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LEGAL CONSULTING

September 23, 2020

E-FILING

Part 2

Rosemary Chiavetta, Secretary
PA Public Utility Commission
Commonwealth Keystone Building
400 North Street
Harrisburg, PA 17105-3265

Re: PPL Electric – DER Management Plan – Docket No. P-2019-3010128
Sustainable Energy Fund Direct Testimony

Dear Secretary Chiavetta:

Enclosed please find SEF St. No. 1 (J. Costlow) (Non-Proprietary version), SEF St. No. 2 (R. Celentano) and SEF Cross Examination Ex. No. 2 for filing in the above-referenced proceeding. Parties have been served in accordance with the Certificate of Service. Please contact me if you have any questions.

Sincerely,

Kenneth L. Mickens, Esquire
Attorney for Sustainable Energy Fund

KLM/bls
Certificate of Service
Enclosures

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BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Petition of PPL Electric Utilities Corporation for Approval of Tariff Modifications and Waiver of Regulations Necessary to Implement its Distributed Energy Resources Management Plan	:	Docket No. P-2019-3010128

SEF Statement No. 2

DIRECT TESTIMONY
RONALD E. CELENTANO

FEBURARY 5, 2020

Q. Please state your name

A. My name is Ronald E. Celentano.

Q. What is your educational background?

A. I have a BS Physics from Stockton State College, and a MS in the field of Mechanical Engineering from the New Jersey Institute of Technology.

Q. What work have you done since completing your education?

A. I first began working in the solar thermal energy field in 1976 after undergraduate school. After graduate school, I worked in demand side management (DSM) with a consulting firm for over 10 years, conducting technical and economic analysis for energy efficiency programs for utilities across the US. This work also involved load shape analysis, rate analysis and hourly building energy simulation.

Q. Where are you employed now?

A. I am self-employed with Celentano Energy Services, located at 7821 Flourtown Ave., Wyndmoor, PA 19038.

Q. Do you work in the field of renewable energy?

A. Yes.

Q. How much of your work is related to solar energy?

A. Virtually 100 % of my work is in solar energy. I have been working as a technical solar PV industry consultant for nearly 25 years.

Q. Can you describe the type of work you do in the solar energy field?

A. I work on a very broad range of issues on the technical side, but I also work on solar policy issues as a volunteer/advocate. My work experience includes the following:

1. I perform work as a technical solar consultant: advisor; analyst; conduct solar assessments; conduct performance testing; solar panel IV curve testing; troubleshooting (hired by solar contractors & customers); commission systems; conduct inspections; represent customers wanting solar systems – I prepare RFPs, preliminary designs, solicit solar contractors, oversee installations. I have provided technical assistance as an expert witness regarding PV system equipment assessment on several projects, and assist with net metering billing analysis and interconnection issues. I also conduct technical/economic/market feasibility studies;
2. I have worked as a trainer, where I have trained hundreds of solar installers; worked many times as a trainer with Solar Energy International and Florida Solar Energy Center, as well as carried out several seminars and workshops on solar PV design, installation, testing and O&M;
3. I have worked in the teaching field, where I've been involved with solar PV curriculum development and training with the DOE/PSU Northern Mid-Atlantic Solar Instructor Training Center, and with PA DEP/PSU Code Official Solar PV Training Project;
4. I have been involved as a solar PV system designer/installer, where I've engineered and designed many solar PV systems, both residential and commercial and I oversee installations; however, I also do carry out DC wiring on jobs; assist solar contractors on projects; work on grid tied with and without battery storage and off-grid systems;

5. I co-authored the Pennsylvania's Solar Future Plan -2017-2019; worked on solar guide books for Philadelphia and Delaware Valley Regional Planning Commission;
6. I have worked on prototype development of new solar products including SRS Solar Tile and the Sol-Street Bench.
7. I am currently the solar consultant/advisor for the City of Philadelphia and wrote RFIs for solar PPAs for Philadelphia schools; I helped prepare the RFP for *Solarize Philly*; I'm also a solar consultant with other municipalities on existing solar projects;
8. I co-designed and administered the first solar rebate program in Pennsylvania, which was in PECO's region under the Sustainable Development Fund, during the early and mid-2000s and I assisted solar contractors with designing and installing the applicable solar PV projects related to the rebate program.
9. I have over two decades of solar policy experience particularly in Pennsylvania, where I was instrumental in shaping net metering and interconnection tariffs, regulation and law; I worked on the PJM – MADRI Interconnection Model Procedures as a resource for commissions developing small generator interconnection rules and practices in Delaware, District of Columbia, Maryland, New Jersey and Pennsylvania; Moreover, I played a key role with the development of the legislation/regulation of the Pennsylvania Alternative Energy Portfolio Standards Act ("AEPS"); I assisted with the AEPS amendment related to closing the borders to out-of-state solar projects (Act 40); and, I helped with the development of the Pennsylvania Sunshine Program.

Q. Are you a member of any professional associations?

A. I am the Vice President of Pennsylvania for the Mid-Atlantic Solar & Storage Industries Association ("MSSIA") and the President of Pennsylvania Solar Energy Industries Association ("PASEIA"); I am a life member of the American Solar Energy Society ("ASES"); I am also a member of the Philadelphia Solar Energy Association ("PSEA"); Keystone Energy Efficiency Alliance ("KEEA"), Green Building United ("GBU"); and, Power Up Gambia.

Q. Are you sponsoring an exhibit in this proceeding?

A. Yes. I am sponsoring SEF Cross Examination Exhibit No. 2, which includes interrogatory responses sponsored by PPL Electric witnesses. These interrogatory responses will be authenticated by PPL Electric witnesses when they appear for cross examination.

Q. Can you further describe PASEIA and MSSIA?

A. PASEIA is a Division of the Mid-Atlantic Solar & Storage Industries Association ("MSSIA"), formerly the Mid-Atlantic Solar Energy Industries Association ("MSEIA"). MSSIA is a not-for-profit trade association made up of businesses and professionals working in Pennsylvania, New Jersey and Delaware involved in the development, manufacturing, design, construction and installation of solar photovoltaic ("PV") and energy storage systems.

Q. Have you previously testified before the Pennsylvania Public Utility Commission?

A. No.

Q. Although PASEIA supports many of the goals in PPL Electric's Petition do you have concerns regarding PPL Electric's apparent urgency regarding this matter?

A. In general, CES/PASEIA supports many of the goals described in PPL Electric's Petition in regard to modernizing the electric grid and improving efficiency and resiliency. However, I question the urgency to implement the proposed DER Management Plan as to solar, particularly when the UL1741 SA standard may not synchronize with revised IEEE 1547-2018 until 2021. Similarly, there is only a small fraction of the distributed generation ("DG") solar PV capacity installed in PPL service territory, as well as across the state of Pennsylvania, with only 0.5% required by 2021, as compared to many states in the country with far higher solar capacity goals. The DER management technology has a long way to go before it is a proven and mature technology for the intended purposes that PPL Electric proposes.

Table 1 shows the annual and cumulative DG (net metered) solar PV capacity and number of PV systems installed in PPL's territory over the past five energy years.

Energy Year	Annual MW	Total MW	Annual # Systems	Total # Systems
2015	3.2	73.5	219	3,404
2016	10.1	83.6	375	3,779
2017	16.6	100.2	1,361	5,140
2018	14.1	114.3	1,333	6,473
2019	23.2	137.6	1,412	7,885

Table 1. DG Solar PV Installations in PPL Territory[1]

California ranks number 1 with the most solar in the nation, totaling more

[1] PUC's Net Metering & Interconnection Reports for 2014, 2015, 2016, 2017, 2018, 2019.

than 26 GW of installed capacity, as compared to about 0.4 GW of solar PV installed in Pennsylvania, which ranks 22nd, as of the third quarter in 2019 (Wood Mackenzie Power & Renewables).

Figure 1 shows the total solar PV capacity installed in many of the states on the East Coast of the nation; clearly Pennsylvania lags far behind most of them, considering its land area size and electric consumption, in comparison. This is even more apparent per capita, as shown in Figure 2. For example, there was only 57.2 MW of DC solar capacity installed in Pennsylvania in calendar year 2019, less than what is installed in New Jersey in two months.

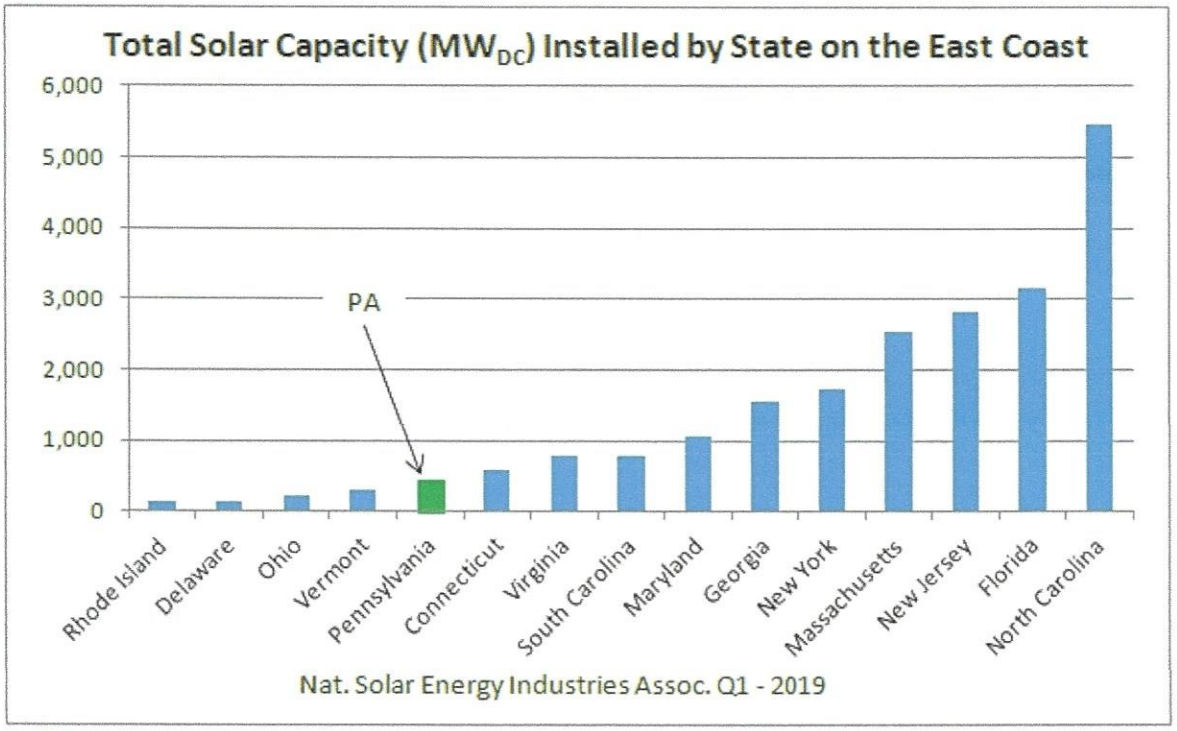

Figure 1. Total Solar Capacity Installed by State on the East Coast

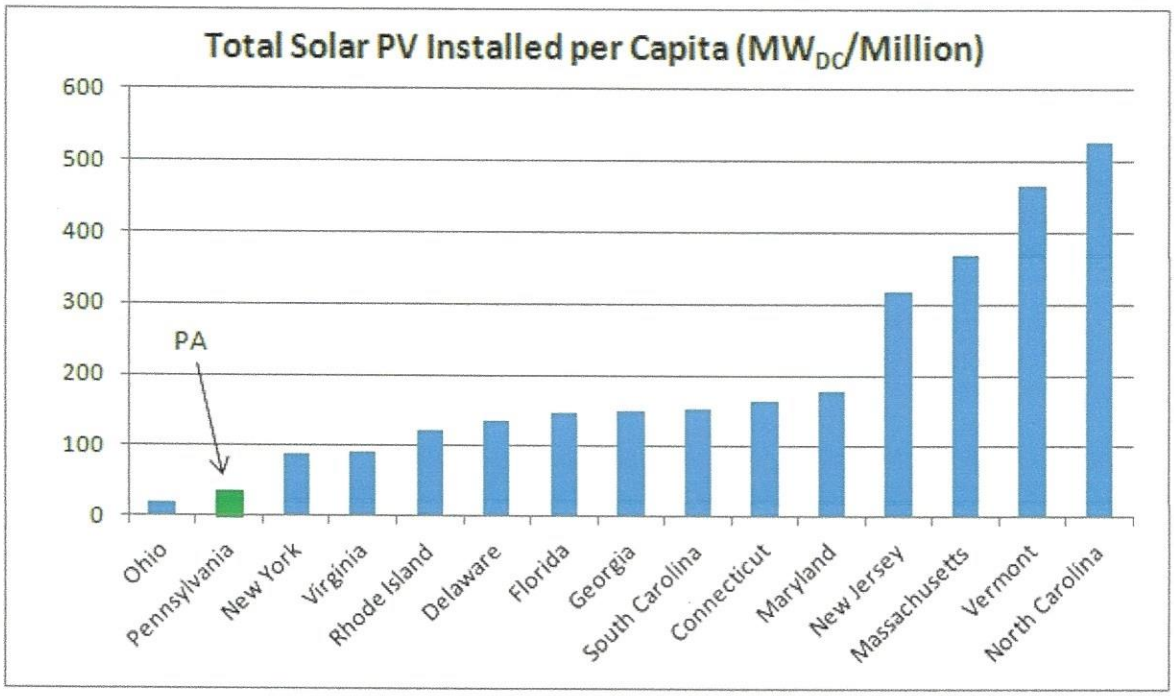

Figure 2. Total Solar Capacity per Capita Installed by State on the East Coast

Q. In the Finding Pennsylvania Solar Future Plan, what was the Distributed Generation capacity for Scenario A and B?

A. The PPL Electric Petition refers to the Pennsylvania Solar Future Plan ("PASF"), which evaluated the impact of solar growth up to 10% of total electric consumption by 2030, which equated to 11 GW of DC solar PV capacity. However, that combined DG solar and grid scale solar capacity where the DG solar capacity ranged from 1.10 GW to 3.85[2] GW DC under the two scenarios reviewed. This is far less DG capacity than what PPL Electric seems to be projecting over the next decade.

[2] Pennsylvania Department of Environmental Protection Pennsylvania Solar Future Plan November 2018 p.XVI.

Q. What are the drivers for current solar installations and how are they working?

A. Without economic drivers, growing solar penetration will be difficult in Pennsylvania. The three financial mechanisms for DG solar in Pennsylvania are the Federal Investment Tax Credit ("ITC"), net metering ("NEM") and the revenue earned from solar renewable energy credit ("SREC") sales through the PA Alternative Energy Portfolio Standard ("AEPS") compliance market.

The value of the ITC as a financial incentive will soon have a minimal to no impact in the near future. The ITC has now dropped to 26% in 2020 from 30%, and will continue to drop to 0% and 10% for residential and non-residential solar projects, respectively, by 2022,[3] consequently slowing the growth of solar penetration in Pennsylvania. NEM, another very important financial incentive needed for solar projects to be cost effective, is beginning to be challenged because of the hyped cost-shift between ratepayers with and without solar, even though a recent study by Carnegie Mellon University, commission by PECO Energy concluded the billing impact to ratepayers from up to 5% solar penetration will only increase by 0.8%.[4]

Finally, the revenue stream from SRECs is also important, though the SREC price has only increased to a modest value of about $30 to $40/SREC in the past year or so[5], from below $10/ SREC before Act 40 and the related regulation were implemented. Currently, the SREC price in Pennsylvania is less than 20% of the SREC price in New Jersey, which would explain the huge solar penetration in that state.[6] But the PA AEPS is scheduled to sunset by May 31, 2021, which would

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[3] Solar Investment Tax Credit, SEIA Fact Sheet, https://www.seia.org/initiatives/solar-investment-tax-credit-itc.
[4] "The value of solar for PECO and its ratepayers", Carnegie Mellon Electricity Industry Center Report CEIC-19-04.
[5] SRECTrade, https://www.srectrade.com/.
[6] SRECTrade, https://www.srectrade.com/.

maintain a 0.5% solar requirement, thereafter[7]. There are legislative bills calling for extending and expanding the solar carve out and Tier 1 renewables to 10% solar by 2030, with consideration of revising that to 5.5% solar by 2025, but the legislators have demonstrated little appetite for expanding the AEPS.

The PPL DERMS proposal would directly affect all three financial elements described above, increase first costs of a solar project (assuming the customer-generator bears the cost of the DER management device and installation) and it would reduce the NEM billing benefits and reduce the SREC revenue if the smart inverters are throttled down to generate less real power. Collectively, this will significantly reduce the already marginal cost effectiveness for investing in solar PV, thus further slowing down the growth of solar in Pennsylvania.

Q. Is PPL Electric's request premature?

A. Yes. It seems that well into the Keystone Solar Future Project, the plan was to install about 500 solar PV systems to help design and test out the smart inverter functionality, the DER management device and communication protocols. Ultimately, it was determined that the Fronius inverter would work for the intended purpose of changing the inverter settings through the DER management device.

However, PPL Electric's response to OCA-IV-2[8] interrogatory provides a list of over 175 inverters from 17 inverter manufacturers (as of 10/25/2019) that will be listed as approved smart inverters meeting the IEEE 1547-2018 Standard, after the revisions of the UL 1741 Standard is published. Yet it seems there is long way to go before PPL Electric's DER management device can work flawlessly with a

[7] Alternative Energy Portfolio Standards Act of 2004, PA Code 52, Chapter 75.
[8] SEF Cross Examination Exhibit ,2 Schedule 1 (OCA-IV-2).

majority of these approved smart inverters. This only demonstrates how premature PPL's immediate request is for requiring all DG inverters to be operating with a DER management device.

PPL Electric's Petition is particularly burdensome for solar contractors that install small residential solar PV systems since they will be responsible for training and installing the DER management device, commissioning it and servicing it (since they will need to go back out to the site if the device is not working properly), all at their cost or additional cost passed through to their customer. Experience and knowledge in the IT field is by far the weakest and most misunderstood area for most solar contractors.

Q. How much will PPL Electric's proposed DER device increase the cost of residential solar systems?

A. With regard to the cost of the DER management device, in PPL Electric's response to SEF-I-15, PPL Electric states that the total unit cost for the DER management device is projected to be approximately $700, and the approximate installation cost is an additional $150.[9] This could increase the total installation cost by 6% to 10% for small residential systems.

Q. Does PPL Electric propose compensation to DER customers for the benefits they bring to PPL Electric's distribution system?

A. In PPL Electric's Support Guide for DER Petition, August 1, 2019, in section 11, Aggregation Benefits from Utilities, one of the bullets indicates that PPL Electric needs a mechanism for compensating DER owners who provide beneficial services to the distribution system, yet PPL Electric's Petition itself makes no mention of any compensation to either the customer-generator or the

[9] SEF Cross Examination Exhibit 2 Schedule 2 (SEF-I-15).

solar installer.

Q. Are smart inverter functions being incorporated in other utility regions in Pennsylvania?

A. Yes, I know they are in PECO's territory. However, PECO's approach is different than PPL Electric's approach. Unlike PPL Electric's distribution system and most everywhere else in Pennsylvania, over 25% of PECO's distribution system consists of 4 kVolt service, which has very little tolerance for increased voltage from solar PV systems. Voltage rise is also a problem on higher voltage service lines as well, but the majority of the problem is on the 4 kV system. Adjusting smart inverter settings, such as power factor or volt/var, can be one of the low or no cost solutions for interconnecting a solar PV system, which may require an engineering study. Consequently, PECO may require smart inverter functionality on a case by case basis, whereas PPL Electric proposes to require all DG systems to utilize smart inverter functions in a dynamic format, possibly continuously adjusting the settings.

Q. Please explain solar ramp rates and the impact from clouds on a large solar array or aggregate group of smaller arrays?

A. In PPL Electric's Support Guide for DER Petition, under 3, Inverter and IEEE 1547-2018, in the section Ramp Rates, there is an inaccurate understanding of the ramp rate for a solar PV system. The inverter does not go from nearly zero to full output when clouds pass by the sun. Even in very overcast cloudy conditions, the PV inverter generates more than 20% of full output as compared to clear sky conditions. PV systems produce power even when it is raining. However, when it is partly cloudy, specifically with cumulous clouds passing in front of the sun, the inverter is typically at about 70% or more when the clouds cover the sun, then

ramps up to full power within seconds after the PV array is fully exposed to the sun. As cumulous clouds pass by the sun, the sharp increase of irradiance is diversified in a sweeping fashion across very large PV arrays, or across many smaller PV arrays in a neighborhood or on commercial rooftops, such that a given substation does not experience an instantaneous spike of injected solar power.

Q. Are you concerned with PPL Electric having unfettered access and control of DERs subject only to Company policy?

A. Yes. There are major concerns with PPL Electric having the authority to manage the smart inverters at their discretion. By adjusting the inverters' settings to generate some "reactive power" as compared to "real power" for example, the solar PV system will generate less recordable electricity and attributes than expected, which will in turn reduce the net metering billing credit and reduce the revenue stream due to a lower amount of SRECs being reported, thereby reducing the cost effectiveness of the solar project.

Q. Does PPL Electric propose to compensate DER customers for the benefits they provide to the distribution system and grid in general?

A. The PPL Electric Petition does not mention anything about compensating the customer-generator or solar project owner for implementing a DER management system. Generally, electric grid and market operations provide compensation for generated ancillary services, such as from solar PV systems and battery storage. PPL Electric obviously recognizes solar PV technology adds value to the distribution system[10], and therefore to all ratepayers, so there should be compensation for that value of service.

Q. Will the DER management device need to be UL tested?

[10] PPL Electric St. No. 1 (Saleh), p. 13.

A. The DER management device will need to be thoroughly tested to assure that it is working as expected. Further, it will need its own UL listing. It can't be expected that the customer-generator or solar project owner would bear the cost of this added device, only to lose net metering credit/revenue when it's used. Moreover, ratepayers should not pay for installing this device, since that would require further regulatory review outside of this Petition proceeding, because this proceeding only targets PPL Electric's territory.

Q. Should PPL Electric be allowed to shutdown DER inverters?

A. No. PPL Electric wants the ability to shut down a solar PV system during a grid outage because it has concerns about the PV system islanding or generating power endangering linemen working on distribution lines during the grid outage. However, the earliest versions of IEEE 1547, including its predecessor IEEE Standard 929-2000, required the inverter to automatically shutdown when a grid outage occurs. Grid tied inverters cannot operate without "seeing" a tight band of grid voltage/frequency levels. Consequently, there is no reason that PPL Electric should require the ability to turn off these systems when they are already disconnected from the grid. Furthermore, the solar PV systems with storage should still be operable as a backup system during grid outages, since these systems were designed and installed for that purpose. In short, PPL Electric should not be authorized to shut down these backup systems.

The UL 1741 SA Standard does offer the "ride-through" feature, if implemented – so there are more permissible high/low voltage/frequency limits beyond the original mandatory limits that could allow an inverter to continue to operate during some minor grid function instability. This is valuable to both the customer-generator and the distribution system.

Q. Do you believe that PPL Electric's Petition should be approved?

A. PPL Electric's Petition should not be approved as filed. I could possibly support a "pilot" program where "opt-in" only solar customer-generators would receive compensation for participating in a "strawman" DER management plan, however, even a program such as this seems years away. If DER management is to be taken seriously, it should be vetted or conceptually framed out through a stakeholder process across the state, not just limited to PPL Electric's territory. In short, in my opinion, PPL Electric has not demonstrated that solar PV technology affects their distribution system differently than other electric distribution companies in Pennsylvania.

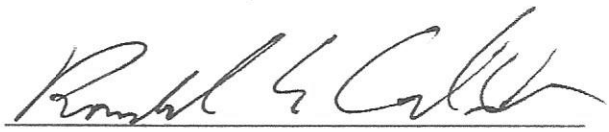
My recommendation is that the Commission proceed with a statewide proceeding and deny PPL Electric's Petition in its current form.

Q. Does this conclude your direct testimony?

A. Yes.

AFFIDAVIT

I, Ronald E. Celentano, certify that I am a consultant testifying on behalf of the Sustainable Energy Fund in this proceeding and that, in said capacity, I am authorized to and do make this Affidavit for it, that the facts set forth in the foregoing SEF St. 2 are true and correct to the best of my knowledge, information and belief. I understand that false statements made herein are made subject to the penalties of 18 Pa. C.S. § 4904, relating to unsworn falsifications to authorities.



Ronald E. Celentano
Consultant

Dated: February 5, 2020

Petition of PPL Electric Utilities Corporation for Approval of Tariff Modifications and Waivers of Regulations Necessary to Implement its Distributed Energy Resource Management Plan

Docket No. P-2019-3010128

SEF
CROSS EXAMINATION
EXHIBIT 2

Petition of PPL Electric Utilities Corporation for Approval of Tariff Modifications and Waivers of Regulations Necessary to Implement its Distributed Energy Resource Management Plan

Docket No. P-2019-3010128

SEF

CROSS EXAMINATION

EXHIBIT 2

Schedule 1

PPL Electric Utilities Corporation
Response to Interrogatories of the
Office of Consumer Advocate, Set IV
Date December 24, 2019
Docket No. P-2019-3010128

Q. OCA-IV-2. Refer to PPL Electric Statement No 1, page 6, lines 14-17. Provide the list of Company-approved smart inverters and the commercially available pricing for each device.

A. OCA-IV-2. PPL Electric's list of approved smart inverters is updated regularly and can be found here:

https://www.pplelectric.com/-/media/PPLElectric/At-Your-Service/Docs/REMSI/Metering-Equipment-Tables/PPL-EU-Smart-Inverter-List.pdf?la=en

The current list, which was updated on October 25, 2019, is also pasted below. PPL Electric does not track pricing for any commercially available inverters.

Until the UL Standard 1741 revisions are published and products certified to the revised standard are commercially available, the Company will use its interim solution to screen inverters as explained in PPL Electric Statement No. 2, page 9, line 21 to page 10, line 3. Please see responses to OCA-III-3(h) and OCA-III-12 for more information.

After the UL Standard 1741 revisions are published, the approved smart inverter list will be updated with inverters that meet IEEE 1547-2018 and UL 1741.

Last updated: 2019-10-25

MANUFACTURER	MODEL #	Nameplate (kW)	Phase(s)
ABB	PVI-3.0-OUTD-US	3	Single

ABB	PVI-3.6-OUTD-US	3.6	Single
ABB	PVI-3.8-OUTD-US	3.8	Single
ABB	PVI-4.2-OUTD-US	4.2	Single
ABB	PVI-5000-OUTD-US	5	Single
ABB	PVI-6000-OUTD-US	6	Single
ABB	UNO-DM-3.3-TL-PLUS-US	3.3	Single
ABB	UNO-DM-3.8-TL-PLUS-US	4.2	Single
ABB	UNO-DM-4.6-TL-PLUS-US	4.6	Single
ABB	UNO-DM-5.0-TL-PLUS-US	5	Single
ABB	Uno-7.6TL-OUTD-US	7.6	Single
ABB	Uno-8.6TL-OUTD-US	8.6	Single
Altenergy Power System (APS)	YC600	0.6	Single
APS	QS1	1.2	Single
APS	QS1200	1.2	Single
APS	YC500A	0.5	Single
APS	YC500i	0.5	Single
APS	YC1000-3	0.9	Three
Canadian Solar	CSI-25KTL-GS-FL	25	Three
Canadian Solar	CSI-30KTL-GS-FL	30	Three
Canadian Solar	CSI-36KTL-GS-FL	36	Three
Canadian Solar	CSI-40KTL-GS-FL	40	Three
Canadian Solar	CSI-50KTL-GS-FL	50	Three
Canadian Solar	CSI-50KTL-GS	50	Three
Canadian Solar	CSI-60KTL-GS	60	Three
Canadian Solar	CSI-66KTL-GS	66	Three
Canadian Solar	CSI-125KTL-GS-E	125	Three
Chint Power Systems (CPS)	SCA50KTL-DO/US-480	50	Three
CPS	SCA60KTL-DO/US-480	60	Three
CPS	SCA100KTL-DO/US-600	100	Three
CPS	SCA125KTL-DO/US-600	125	Three
Darfon	H5001	5	Single
Delta	Solivia 3.0TL	3	Single

Delta	Solivia 3.8TL	3.8	Single
Delta	Solivia 5.2TL	5.2	Single
Delta	Solivia 6.6TL	6.6	Single
Delta	Solivia 7.6TL	7.6	Single
Delta	M4-TL-US	3.84	Single
Delta	M5-TL-US	4.8	Single
Delta	M6-TL-US	5.76	Single
Delta	M8-TL-US	7.68	Single
Delta	M10-TL-US	9.6	Single
Delta	M42U	42	Three
Delta	M60U	60	Three
Delta	M80U	80	Three
Enphase	IQ6	0.24	Single
Enphase	IQ6+	0.29	Single
Enphase	IQ7	0.25	Single
Enphase	IQ7+	0.295	Single
Enphase	IQ7X	0.32	Single
Enphase	IQ7XS	0.32	Single
Fronius USA	Primo 3.8-1	3.8	Single
Fronius USA	Primo 5.0-1	5	Single
Fronius USA	Primo 6.0-1	6	Single
Fronius USA	Primo 7.6-1	7.6	Single
Fronius USA	Primo 8.2-1	8.2	Single
Fronius USA	Primo 10.0-1	10	Single
Fronius USA	Primo 11.4-1	11.4	Single
Fronius USA	Primo 12.5-1	12.5	Single
Fronius USA	Primo 15.0-1	15	Single
Fronius USA	Symo 10.0-3	10	Three
Fronius USA	Symo 12.0-3	12	Three
Fronius USA	Symo 12.5-3	12.5	Three
Fronius USA	Symo 15.0-3	15	Three
Fronius USA	Symo 17.5-3	17.5	Three
Fronius USA	Symo 20.0-3	20	Three
Fronius USA	Symo 22.7-3	22.7	Three
Fronius USA	Symo 24.0-3	24	Three

Ginlong Solis	Solis-1P-1K-4G-US	1	Single
Ginlong Solis	Solis-1P-1.5K-4G-US	1.5	Single
Ginlong Solis	Solis-1P-2K-4G-US	2	Single
Ginlong Solis	Solis-1P-2.5K-4G-US	2.5	Single
Ginlong Solis	Solis-1P-3K-4G-US	3	Single
Ginlong Solis	Solis-1P-3.6K-4G-US	3.6	Single
Ginlong Solis	Solis-1P-4K-4G-US	4	Single
Ginlong Solis	Solis-1P-4.6K-4G-US	4.6	Single
Ginlong Solis	Solis-1P-5K-4G-US	5	Single
Ginlong Solis	Solis-1P-6K-4G-US	6	Single
Ginlong Solis	Solis-1P7K-4G-US	7	Single
Ginlong Solis	Solis-1P7.6K-4G-US	7.6	Single
Ginlong Solis	Solis-1P8K-4G-US	8	Single
Ginlong Solis	Solis-1P8.6K-4G-US	8.6	Single
Ginlong Solis	Solis-1P9K-4G-US	9	Single
Ginlong Solis	Solis-1P10K-4G-US	10	Single
Ginlong Solis	Solis-25K-US-SW	25	Three
Ginlong Solis	Solis-30K-US-SW	30	Three
Ginlong Solis	Solis-36K-US-SW	36	Three
Ginlong Solis	Solis-40K-US-SW	40	Three
Ginlong Solis	Solis-50K-US-SW	50	Three
Ginlong Solis	Solis-50K-US-F-SW	50	Three
Ginlong Solis	Solis-60K-US-F-SW	60	Three
Ginlong Solis	Solis-66K-US-F-SW	66	Three
Ginlong Solis	Solis-100K-EHV-5G	100	Three
Ginlong Solis	Solis-125K-EHV-5G	125	Three
Outback Power	FXR2524A	2.5	Single
Outback Power	FXR3048A	3	Single
Outback Power	VFXR3524A	3.5	Single
Outback Power	VFXR3648A	3.6	Single
Outback Power	GS4048A	4	Single
Outback Power	GS8048A	8	Single
SMA	SB3.0-US	3	Single
SMA	SB3.8-US	3.8	Single
SMA	SB5.0-US	5	Single

SMA	SB6.0-US	6	Single
SMA	SB7.0-US	7	Single
SMA	SB7.7-US	7.7	Single
SMA	STP12000TL-US-10	12	Three
SMA	STP15000TL-US-10	15	Three
SMA	STP20000TL-US-10	20	Three
SMA	STP24000TL-US-10	24	Three
SMA	STP30000TL-US-10	30	Three
SMA	STP33-US-41	33.3	Three
SMA	STP CORE1 33-US	33.3	Three
SMA	STP50-US-40	50	Three
SMA	STP50-US-41	50	Three
SMA	STP CORE1 50-US	50	Three
SMA	STP62-US-41	62.5	Three
SMA	STP CORE1 62-US	62.5	Three
SMA	SHP 125-US-20	125	Three
SMA	SHP 150-US-20	150	Three
Sol-Ark	8K	8	Single
Solar City	H6	6	Single
SolarEdge	SE3000A-US	3	Single
SolarEdge	SE3000H-US	3	Single
SolarEdge	SE3800A-US	3.8	Single
SolarEdge	SE3800H-US	3.8	Single
SolarEdge	SE5000A-US	5	Single
SolarEdge	SE5000H-US	5	Single
SolarEdge	SE6000A-US	6	Single
SolarEdge	SE6000H-US	6	Single
SolarEdge	SE7600A-US	7.6	Single
SolarEdge	SE7600H-US	7.6	Single
SolarEdge	SE7700A-US	7.7	Single
SolarEdge	SE10000A-US	10	Single
SolarEdge	SE10000H-US	10	Single
SolarEdge	SE11400A-US	11.4	Single
SolarEdge	SE11400H-US	11.4	Single
SolarEdge	SE9kUS	9	Three

SolarEdge	SE10kUS	10	Three
SolarEdge	SE14.4kUS	14.4	Three
SolarEdge	SE20kUS	20	Three
SolarEdge	SE30kUS	30	Three
SolarEdge	SE33.3kUS	33.3	Three
SolarEdge	SE43.2kUS	43.2	Three
SolarEdge	SE66.6kUS	66.6	Three
SolarEdge	SE100kUS	100	Three
SunPower	SPR-E19-315-D-AC	0.315	Single
SunPower	SPR-E19-320-D-AC	0.32	Single
SunPower	SPR-E19-320-E-AC	0.32	Single
SunPower	SPR-E19-320-BLK-E-AC	0.32	Single
SunPower	SPR-E20-327-D-AC	0.32	Single
SunPower	SPR-E20-327-E-AC	0.32	Single
SunPower	SPR-E20-327-BLK-E-AC	0.32	Single
SunPower	SPR-E21-335-D-AC	0.32	Single
SunPower	SPR-X19-315-D-AC	0.315	Single
SunPower	SPR-X19-315-BLK-D-AC	0.315	Single
SunPower	SPR-X20-327-D-AC	0.32	Single
SunPower	SPR-X20-327-BLK-D-AC	0.32	Single
SunPower	SPR-X20-327-E-AC	0.32	Single
SunPower	SPR-X20-327-BLK-E-AC	0.32	Single
SunPower	SPR-X21-335-D-AC	0.32	Single
SunPower	SPR-X21-335-BLK-D-AC	0.32	Single
SunPower	SPR-X21-335-E-AC	0.32	Single
SunPower	SPR-X21-335-BLK-E-AC	0.32	Single
SunPower	SPR-X21-345-D-AC	0.32	Single
SunPower	SPR-X21-345-E-AC	0.32	Single
SunPower	SPR-X21-345-BLK-E-AC	0.32	Single
SunPower	SPR-X21-350-BLK-D-AC	0.32	Single
SunPower	SPR-X21-350-E-AC	0.32	Single
SunPower	SPR-X21-350-BLK-E-AC	0.32	Single
SunPower	SPR-X22-360-D-AC	0.32	Single
SunPower	SPR-X22-360-E-AC	0.32	Single
SunPower	SPR-X22-360-BLK-E-AC	0.32	Single

SunPower	SPR-X22-370-D-AC	0.32	Single
SunPower	SPR-X22-370-E-AC	0.32	Single
SunPower	SPR-X22-370-BLK-E-AC	0.32	Single
Yaskawa Solectra Solar	PVI 50 TL	50	Three
Yaskawa Solectra Solar	PVI 60 TL	60	Three

Petition of PPL Electric Utilities Corporation for Approval of Tariff Modifications and Waivers of Regulations Necessary to Implement its Distributed Energy Resource Management Plan

Docket No. P-2019-3010128

SEF
CROSS EXAMINATION
EXHIBIT 2
Schedule 2

PPL Electric Utilities Corporation
Response to Interrogatories of the
Sustainable Energy Fund, Set I
Date October 30, 2019
Docket No. P-2019-3010128

Q. SEF-I-15. Please provide a list of all PPL Electric approved communication devices, their initial cost and any ongoing or monthly or annual costs. List the Manufacture Suggested Retail Price for each communication device.

A. SEF-I-15. The communication devices (also referred to as "DER Management Device") currently in use on PPL Electric's system are:

- Landis+Gyr Integrated Wangate Radio (IWR) Series 5 mesh network radio.
- CalAmp Vanguard 5530 cellular modem.

The total unit price for either device is approximately $1,400, including assembly. Approximate installation cost is an additional $250.

PPL Electric has contracted with a vendor to repackage a DER Management Device into a more affordable and easier-to-install solution. The solution will contain one of the following communication devices: (a) a miniaturized mesh network radio or (b) a miniaturized cellular modem. The communication device will be housed in a meter collar, simplifying assembly and installation compared to the existing solutions. Total unit cost for this DER Management Device is projected to be approximately $700. Approximate installation cost is an additional $150.

Most customers will use mesh network-based solution. There is no ongoing cost associated with this solution.

In rare cases where a cellular-based solution is needed, the ongoing cost is approximately $90/year.

CERTIFICATE OF SERVICE
(Docket No. P-2019-3010128)

I hereby certify that a true and correct copy of the foregoing SEF Direct Testimony (SEF St. 1 (J. Costlow) (Non-Proprietary version) & SEF St. 2 (R. Celentano)) and SEF Cross Examination Ex. 2 have been served upon the following persons, in the manner indicated, in accordance with the requirements of 52 Pa. Code § 1.54 (relating to service by a participant).

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Date: September 23, 2020