# PUBLIC SERVICE COMMISSION OF MARYLAND

# RENEWABLE ENERGY PORTFOLIO STANDARD REPORT

**With Data for Calendar Year 2018**

In compliance with Section 7-712 of
the Public Utilities Article,
*Annotated Code of Maryland*

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December 2019

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# I. INTRODUCTION

This document constitutes the annual report of the Public Service Commission of Maryland ("Commission") regarding the implementation of the Maryland Renewable Energy Portfolio Standard ("RPS") Program, with data for calendar year 2018. This report is submitted pursuant to § 7-712 of the Public Utilities Article, *Annotated Code of Maryland* ("PUA"), which requires the Commission to report to the General Assembly on the status of the implementation of the RPS Program on or before December 1 of each year.[1] The Maryland RPS Program is designed to support a stable and predictable market for energy generated from renewables, and to lower the cost to consumers of electricity produced from these resources. Implementation of the RPS Program assists in overcoming market barriers seen as impediments to the development of the industry. Moreover, increasing reliance upon renewable energy technologies to satisfy electric power requirements can result in long-term emission reductions, increased fuel diversity, and economic benefits to the State.[2]

The calendar year 2018 electricity supplier compliance reports, as verified by the Commission, indicate that the State of Maryland RPS obligations were almost entirely fulfilled through the submission of the appropriate level of Tier 1 and Tier 2 Renewable Energy Credits ("RECs").[3] Remaining calendar year 2018 RPS obligations were satisfied by compliance fees, also known as alternative compliance payments ("ACPs"). One supplier went out of business without satisfying its 2018 RPS obligations.[4]

## A. Objectives of the Program

The objective of PUA § 7-701 *et seq.* (hereinafter, "RPS Statute") is to recognize and to develop the benefits associated with a diverse portfolio of renewable energy resources to serve Maryland. The State's RPS Program does this by recognizing the environmental and consumer benefits associated with renewable energy. The RPS Program requires electricity suppliers to supply a prescribed minimum portion of their retail electricity sales with various renewable energy sources, which have been classified within the RPS Statute as Tier 1 and Tier 2 renewable sources. The program is implemented through the creation, sale, and transfer of RECs.

The development of renewable energy resources is further promoted by requiring electricity suppliers to pay an ACP for failing to acquire sufficient RECs to satisfy the RPS as set forth in PUA § 7-703. Compliance fees are deposited into the Maryland Strategic Energy Investment Fund ("SEIF") as dedicated funds to provide for loans and grants that spur the creation of new Tier 1 renewable energy resources in the State. Responsibility for developing renewable energy resources is vested with the Maryland Energy Administration ("MEA").

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[1] Electricity suppliers must file a RPS compliance report with the Commission for the prior calendar year by April 1st of the subsequent year. Consequently, this report, which is due to the General Assembly in December 2019, highlights data from electricity suppliers' 2018 compliance reports and other relevant 2018 data. In compliance with PUA § 7-712, topics addressed in this report include the availability of Tier 1, Tier 1 Solar, and Tier 2 renewable energy sources, compliance fees collected to support in-State renewable projects, and other pertinent information.

[2] *See* PUA § 7-702, which describes the legislative intent and legislative findings in support of the enactment of the Maryland Renewable Energy Portfolio Standard.

[3] *See* Section I.B.2 for a description of eligible Tier 1 and Tier 2 resources and requirements.

[4] The supplier failed to retire the required RECs or pay ACPs. Retail electric sales by this supplier represented less than 0.0004% of total 2018 sales subject to compliance.

## B. Overview of the Maryland RPS Program

Under the RPS Program, Maryland electricity suppliers are required to demonstrate compliance on an annual basis with an escalating renewable energy portfolio standard. This requirement applies to both competitive retail suppliers and electric companies in the State—including those that provide Standard Offer Service.[5] Electricity suppliers must file annual compliance reports with the Commission verifying that the renewable requirement for each entity has been satisfied.

A REC constitutes the renewable attributes associated with the production of one megawatt-hour ("MWh") of electricity generated using eligible renewable resources. As such, a REC is a uniquely-identified tradable commodity equal to one MWh of electricity generated or obtained from an eligible renewable energy resource. Generators and electricity suppliers may trade RECs using a Commission-approved system known as the Generation Attributes Tracking System ("GATS"). The GATS system is operated by PJM Environmental Information Services, Inc. ("PJM-EIS") and is designed to track the ownership and trading of generation attributes.[6] A REC has a three-year lifespan during which it may be transferred, sold, or redeemed. However, each electricity supplier must document annually the retirement of RECs equal to the percentage specified by the RPS Statute,[7] or pay an ACP commensurate with any shortfalls.

### 1. Registration of Renewable Energy Facilities

Facilities eligible for the Maryland RPS Program must be located in PJM (the wholesale bulk power control area in which Maryland resides)[8] or in a control area that is adjacent to the PJM region,[9] so long as the electricity produced is delivered into the PJM region. However, facilities generating electricity from solar energy, geothermal, poultry litter–to–energy, waste–to–energy, or refuse–derived fuel are eligible only if the facility is connected with the electric

[5] Standard Offer Service ("SOS") is electricity supply purchased from an electric company by the company's retail customers who cannot or choose not to transact with a competitive supplier operating in the retail market. *See* PUA §§ 7-501(n), 7-510(c).

[6] An attribute is "a characteristic of a generator, such as location, vintage, emissions output, fuel, state RPS Program eligibility, etc." PJM-EIS, *GATS Operating Rules* (May 2014) at 3.

[7] Using the Tier 2 RPS requirement as an example, assume a hypothetical electricity supplier operating in the State had 100,000 MWh in retail electricity sales for 2018. In 2018, the Tier 2 requirement was 2.5%; therefore, the electricity supplier would have to either verify the purchase of 2,500 Tier 2 RECs or pay an ACP for deficits. Similar requirements apply to Tier 1 and Tier 1 Solar, although the percentage obligation and ACP denomination differs depending on the tier and calendar year, as outlined by the RPS Statute.

[8] The PJM wholesale market includes all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia.

[9] A control area is an "electric system or systems, bounded by interconnection metering and telemetry, capable of controlling generation to maintain its interchange schedule with other Control Areas and contributing to frequency regulation. For the purposes of this document, a Control Area is defined in broad terms to include transmission system operations, market, and load-serving functions within a single organization. A Control Area operator may be a system operator, a transmission grid operator, or a utility." PJM-EIS, Generation Attribute Tracking System (*GATS) Operating Rules* (April 2018) at 5. For example, the multi-state area controlled by the PJM Regional Transmission Operator is one control area, as is the adjacent Midwest Independent System Operator ("ISO") multi-state area, and the adjacent New York ISO.

distribution grid serving Maryland. Finally, energy from a thermal biomass system must be generated in Maryland to qualify for the RPS program.[10]

Before recommending certification of a Renewable Energy Facility ("REF"), Commission Staff must determine whether the facility meets the standards set forth by the RPS Statute and Commission Regulations (COMAR 20.61). REF applicants who qualify under Maryland's RPS Program must complete the appropriate application for REF certification posted on the Commission's RPS website.[11] In addition to the geographic requirements, applicants must also meet the fuel source requirements associated with Tier 1 or Tier 2 (*see* Table 1, below). Verification of the fuel source is completed with the aid of Energy Information Administration Form 860 ("EIA-860") to validate each facility's rated nameplate capacity, fuel source(s), location, and commercial operation in-service date.[12] Facilities that co-fire a REC-eligible renewable fuel source with non-eligible fuel sources must also submit a formula or methodology to account for the proportion of total electricity generated by the eligible fuel sources, which then may be credited with RECs. In addition to obtaining Commission certification, all REFs must register with GATS to track and transact business related to RECs. The GATS account must be established with the certification number issued by the Commission upon approval of the REF application.

2. Maryland RPS Annual Percentage Requirements

To comply with the Maryland RPS Program, electricity suppliers must acquire RECs derived from Maryland-certified Tier 1 and Tier 2 renewable sources, as defined in PUA § 7-701. Eligible fuel sources for Tier 1 RECs and Tier 2 RECs are listed in Table 1; solar has its own standard within Tier 1.

[10] There are currently no thermal biomass facilities in Maryland.

[11] REF applications are maintained by the Commission and are accessible online, available at: http://www.psc.state.md.us/electricity/wp-content/uploads/sites/2/Application-for-Certification-as-a-Renewable-Energy-Facility.pdf.

[12] Submitting Form EIA-860 is a requirement under Section 13(b) of the Federal Energy Administration Act of 1974 ("FEAA") (Public Law 93-275) for generating plants, regulated and unregulated, which have a nameplate rating of 1 MW or more, are operating or plan to operate within 5 years, and are connected to the transmission grid.

**Table 1 Eligible Tier 1 and Tier 2 Sources**

| Tier 1 Renewable Sources | Tier 2 Renewable Sources |
|---|---|
| • Solar, including energy from photovoltaic technologies and solar water heating systems<br>• Wind<br>• Qualifying Biomass<br>• Methane from a landfill or wastewater treatment plant<br>• Geothermal<br>• Ocean<br>• Fuel Cell that produces electricity from a Tier 1 source<br>• Hydroelectric power plant less than 30 MW capacity<br>• Poultry litter-to-energy<br>• Waste-to-energy<br>• Refuse-derived fuel<br>• Thermal energy from a thermal biomass system | • Hydroelectric power other than pump storage generation<br><br>*(Note: Tier 1 RECs may be used to satisfy Tier 2 obligations)* |

As shown in the table below, there is a different percentage schedule corresponding to each tier and set-aside requirement comprising the Maryland RPS Program.

- The Tier 1 requirements gradually increase until peaking in 2030, after which they are maintained at those levels.

- The Tier 1 Solar set-aside requirement increases from 1.5 percent in 2018, to 14.5 percent by 2030.[13] This ramp-up period for the solar carve-out corresponds in part with the implementation of the pilot program on community solar energy generating facilities, which was established by the passage of Senate Bill 398 and House Bill 1087 and signed into law in May, 2015. The three-year pilot program was extended through 2024 by House Bill 683, enacted in May, 2019. There is a potential that Solar Renewable Energy Credits ("SRECs") generated by eligible community solar facilities could serve to help meet the increasing Tier 1 Solar set-aside in the coming years.

- Beginning in 2017, a constant Tier 1 Offshore Wind set-aside of up to 2.5 percent commenced as part of the Tier 1 portfolio.[14] In Order No. 88192, the Commission

[13] "Tier 1 Solar set-aside" refers to the requirement to obtain RECs for energy derived from qualified solar energy facilities. The Tier 1 Solar set-aside requirement applies to retail electricity sales in the State by electricity suppliers and is a sub-set of the Tier 1 standard.

[14] The Maryland Offshore Wind Energy Act of 2013 (2013 Md. Laws, Ch. 003) established an offshore wind set-aside within the Tier 1 requirement. Beginning in 2017, Tier 1 may include a Commission-determined amount of offshore wind RECs ("ORECs"), not to exceed 2.5%. The project must be generating RECs in order for the

established specific offshore wind carve-outs from 2021 through 2042 ranging from 0.60 percent to 2.03 percent. Senate Bill 516, enacted in May, 2019, increased the RPS requirements to 50% by 2030, and established additional offshore wind carve-outs beginning in 2027. The Commission will incorporate these increased carve-outs into the offshore wind RPS obligations as part of its review of Round 2 offshore wind project applications.

- Maryland's Tier 2 requirement was eliminated at the end of compliance year 2018. Senate Bill 516 re-established a 2.5 percent requirement beginning October 1, 2019 and extending through compliance year 2020, after which the Tier 2 obligation again sunsets.

**Table 2 Annual RPS Requirements by Tier**

| Compliance Year | Tier 1 Non-Solar | Tier 1 Solar | Offshore Wind[15] | Tier 2 | Total |
|---|---|---|---|---|---|
| 2018 | 14.3% | 1.5% | 0.0% | 2.5% | 18.3% |
| Pre-SB516 2019[16] | 18.45% | 1.95% | 0.0% | N/A | 20.4% |
| Post-SB516 2019[17] | 15.2% | 5.5% | 0.0% | 2.5% | 23.2% |
| 2020 | 22.0% | 6.0% | 0.0% | 2.5% | 30.5% |
| 2021 | 21.93% | 7.5% | 1.37% | N/A | 30.8% |
| 2022 | 23.24% | 8.5% | 1.36% | N/A | 33.1% |
| 2023 | 23.87% | 9.5% | 2.03% | N/A | 35.4% |
| 2024 | 25.19% | 10.5% | 2.01% | N/A | 37.7% |
| 2025 | 26.49% | 11.5% | 2.01% | N/A | 40.0% |
| 2026 | 28.01% | 12.5% | 1.99% | N/A | 42.5% |
| 2027 | 30.02% | 13.5% | 1.98% | N/A | 45.5% |
| 2028 | 31.04% | 14.5% | 1.96% | N/A | 47.5% |
| 2029 | 33.06% | 14.5% | 1.94% | N/A | 49.5% |
| 2030+ | 33.56% - 34.9% | 14.5% | 0.60% - 1.94% | N/A | 50.0% |

obligation to begin. In the absence of a Commission-determined OREC obligation, electricity suppliers must satisfy the carve-out using RECs derived from other Tier 1 renewable sources.

[15] As defined by PUA § 7-703(b), beginning in 2017 the RPS requirements include "an amount set by the Commission…not to exceed 2.5%, derived from offshore wind energy." The Commission set the offshore wind energy carve-out in Order No. 88192. As "a payment may not be made for an OREC [Offshore Renewable Energy Credit] until electricity supply is generated by the offshore wind project," and as the RPS obligation must be established at least three years in advance of the calendar year in which the purchase obligation takes effect, the carve-out may begin no sooner than January 1, 2021.

[16] Senate Bill 516, enacted into law in May, 2019, increased RPS targets beginning October 1, 2019.

[17] *Id.*

At certain renewable procurement cost thresholds, an electricity supplier can request that the Commission consider a delay in scheduled Tier 1 and Tier 1 Solar RPS percentages.[18] To date, no such request has been made by electricity suppliers operating in the Maryland marketplace.

3. Maryland RPS Alternative Compliance Payment Requirements

Electricity suppliers who do not meet their RPS obligation through the retirement of eligible RECs must submit an ACP for every unit of shortfall. Table 3 presents the ACP schedule separated by tiers for each compliance year of the RPS Program moving forward.

**Table 3 ACP Schedule ($/MWh)**

| Compliance Year | Tier 1 Non-Solar | Tier 1 Solar | Tier 2 | IPL[19] Tier 1 |
|---|---|---|---|---|
| 2018 | $37.50 | $175 | $15 | $2 |
| Pre-SB516 2019[20] | $37.50 | $150 | N/A | $2 |
| Post-SB516 2019[21] | $30 | $100 | $15 | $2 |
| 2020 | $30 | $100 | $15 | $2 |
| 2021 | $30 | $80 | N/A | $2 |
| 2022 | $30 | $60 | N/A | $2 |
| 2023 | $30 | $45 | N/A | $2 |
| 2024 | $27.50 | $40 | N/A | $2 |
| 2025 | $25 | $35 | N/A | $2 |
| 2026 | $24.75 | $30 | N/A | $2 |
| 2027 | $24.50 | $25 | N/A | $2 |
| 2028 | $22.50 | $25 | N/A | $2 |
| 2029 | $22.50 | $22.50 | N/A | $2 |
| 2030+ | $22.35 | $22.35 | N/A | $2 |

ACPs are remitted to the Maryland SEIF as dedicated funds to provide for loans and grants that spur the creation of new Tier 1 renewable energy resources.[22] As outlined by statute, compliance fees may only be used to support the creation of new Tier 1 renewable energy

[18] PUA § 7-705(e)-(f).

[19] Industrial Process Load ("IPL") means the consumption of electricity by a manufacturing process at an establishment classified in the manufacturing sector under the North American Industry Classification System. Under PUA § 7-705(b)(2) and COMAR 20.61.01.06 E(5), a supplier sale for IPL is required to meet the entire Tier 1 obligation for electricity sales, including solar. However, the ACP for an IPL Tier 1 non-solar shortfall and a Tier 1 solar shortfall is the same. For IPL, there is no ACP for Tier 2 shortfalls.

[20] Senate Bill 516, enacted into law in May, 2019, modified the ACP schedule beginning October 1, 2019.

[21] *Id.*

[22] As a special, non-lapsing fund, the SEIF is also the depository of revenues generated through the sale of $CO_2$ allowances under the Regional Greenhouse Gas Initiative, the first market-based regulatory program in the United States to reduce greenhouse gas emissions.

resources in the State; the use of ACPs remitted to satisfy the Tier 1 Solar RPS obligation are further restricted to support the creation of new *solar* energy resources in Maryland.[23]

## II. ELECTRICITY SUPPLIER COMPLIANCE REPORTS

Calendar year 2018 marked the 13th compliance year for the Maryland RPS, and the 11th year for electricity suppliers to comply with the Tier 1 Solar set-aside. The RPS compliance reports submitted to the Commission by electricity suppliers, along with information obtained from GATS, provide information regarding the retired RECs and the underlying REFs (*e.g.*, type and location of generators) utilized by electricity suppliers to comply with Maryland RPS obligations.[24] RPS compliance reports were filed by 103 electricity suppliers, including 77 competitive retail suppliers; 15 brokers or competitive electricity suppliers with zero retail electricity sales; and 11 electric companies, of which four are investor-owned utilities.

According to the filed compliance reports, there were approximately 61.5 million MWh of total retail electricity sales in Maryland for 2018 (up from 59.1 million MWh in 2017); 60.0 million MWh of retail electricity sales were subject to RPS compliance, and 1.5 million MWh were exempt.[25] Maryland electricity suppliers retired about 11.1 million RECs in 2018, more than both the calculated obligation for the year and the 9.0 million RECs retired for compliance in 2017. The total cost of RECs retired in 2018 totaled $84.8 million, up from $72.0 million in 2017.

Table 4 displays the average cost per REC retired in each tier since 2008. The decline in Tier 1 and Tier 2 REC prices likely reflects a combination of an increase in the number of renewable energy facilities capable of providing RECs and downward price pressure coming from cheaper SRECs. The drop in SREC prices may be attributable to decreasing solar technology costs and an increasing number of solar facilities eligible to meet the SREC requirements as compared to when the solar carve-out was first initiated.

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[23] State Gov't § 9-20B-05(i).

[24] According to PUA § 7-709, a REC can be diminished or extinguished before the expiration of three years by the electricity supplier that received the credit; a nonaffiliated entity of the electricity supplier that purchased or otherwise received the transferred credit; or demonstrated noncompliance by the generating facility with the requirements of PUA § 7-704(f). In the PJM region, the regional term of art is "retirement," which describes the process of removing a REC from circulation by the REC owner, *i.e.,* the owner "diminishes or extinguishes the REC." PJM-EIS, *GATS Operating Rules* (May 2014) at 54-56.

[25] According to PUA § 7-703(a)(2), exceptions for the RPS requirement may include IPL which exceeds 300,000,000 kWh by a single customer in a year; regions where residential customer rates are subject to a freeze or cap (*see* PUA § 7-505); or electric cooperatives under a purchase agreement that existed prior to October 1, 2004, until the expiration of the agreement. COMAR 20.61.01.06(D) exempts any sale of electricity that is marketed or otherwise represented to customers as renewable or having characteristics of a Tier 1 renewable source or Tier 2 renewable source.

**Table 4 Average Cost of RECs per Tier (2008 – 2018)**

| Year | Tier 1 Non-Solar | Tier 1 Solar | Tier 2 |
|---|---|---|---|
| 2008 | $0.94 | $345.45 | $0.56 |
| 2009 | $0.96 | $345.28 | $0.43 |
| 2010 | $0.99 | $328.57 | $0.38 |
| 2011 | $2.02 | $278.26 | $0.45 |
| 2012 | $3.19 | $201.92 | $0.44 |
| 2013 | $6.70 | $159.71 | $1.81 |
| 2014 | $11.64 | $144.06 | $1.81 |
| 2015 | $13.87 | $130.39 | $1.71 |
| 2016 | $12.22 | $110.63 | $0.96 |
| 2017 | $7.14 | $38.18 | $0.47 |
| 2018 | $6.54 | $31.91 | $0.66 |

As demonstrated by the table below, the aggregated cost of compliance with the Maryland RPS Program displayed a declining growth rate from 2013 through 2016, peaking at $136.2 million in 2016. In spite of increasing RPS percentage requirements in-State and greater demand for RECs within the surrounding region,[26] total REC costs in 2017 fell approximately 47 percent between 2017 and 2016. Tier 1 and Solar REC prices fell an additional 8 percent and 16 percent in 2018, respectively, while Tier 2 REC prices increased by approximately 40 percent.

**Table 5 Total Cost of RECs per Year (2013 – 2018)**

| | Tier | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|
| **Total REC Costs** | Tier 1 | $32,664,171 | $70,630,620 | $85,054,001 | $88,200,121 | $50,045,621 | $56,406,247 |
| | Solar | $21,417,989 | $29,372,737 | $39,055,714 | $45,556,987 | $21,275,664 | $27,351,388 |
| | Tier 2 | $2,751,643 | $3,987,557 | $2,617,917 | $1,441,416 | $687,785 | $1,049,293 |
| | **Total** | **$56,833,803** | **$103,990,914** | **$126,727,632** | **$135,198,523** | **$72,009,071** | **$84,806,928** |
| **Total RECs Retired** | Tier 1 | 4,871,586 | 6,062,135 | 6,134,653 | 7,216,439 | 7,006,113 | 8,627,737 |
| | Solar | 134,124 | 203,884 | 299,525 | 411,787 | 557,224 | 857,232 |
| | Tier 2 | 1,526,789 | 1,521,022 | 1,531,279 | 1,501,587 | 1,448,567 | 1,599,819 |
| | **Total** | **6,532,499** | **7,787,041** | **7,965,457** | **9,129,813** | **9,011,904** | **11,084,788** |
| **RPS % Required** | Tier 1 | 7.95% | 9.95% | 10.00% | 12.00% | 12.15% | 14.30% |
| | Solar | 0.25% | 0.35% | 0.50% | 0.70% | 0.95% | 1.50% |
| | Tier 2 | 2.50% | 2.50% | 2.50% | 2.50% | 2.50% | 2.50% |
| | **Total** | **10.70%** | **12.80%** | **13.00%** | **15.20%** | **15.60%** | **18.30%** |

ACPs accounted for only a small fraction ($67,796) of the total $84.8 million RPS compliance costs in 2018. Reliance on ACPs increased slightly in 2018 (compared to $55,032 in

[26] In addition to Maryland, 7 other PJM states (DE, IL, MI, NJ, NC, OH, and PA) plus the District of Columbia have a RPS mandate outlined in statute, while an additional 2 PJM states (IN, VA) have a voluntary RPS goal.

2017). The majority of ACPs paid in 2018 were made in lieu of purchasing Tier 1 RECs to satisfy Industrial Process Load ("IPL") obligations.[27]

**Table 6 Results of the 2018 RPS Compliance Reports**

| RPS Compliance Year | | Tier 1 Non-Solar | Tier 1 Solar | Tier 1 IPL | Tier 2 | Total |
|---|---|---|---|---|---|---|
| 2018 | RPS Obligation | 8,627,719 | 857,023 | 32,293 | 1,500,715 | **11,017,750** |
| | Retired RECs | 8,627,737 | 857,232 | - | 1,599,819 | **11,084,788** |
| | ACP Required | $2,280 | $795 | $64,586 | $135 | **$67,796** |

*Note: Some electricity suppliers retired more RECs than required.*

RECs are valid to demonstrate RPS compliance for the calendar year in which they were generated and in the following two calendar years.[28] Figure 1 aggregates the Maryland RPS tiers on the basis of generation year. For the 2018 compliance year, 44.9 percent of RECs retired were generated in 2018; 40.8 percent in 2017; and the remaining 14.3 percent were generated in 2016.

**Figure 1 RECs Retired in 2018 by Generation Year**

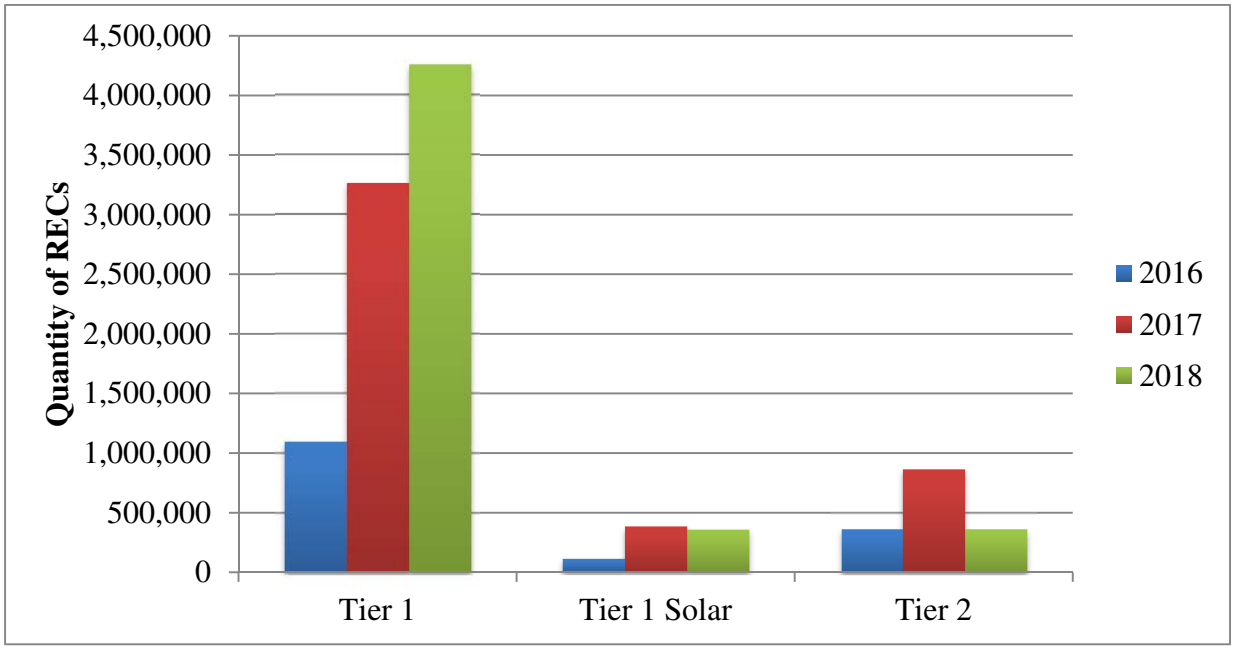
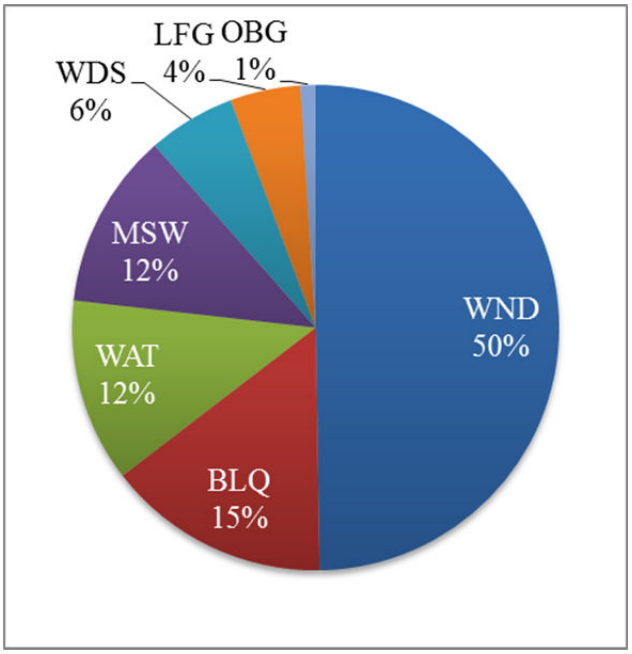



Figure 2 illustrates the fuel sources used to satisfy Tier 1 RPS requirements for the 2018 RPS compliance year. Of the Tier 1 RECs retired for 2018, the resources from which the RECs were sourced consisted primarily of wind, black liquor, and small hydroelectric plants. Although not pictured, Tier 2 RPS requirements for the 2018 RPS compliance year were satisfied exclusively by RECs derived from hydroelectric power.

[27] The ACP for Tier 1 IPL obligations is $2 per MWh, significantly lower than the average non-solar Tier 1 REC ($6.54) and solar Tier 1 REC ($31.91).
[28] COMAR 20.61.03.01 C (unless the REC is diminished or extinguished before expiration).

**Figure 2 2018 Tier 1 Retired RECs by Fuel Source[29]**

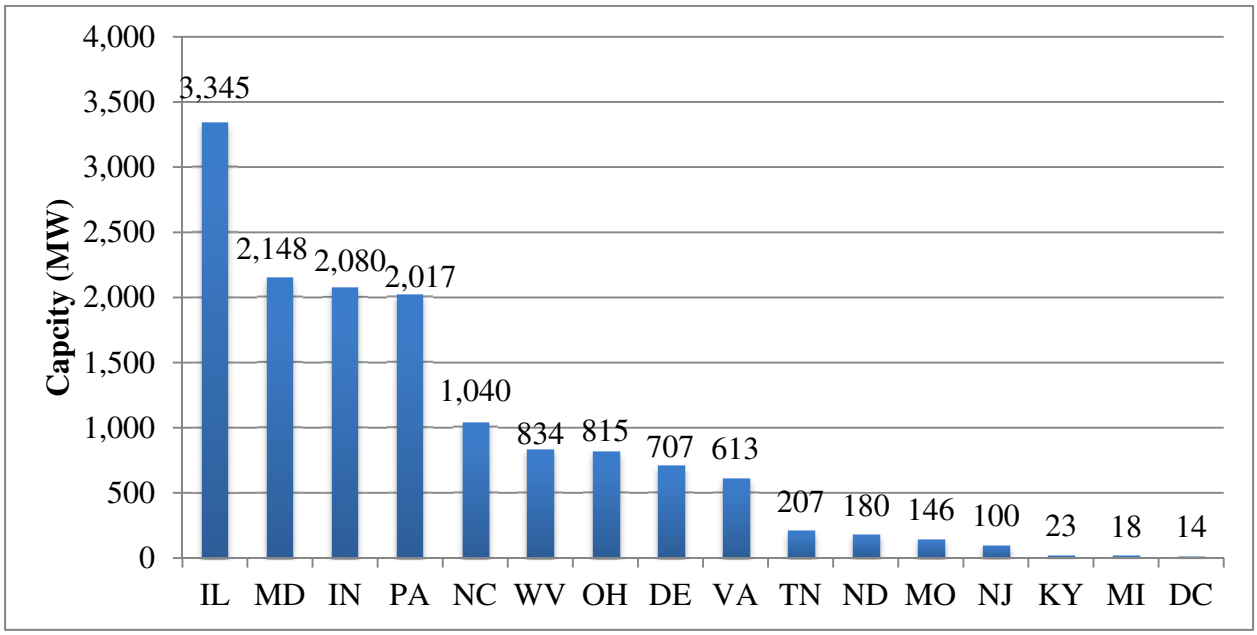



Abbreviations: BLQ, Black Liquor; LFG, Landfill Gas; MSW, Municipal Solid Waste; OBG, Other Biomass Gas; WAT, Small Hydroelectric; WDS, Wood and Waste Solids; WND, Wind.

Figure 3 presents the geographical location and the total generating capacity (14,288 MW, an increase from 13,764 MW in 2017) for all Maryland RPS-certified facilities regardless of Tier. RPS requirements also exist in the surrounding states, which generally support out-of-state and regional market participation. Of the renewable facilities that are eligible to participate in the Maryland RPS Program, 45 percent of the corresponding capacity is located in the Mid-Atlantic States. The remaining eligible resource capacity is distributed across 9 other states.

[29] WAT includes Tier 1 only. Qualifying biomass sourced from agricultural crops, geothermal, and solar thermal contributed too few RECs to be seen on the chart.

**Figure 3 Total Rated Capacity by State (MW)** [30]




For the 2018 compliance year, Figure 4 displays aggregated REC data to convey general relationships among the States that contributed RECs. Illinois supplied the largest number of RECs purchased by retail electricity suppliers (22.9 percent), followed by Maryland (21.6 percent), Pennsylvania (13.8 percent), and Virginia (10.2 percent). The remaining 13 states contributed a total of 31.4 percent of all RECs retired in 2018. The majority of RECs from in-State generators were sourced from large hydroelectric (22.9 percent) and solar photovoltaic (35.8 percent).

[30] PJM-EIS, Generation Attribute Tracking System, Database query, (June 1, 2018). The information in this figure does not include Commission-authorized REFs that have not established a REC account with PJM GATS.

**Figure 4 Number of RECs Retired by Facility Location (2018)**

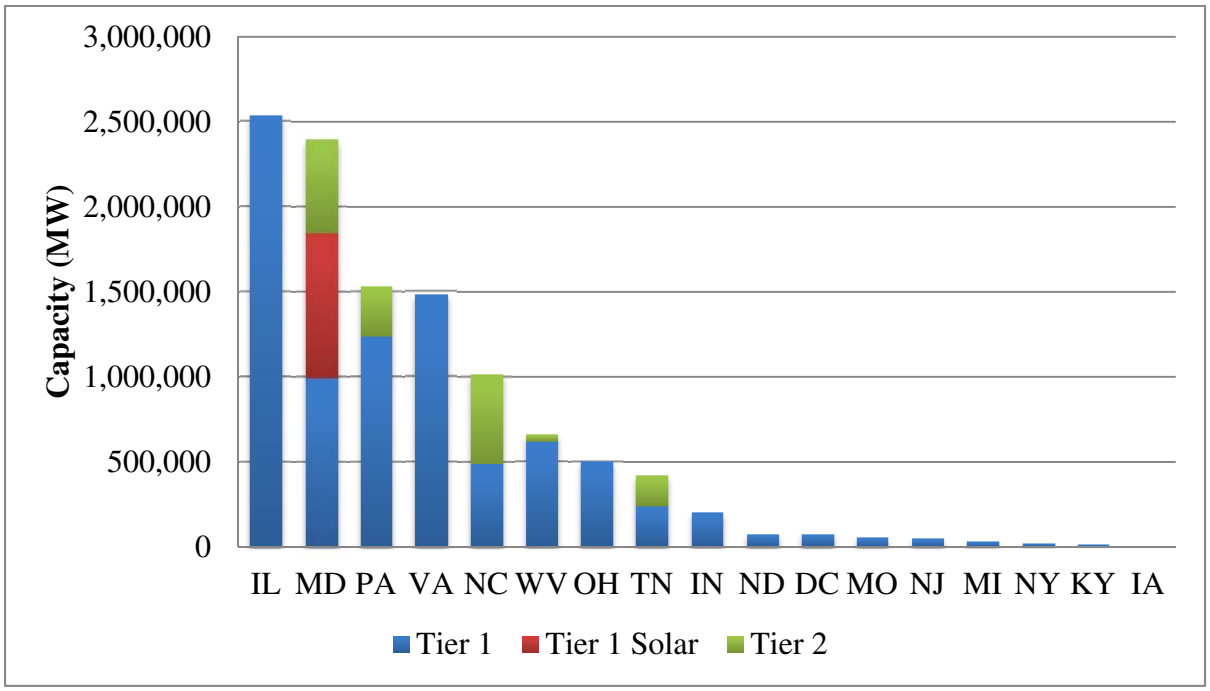



Table 7 and Table 8 provide the quantitative data in support of the previous figure. Table 7 provides the reported levels of RECs retired by Maryland electricity suppliers in 2018 on a Tier and aggregate basis, whereas Table 8 provides the information on a percentage basis. As noted above, Illinois-generated RECs, followed by Maryland, Pennsylvania, and Virginia were used in the largest aggregate amounts by Maryland electricity suppliers for 2018 RPS compliance.

**Table 7 2018 REC Retirement by State**

| State | Tier 1 Non-Solar | Tier 1 Solar | Tier 2 | All Tiers |
|---|---|---|---|---|
| IL | 2,535,224 | - | - | 2,535,224 |
| MD | 990,339 | 857,232 | 548,309 | 2,395,880 |
| PA | 1,235,555 | - | 298,753 | 1,534,308 |
| VA | 1,482,081 | - | - | 1,482,081 |
| NC | 488,645 | - | 529,003 | 1,017,648 |
| WV | 618,354 | - | 38,958 | 657,312 |
| OH | 501,336 | - | 4,132 | 505,468 |
| TN | 241,441 | - | 180,664 | 422,105 |
| IN | 199,349 | - | - | 199,349 |
| ND | 80,079 | - | - | 80,079 |
| DC | 78,538 | - | - | 78,538 |
| MO | 57,257 | - | - | 57,257 |
| NJ | 49,256 | - | - | 49,256 |

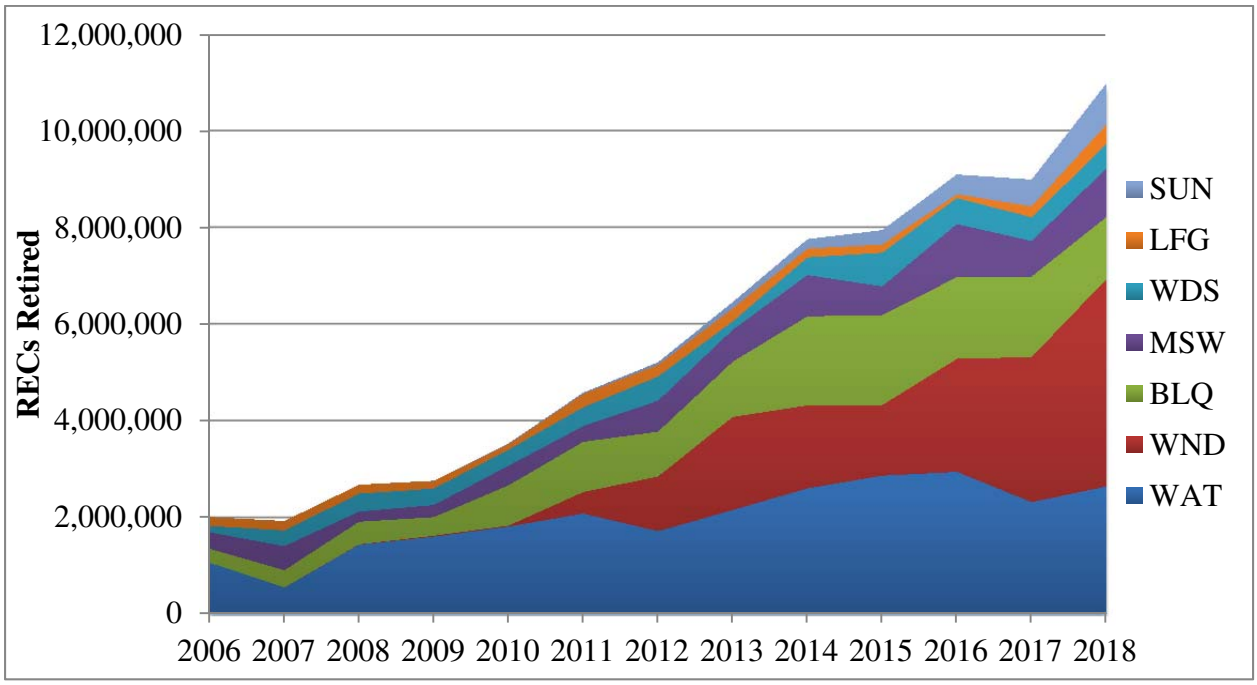
| State | Tier 1 Non-Solar | Tier 1 Solar | Tier 2 | All Tiers |
|---|---|---|---|---|
| MI | 31,434 | - | - | 31,434 |
| NY | 22,897 | - | - | 22,897 |
| KY | 11,414 | - | - | 11,414 |
| IA | 4,538 | - | - | 4,538 |
| **Total** | **8,627,737** | **857,232** | **1,599,819** | **11,084,788** |

**Table 8 2018 REC Retirement by State (%)**

| State | Tier 1 Non-Solar | Tier 1 Solar | Tier 2 | All Tiers |
|---|---|---|---|---|
| IL | 29.4% | 0.0% | 0.0% | 22.9% |
| MD | 11.5% | 100.0% | 34.3% | 21.6% |
| VA | 14.3% | 0.0% | 18.7% | 13.8% |
| PA | 17.2% | 0.0% | 0.0% | 13.4% |
| NC | 5.7% | 0.0% | 33.1% | 9.2% |
| WV | 7.2% | 0.0% | 2.4% | 5.9% |
| OH | 5.8% | 0.0% | 0.3% | 4.6% |
| TN | 2.8% | 0.0% | 11.3% | 3.8% |
| IN | 2.3% | 0.0% | 0.0% | 1.8% |
| ND | 0.9% | 0.0% | 0.0% | 0.7% |
| NJ | 0.9% | 0.0% | 0.0% | 0.7% |
| IA | 0.7% | 0.0% | 0.0% | 0.5% |
| DC | 0.6% | 0.0% | 0.0% | 0.4% |
| MI | 0.4% | 0.0% | 0.0% | 0.3% |
| MO | 0.3% | 0.0% | 0.0% | 0.2% |
| NY | 0.1% | 0.0% | 0.0% | 0.1% |
| KY | 0.1% | 0.0% | 0.0% | 0.0% |
| **Total** | **100.0%** | **100.0%** | **100.0%** | **100.0%** |

Figure 5 illustrates the growth in RECs retired in total and by fuel type from the beginning of the RPS requirement in 2006. For the second year in a row, wind ("WND") was the largest contributor of RECs. Total wind RECs retired for compliance have nearly tripled since 2015, and year-over-year wind REC retirements increased by approximately 43 percent. In contrast, black liquor (BLQ) REC retirements have fallen to the lowest levels since 2013, with a year-over-year decrease of about 23 percent. Note that the contributions from qualifying biomass sourced from agricultural crops, geothermal, other biomass liquid and gas, and solar thermal are too small to be seen on this chart.

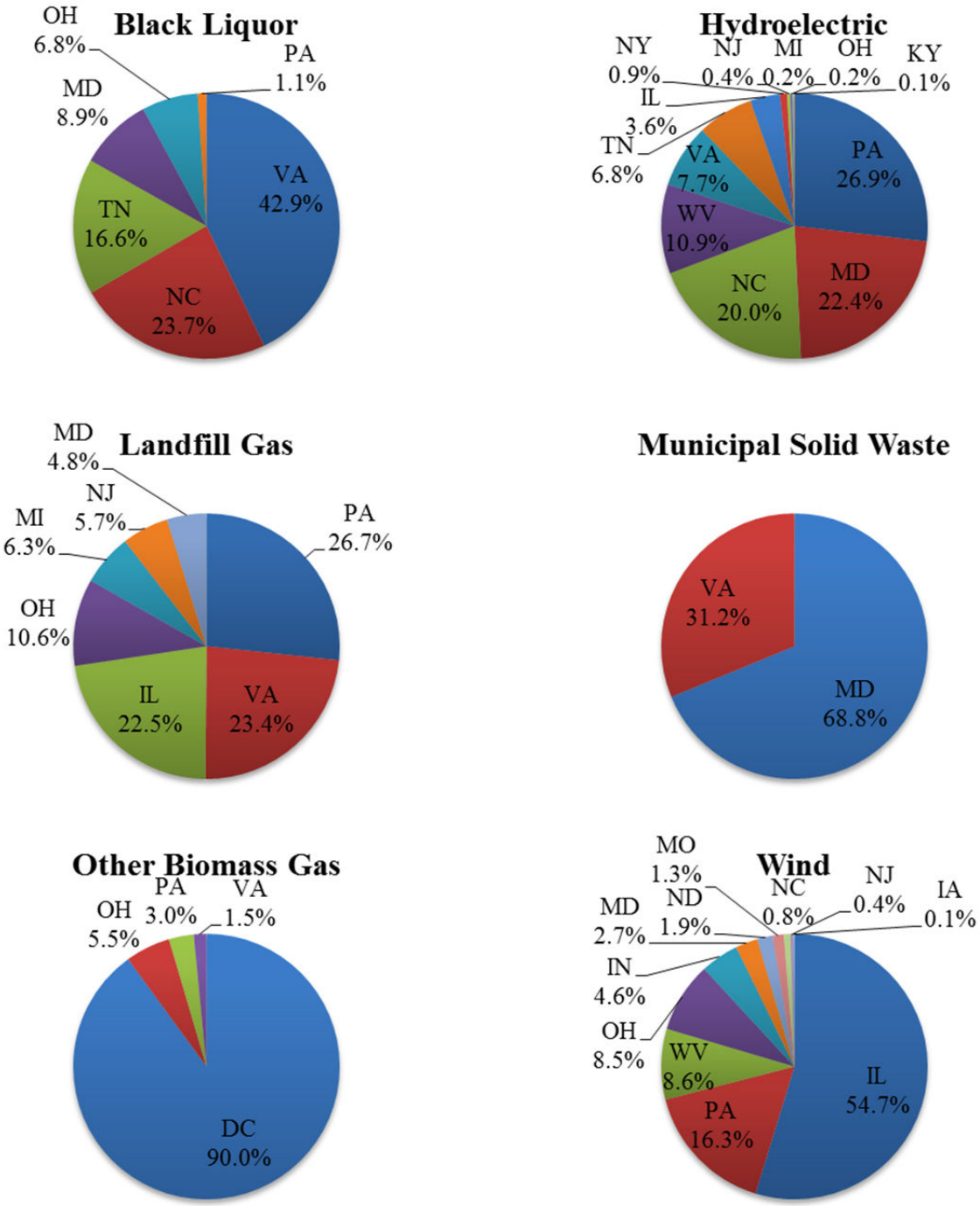
**Figure 5 RECs Retired by Fuel Type (2006 – 2018)**



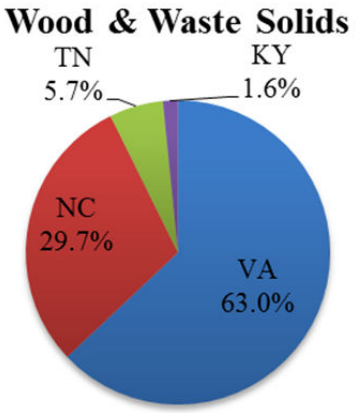

Abbreviations: BLQ, Black Liquor; LFG, Landfill Gas; MSW, Municipal Solid Waste; SUN, Solar Photovoltaic; WAT, Hydroelectric; WDS, Wood and Waste Solids; WND, Wind.

In 2018, all of the RECs retired from geothermal and solar sources originated in Maryland, while all of the qualifying biomass sourced from agricultural crops was located in North Carolina. The seven remaining fuels used to comply with Maryland's 2018 RPS requirements corresponded to RECs generated in multiple other states, and Figure 6 shows the percentage contribution from each state for each of these seven fuels. Facilities located in Maryland provided the majority of municipal solid waste RECs and the second largest percentage of hydroelectric RECs retired for compliance in 2018. Conversely, Maryland resources provided only 8.9 percent of black liquor RECs, 4.8 percent of landfill gas RECs, and 2.7 percent of wind RECs. No other biomass gas or wood and waste solids RECs derived from in-state facilities were retired for RPS compliance.

**Figure 6 Percentage of RECs Generated in Each State, by Fuel (2018)** [31]




[31] Additional information pertaining to the source of renewable energy used to meet Maryland's 2018 RPS compliance requirements is presented in Appendices A and B. Appendix A provides a breakdown of the *number of RECs* used by electricity suppliers according to tier, fuel type, and facility location, while Appendix B presents the *number of facilities* by tier, fuel type, and facility location that provided RECs for compliance.




## III. MARYLAND RENEWABLE ENERGY FACILITIES

Implementation of the Maryland RPS Program can provide an incentive for renewable generators to locate in Maryland and generate electricity. The renewable requirement establishes a market for renewable energy, and to the extent Maryland's geography and natural resources can be utilized to generate renewable electricity, developers may locate projects within the State. This section of the report provides information about the REFs located in Maryland in 2018.[32] Renewable energy generated in Maryland can be used both in Maryland and in other states for RPS compliance purposes, and also can be sold in support of competitive retail electricity supplier product offerings (*i.e.*, green power products).[33] Green power products are generally offered to the public with higher concentrations electricity generated by renewable energy resources (*e.g.,* 50 or 100%) than required by State RPS requirements.

As shown in Table 9, in 2018 eligible sources located within Maryland generated approximately 1.5 million Tier 1 non-solar RECs, 1.1 million Tier 1 SRECs, and 2.8 million Tier 2 RECs. Additional analysis pertaining to the Maryland-based renewable generators is presented in Appendices C through E. Appendix C shows the disposition of RECs generated in Maryland in 2018. Appendix D provides the number of renewable energy facilities by county that are both located in Maryland, and registered with GATS to participate in any one of the PJM States' RPS programs. Appendix E provides the total capacity of these facilities, broken out by county and tier.

[32] Specific information pertaining to the State's REFs as described herein was made available by PJM-EIS in the GATS State Agency Report.

[33] Facilities located in Maryland are not necessarily registered by the Commission for the Maryland RPS; rather, certain facilities may seek certification out-of-state in support of a long-term contract for the RECs from an out-of-state counterparty. Counterparties can include an electricity supplier operating in a different state and purchasing the RECs to satisfy the RPS requirement for another state or other entities, such as brokers that purchase the REC output for resale.

**Table 9 2018 Maryland Generated RECs by Fuel Source**

| Fuel Type | | RECs (Quantity) | RECs (Percent) |
|---|---|---|---|
| **Tier 1** | Black Liquor | 86,619 | 1.6% |
| | Geothermal | 1,999 | 0.0% |
| | Land Fill Gas | 82,072 | 1.5% |
| | Municipal Solid Waste | 721,572 | 13.4% |
| | Solar Thermal[34] | 15 | 0.0% |
| | Small Hydro | 42,268 | 0.8% |
| | Wood Waste | 16,504 | 0.3% |
| | Wind | 570,087 | 10.6% |
| **Tier 1 Solar** | Solar PV | 1,072,423 | 19.9% |
| | Solar Thermal | 3,844 | 0.1% |
| **Tier 2** | Large Hydro | 2,788,413 | 51.8% |
| | **Total** | **5,385,816** | **100.0%** |

Table 10 presents additional detail regarding the disposition of Maryland-generated RECs in calendar year 2018. Approximately 47 percent of the RECs generated by renewable facilities located within Maryland during 2018 are available for potential future sale in Maryland or in other states in subsequent compliance years. Slightly over half of all RECs generated in Maryland were retired in 2018 to meet the RPS requirements in Maryland and various other PJM states. Labeled as "Other" in Table 10, just 1.1 percent of RECs were used for other purposes, which may include pending transfers between parties.

**Table 10 Disposition of 2018 Maryland Generated RECs**

| REC Tier | Available | RPS Compliance | Other | Total |
|---|---|---|---|---|
| Tier 1 Non-Solar | 591,767 | 926,355 | 3,014 | 1,521,136 |
| Tier 1 Solar | 714,722 | 361,380 | 165 | 1,076,267 |
| Tier 2 | 1,232,753 | 1,489,387 | 66,273 | 2,788,413 |
| **Total** | **2,539,242** | **2,777,122** | **69,452** | **5,385,816** |
| **(%)** | **47.1%** | **51.6%** | **1.3%** | **100.0%** |

Source: PJM-EIS

Table 11 presents, on a state-by-state basis, the distribution of the RECs both generated in-State and retired for RPS compliance purposes. In 2018, Maryland-generated RECs were retired for compliance purposes in six jurisdictions: the District of Columbia, Delaware, Illinois, Maryland, New Jersey, and Pennsylvania. Approximately 33 percent of the RECs generated by in-State facilities in 2018 were retired for compliance purposes in Maryland, a 49 percent decrease from 2017 levels. This decline was principally driven by larger exports of Maryland-generated wind and large hydroelectric RECs as compared to prior years. It is also worth noting that compliance year 2017 was an outlier for the proportion of Maryland-generated RECs retired

[34] Tier 1 Solar RECs may be used to satisfy Tier 1 obligations.

in-State for compliance; a much lower percentage of Maryland-generated RECs have historically been retired for compliance.[35]

**Table 11 2018 Maryland Generated RECs Retired for RPS Compliance by State**

| Tier | Fuel Type | DC | DE | IL | MD | NJ | PA | Total |
|---|---|---|---|---|---|---|---|---|
| Tier 1 Non-solar | Black Liquor | - | - | - | 50,356 | - | - | 50,356 |
| | Geothermal | - | - | - | 64,572 | - | - | 64,572 |
| | Land Fill Gas | - | - | - | 1,636 | - | - | 1,636 |
| | Municipal Solid Waste | - | - | - | 13,958 | 31,968 | 2,522 | 48,448 |
| | Small Hydro | - | - | - | 380,220 | - | - | 380,220 |
| | Solar Thermal | - | - | - | 3 | - | - | 3 |
| | Wood Waste | - | - | - | 35,570 | - | - | 35,570 |
| | Wind | - | 109,026 | - | 68,180 | 218,700 | - | 395,906 |
| | **Subtotal** | - | 109,026 | - | 564,136 | 250,668 | 2,522 | 926,355 |
| | **Percentage** | 0.0% | 11.8% | 0.00% | 60.9% | 27.1% | 0.3% | 100.0% |
| Tier 1 Solar | Solar PV | 1,636 | - | 2 | 358,857 | - | - | 360,495 |
| | Solar Thermal | - | - | - | 885 | - | - | 885 |
| | **Subtotal** | 1,636 | - | 2 | 359,742 | - | - | 361,380 |
| | **Percentage** | 0.5% | 0.0% | 0.00% | 99.5% | 0.0% | 0.0% | 100.0% |
| Tier 2 | Large Hydro | - | - | 1,233,393 | - | - | 255,994 | 1,489,387 |
| | **Subtotal** | - | - | 1,233,393 | - | - | 255,994 | 1,489,387 |
| | **Percentage** | 0.0% | 0.0% | 82.8% | 0.0% | 0.0% | 17.2% | 100.0% |
| All Tiers | **Grand Total** | 1,636 | 109,026 | 1,233,395 | 923,878 | 250,668 | 258,516 | 2,777,122 |
| | **Percentage** | 0.1% | 3.9% | 44.41% | 33.3% | 9.0% | 9.3% | 100.0% |

Source: PJM-EIS.

## IV. CONCLUSION

The electricity supplier compliance reports for 2018, verified by the Commission, indicate that nearly all of the Maryland RPS obligations were met via the purchase and retirement of RECs, with only $67,796 in ACPs remitted for compliance purposes. Nearly 41 percent of RECs used for compliance in 2018 came from in-State resources, up from approximately 25 percent in 2017. RECs derived from three fuel types—wind (39.7 percent), black liquor (14.8 percent), and small hydroelectric (12.2 percent)—were the predominant sources of Tier 1 compliance in 2018, with those RECs sourced primarily from Illinois, Virginia, and Pennsylvania, respectively. The Tier 1 Solar carve-out was met by the retirement of RECs generated exclusively in Maryland. Companies demonstrated Tier 2 compliance by purchasing RECs derived from large hydroelectric sources, with 34.3 percent of the Tier 2 RECs sourced from Maryland REFs.

Throughout this next year, the Commission will continue to review applications from facilities requesting certification as a Maryland REF; oversee the RPS Program; and verify that

[35] For example, 50.3% of RECs generated by in-State facilities in 2011 were retired for Maryland RPS purposes, and only 2.3% in 2010.

the electricity suppliers in Maryland procure a sufficient amount of electricity generated by renewable resources.

# APPENDICES

# Appendix A 2018 Retired RECs by Facility

| Tier 1* | | | | | |
|---|---|---|---|---|---|
| **Facility Name** | **Fuel** | **State** | **Quantity** | **GEO %** | **Tier 1** |
| Baratta | GEO | MD | 31 | 1.13% | 0.00% |
| Benigni, C. | GEO | MD | 29 | 1.06% | 0.00% |
| Bird, J. | GEO | MD | 134 | 4.89% | 0.00% |
| Bird, W. | GEO | MD | 27 | 0.99% | 0.00% |
| Brenny, M. | GEO | MD | 24 | 0.88% | 0.00% |
| Cipriani, A. 1 | GEO | MD | 26 | 0.95% | 0.00% |
| Cipriani, A. 2 | GEO | MD | 19 | 0.69% | 0.00% |
| Custer, C. | GEO | MD | 35 | 1.28% | 0.00% |
| Daly, M. | GEO | MD | 38 | 1.39% | 0.00% |
| Dickerson, L. | GEO | MD | 40 | 1.46% | 0.00% |
| Dixon, T. | GEO | MD | 67 | 2.45% | 0.00% |
| Dorman, K. | GEO | MD | 59 | 2.15% | 0.00% |
| Field, J. | GEO | MD | 127 | 4.64% | 0.00% |
| Gilotra, R. | GEO | MD | 73 | 2.67% | 0.00% |
| Graziani | GEO | MD | 54 | 1.97% | 0.00% |
| Gugerty, B. | GEO | MD | 86 | 3.14% | 0.00% |
| Harding, A. | GEO | MD | 38 | 1.39% | 0.00% |
| Harrison, H. | GEO | MD | 21 | 0.77% | 0.00% |
| Hendrickson | GEO | MD | 46 | 1.68% | 0.00% |
| Hucht | GEO | MD | 24 | 0.88% | 0.00% |
| Jack | GEO | MD | 35 | 1.28% | 0.00% |
| Jackson, C. | GEO | MD | 60 | 2.19% | 0.00% |
| Jarboe | GEO | MD | 55 | 2.01% | 0.00% |
| Jocic, B. | GEO | MD | 19 | 0.69% | 0.00% |
| Kawalek, J. | GEO | MD | 46 | 1.68% | 0.00% |
| Keeney, A. | GEO | MD | 74 | 2.70% | 0.00% |
| Kosydar | GEO | MD | 28 | 1.02% | 0.00% |
| Lee, A. | GEO | MD | 33 | 1.21% | 0.00% |
| Lehr, M. | GEO | MD | 64 | 2.34% | 0.00% |
| Leung | GEO | MD | 78 | 2.85% | 0.00% |
| Loudermilk, G. | GEO | MD | 163 | 5.95% | 0.00% |
| MacInnes | GEO | MD | 22 | 0.80% | 0.00% |
| Martin, D. | GEO | MD | 31 | 1.13% | 0.00% |
| McPartland, K. | GEO | MD | 77 | 2.81% | 0.00% |
| McWilliams | GEO | MD | 59 | 2.15% | 0.00% |
| Menning, J. | GEO | MD | 55 | 2.01% | 0.00% |
| Mignini, A. | GEO | MD | 45 | 1.64% | 0.00% |
| Overstreet | GEO | MD | 118 | 4.31% | 0.00% |
| Parker | GEO | MD | 30 | 1.10% | 0.00% |
| Parlegreco, D. | GEO | MD | 67 | 2.45% | 0.00% |
| Patel, K. | GEO | MD | 52 | 1.90% | 0.00% |
| Richardson, J. | GEO | MD | 26 | 0.95% | 0.00% |
| Ryan, J. | GEO | MD | 19 | 0.69% | 0.00% |
| Santin, D. | GEO | MD | 24 | 0.88% | 0.00% |
| Scheihing, P. | GEO | MD | 9 | 0.33% | 0.00% |
| Shriner | GEO | MD | 22 | 0.80% | 0.00% |
| Smith, H. | GEO | MD | 87 | 3.18% | 0.00% |
| Smith, J. | GEO | MD | 27 | 0.99% | 0.00% |
| Snyderman, C. | GEO | MD | 64 | 2.34% | 0.00% |
| Sotzen | GEO | MD | 60 | 2.19% | 0.00% |
| Traber, T. | GEO | MD | 19 | 0.69% | 0.00% |
| Verde, J. | GEO | MD | 26 | 0.95% | 0.00% |
| Vorhauer | GEO | MD | 37 | 1.35% | 0.00% |
| Wissel, J. | GEO | MD | 70 | 2.56% | 0.00% |
| Yarrington, M. | GEO | MD | 39 | 1.42% | 0.00% |
| | | **Total** | **2,738** | **100.00%** | **0.03%** |

| Tier 1* | | | | | |
|---|---|---|---|---|---|
| **Facility Name** | **Fuel** | **State** | **Quantity** | **LFG %** | **Tier 1** |
| ACE Cumberland | LFG | NJ | 2,024 | 0.50% | 0.02% |
| AEP Cloyds | LFG | VA | 4,703 | 1.17% | 0.05% |
| AP Arden | LFG | PA | 3,291 | 0.82% | 0.04% |
| AP Reichs Ford | LFG | MD | 536 | 0.13% | 0.01% |
| Archbald | LFG | PA | 15,268 | 3.78% | 0.18% |
| Blue Ridge | LFG | PA | 7,391 | 1.83% | 0.09% |
| Broad Mountain | LFG | PA | 3,704 | 0.92% | 0.04% |
| BWWTP | LFG | MD | 3,786 | 0.94% | 0.04% |
| CID LFG | LFG | IL | 7,010 | 1.74% | 0.08% |
| Countryside | LFG | IL | 2,911 | 0.72% | 0.03% |
| Dixon Lee | LFG | IL | 1,856 | 0.46% | 0.02% |
| Easton LFG | LFG | MD | 5,869 | 1.45% | 0.07% |
| Fairless Hills | LFG | PA | 63,771 | 15.80% | 0.74% |
| FE Carbon Alum | LFG | OH | 29,393 | 7.28% | 0.34% |
| FE Erie County | LFG | OH | 1,244 | 0.31% | 0.01% |
| FE Lorain | LFG | OH | 5,551 | 1.38% | 0.06% |
| FE Mahoning | LFG | OH | 6,633 | 1.64% | 0.08% |
| Greene Valley | LFG | IL | 21,426 | 5.31% | 0.25% |
| Lake Gas | LFG | IL | 11,564 | 2.87% | 0.13% |
| Lakeview Gas | LFG | PA | 5,189 | 1.29% | 0.06% |
| Livingston | LFG | IL | 13,179 | 3.27% | 0.15% |
| Mallard Lake | LFG | IL | 15,000 | 3.72% | 0.17% |
| Martinsville | LFG | VA | 3,328 | 0.82% | 0.04% |
| ME Lebanon | LFG | PA | 58 | 0.01% | 0.00% |
| Monmouth | LFG | NJ | 473 | 0.12% | 0.01% |
| Morris | LFG | IL | 986 | 0.24% | 0.01% |
| Newland Park | LFG | MD | 1,943 | 0.48% | 0.02% |
| Edgeboro | LFG | NJ | 991 | 0.25% | 0.01% |
| Orchard Hills | LFG | MI | 25,374 | 6.29% | 0.29% |
| PEP Ritchie Bwn | LFG | MD | 4,467 | 1.11% | 0.05% |
| PEP Ritchie PG | LFG | MD | 2,831 | 0.70% | 0.03% |
| PL Pine Grove | LFG | PA | 18 | 0.00% | 0.00% |
| PN Northern Tier | LFG | PA | 5,503 | 1.36% | 0.06% |
| PN Shippensburg | LFG | PA | 2,275 | 0.56% | 0.03% |
| Prairie View | LFG | IL | 3,916 | 0.97% | 0.05% |
| PS Pennsauken | LFG | NJ | 1,324 | 0.33% | 0.02% |
| Rochelle Energy | LFG | IL | 10,031 | 2.49% | 0.12% |
| Sayrevil | LFG | NJ | 18,054 | 4.47% | 0.21% |
| Settlers Hill | LFG | IL | 2,985 | 0.74% | 0.03% |
| Suffolk Energy | LFG | VA | 1,751 | 0.43% | 0.02% |
| Tullytown | LFG | PA | 1,231 | 0.30% | 0.01% |
| VP Amelia | LFG | VA | 2,195 | 0.54% | 0.03% |
| VP Bethel | LFG | VA | 11,226 | 2.78% | 0.13% |
| VP Brunswick | LFG | VA | 4,343 | 1.08% | 0.05% |
| VP Charles City | LFG | VA | 18,758 | 4.65% | 0.22% |
| VP Chesterfield | LFG | VA | 10,921 | 2.71% | 0.13% |
| VP King Queen | LFG | VA | 380 | 0.09% | 0.00% |
| VP King George | LFG | VA | 18,902 | 4.68% | 0.22% |
| VP Northeast | LFG | VA | 13,538 | 3.35% | 0.16% |
| VP Peninusla | LFG | VA | 4,401 | 1.09% | 0.05% |
| VP VA Beach | LFG | VA | 123 | 0.03% | 0.00% |
| | | **Total** | **403,625** | **100.00%** | **4.68%** |

# Appendix A 2018 Retired RECs by Facility (Cont'd)

**Tier 1 (Cont'd)***

| Facility Name | Fuel | State | Quantity | WND % | Tier 1 |
|---|---|---|---|---|---|
| Adam | WND | IL | 2,898 | 0.07% | 0.03% |
| AEP Blue Creek | WND | OH | 144,960 | 3.38% | 1.68% |
| AEP Bluff Point | WND | IN | 55,712 | 1.30% | 0.65% |
| AEP Fowler R1A | WND | IN | 9,645 | 0.22% | 0.11% |
| AEP Fowler R3 | WND | IN | 28,444 | 0.66% | 0.33% |
| AEP Fowler R4 | WND | IN | 10,000 | 0.23% | 0.12% |
| AEP Hog Creek | WND | OH | 195,116 | 4.55% | 2.26% |
| AEP Meadow L3 | WND | IN | 920 | 0.02% | 0.01% |
| AEP Meadow L4 | WND | IN | 6,141 | 0.14% | 0.07% |
| AEP Meadow L5 | WND | IN | 50,505 | 1.18% | 0.59% |
| AEP Paulding | WND | OH | 25,243 | 0.59% | 0.29% |
| AEP Wildcat | WND | IN | 27,982 | 0.65% | 0.32% |
| AP Beech Ridge | WND | WV | 18,313 | 0.43% | 0.21% |
| AP Criterion | WND | MD | 25,118 | 0.59% | 0.29% |
| AP Fair Wind | WND | MD | 34,725 | 0.81% | 0.40% |
| AP 4-Mile Ridge | WND | MD | 28,807 | 0.67% | 0.33% |
| AP Greenland | WND | WV | 118,046 | 2.75% | 1.37% |
| AP Pinnacle | WND | WV | 196,407 | 4.58% | 2.28% |
| AP Roth Rock | WND | MD | 27,262 | 0.64% | 0.32% |
| AP Twin Ridges | WND | PA | 124,428 | 2.90% | 1.44% |
| Big Sky | WND | IL | 102,081 | 2.38% | 1.18% |
| Bishop Hill | WND | IL | 756,083 | 17.62% | 8.76% |
| Camp Grove 1 | WND | IL | 46,986 | 1.10% | 0.54% |
| Cayuga Ridge | WND | IL | 309,883 | 7.22% | 3.59% |
| Crescent Ridge | WND | IL | 67,829 | 1.58% | 0.79% |
| Crystal Lake III | WND | IA | 99 | 0.00% | 0.00% |
| Eco Grove | WND | IL | 49,530 | 1.15% | 0.57% |
| Farmer City | WND | MO | 57,257 | 1.33% | 0.66% |
| Findlay | WND | OH | 810 | 0.02% | 0.01% |
| Fowler Ridge | WND | IN | 10,000 | 0.23% | 0.12% |
| FPL Crystal Lake | WND | IA | 4,439 | 0.10% | 0.05% |
| Grand Ridge 1 | WND | IL | 46,512 | 1.08% | 0.54% |
| Grand Ridge 2 | WND | IL | 39,199 | 0.91% | 0.45% |
| Grand Ridge 3 | WND | IL | 42,100 | 0.98% | 0.49% |
| Harpster | WND | OH | 387 | 0.01% | 0.00% |
| High Trail | WND | IL | 204,484 | 4.77% | 2.37% |
| Jersey-Atlantic | WND | NJ | 16,390 | 0.38% | 0.19% |
| Kelly Creek | WND | IL | 218,754 | 5.10% | 2.54% |
| Mendota Hills | WND | IL | 29,717 | 0.69% | 0.34% |
| Meyersdale | WND | PA | 52,445 | 1.22% | 0.61% |
| Minonk | WND | IL | 19,982 | 0.47% | 0.23% |
| Old Trail | WND | IL | 32,498 | 0.76% | 0.38% |
| Pilot Hill | WND | IL | 64,069 | 1.49% | 0.74% |
| PL Locust Ridge | WND | PA | 9,651 | 0.22% | 0.11% |
| PN Armenia Mtn. | WND | PA | 7,457 | 0.17% | 0.09% |
| PN Highland N. | WND | PA | 42,466 | 0.99% | 0.49% |
| PN Laurel Hills | WND | PA | 801 | 0.02% | 0.01% |
| PN Lookout | WND | PA | 116,807 | 2.72% | 1.35% |
| PN Mehoopany 1 | WND | PA | 132,582 | 3.09% | 1.54% |
| PN Patton | WND | PA | 30,206 | 0.70% | 0.35% |
| PN Ringer Hill | WND | PA | 41,748 | 0.97% | 0.48% |
| PN Sandy Ridge | WND | PA | 62,959 | 1.47% | 0.73% |
| PN Stony Creek | WND | PA | 76,128 | 1.77% | 0.88% |
| Providence Hgt. | WND | IL | 62,618 | 1.46% | 0.73% |
| Radfords Run | WND | IL | 68,236 | 1.59% | 0.79% |
| Sublette | WND | IL | 88,413 | 2.06% | 1.02% |
| Talbot County | WND | MD | 70 | 0.00% | 0.00% |
| Tatanka | WND | ND | 80,079 | 1.87% | 0.93% |
| Top Crop 1 | WND | IL | 59,062 | 1.38% | 0.68% |
| Top Crop 2 | WND | IL | 37,302 | 0.87% | 0.43% |

**Tier 1 (Cont'd)***

| Facility Name | Fuel | State | Quantity | WND % | Tier 1 |
|---|---|---|---|---|---|
| VP Desert | WND | NC | 35,267 | 0.82% | 0.41% |
| VP New Creek | WND | WV | 36,305 | 0.85% | 0.42% |
| Zephyr | WND | OH | 68 | 0.00% | 0.00% |
| | | **Total** | **4,290,431** | **100.00%** | **49.73%** |

| Facility Name | Fuel | State | Quantity | WAT % | Tier 1 |
|---|---|---|---|---|---|
| AEP Buck | WAT | VA | 86,017 | 8.18% | 1.00% |
| AEP Fries | WAT | VA | 29,662 | 2.82% | 0.34% |
| AEP Glen Ferris | WAT | WV | 13,887 | 1.32% | 0.16% |
| Allegheny | WAT | PA | 5,447 | 0.52% | 0.06% |
| Allegheny Rvr 6 | WAT | PA | 4,291 | 0.41% | 0.05% |
| Allegheny Rvr 8 | WAT | PA | 121,072 | 11.51% | 1.40% |
| Allegheny Rvr 9 | WAT | PA | 113,126 | 10.76% | 1.31% |
| AP Misc | WAT | WV | 14,231 | 1.35% | 0.16% |
| BC Brighton | WAT | MD | 607 | 0.06% | 0.01% |
| Beardslee | WAT | NY | 55 | 0.01% | 0.00% |
| Beebee Island | WAT | NY | 1,836 | 0.17% | 0.02% |
| Big Shoals | WAT | VA | 1,487 | 0.14% | 0.02% |
| Black River | WAT | NY | 1,372 | 0.13% | 0.02% |
| Brasfield | WAT | VA | 11,435 | 1.09% | 0.13% |
| Upper Sterling | WAT | IL | 10,664 | 1.01% | 0.12% |
| Coleman Falls | WAT | VA | 6,372 | 0.61% | 0.07% |
| Conemaugh | WAT | PA | 34,079 | 3.24% | 0.39% |
| Cushaw | WAT | VA | 717 | 0.07% | 0.01% |
| Deep Creek 32 | WAT | MD | 43,958 | 4.18% | 0.51% |
| Deferiet | WAT | NY | 4,180 | 0.40% | 0.05% |
| Dixon | WAT | IL | 18,446 | 1.75% | 0.21% |
| E.J. West | WAT | NY | 120 | 0.01% | 0.00% |
| French Paper | WAT | MI | 6,060 | 0.58% | 0.07% |
| Great Falls | WAT | NJ | 10,000 | 0.95% | 0.12% |
| Halifax | WAT | VA | 4,286 | 0.41% | 0.05% |
| Holcomb Rock | WAT | VA | 9,085 | 0.86% | 0.11% |
| Lakeview Hydro | WAT | VA | 542 | 0.05% | 0.01% |
| Lockport | WAT | IL | 67,014 | 6.37% | 0.78% |
| London | WAT | WV | 81,294 | 7.73% | 0.94% |
| Lyons Falls | WAT | NY | 2,777 | 0.26% | 0.03% |
| Marmet | WAT | WV | 79,232 | 7.53% | 0.92% |
| Moomaws Dam | WAT | VA | 2,181 | 0.21% | 0.03% |
| Mother Ann Lee | WAT | KY | 3,455 | 0.33% | 0.04% |
| Niagara | WAT | VA | 4,413 | 0.42% | 0.05% |
| Prospect | WAT | NY | 3,193 | 0.30% | 0.04% |
| Reusens | WAT | VA | 19,128 | 1.82% | 0.22% |
| Schoolfield | WAT | VA | 17,724 | 1.69% | 0.21% |
| Snowden | WAT | VA | 4,607 | 0.44% | 0.05% |
| Soft Maple | WAT | NY | 1,834 | 0.17% | 0.02% |
| Trenton | WAT | NY | 7,530 | 0.72% | 0.09% |
| VP Emporia | WAT | VA | 7,769 | 0.74% | 0.09% |
| Winfield | WAT | WV | 60,639 | 5.77% | 0.70% |
| York Haven | WAT | PA | 106,204 | 10.10% | 1.23% |
| Yough | WAT | PA | 29,576 | 2.81% | 0.34% |
| | | **Total** | **1,051,604** | **100.00%** | **12.19%** |

| Facility Name | Fuel | State | Quantity | MSW % | Tier 1 |
|---|---|---|---|---|---|
| Covanta Fairfax | MSW | VA | 315,012 | 31.24% | 3.65% |
| Montgomery | MSW | MD | 308,910 | 30.63% | 3.58% |
| Wheelabrator | MSW | MD | 384,595 | 38.13% | 4.46% |
| | | **Total** | **1,008,517** | **100.00%** | **11.69%** |

# Appendix A 2018 Retired RECs by Facility (Cont'd)

**Tier 1 (Cont'd)***

| Facility Name | Fuel | State | Quantity | AB % | Tier 1 |
|---|---|---|---|---|---|
| Kapstone Kraft | AB | NC | 40 | 100.00% | 0.00% |
| | | **Total** | **40** | **100.00%** | **0.00%** |

| Facility Name | Fuel | State | Quantity | BLQ % | Tier 1 |
|---|---|---|---|---|---|
| AEP W Kingsport | BLQ | TN | 212,627 | 16.60% | 2.46% |
| Chillicothe | BLQ | OH | 87,172 | 6.81% | 1.01% |
| Covington | BLQ | VA | 172,964 | 13.51% | 2.00% |
| Domtar Paper | BLQ | NC | 245,086 | 19.14% | 2.84% |
| Franklin Mill | BLQ | VA | 98,762 | 7.71% | 1.14% |
| Hopewell | BLQ | VA | 110,064 | 8.59% | 1.28% |
| Johnsonburg Mill | BLQ | PA | 13,741 | 1.07% | 0.16% |
| Kapstone Kraft | BLQ | NC | 58,840 | 4.59% | 0.68% |
| Luke Mill | BLQ | MD | 114,111 | 8.91% | 1.32% |
| West Point | BLQ | VA | 167,341 | 13.07% | 1.94% |
| | | **Total** | **1,280,708** | **100.00%** | **14.84%** |

| Facility Name | Fuel | State | Quantity | OBG % | Tier 1 |
|---|---|---|---|---|---|
| Allentown | OBG | PA | 2,642 | 3.03% | 0.03% |
| Atlantic Trtmnt | OBG | VA | 1,334 | 1.53% | 0.02% |
| Buckeye BioGas | OBG | OH | 585 | 0.67% | 0.01% |
| Central Ohio | OBG | OH | 228 | 0.26% | 0.00% |
| DC Water Bailey | OBG | DC | 78,538 | 89.99% | 0.91% |
| Haviland | OBG | OH | 3,909 | 4.48% | 0.05% |
| Zanesville | OBG | OH | 37 | 0.04% | 0.00% |
| | | **Total** | **87,273** | **100.00%** | **1.01%** |

| Facility Name | Fuel | State | Quantity | WDS % | Tier 1 |
|---|---|---|---|---|---|
| AEP W Kingsport | WDS | TN | 28,814 | 5.73% | 0.33% |
| Covington | WDS | VA | 60,343 | 12.00% | 0.70% |
| Cox Waste | WDS | KY | 7,959 | 1.58% | 0.09% |
| Domtar Paper | WDS | NC | 148,200 | 29.48% | 1.72% |
| Hopewell | WDS | VA | 8,111 | 1.61% | 0.09% |
| Kapstone Kraft | WDS | NC | 1,212 | 0.24% | 0.01% |
| Pittyslvania | WDS | VA | 9,148 | 1.82% | 0.11% |
| VP South Boston | WDS | VA | 227,507 | 45.25% | 2.64% |
| West Point | WDS | VA | 11,501 | 2.29% | 0.13% |
| | | **Total** | **502,795** | **100.00%** | **5.83%** |

**Tier 2**

| Facility Name | Fuel | State | Quantity | WAT % | Tier 2 |
|---|---|---|---|---|---|
| Summersville | WAT | WV | 5,645 | 0.35% | 0.35% |
| Conowingo | WAT | MD | 548,309 | 34.27% | 34.27% |
| Covanta | WAT | WV | 33,313 | 2.08% | 2.08% |
| Falls | WAT | NC | 21,431 | 1.34% | 1.34% |
| Gaston | WAT | NC | 2,921 | 0.18% | 0.18% |
| High Rock | WAT | NC | 85,676 | 5.36% | 5.36% |
| Lake Lynn | WAT | PA | 48,495 | 3.03% | 3.03% |
| Narrows | WAT | NC | 138,885 | 8.68% | 8.68% |
| Piney | WAT | PA | 2,736 | 0.17% | 0.17% |
| Racine | WAT | OH | 4,132 | 0.26% | 0.26% |
| Roanoke | WAT | NC | 6,653 | 0.42% | 0.42% |
| Safe Harbor 1 | WAT | PA | 247,522 | 15.47% | 15.47% |
| Tuckertown | WAT | NC | 117,264 | 7.33% | 7.33% |
| XIC Calderwood | WAT | TN | 180,664 | 11.29% | 11.29% |
| XIC Cheoah | WAT | NC | 156,173 | 9.76% | 9.76% |
| | | **Total** | **1,599,819** | **100.00%** | **100.00%** |

**Summary**

| | |
|---|---|
| Tier 1 REC Total | 8,627,737 |
| SREC Total | 857,232 |
| Tier 2 REC Total | 1,599,819 |
| Grand Total | 11,084,788 |

*Solar facilities are not represented in this table. In 2018, 54,026 facilities produced 857,232 SRECs.

**Resource Definitions**

| | | | |
|---|---|---|---|
| Agriculture Waste | AB | Municipal Solid Waste | MSW |
| Black Liquor | BLQ | Other Biomass Gas | OBG |
| Geothermal | GEO | Wood/Waste Solids | WDS |
| Hydroelectric | WAT | Wind | WND |
| Landfill Gas | LFG | | |

## Appendix B Location of Facilities that Provided RECs for 2018 RPS Compliance

| | DC | IA | IL | IN | KY | MD | MI | MO | NC | ND | NJ | NY | OH | PA | TN | VA | WV | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Tier 1 Non-solar*** | | | | | | | | | | | | | | | | | | |
| Agricultural Byproduct | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | **1** |
| Black Liquor | - | - | - | - | - | 1 | - | - | 2 | - | - | - | 1 | 1 | 1 | 4 | - | **10** |
| Geothermal | - | - | - | - | - | 55 | - | - | - | - | - | - | - | - | - | - | - | **55** |
| Landfill Gas | - | - | 11 | - | - | 6 | 1 | - | - | - | 5 | - | 4 | 11 | - | 13 | - | **51** |
| Municipal Solid Waste | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - | 1 | - | **3** |
| Other Biomass Gas | 1 | - | - | - | - | - | - | - | - | - | - | - | 4 | 1 | - | 1 | - | **7** |
| Solar Thermal | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | **1** |
| Small Hydro | - | - | 3 | - | 1 | 2 | 1 | - | - | - | 1 | 9 | - | 7 | - | 15 | 5 | **44** |
| Wood Waste | - | - | - | - | 1 | - | - | - | 2 | - | - | - | - | - | 1 | 5 | - | **9** |
| Wind | - | 2 | 21 | 9 | - | 5 | - | 1 | 1 | 1 | 1 | - | 6 | 12 | - | - | 4 | **63** |
| ***Tier 1 Solar*** | | | | | | | | | | | | | | | | | | |
| Solar PV | - | - | - | - | - | 53,252 | - | - | - | - | - | - | - | - | - | - | - | **53,252** |
| Solar Thermal | - | - | - | - | - | 774 | - | - | - | - | - | - | - | - | - | - | - | **774** |
| ***Tier 2*** | | | | | | | | | | | | | | | | | | |
| Large Hydro | - | - | - | - | - | 1 | - | - | 7 | - | - | - | 1 | 3 | 1 | - | 2 | **15** |
| **Total** | **1** | **2** | **35** | **9** | **2** | **54,099** | **2** | **1** | **13** | **1** | **7** | **9** | **16** | **35** | **3** | **39** | **11** | **54,285** |

Note: In order to prevent double counting, facilities using multiple fuels are only listed under their primary fuel.

## Appendix C Disposition of 2018 Vintage RECs Generated in Maryland

| Fuel Type and Tier | RECs Retired for RPS Compliance by State | | | | | | | Available | Other | Total RECs Generated |
|---|---|---|---|---|---|---|---|---|---|---|
| | DC | DE | IL | MD | NJ | PA | Total | | | |
| Black Liquor | - | - | - | 64,572 | - | - | 64,572 | 22,047 | - | **86,619** |
| Geothermal | - | - | - | 1,636 | - | - | 1,636 | 363 | - | **1,999** |
| Landfill Gas | - | - | - | 13,958 | 31,968 | 2,522 | 48,448 | 32,191 | 1,433 | **82,072** |
| Municipal Solid Waste | - | - | - | 380,220 | - | - | 380,220 | 341,352 | - | **721,572** |
| Small Hydro | - | - | - | 35,570 | - | - | 35,570 | 6,698 | - | **42,268** |
| Solar Thermal | - | - | - | 3 | - | - | 3 | 12 | - | **15** |
| Wind | - | 109,026 | - | 68,180 | 218,700 | - | 395,906 | 172,600 | 1,581 | **570,087** |
| Wood Waste | - | - | - | - | - | - | - | 16,504 | - | **16,504** |
| ***Tier 1 Non-solar Total*** | **-** | **109,026** | **-** | **564,139** | **250,668** | **2,522** | **926,355** | **591,767** | **3,014** | **1,521,136** |
| Solar PV | 1,636 | - | 2 | 358,857 | - | - | 360,495 | 711,763 | 165 | **1,072,423** |
| Solar Thermal | - | - | - | 885 | - | - | 885 | 2,959 | - | **3,844** |
| ***Tier 1 Solar Total*** | **1,636** | **-** | **2** | **359,742** | **-** | **-** | **361,380** | **714,722** | **165** | **1,076,267** |
| Large Hydro | - | - | 1,233,393 | - | - | 255,994 | 1,489,387 | 1,232,753 | 66,273 | **2,788,413** |
| ***Tier 2 Total*** | **-** | **-** | **1,233,393** | **-** | **-** | **255,994** | **1,489,387** | **1,232,753** | **66,273** | **2,788,413** |
| ***Grand Total*** | **1,636** | **109,026** | **1,233,395** | **923,881** | **250,668** | **258,516** | **2,777,122** | **2,539,242** | **69,452** | **5,385,816** |

**Appendix D Number of Renewable Energy Facilities Located in Maryland**

| Maryland County | Tier 1 Non-Solar | Tier 1 Solar | Tier 2 | Total |
|---|---|---|---|---|
| Allegany | 1 | 53 | - | 54 |
| Anne Arundel | 32 | 8,272 | - | 8,304 |
| Baltimore | 9 | 7,155 | - | 7,164 |
| Baltimore City | 1 | 1,095 | - | 1,096 |
| Calvert | - | 790 | - | 790 |
| Caroline | - | 289 | - | 289 |
| Carroll | - | 2,149 | - | 2,149 |
| Cecil | - | 1,429 | - | 1,429 |
| Charles | - | 2,681 | - | 2,681 |
| Dorchester | - | 293 | - | 293 |
| Frederick | 5 | 2,665 | - | 2,670 |
| Garrett | 6 | 57 | - | 63 |
| Harford | 7 | 3,797 | 1 | 3,805 |
| Howard | 13 | 3,538 | - | 3,551 |
| Kent | - | 322 | - | 322 |
| Montgomery | 14 | 10,291 | - | 10,305 |
| Prince Georges | 6 | 16,925 | - | 16,931 |
| Queen Annes | 4 | 612 | - | 616 |
| Somerset | 1 | 266 | - | 267 |
| St Marys | - | 1,355 | - | 1,355 |
| Talbot | 4 | 217 | - | 221 |
| Washington | 2 | 1,081 | - | 1,083 |
| Wicomico | 2 | 1,009 | - | 1,011 |
| Worcester | 1 | 489 | - | 490 |
| **Total** | **108** | **66,830** | **1** | **66,939** |

Note: This list includes all renewable generators that are both: 1) located within Maryland, and 2) registered to participate in any one of the PJM states' renewable energy programs as of November 1, 2019.

**Appendix E Capacity of Renewable Energy Facilities Located in Maryland (MW)**

| Maryland County | Tier 1 Non-Solar | Tier 1 Solar | Tier 2 | Total |
|---|---|---|---|---|
| Allegany | 65.0 | 2.7 | - | 67.7 |
| Anne Arundel | 4.0 | 96.7 | - | 100.6 |
| Baltimore | 66.5 | 87.9 | - | 154.4 |
| Baltimore City | 0.1 | 14.7 | - | 14.8 |
| Calvert | - | 8.9 | - | 8.9 |
| Caroline | - | 9.6 | - | 9.6 |
| Carroll | - | 30.7 | - | 30.7 |
| Cecil | - | 35.0 | - | 35.0 |
| Charles | - | 45.6 | - | 45.6 |
| Dorchester | - | 12.9 | - | 12.9 |
| Frederick | 2.1 | 86.8 | - | 88.8 |
| Garrett | 210.0 | 3.6 | - | 213.6 |
| Harford | 1.4 | 69.8 | 474.0 | 545.1 |
| Howard | 1.3 | 45.8 | - | 47.1 |
| Kent | - | 12.8 | - | 12.8 |
| Montgomery | 81.1 | 117.7 | - | 198.8 |
| Prince George's | 13.5 | 194.3 | - | 207.8 |
| Queen Anne's | 0.1 | 40.9 | - | 41.0 |
| Somerset | 3.8 | 109.7 | - | 113.5 |
| St. Mary's | - | 14.8 | - | 14.8 |
| Talbot | 70.3 | 12.7 | - | 83.0 |
| Washington | 0.1 | 66.7 | - | 66.8 |
| Wicomico | 6.0 | 40.7 | - | 46.7 |
| Worcester | 0.0 | 9.1 | - | 9.1 |
| **Total** | **525.1** | **1,170.2** | **474.0** | **2,169.3** |

Note: This list includes all renewable generators that are both: 1) located within Maryland, and 2) registered to participate in any one of the PJM states' renewable energy programs as of November 1, 2019.