

Long-Term Electricity Report for Maryland (LTER) Renewable Energy Portfolio Standard White Paper to Support LTER Assumptions

November 30, 2010

Renewable Energy Resources Input Assumptions - Reference Case

Tier 1 Solar Energy Resources in Maryland currently generate approximately 8 GWh of electricity per year. Solar electricity output is expected to increase to 720 GWh by 2022. Development of several large utility-scale solar projects will produce sufficient electricity to meet the Tier 1 Solar RPS in the short term (2011 – 2018). However, while a significant amount of new solar capacity is installed, only 50 percent of the 2022 Tier 1 Solar requirement is likely to be met. Thus the input assumption is that there is sufficient solar capacity to meet the Maryland RPS up through 2018.

Tier 1 Non-Solar Energy Resources in PJM currently generate approximately 20,100 GWh of electricity per year which is more than enough to supply the regional 2010 Tier 1 Non Solar renewable energy requirements established in Maryland and those of the PJM state's with similar renewable energy portfolio standards. Development of Tier 1 Non Solar renewable resources are assumed to keep pace with demand so that the region's RPS requirements are met throughout the study period (2010-2030).

Tier 2 Energy Resources in PJM currently generate approximately 18,000 GWh of electricity per year, which is more than enough to supply the regional Tier 2 renewable energy requirements established in Maryland and those of the PJM state's with similar renewable energy portfolio standards. Very little new Tier 2 generation is required to meet the regional requirements throughout the study period.

Renewable Energy Resources Input Assumptions - High Renewable Case

The high renewable energy scenario is based the assumption that all existing state RPS requirements (i.e., for all states having an RPS) are achieved (including solar requirements), with the addition of a federal renewable energy requirement. In those instances where the federal requirement is less than the state requirement, it is assumed that the state requirement remains in effect and continues to be met. The Federal RPS is set at 7 percent in 2015, increasing 1 percent per year to 12 percent by 2020 and staying at 12 percent for utilities serving greater than 4,000 GWh of annual energy (accounts for about 80 percent of retail sales).

Supporting Documentation of Input Assumptions

This white paper summarizes the findings of the attached recent draft report prepared by the Power Plant Research Program, entitled, *2010 Inventory of Renewable Energy Generators Eligible for the Maryland Renewable Energy Portfolio Standard*. This draft report uses the PJM Generation Attributes Tracking System (“GATS”) to produce an inventory of available renewable energy resources that would qualify under the Maryland Renewable Energy Portfolio Standard (“RPS”) and provides a status report comparing the availability of renewable energy in the PJM region with the requirements of state RPS policies.

The Maryland RPS was established under the 2004 Maryland Renewable Energy Portfolio Standard and Credit Trading Act (Maryland RPS Act).¹ The Maryland RPS Act distinguished between energy derived from Tier 1 and Tier 2 facilities (Table 1). Subsequent amendments to the Maryland RPS Act established a specific requirement for Tier 1 solar resources, so while solar resources remain a Tier 1 resource, they are typically accounted for separately for purposes of meeting the solar energy requirement.

Table 1 – Maryland Tier 1 and Tier 2 Classification
Tier 1 Qualifying Facilities
Solar – photovoltaic (PV) and solar thermal systems that produce electric power
Wind
Qualifying biomass* (.)
Methane from the anaerobic decomposition of organic materials in a landfill or a wastewater treatment plant
Geothermal
Ocean energy
Fuel cells powered by methane or biomass
Hydroelectric plants under 30 MW licensed by FERC** or exempt from licensing
Poultry litter-to-energy facilities
Tier 2 Qualifying Facilities
Hydroelectric plants, other than pumped storage
Waste-to-energy facilities
*Includes black liquor, the liquid waste material remaining from pulpwood cooking or papermaking process.
** FERC is the Federal Energy Regulatory Commission.

The Maryland RPS Act has been amended three times -- in 2007, 2008 and 2010. In addition to adding a specific solar energy requirement in 2007, these amendments modified the types of qualifying renewable energy sources eligible to receive credit under the RPS, changed the geographic eligibility of facilities to exclude the PJM region’s adjacent states, and increased the percentage of electricity sales that

¹ The State of Maryland, 2004, “Electricity Regulation - Renewable Energy Portfolio Standard and Credit Trading - Maryland Renewable Energy Fund.” Available on the internet at: <http://mlis.state.md.us/2004rs/billfile/hb1308.htm>

must come from renewable energy sources for each year the RPS is in effect. The RPS requires suppliers to purchase a certain amount of their energy from renewable energy resources using a renewable energy certificate (“REC”) to demonstrate compliance.² Those suppliers unable (or unwilling) to purchase a sufficient amount of renewable energy resources have to pay an alternative compliance payment (“ACP”) for each megawatt-hour of renewable energy that they are short. Table 2 displays the current percentage requirements of the Maryland RPS, and the ACP for each year as provided for in the RPS Statute.³

Year	Percent of Energy Sales Required to be Renewable			Alternative Compliance Payment for Suppliers Unable to Obtain Sufficient Renewable Energy Certificates		
	Tier 1 Solar (Percent) ¹	Tier 1 Non-Solar (Percent)	Tier 2 (Percent) ²	Tier 1 Solar (\$/SREC) ³	Tier 1 Non-Solar (\$/REC)	Tier 2 (\$/REC)
2006	--	1.0	2.5	--	\$20	\$15
2007	--	1.0	2.5	--	\$20	\$15
2008	0.005	2.0	2.5	--	\$20	\$15
2009	0.010	2.0	2.5	\$400	\$20	\$15
2010	0.025	3.0	2.5	\$400	\$20	\$15
2011	0.05	4.95	2.5	\$400	\$40	\$15
2012	0.10	6.40	2.5	\$400	\$40	\$15
2013	0.20	8.00	2.5	\$400	\$40	\$15
2014	0.30	10.00	2.5	\$400	\$40	\$15
2015	0.40	10.10	2.5	\$350	\$40	\$15
2016	0.50	12.20	2.5	\$350	\$40	\$15
2017	0.55	12.55	2.5	\$300	\$20	\$15
2018	0.90	14.90	2.5	\$250	\$20	\$15
2019	1.20	16.20	--	\$200	\$20	--
2020	1.50	16.50	--	\$150	\$20	--
2021	1.85	16.85	--	\$100	\$20	--
2022 (and beyond)	2.00	18.00	--	\$50	\$20	--

1 - Solar requirement started in compliance year 2008.
2 - Tier 2 requirement sunsets at the end of 2018.
3- SREC is a renewable energy certificate generated by solar energy resources.

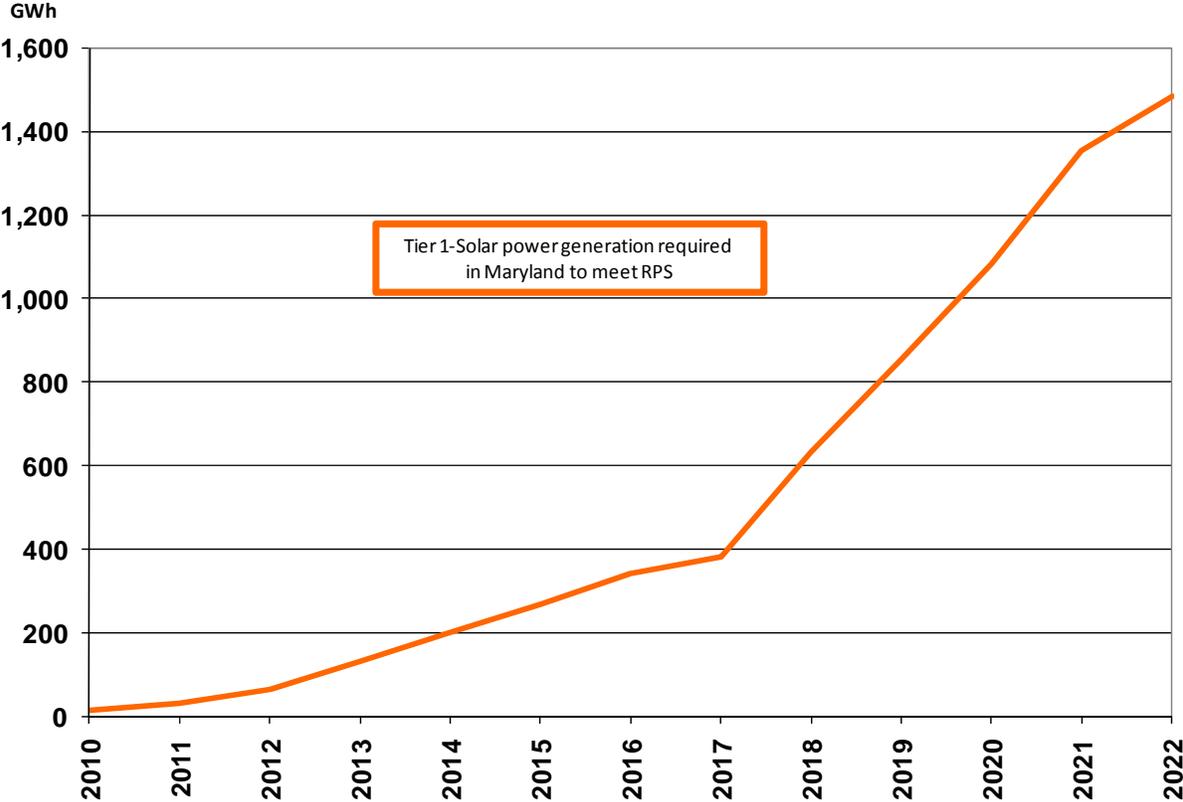
² A renewable energy certificate (REC) represents the renewable energy traits of the eligible renewable resources and is often sold separate from the electrical output of the power plant.

³ §7-701 et seq. of the Public Utility Companies Article, *Annotated Code of Maryland*, “Renewable Energy Portfolio Standard”.

Tier 1 - Solar Energy

A significant modification to the 2004 Maryland RPS is the addition of a specific solar energy requirement which was first introduced as part of the 2007 amendment and then modified in 2010 when the compliance schedule was accelerated and the ACP increased for the 2011 to 2016 period. The Maryland solar energy requirement limits eligibility to solar energy facilities located in Maryland. Maryland currently has 610 solar units totaling 6.2 MW of capacity that is projected to generate approximately 8.1 GWh of electricity in 2010. The 2010 solar energy RPS requirement is about 16 GWh and therefore, Maryland is estimated to fall short (by nearly 50 percent) of the generation capacity needed to meet its 2010 RPS solar requirement. This requirement will double over the next few years to about 32 GWh in 2011; 66 GWh in 2012; and 132 GWh in 2013, after which the annual required percentage growth rate reduces slightly, and is projected to reach about 1,484 GWh in 2022 (Figure 1).

Figure 1 – Projected Electric Generation Required to Meet Maryland Solar RPS



Substantial (approximately 54 percent per year) and sustained (every year from 2010 through 2022) growth of solar generation will be required to meet future Maryland solar requirements. The draft *2010 Inventory of Renewable Energy Generators Eligible*

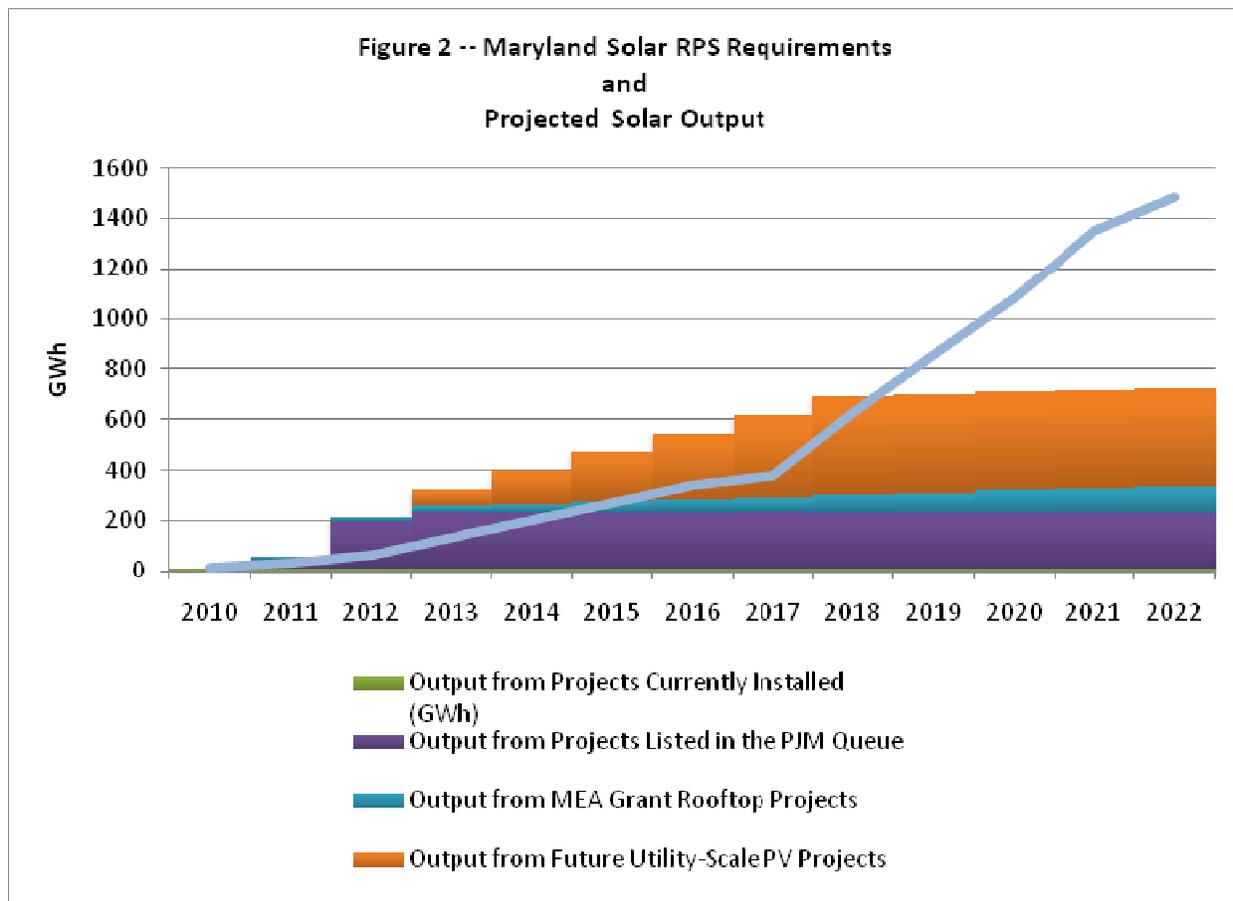
for the Maryland Renewable Energy Portfolio Standard does not project the amount of solar development that will occur in over the next 20 years. However, it does conclude that in order to meet the Solar RPS, there will be a need for several larger, utility-scale projects. Examining the PJM Queue we see that there are several such projects already proposed in Maryland (Table 3). Whether these projects move forward to construction is uncertain. However, given the attractive incentives for solar energy, the economic downturn which put off development of economically questionable projects, and recent changes to the PJM Interconnection process to discourage speculative interconnection requests, we assume that all of the proposed projects will move forward to construction.

Date Entered into the PJM Queue	PJM Substation: Point of Interconnection	Size (MW)	Estimated Annual Output (GWh)*	Planned In Service Date
7/8/2009	Vienna	6	7.9	2010 Q4
12/18/2009	Church	9	11.8	2011 Q2
4/20/2010	Laurel 69kV	20	26.3	2011 Q2
4/30/2010	Emmitsburg 34kV	14	18.4	2011 Q4
4/30/2010	Kenney	5	6.6	2011 Q2
5/10/2010	Kennedyville 1 69kV	20	26.3	2011 Q4
5/10/2010	Kennedyville 2 69kV	20	26.3	2011 Q4
7/30/2010	Kenney 69kV	20	26.3	2012 Q2
8/31/2010	Pemberton 12kV	5	6.6	2012 Q1
8/31/2010	Delmar 12kV	20	26.3	2012 Q1
9/14/2010	Church 69kV	20	26.3	2011 Q2
9/30/2010	Worcester 25kV	13	17.1	2012 Q2
TOTAL		172	226.1	

* Assumes a 15 percent capacity factor.

Meeting the Maryland Solar RPS will be challenging given the current amount of installed capacity and the rate of development that will be required to meet the Solar RPS in future years. However, there are already a significant number of larger facilities planned for development, and growth in the solar industry is expected to continue over the next few years. Assuming that the projects listed in the queue move ahead as planned; that additional utility-scale projects are proposed and developed; and that the Maryland Energy Administration continues to support solar energy development through issuing grants and other incentives; it seems as though there will be sufficient solar energy resources available to meet the Maryland RPS through 2018. However, given the steep increase in the solar requirement and the decline in the ACP which is scheduled to drop below \$200/Solar REC after 2019, there is some question as to whether or not the interest in developing large utility-scale projects will continue in the final years of the RPS. Without consistent and significant growth in larger, utility-scale

projects, in-state development of solar energy projects is likely to fall short of what is required to meet the RPS (Figure 2).



Assumptions for Figure 2:

1. All projects currently listed in the PJM queue are built and operational by 2014.
2. MEA continues to provide grants for residential and mid-size commercial projects so that 6.6 MW of solar are installed per year.
3. Utility-scale projects continue to move ahead for average development of 50 MW/year in Maryland up until 2019 when the Solar Alternative Compliance Payment falls below \$200. After that period no new utility-scale solar is assumed.
4. All in-state resources are made available to Maryland electricity suppliers for purposes of meeting the Maryland Solar RPS.

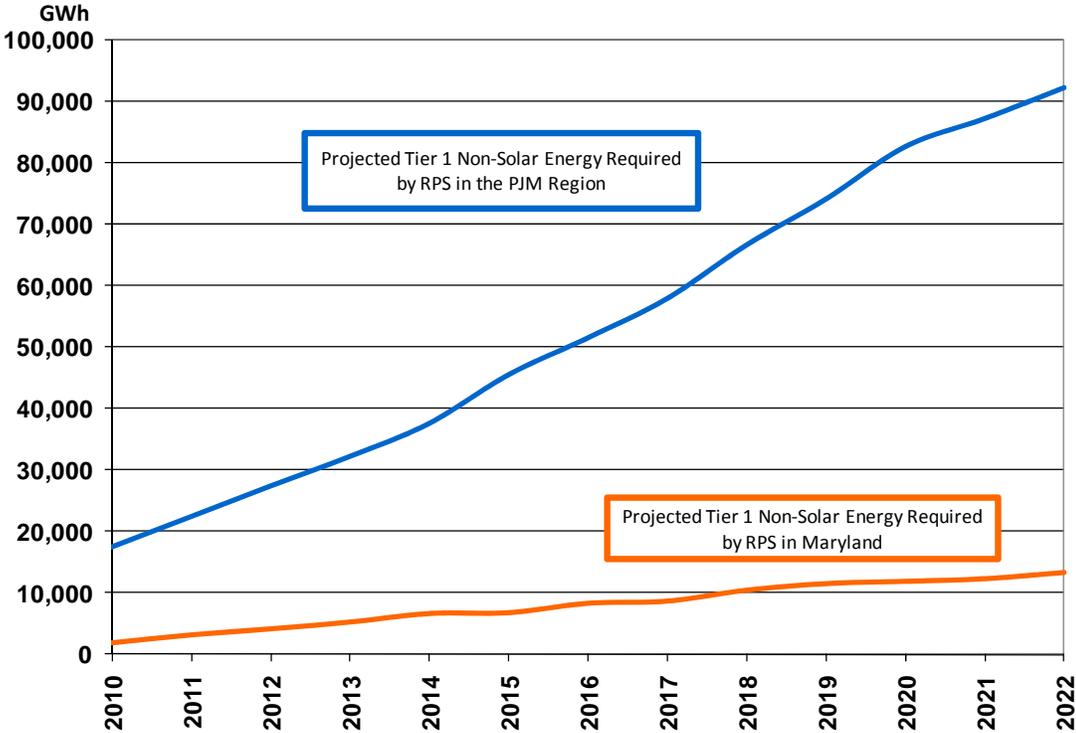
Further challenging the ability of Maryland's electricity suppliers to meet the solar RPS is that Maryland solar generation can be used to satisfy other state RPS requirements. In the PJM region, Maryland solar is eligible to meet the solar and/or general RPS requirements in Delaware, the District of Columbia, Illinois, North Carolina, Pennsylvania, Virginia, and West Virginia. Some of these states also have higher payments associated with non-compliance. For instance, the Pennsylvania solar alternative compliance payment is equal to twice the average market value of solar RECs sold within the PJM region. In July 2010, the average price of solar RECs was about \$584 making the 2010 Pennsylvania alternative compliance payment about

\$1,168 per solar REC shortfall. In comparison, the 2010 alternative compliance payment in Maryland is \$400 per solar REC shortfall. This situation is likely to create economic pressures that may result in Maryland solar RECs being directed outside of Maryland.

Tier 1 Non-Solar

Maryland’s Tier 1 Non-Solar RPS requirements allow Maryland electric suppliers to source Tier 1 Non-Solar RECs from within the PJM region. Maryland will require about 1,927 GWh of Tier 1 Non-Solar generation in 2010; 3,212 GWh in 2011; 4,194 GWh in 2012; and increasing to an estimated 13,354 GWh by 2022 (Figure 3). Tier 1 Non-Solar resources are projected to generate approximately 21,000 GWh in 2010. Generation from Tier 1 Non-Solar resources within the PJM control area are sufficient to satisfy the 2010 Tier 1 Non-Solar REC requirements of all PJM members. The PJM regional RPS requirement for Tier 1 Non-Solar RECs in 2022, however, is about five times the current estimated output of installed generation, and Tier 1 Non-Solar renewable resource capacity will need to grow at approximately 14 percent annually to meet future PJM Regional RPS requirements.

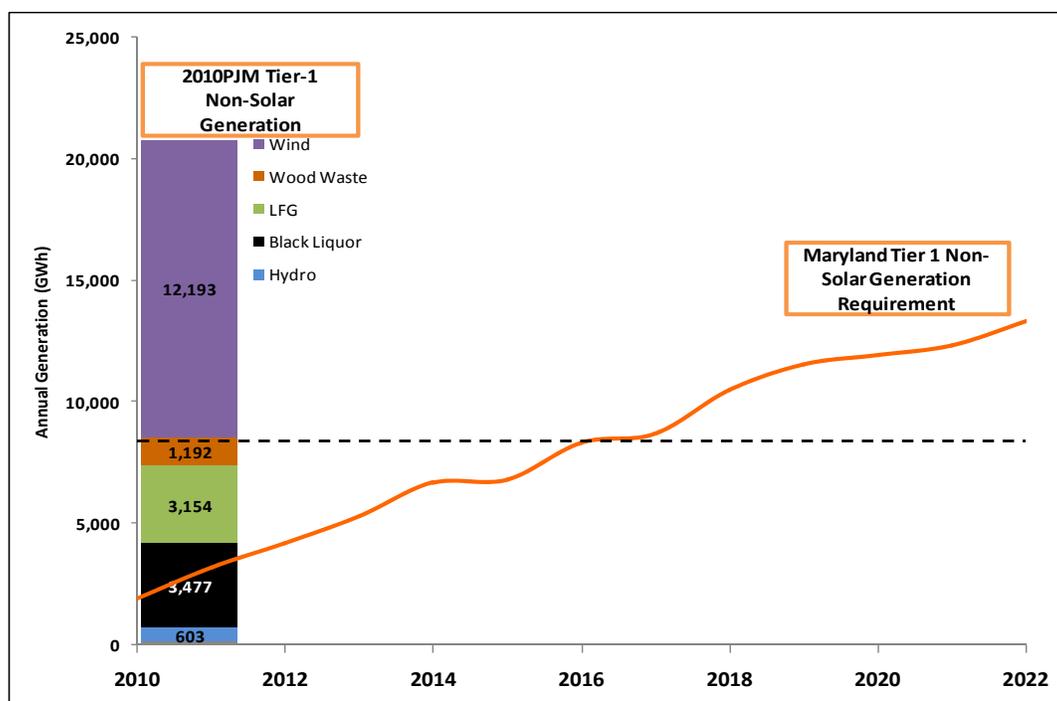
Figure 3 – Projected Tier 1 Electric Generation Required to Meet Maryland and PJM-wide RPS



Including Maryland, 7 of the 13 PJM states (including the District of Columbia) have established a renewable portfolio standard based on the use of RECs tracked under the PJM GATS program.⁴ Each RPS is different, with varying resource eligibility, percentage requirements, and ACPs. The variation of RPS requirements is a significant element when analyzing the amount of renewable resources available to any particular state. Resources eligible in one state but not another may allow for an imbalance in state REC prices until the point at which all states are competing for the same renewable resources.

Figure 4 depicts the estimated annual output of the renewable energy resources eligible for use in Maryland. Note that there is 3,477 GWh available from black liquor, 603 GWh from small hydroelectric facilities, and an additional 1,192 from wood waste resources eligible for Tier 1 requirements in Maryland. These resources may not be considered eligible resources for all PJM state RPSs. For example, of those states that use PJM GATs traded RECS, only Maryland and Pennsylvania allow for the use of black liquor to qualify as a Tier 1 renewable resource. The combination of small hydro, and black liquor can be used to meet a significant portion of the RPS requirements for Maryland up until 2012.

Figure 4. Comparison of Available Tier 1 Non-Solar Renewable Resources and Maryland’s Tier 1 Non-Solar RPS Requirement



⁴ Delaware, New Jersey, Ohio, Pennsylvania, Illinois, Maryland, and the District of Columbia have REC-based RPS requirements that make use of the PJM GATS system. North Carolina, Virginia, West Virginia, and Michigan have renewable energy requirements or goals but do not make use of regional RECs tracked via PJM GATS. Neither Indiana nor Kentucky have an RPS.

Over time, as state requirements increase and the lower cost Tier 1 Non-Solar resources such as small hydro, black liquor, landfill gas, and wood waste are exhausted, the suppliers will need to identify additional renewable energy suppliers to provide energy and RECs for meeting compliance with their RPS. Based on the current inventory of renewable resources and the analysis of what will be required to meet Tier 1 Non-Solar RPS compliance in Maryland and across PJM, it appears as though Maryland exhausts its supply of low-cost Tier 1 Non-Solar resources around 2016 (Figure 4). After that we expect the average Tier 1 Non-Solar REC price to equalize across the PJM as suppliers compete for new wind, landfill gas and biomass RECS to meet their state RPS requirements. Nonetheless, given the current trends for development and construction of new Tier 1 Non-Solar renewable resources, it appears as though sufficient Tier 1 Non-Solar resources will be available to meet all current PJM RPS requirements throughout the LTER study period.

Tier 2

Maryland suppliers generate significantly more Tier 2 power than Maryland's current and future requirements. PJM regional Tier 2 resources will produce approximately 18,800 GWh of energy in 2010. Maryland will produce 3,700 GWh of that energy and is home to one large Tier 2 qualifying hydroelectric facility—Conowingo Dam (474 MW)—and to three facilities using municipal solid waste for fuel which provide an additional 141 MW of installed Tier 2 capacity. Tier 2 power across the PJM region will need to expand at about 0.4 percent annually up until the expiration of the Tier 2 requirement in 2018. With projects currently under development, such as relicensing and expansion of existing hydroelectric facilities, the needs for Tier 2 resources will be easily met.

Conclusions

Each of Maryland's RPS categories (i.e., Tier 1 Solar, Tier 1 Non-Solar, and Tier 2) have distinct goals and ACP schedules when goals are not achieved. Table 4 summarizes Maryland's and the total PJM control area's RPS 2010 and 2022 total power generation and projected renewable electric power requirements and provides the estimated required average annual growth rates to achieve 2022 RPS goals. As indicated in Table 14, there are sufficient resources available within PJM to achieve the Tier 2 renewable targets without significant additional development of Tier 2 facilities. In order to meet the Tier 1 Solar RPS, a significant amount of growth and development will be required, approximately 54 percent average annual growth in Maryland-specific installed capacity sustained between 2010 and 2022. While this level of investment is possible, the declining ACP may challenge developers in the years out beyond 2016. The Tier 1 Non-Solar requirement appears to be achievable with sustained growth rates of 13 percent or higher for the PJM region.

Table 4 – Summary of RPS Requirements and Generation			
Maryland		2010 GWh	2022 GWh
Energy/RPS Requirements	Total Electric	62,300	74,200
	Tier 1-Solar	16	1,480
	Tier 1-Other	1,930	13,400
	Tier 2	1,610	(sunsets in 2018)
Estimated Generation			Annual Growth Rate Required To Meet 2022 RPS
	Tier 1-Solar	8.1	54%
	Tier 1-Other	470	32%
	Tier 2	2,720	(sunsets in 2018)
PJM Region		2010 GWh	2022 GWh
Energy/RPS Requirements	Total Electric	748,700	864,500
	Tier 1-Solar	302	7,700
	Tier 1-Other	17,500	92,200
	Tier 2	13,000	19,300
Estimated Generation			Annual Growth Rate Required To Meet 2022 RPS
	Tier 1-Solar	262	33%
	Tier 1-Other	20,600	13%
	Tier 2	18,400	0.4%