



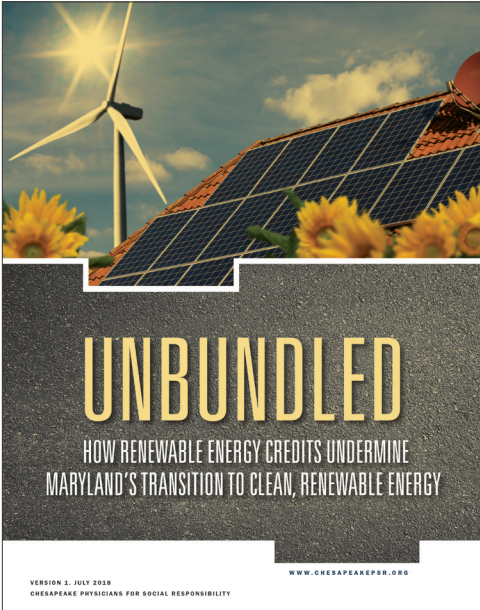
UNBUNDLED

HOW RENEWABLE ENERGY CREDITS UNDERMINE
MARYLAND'S TRANSITION TO CLEAN, RENEWABLE ENERGY

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HOW RENEWABLE ENERGY CREDITS UNDERMINE MARYLAND'S TRANSITION TO CLEAN, RENEWABLE ENERGY

Version 1: July 17, 2018

We hope this report will contribute to the discussion in Maryland about how best to increase the amount of clean, renewable electricity produced and consumed in the state.

While we have endeavored to make this report as accurate as possible, there are no doubt errors, omissions, and improvements that can be made. That is why we would like to hear from you on how we can improve this report.

Based on your input and further research we are conducting, we expect to have a second version of this report completed by the middle of October 2018.

We look forward to hearing from you.

Tim Whitehouse, Executive Director
Chesapeake PSR

"In 2016, Maryland utilities retired over 7 million non-solar Renewable Energy Credits (RECs) at a cost of over \$88 million to meet their requirements under the Renewable Portfolio Standard. Based on our review of Public Service Commission records, it is likely that all of these RECs were 'unbundled,' meaning no energy was purchased by the Maryland utilities as part of these transactions. Unbundled RECs are no-strings-attached subsidies to energy producers from Maryland ratepayers. Unbundled RECs allow utilities to continue to purchase electricity from fossil fuels sources while claiming credit for renewable energy that was produced and purchased elsewhere. And much of the energy subsidized by Maryland ratepayers is as bad or worse for the climate and human health than burning fossil fuels."

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EXECUTIVE SUMMARY

Since 2004, Maryland has sought to increase the percentage of renewable energy in its electricity mix by requiring utilities and other retail suppliers to comply with a Renewable Portfolio Standard (RPS). The RPS currently sets a goal of 25% renewable electricity by 2020.

After more than a decade of experience with the RPS, this report concludes there are serious structural flaws in the RPS that must be corrected before meaningful renewable electricity targets can be reached. The least understood and most harmful flaw is allowing utilities to use unbundled renewable energy credits (“unbundled RECs”) to meet their renewable energy requirements.

The use of unbundled non-solar RECs allows Maryland to claim credit for renewable energy produced and sold elsewhere while continuing to buy electricity generated from fossil fuels and nuclear power. Unbundled RECs are no-strings-attached subsidies from Maryland ratepayers to energy producers, often in far away places. They do not involve the purchase of energy by Maryland utilities.

Excluded from our analysis in this report are RECs generated from Maryland’s in-state solar and offshore wind requirements. The market dynamics and energy outcomes of these RECs are different and merit separate analysis. Solar and offshore wind are very small portion of Maryland’s RPS.

The original theory behind allowing utilities to use unbundled RECs to meet their RPS requirements was that the sale of these RECs would provide an additional income stream to owners and developers of renewable energy projects, thereby stimulating new investments in renewable energy sources and strengthening Maryland’s economy.

In reviewing data from Maryland’s Public Service Commission, however, we have found that Maryland’s RPS does little to incentivize new clean, renewable energy production or provide economic benefits to Maryland. Specifically, we have identified four key problems arising from Maryland’s use of unbundled RECs.

- First, there is no available evidence that unbundled RECs purchased by Maryland utilities are used to finance new renewable energy. Unbundled RECs represent additional revenue for energy producers with no strings attached.
- Second, there is no evidence that unbundled non-solar RECs bring significant economic development to the state.
- Third, Maryland allows utilities to buy RECs from sources that are neither clean nor “green.”
- Fourth, Maryland ratepayers are forced to pay extra money on their energy bills to cover the costs of unbundled REC purchases but get few of the promised environmental, health or economic benefits in return.

The report finds that the RPS fails customers in many specific ways. For example:

- We estimate that Maryland ratepayers spent over \$296 million for non-solar unbundled RECs between 2008-2016. About 86% of these subsidies went to out-of-state companies and communities, from as far away as North Dakota and Tennessee. This is wrong for all Maryland residents, but particularly for the many low-income residents who struggle to pay basic expenses and often must choose between rent, medical care, and energy bills.
- Virginia and Illinois are the biggest beneficiaries of the non-solar portion of Maryland’s RPS. We estimate that Maryland ratepayers have sent about \$84 million in subsidies to Virginia energy producers and \$46.5 million to Illinois producers, compared with about \$43 million that was spent in-state. Fifteen other states have benefited from subsidies from Maryland ratepayers.
- Many of these subsidies look more like corporate welfare, and less like renewable energy development. For example, Maryland residents are subsidizing biomass plants in Virginia that are owned by Dominion Energy Virginia and Northern Virginia Electric Cooperative. That is nice for Virginia customers, who already pay lower energy prices than Maryland residents, but it is hard to see where the benefit is for either Maryland or the environment.

- Maryland ratepayers are funding local development projects with significant financial returns for communities and companies in Ohio, Kentucky and elsewhere. These projects provide no benefits to Maryland ratepayers and siphon money away from potential development projects in Maryland.
- Every year, Maryland utilities have purchased increasing number of unbundled RECs from wind and hydro projects. Almost all of these purchases are from out-of-state facilities that have not established that they need Maryland subsidies to remain viable or to expand production, or that it is in Maryland's interest to fund their operations.
- In 2016, almost half of the RECs used to satisfy Maryland's RPS came from polluting energy sources such as black liquor and biomass, the great majority of which are located out of state. Stuningly, an evaluation by the Maryland Energy Administration of the RECs retired by Maryland utilities in 2015 showed that the Tier 1 RECs had higher carbon dioxide emissions than Maryland's normal electricity supply, which is a mix of coal, natural gas, and nuclear fueled sources.

A Path Forward?

Other leading states have recognized the problem with unbundled RECs. California, New York and Illinois, for example, have taken steps to limit or end the use of unbundled RECs in their states in order to maximize the benefits to their residents while managing costs. In Maryland, while there is a growing debate about the state's reliance on unbundled RECs to meet its energy targets, no clear consensus exists on a legislative path forward.

Two bills introduced during the 2018 legislative session highlight this lack of consensus. One bill, the Clean Energy Jobs Act, would not only expand in-state solar, but also greatly expand the use of unbundled RECs to meet renewable energy targets. The other bill, the 100% Clean Renewable Energy and Equity Act, would eliminate the unbundled REC system and require Maryland utilities to purchase increasing amounts of clean, renewable energy strictly defined as solar, wind, small-scale hydro and ocean tidal every year.

Similar bills are expected to be back in 2019. Thus, understanding how well the existing RPS works is critical for legislators in deciding how to establish and meet renewable energy goals in a way that benefits Maryland residents

Maryland has an opportunity today to take the next big step towards a grid built on clean, renewable energy. Making the most of that opportunity requires learning from our years of experience what works and what doesn't, what delivers tangible benefits and what merely costs more.

There is an easy fix to Maryland's RPS. With prices for renewable energy dropping rapidly, the Maryland General Assembly should set yearly requirements for the amount of clean, renewable electricity that Maryland utilities must buy each year and end the ability of utilities to buy unbundled RECs to meet renewable electricity goals.

Allowing utilities to buy unbundled RECs from poor-quality, out of state projects and claim it as renewable energy for Maryland is bad climate and economic policy, and it leads to misleading claims about the progress we are making in cleaning up our power grid. These subsidies would be better spent building a clean energy economy in Maryland.

INTRODUCTION

Fourteen years ago, Maryland joined a national movement to start cleaning up our power grid by requiring electricity suppliers to buy more renewable energy. The Renewable Portfolio Standard (RPS) established in 2004 set a mandate for utilities and other competitive retail suppliers to procure 7.5% of their electricity supply from “renewable” sources by 2019; since then, this mandate has risen to 25% by 2020.

Today, as the General Assembly considers increasing the targets further, it is critical to examine whether the RPS law as currently structured is achieving its mission.

After more than a decade of experience with this program, we conclude that Maryland’s RPS is not achieving its mission. There are serious structural flaws that must be corrected before meaningful renewable energy targets can be reached. The least understood and most harmful flaw is allowing Maryland utilities to use unbundled renewable energy credits (“unbundled RECs”) to meet their renewable electricity requirements.

This allows Maryland to claim credit for renewable energy produced and sold elsewhere while continuing to buy electricity generated from fossil fuels.

The use of unbundled RECs in Maryland undermines the state’s transition to clean electricity, costs ratepayers hundreds of millions of dollars, and impedes efforts to bring transparency and predictability to Maryland’s electricity sector.

To explain the problem of unbundled RECs, this paper is divided into four sections.

- **Section 1** provides an overview of Maryland’s RPS law and how it works. It reviews Maryland’s definition of renewable energy and describes how Maryland utilities rely primarily on a system of unbundled RECs instead of direct energy purchases to meet their obligations under the RPS. It also explains in more technical terms how RECs are created within our regional grid system and how they are “retired” to meet RPS requirements.
- **Section 2** explains why the use of unbundled RECs is a problem. It reviews data on REC purchases between 2008 and 2016 by fuel source, facility location and annual costs. Based on these data, it concludes that Maryland’s use of unbundled RECs fails to promote the development of “new” renewable energy, often incentivizes the use of “dirty” energy, and provides direct transfers of wealth from Maryland residents to out-of-state business interests with few if any tangible economic benefits provided in return.

Excluded from our analysis are RECs generated from Maryland’s in-state solar and offshore wind requirements. The market dynamics and energy outcomes of these RECs — often referred to as SRECs and ORECs respectively — are different and merit separate analysis. At present, they represent a very small percentage of Maryland’s RPS.

- **Section 3** examines how other states have limited or ended the use of unbundled RECs to meet state renewable energy goals. It then briefly compares the proposed use of unbundled RECs in the Clean Energy Jobs Act and the 100% Clean Renewable Energy and Equity Act, two renewable energy bills introduced in the 2018 Maryland General Assembly.
- **Section 4** concludes that Maryland’s RPS has failed to live up to its original expectations, in large part because it has failed to curtail its reliance on unbundled RECs. We recommend that Maryland replace the use of unbundled RECs with a system that requires Maryland utilities actually to purchase clean, renewable energy. We believe this will provide greater climate, job and economic benefits to Maryland residents.

Finally, the Appendix provides tables on the average price per non-solar REC for each year between 2008 and 2016, on the types of RECs purchased by Maryland utilities by fuel sources, year, state and facility between 2008 and 2016, and on the location and fuel source of non-solar renewable energy credits bought by Maryland utilities between 2008 and 2016.

“The use of unbundled RECs in Maryland undermines the state’s transition to clean electricity, costs ratepayers hundreds of millions of dollars, and impedes efforts to bring transparency and predictability to Maryland’s electricity sector.”

SECTION 1: MARYLAND'S RENEWABLE PORTFOLIO STANDARD

Maryland's RPS is intended to serve as the main driver for increasing the use of renewable electricity in Maryland. Maryland's definition of renewable energy includes sources like solar and wind, as well as polluting, carbon-emitting sources like burning wood and wood waste, chicken litter, municipal trash, black liquor, and landfill gas.

In passing the Renewable Portfolio Standard in 2004, the Maryland General Assembly stated that its intent was to:

- recognize the economic, environmental, fuel diversity, and security benefits of renewable energy resources;
- establish a market for electricity from these resources in Maryland; and
- lower the cost to consumers of electricity produced from these resources.¹

The General Assembly also found that:

- the benefits of electricity from renewable energy resources, including long-term decreased emissions, a healthier environment, increased energy security, and decreased reliance on and vulnerability from imported energy sources, accrue to the public at large; and
- electricity suppliers and consumers share an obligation to develop a minimum level of these resources in the electricity supply portfolio of the State.²

To achieve those goals, Section 7-703 of the Maryland Public Utility Code requires Maryland utilities to use RECs to satisfy their renewable energy requirements. A REC is issued when one megawatt-hour of electricity is generated from an eligible renewable energy source as defined in Maryland's RPS statute.³

Utilities can use their own RECs from the electricity they produce from renewable resources, or they can buy RECs from other utilities or brokers. For a REC to count toward Maryland's RPS, it must be "retired" and not used again.⁴

Generating a REC

Once electrons flow into the grid they are indistinguishable from one another, making it impossible to know whether they were generated by solar, coal or gas-fired power plants, municipal waste burning, or some other source. Issuing RECs helps address this tracking and accounting problem. PJM, the operator of the large electricity grid of which Maryland is a small part (about 8 percent), issues an electronic time, date, and power generating station ID stamp for each unit (megawatt-hour or MWh) of electricity generated within its purview. For sources designated as "renewable," this time, date, and power station ID become a "Renewable Energy Credit" or certificate (REC). The average retail price of a megawatt-hour (MWh) of electricity in Maryland in 2016 was about \$122 of which the generation component alone was about \$30, excluding transmission, distribution, and all other costs. The definition of "renewable energy" varies by state.



"The variation in the sources of the RECs from year-to-year, as well as the cost of RECs, indicates that essentially all Maryland RECs that are retired are unbundled."⁸

In Maryland, utilities are required to retire an increasing amount of RECs every year until 2020. Utilities must retire RECs equivalent to 18.3 percent of their electricity sales in 2018, 20.4 percent in 2019 and 25 percent by 2020.⁵

Generally, Maryland utilities can purchase RECs from any approved generators in the PJM grid⁶ or grids that feed into it. PJM covers all or portions of 13 states and the District of Columbia, stretching from the East Coast to Illinois. Including grids that feed into it increases the geographic coverage northward to New York, as far west as North and South Dakota, and as far south as Tennessee.⁷

Maryland also has specific in-state carve-outs for solar and offshore wind, which means utilities must purchase a certain percentage of RECs from these in-state sources. However, these carve-outs represent a very small percentage of the current RPS — 2.5% maximum for solar and 2.5% maximum for offshore wind.

Maryland allows utilities to retire bundled or unbundled RECs. A bundled REC is one sold with the electricity itself. That means the Maryland buyer — usually a utility — gets both the energy and the REC as a unit. If the energy and RECs are "unbundled," the facility owner sells the electricity to one utility and the RECs to another utility or other buyer.

In Maryland, utilities rely on unbundled RECs to meet their RPS requirements. The variation in the sources of the RECs from year-to-year, as well as the cost of RECs, indicates that essentially all Maryland RECs that are retired are unbundled.⁸

Here is an actual example of how the unbundled REC system works.

The owner of a wind farm in North Dakota sells the electrical output from a facility to a local utility in North Dakota, but sells the unbundled RECs corresponding to that same amount of electricity to a utility in Maryland.⁹ The Maryland utility can use the RECs to count toward Maryland's RPS requirements, even though the Maryland utility had to purchase actual electricity for its customers from some other generation source, most likely a power plant that uses coal, gas, or nuclear fuel.

Because utilities pass the cost of purchasing RECs on to their ratepayers, unbundled RECs are a subsidy from Maryland ratepayers to renewable energy producers, even producers in faraway places.

The original theory behind allowing utilities to purchase unbundled RECs was that the RECs would provide an additional income stream to developers and owners of renewable energy projects, like the owners of the wind farm in North Dakota. The extra income, it was hoped, would stimulate new development and production of more renewable energy that, at the time, was more expensive than fossil fuels. This system of financing renewable energy projects was deemed environmentally and economically desirable for Maryland at the time the RPS was passed.

However, this theory has not been borne out by Maryland's experience with unbundled RECs.

"Because utilities pass the cost of purchasing RECs on to their ratepayers, unbundled RECs are a subsidy from Maryland ratepayers to renewable energy producers, even producers in faraway places."

SECTION 2: THE PROBLEM WITH UNBUNDLED RECs

Since the RPS began operating in 2006, little attention has been given to the use of unbundled RECs to achieve compliance, and how that impacts actual energy consumption and production, ratepayer costs, and job creation in Maryland.

After analyzing the available data, we have found four key problems arising from Maryland’s use of unbundled RECs.

First, there is no available evidence that the unbundled non-solar RECs purchased by Maryland utilities are used to finance new renewable energy. Instead, unbundled RECs represent additional revenue for energy producers with no strings attached. This is good for the bottom line of energy producers, but not for the climate or the health of Maryland residents. It appears highly likely that unbundled RECs are not offsetting fossil fuel power generation, either in-state or out-of-state, but are costing Maryland residents money that could be put to better use supporting new, in-state renewables.

Second, there is no evidence that unbundled non-solar RECs bring significant economic development to the state. Most of the money Maryland utilities spend on unbundled RECs is spent outside the state. The local economic benefits and jobs associated with renewable energy development have been touted as a major selling point of the RPS program, but closer inspection reveals the vast majority of funds generated by Maryland’s purchase of unbundled RECs benefit other states.

Figure 1: Unbundled Non-Solar Renewable Energy Credits 2016
2016 Tier 1 Non-Solar Retired RECs by Fuel Source and Location of Producer: 7,216,439
Cost to Maryland Ratepayers: \$88,200,121

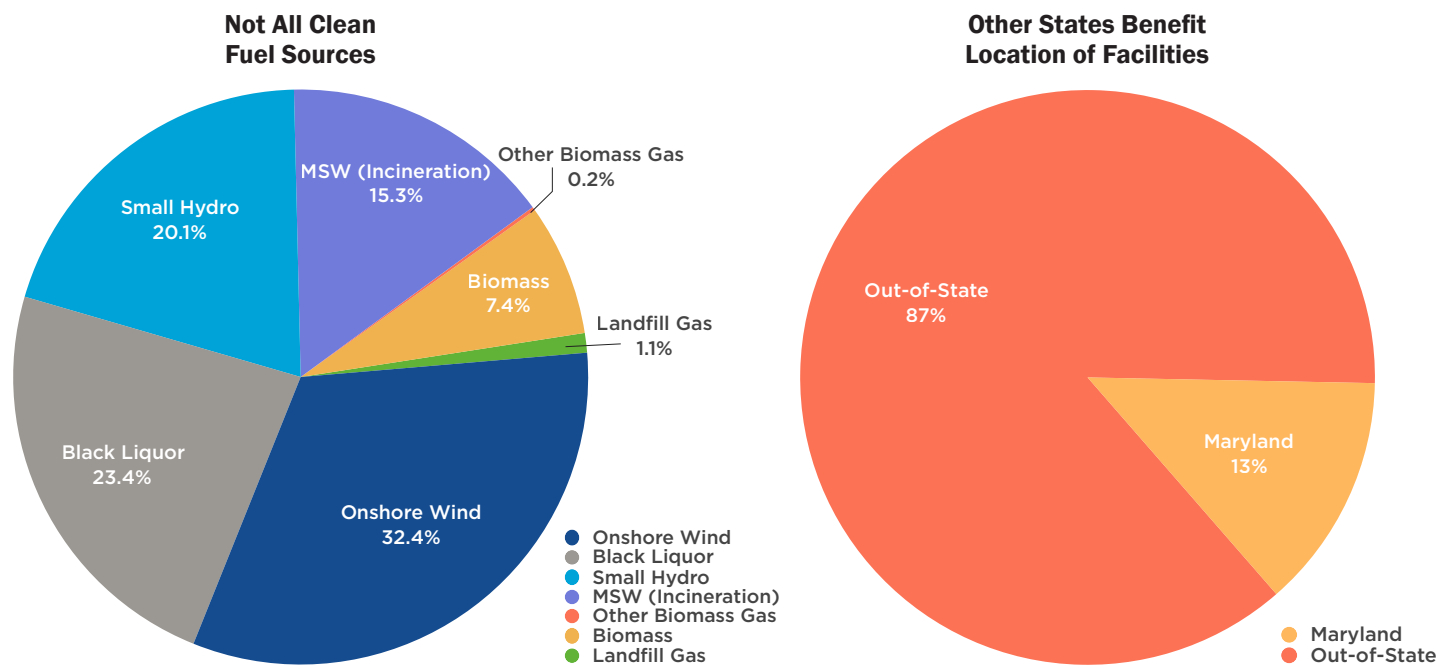


Figure 1: In 2016, Maryland utilities retired over 7 million non-solar Renewable Energy Credits (RECs) at a cost of over \$88 million to meet their requirements under the Renewable Portfolio Standard. Based on our review of Public Service Commission records, it is likely that all of these RECs were "unbundled," meaning no energy was purchased by the Maryland utilities as part of these transactions. Unbundled RECs are no-strings-attached subsidies to energy producers from Maryland ratepayers. Unbundled RECs allow utilities to continue to purchase electricity from fossil fuels sources while claiming credit for renewable energy that was produced and purchased elsewhere. And much of the energy subsidized by Maryland ratepayers is as bad or worse for the climate and human health than burning fossil fuels.

Third, Maryland allows utilities to buy RECs from sources that are neither clean nor “green.” Maryland defines power generation from the combustion of trash, biomass, and black liquor as “renewable,” yet these are among the most polluting sources of energy production available. Unfortunately, these sources provide nearly half the RECs used to satisfy the Maryland RPS. Residents who believe they are paying for environmentally preferable sources of energy are being deceived. They may well be using the same amount of fossil fuel or nuclear energy as previously, while subsidizing the burning of wood, trash and black liquor. An evaluation by the Maryland Energy Administration of the RECs retired by Maryland utilities in 2015 showed that the Tier 1 RECs (the main RECs in Maryland’s RPS) had higher CO2 emissions than Maryland’s normal electricity supply, which is a mix of coal, natural gas, and nuclear sources.¹⁰ The lack of understanding about Maryland’s RPS has caused misleading claims and incorrect statements about Maryland’s progress in mitigating climate change and reducing other forms of pollution.

“In 2015, Tier 1 RECs (the main RECs in Maryland’s RPS) had higher CO2 emissions than Maryland’s normal electricity supply, which is a mix of coal, natural gas, and nuclear sources. The lack of understanding about Maryland’s RPS has caused misleading claims and incorrect statements about Maryland’s progress in mitigating climate change and reducing other forms of pollution.”

Fourth, Maryland ratepayers are forced to pay extra money on their energy bills to cover the costs of unbundled REC purchases, but get few of the promised environmental, health, or economic benefits in return. We estimate that Maryland ratepayers spent over \$296 million for unbundled RECs between 2008-2016. These subsidies provided by Maryland ratepayers are wrong for all Maryland residents, but particularly for the many low-income residents who struggle to pay basic expenses and often must choose between rent, medical care, and energy bills.

To illustrate these problems, we discuss below the use of unbundled small hydro and wind RECs in Maryland’s RPS, as well as RECs from biomass, black liquor, incineration and other sources.

Table 1: Estimated Amounts Spent by Maryland Ratepayers to Buy Non-Solar Renewable Energy Credits (RECs) Under Maryland's RPS 2008-2016 (1)

State	Biomass	Small Hydro	Landfill Gas	Black Liquor	Tier 1 MSW*	OBG**	Wind	Total	%
Virginia	\$21,260,079.24	\$6,841,555.29	\$266,984.03	\$51,727,473.08	\$3,841,142.40			\$83,937,234.04	28.3%
Illinois		\$1,283,063.32	\$2,638,852.02				\$42,695,727.89	\$46,617,643.23	15.7%
Maryland		\$1,089,724.38	\$1,465,157.34	\$5,125,177.04	\$33,464,283.03		\$1,576,649.12	\$42,720,990.91	14.4%
Pennsylvania	\$207,622.89	\$16,567,856.12	\$1,572,453.67	\$4,916,688.19			\$11,067,662.30	\$34,332,283.17	11.6%
West Virginia		\$13,173,243.21					\$8,629,216.95	\$21,802,460.16	7.3%
New York		\$19,038,182.84						\$19,038,182.84	6.4%
Ohio	\$647,985.74		\$679,524.43	\$6,187,725.82		\$525,761.62	\$1,370,563.08	\$9,411,560.69	3.2%
Indiana							\$9,191,477.54	\$9,191,477.54	3.1%
North Carolina	\$1,183,593.19	\$291,884.23	\$253,915.12	\$7,308,854.31				\$9,038,246.85	3.0%
Tennessee	\$1,207,382.48		\$30,786.69	\$7,313,419.03				\$8,551,588.20	2.9%
North Dakota							\$3,534,149.15	\$3,534,149.15	1.2%
Iowa							\$3,318,428.58	\$3,318,428.58	1.1%
Missouri							\$2,151,927.26	\$2,151,927.26	0.7%
Michigan	\$409,130.86	\$233,925.22	\$263,366.53	\$123,336.46				\$1,029,759.07	0.3%
Kentucky	\$281,625.81	\$4,688.06	\$700,411.74					\$986,725.61	0.3%
New Jersey		\$233,925.22	\$375,191.16					\$609,116.38	0.2%
Delaware			\$378,757.72					\$378,757.72	0.1%
Wisconsin	\$4,950.88			\$32,419.64				\$37,370.52	0.0%
	\$25,202,371.09	\$58,758,047.89	\$8,625,400.45	\$82,735,093.57	\$37,305,425.43	\$525,761.62	\$83,535,801.87	\$296,687,901.92	100.0%

Table 1: Includes all Tier 1 sources of energy except in-state solar and geothermal and a few very unusual RECs -- Other Biomass Liquid, Blast Furnace Gas, and Agriculture Crops. Estimates are based on the average cost of RECs during the calendar year as reported by the Public Service Commission (PSC) in their annual reports on the Renewable Portfolio Standard. The actual cost of each individual REC purchase by a Maryland utility may vary and is not released by the PSC. See Appendix Table H for corresponding REC purchases.

Small Hydro Power

At first glance, one success of Maryland’s RPS would appear to be the huge increases in the use of small-scale hydropower. Between 2007 and 2016, the number of RECs purchased by Maryland utilities from small-scale hydro plants increased over 2,500 percent from 54,414 to 1,450,307, for a total of just over 7,300,000 RECs during this 10-year period.

There is no evidence, however, that the money used to purchase these RECs stimulated new investments in hydropower or brought any tangible economic benefits to Maryland.

Between 2007 and 2016, capacity and generation from small hydropower facilities have remained relatively steady both regionally and nationally.¹¹ Many of the dams that generate RECs for Maryland’s RPS have been producing hydropower for decades, some for over a century. In 2016, the largest number of RECs for small hydro-facilities went to dams that were built between 1901 and 1989.

In addition, most Maryland ratepayer money was sent out-of-state. In 2016, for example, Maryland utilities bought RECs from 41 small hydro plants; only two were in Maryland. Between 2008 and 2016, 38.93 percent of Maryland’s small hydro RECs came from New York; 25.17 percent came from Pennsylvania; 17.62 percent came from West Virginia; and 9.44 percent came from Virginia. The remainder came from Michigan, Illinois, and New Jersey.

What were these Maryland subsidies used for? We do not know. Did these subsidies benefit Maryland residents in any way? Probably not.

Maryland’s RPS has no mechanism to determine when out-of-state small hydro facilities need financial support to remain viable or expand production. Furthermore, if out-of-state dams do need financial assistance, there is no reason why Maryland ratepayers should provide this assistance instead of the state where the dam is located.

As just noted, a majority of Maryland’s small hydro RECs were sourced from New York and Pennsylvania in 2016, yet both states support their small hydro facilities with their own clean energy standards. In fact, New York designates in-state small hydro facilities that are at risk of closure as Tier II “maintenance” sources¹², but rather than requiring New York utilities to buy RECs from them, the state provides the facilities with direct support. That leaves these facilities free to sell their RECs to buyers in other states, even though they may no longer “need” the revenue.¹³ Under these circumstances, it is hard to fathom why Maryland residents should pay for these RECs.

An example from Illinois further demonstrates the problems with buying unbundled hydro RECs. In 2016 (see Table 2), a Maryland utility retired 16,983 unbundled RECs from energy produced by the Lockport Powerhouse Dam outside of Chicago.¹⁴ This appears to be the first time that a Maryland utility used RECs from this dam to meet its Maryland’s RPS requirements. The dam, **built in 1907**, produced 35.6 million kWh of electric power and generated \$990,097 in revenue in 2016. The dam is managed by the Metropolitan Water Reclamation District (MWRD) of Greater Chicago to optimize flood protection and water management for the businesses and homes within its service district.

One of the stated goals of this management entity is “to recover resources in a way that has a return on investment and can produce private sector jobs in our region.” The specific strategy outlined in its 2018 Update report with respect to the Lockport Dam is to “Market electrical capacity at Lockport to maximize return on investment.”

Maryland subsidies to the Lockport Dam helped MWRD achieve its goals for the greater Chicago area — they increased Chicago MWRD’s

Table 2: An Example of Small Hydro RECs: Lockport Powerhouse, Will County, Illinois

	Annual Power Generation MW	RECs sold to Maryland Utilities	Revenue from Power Generation
2017	37,583	Data not yet available	\$1,041,780.24
2016	35,595	16,983	\$990,097.68
2015	41,595	0	\$1,299,793.17
2014	41,518	0	\$1,390,418.00
2013	33,070	0	\$1,012,462.00
2012	23,589	0	\$686,081.00
2011	42,412	0	\$1,341,578.13
2010	36,333	0	\$1,093,103.26
2009	50,638	0	\$1,978,605.23
2008	49,021	0	\$2,728,545.44
2007	44,586	0	\$1,759,241.20
2006	40,946	0	\$1,742,566.04
2005	38,014	0	\$1,741,079.14
2004	38,677	0	\$1,769,698.61
2003	36,352	0	\$1,658,073.69
2002	42,389	0	\$1,949,350.25

Table 2: This chart illustrates how Maryland ratepayers are subsidizing old hydro dams that do not need subsidies from Maryland. The purpose of the Lockport Power House Dam, located outside of Chicago, is to optimize flood protection and water management in its service district and to market electricity to maximize a return on its investment. In 2016, a Maryland utility bought 16,983 unbundled RECs produced by the dam. These RECs showed up as new renewable energy in Maryland, although the dam has been operational since 1907. The dam operator sells its energy to ComEd, a local Illinois utility owned by Exelon. Maryland ratepayers received no discernible benefit from the tens of millions of dollars they have paid to subsidize out-of-state dams like Lockport.

return on investment — but they failed to bring economic benefits to Maryland, and cost ratepayers money that could have been better used to finance new wind and solar facilities built by Maryland workers.

Onshore Wind

Another success of Maryland’s RPS would appear to be the huge increases in RECs generated from wind. The number of RECs purchased annually by Maryland utilities from wind power increased from 0 in 2007 to 2,339,596 in 2016, for a cumulative total of just over 9,077,556 RECs.

A closer look at the data indicates that these purchases provided few benefits to Maryland ratepayers or Maryland’s economy. Our review of PSC data indicates that in 2016, Maryland utilities bought wind RECs from 9 states. Only one percent of the RECs came from Maryland. The vast majority of RECs came from Mid-western states. Forty-nine percent came from Illinois.

Table 3 shows that of the 40 facilities that sold RECs to brokers or utilities for compliance in Maryland, over half came online between 2003 and 2009. The financing for these projects was arranged years before Maryland utilities bought these RECs, making it unlikely that future Maryland REC sales were a necessary factor in enabling the projects to move forward. Most of the unbundled RECs are purchased via short-term contracts, making it impossible to know the extent to which Maryland ratepayers are financing new renewable energy, and if so, whether there are any benefits for Maryland.

Here are two examples that illustrate this point.

The first example is the Tatanka Wind Farm in North and South Dakota, which came online in 2008. In 2016, a Maryland utility purchased 282,055 RECs from the wind farm to meet the state’s RPS obligations. The second example is the Farmer City Wind Farm in Missouri, which came online in 2009. In 2016, a Maryland utility bought 171,742 RECs from this wind farm. This was the first time Maryland utilities bought RECs from these wind farms. Both wind farms are holdings of large international corporations. Although Maryland ratepayers are subsidizing these corporations, there is no evidence that these companies need subsidies from Maryland ratepayers or that the subsidies provided by Maryland ratepayers will benefit Maryland in any way.

The numbers of RECs procured by Maryland utilities from any one wind farm typically fluctuates greatly from one year to the next. For instance, Bishop Hill in Illinois, the largest source of wind RECs retired in Maryland in 2016, came online in 2012, but Maryland utilities did not buy any RECs from this wind farm until 2015.¹⁵ Few, if any, of the wind REC contracts appear to be long-term, the type of contract most conducive for unbundled RECs to stimulate new wind farm construction.

A valid question to ask is whether unbundled RECs are still needed to make large-scale wind development viable. The answer appears to be no. Another valid question is whether out-of-state wind RECs purchased by Maryland utilities have stimulated wind farm construction significantly. The evidence in favor of such a hypothesis is weak at best.

"A valid question to ask is whether unbundled RECs are still needed to make large-scale wind development viable. The answer appears to be no. Another valid question is whether out-of-state wind RECs purchases by Maryland utilities have stimulated wind farm construction significantly. The evidence in favor of such a hypothesis is weak at best."

**Table 3:
Year Wind Facilities Came
Online that Sold RECs into
Maryland in 2016**

Yr Online	No of Facilities	No of RECs
2003	1	10,481
2007	5	149,559
2008	4	381,669
2009	11	849,807
2010	4	65,349
2011	5	184,073
2012	7	690,828
2015	2	7,106
2016	1	724
	40	2,339,596

**Table 4:
Location of Wind
Facilities that Sold RECs
into Maryland in 2016**

Location	No of RECs	%
Illinois	1,149,225	49%
North Dakota	282,055	12%
Pennsylvania	265,164	11%
West Virginia	206,528	9%
Missouri	171,742	7%
Iowa	171,230	7%
Indiana	48,908	2%
Maryland	26,463	1%
Ohio	18,281	1%
	2,339,596	100%

Table 3: Maryland residents spend a lot of money subsidizing old onshore wind farms located very far from Maryland through the purchase of unbundled RECs. As this table illustrates, over half the wind facilities being subsidized by Maryland ratepayers came online between 2003 and 2009.

Table 4: Wind Farms in Illinois, North Dakota and Pennsylvania generated over 60% of the wind RECs bought by Maryland utilities. These wind farms do not need to demonstrate that they need Maryland subsidies to remain viable or to expand production, or that they will spend the money given to them by Maryland ratepayers in a way that provides benefits to Maryland.

Today in many parts of the U.S., including in states within PJM, wind is now the cheapest form of energy. Buyers who enter long-term power purchase agreements provide financial certainty for the developer. By contrast, the possibility that a Maryland utility may purchase unbundled wind RECs from the facility once it is in operation is less likely to affect the project's economic viability. These later REC sales merely put extra money in the pocket of the project's owner — and that project, as we have already noted, is unlikely to be in Maryland.

As discussed in Section 3, other leading states have been moving towards procuring wind RECs mainly from new in-state or nearby facilities through long-term contracts that provide certainty for developers and financiers. This includes Illinois, the source of almost half of Maryland's wind RECs.

Biomass, Black Liquor, and Incineration

Another serious problem with Maryland's RPS is that it allows utilities to purchase RECs from facilities that burn trash, biomass, pulp and paper, and other energy sources that are as bad or worse for human health and the climate as burning fossil fuels.

In 2016, almost half of Maryland's RPS came from these polluting energy sources. Allowing RECs from these sources siphons off money from Maryland consumers while increasing pollution.

"In 2016, almost half of Maryland's RPS came from these polluting energy sources. Allowing RECs from these sources siphons off money from Maryland consumers while increasing pollution."

BIOMASS

Take the burning of biomass. Maryland defines biomass to include mill residue, precommercial softwood thinning, slash, brush, yard waste and agricultural and silvicultural sources.¹⁶ In 2016, the burning of biomass accounted for 7.4 percent of Maryland's renewable portfolio standard. Facilities selling credits to Maryland were in Tennessee, Kentucky, North Carolina, Virginia and North Carolina.

Maryland has no biomass facilities approved to sell REC credits.

Treating woody biomass as a renewable fuel relies on a faulty assumption that newly-planted trees capture as much carbon dioxide as is emitted by the cutting and burning of mature trees. Not only is this not true in the near term, when carbon emissions matter most, but burning wood also causes more toxic air pollution than coal.¹⁷

"By selling unbundled RECs to Maryland, the Virginia utilities such as Dominion Energy save money for Virginia customers. That's very nice for Virginia customers, who already enjoy lower electricity rates than Marylanders, but it is hard to see where the benefit is for either Maryland or the environment."

Maryland residents have another reason to complain about paying for unbundled biomass RECs: none of the power serves Maryland. Two of the Virginia biomass plants that supply RECs to Maryland utilities are owned by Dominion Energy Virginia; another is owned by Northern Virginia Electric Cooperative. All three generate electricity to sell to Virginia residents.¹⁸ By selling unbundled RECs to Maryland, the Virginia utilities such as Dominion Energy save money for Virginia customers. That's very nice for Virginia customers, who already enjoy lower electricity rates than Marylanders, but it is hard to see where the benefit is for either Maryland or the environment.

Big corporations are not the only ones benefitting. Take the Kentucky company that sells credits to a Maryland utility from a biomass co-generation plant on the site of its mill. The co-generation facility has been in operation since 1994. The plant burns wood waste to produce steam and electricity that is used at the company's facility. The excess electricity is sold to East Kentucky Power. A spokesman for the company is quoted in a local newspaper as saying the system produced net savings of about \$1.2 million in 2014 and 2015, with rates of return even higher at other times.¹⁹ It seems obvious that the facility does not need the support of Maryland ratepayers to thrive. Kentucky itself has no RPS.

BLACK LIQUOR

Black liquor is another example of this problem. Black liquor accounts for 23.4 percent of Maryland's RPS. Black liquor is a waste product of the pulp and paper industry and has been used to produce energy at pulp mills since the 1930s. The use of black liquor as an energy source

makes these mills mostly self-sufficient for their electricity needs.

Maryland is the only state that defines black liquor as renewable energy for the purpose of their RPS. That means paper companies located anywhere in PJM or in grids that feed into the PJM look to Maryland consumers to subsidize their operations. Maryland ratepayer money generates an extra income stream for these pulp mills, with little or no energy added to the grid.

Environmentalists and health advocates have failed in past efforts to remove black liquor from the RPS because of concerns by legislators about the economic impact this would have on the Luke Paper Mill in Western Maryland. However, the Luke Paper Mill accounted for only 4.07 percent of black liquor RECs sold to Maryland in 2016. The rest came from facilities in Virginia, North Carolina, Ohio, and Tennessee.

If concern for the welfare of Luke Paper Mill is keeping black liquor in the RPS, the General Assembly could save money by simply writing the company a check. Better still, it would work with the company, the union representing the workers, and researchers to determine the kind of support needed to create a long-term job-supporting and ecologically sustainable paper production factory in the state.

WASTE-TO-ENERGY OR INCINERATION

Trash burning is another polluting source of RECs under the Maryland RPS. Waste-to-energy (WTE) plants — commonly referred to as incinerators — produce electricity, but they also produce toxic emissions — both greenhouse gases and conventional pollutants. These concerns have led other leading states to exclude or restrict the eligibility of WTE plants under their RPS laws.

One example is particularly instructive. A provision of the New Jersey RPS law makes out-of-state WTE plants eligible if the facility is located in a state with retail competition and receives approval from the New Jersey Department of Environmental Protection (DEP). Under this provision, RECs from the Covanta WTE plant in Fairfax, Virginia were being supplied to New Jersey utilities — until the DEP reviewed the facility and ruled it ineligible.²⁰ RECs from the Covanta plant are now being sold to Maryland utilities instead.

Landfill Gas and Other Biogases

Maryland's RPS also allows the use of unbundled RECs from landfill gas and other biomass gas. Landfill gas projects involve collecting methane to use as a fuel source to produce electricity that is distributed into the regional electric utility grid. Other biomass gas includes anaerobic digestion, which is used to manage wastes and produce fuels.

Between 2008 and 2016, Maryland utilities bought 1,676,884 RECs from landfill gas from 11 states; only 12% of those came from Maryland. Between 2013 and 2016, Maryland utilities bought 46,654 RECs from other biogas facilities. All of these were from Ohio.

The two examples below illustrate why urgent changes are needed to the use of unbundled RECs in Maryland's RPS.

The first reveals how Maryland ratepayers came to subsidize the bills of Oberlin, Ohio residents without producing a single new kilowatt-hour of clean electricity. According to an article in the Oberlin *News-Tribune*,²¹ Oberlin Municipal Light & Power System (OMLPS) bought RECs when purchasing energy, primarily from landfill gas-to-energy sites. That is, the Oberlin utility purchased electricity bundled with its RECs. The utility then

Figure 2: Virginia Comes Out on Top

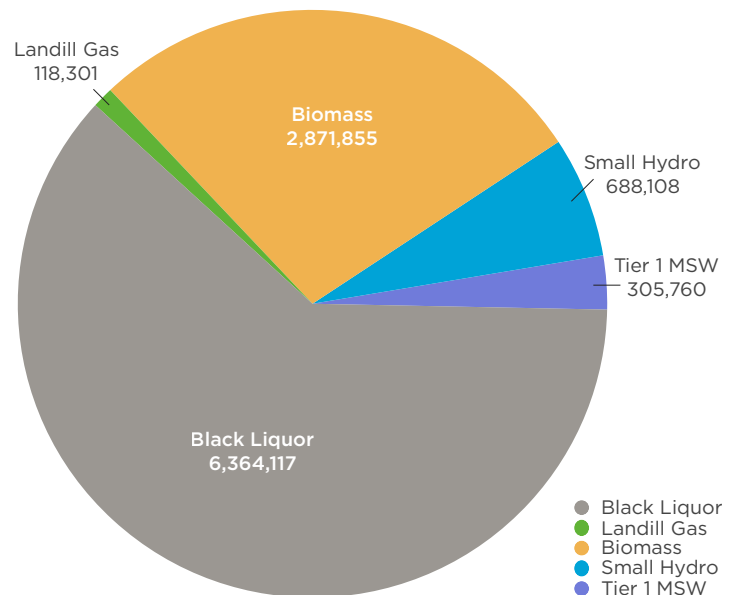


Figure 2: Between 2008-2016, Maryland ratepayers spent about \$84 million to buy about 10,348,141 unbundled renewable energy credits from Virginia, more than any other state. About 93 percent of these credits subsidized existing dirty energy sources that provided energy to Virginia utilities or companies. Virginia does not provide similar subsidies to these energy sources, and its residents have lower utility rates.

unbundled the RECs and sold the RECs at a profit to utilities in Maryland and other states, who then passed those costs on to their ratepayers.²²

The article in the News-Tribune describes RECs as allowing states “to meet stricter pollution standards without reducing pollution.”

Because OMLPS is a community-owned, not-for-profit electric utility, the Oberlin City Council voted to rebate to its customers \$2.2 million of the money made from selling these RECs to Maryland and the other states. The Council then voted to put the remaining funds in the utility’s sustainable reserve fund for energy conservation and efficiency programs.

Oberlin residents got the economic benefits from the development of the landfill gas project, the energy from the project, reduced air pollution and lower energy rates. Maryland ratepayers got higher bills and certificates the utility could apply to the state’s RPS, but no electricity. They had to buy that elsewhere.

The second case pertains to a biomass gas project involving a public-private partnership between the City of Wooster, Ohio and a private energy group to update and operate anaerobic digesters at the City’s Water Pollution Control Plant. Between 2014 and 2016, Maryland utilities bought 11,277 RECs generated from this facility.

According to a company fact sheet, the biogas produced by the digester generates enough electricity to allow the treatment plant to recognize \$500,000 in operational savings annually.²³

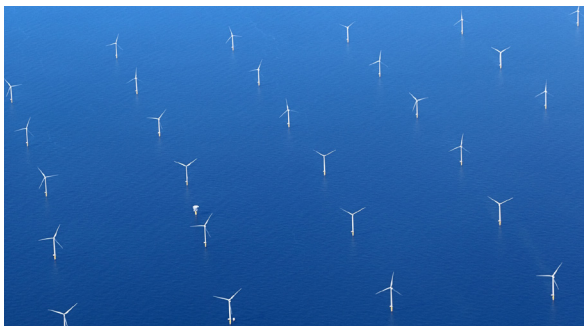
Ohio is the only state currently taking advantage of Maryland’s lax rules on unbundled RECs for other biomass gases. Maryland ratepayers have subsidized eight projects in Ohio since 2013 for an amount we estimate to be over \$500,000. These local development projects in Ohio result in significant financial returns for the Ohio communities involved while siphoning money away from potential Maryland development projects.

SECTION 3: FIXING A BROKEN SYSTEM

Other leading states have limited the use of unbundled RECs to maximize the benefits to their residents while managing costs. In California, at least 90% of program goals now must be met with bundled energy and RECs delivered to California. Only 10% of RECs may be unbundled.²⁴ Beginning in 2021, at least 65% of procurement must come from long-term contracts of 10 years or more, a requirement that helps developers get financing for new projects. Reporting from the state's investor-owned utilities shows wind, solar and geothermal dominate the REC sources.²⁵

Like California, New York recently increased its renewable energy goals to 50% by 2030. RECs must come from facilities that commenced operation after January 1, 2015, ensuring the law promotes new development, and either the facilities must be located in New York or the electricity must be delivered and sold in New York under contract. Most RECs are procured by power agency NYSERDA under 20-year contracts and then resold to utilities.²⁶

"In Maryland, there is a growing debate about the state's reliance on unbundled RECs to meet its energy target, but no clear consensus on a legislative path forward."



An Easy Fix

There is an easy fix to Maryland's RPS. With prices for renewable energy dropping rapidly, the Maryland General Assembly should require Maryland utilities to buy increasing amounts of clean, renewable electricity each year. That should end the use of unbundled RECs. Unbundled RECs allow Maryland utilities to continue the state's reliance on fossil fuel and nuclear power and cost Maryland ratepayers tens of millions of dollars a year. Other states have had the courage to end or limit the costly practice of using unbundled RECs.

Illinois updated its RPS in 2017. Although the law retained its existing goal of 25% by 2026, it significantly tightened eligibility. At least 75% of the RECs must come from wind and solar projects, and facilities must be located in Illinois, or in an adjacent state if the facility meets a public interest test. The Illinois Power Agency now procures RECs for utilities using 15-year contracts.²⁷

In Maryland, there is a growing debate about the state's reliance on unbundled RECs to meet its energy target, but no clear consensus on a legislative path forward. During the 2018 legislative session, two bills were introduced to increase the RPS that would have addressed the issue of unbundled RECs in very different ways.

One bill, the Clean Energy Jobs Act (CEJA), would have increased the RPS to 50 percent by 2030. Under the CEJA, Maryland utilities would have to retire RECs from in-state solar and offshore wind equal to about 20 percent of their electricity sales. The remaining 30 percent, about 17 million RECs in 2030 or just over 163 million RECs between 2020 and 2030, could come from any unbundled REC sources that qualify as renewable energy, including onshore wind, biomass, black liquor, landfill gas, and anaerobic digestion.²⁸

The other bill, the 100% Clean Renewable Energy and Equity Act, would have eliminated the unbundled REC system and required Maryland electricity suppliers to purchase solar, wind, small-scale hydroelectricity, or ocean tidal-generated electricity equal to 100% of their in-state retail sales in 2035.²⁹

We expect variations on both bills to be introduced during the 2019 legislative session, and that discussions will continue on whether to allow Maryland utilities to use unbundled RECs to meet their RPS requirements.

SECTION 4: FINDINGS AND RECOMMENDATIONS

Our review of Maryland's RPS has found that it does little to incentivize new clean renewable energy production that benefits Maryland's economy. This is because the law allows utilities to purchase unbundled RECs to meet their renewable mandates.

Maryland ratepayers, through the use of unbundled RECs, are essentially subsidizing:

- Forms of energy production that pollute the air, water, and soil, and add greenhouse gases to the air;
- Job creation in other states;
- Existing renewable energy projects that were built long ago, have not expanded, and may not even need subsidies any longer to be profitable; and
- The internal business operations of industries producing energy from their waste products for their use.

In many cases, the technologies involved are neither clean nor "green," and many purchases are less about buying renewable energy and more about corporate welfare.

If Maryland increases its RPS targets without addressing these deficiencies, we will find ourselves paying more, yet not gaining the benefits we expect. Simply buying more unbundled RECs from other states leaves us using electricity predominantly produced by fossil fuel and nuclear power plants. This unbundled REC mechanism fails to deliver the promised economic opportunities and health benefits of replacing fossil fuels with clean, renewable energy. In fact, it further subsidizes pollution and damage to public health.

"Maryland has an opportunity today to take the next big step towards a grid built on clean, renewable energy. Making the most of that opportunity requires learning from our years of experience what works and what doesn't, what delivers tangible benefits and what merely costs more."

This does not have to be the case. Much has changed in the 14 years since Maryland first adopted an RPS. Technological advances and steep price declines have made wind and solar among the cheapest sources of electricity available in most states today. Many utilities now increasingly favor these clean renewables to meet new demand and replace aging fossil fuel plants. As a result, states can reasonably insist that utilities prioritize new clean, renewable energy in the electricity delivered to their residents — not just buy unbundled RECs from existing projects in other states.

As this report has discussed, other leading states like California, New York, and Illinois are beginning to do this. Maryland has an opportunity today to take the next big step towards a grid built on clean, renewable energy. Making the most of that opportunity requires learning from our years of experience what works and what doesn't, what delivers tangible benefits and what merely costs more.

Buying unbundled RECs, including from poor-quality, out of state projects is bad climate and economic policy, and it leads to misleading claims about the progress we are making in cleaning up our power grid. These subsidies would be better spent building a clean energy economy in Maryland.

ENDNOTES

- 1 MD Pub Util Code § 7-702(a) (2017)
- 2 MD Pub Util Code § 7-702(b) (2017)
- 3 MD Pub Util Code § 7-704 (2017)
- 4 The retirement of a REC means that the REC has been used by the owner and can no longer be sold. Maryland RECs are tracked on Generation Attribute Tracking System (GATS), a system managed by PJM Interconnection, the regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia.
- 5 <https://www.energy.gov/savings/renewable-energy-portfolio-standard>
- 6 The electrical grid consists of the network of generating facilities and wires that delivers electricity from producers to consumers. As a grid operator, PJM ensures that sufficiency and reliability of electric service within its territory, but it does not itself own generating facilities or the transmission and distribution wires.
- 7 <https://www.eia.gov/todayinenergy/detail.php?id=790>
- 8 Maryland's Public Service Commission (PSC) provides limited information on RECs in an annual report it publishes on the implementation of Maryland's RPS program. The report contains information on RECs retired by fuel source, by state, and by facility location. It also contains the average annual costs of a REC. The report does not contain important information such as the name of the Maryland utility retiring the RECs, the name of the entity selling the RECs, the costs for individual REC purchases, and whether the RECs were bundled or unbundled. Chesapeake PSR has sent a Public Information Act to obtain this information from the PSC.
- 9 Note that North Dakota does not have a mandatory RPS of its own. So in this example, residents of North Dakota get the economic and job benefits of having wind energy generated in their state, but Maryland utility customers partially pay for it.
- 10 See Slide 14 in MEA's May 21, 2015 EmPOWER and RPS Progress Update at <http://mde.maryland.gov/programs/Air/ClimateChange/MCCC/MWG/MWGHandout3MEA05212015.pdf>
- 11 <https://www.nrel.gov/docs/fy18osti/70098.pdf>
- 12 State of New York Public Service Commission, Order Adopting Measures for the Retention of Existing Baseline Renewable Resources, March 16, 2018. <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={E39056A8-0C5B-4116-B51C-F7DD-BABD4134}>
- 13 NYSERDA Director of Large Scale Renewables Doreen Harris explained in an email: "Financial support for Tier 2 resources is provided by the state on a case-by-case basis and is based upon the financial need to the generating unit. This financial support is not a REC contract, and therefore the Tier 2 generator retains the RECs and can pursue other sources of compensation for their RECs."
- 14 <https://www.mwrd.org/irj/portal/anonymous/Lockport>
- 15 <https://www.illinoiswindmills.org/wind-farms>
- 16 §701(l)
- 17 See <https://insideclimatenews.org/news/20140409/epa-loopholes-allow-biomass-emit-more-toxic-air-pollutants-coal-study-says>
- 18 See Public Service Commission of Maryland, Renewable Energy Portfolio Standard Report, January 2018, Appendix A, page 24. NOVEC owns the VP South Boston facility, in service since 2013; Dominion owns the Hopewell facility, also placed in service in 2013, and the Multitrade plant in Pittsylvania, which dates to 1994. The three facilities are discussed in Center for Natural Capital, Biomass and Bioenergy in Virginia: State of the State 2014, page 11. Available at <http://naturalcapital.us/wp-content/uploads/2014/08/State-of-Biomass-and-Bioenergy-in-Virginia-Version-1-8-26-14.pdf>.
- 19 <http://www.kentucky.com/news/state/article123737059.html>
- 20 http://www.njcleanenergy.com/files/file/Renewable_Programs/6-18-14-8B.pdf
- 21 <https://www.theoberlinnewstribune.com/news/4722/rec-use-complicated-controversial>
- 22 <https://www.ecowatch.com/this-small-town-generated-2-million-from-selling-recs-now-they-have-to-1882193138.html> This article states the city sold the RECs at a high price and replaced them with cheaper wind RECs, a practice known as REC arbitrage. Arbi-

trage allows a provider to meet RPS requirements more cheaply—in this case, at the expense of Maryland consumers.

- 23 https://americanbiogascouncil.org/projectProfiles/woosterOH_to_print.pdf
- 24 See the table at http://www.energy.ca.gov/portfolio/pous/cerritos/Cerritos_RPS_Plan.pdf At least 75% must be in-state, at most 10% can be unbundled, and the rest is “PCC-2” which is bundled energy-REC contracts that can be out of state electricity.
- 25 See California Public Utilities Commission, Renewables Portfolio Standard Annual Report, November 2017, http://www.cpuc.ca.gov/uploadedFiles/CPUC_Website/Content/Utilities_and_Industries/Energy/Reports_and_White_Papers/Nov%202017%20-%20RPS%20Annual%20Report.pdf
- 26 See State of New York Public Service Commission, Order adopting a clean energy standard, August 1, 2016. Available at <https://www.nysed.gov/All%20Programs/Programs/Clean%20Energy%20Standard>
- 27 Illinois Power Agency Act, <http://www.ilga.gov/legislation/ilcs/ilcs5.asp?ActID=2934&ChapterID=5>
- 28 The Clean Energy Jobs Act of 2018 proposed to remove waste-to-energy or incineration from the definition of renewable energy.
- 29 Chesapeake Physicians for Social Responsibility supported the 100% Clean Renewable Energy and Equity Act and opposed the Clean Energy Jobs Act.

APPENDIX A*

Table A: Average Price Per Non-Solar REC

2008	2009	2010	2011	2012	2013	2014	2015	2016
0.94	0.96	0.99	2.02	3.19	6.70	11.64	13.87	12.53

Table B: Number of Black Liquor RECs Purchased by Maryland Utilities by Year, State and Facility

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total 2008-2016	%
Maryland											
Luke Mill	58,145	89,739	55,205	244,937	106,251	120,290	130,022	65,887	68,855	939,331	9.22%
Virginia											
Covington	111,015	69,777	86,808	338,558	203,209	180,466	438,799	419,126	341,348	2,189,106	
Hopewell Mill	51,952		198,430	196,913	82,984	147,125	147,921	187,071	159,444	1,171,840	
Franklin Mill	40,921	207,624	103,403	171,627	228,182	143,655	336,186	220,076	208,420	1,660,094	
West Point Mill					190,912	266,013	317,812	285,235	254,582	1,314,554	
MeadWestvaco							28,523			28,523	
VA Total	203,888	277,401	388,641	707,098	705,287	737,259	1,269,241	1,111,508	963,794	6,364,117	62.44%
Ohio											
PH Glatfelter	162,215									162,215	
Chillicothe					53,086	110,997	120,918	154,392	125,564	564,957	
OH Total	162,215				53,086	110,997	120,918	154,392	125,564	727,172	7.13%
Michigan											
Escabana	43,000		83,754							126,754	1.24%
Pennsylvania											
PH Glatfelter		23,586	308,507	86,057			15,207			433,357	
Spring Grove					52,767	174,681	112,976	81,811		422,235	
Johnsonburg Mill							2,607	30,208		32,815	
PA Total		23,586	308,507	86,057	52,767	174,681	130,790	112,019		888,407	8.72%
Wisconsin											
Kaukauna				352	9,940					10,292	0.10%
Tennessee											
AEP W Kingsport							131,326	234,402	202,205	567,933	5.57%
North Carolina											
Kapstone							44,991			44,991	
Kapstone Kraft							13,532	179,995	158,729	352,256	
Domtar Paper									170,969	170,969	
NC Total							58,523	179,995	329,698	568,216	5.57%
Total	467,248	390,726	836,107	1,038,444	927,331	1,143,227	1,840,820	1,858,203	1,690,116	10,192,222	100.00%

* Data compiled from Public Service Commission of Maryland, Renewable Energy Portfolio Standard reports, 2008-2016

Table C: Number of Small Hydro RECs Purchased by Maryland Utilities by Year, State and Facility

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total 2008-2016	%
Maryland											
Deep Creek	7,898	32,144	530	27,876	11,512	35,030	21,703	5,000	26,735	168,428	
KC Brighton									5,285	5,285	
MD Total	7,898	32,144	530	27,876	11,512	35,030	21,703	5,000	32,020	173,713	2.38%
Virginia											
AEP Buck								60,318	55,920	116,238	
AEP Fries		114		22,672		25,283	30,989	16,086	30,141	125,285	
Big Shoals		334	548	3,204	141	1,443	2,089	2,000	1,394	11,153	
Brasfield							18,409	8,387	12,268	39,064	
Coleman Falls		533	1,719	8,868	1,353	5,153	6,654	8,273	6,055	38,608	
Cushaw							12,328	8,816	7,535	28,679	
Halifax							3,350	2,214	4,014	9,578	
Holcomb Rock		1,403	1,575	12,503	2,543	8,164	11,186	10,975	11,513	59,862	
Lakeview							1,289	1,633	997	3,919	
Niagara						3,119	6,046	5,505	718	15,388	
Schoolfield		200	10	29,145	18,130	18,384	7,179	13,528	28,126	114,702	
Snowdon		3,817	3,288	16,878	5,400	17,671	16,173	17,579	17,495	98,301	
VP Emporia						5,986	5,719	7,783	7,843	27,331	
VA Total		6,401	7,140	93,270	27,567	85,203	121,411	163,097	184,019	688,108	9.44%
Michigan											
French Paper							837	6,879	10,277	17,993	0.25%
Pennsylvania											
Allegheny				36,240					60,559	51,679	148,478
Allegheny 5					38,833	17,451					56,284
Allegheny 5-1			25,679				18,223				43,902
Allegheny Lock				69,111	38,819	22,577	18,518	64,497	47,429	260,951	
Allegheny River					79,339		176,679	199,448	168,865	624,331	
Allegheny River 8						76,616				76,616	
Allegheny River 9						168,467				168,467	
Conemaugh	5,070	430	26,701	55,027	30,533	29,311	29,982	4,889	20,000	201,943	
Piney	12,217	43,700	10,366							66,283	
York Haven								47,676	139,416	187,092	
PA Total	17,287	44,130	62,746	160,378	187,524	314,422	243,402	377,069	427,389	1,834,347	25.17%
West Virginia											
AEP Glen Ferris							4,453	19,766	23,790	48,009	
AP Misc Hydro	15,378	46,570	60,523	60,061	41,120	26,551	22,218	71,338	52,599	396,358	
London						35,743	76,148	70,155	92,532	274,578	
Marmet						26,889	85,193	63,698	66,784	242,564	
Winfield						25,137	89,638	94,033	113,815	322,623	
WV Total	15,378	46,570	60,523	60,061	41,120	114,320	277,650	318,990	349,520	1,284,132	17.62%

Table C: Number of Small Hydro RECs Purchased by Maryland Utilities by Year, State and Facility (cont.)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total 2008-2016	%
Wisconsin											
Little Quinnesec			2,131	26,210	21,700					50,041	0.69%
Kentucky											
Mother of Ann Lee								338		338	0%
North Carolina											
Blewett			192,754	7,846	16,900						
Marshall			15,505	7,895							
NC Total			208,259	15,741	16,900					240,900	3.31%
New Jersey											
Great Falls							10,616	6,681	19,131	36,428	0.50%
Illinois											
Dixon				2,385	15,914	14,418	3,829	13,593	26,075	76,214	
Lockport									16,983	16,983	
Upper Sterling					1,044	4,933	6,582	9,491	9,068	31,118	
IL Total				2,385	16,958	19,351	10,411	23,084	52,126	124,315	1.71%
New York											
Beardslee			33,335	8,444	21,758	6,357	23,526	37,681	39,734	170,835	
Beebee Island						1,327	17,644	23,383	37,137	79,491	
Black River							13,815	22,175	9,096	45,086	
Deferiet						7,946	27,795	53,202	35,402	124,345	
E.J. West			53,708	21,221	22,000	31,340	57,237	38,911	37,485	261,902	
Granby			8,567	19,960	5,421	17,558	17,341	33,740	26,297	128,884	
Inghams	33,436	43,584	24,578	25,190	12,229	1,413	8,664	11,011	5,987	166,092	
Lyon Falls								10,289	14,670	24,959	
Prospect	16,398	58,489	54,703	132,359	32,387	26,659	41,129	73,240	39,700	475,064	
Soft Maple						4,131	14,797	18,894	21,832	59,654	
Trenton	121,474	235,925	122,311	204,602	117,600	93,911	180,532	115,906	108,485	1,300,746	
NY Total	171,308	337,998	297,202	411,776	211,395	190,642	402,480	438,432	375,825	2,837,058	38.93%
Total	211,871	467,243	638,531	797,697	534,676	758,968	1,088,510	1,339,570	1,450,307	7,287,373	100.00%

Table D: Number of Biomass RECs Purchased by Maryland Utilities by Year, State and Facility

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total 2008-2016	%
Virginia											
Multitrade of Pittsylvania	257,213	166,089	72,883	255,848	380,745	58,189	65,619	65,873	43,268	1,365,727	
Hopewell Mill	15,648		22,715	73,195	33,504	29,073	21,223	22,966	10,355	228,679	
Covington Mill (Facility)	6,907			41,401				160,732	58,940	267,980	
Covington Mead Westvaco			12,263		20,509	43,807	43,958			120,537	
West Point Mill						27,881	82,514	58,307	5,856	174,558	
VP South Boston							116,394	332,971	265,009	714,374	
VA Total	279,768	166,089	107,861	370,444	434,758	158,950	329,708	640,849	383,428	2,871,855	77.50%
Michigan											
Cadillac RE	75,328	125,617	69,942	6,925						277,812	
Hillman	6,686	49,883	81,138							137,707	
MI Total	82,014	175,500	151,080	6,925						415,519	11.21%
Pennsylvania											
Viking Energy Northumbeland			8,944	8,894	28,645	13,347				59,830	1.61%
Wisconsin											
Kaukauna					1,552					1,552	0.04%
Kentucky											
Cox Waste							7,958	8,681	5,474	22,113	0.60%
North Carolina											
VP Cravenwood	4,756	444	55,000							60,200	
Kapstone Kraft								1,565	323	1,888	
Domtar Paper									87,669	87,669	
NC Total	4,756	444	55,000					1,565	87,992	149,757	4.04%
Tennessee											
AEP W Kingsport								32,684	60,180	92,864	2.51%
Ohio											
Coshocton Mill	5,300		9,305	40	35,022	626	27,422	14,319		92,034	2.48%
Total	371,838	342,033	332,190	386,303	499,977	172,923	365,088	698,098	537,074	3,705,524	100%

Table E: Number of On-Shore Wind RECs Purchased by Maryland Utilities by Year, State and Facility

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total 2008-2016	%
Illinois											
Adam								1,772	438	2,210	
Bishop Hill								350,000	597,150	947,150	
Mendota Hills	6,242	10,000	4			9,188				25,434	
COM High Trail		1,276		9,667			8,237		80,016	99,196	
COM Old Trail			1,152	38,644	95,273	1,048	30,713			166,830	
COM Grand Ridge				38,956			66,753	19,722		125,431	
COM Eco Grove				19,376	41,685	49,691	25,000	5,557	1,051	142,360	
COM Minonk							44,812	20,502	16,246	81,560	
Cayuga Ridge				766	138,364	387,486	476,647	384,970	406,542	1,794,775	
Big Sky					87,048	32,951	115,500		12,076	247,575	
Camp Grove					14,788	38,065	73,754	433	6,353	133,393	
Grand Ridge									5,526	5,526	
Grand Ridge 1					10,627	92,929				103,556	
Grand Ridge 2						42,480				42,480	
Grand Ridge 3					2,756	45,483				48,239	
Top Crop					55,614		24,505	4,135	11,989	96,243	
Top Crop 1						36,419				36,419	
Top Crop 2						25,000				25,000	
Crescent Ridge							46,793			46,793	
Providence Hts.									11,838	11,838	
IL Total	6,242	11,276	1,156	107,409	446,155	760,740	912,714	787,091	1,149,225	4,182,008	46.10%
Iowa											
Century 1		4,677	23	147,309	121,351					273,360	
Crystal Lake								19,235	76,429	95,664	
Crystal Lake Wind								15,641	94,801	110,442	
IA Total		4,677	23	147,309	121,351			34,876	171,230	479,466	5.29%
West Virginia											
AP Beech Ridge				43,121	15,939	65,749	45,788	27,650	9,699	207,946	
Ap Greenland									24,501	24,501	
AP Greenland Gap				42,218	47,603	28,961	32,847	36,067		187,696	
AP Laural								5,458	770		
Laurel Mountain						24,341	14,368			38,709	
Pinnacle						51,488	113,749	151,232	171,558	488,027	
WV Total				85,339	63,542	170,539	206,752	220,407	206,528	953,107	10.51%
Maryland											
Klondike Rd Wind				118	108	201	183	169	141	920	
Criterion					129,409	31,093		239		160,741	
Roth Rock						32,016	8,727	21,494	26,322	88,559	
MD Total				118	129,517	63,310	8,910	21,902	26,463	250,220	2.76%
Missouri											
Farmer City									171,742	171,742	1.89%

Table E: Number of On-Shore Wind RECs Purchased by Maryland Utilities by Year, State and Facility (cont.)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total 2008-2016	%
Pennsylvania											
Meyersdale Windpower		3,711	8,314		11,906	34,618	27,796		10,481	96,826	
PN Stoney Creek			383	69,511	72,818	100,915	67,174	74,607	42,709	428,117	
PN Allegheny Ridge				18,000		77,953	57,512		38,251	191,716	
PN Armenia Mt				6,093	2,025	32,696		13,790	7,362	61,966	
PL Locust Ridge				1,335	5,500	26,738	5,346	6,338	6,014	51,271	
Highland North					7,400	37,420			3,323	48,143	
PN Highland							25,000			25,000	
PN Lookout							7,967		81,762	89,729	
Lookout						2,098		53,590		55,688	
PN Mehoopany							113,155		69,081	182,236	
Mehoopany						74,164		99,224		173,388	
Sandy Ridge						3,305			441	3,746	
Twin Ridges						15,000			2,775	17,775	
AP South Chestnut							338	2,985	1,153	4,476	
AP Twin Ridges							6,644			6,644	
Laurel Hills								1,776		1,776	
Patton								1,360	1,812	3,172	
PA Total		3,711	8,697	94,939	99,649	404,907	310,932	253,670	265,164	1,441,669	15.89%
Indiana											
Fowler Ridge								35,089	320	35,409	0.60%
AEP Fowler Ridge								70,540	31,336	101,876	
Fowler Ridge 1					48,784	60,525				109,309	
Fowler Ridge II							113,701			113,701	
Fowler Ridge 3					11,587	61,256				72,843	
Meadow Lake 1					96,223	92,555				188,778	
Meadow Lake 2					16,975	50,600				67,575	
Meadow Lake 3						53,235				53,235	
Meadow Lake 4					201	32,367				32,568	
AEP Fowler Ridge		353	8,343	9,852	93,773	134,635	49,832			296,788	
AEP Meadow Lake							40,053	13,176	17,252	70,481	
AEP Wildcat							35,651	973		36,624	
IN Total		353	8,343	9,852	267,543	485,173	239,237	119,778	48,908	1,179,187	13.00%
Ohio											
Blue Creek					4,373	42,841	27,173	22,440	10,451	107,278	
Haviland Wind							13,562	3,974		17,536	
Findlay									2,904	2,904	
Harpster									724	724	
Zephyr									4,202	4,202	
OH Total					4,373	42,841	40,735	26,414	18,281	132,644	1.46%
North Dakota											
Tatanka									282,055	282,055	3.11%
Total	6,242	20,017	18,219	444,966	1,132,130	1,927,510	1,719,280	1,464,138	2,339,596	9,072,098	100%

Table F: Number of Landfill Gas RECs Purchased by Maryland Utilities by Year, State and Facility

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total 2008-2016	%
Virginia											
I-95 Landfill	1,593			37,408	560						
Martinsville						3,806	711		4,040		
Richmond Electric	6,642		90	5,924	251	1,081					
VP Amelia					3,215	1,748		1,392	6		
VP Brunswick								1,526			
VP Bethel									3,230		
VP Charles City					1,352				2,258		
VP Chesterf						1,172	1,680		1,221		
VP King								77	3,623		
VP King and Queen						1,790	2,000				
VP King George					2,185	1	374				
VP Henrico					1,559						
VP Northeast					1,307			4,323	11,194		
VP Peninsula					7,400			990			
Westchester							572				
VA Total	8,235		90	43,332	17,829	9,598	5,337	8,308	25,572	118,301	7.05%
Pennsylvania											
Archibald					35,658	14,262					
PL Archibald				12,918	10,340	10,800	3,472	223			
Archibald Power Station				48,037			31,559				
AP Arden				5,545	4,523	4,241		1,685	5,294		
AP Upton					4,521		360				
Broad Mountain				2,033		4,900	2,699	875	4,207		
Lakeview Gas				4,071	5,738	1,512	981		683		
PL N Lebnon				493							
Fairless Hills					43,769			1,670	1,330		
PE Pottstown					5,154	2,291	1,576				
PL Pine Grove					1,109		546				
PE SE Ches Co						1,286	461	19			
Tullytown						4,282	2,420	4,329			
PA Total				73,097	110,812	43,574	44,074	8,801	11,514	291,872	17.41%
Delaware											
Croda Atlas Pt								4,654	750		
Edge Moor	29,165	36,839	48,639	54,111	17,647						
DPL Southern				10,279		385					
DPL Central				2,443							
DE Total	29,165	36,839	48,639	66,833	17,647	385		4,654	750	204,912	12.22%
North Carolina											
New Bern								10,452	8,496		
Charlotte Motor Speedway	2,650										
NC Total	2,650							10,452	8,496	21,598	1.29%

Table F: Number of Landfill Gas RECs Purchased by Maryland Utilities by Year, State and Facility (cont.)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total 2008-2016	%
Maryland											
AP Reichs Ford				915			36				
BC Alpha Ridge						3,941			57		
BC Millersville						16,773	7,625	2,087	5,803		
BWWTP					8,738	7,407			4,707		
BWWTP Co-Gen Plant			97	1,989			11,704				
DPL NWLND					894		1,691	8,218	5,923		
PEP Ritchie Brown				6,281	2,845	8,385	6,574	2,747	10,267		
PEP Oaks						88	6,106	711			
PEP Gude							1,742				
PEP Ritchie PG		20,938	5,181		6,149	2,767	5,035	1,419	403		
PEP Ritchie PG Cogen				11,029							
Worcester County					1,774	7,126					
MD Total		20,938	5,278	20,214	20,400	46,487	40,513	15,182	27,160	196,172	11.70%
Ohio											
FE Erie County							353	2,018	3,026		
Lorain County								16,733			
FE Lorain								8,641			
FE Geneva							2,311		3		
FE Mahoning							2,192	2,104	1,022		
FE Carbon Alum							4,954	7,604			
OH Totals							9,810	37,100	4,051	50,961	3.04%
Illinois											
CID					4,743	9,206		7,417	724		
CID LFG Turbines				3,403			3,945				
COM Proviso				5,000							
Des Plaines				1,069	939	332	2,830				
Mallard Lake	21,864			3,627	10,000	7,602	7,680	3,247	1,356		
Rockford Electric	2,096										
Quad Cities	1,593										
South Barrington Electric	510			5,525							
Lake Gas Recovery		899		5,404	9,676	11,597	2,552	9,525			
Kankakee		197		2,221	3,156	5,247	995				
Settlers Hill				11,697	17,383	19,272	4,034	4,978			
Greene Valley				10,075	9,054	17,305	4,954	16,602			
Beecher				7,925		598	6,598				
Woodland				7,251	8,838	18,380	5,203	26,412			
Westchester				228	443	125					
Prairie View						9,886	6,907	1,685			
Rochelle Energy						9,013		1,866			
IL Total	26,063	1,096		63,425	64,232	108,563	45,698	71,732	2,080	382,889	22.83%

Table F: Number of Landfill Gas RECs Purchased by Maryland Utilities by Year, State and Facility (cont.)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total 2008-2016	%
New Jersey											
Monmouth						109		1,746	752		
Monmouth Landfill				1,262							
O'Brien Edgeboro						28,968	6,415	3,286			
Pennsauken Landfill				11,851							
NJ Totals				13,113		29,077	6,415	5,032	752	54,389	3.24%
Michigan											
Arbor Hills	101,681	84,701	39,456								
Lyon Dev	9,070		10,726								
C&C Electric	7,552	13,682	8,115								
MI Total	118,303	98,383	58,297							274,983	16.40%
Tennessee											
Chestnut Ridge					9,651					9,651	0.58%
Kentucky											
Bavarian						5,991	6,998	5,264			
Green Valley						3,181	3,943	2,409			
Hardin County						7,039	5,287	677			
Laurel Ridge						4,060	5,307	1,686			
Pendleton County						10,778	7,120	1,416			
KY Total						31,049	28,655	11,452		71,156	4.24%
Total	184,416	157,256	112,304	280,014	240,571	268,733	180,502	172,713	80,375	1,676,884	100%

Table G: Other Biogas RECs Purchased by Maryland Utilities by Year, State, Facility

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total 2008-2016
Ohio										
AEP Zanesville							331	28		359
Buckeye BioGas						1,186	1,235	1,037	2,433	5,891
Central Ohio						5,340	3,588	833	3,678	13,439
French Creek							960	232	1,225	2,417
Haviland Energy						1,699	3,125	1,229	2,062	8,115
Van Erk Dairy								460	1,209	1,669
Wooster Renewable							3,905	2,366	5,906	12,177
Zanesville Energy						1,275	440	279	593	2,587
Total						9,500	13,584	6,464	17,106	46,654

**Table H: Location and Fuel Source of Non-Solar Renewable Energy Credits (RECs)
Bought by Maryland Utilities Under Maryland's RPS 2008-2016**

State	Biomass	Small Hydro	Landfill Gas	Black Liquor	Tier 1 MSW* *incineration	Other Biomass Gas	Wind	Total	Percentage
Virginia	2,871,855	688,108	118,301	6,364,117	305,760			10,348,141	29.1%
Illinois		124,315	382,889				4,182,008	4,689,212	13.2%
Maryland		173,713	196,172	939,331	3,289,379		250,220	4,848,815	13.6%
Pennsylvania	59,830	1,834,347	291,872	888,407			1,441,669	4,516,125	12.7%
West Virginia		1,284,132					953,107	2,237,239	6.3%
New York		2,837,058						2,837,058	8.0%
Ohio	92,034		50,961	727,172		46,654	132,644	1,049,465	2.9%
Indiana							1,179,187	1,179,187	3.3%
North Carolina	149,757	240,900	21,598	568,216				980,471	2.8%
Tennessee	92,864		9,651	567,933				670,448	1.9%
North Dakota							282,055	282,055	0.8%
Iowa							479,466	479,466	1.3%
Missouri							171,742	171,742	0.5%
Michigan	415,519	17,993	274,983	126,754				835,249	2.3%
Kentucky	22,113	338	71,156					93,607	0.3%
New Jersey		36,428	54,389					90,817	0.3%
Delaware			204,912					204,912	0.6%
Wisconsin	1,552	50,041		10,292				61,885	0.2%
Total	3,705,524	7,287,373	1,676,884	10,192,222	3,595,139	46,654	9,072,098	35,575,894	100.0%

CHESAPEAKE PSR
PHYSICIANS FOR SOCIAL RESPONSIBILITY 

325 East 25th St. | Baltimore, MD, 21218
Tim Whitehouse, Executive Director | twhitehouse@psr.org | 240-246-4492
WWW.CHESAPEAKEPSR.ORG
