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Summary Solar Assessment Prepared For:
Springfield Township Administration (MontCo)

Prepared By:
Celentano Energy Services (CES)

June 28, 2024 (Final-Rev)

Overview

This is a summary feasibility report regarding a solar photovoltaic (PV) assessment conducted by Celentano Energy Services (CES) for the Springfield Township (TWP) Administration, in Montgomery County, Pennsylvania. ***Note:*** Throughout this report, the *Public Works Equipment Shed* is referred to as the "PW East Shed", and the *Public Works Exterior Storage Shed* is referred to as the "PW West Shed". This is a revised solar assessment based on one that was initially carried out by CES in 2022. This final draft version consists of solar PV arrays installed on the rooftops of the TWP Administration/Police building and the TWP Public Works (PW) Main building, as well as the PW East Shed rooftop.

The annual solar generation from the solar PV systems would meet all the annual electricity usage for these two accounts, as well as the annual usage at the TWP Library, with more to spare. Pennsylvania's virtual meter aggregation net metering law would allow the annual excess solar generation to offset the TWP Library's electric usage, without needing physical wires to connect the buildings together.

Figure 1 shows the three building rooftops that would have solar PV arrays installed (one solar PV system for the Admin/Police building; a second solar PV system consisting of two rooftop arrays on the Public Works Main building and the PW East Shed), and the Library building.

The tasks for carrying out this solar assessment included reviewing the twelve months of electricity usage in 2023 all three accounts (i.e., Admin/Police, Public Works and the Library); prepare preliminary layouts of solar PV arrays on the Admin/Police and Public Works Main and East Shed building rooftops; simulate the solar generation and estimate the billing impacts; and carryout a 30 year cash flow analysis.

Update Note: CES, TWP officials, and others revisited the TWP sites on June 14, 2024, and verified the PECO service points for the Admin/Police and Public Works buildings, as shown in Figure 1. At the Public Works site, underground service runs between the PW West Shed location to the PW East Shed, then to the Public Works Main building (indicated by the straight dashed lines).

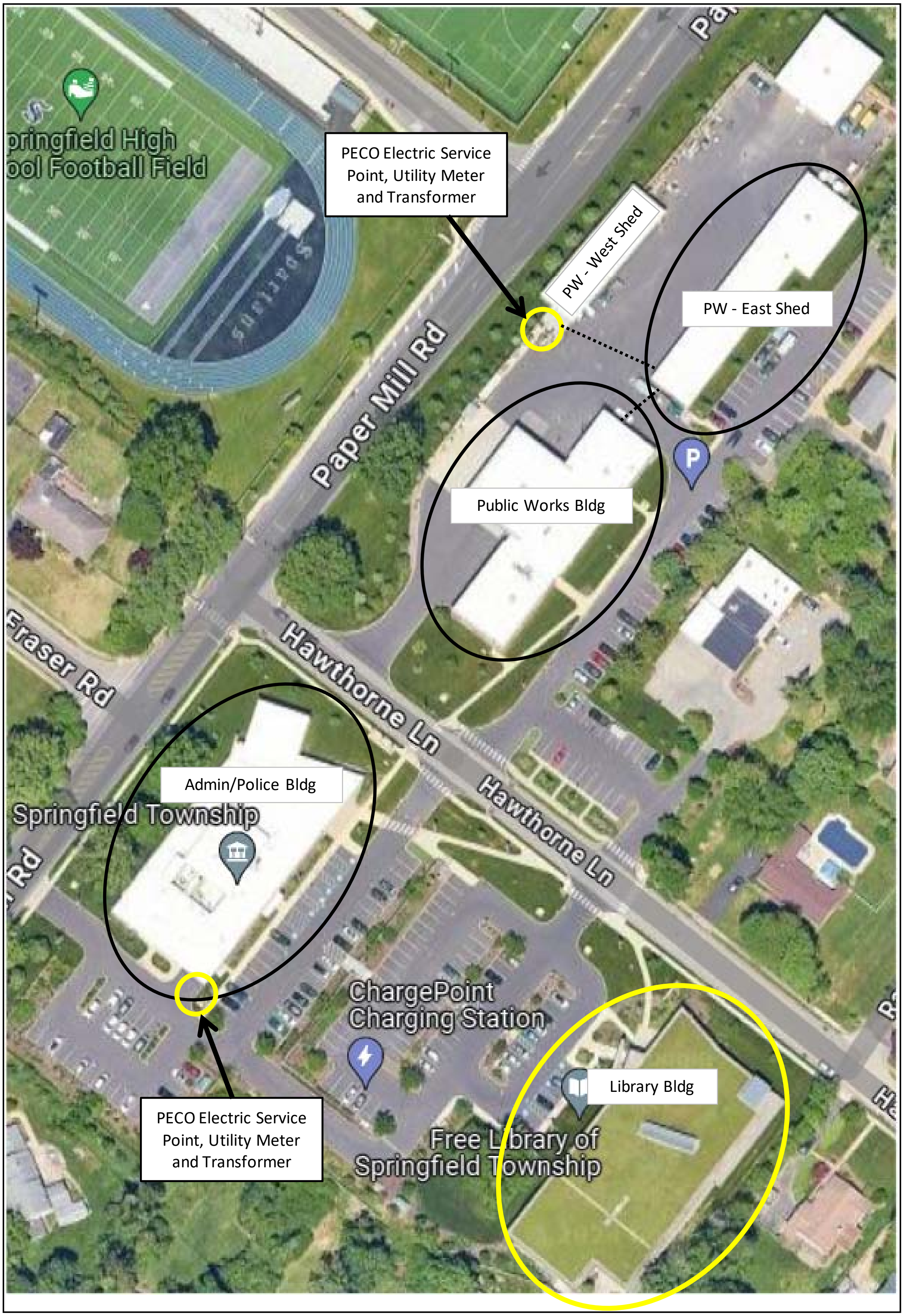


Figure 1. Springfield TWP Buildings – Proposed Location for Solar PV Arrays (Black) and Virtual Solar Designation (Yellow)

Summary of Results

Table 1 below shows the summary of results, aggregating across all the relative Springfield TWP building accounts.

Total Solar PV Capacity (kW)	453
Full Installation Cost	$1,041,348
Price per Watt Installed ($/watt)	2.30
IRA/ITC Elective Payment (30%)	$312,404
Act 129 Incentive ($0.10/kWh - Year 1)	$57,561
Adjusted Net Installation Cost	$671,383

Solar Generation (kWh) - Year One	575,605
Electricity Usage Offset	112%
Electricity Bill Savings - Year One	$45,832
SREC Revenue - Year One	$21,585
Estimated Total Revenue – 30 Years	$2,403,516
Estimated Total Expenses – 30 Years	$1,700,227

Positive Cashflow Payback (Years)	9.2
Net Present Value (NPV)	$217,902
Internal Rate of Return (IRR)	13.5%
TOTAL NET SAVINGS OVER 30 YEARS	$703,289
Total Levelized Cost of Electricity ($/kWh)	$0.07399
Value of Energy Generated ($/kWh)	$0.07005

Table 1. Summary of Results

Section 1. Methodology

Basis of Design

Using the SolarEdge Design software, the following considerations were taken into account with regard to the array layout of solar PV modules and the balance of system devices for preliminary engineering:

- Ballasted Racking (for mounting modules on flat roof surfaces and slightly pitched roofs, up to 7 degrees)
- DC Optimizer (connected to each module to optimize performance and execute rapid shutdown as a safety requirement when the system is turned off)

- Three Phase Inverters
- Integrated Inverter Manufacturer Monitoring System

Array Layout

The SolarEdge Design software was used to populate the modules throughout the rooftop areas based on Google Maps satellite views of the buildings. The software has a database of commercially available solar PV modules and a Q-Cell 420-watt bi-facial module (i.e., solar cells on both front and back of the module frame) was selected. Solar modules can be much larger than this, up to 600 watts and more, but the smaller modules allow for more of them to be placed within roof boundaries, thus providing more array capacity. The bi-facial modules were placed on all the open ballast racking, allowing indirect or reflective irradiance to collect on the backside of the module, resulting in a little more solar generation.

Two different types of ballasted racking systems were used. An East/West facing racking system was used on all the relatively flat rooftops on the Admin/Police building, including the upper or penthouse rooftop area, and on the Public Works Main building. On the roughly 5 degree pitched rooftops on the Admin/Police building and the Public Works East Shed building, a more conventional ballasted racking system was used. Note, this racking system can be installed on roof pitches up to 7 degrees, but they can also be strategically attached onto the roof for additional support. The installed unit weight (including the solar modules) of these ballasted racking systems range between 3 and 8 PSF, which can be assumed as inputs for conducting structural analysis for the building roofs.

The module layout was then edited by removing or aligning selected modules considering the following:

- Roof Pitch: Flat < 5 Degree - East/West Ballasted Racking System
- Roof Pitch: 5 – 6 Degree – Conventional Ballasted Racking System
- Shading from HVAC and other obstacles on the roofs
- Setbacks 3’
- Walkways / Access to equipment
- Roof Drains / Crickets – Typically racking is not installed in these areas, but for this analysis, these areas were also covered with ballasted racking

PVWatts

The National Renewable Energy Laboratory’s (NREL) PVWatts Calculator is an online software that simulates monthly and annual solar generation. After the array layout was completed, the total solar system DC capacity was known for each building, which was input to the PVWatts model. Other PVWatts inputs are location (with regard to weather data), array tilt and azimuth (orientation), various system losses (i.e., module mismatch characteristics, light-induced degradation, soiling, etc.), array racking type (i.e., open racking, flush mounted, single or dual tracking, etc.), inverter efficiency, and other assumed inputs. The annual solar generation results from the PVWatts model were inputs to the financial pro forma analysis model.

Utility Bill Review

Springfield TWP procures electricity from PECO, the default supplier in PECO's territory. CES did not review the actual bills for the Admin/Police, Public Works and Library accounts, but rather collected monthly kWh usage data by each account recently processed by a volunteer of the Springfield TWP EAC. All three accounts are under PECO's Commercial General Service, 0 – 100 kW, and the weighted generation rate of $0.079632/kWh was used in this analysis (also accounting for price-to-compare for annual excess generation). Table 2 shows the annual electric usages by each of the accounts in 2023.

Admin/Police Building Account	177,840 kWh/yr
Public Works Account	89,120 kWh/yr
Library Account	247,477 kWh/yr
Total Usage	514,437 kWh/yr

Table 2. 2023 Electric Usage by Account

Pro forma

A pro forma is a financial model used to measure the potential future impacts of different business decisions. The pro forma used in this analysis was from the Solar Schools Toolkit, developed in 2023 by the Philadelphia Solar Energy Association and sponsored by the Pennsylvania Department of Environmental Protection (DEP). Several inputs for this model include the total PV capacity in kW_{DC}, unit installation cost, operating and maintenance costs, and other assumptions. Most of these are described below in ***Section 4. Financial Analysis*** section. The pro forma results include positive cash flow payback (years), net present value (NPV), internal rate of return (IRR), first year and 30 years of cost savings, etc., and a 30-year cash flow analysis.

Section 2. Proposed Solar Projects Design

The next step of this analysis was to provide a rough scope of potential solar photovoltaic projects at the three TWP buildings. Each of the solar PV array layouts were developed using the free online SolarEdge software program.

For the flat roof layout for both the Admin/Police and Public Works Main buildings, an East/West ballasted roof-mount racking system was assumed; this racking system orients the modules at a 8° tilt, facing opposite directions. The UniRAC RoofMount RMDT East/West ballasted racking system was assumed for this application (see ***Sample Equipment Spec Sheets*** in **Section 7. Addendum**). For the slightly tilted roofs, assumed to be 5° for the Admin/Police building and 6° for the Public Works East Shed building, a conventional ballasted roof-mount racking system was assumed, which orients the modules at a 5° tilt in one direction. Therefore, when combining the tilted roofs and the rack tilted modules, the solar PV array tilts for these two applications were 10° and 11°, respectively. The UniRAC EcoFoot 5D ballasted racking system was assumed for this application (see ***Sample Equipment Spec Sheets*** in **Section 7. Addendum**).

For the ballasted modules, the SolarEdge software automatically determines the row spacing such that the modules do not cast inter-row shading on nearby rows of modules. The array azimuth was set parallel to the building roof edge closest to due South.

The selected solar PV module for all the ballasted roof-mounted racking arrays was the 420-watt Wp QPeak Duo L-G8.3, bifacial module (see ***Sample Equipment Spec Sheets*** in **Section 7. Addendum**). Once the layouts were completed, the SolarEdge software revealed the solar PV capacities for each building; these capacities, along with array tilt, azimuth, and other input assumptions, were entered into PVWatts to calculate the expected electrical output from these systems. The three rooftop solar PV systems combined has a total rated capacity of 452.76 kW_{DC}, resulting in an expected Year 1 production of 575,605 kWh. The SolarEdge software also sized up the inverters, along with specific optimizers. This included the following: Admin/Police building, one SE120K-US inverter (120 kW_{AC}); Public Works Main building, five SE30K-US inverters (total – 150 kW_{AC}); and Public Works East Shed building – one SE80K-US (80 kW_{AC}). (see ***Sample Equipment Spec Sheets*** in **Section 7. Addendum**).

The following images show satellite views of the solar array layouts for the Site 1 - Admin/Police building, and Site 2 - Public Works Main building (Site 2.1) and East Shed building (Site 2.2). Based on the recent re-visit of both sites on June 14, 2024, the location for the inverters for the Admin/Police solar PV system would most likely be on the roof, on the inside of the Eastern wall of the partitioned Penthouse structure.

Regarding the Public Works site, the inverters would most likely be located on the Southern outside wall of the PW West Shed, close to the PECO Service Point for that site (see Figure 1 on page 2). Possibly solar arrays could also be installed on the PW West Shed rooftop, as well, because the inverters would be so close to those arrays, but this scenario was not considered in this feasibility analysis. The DC output conductors from the solar arrays on the rooftops from the PW main building and the PW East Shed would be routed down the sides of those buildings and under the pavement to the inverters on the PW West Shed wall. It is possible there are additional empty conduits running under the pavement preserved for future use wiring opportunities. If this is true, this could be used for routing the solar PV wiring without needing to trench through the payment.

Lastly, these inverters are typically three phase at 480 VAC, where 480/208 step down transformers would be needed to connect to the 208 VAC service - one for the Admin/Police building and one for the Public Works building. These transformers can be located close to the PECO transformers and interconnected at the PECO meters as line side or supply side connections, where additional PECO meter pans will also need to be installed. The required utility isolation switches can be located at these points, as well.

Site 1: Springfield TWP Admin/Police Building

Address	1510 Papermill Road Wyndmoor, PA 19038

System Design/Performance Details

System Size (DC)	200 kW
Generation (1st year)	251,384 kWh
2023 Usage	177,840 kWh
Electricity Offset	95%
Excess to Library	82,758 kWh

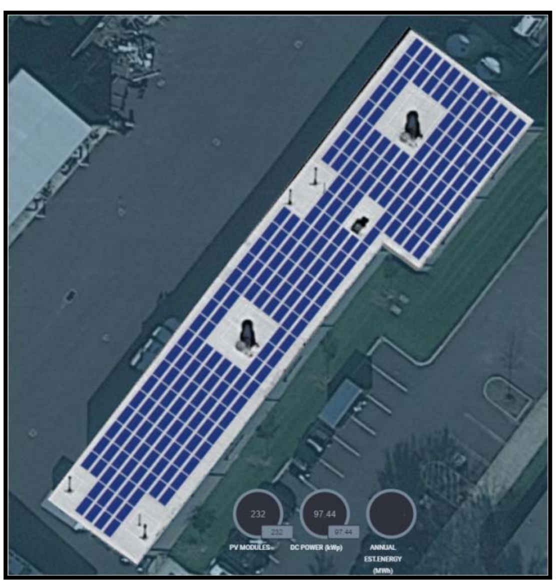
Site 2: Springfield TWP Public Works

Address	1600 Papermill Road Wyndmoor, PA 19038

System Design/Performance Details

System Size (DC)	254 kW (combined)
Generation (1st year)	324,222 kWh
2023 Usage	177,840 kWh
Electricity Offset	100%
Excess to Library	235,102 kWh

Site 2.1 - PW Main Building – 156.24 kW_{DC}



Site 2.2 - PW East Shed Building – 97.44 kW_{DC}

Section 3. Summary of Solar Generation vs Electric Usage

As described earlier, the preliminary solar PV systems designed for the Admin/Police and Public Works buildings will collectively generate more than the electric usage for both of those accounts, with the excess generation offsetting the electric usage at the TWP Library, with more to spare. Table 3 shows on a monthly basis, how the excess generation carries over to the Library account.

	Admin/Police			Public Works			Library		
Month	Solar kWh	2023 Usage kWh	Net kWh	Solar kWh	2023 Usage kWh	Net kWh	VMA Solar kWh	2023 Usage kWh	Net kWh
Jan	11,809	14,640	2,831	15,535	8,160	-7,375	7,375	16,890	9,515
Feb	15,636	13,200	-2,436	20,348	6,560	-13,788	16,224	16,126	-98
Mar	23,248	14,240	-9,008	30,053	6,960	-23,093	32,102	17,371	-14,731
Apr	26,439	12,240	-14,199	33,969	6,240	-27,729	41,928	17,161	-24,767
May	28,592	13,760	-14,832	36,417	6,400	-30,017	44,849	18,869	-25,980
June	29,571	17,840	-11,731	37,759	8,080	-29,679	41,409	22,354	-19,055
July	30,812	18,960	-11,852	39,483	8,320	-31,163	43,015	25,385	-17,630
Aug	25,298	17,200	-8,098	32,536	8,320	-24,216	32,314	28,358	-3,956
Sept	21,603	14,960	-6,643	27,845	7,680	-20,165	26,808	23,101	-3,707
Oct	16,759	12,800	-3,959	21,816	6,960	-14,856	18,815	19,469	654
Nov	11,953	12,400	447	15,715	7,120	-8,595	8,595	18,888	10,293
Dec	9,663	15,600	5,937	12,746	8,320	-4,426	4,426	23,505	19,079
Annual	251,384	177,840	-73,544	324,222	89,120	-235,102	317,860	247,477	-70,383

Table 3. Monthly Solar Generation vs. Electric Usage and Carry-Over to the Library Account

For example, in January, the generation from the solar PV system at the Admin/Police building will not fully meet all of the electric usage at that building, whereby PECO will bill that account for 2,831 kWh of electricity, and no solar generation will carry over to the Library. This is also true for months November and December. However, the Public Works solar system will generate more than the electric usage for that building for every month. Any monthly excess of solar generation from either the Admin/Police or the Public Works systems will carry over to the Library, which shows up under the column heading, VMA Solar (i.e., virtual meter aggregation), and will offset some of or all of the electric usage for that month at the Library.

Therefore, the Library will only be charged for 9,515 kWh in January. The Library will also be charged for electric usage in October through December, as well. Note, however, the excess solar generation in February through September – will be credited back to the TWP at the price-to-compare (PTC) at the end of the reporting year (i.e., end of May), where the PTC is valued at PECO's generation rate and the transmission rate. For this analysis, it was estimated to be $0.079632/kWh. Although the solar generation doesn't always offset 100% of the monthly electric usage, the excess from most of the other months equates to about 112% over generation on an annual basis across all three accounts.

Section 4. Financial Analysis

The financial analysis conducted for this feasibility study was based on the inputs, computations, and results of the Solar School Toolkit pro forma model, specifically for direct ownership for nonprofit and tax-exempt entities. Some of these input assumptions and sections of the pro forma are described below.

Assumptions

The general input assumptions into the pro forma included many key data points about the Springfield TWP - the site, system installation, contract prices, the expanded federal Solar Investment Tax Credit, future electricity costs, etc. Some are default values, whereas others are input specific to the solar project metrics.

Installation Cost

Typically, the metric used for the cost of installing solar is dollars per watt of DC capacity, or $/watt, where the DC capacity is the sum of all the solar modules based on their nameplate value. This is typically the cost value that may be seen in a developer's proposal to install a solar project. The $/watt installation cost typically corresponds to economies of scale, so the larger the solar PV system, the lower the $/watt tends to be. For this feasibility study, $2.30/watt was assumed for the turnkey installation cost, including the equipment and labor for installing the project, permits, interconnection, and much of the design work and other soft costs.

Incentives

One of the incentives available for offsetting the installation costs is the Federal Investment Tax credit (ITC), which is 30% off the entire installation cost of the solar project. The recent Inflation Reduction Act (IRA) expanded the ITC to be available for nonprofit and tax-exempt entities, which is provided by way of a one time payment (a.k.a., elective payment) to the entity after the project is in operation. Another incentive is provided by PECO Energy for all the solar generation produced in the first year that offsets the on-site energy usage. This commercial solar program incentive of $0.10/kWh of solar generation is based on Pennsylvania's Act 129. However, PECO Energy can change this incentive rate at anytime at their discretion. Since these systems generated annual excess generation, this analysis may have slightly overstated the incentive payment; therefore, further review may be needed.

Electricity Price and Other Financial Assumptions

For this analysis, as mentioned above, PECO Energy is assumed to be the generation supplier, charging a weighted supply rate of $0.079632/kWh. This is also assumed as the electricity cost savings rate used for the net metering billing mechanism that produces the bill savings from generating on-site solar energy. Every kWh generated from the solar system directly offsets the kWh usage at the site. Note that only electric distribution companies (i.e., PECO Energy), are required to provide net metering benefits based on the volumetric rate on a bill. Third-party suppliers, such as Constellation, and others are not obligated to provide this benefit. Fortunately Springfield TWP is already a PECO customer.

Financing

This analysis considered three types of financing likely to be part of a solar project. A construction loan is an interest-only, short-term loan to cover project construction costs during the construction period. Once the solar project is complete and placed in service, the construction loan is then converted into (1) a short-term bridge loan, an interest-only loan that provides capital that will later be reimbursed by the Elective Payment from the IRS under the Investment Tax Credit provisions and other grants that get paid some months after the solar system has been placed in service; and (2) a long-term permanent loan with fixed monthly payments of principal and interest. The interest rates for all three loans were assumed to be 6.5%, and the permanent loan term was assumed to be 20 years.

Please note that the 30% ITC decreases to 15% if tax-exempt financing is used. The current 10-year treasury rate is hovering around 4.5% and may be a better option for the TWP depending on when and if the TWP finances through a tax-exempt bond. The TWP may also bundle the financing with other capital upgrades such as other new construction projects, roof replacements, or major retrofits, including energy conservation measures.

Cash Contribution

It was assumed that a modest cash contribution of $75,000 for both the Admin/Police and Power Works projects was provided, especially for some of the up-front predevelopment expenses, before the project is firm enough to justify the work of securing financing.

Operation and Maintenance (O&M)

Although there aren’t many O&M costs associated with solar PV systems, as there are no moving parts, there are some routine measures typically taken on an annual basis, such as visiting the site and looking for any significant red flags. The system could be operating properly, but perhaps there are accumulated dry leaves that got caught up under the ballast racking system, or some of the free-air wire between the solar modules dropped onto the roof surface from the wire management fixtures - these are not concerning issues, but they should be rectified. There may be other issues causing operation issues that may need periodic attention. However, the main O&M cost is the replacement of the inverter, as well as both labor and equipment. The inverters typically have a 10-year warranty, though some have longer ones, even when they might fail prematurely and the equipment is covered, but there are still labor costs to consider. Since this analysis looks out 30 years, it can be assumed that the inverter could be replaced two or three times. Based on National Renewable Energy Laboratories survey findings on O&M costs and some reality check adjustments, it was assumed that the diversified average annual O&M cost was $\$8/kW_{DC}$ of solar PV capacity over the 30 year period.

Other Costs

These could include increased insurance premiums, project management fees, and other costs. It was assumed these costs were $0 and were absorbed in the TWP's business-as-usual costs.

Summary of Results

Table 4 below shows the summary of results, aggregating across all the relative Springfield TWP building accounts (this is the same as Table 1, at the beginning of this report).

Total Solar PV Capacity (kW)	453
Full Installation Cost	$1,041,348
Price per Watt Installed ($/watt)	2.30
IRA/ITC Elective Payment (30%)	$312,404
Act 129 Incentive ($0.10/kWh - Year 1)	$57,561
Adjusted Net Installation Cost	$671,383

Solar Generation (kWh) - Year One	575,605
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SREC Revenue - Year One	$21,585
Estimated Total Revenue – 30 Years	$2,403,516
Estimated Total Expenses – 30 Years	$1,700,227

Positive Cashflow Payback (Years)	9.2
Net Present Value (NPV)	$217,902
Internal Rate of Return (IRR)	13.5%
TOTAL NET SAVINGS OVER 30 YEARS	$703,289
Total Levelized Cost of Electricity ($/kWh)	$0.07399
Value of Energy Generated ($/kWh)	$0.07005

Table 4. Summary of Results

Table 5 shows the pro forma 30 year cash flow results.

TABLE 5

Springfield Township – Combined Solar Projects for Admin/Police, Public Works and Library Buildings

30-Year Pro Forma

			REVENUE					EXPENSES					CASH FLOW		
Year	Solar Generation (kWh)	Electricity Price ($/kWh)	Electricity Bill Savings ($)	SREC Revenue ($)	IRA/ITC Elective Payment ($)	Act 129 Incentive ($)	Total Revenue ($)	Cash Contributions & Construction Financing Interest ($)	Bridge & Permanent Financing P&I & Debt Srvcs ($)	Operating & Maintenance ($)	Contract Srvcs, Insurance & Other Fees ($)	Total Expenses ($)	Net Annual Cash Flow ($)	Net Annual Discounted Cash Flow ($)	Cumulative Cash Flow ($)
0	0	–	$0	$0	$0	$0	$0	$102,710	$0	$0	$0	$102,710	($102,710)	($102,696)	($102,710)
1	575,605	0.07962	$45,832	$21,585	$312,404	$57,561	$437,382	$0	$436,781	$3,622	$0	$440,403	($3,021)	($2,877)	($105,731)
2	572,727	0.08082	$46,286	$21,907	$0	$0	$68,193	$0	$53,358	$3,695	$0	$57,052	$11,141	$10,104	($94,590)
3	569,864	0.08203	$46,746	$22,233	$0	$0	$68,979	$0	$53,358	$3,768	$0	$57,126	$11,853	$10,238	($82,737)
4	567,014	0.08326	$47,210	$22,565	$0	$0	$69,774	$0	$53,358	$3,844	$0	$57,201	$12,573	$10,342	($70,164)
5	564,179	0.08451	$47,678	$22,901	$0	$0	$70,579	$0	$53,358	$3,921	$0	$57,278	$13,301	$10,420	($56,863)
6	561,359	0.08578	$48,152	$23,242	$0	$0	$71,394	$0	$53,358	$3,999	$0	$57,357	$14,037	$10,473	($42,827)
7	558,552	0.08706	$48,629	$23,588	$0	$0	$72,218	$0	$53,358	$4,079	$0	$57,437	$14,781	$10,503	($28,046)
8	555,759	0.08837	$49,112	$23,940	$0	$0	$73,052	$0	$53,358	$4,161	$0	$57,518	$15,534	$10,512	($12,512)
9	552,980	0.08970	$49,600	$24,296	$0	$0	$73,896	$0	$53,358	$4,244	$0	$57,602	$16,294	$10,502	$3,782
10	550,215	0.09104	$50,092	$24,658	$0	$0	$74,750	$0	$53,358	$4,329	$0	$57,686	$17,064	$10,474	$20,846
11	547,464	0.09195	$50,340	$25,026	$0	$0	$75,366	$0	$53,358	$4,415	$0	$57,773	$17,593	$10,285	$38,439
12	544,727	0.09287	$50,589	$25,399	$0	$0	$75,988	$0	$53,358	$4,504	$0	$57,861	$18,126	$10,092	$56,565
13	542,003	0.09380	$50,839	$25,777	$0	$0	$76,617	$0	$53,358	$4,594	$0	$57,951	$18,665	$9,897	$75,231
14	539,293	0.09474	$51,091	$26,161	$0	$0	$77,252	$0	$53,358	$4,686	$0	$58,043	$19,209	$9,701	$94,440
15	536,597	0.09568	$51,344	$26,551	$0	$0	$77,895	$0	$53,358	$4,779	$0	$58,137	$19,758	$9,503	$114,198
16	533,914	0.09664	$51,598	$26,947	$0	$0	$78,545	$0	$53,358	$4,875	$0	$58,233	$20,312	$9,304	$134,510
17	531,244	0.09761	$51,854	$27,348	$0	$0	$79,202	$0	$53,358	$4,972	$0	$58,330	$20,872	$9,105	$155,382
18	528,588	0.09858	$52,110	$27,756	$0	$0	$79,866	$0	$53,358	$5,072	$0	$58,429	$21,436	$8,906	$176,818
19	525,945	0.09957	$52,368	$28,169	$0	$0	$80,537	$0	$53,358	$5,173	$0	$58,531	$22,006	$8,708	$198,825
20	523,315	0.10057	$52,627	$28,589	$0	$0	$81,216	$0	$53,358	$5,277	$0	$58,634	$22,582	$8,510	$221,407
21	520,699	0.10157	$52,888	$0	$0	$0	$52,888	$0	$0	$5,382	$0	$5,382	$47,506	$17,049	$268,912
22	518,095	0.10259	$53,150	$0	$0	$0	$53,150	$0	$0	$5,490	$0	$5,490	$47,660	$16,290	$316,572
23	515,505	0.10361	$53,413	$0	$0	$0	$53,413	$0	$0	$5,600	$0	$5,600	$47,813	$15,564	$364,385
24	512,927	0.10465	$53,677	$0	$0	$0	$53,677	$0	$0	$5,712	$0	$5,712	$47,965	$14,871	$412,351
25	510,363	0.10570	$53,943	$0	$0	$0	$53,943	$0	$0	$5,826	$0	$5,826	$48,117	$14,207	$460,467
26	507,811	0.10675	$54,210	$0	$0	$0	$54,210	$0	$0	$5,942	$0	$5,942	$48,267	$13,573	$508,735
27	505,272	0.10782	$54,478	$0	$0	$0	$54,478	$0	$0	$6,061	$0	$6,061	$48,417	$12,967	$557,152
28	502,745	0.10890	$54,748	$0	$0	$0	$54,748	$0	$0	$6,182	$0	$6,182	$48,565	$12,387	$605,717
29	500,232	0.10999	$55,019	$0	$0	$0	$55,019	$0	$0	$6,306	$0	$6,306	$48,713	$11,833	$654,430
30	497,731	0.11109	$55,291	$0	$0	$0	$55,291	$0	$0	$6,432	$0	$6,432	$48,859	$11,303	$703,289
	16,072,725		$1,534,913	$498,638			$2,403,516		$1,450,576	$146,941	$0	$1,700,227	$703,289		

Section 5. Considerations

Solar Renewable Energy Credits (SRECs)

The solar project will also generate Solar Renewable Energy Certificates (SRECs), which equate to 1 MWh of solar generation and have market value. Pennsylvania SREC rates have ranged from $48/SREC in May 2023 to $29/SREC in November 2023, but they are currently valued at $35/SREC (May 2024). In the SREC Revenue line of the pro forma, $30 per SREC was assumed, and therefore the TWP could expect to earn approximately $21,585 in the first year, should it decide to sell the environmental attributes. Of course, the TWP may wish to retain the environmental attributes – the SRECs, or any future carbon credits – it may dedicate any SREC revenue to other TWP needs, making this SREC/carbon revenue unavailable for the project's financial pro forma.

It should be noted that CES extended this $30/SREC revenue assumption for 20 years of the analysis. While Pennsylvania's Alternative Energy Portfolio Act's mandated percentages for clean energy stop increasing in 2021, this analysis shows the revenue continuing through 2044 because it is reasonable to assume Pennsylvania and the U.S. will continue to recognize some monetization of the environmental attributes of the solar generation – cap-and-trade or carbon tax – will be in place. Whatever risk is contained in this assumption is likely offset by our decision to keep SRECs prices starting at $30/SREC with a 2% annual escalation over 20 years of the 30-year analysis period.

Net Metering

Net metering enables the TWP to be compensated for its solar electricity production that exceeds its current electricity demand. As the policy stands, the TWP would be eligible to receive the full retail rate of any volumetric electricity sent back to the grid. However, under Pennsylvania law and regulations, net metering is only required for default service customers of the local electric distribution company, not entities that purchase electricity through a third-party electricity supplier such as Constellation – but, this is not an issue for the TWP.

It is important to note that distribution and transmission demand charges ($/kW), are not volumetric charges ($/kWh), and are often not reduced that much. Although there would be some demand charge savings, it is extremely difficult to estimate how much that could be; therefore, to be conservative, it is best not to assume these bill savings.

Interconnection

CES reviewed the PECO Interconnection Viability Map, which seems to indicate that interconnecting solar PV on the distribution system where the Springfield TWP buildings are located is potentially viable (i.e., green bubble markers). See the map in Figure 2.

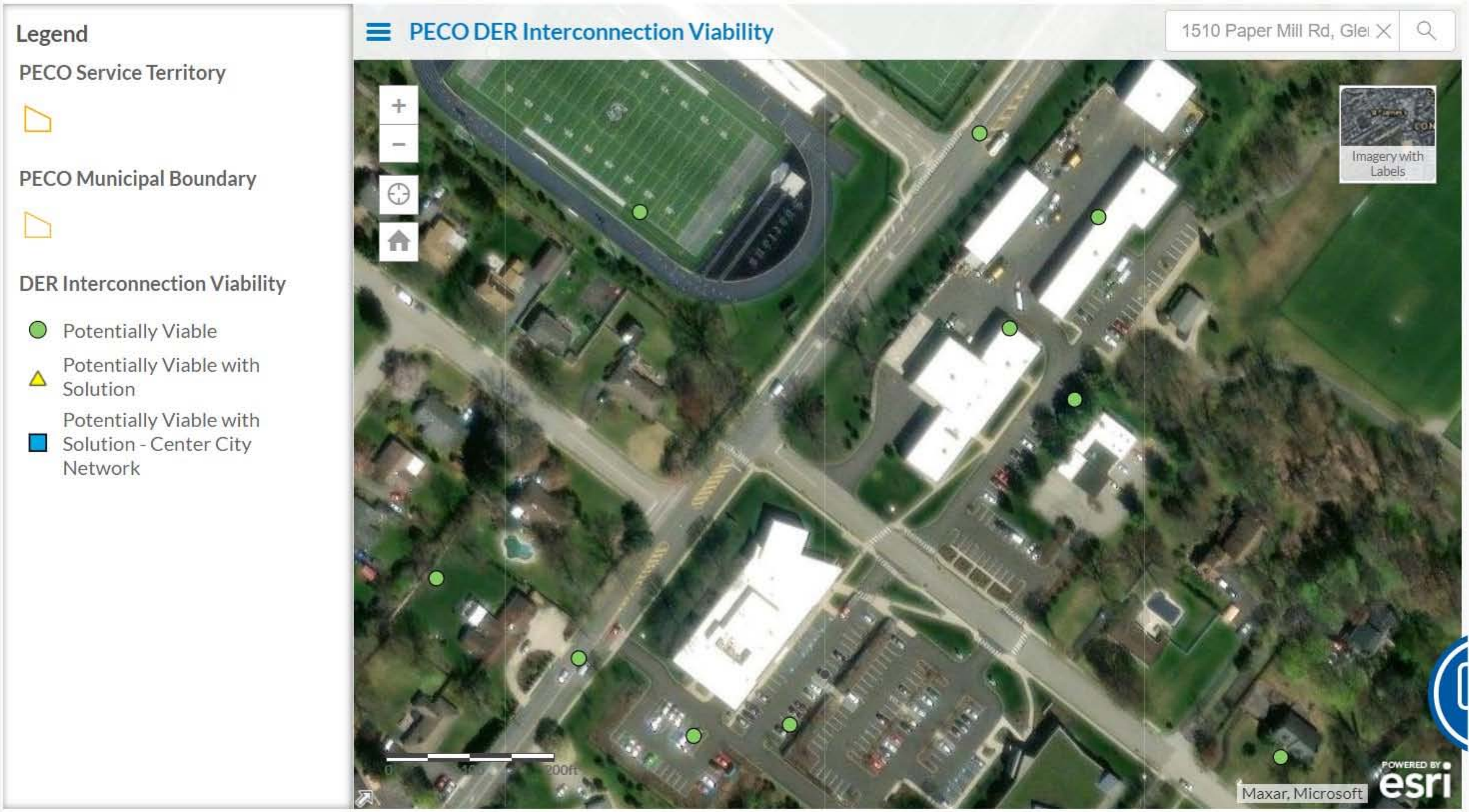


Figure 2. PECO Interconnection Viability Map over the Springfield TWP Buildings (note the green bubbles indicating Potentially Viable for interconnection

As mentioned in *Section 2. Proposed Solar Projects Design*, all the inverters are three phase at 480 VAC, where 480/208 step down transformers would be needed - one for the Admin/Police building and one for the Public Works building - before interconnecting onto the 208 VAC service at the corresponding buildings. The 480 VAC output conductors from the five 30 kW inverters for the Admin/Police system would be wired and combined in an accumulation panel on the roof of that building, then wired to the 480/208 transformer located on the ground near the PECO transformer and utility meter, then interconnected as a line-side tap on the feeder side of the 208 VAC service (including all the overcurrent protection devices and other devices necessary). A second utility meter pan will also need to be installed.

Same with the Public Works building, the 480 VAC output conductors from the 120 kW inverter and the 80 kW inverter would be wired and combined in an accumulation panel, all mounted on the South side of the outside PW West Shed wall, then wired to the 480/208 transformer close to the PECO transformer and utility meter, then interconnected as a line-side tap on the feeder side of the 208 VAC service (including all the overcurrent protection devices and other devices necessary), along with a second utility meter pan.

These solar PV systems are too large to interconnect on the load-side or onto a breaker in any of the electric panels. Line-side connections are very common for applications like this. More details about interconnecting the solar systems onto the service are beyond the scope of this feasibility assessment, but the overall cost of the solar project always includes the interconnection costs.

Section 6. Next Steps

1. Structural Analysis

   Assuming Springfield TWP wants to further explore installing solar PV arrays on the Admin/Police and the Public Works Main and East Shed buildings, and possibly on the PW West Shed roof, then it would make sense to have a structural analysis conducted for these roofs. As mentioned above, the range of the installed weight for solar modules on a ballasted racking system is about 3 PSF to 8 PSF.

2. Request for Proposal Guidance

   After structural analysis is completed and there are no load issues with installing ballasted solar on the given building rooftops, and the TWP is still interested in going forward with a solar project, then CES can help the TWP consider a couple of options, such as – 1) traditional pathway – hire an engineering firm to design-bid-build the whole project, then separately bid out and hire the solar contractor to install the engineered system; or, 2) hire an engineering firm or alternative to oversee the bidding, and contract oversight of a design/build contract.

3. Tax-exempt Financing

   Should the TWP decide to finance the solar project, the TWP's lender should perform a cash flow analysis with tax-exempt and conventional financing. The federal incentive for conventional financing is 30% of the total project cost, while the incentive will decrease to 15% if the project is financed with tax-exempt bonds.

Section 7. Addendum (Solar Array Layouts and Sample Equipment Spec Sheets)

Figure 3

Springfield TWP Admin / Police Building

Array Layout

Figure 4

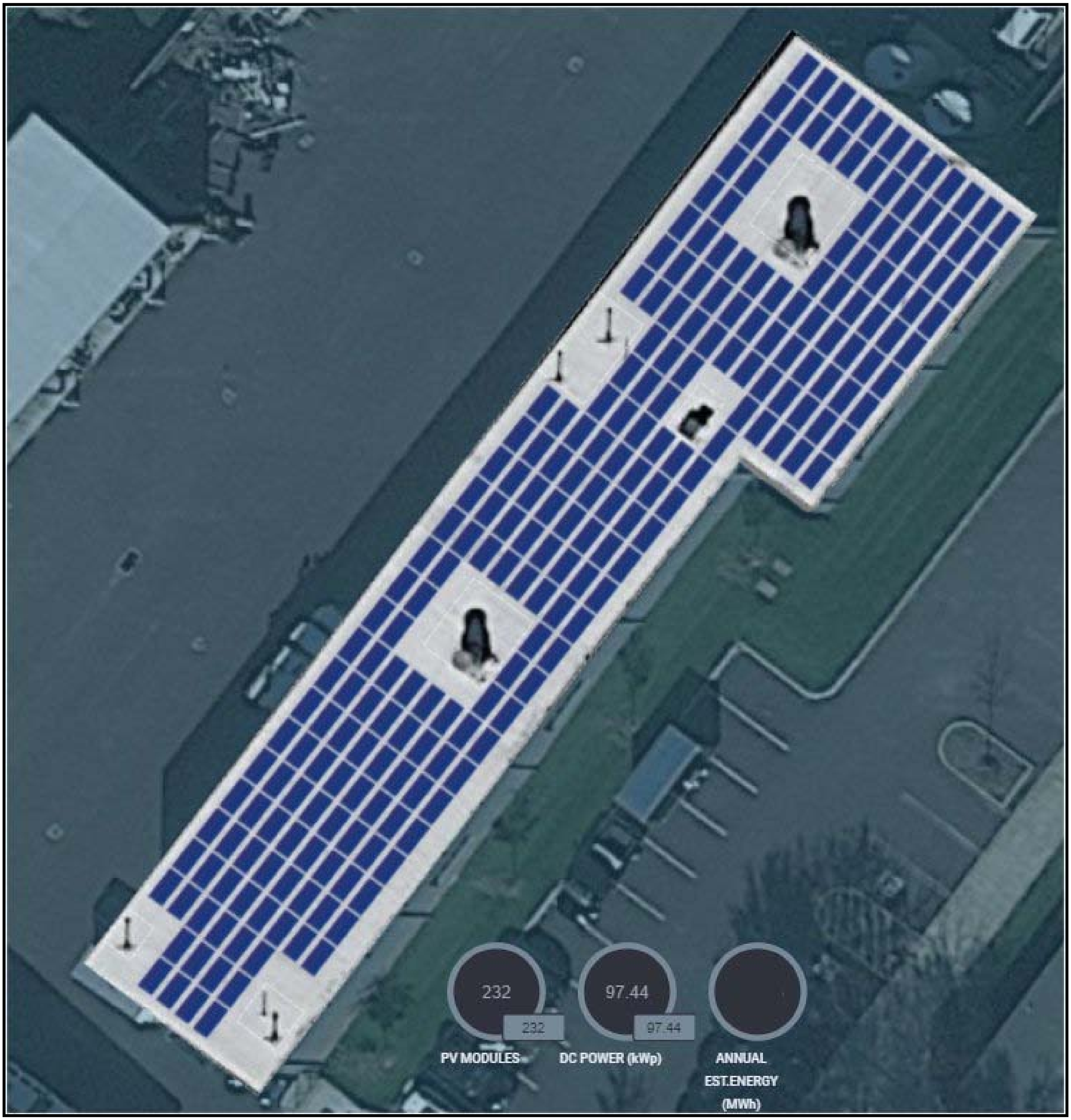
Springfield TWP Public Works Main Building

Array Layout

Figure 5

Springfield TWP Public Works – East Shed Building

Array Layout



Sample Equipment Data Sheets

ROOFMOUNT | RMDT

UNIRAC
BETTER SOLAR STARTS HERE

MAXIMUM ENERGY DENSITY

- Up to 33% more modules on the roof.
- 8 Degree Dual Tilt.
- G235 steel, double the corrosion protection of other racking products.

FASTER INSTALLATION

- Place panel, then clamp for single person module installation .
- Integrated bonding with single tool, hassle-free installation.
- Elimination of wind deflectors and fire skirts streamlines system installation.
- Ship up to 1 MW per truck with compact packaging.

UNIRAC 25 YEAR FULL-SYSTEM WARRANTY

WHY ROOFMOUNT RMDT?

Maximize energy density and minimize cost with RMDT, UNIRAC's ballasted dual tilt flat roof mounting system. Fewer components, single tool installation, snap-in hardware, and integrated bonding ensure high speed installation, while optional roof attachment, MLPE mount, and wire management provide a complete solution. UNIRAC's unmatched commercial project support makes construction easy, from permitting through installation, and RMDT is supported by North America's largest distribution network. Plus, enjoy peace of mind with UNIRAC's industry-leading 25-year warranty.

FOR QUESTIONS OR CUSTOMER SERVICE CONTACT:
505-242-6411 | SALES@UNIRAC.COM | WWW.UNIRAC.COM
PUB2024JAN01-V1

CONFORMS TO UL2703

ISO 9001:2015 14001:2015 CERTIFIED

Q.PEAK DUO L-G8.3 / BFG
410-425

BIFACIAL DOUBLE GLASS MODULE WITH EXCELLENT RELIABILITY AND ADDITIONAL YIELD

EUPD RESEARCH
TOP BRAND PV
MODULES
EUROPE
2020

Q CELLS
Yield Security

BIFACIAL ENERGY YIELD GAIN OF UP TO 20 %
Bifacial Q.ANTUM solar cells make efficient use of light shining on the module rear-side for radically improved LCOE.

LOW ELECTRICITY GENERATION COSTS
Q.ANTUM DUO combines cutting edge cell separation and innovative wiring with Q.ANTUM Technology for higher yield per surface area, lower BOS costs, higher power classes, and an efficiency rate of up to 20.1 %.

INNOVATIVE ALL-WEATHER TECHNOLOGY
Optimal yields, whatever the weather with excellent low-light and temperature behavior.

ENDURING HIGH PERFORMANCE
Long-term yield security with Anti LID and Anti PID Technology[1], Hot-Spot Protect and Traceable Quality Tra.Q™.

FRAME FOR VERSATILE MOUNTING OPTIONS
High-tech aluminum alloy frame protects from damage, enables use of a wide range of mounting structures and is certified regarding IEC for high snow (5400 Pa) and wind loads (3000 Pa).

A RELIABLE INVESTMENT
Double glass module design enables extended lifetime with 12-year product warranty and improved 30-year performance warranty[2].

[1] APT test conditions according to IEC/TS 62804-1:2015 method B (−1500V, 168h) including post treatment according to IEC 61215-1-1 Ed. 2.0 (CD)
[2] See data sheet on rear for further information

THE IDEAL SOLUTION FOR:

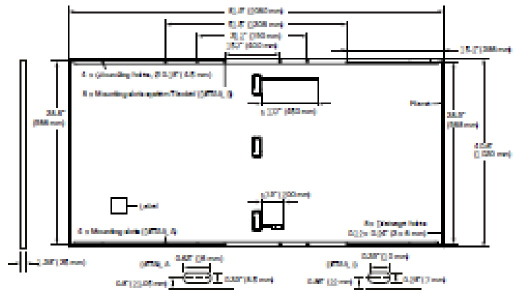
- Rooftop arrays on commercial / industrial buildings
- Ground-mounted solar power plants

Engineered in Germany

Q CELLS

MECHANICAL SPECIFICATION

Format	81.9 in × 40.5 in × 1.37 in (including frame) (2080 mm × 1030 mm × 35 mm)
Weight	62.8 lbs (28.5 kg)
Front Cover	0.07 in (2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	0.07 in (2 mm) semi-tempered glass
Frame	Anodized aluminum
Cell	6 × 24 monocrystalline Q.ANTUM solar half cells
Junction Box	3.42-3.94 in × 1.26-1.51 in × 0.73 in (87-100.3 mm × 32-38.5 mm × 18.7 mm), IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥17.7 in (450 mm), (−) ≥7.87 in (200 mm)
Connector	Stäubli MC4-Evo2, Hanwha Q CELLS HQC4, Amphenol UTX, Renhe 05-8, JMTHY JM601A, Tongling Cable01S-F; IP68 or Friends PV2e; IP67



ELECTRICAL CHARACTERISTICS

POWER CLASS			410		415		420		425	
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] AND BSTC[1] (POWER TOLERANCE +5 W / −0 W)										
				BSTC*		BSTC*		BSTC*		BSTC*
Minimum: Power at MPP[1]	P_{MPP}	[W]	410	448.5	415	453.9	420	459.4	425	464.9
Short Circuit Current[1]	I_{SC}	[A]	10.65	11.65	10.69	11.7	10.74	11.75	10.78	11.80
Open Circuit Voltage[1]	V_{OC}	[V]	48.34	48.52	48.59	48.76	48.84	49.01	49.09	49.26
Current at MPP	I_{MPP}	[A]	10.13	11.09	10.18	11.14	10.22	11.18	10.27	11.23
Voltage at MPP	V_{MPP}	[V]	40.46	40.45	40.77	40.76	41.08	41.07	41.39	41.38
Efficiency[1]	η	[%]	≥19.1	≥20.9	≥19.4	≥21.2	≥19.6	≥21.4	≥19.8	≥21.6

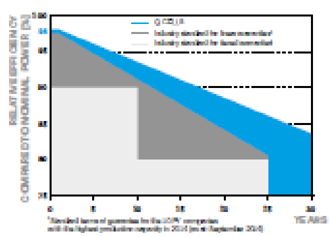
Bifaciality of P_{MPP} and I_{SC} 70% ± 5% • Bifaciality given for rear side irradiation on top of STC (front side) • According to IEC 60904-1-2

[1]Measurement tolerances P_{MPP} ±3%; I_{SC}, V_{OC} ±5% at STC: 1000 W/m²; *at BSTC: 1000 W/m² + φ × 135 W/m², φ = 70% ± 5%, 25 ± 2 °C, AM 1.5 according to IEC 60904-3

MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]			410	415	420	425
Minimum: Power at MPP	P_{MPP}	[W]	307.1	310.8	314.5	318.3
Short Circuit Current	I_{SC}	[A]	8.58	8.61	8.65	8.69
Open Circuit Voltage	V_{OC}	[V]	45.58	45.82	46.05	46.29
Current at MPP	I_{MPP}	[A]	7.98	8.01	8.05	8.08
Voltage at MPP	V_{MPP}	[V]	38.49	38.79	39.09	39.38

[2]800 W/m², NMOT, spectrum AM 1.5

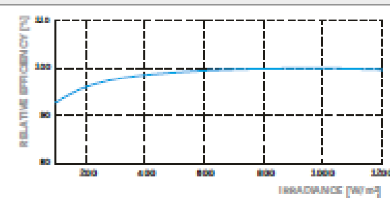
Q CELLS PERFORMANCE WARRANTY



At least 98% of nominal power during first year. Thereafter max. 0.5% degradation per year. At least 93.5% of nominal power up to 10 years. At least 83.5% of nominal power up to 30 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Q CELLS sales organisation of your respective country.

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²)

TEMPERATURE COEFFICIENTS

Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	−0.27
Temperature Coefficient of P_{MPP}	γ	[%/K]	−0.35	Nominal Module Operating Temperature	NMOT	[°F]	108 ± 5.4 (42 ± 3 °C)

PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage V_{SYS}	[V]	1500 (IEC) / 1500 (UL)	PV module classification	Class II
Maximum Series Fuse Rating	[A DC]	20	Fire Rating based on ANSI / UL 61730	TYPE 19[4]
Max. Design Load, Push / Pull[3]	[lbs / ft²]	75 (3600 Pa) / 42 (2000 Pa)	Permitted Module Temperature on Continuous Duty	−40 °F up to +185 °F (−40 °C up to +85 °C)
Max. Test Load, Push / Pull[3]	[lbs / ft²]	113 (5400 Pa) / 63 (3000 Pa)		

[3]See Installation Manual

[4]New Type is similar to Type 3 but with metallic frame

QUALIFICATIONS AND CERTIFICATES

UL 1703, CE-compliant, IEC 61215:2016, IEC 61730:2016, U.S. Patent No. 9,893,215 (solar cells)

PACKAGING AND TRANSPORT INFORMATION

Horizontal packaging	83.8 in 2130 mm	42.5 in 1080 mm	47.1 in 1196 mm	1912 lbs 867.4 kg	22 pallets	22 pallets	29 modules

Note: Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation and use of this product.

Hanwha Q CELLS America Inc.

400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | **TEL** +1 949 748 59 96 | **EMAIL** inquiry@us.q-cells.com | **WEB** www.q-cells.us

Three Phase Inverter with Synergy Technology

For the 277/480V Grid for North America

SE80KUS / SE100KUS / SE110KUS / SE120KUS

INVERTER

Powered by unique pre-commissioning process for rapid system installation

- Pre-commissioning feature for automated validation of system components and wiring during the site installation process and prior to grid connection
- Easy 2-person installation with lightweight, modular design (each inverter consists of 2 or 3 Synergy units and 1 Synergy Manager)
- Independent operation of each Synergy unit enables higher uptime and easy serviceability
- Built-in thermal sensors detect faulty wiring, ensuring enhanced protection and safety
- Built-in arc fault protection and rapid shutdown
- Built-in PID mitigation for maximized system performance
- Monitored* and field-replaceable surge protection devices, to better withstand surges caused by lightning or other events
- Built-in module-level monitoring with Ethernet or cellular communication for full system visibility

*Applicable only for DC and AC SPDs

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/ Three Phase Inverter with Synergy Technology

For the 277/480V Grid for North America

SE80KUS / SE100KUS / SE110KUS / SE120KUS

MODEL NUMBER	SE80KUS	SE100KUS	SE110KUS	SE120KUS	
APPLICABLE TO INVERTERS WITH PART NUMBER	SExxK-USx8Ixxxx				UNITS
OUTPUT					
Rated AC Active Output Power	80000	100000	110000	120000	W
Maximum AC Apparent Output Power	80000	100000	120000	120000	VA
AC Output Line Connections	3W + PE, 4W + PE				
Supported Grids	WYE: TN-C, TN-S, TN-C-S, TT, IT; Delta: IT				
AC Output Voltage Minimum-Nominal-Maximum[1] (L-N)	244 – 277 – 305				Vac
AC Output Voltage Minimum-Nominal-Maximum[1] (L-L)	422.5 – 480 – 529				Vac
AC Frequency Min-Nom-Max[1]	59.5 – 60 – 60.5				Hz
Maximum Continuous Output Current (per Phase, PF=1)	96.5	120	144.3		Aac
GFDI Threshold	1				A
Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds	Yes				
Total Harmonic Distortion	≤ 3				%
Power Factor Range	±0.85 to 1				
INPUT					
Maximum DC Power (Module STC) Inverter / Synergy Unit	140000 / 70000	175000 / 58300	210000 / 70000		W
Transformer-less, Ungrounded	Yes				
Maximum Input Voltage DC+ to DC-	1000				Vdc
Operating Voltage Range	850 – 1000				Vdc
Maximum Input Current	2 x 48.25	3 x 40	3 x 48.25		Adc
Reverse-Polarity Protection	Yes				
Ground-Fault Isolation Detection	167kΩ sensitivity per Synergy Unit[2]				
CEC Weighted Efficiency	98.5				%
Nighttime Power Consumption	< 8	< 12			W
ADDITIONAL FEATURES					
Supported Communication Interfaces[3]	2 x RS485, Ethernet, Wi-Fi (optional), Cellular (optional)				
Smart Energy Management	Export Limitation				
Inverter Commissioning	With the SetApp mobile application using built-in Wi-Fi access point for local connection				
Arc Fault Protection	Built-in, User Configurable (According to UL1699B)				
Photovoltaic Rapid Shutdown System	EC 2014, 2017 and 2020, Built-in				
PID Rectifier	Nighttime, built-in				
RS485 Surge Protection (ports 1+2)	Type II, field replaceable, integrated				
AC, DC Surge Protection	Type II, field replaceable, integrated				
DC Fuses (Single Pole)	25A, integrated				
DC SAFETY SWITCH					
DC Disconnect	Built-in				
STANDARD COMPLIANCE					
Safety	UL1699B, UL1741, UL1741 SA, UL1741 SB, UL1998, CSA C22.2#107.1, Canadian AFCI according to T.I.L. M-07				
Grid Connection Standards	IEEE 1547-2018, Rule 21, Rule 14 (HI)				
Emissions	FCC part 15 class A				

(1) For other regional settings please contact SolarEdge support.
(2) Where permitted by local regulations.
(3) For specifications of the optional communication options, visit the Communication product page or the Knowledge Center to download the relevant product datasheet.

INVERTERS

Three Phase Inverters for the 277/480V Grid

for North America

SE30KUS / SE40KUS

The best choice for SolarEdge enabled systems

- Specifically designed to work with power optimizers
- Quick and easy inverter commissioning directly from a smartphone using SolarEdge SetApp
- Fixed voltage inverter for superior efficiency (98.5%) and longer strings
- Built-in type 2 DC and AC Surge Protection, to better withstand lightning events
- Small, lightest in its class, and easy to install outdoors or indoors on provided bracket
- Integrated arc fault protection and rapid shutdown for NEC 2014 and 2017, per articles 690.11 and 690.12
- Built-in module level monitoring with Ethernet, wireless, or cellular communication for full system visibility
- Integrated safety switch
- UL1741 SA and SB certified, for CPUC Rule 21 grid compliance

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Three Phase Inverters for the 277/480V Grid[(1)]

for North America

SE30KUS / SE40KUS

MODEL NUMBER APPLICABLE TO INVERTERS WITH PART NUMBER	SE30KUS	SE40KUS	UNITS
	SEXXK-USX8IXXXX		
OUTPUT			
Rated AC Power Output	30000	40000	W
Maximum Apparent AC Output Power	30000	40000	VA
AC Output Line Connections	3W + PE, 4W + PE		
AC Output Voltage Minimum-Nominal-Maximum[(2)] (L-N)	244 – 277 – 305		Vac
AC Output Voltage Minimum-Nominal-Maximum[(2)] (L-L)	422.5 – 480 – 529		Vac
AC Frequency Min-Nom-Max[(2)]	59.3 – 60 – 60.5		Hz
Maximum Continuous Output Current (per Phase)	36.25	48.25	Aac
GFDI Threshold	1		A
Utility Monitoring, Islanding Protection, Country Configurable Set Points	Yes		
Total Harmonic Distortion	≤ 3		%
Power Factor Range	+/- 0.85 to 1		
INPUT			
Maximum DC Power (Module STC)	52500	70000	W
Transformer-less, Ungrounded	Yes		
Maximum Input Voltage DC+ to DC-	1000		Vdc
Operating Voltage Range	840 – 1000		Vdc
Maximum Input Current	36.25	48.25	Adc
Maximum Input Short Circuit Current	55		Adc
Reverse-Polarity Protection	Yes		
Ground-Fault Isolation Detection	167kΩ Sensitivity[(3)]		
CEC Weighted Efficiency	98.5		%
Night-time Power Consumption	<4		W
ADDITIONAL FEATURES			
Supported Communication Interfaces	2 x RS485, Ethernet, Cellular (optional)		
Inverter Commissioning	With the SetApp mobile application using built-in access point for local connection		
Arc Fault Protection	Integrated, User Configurable (According to UL1699B)		
Rapid Shutdown	NEC2014, NEC2017 and NEC2020 compliant/certified		
RS485 Surge Protection Plug-in	Supplied with the inverter, Built-in		
DC Surge Protection	Type II, field replaceable, Built-in		
AC Surge Protection	Type II, field replaceable, Built-in		
DC Fuses (Single Pole)	25A, Built-in		
Smart Energy Management	Export Limitation		
DC SAFETY SWITCH			
DC Disconnect	Integrated		
STANDARD COMPLIANCE			
Safety	UL1741, UL1741 SA, UL1741 SB, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07		
Grid Connection Standards	IEEE1547-2018, Rule 21, Rule 14 (HI)		
Emissions	FCC Part 15 class A		
INSTALLATION SPECIFICATIONS			
AC Output Conduit Size / AWG Range	¾" or 1" / 6 – 10 AWG		
DC Input Conduit Size / AWG Range	¾" or 1" / 6 – 12 AWG		
Number of DC Inputs Pairs	4		
Dimensions with Safety Switch (H x W x D)	31.8 x 12.5 x 11.8 / 808 x 317 x 300		in / mm
Weight with Safety Switch	78.2 / 35.5		lb / kg
Cooling	Fans (user replaceable)		
Noise	< 62		dBA
Operating Temperature Range	-40 to +140 / -40 to +60(4)		°F / °C
Protection Rating	NEMA 3R		
Mounting	Bracket provided		

(1) For 120/208V inverters refer to the Three Phase Inverters for the 120/208V Grid for North America datasheet.
(2) For other regional settings please contact SolarEdge support.
(3) Where permitted by local regulations.
(4) For power de-rating information refer to the Temperature De-rating - Technical Note (North America)

CE

Power Optimizer

For North America

P1100

POWER OPTIMIZER

PV power optimization at the module level

The most cost-effective solution for commercial and large field installations

- Specifically designed to work with SolarEdge inverters
- High efficiency with module-level MPPT, for maximized system energy production and revenue, and fast project ROI
- Superior efficiency (99.5%)
- Balance of System cost reduction; 50% less cables, fuses, and combiner boxes; over 2x longer string lengths possible
- Fast installation with a single bolt
- Advanced maintenance with module-level monitoring
- Module-level voltage shutdown for installer and firefighter safety
- Use with parallel PV modules connected in series

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/ Power Optimizer

For North America

P1100

Power Optimizer Model (Typical Module Compatibility)	P1100 (for up to 2 x high power or bi-facial modules)	Units
INPUT		
Rated Input DC Power[1]	1100	W
Connection Method	Single input for series connected modules	
Absolute Maximum Input Voltage (Voc at lowest temperature)	125	Vdc
MPPT Operating Range	12.5 – 105	Vdc
Maximum Short Circuit Current per input (Isc)	14.1	Adc
Maximum Efficiency	99.5	%
Weighted Efficiency	98.6	%
Overvoltage Category	II	
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)		
Maximum Output Current	18	Adc
Maximum Output Voltage	80	Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)		
Safety Output Voltage per Power Optimizer	1 ± 0.1	Vdc
STANDARD COMPLIANCE		
Photovoltaic Rapid Shutdown System	NEC 2014	
EMC	FCC Part 15 Class A, IEC61000-6-2, IEC61000-6-3	
Safety	IEC62109-1 (class II safety), UL1741, CSA C22.2#107.1	
Material	UL94 V-0, UV Resistant	
RoHS	Yes	
INSTALLATION SPECIFICATIONS		
Compatible SolarEdge Inverters	All commercial three phase inverters	
Maximum Allowed System Voltage	1000	Vdc
Dimensions (W x L x H)	129 x 162 x 59 / 5.1 x 6.4 x 2.3	mm / in
Weight	1064 / 2.34	gr / lb
Input Connector	MC4[2]	
Input Wire Length	1.6 / 5.24	m / ft
Output Wire Length	2.4 / 7.8	m / ft
Output Wire Type / Connector	Double Insulated / MC4	
Operating Temperature Range[3]	-40 to +85 / -40 to +185	°C / °F
Protection Rating	IP68 / NEMA6P	
Relative Humidity	0 – 100	%

(1) Rated power of the module at STC will not exceed the Power Optimizer "Rated Input DC Power". Modules with up to +5% power tolerance are allowed.
(2) For other connector types please refer to: Power Optimizer Input Connector Compatibility Technical Note.
(3) For ambient temperatures above +70°C / +158°F power de-rating is applied. Refer to the Temperature De-rating Technical Note for more details.

PV System Design Using a SolarEdge Inverter[4][5]		208V Grid SE10K	208V Grid SE17.3K*	277/480V Grid SE30K	277/480V Grid SE40K*	
Compatible Power Optimizers		P1100				
Minimum String Length	Power Optimizers	8	10	14	14	
	PV Modules	15	19	27	27	
Maximum String Length	Power Optimizers	30	30	30	30	
	PV Modules	60	60	60	60	
Maximum Continuous Power per String		7200	8820	15300	15300	W
Maximum Allowed Connected Power per String[6]		1 string – 8400	1 string – 10020	1 string – 17550	2 strings or less – 17550	W
		2 strings or more – 9800	2 strings or more – 12020	2 strings or more – 20300	3 strings or more – 20300	
Parallel Strings of Different Lengths or Orientations		Yes				
Maximum Difference in Number of Power Optimizers Allowed Between the Shortest and Longest String Connected to the Same Inverter Unit		5 Power Optimizers				

* The same rules apply for Synergy units of equivalent power ratings, that are part of the modular Synergy Technology inverter.
(4) For each string, a Power Optimizer may be connected to a single PV module if 1) each Power Optimizer is connected to a single PV module or 2) it is the only Power Optimizer connected to a single PV module in the string.
(5) Design with three phase 208V inverters is limited. Use the SolarEdge Designer for verification.
(6) To connect more STC power per string, design your project using SolarEdge Designer.

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