RPS itself is a market-based policy, in that it relies on competitive markets to generate specified amounts of renewable electricity at the lowest possible cost. As the market share of renewable conversion technologies expands and as these technologies take advantage of economies of scale, their costs are expected to decrease. A renewable energy policy should strive to disseminate the benefits of renewable energy while reducing the cost differential between renewable power and energy from conventional sources. A well-conceived RPS is an effective and efficient means of accomplishing these goals.

3. RPS Experience In Other States

To date, at least 15 states have implemented some form of minimum renewable energy standards, including Arizona, Connecticut, Iowa, Maine, Massachusetts, Minnesota, Nevada, New Jersey, New Mexico, Pennsylvania, Texas, and Wisconsin. In some cases these renewable portfolio standards were established as a part of state electricity industry restructuring, while in others they simply apply to regulated electric utilities.

The minimum renewable energy requirements are usually designed to gradually increase over time up to a maximum amount. Because each state has different definitions of resource eligibility as well as renewable resource potentials that are specific to the state or region, it is difficult to make absolute comparisons of these standards. For example, the Massachusetts standard employs a strict definition of eligible resources that excludes hydroelectric power and municipal solid waste and includes only new renewables. On

[3] United States Department of Energy Office of Energy Efficiency and Renewable Energy (EERE). "Quick Facts about Wind Energy," <http://www.eere.energy.gov/wind/web.html>.

the other extreme, Maine's standard requires no new renewable resources and includes hydroelectric and wood-burning plants. The table below presents a summary of the states with RPS policies, and the goals established in each state.

Table 3.1 States With Renewable Portfolio Standards

State	RPS Goal (percent of state's retail electricity sales).
Arizona	1.1% by 2007, 60% of which must be solar.
California	20% by 2017.
Connecticut	13% by 2009*
Iowa	2% by 2011.
Maine	30% by 2000.
Massachusetts	4% by 2009, 1%/year thereafter.
Minnesota	3.6% by 2002, 4.8% by 2012.
Nevada	15% by 2013, 5% of which must be solar.
New Jersey	6.5% by 2012.
New Mexico	5% of standard offer, 10% by 2011.
Pennsylvania	Varies by utility.
Texas	2.2% by 2009.
Wisconsin	2.2% by 2011.

Source: Union of Concerned Scientists, "State Minimum Renewable Energy Requirements (as of 01/2003).
**At least 6% must be Class I, which includes solar, wind, new sustainable biomass, landfill gas, and fuel cells.*

Some other states have adopted Minimum Renewable Energy Goals. These are presented in the following table.

Table 3.2 States With Renewable Energy Goals

State	RPS Goal (percent of state's retail electricity sales).
Hawaii	9% in 2010.
Illinois	15% in 2020.
Minnesota	10% in 2015.

Source: Union of Concerned Scientists, "State Minimum Renewable Energy Goals (as of 01/2003).

4. Key Elements of a Successful RPS

The experience of other states has demonstrated that the RPS is only effective when key design elements are carefully considered and implemented. A discussion of some of these elements follows below.

Eligible Resources

"New" renewable resources are typically distinguished as such if they begin commercial operation after a clearly defined date. New resources are generally preferred to existing ones for the purposes of RPS compliance, because new facilities provide greater incremental benefits, and it is assumed that existing facilities are economically self sufficient without the aid of the RPS.

Eligible resources should also meet certain environmental standards. Renewable resource facilities that produce emissions, such as a biomass-fired facility, should be subject to stringent emissions standards. Municipal solid waste incineration, because of its associated mercury and dioxin emissions, should not be allowed to participate in the RPS. Acceptable sources can include wind, solar, biomass, low-impact hydro, landfill gas, geothermal, ocean, and fuel cells – though policymakers in each jurisdiction must exercise caution to ensure that the RPS does not support resources that fail to provide significant net environmental benefits.

In order to be eligible for the RPS, renewable generators must also located in a region where their operation will result in benefits to Maryland's citizens and electricity customers. Renewable resources that are located in Maryland will clearly provide direct benefits to the state, both in terms of reduced environmental impact and enhanced economic development. Renewable facilities that are located outside of state borders but within the PJM transmission area also can sell power to Maryland and provide benefits by displacing generation from non-renewable resources in the region.

Applying the RPS Requirement to All Retail Sales

The RPS should apply to all entities that sell electricity to retail customers in Maryland. In this way, the RPS will apply to all generators that serve Maryland customers, regardless of whether the generator is located in Maryland or not. This provision ensures that the renewables requirement will be applied equitably across generators and will not create anti-competitive conditions.

Similarly, the RPS should apply to all retail electricity sales made within Maryland. This means that all customers – including those provided with "standard offer" services, with "default" services, or with services developed under settlement agreements – participate in the RPS. In this way, all electricity customers will contribute their fair share of support to the new renewable resources, regardless of where they purchase their generation services.

Some retail electric suppliers may decide to offer several different electricity "products." For example, a seller may decide to offer one "green" product, one product tied to telephone and cable services, and one simple, low-cost electricity service. The RPS should be applied to each individual product offered by each retail electricity seller. If a supplier is allowed to comply with the RPS on an average, company-wide basis, then "premium" green products marketed by an electric company at a higher price to a small portion of customers could be used to meet the standard. This would have the "volunteer" customers bearing the short-term costs of diversifying the company's energy resource mix even though it will benefit all customers. The RPS must be designed so that all electricity customers contribute to their fair portion of the RPS, regardless of which electricity product they buy.

Customers that self-generate a large amount of electricity should also be required to comply with the RPS. This measure is necessary to ensure that large customers do not bypass the RPS requirement by installing their own generation systems. The RPS legislation should include an appropriate size threshold, such as one megawatt.

Mechanisms for Demonstrating RPS Compliance

There are two main mechanisms that can be used for retail electricity sellers to demonstrate that they are complying with the RPS: the contract path approach and the tradable credit approach.

Contract Path Demonstration

Under this approach, each retail electricity seller must demonstrate that it either owns a qualifying renewable technology that has produced energy, or that it has purchased power from a qualifying renewable technology. Under both circumstances, it is necessary to demonstrate that the renewable generation is only being used for RPS compliance by a single retail electricity seller (i.e., that there is no double-counting). This demonstration is achieved through a "contract path" approach, whereby energy generation and its renewable attributes are tracked from the power plant to the retail buyer, according to the path of financial contracts among all of the buyers and sellers of the power.

This approach requires that some agency act as a central administrator to track the power sales and renewable attributes. This task is administratively complex and requires a great deal of information regarding the contractual relationship between generators, wholesale buyers and sellers, including the hourly generation of all power plants and the hourly retail demand of each retail supplier. It may also require the processing of confidential information, thereby limiting the number of entities that can act as the central administrator.

Tradable Credit Demonstration

Renewable Energy Credits (RECs) can be established as an alternative means of demonstrating compliance with an RPS. Under this approach, each qualifying renewable generator would receive a REC for every kWh of renewable generation. These generators would then have two products to sell separately: generation would be sold into the power market, and the RECs would be sold to retail electricity sellers for their compliance with the RPS. This means that retail electricity sellers would not have to actually purchase renewable generation to comply with the RPS – the purchase of an REC would serve the same purpose. It also means that there is no need for a central administrator to track the flows of power and the associated renewable attributes.

One of the benefits of the tradable credit approach is that it significantly increases the ability to buy and sell the renewable attributes and increases the flexibility of the retail electricity suppliers for compliance with the RPS. This should help reduce some of the barriers and transaction costs associated with RPS compliance. The tradable credit approach also helps to promote a more competitive market in renewable resources, by increasing the number and types of players that can participate in the RECs market, intensifying competition for renewable attributes, and facilitating forward markets, price hedging, and project financing.

Consistency With Neighboring Systems

One of the key issues to work out with any RPS compliance demonstration mechanism is how to deal with power sales and purchases from other regions. Under both systems described above, it is necessary to ensure that power was indeed generated from RPS qualified facilities, that the power was somehow delivered to Maryland (if so desired), and that the power is used to comply with only one RPS requirement and only once.

One way to achieve this goal is to require that power purchases from another region will only be eligible for the RPS if that region has an RPS compliance demonstration mechanism that is consistent with the mechanism used in Maryland. In other words, if Maryland adopts a tradable credit approach, then power from a neighboring region would qualify for the Maryland RPS as long as that region (a) also has some form of tradable credit approach, and (b) the approach has a similar design and requirements.

The more states that adopt the RPS in the Mid-Atlantic region, the more effective and financially viable such a tradable credit approach would be. By expanding the resource base and enhancing the competitive market for tradable renewable credits, a regional-level RPS provides retail electric suppliers with greater flexibility to meet the RPS at the least possible cost. By aggregating the natural gas demand reduction effects of renewable resources in several states, a regional-level RPS would further mitigate incremental renewable costs, perhaps even reducing overall electricity costs if marginal gas supply in the region is severely constrained. By joining New Jersey in adopting the RPS, Maryland could provide momentum for neighboring states to follow suit.

PJM is currently in the process of developing a Generation Attributes Tracking System (GATS), similar to the Generation Information System (GIS) that was recently implemented by the New England Power Pool (NEPOOL). Once in place, GATS will support reporting, compliance, and verification requirements related to the environmental attributes of electric generation, and could be used to create tradable certificates for RPS compliance. GATS is scheduled to become functional in the second quarter of 2004. Relying on GATS for Maryland RPS credit trading will be more cost effective than the state assuming responsibility for developing a credit tracking and trading system.

RPS Enforcement Mechanisms

Effective noncompliance mechanisms are important to ensure that retail electric suppliers fulfill their RPS obligations and to provide investors with confidence that a market will exist for electricity generated from renewable sources. A simple monetary penalty should be used for this purpose, whereby retail electricity sellers are charged a fee for each MWh that is not in compliance. In order to encourage retail electric suppliers to comply and to minimize the costs of administrative and enforcement oversight, the magnitude of the penalty should be significantly larger than the expected cost of compliance. For example, a compliance fee of 5 ¢/kWh should be large enough to encourage retail sellers to meet the requirements of the RPS.

A monetary penalty of this type can also act as a cap on the compliance costs incurred by retail electric suppliers. If compliance costs turn out to be higher than the monetary penalty, then suppliers will simply choose to pay the penalty instead of complying with the RPS. Setting the penalty amount too low, however, could result in underinvestment in renewable technology. Such a scenario would undermine the key RPS goal of increasing the state's generation from renewable sources and diminish the benefits that would result from a growing reliance on renewable power.

If the noncompliance penalty is sufficiently high, Maryland will collect few, if any, revenues. Any revenues that happen to be generated by a monetary penalty should be used to support the development of renewable resources in Maryland. This enables the state to continue pursuing the RPS goals even if some retail electricity suppliers do not fulfill their RPS obligations.

5. Renewable Resource Options

Predicting the financial impact of the RPS requires an assessment of the eligible resources in the state or region in question. Based on the availability of these resources and estimates of their costs, we were able to estimate the costs of the RPS. Then, by comparing these costs to the costs of generating electricity from conventional sources, we estimated the net impact of the RPS on Maryland's retail electricity prices. This section of the report includes an overview of the potential for different renewable resources to meet the state's RPS.

Wind

Wind technology is the fastest growing power generation source in the world. Currently, the installed wind power capacity in the Mid-Atlantic region is extremely limited, but studies indicate that the region has large potential for wind power. Maryland has enough wind potential to generate almost 700 GWh per year, and the five Mid-Atlantic states have the potential to generate nearly 24,000 GWh of electricity per year.[4] (As a point of reference, the Maryland RPS calls for approximately 6,150 GWh of generation from all renewable resources in 2013).

Wind energy does not produce any emissions and relies on a free, non-depletable fuel source. The relatively high capital cost of wind turbines can be partially offset by low operating costs and a federal production tax credit of about 1.8 ¢/kWh (Congress will decide whether to extend the tax credit this year). In some areas, wind power is already cost competitive with electricity from fossil fuel-based sources. In the PJM region, we have assumed that the wind power used to meet the Maryland RPS will have capacity factors ranging from 32% to 34%.[5] At a 32% capacity factor, the levelized cost of wind generation (including the production tax credit and capacity payments) is about 4.9 ¢/kWh. At 34% capacity factor, the cost declines to roughly 4.5 ¢/kWh.

4 EERE 1998. "State Renewable Profiles."

5 These assumptions regarding wind turbine capacity factors for the MD RPS are based on assumptions used in *Powerful Solutions, Seven Ways to Switch America to Renewable Electricity*, Union of Concerned Scientists, January 1999, as well as discussions with developers of wind turbines in the PJM region.

One limitation of wind energy is its intermittent nature – it can only provide power when the wind is blowing at sufficiently high speeds, and those times may not always coincide with when electricity is needed. Fortunately, the ability to predict wind generation into the short-run future has improved, and the wind generation adds to the reliability of the system even though its output is intermittent.

Solar

Like wind, solar energy does not produce any harmful emissions and relies on a free fuel source. However, the high capital costs of solar photovoltaic (PV) technology have limited its development. The RPS should spur new investment PV technology, but the solar energy-produced fraction of renewable energy that meets the RPS requirement is expected to be relatively small. Currently, solar rooftop photovoltaic systems generate electricity at a cost of about 28 ¢/kWh. This cost is expected to decrease with time as new investments in photovoltaic technology result in efficiency improvements and greater economies of scale.

Solar energy will likely be developed in specific niches of the electricity market where it will either receive substantial subsidies, receive credit for avoided transmission and distribution costs in areas where the electricity supply is constrained, or be installed for non-economic reasons.

Biomass

Biomass sources can include a broad category of organic material ranging from wood waste to dedicated energy crops. The potential for biomass energy in a given state or region is usually limited by the amount of feedstock (or fuel) that is locally available and the distance it must be transported from its origin to the energy conversion facility. Biomass can be used as a stand-alone fuel or it can be co-fired with a non-renewable fuel to generate electricity.

While biomass-fired generation typically reduces net emissions of carbon dioxide (CO_2) and sulfur dioxide (SO_2), its emissions of smog-forming nitrogen oxides (NO_X) can be higher than those of some conventional sources. Biomass energy can be produced relatively cheaply when it is co-fired with coal at existing power plants, thus avoiding the need for significant capital investment. Because of the high number of coal-fired power plants in the PJM region, the potential for generation from biomass co-firing is large. Stand-alone biomass facilities are more expensive than biomass co-firing, with a generation cost of about 7.0 ¢/kWh.

Landfill Gas

Landfill-gas-to-energy (LFGTE) projects utilize the gas that forms from the decomposition of organic materials at a landfill. Similar to biomass, LFGTE likely reduces net CO2 and SO2 emissions but may have limited or negative impacts on NOx emissions. Some recycling advocates have questioned the inclusion of LFGTE in policies that incentivize renewable energy because of its association with unsustainable waste management practices.

LFGTE often costs less than other renewable sources of electricity and has already been developed at over 300 landfill sites in the country. Because it is a mature technology, LFGTE does not have as much potential as other renewable energy sources such as wind. The EPA has identified 39 potential sites for LFGTE projects in the Mid-Atlantic region with a total potential capacity of roughly 130 MW.[6] This is similar to the UCS estimate of 146 MW of LFGTE capacity in 2010 under a 10% national RPS.

Table 5.1 shows the costs of the technologies that are expected to contribute to the RPS in Maryland.[7] These costs are primarily based on information developed by the US Energy Information Administration (EIA) in the Annual Energy Outlook 2003. By comparison, the current wholesale electricity generation cost in Maryland is approximately 3.5 ¢/kWh.

Table 5.1. Costs of Renewable Technologies in 2002

	Overnight Capital Cost in ($/kW)	Fixed Operation and Maintenance Cost ($/kW)	Fuel Cost Component (¢/kWh)	Total Cost of Generation (¢/kWh)
Wind – 32% CF	979	26	0	4.9
Wind – 34% CF	979	26	0	4.5
Solar	3,823	10	0	28.1
Biomass Stand-alone	1,722	45	2.0	7.0
Landfill Gas	1,426	150	0	5.3

Source: AEO 2003. All costs are in 2000 dollars. The total cost of generation includes UCAP payments and production tax credits.

6. Potential Cost Impacts of the Maryland RPS

Base Case Assumptions and Analysis

Our analysis includes a rough forecast of the wholesale market price in PJM through 2013. This price is then compared to the cost of the renewables to determine the incremental cost of each unit of renewable generation – also known as the RPS premium. We use information from futures markets to estimate the PJM wholesale market price for 2003 and 2004.[8] We then assume that the PJM wholesale market price will increase steadily until 2008 when a new natural gas combined cycle plant will represent the marginal cost of electricity. The costs of the gas plant, including fuel costs, are based on the assumptions in the EIA's Annual Energy Outlook 2003. This results in a PJM

6 EPA 2003. "LMOP Landfill and Project database." Last updated 1/29/03, available at <http://www.epa.gov/lmop/projects/lmopdata.xls>.

7 Geothermal and ocean energy also qualify for the Maryland RPS. In the PJM area, the potential for the development of these technologies in the near term is relatively small, therefore we assume that neither geothermal nor ocean energy is expected to contribute to the RPS.

8 PJM wholesale peak forward prices provided by Energy Argus. We applied a multiplier to this number to estimate the all-hour price.

wholesale price of electricity of roughly 3.5 ¢/kWh in 2006, increasing to 4.0 ¢/kWh in 2013.

We then assume that some form of renewable credit trading system is established to support the RPS. This means that the marginal renewable resource will set the price for the renewable credits, and that this single price will apply to all renewable energy used to meet the RPS. Because of this effect, the exact mix of renewables will not have a large effect on the cost impact of the RPS. The marginal renewable will determine the RPS premium and thus the cost impact.

Because of its high potential in the PJM region, we expect that wind generation will be the marginal resource. We have assumed that the marginal wind resource will be dominated by relative high-class wind (i.e., 34% capacity factor) in the early years of the RPS. We have also assumed that in later years the lower class wind (i.e., 32% capacity factor) will become the marginal resource. This would happen if the supply of high-class wind resources in the region is insufficient to meet the RPS.

The value of the RPS premium will simply be the difference between the levelized costs of this wind generation and the projected wholesale electricity price. We estimate that the levelized cost of lower-class wind generation in PJM will rise from 4.5 ¢/kWh in 2006 to 4.7 ¢/kWh in 2013, assuming that the higher-cost wind plays an increasing larger role in future years.

Sensitivity Analyses

Because the future price impacts of the RPS are dependent on a number of variables that are difficult to predict, our analysis includes four sensitivity analyses in addition to the base case:

<u>Case 1: High Natural Gas Price – 25%.</u> Natural gas prices are an important factor in determining future electricity prices, and their variability will influence the cost impacts of the RPS. This scenario assumes that future natural gas prices will be 25% higher than the price projections of the US EIA. Higher gas prices will result in higher costs of generation from conventional sources, which should reduce the incremental cost of the RPS.

<u>Case 2: High Natural Gas Price – 50%.</u> This is the same as Case 2, except natural gas prices are assumed to be 50% higher than in the base case.

<u>Case 3: RPS Reduces Natural Gas Price by 2%.</u> By reducing demand for natural gas, generation from renewable resources reduces gas prices, thus mitigating the cost impact of the RPS. The EIA study of the impacts of national RPS found that a 10% RPS in 2010 would cause natural gas prices to decline by 4.6% from the reference case. Rather than attempt to determine the effect of the Maryland RPS on regional gas prices, our analysis models the RPS cost impacts of a hypothetical 2% reduction in the natural gas price that is phased in between 2006 and 2013.

<u>Case 4: RPS Reduces Natural Gas Price by 4%.</u> This is the same as Case 3, using a gas price reduction percentage more similar to the outcome of the EIA study. This could occur if several additional states in the region or country also adopt the RPS.

Case 5: Renewable Premium = 2 ¢/kWh. This scenario represents the maximum price impact of the current RPS bill. The bill as written provides for a 2 ¢/kWh compliance fee for each kWh that the electricity supplier falls short of its RPS obligation. This scenario assumes that the costs of renewable generation reach or exceed the 2 ¢/kWh threshold.

Our analysis assumes that the RPS applies to all retail electric customers and allows for credit trading for all generation in the PJM area. Tables 6.1 and 6.2 summarize the cost impacts of the RPS.

Table 6.1 Projected RPS Cost Premium

	2006		**2010**		**2013**	
	RPS Premium (¢/kWh)	% of Retail Cost	RPS Premium (¢/kWh)	% of Retail Cost	RPS Premium (¢/kWh)	% of Retail Cost
Base Case	0.95	0.1%	0.93	0.5%	0.81	0.8%
High Gas Price: 25%	0.56	0.0%	0.30	0.1%	0.12	0.1%
High Gas Price: 50%	0.17	0.0%	-0.34	-0.1%	-0.58	-0.4%
RPS Reduces Gas Price 2%	0.98	0.1%	0.98	-0.3%	0.87	-0.6%
RPS Reduces Gas Price 4%	1.01	0.1%	10.29	-1.1%	0.93	-2.0%
RPS Premium = 2 ¢/kWh	2.00	0.1%	2.00	1.1%	2.00	1.9%

Table 6.2 Projected Residential Bill Impacts for Typical Customer ($/month)

	2006	**2010**	**2013**
Base Case	0.06	0.50	0.82
High Gas Price: 25%	0.03	0.14	0.10
High Gas Price: 50%	0.01	-0.13	-0.43
RPS Reduces Gas Price 2%	0.06	-0.29	-0.65
RPS Reduces Gas Price 4%	0.06	-1.08	-2.13
RPS Premium = 2 ¢/kWh	0.13	1.07	2.02

The results of our analysis suggest that the cost impacts of the RPS will be very small, and might even be negative. In the base case, the RPS premium is roughly one ¢/kWh throughout the study period. By 2013 the total cost of the RPS will represent only 0.8% of the total cost of all retail electricity purchases in the state. The typical residential customer can expect his or her monthly electricity bill to increase between roughly six cents and eighty-two cents from 2006 to 2013. (The actual cost in any given year will depend on how retail suppliers choose to distribute the costs over time but could be roughly equivalent to an average of this range.)

As expected, if the price of natural gas turns out to be higher than in the base case, the cost impact of the RPS will be considerably lower. In the case where gas prices turn out to be 25% higher than forecast, the RPS will essentially cause no increased costs to retail rates. In the highest gas price scenario, the RPS will actually *lower* the total retail cost of electricity.

The natural gas demand reduction analysis indicates that a reduction of only 2% in natural gas prices would be sufficient to more than offset the incremental cost of renewable resources. If natural gas prices are reduced by 4%, as could result from a regional or national RPS, then the RPS could save Maryland electric customers up to $2.13 per month by 2013.

In the last sensitivity analysis, which assumes the RPS premium equals the 2 ¢/kWh compliance fee, the total RPS cost represents 1.9% of total retail electricity costs in 2013, and the monthly residential bill impacts range from 13 cents in 2006 to slightly over two dollars in 2013.

7. Conclusions and Recommendations

The primary conclusion of our analysis is that Maryland can adopt minimum renewable energy standards at little or no net cost to Maryland consumers.

The degree to which the RPS will affect electricity prices in Maryland depends on a number of interrelated factors. According to our base case analysis, the RPS will have less than a one percent impact on retail electricity prices in Maryland. For the typical residential electricity customer, this translates to a monthly bill increase of less than one dollar per month.

If future natural gas prices turn out to be higher than predicted, the incremental RPS costs should be even lower, and its price impacts could be negligible. In practice, the RPS may work to effectively lower natural gas prices by reducing demand on a resource that will likely face significant supply constraints in the future. Our analysis suggests that a 2% to 4% reduction in natural gas prices would slightly *lower* retail electricity costs in Maryland.

Following is list of key considerations for any renewable energy standard:

<u>It must apply to all retail sales; all customers and all classes of customers.</u> Many proposals exempt entire categories of customers. To ensure that all electricity consumers in the state share the costs and benefits of renewable energy, the RPS bill must include all retail electric customers in the state.

<u>An RPS compliance tracking system should strive to be consistent with systems being developed by the regional grid operators.</u> Granting eligibility to resources within the PJM area would allow for the development of low-cost, high-potential renewables in almost all of the Mid-Atlantic region and provide for the creation of a robust market for tradable renewable electricity credits. Maryland policy makers should incorporate the PJM Generation Attributes Tracking System (GATS). Relying on GATS will be more cost effective than the state assuming responsibility for developing a credit tracking and trading system.

<u>RPS enforcement mechanisms</u>. The 2¢/kWh compliance being considered by many in Maryland may be too low to encourage all retail sellers to purchase renewable resources. If renewable resources turn out to cost more than 2¢/kWh – or if there is simply a *perception* that they will cost more – then retail sellers will choose to pay the compliance

fee rather than purchase the renewables. This will undermine the stability of the RPS, and may not lead to the renewable generation specified in the current RPS proposal. We believe that a cap of 5¢/kWh will be much more effective in promoting compliance with the RPS.

If the compliance fee is not raised above the current level, then the RPS proposal should explicitly prevent electric distribution companies from passing the costs of the compliance fee through to its ratepayers. This provision will encourage electric utilities to purchase renewable resources rather than pay the compliance fee.

The current RPS proposal specifies that all revenues raised through the compliance fee will be used to support a Maryland Clean Energy Fund. While it is important that compliance fees are used to support renewables, we are concerned that this is a risky means of supporting such a fund. The extent to which retail sellers will comply with the RPS could change significantly from year to year, resulting in unstable revenues for the Clean Energy Fund and making it difficult for the fund managers and recipients to plan for how best to utilize the funds. A better approach would be to adopt a small charge on all customers' electric bills to provide stable funding for the Clean Energy Fund. Any revenues that are collected from the RPS compliance fee could be used to supplement this fund.