Public Rooftop Solar PV Arrays in Media Borough: Status and Recommendations

Photo: Open Sky Energy

Media, PA

July 5, 2016

Prepared by:
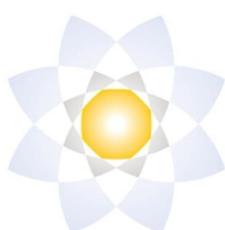
practical energy solutions

With assistance from:
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Delaware Valley Regional Planning Commission, Philadelphia, PA

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Introduction to Solar PV

Figure 1 shows how grid-tied photovoltaic (PV) solar arrays work. The building systems directly consume power "real time" as it is generated by the solar PV array. If the customer owns the PV system, the customer does not have to pay the utility for this power, and this provides a guaranteed (although variable) long-term utility cost reduction. If at any given point in time, the system generates more solar power than the facility uses, the unused electricity feeds into the electric distribution system (grid). This practice of feeding solar power into the grid is known as *net metering*.

Figure 1: Solar system graphic
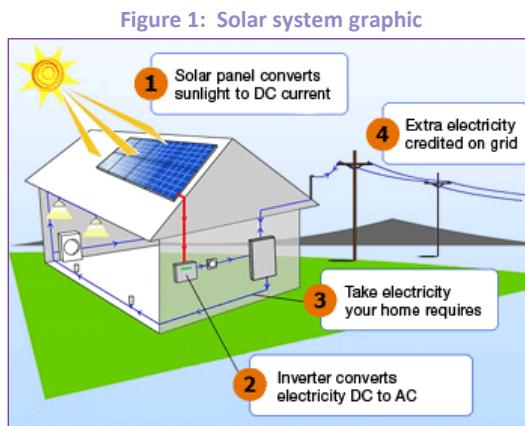
Credits

In Pennsylvania, the utility (PECO) credits the customer for this unused solar electricity at the *full retail price* per kWh. The full retail price includes generation, distribution, and transmission charges. Customers receive this credit, however, only if they install a special "PECO out" meter to track the outgoing power. Typically, it is also recommended that solar PV customers remain with their default supply provider (PECO) to ensure this full-price credit.

If, at the end of each reporting year (May 31), the customer has put more power into the grid than the customer purchased from the grid throughout the year, PECO will credit this annual excess at a rate known as the *price to compare*. This price is lower than the full retail price because it includes generation and transmission, but not distribution, charges.

> *The* price to compare *is proposed by PECO and approved by the PA Public Utility Commission. It changes with each tariff update, approximately every quarter. PECO's current price to compare for Media (PECO's small commercial general service tariff) is $7.409/kWh and is expected to decline to $7.188 in Sept. 2016.*

Utility Cost Structure

Figure 2 (next page) shows an example of a utility bill for a facility with a PECO out meter (Media Public Works garage). Note that under this rate structure, transmission charges are not likely to be impacted by the solar generation because they are calculated based on *peak demand* (the greatest use of power during any 15-minute interval during the billing period). The solar array cannot offset peak demand on cloudy days, or when a lot of power is consumed during dark hours. In addition, small systems do not produce enough power to offset significant peaks even when they do occur mid-day.

Figure 2: Media Borough Public Works Garage PECO bill

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Account Number 27908-01005          BOROUGH OF MEDIA RS-IN/OUT 664 W BALTIMORE PIKE MEDIA
Acct ID:

Meter Information
    Read    Meter    Load            Reading           Meter Reading
    Date    Number   Type            Type      Previous        Present    Diff    Mult X    Usage
    10/06   020626495 General Service  Total Ccf   5648 ACT      5654 ACT    6       1         6
    10/06   308829667 General Service  Tot kwh    80088 EST     82942 EST   2854    1         2854
    10/06   308829667 General Service  Pk kw       0.00 EST      5.64 EST   5.64    1         5.64
    10/06   308829604 Out w/o Flow Thr Tot kwh    11352 ACT     11399 EST   47      1         47
    10/06   308829604 Out w/o Flow Thr Pk kw       0.00 ACT      1.30 EST   1.30    1         1.30
    Total Ccf Used...................6        Distribution kw - Measured..............5.6
    Total kwh Used...................2,854    Generation kw - Measured................5.6
                                              Transmission kW - Measured..............5.6

Current Period
    Gas Commercial Heating Service              Service 09/07/2015 to 10/06/2015 - 29 Days
    Customer Charge                                                    $28.55
    Natural Gas Supply Charges       6 Ccf    X  $0.29495    1.77
    Distribution Charges             6 Ccf    X   0.36221    2.17
    Balancing Service Charges        6 Ccf    X   0.02305    0.14
    Gas Cost Adjustment Charges      6 Ccf    X   0.03659    0.22
    State Tax Adjustment                                    -0.07

    Total current charges                                             $32.78

    Electric Commercial Service 0-100kW         Service 09/07/2015 to 10/06/2015 - 29 Days
    Customer Charge                                                    $40.48
    Generation Charges               2,807 kWh  X  $0.08310  233.26
    Transmission Charges             5.60 kw    X   1.84000   10.30
    Distribution Charges             5.60 kw    X   5.53000   30.97
    Distribution Charges             2,807 kWh  X   0.00410   11.51
    Energy Efficiency Charge         2,854 kWh  X   0.00240    6.85
    State Tax Adjustment                                     -0.24
    Total current charges                                            $333.13

Other Basic Charges
    Thank you for your payment of $256.01
    Total amount due                                                 $365.91
    Estimated Meter Reading.
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Media Public Works Garage Solar PV System

Total kWh pulled from the grid this month: 2,854 kWh

Total unused solar kWh fed back into the grid: 47 kWh

Total kWh purchased from the grid: 2,807 kWh

Notes: The bill does not show total solar electricity consumption. The energy efficiency charge is based on total kWh used.

Current Status of Media's Solar PV Systems

Between 2004 and 2010, nine roof top solar photovoltaic arrays were installed on public buildings in Media Borough. The Borough's original intent for installing the solar PV arrays was to:
- Increase use of solar energy throughout the Borough;
- Make Media a premier demonstration project for the environmental, educational, and economic advantages of clean energy production; and
- Lay the foundation for a future microgrid that provides emergency power for critical loads.

The systems total 35.8 kW in installed capacity. Together, they are capable of generating an estimated 50,135 kWh of electricity annually and offsetting the CO_2 emissions-equivalent of approximately 6 passenger cars/ year. All installations were fully or majority grant-funded, and costs to the building owners totaled less than $9,000. If all systems were fully operational, we estimate potential utility savings to be about $3,750/year at PECO's current commercial electricity rates. Not all of the systems are currently functional, however, and the full utility savings potential is not being realized. Table 1 provides an overview of the current status.

Location:	Size (kW)	Current Annual Generation (kWh)*	% of Annual Electricity Use	Annual CO₂ Avoidance (lbs)	Date Installed	PECO "Out-Metered"?	Solar Power Monitoring Capable?**	Installed Cost	Cost to Owner	Notes
NON BOROUGH-OWNED:										
Armory	4.8	4,860	N/A	6,124	2004	Unsure (Dial type PECO out meter)	No	$ 38,906.00	$ -	Unsuccessfully attempted to install solar monitor Dec 2013. 1 of 3 intervers recently replaced.
Library	4.8	-	N/A	-	Oct-05	No	No	$ 38,491.26	$ -	System removed from roof pending renovation. Production averages 6,400 kWh/year.
Media Elementary School	4.8	7,300	N/A	9,198	Oct-05	No	Unsure	$ 38,491.26	$ -	2013 upgrade increased production from approximately 5,800 to 7,300 kWh annually.
Media Theatre	5.16	1,830	N/A	2,306	Spring 2007	No	Yes (Locus)	$ 48,662.00	$ 1,500	Produces about 30% of actual capacity of 6,100 kWh/year.
Sweney Building	4.725	5,900	<1%	7,434	Jul-08	Yes	Yes	$ 42,930.00		
Media Youth Center	1.26	1,575	N/A	1,985	Summer 2009	No	Unsure	$ 10,000.00 (est)	$ -	
BOROUGH-OWNED:										
Borough Hall	4.725	-	0%	-	Jul-08	Unsure (Dial type PECO out meter)	Yes (Locus)	$ 42,930.00	$ 1,790	Not functional; system failed in 2015. Capable of producing about 5,400 kWh/year (2% of annual electricity use).
PW Garage	5.2	6,500	22%	8,190	Jan-10	Yes	Unsure	$ 42,930.00	$ 3,968	
Firehouse	5.16	-	0%	-	Spring 2006	No	Yes (Locus)	$ 47,162.00	$ 1,500	Not functional. Capable of producing 6,100 kWh/year (5% of annual electricity use).
TOTAL:	**35.8**	**27,965**		**35,236**				**$ 350,503**	**$ 8,758**	

*Represents current generation, not actual generating capacity. See "Notes" column for system status.*
**Solar power monitoring enables generation, cost and environmental savings to be monitored and graphically displayed for the benefit of the community and building occupants.

Table 1: Status of Media Borough's rooftop PV systems

Opportunities and Recommendations

It is an ideal time to pursue a community solar PV program and demonstrate support for solar power as a preferred energy resource. Solar PV adoption is much more achievable today than it was just 5 to 10 years ago, and interest is strong. Solar panels have become far less expensive and more efficient as the industry has scaled up and technology has improved. Since the Borough installed its panels, the average installation cost/watt declined approximately 60% -- from $10 (average paid by the Borough) to $3.00-$3.50 for commercial systems. This sharp decline is expected to continue, hitting $1/watt by 2024 (Figure 3). In addition, battery storage technology is rapidly becoming available for creating community-based microgrids.

Figure 3: Current and future solar PV costs
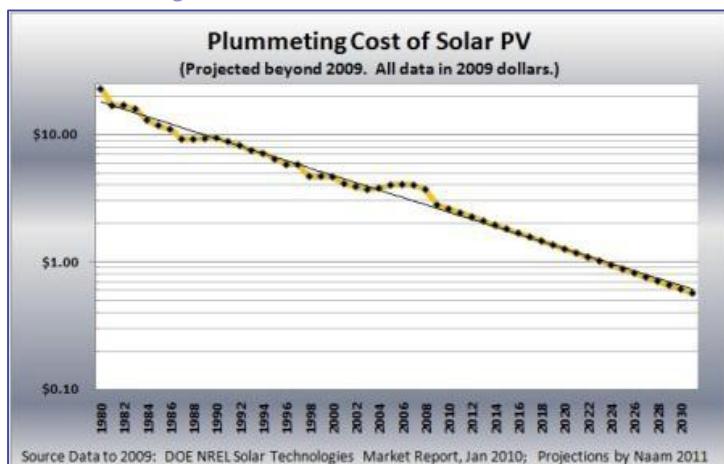
Specifically, Media should (1) repair the non-functioning solar PV arrays to ensure 100% functionality, and (2) tie Media's solar PV leadership to broader community solar goals, to accelerate solar PV adoption throughout the Borough.

Ensure Solar Functionality

To ensure solar PV system functionality, Media Borough should:

- Diagnose the status of all existing systems, including:
    - *Operability*. Currently, three systems are not operational and one system is operating at approximately 30% capacity.
    - *Solar power monitoring capability*. Five systems are either not equipped, or it is unclear if they are equipped, with monitoring hardware that enables graphic display of real-time solar power generation and environmental and cost benefits. At least three arrays are equipped with a Locus Energy gateway (Table 1).
    - *Warranties*. Identify any existing inverter warranties, which may or may not include the Youth Center, Fire House and Borough Hall. The remaining inverters have exceeded their warranty periods.
- Repair underperforming and nonfunctional arrays.
- Determine a disposition for the array previously on the library roof.
- Create a plan to equip all arrays with a uniform solar power monitoring capability to enable communication of generation data via the internet to a common graphic platform accessible by the community. As part of this effort:
    - Identify and address any internet security concerns (school, police department).
    - Select a cost-effective graphic platform that does not require a monthly fee.
    - Conduct a cost analysis and identify cost-sharing partners, including the Sustainable Development Fund, non-Borough building owners with arrays (i.e., County, school district), and business partners.
- Document a plan to perform annual inspections and maintenance for existing arrays.
- Assign responsibility to a Borough staff member for managing technical issues and procure the support of a qualified, independent solar consultant.

These actions will help ensure that the solar systems become and remain fully functional.

Support Community-wide Solar PV Adoption

To accelerate community-wide solar PV adoption, Media Borough should:

- Host a community discussion about the Borough's solar PV goals and objectives. Articulating community goals for the Borough and community, and generating a resultant policy guideline, will lay a foundation for moving forward and help ensure commitment.
- Continue efforts to secure technical assistance via the *US DOE SolSmart* program (www.solsmart.org).
- Create and implement an educational campaign to engage residents and businesses around the value and benefits of solar PV, and support residents and businesses in adopting solar systems. Consider working with *Transition Town Media* to build upon the group's *Solarize* campaign.
- Consider moving forward with solar monitoring via an internet-based, community-accessible graphic platform.

A Note About Graphic Platforms for Solar Power Monitoring

Monitoring and displaying total solar electricity generation can be very beneficial to verify the performance of the solar PV systems installed in Media, track savings, and motivate support for solar. It will also provide the community an interactive way to understand the benefits of Media Borough's solar power leadership. By tying the nine solar systems into a shared web-based visualization tool like the one in place at the County's Government Center (Figure 4), the Borough can further increase awareness of the panels and create momentum toward a cleaner energy future.

Figure 4: Screen shot of the solar power graphic panel at the Delaware County Government Services Center