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MEMORANDUM

TO: Philip Cherry
Director
Division of Energy & Climate

FROM: Thomas Noyes 
Principal Planner for Utility Policy
Division of Energy & Climate

DATE: March 10, 2016

SUBJECT: **Revised Renewable Energy Portfolio Standards Cost Cap Analysis**

Executive Summary

The Division of Energy & Climate is required to report on the cost of RPS compliance under Section 4.0 of 104 Implementation of Renewable Energy Portfolio Standards Cost Cap Provisions (Regulation) promulgated under 26 *Del. C.* § 354(i) & (j). The Director of the Division may, in consultation with the PSC, decide to freeze the RPS as provided in Section 5.0 of the Regulation. In this memorandum, I present the calculations required in Section 4.0 and assess the benefits of the RPS as provided in Section 5.0 of the Regulation.

Additionally, I have revised some of the calculations in response to comments received prior to our briefing to the PSC on February 23, 2016 by subtracting the cost of RPS compliance from the total retail costs of electricity and by reducing the overall economic benefits of the solar PV business in Delaware as noted below.

For Compliance Year 2014/15 (June 1, 2014 to May 31, 2015) the benefits exceeded the costs of compliance for the RPS and the solar PV carve-out.

The externality benefits and the economic benefits of solar PV used to satisfy DPL's solar carve-out totaled 4.58 percent, far greater than the 1.50 percent cost of solar PV compliance. The

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externality benefits and the economic benefits of renewable energy used to satisfy DPL's RPS requirement totaled 7.29 percent, far greater than the 3.93 percent cost of RPS compliance.

Based on this analysis, it is recommended that you exercise your statutory discretion and decide to not freeze the RPS or the solar PV carve-out of the RPS. The costs and benefits for the solar PV carve-out and the RPS are presented in detail below.

The figure for the total retail costs of electricity has been revised from \$681,407,897 to \$655,626,991 by subtracting the cost of RPS compliance. This change, I believe, is more consistent with the language of the regulation. This change slightly increases the calculation of both the costs and benefits on a percentage basis, though not by a decisive amount.

Solar PV Costs and Benefits

I have calculated the solar PV cost of compliance as follows:

Section 4.3 Solar Renewable Energy Cost of Compliance

The Solar Energy Cost of Compliance in Compliance Year 2014/15 was \$9,857,168, or 1.50 percent of the total retail cost of electricity of \$655,626,991. (Appendix 3) The statute gives the Director discretion, in consultation with the PSC, to decide whether to freeze the RPS. Section 5.0 of the Regulation directs how the Director will make a determination whether to declare a freeze.

I have analyzed the benefits to be considered in a determination as follows:

Section 5.4.1 Overall energy market conditions

Overall market energy conditions have not changed sufficiently enough to significantly affect this analysis.

Section 5.4.2 Avoided cost benefits from solar PV carve-out

Avoided cost benefits are those market benefits known as price suppression effects attributable to reduced demand because of distributed renewable energy generation in PJM, which leads to lower capacity and energy prices particularly at times of peak demand. The Division has worked with the National Renewable Energy Laboratory (NREL), Delmarva Power and PJM Interconnection LLC to develop methods to calculate the price suppression effects of distributed PV in Delaware. NREL calculated the distributed PV generation for each of 8,760 hours of compliance year 2013/14 and the degree to which this output suppressed market prices based on PJM's monthly locational marginal price curve. NREL calculated the price suppression effect of distributed PV in Delaware to be between 0.05 percent and 0.5 percent of the total retail cost of electricity during compliance year 2013/14. (Appendix 5)

The Division has engaged NREL to refine the methods and repeat the calculation for compliance year 2014/15. Since that calculation has not been performed, no result is presented for your consideration in this report.

Section 5.4.3 Externality benefits due to solar PV carve-out

Externality benefits of the RPS, which are described in more detail below, totaled \$21,828,158, or 3.16 percent of the total retail costs of electricity in CY 2014/15. I apportioned 14.25 percent of these benefits to solar PV based on the ratio of MWh generated of solar PV to all renewable energy generated during the compliance year. (Appendix 4) The solar PV portion of the externality benefits totaled \$2,948,628, or 0.45 percent of the total retail cost of electricity.

Section 5.4.4 Economic impacts of the deployment of renewable energy in Delaware.

The Division, working through the Maryland-D.C.-Virginia Solar Energy Industries Association (MDV-SEIA), surveyed the local solar energy industry in Delaware. The survey reported 300 jobs totaling \$21 million in salaries. (Appendix 9) The Division gave the survey results to the Delaware Economic Development Office (DEDO), which ran the numbers through its IMPLAN software package. The IMPLAN results show that the total direct, indirect and induced economic benefits are \$37,637,711, which would be 5.74 percent of total retail costs of electricity. (Appendix 10)

In response to some comments received before the briefing for the PSC, I researched the question of how many of the 300 solar jobs in Delaware support the development of solar PV in state, and how many support the development of solar PV in neighboring states (Maryland, Pennsylvania and New Jersey). I consulted with the MDV-SEIA and spoke directly with large and small solar energy companies on a confidential basis to review their sales and employment figures. Based on this research, I concluded that the economic impact analysis should be adjusted by a factor of 0.72 to reflect the amount of work performed to build solar PV in neighboring states by employees located in Delaware. This reduces the economic impact of the PV industry in Delaware from \$37,637,711 to \$27,099,152 in direct, indirect and induced economic effects.

It should be noted that the number and economic value of the jobs lost could be higher if we were to freeze the RPS. Companies could choose to locate in neighboring states if the sales volume in Delaware were to decrease sharply. In other words, instead of locating jobs in Delaware that partially serve neighboring states, companies could decide to locate out of state to serve a reduced solar market in Delaware. While this effect could be significant, we have no way of estimating the impact short of freezing the RPS for a year or longer and seeing the results. I think the factor we used is a conservative reflection of the industry reality on the ground.

This further analysis does not significantly alter my conclusions regarding the overall costs and benefits of solar PV in Delaware.

The results summarized below clearly show that the benefits of the solar PV carve-out exceed the costs:

Solar PV	Cost in \$	% of Retail
Total Retail Costs of Electricity	\$ 655,626,991	
GEF used to support PV	\$ 2,391,217	
DPL SREC procurement	\$ 7,465,951	
Solar Cost of Compliance	\$ 9,857,168	1.50%
Benefits		
Market conditions	n/a	n/a
Avoided costs capacity in MW	n/a	n/a
Avoided costs energy in MWh	n/a	n/a
Externalities NOx and SO2	\$ 2,282,483	0.35%
Externalities CO2	\$ 666,145	0.10%
Economic impacts	\$ 27,099,152	4.13%
Total benefits	\$ 30,047,780	4.58%
Net Cost (Benefit) of PV Compliance	\$ (20,190,613)	(3.08%)

Conclusion

The externality benefits and the economic benefits of the solar PV used to satisfy DPL's solar carve-out totaled 4.58 percent, far greater than the 1.50 percent cost of solar PV compliance. Therefore, based on the Regulation, you as Director would be justified in deciding not to freeze the solar carve-out.

RPS Costs and Benefits

The RPS cost of compliance is calculated as follows:

Section 4.2 Renewable Energy Cost of Compliance

The Cost of RPS Compliance in Compliance Year 2014/15 was \$25,780,907, 3.93 percent of the total retail costs of electricity. (Appendix 3) The statute gives the Director discretion, in consultation with the PSC, to decide whether to freeze the RPS. Section 5.0 of the Regulation directs how the Director will make a determination of whether to freeze the RPS.

I have analyzed the benefits to be considered in a determination as follows:

Section 5.4.1 Overall energy market conditions

Overall market energy conditions have not changed sufficiently enough to significantly affect this analysis.

Section 5.4.2 Avoided cost benefits from the RPS

Avoided cost benefits are described in more detail above. Since that calculation is provisional and has not been performed for CY 2014/15, no result is presented for your consideration in this report.

Section 5.4.3 Externality benefits due to the RPS

Delmarva Power calculated the externality benefits of renewable energy in its 2014 Integrated Resource Plan (IRP). This externality benefit calculation incorporates the avoided mortality costs for NO_x and SO₂ and the social cost of CO₂ emissions. DPL calculated the externality benefits of reduced emissions of NO_x and SO₂ due to renewable energy in Delaware to be \$16,019,038 based on the assumption that renewable energy displaced 50 percent of the PJM generation mix (which can be considered a conservative estimate due to the efficiency of the grid). (Appendix 6, p. 79)

The cost of CO₂ is calculated to be \$4,675,171. DPL set the cost of CO₂ to be \$1 per metric ton, the low end of the EPA/OMB range of the social cost of carbon (SCC) at the time the IRP was prepared. The EPA/OMB social cost of carbon (SCC) has been updated since then. Using these updated figures, I took the figure of \$36.00 per metric ton for 2015, which assumes a 3.0 percent discount rate of future costs in 2007 dollars. (Appendix 7, p. 3) The figure in 2007 dollars has been adjusted using the CPI (Appendix 8), resulting in a SCC of \$32.19 in 2015 dollars. As with DPL's externality calculations, it is assumed that renewable energy displaced 50 percent of the PJM generation mix.

The Regulation includes "improvements to habitat" as part of the definition of externality benefits. We have not developed methods for calculating habitat benefits of renewable energy.

Externality benefits of the RPS in Delaware in CY 2014/15 totaled \$20,694,209, or 3.16 percent of the total retail costs of electricity.

Section 5.4.4 Economic impacts of the deployment of renewable energy in Delaware.

The economic impacts of solar PV in Delaware are described above, and the results are incorporated into the overall RPS calculations.

The results summarized below clearly show that the benefits exceeded the cost of compliance:

All Renewable Resources	Cost in \$	% of Retail
Total Retail Costs of Electricity	\$ 655,626,991	
GEF to support renewable resources	\$ 2,391,217	
DPL REC and SREC procurement	\$ 23,389,690	
Renewable Energy Cost of Compliance	\$ 25,780,907	3.93%
Benefits		
Market conditions	n/a	n/a
Avoided costs capacity in MW	n/a	n/a
Avoided costs energy in MWh	n/a	n/a
Externalities NOx and SO2	\$ 16,019,038	2.44%
Externalities CO2	\$ 4,675,171	0.71%
Economic impacts	\$ 27,099,152	4.13%
Total benefits	\$ 47,793,361	7.29%
Net Cost (Benefit) of RPS Compliance	\$ (22,012,455)	(3.36%)

Conclusion

The externality benefits and the economic benefits of renewable energy used to satisfy DPL's RPS requirement total 7.29 percent, far greater than the 3.93 percent cost of RPS compliance. Therefore, based on the Regulation, you would be justified in deciding not to freeze the RPS.

Appendices:

1. Renewable Energy Portfolio Standards Act (REPSA), 26 *Del. C.* Subchapter III-A. Renewable Energy Portfolio Standards
2. Regulation 104 Implementation of Renewable Energy Portfolio Standards Cost Cap Provisions
3. DPL RPS Report for Compliance Year 2014/15
4. RPS Costs and Benefits worksheet, Division of Energy & Climate, February 2016
5. “Delaware Solar PV LMP and Capacity Cap Analysis”, John Nangle, Kim Peterson & Blaise Stoltenberg, National Renewable Energy Laboratory, November 2014
6. *2014 Integrated Resource Plan*, Delmarva Power, December 2014, pp. 76-90, with Appendices 1-3
7. *Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866*, Interagency Working Group on Social Cost of Carbon, United States Government, Revised July 2015
8. US Department of Labor, CPI Detailed Report-July 2015, p. 71
9. Email correspondence from MDV-SEIA on solar PV jobs in Delaware
10. IMPLAN results on solar PV jobs in Delaware