

Q&As from the Green Power Partnership’s Webinar on Solar Power Purchase Agreements

[A recording and presentations from the webinar are available at:
http://www.epa.gov/greenpower/events/july28_webinar.htm]

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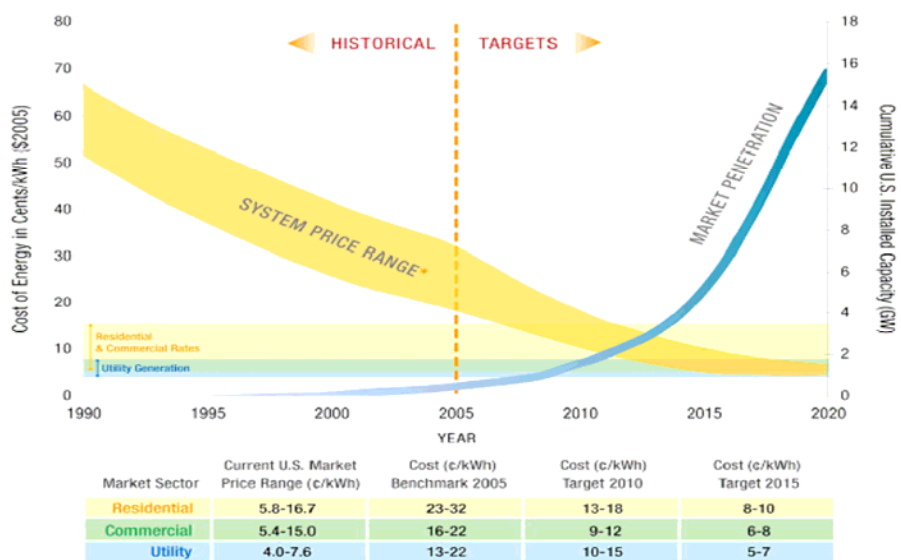
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Financial Questions

- What are the costs associated with installation and how may those be changing over the next 3 years?
- What is the current average cost per watt for installed systems and where do you see it reducing down too?
- What role are incentives playing in driving the cost of solar panels down?

Answer: [From EPA] The Lawrence Berkeley National Laboratory (LBNL) recently reported that the average installed costs – in terms of real 2007 dollars per installed watt (DC-STC) and prior to receipt of any direct financial incentives or tax credits – declined from \$10.5/W in 1998 to \$7.6/W in 2007. The overall decline in installed costs over this time period is primarily attributable to a reduction in non-module costs, which suggests that state and local PV deployment programs – which likely have a greater impact on non-module costs than on module prices – have been at least somewhat successful in spurring cost reductions. Other sources indicate that the next wave of cost reductions will come from reductions in components such as solar modules. The LBNL report can be downloaded at <http://eetd.lbl.gov/ea/emp/reports/lbnl-1516e.pdf>.

DOE projects the following cost curves for solar PV:



- What can a business expect to pay per kWh through an SEaaS?

Answer: [From EPA] The delivered cost of electricity will vary from project to project. Lazard Ltd recently conducted a study comparing the levelized cost of electricity (LOCE) for various Alternative Energy generation technologies. This

study indicates that, on average, solar crystalline PV technology delivers a LOCE of between 12.8-15.4 cents per kilowatt hour. Thin film solar PV delivers an estimated 9.6-12.4 cents per kilowatt hour. These are general estimates for solar PV under certain assumptions. To understand the basis for these figures the Lazard study can be downloaded at

[http://www.narucmeetings.org/Presentations/2008%20EMP%20Levelized%20Cost%20of%20Energy%20-%20Master%20June%202008%20\(2\).pdf](http://www.narucmeetings.org/Presentations/2008%20EMP%20Levelized%20Cost%20of%20Energy%20-%20Master%20June%202008%20(2).pdf) .

- Are solar rates for a PPA installation less than or comparable generally to existing grid rates?
- How is the pricing of the purchased electricity structured? Is it a fixed rate per kWh for the term of the PPA? Is there a standard escalation?
- How is the PPA electricity rates determined? Are they normally above current costs/kWh, to take into account the fixed rate for long period (20yrs)?
- How are PPA rates determined, what do they generally look like, and is there any guarantee that they'll be lower than the prevailing utility rates?
- Are solar power purchase agreements fixed price hedges or do the prices rise over the term?
- What is the typical structure for PPA pricing? Is it a set % below retail rate or set \$/mWh?
- Will a long term solar purchase agreement be the same or lower compared to the electricity rate a customer is buying from conventional sources, even in places like Ohio where the rate is as low as \$0.07-0.09 per kWh?

Answer: [From EPA] One of the many benefits that solar power purchase agreements (SPPA) provide the host organization is a guaranteed predictable cost of electricity less than conventional utility rates. Most SPPA contracts include an electricity cost escalator rate over the term of the contract. The escalation rate accounts for system production decreases over time, and inflation-related cost increases for system operation and maintenance. Whether the starting price is higher or lower than the customer's current utility rate depends on how the pricing is structured. The price negotiation includes where to start the kWh rate, using a fixed or step-based escalator rate, or some combination of kWh rate and inflation schedule that accounts for the time-value of money, and provides a return on investment for the system owners. Ultimately, the cost of kWh depends on the size and complexity of the project, the incentives available to the system owner, the various options afforded to the customer, and the host's credit rating. For additional information on SPPA rate structures and factors impacting the delivered cost of electricity please see the Rarus Institutes Guide to Solar Power Purchase Agreements at:

http://www.californiasolarcenter.org/pdfs/ppa/Rarus_SPPACustomersGuide_v20081005LR.pdf

- What is the typical ROI time?

Answer: [From EPA] From the solar host perspective, the project requires no capital investment and can often be cash flow positive from day one. System developers and investors typically realize their investment objectives within 5 to 8 years after realizing applicable tax incentives, depreciation and other financial benefits.

- Is financing harder to obtain in the current credit market?

Answer: [From EPA] Although financing has slowed in the current financial market, projects are still being built and financed. In response to recent economic issues, investors are requiring higher returns on investment.

- If the provider owns a % share in the solar installation, does the provider also own a % of the REC?

Answer: [From EPA] The ownership of the renewable energy certificates (RECs) can be assigned to any party and should be clearly addressed in the solar power purchase agreement (SPPA). It is often the case that the system developer assumes ownership of the RECs and sells them in order to help finance the system. If the system host does not retain ownership of the associated RECs, the host can not claim they are using solar power. However, the host can also stipulate in the SPPA that the developer purchase RECs on the open market, and transfer ownership of those RECs to the host organization in order that the host make claims about being green powered (not necessarily solar powered). This situation is called REC arbitrage. REC values vary widely as a result of such factors as resource type, supply and demand for the RECs in the region they are produced, as well as the vintage of the REC. Thus system developers and hosts can take advantage of REC arbitrage opportunities by selling RECs produced by onsite systems and replacing them with less expensive RECs from other sources.

Questions Addressed to Staples

- How does Staples estimate dollar value of peak load shaving capability of PV systems? What models are available for predicting savings associated with peak load shaving?

Answer: [From Mark Buckley of Staples] We look at the the power that the PV system would have provided and add it to the load curve of our net power consumption off of the grid to determine the approximate peak savings

- What electricity price was the tipping point to make it worthwhile for Staples to install?

Answer: [From Mark Buckley of Staples] Since there is no capital or O&M expenses to Staples we look at the initial price of the agreement (below the bundled price of electricity) and the long range hedge value against fuel cost

increases, T&D increases and peak demand to determine whether a project is worthwhile moving forward.

- For Staples are costs below bundled utility pricing? Typically at a premium.

Answer: [From Mark Buckley of Staples] All of our solar agreements are priced below the average annual price per kWh for power including T&D, generation and peak demand in that location.

- Is Staples able to claim any portion of the Federal Investment Tax Credit? Does Staples participate as an equity investor with SunEdison to claim tax benefits?

Answer: [From Mark Buckley of Staples] No, all of those benefits are claimed by SunEdison.

- What is the average price per kWh of Staples PPA agreements?

Answer: [From Mark Buckley of Staples] We cannot disclose pricing per our non-disclosure agreement.

- How much is Staples paying per kWh under your solar PPAs?

Answer: [From Mark Buckley of Staples] We cannot disclose pricing per our non-disclosure agreement.

Policy Questions

- Any comments on legislative barriers? Specifically, in Florida, PPAs are being held back due to a block on third party power sales, where only Public Power companies can sell energy to the general public.
- What states currently allow the SPPA? What states are pending decisions?
- I live in a state that does not permit retail choice. Our PSC has advised that a third party coming in and providing solar would violate state law because it would infringe upon an electric utility's monopoly. Have you encountered in this in other state

Answer: [From EPA] States currently diverge in opinion and policy on whether a system that is owned by entity other than a utility customer may net meter. The concept is that if a third party owns a solar facility and sells power to a utility customer, that makes the owner a utility subject to the Utility Commission regulation. As such, it also means that the owner of the system is violating the utility's exclusive franchise and would need to cease operation. Some argue that third party owners are not utilities under typical state definitions because each onsite system serves just one customer, not the general public. States that have addressed, or are in the process of addressing, this issue include: California,

Colorado, Oregon, Arizona, Nevada, New Mexico, Utah, Washington, Texas, New Jersey, Massachusetts, Florida. For more information see “Solar PV Financing: Legal Challenges to the Third-Party Ownership” at http://dukespace.lib.duke.edu/dspace/bitstream/10161/843/1/MP_kwk5_a_200905.pdf

- Which states or cities have high demand for PPAs?
- Other than CA & NJ, what other states are emerging as leaders in implementing PPAs?

Answer: [From EPA] According to the Interstate Renewable Energy Council (IREC), approximately 95 percent of total cumulative installed solar capacity exists in 10 states nationwide.¹ Solar Power Purchase Agreements have played significant role in the deployment of capacity for many of these states. In addition, many of these states have also made rulings in favor of third-party ownership. For further information on net metering rulings for third-party ownership, please see the Database for State Incentives for Renewable Energy (DSIRE) at <http://www.dsireusa.org/solar/>.

Table 2: TOP TEN STATES BY CUMULATIVE CAPACITY
Ranked by Grid-Connected PV Cumulative Installed Capacity through 2008

	MW _{DC}	Market Share
1. California	528	67%
2. New Jersey	70	9%
3. Colorado	36	5%
4. Nevada	34	4%
5. Arizona	25	3%
6. New York	22	3%
7. Hawaii	14	2%
8. Connecticut	9	1%
9. Oregon	8	1%
10. Massachusetts	8	1%
All Other States	39	5%
Total	792	

- How do you deal with States, (e.g. NY), where incentives are tied to REC claims?

Answer: [From EPA] Very few state incentive programs have ruled that REC ownership is automatically transferred to the utility resulting from the receipt of an incentive. The Database for State Incentives for Renewable Energy publishes a state rebates policy comparison spreadsheet that details the REC ownership situations for each incentive program (<http://www.dsireusa.org/solar/comparisontables/?rpt=1>). If the RECs are not available to the developer or the host customer, then the RECs cannot be used to

¹ IREC, Solar Trends Market Report 2008, http://www.irecusa.org/fileadmin/user_upload/NationalOutreachDocs/SolarTrendsReports/IREC_Solar_Market_Trends_Report_2008.pdf

help finance the system or used to make claims. In the absence of ownership of the RECs produced by the system, the solar host can buy RECs on the open market in order to make claims, replacing those produced by the system.

- How will the Berkeley plan and AB811 affect PPAs?

Answer: [From EPA] California AB811 gives cities and counties the ability to offer low-interest loans for solar PV systems to homeowners and small businesses. Residents would pay back the loans through assessments on property tax bills; if they move, the outstanding loan balance is taken over by the new owner. “Charter cities” such as Berkeley and San Francisco have supreme authority over municipal affairs and have successfully been able to offer low interest loans that are attached to the property and not the owner. Without the AB811, some of California’s 370 other “general law cities” are bound by state laws that might have been prohibitive in pursuing this approach. The addition of policies such as AB811 and the Berkeley solar program only increases the options available to prospective solar hosts. Parties interested in installing a solar PV system should weigh each option and choose the financing mechanism that best meets your goals.

Site/Building Questions

- How has leasing real estate affected renewable energy/solar deployment?

Answer: [From EPA] Many solar hosts have successfully installed solar PV systems on leased space facilities. If the solar host does not own the building, there is the added complexity of having the building owner added to the mix of stakeholders who must agree on the contractual aspects of the solar PV project. There are a variety of issues that parties must consider when dealing with solar power purchase agreements on leased space facilities.

- Is there a formula to determine kilowatts needed vs roof footprint/sq.ft.available

Answer: [From EPA] A good rule of thumb is 100 sq. ft. for each kilowatt (kW) of system capacity for crystalline technologies and 175 sq. ft. for each kilowatt of thin film PV products.

Questions Addressed to Staples

- Have you had any problems with the insurance on a building after an array has been erected?

Answer: [From Mark Buckley of Staples] No, we have not.

- On the buildings that Staples does not own, what arrangements are you making with the landlord? Renting the roof space?

Answer: [From Mark Buckley of Staples] Staples negotiates a separate lease amendment for each installation. We do not rent any additional roof space.

- What percentage of buildings are owned by Staples vs. LLs., does he have stats on solar on staples vs LL owned buildings?

Answer: [From Mark Buckley of Staples] For our retail sites 98 percent of all facilities are leased, not owned. For our large nonretail office and distribution centers, we prefer to develop and own. We do have many buildings which we have assumed leases due to acquisition etc. So, about 50 percent plus are leased. Of the 27 projects completed to date only (4) are owned by Staples.

Technology Questions

- Is there a minimum size (kW or MW) for a PPA?

Answer: During the webinar, Mark Culpepper indicated that SunEdison has a 75 – 100 kW entry point for SPPAs. transcript.

- Does the energy that is generated go into batteries or the building's main distribution?

Answer: [From EPA] In most cases solar PV systems use the building's main distribution infrastructure, which uses the utility grid as the "battery" by way of net metering. As the system produces more electricity than the facility can use it runs the excess electricity back onto the grid, running the meter backwards and creating a "credit" that the facility can use at a later time when the system is not producing enough power to meet the facility's load.

- Are there any solutions for how to store solar power? It's my understanding that this is a major problem in the industry.

Answer: [From EPA] For many renewable system owners the policy of net metering is enough to financially "store" the value of unused electricity produced by the system. As the system produces more electricity than the facility can use it runs the excess electricity back onto the grid, running the meter backwards and creating a "credit" that the facility can use at a later time when the system is not producing enough power to meet the facility's load. In terms of the physical storage of electricity, some technologies do exist, but are often cost prohibitive for most applications. Batteries, fuel cells, fly wheels, compressed air, hydro pumping and other options are possible.

- Due to the rapid evolution of PV Technology, which PV cells are the most desirable for use in new arrays at this time, and conversely which PV cells are now so relatively inefficient that they should be avoided?

Answer: [From EPA] The answer is to choose the PV technology that will deliver the lowest cost per kilowatt-hour. Some solar PV technologies such as Thin Film are less efficient in converting sunlight to electricity, but cost less to do it. Whereas others types of PV technologies such as Monocrystalline Silicon Panels are more efficient, but also cost more to produce. For a good review of the different types of PV technologies, see:
<http://www.masstech.org/cleanenergy/solar/paneltypes.htm>.

- What is the current, expected life span of an inverter used on a solar array?
- Are invertors typically covered in the SPPA for the life of the contract?
- Is there any info available on the maintenance costs of solar panels?

Answer: [From EPA] It is reasonable to expect to have to replace the inverter at least once during the service life of the solar PV system. Inverters typically have warranties from 5 to 20 years depending on the manufacturer. Many state incentive programs have minimum warranty requirements for individual system components in order to qualify for state incentive funding. Solar panels have no moving parts and thus have very few issues with failures or maintenance requirements. The only maintenance related issue needing to be addressed for the solar PV modules is their cleaning, which is often done on an annual basis. The solar developer will often build into the agreement a ongoing service contract that includes the cleaning of the modules. Solar hosts should be aware that roof access to the solar PV system by the solar developer staff is a requirement in order to ensure the system can be maintained and to minimize downtime. Ongoing maintenance and the replacement of the inverter should be included as part of the solar power purchase agreement.

- What are some typical causes of system downtime?
- How often do outages occur and what kind of back up systems can be put into place (just tied to grid) how long does it take to get back up, if tied to grid how does a customer even know that system is down?

Answer: [From EPA] Inverter service and maintenance is the primary cause for system downtime. Because the solar modules do not have moving parts they have a very low failure rate. Real-time monitoring of a system can help detect component failures and minimize system downtimes. Since a solar power purchase agreement often guarantees a specific output (kWh) for the system, the system developer will include the capability of real-time monitoring as part the agreement. If the system performance falls out of the expected operating output range, the solar developer will dispatch a technician onsite to troubleshoot the problem. Downtimes can vary in length depending on the cause of the system

failure. In many cases the system can be put back on-line in a matter of hours, with worst case situations being measured in days.

- How do PV panels affect the roofing membranes and who is responsible or takes care of the liability if the roofing materials fail?

Answer: [From EPA] There are a variety of options available for mounting solar PV systems to a facility. Some systems use post mounts that penetrate into the structural members of the roof. Other systems use ballasted systems that sit on top of the roof itself and require no roof penetrations. Still further, some solar PV products are incorporated into the roof membrane and are installed as part of a complete re-roofing project. Generally, solar system developers work with a qualified roofing sub-contractor who will seal and warranty any roof penetrations made by the addition of a solar PV system. The host customer is not typically liable for roofing failures. The roof penetrations made by a solar PV system are similar as any other roof penetration and don't require any special consideration when sealing them for long-term performance. Issues resulting from solar PV installations are few, but need to be addressed in the solar power purchase agreement.

- How much flexibility does the customer have in the design phase of a SEaaS project (i.e., redundant interconnections, choice of PV panels, inverters, multiple inverters, etc.)

Answer: [From EPA] One of the primary reasons for pursuing a solar power purchase agreement is that the customer often does not view the solar development process as part of its organization's core business practices. Therefore, many customers do not typically get involved at the design level. Host input and system design flexibility of the system can be considered, however, this should be addressed early in the negotiation process.

Questions Addressed to Staples

- Do your SPPAs address Technology upgrades? How? Are you considering SPPAs outside the US? If so, are there any lessons learned you can pass on?

Answer: [From Mark Buckley of Staples] First, These do not address specific technology upgrades ie. panel technology improvements. They do, however, cover replacement of inverters, etc., which will occur during the course of a 20-year PPA. Second, we are looking at PPAs outside of the US, but to date have not initiated a contract. Many countries have feed-in tariffs and are not as attractive from a business standpoint.

Utility Questions

- Which states/utilities do not allow the PPA model? What is the best way to find out if PPAs are allowed in a state or utility service territory?

Answer: [From EPA] The Database of State Incentives for Renewable Energy (DSIRE) is a good resource for tracking state policy decisions related to third-party ownership. States that have made rulings or are in the process of making rulings include California, Oregon, Nevada, Colorado, Utah, New Mexico, Arizona, Texas, Florida, and Massachusetts. States such as Washington and New Jersey have not made rulings, but appear to have favorable views on the third-party ownership. Florida has ruled against third party ownership through solar power purchase agreements, but does recognize leasing as an option for solar PV. The following resources provide some additional information with this every changing policy issue:

<http://www.dsireusa.org/solar/>

http://www.narucmeetings.org/Presentations/Solar_Keyes2009.pdf

- What determines whether utilities (both municipal and investor-owned) will allow PPA's? is it a state by state regulations or a utility-based decision. What can corporations do to urge their utilities to allow PPA's?
- What roles are utilities playing in the solar PPA market? Are PPAs helping to develop utility-sponsored solar projects?

Answer: [From EPA] Various new applications of third-party ownership are being explored in states that recognize this business model. Some utilities are looking at the various ownership, operation and control options available for siting systems on either the customer or utility side of the meter. The following reports provide additional information on how the evolution of the PV business model is taking shape today and for the future:

www.nrel.gov/docs/fy08osti/42304.pdf

<http://www.solarelectricpower.org/docs/Special%20Report.Electric%20Utilities%20and%20Solar.pdf>

http://www.solarelectricpower.org/docs/Utility%20Business%20Model%20FINAL%2003_8.pdf

- Are there markets that the local utility providers bring resistance to the project?
- What are some common obstacles or "friction" that PPAs might encounter with the utility company?

Answer: [From EPA] The primary issue for many utilities is that they see onsite system generation as a reduction in their baseload demand and in their ability to cost recover for conventional generation assets. Some utilities have been resistant to allowing distributed generation for this reason. However, many states are currently addressing third party ownership of systems and whether these system owners should be regulated by state Commissions as a utility. The issue of third-

party ownership is often dealt with through state regulatory commissions and net-metering policy decisions. Other issues include interconnection policies as well as caps placed on the size or aggregate capacity that can be integrated into the utility grid.

- If a system is creating more energy than needed, does the SPPA have access to sell the energy to other customers?

Answer: [From EPA] Typically no, but recently a handful of states have expanded net metering by allowing meter aggregation for multiple systems at different facilities on the same piece of property owned by the same customer. A small number of states (including California) allow “virtual” meter aggregation, for the purposes of net metering for certain customers, for multiple systems at different facilities on different properties owned by the same customer. In addition, “community net metering” or “neighborhood net metering,” which allows for the joint ownership of a solar energy system by different customers, is in effect or under development in a small number of states, including Massachusetts. For additional information on this subject please see: <http://www.dsireusa.org/solar/solarpolicyguide/?id=17>

Questions Addressed to Staples

- Has Staples had any experiences with reticent utilities?

Answer: [From Mark Buckley of Staples] Overall, our experience with utilities has been good.

- How have utilities helped or hindered your work in deploying solar and establishing PPAs?

Answer: [From Mark Buckley of Staples] Lack of standards around metering and interconnecting agreements can create challenges with rolling out a portfolio solar strategy. Some utilities do not view these solar projects as priorities for meter installation and cut over but overall they have been helpful.

Other Questions

- Who owns the RECs in a PPA?

Answer: [From EPA] SREC ownership is generally spelled out in the SPPA, but by default, ownership goes to the owner of the array.

- Where can homeowners and small building owners go for PPAs?

Answer: [From EPA] NREL recently published a report entitled “Solar Photovoltaic Financing: Residential Sector Deployment” <http://www.nrel.gov/docs/fy09osti/44853.pdf> . NREL has also issued a report on Solar Leasing for Residential Photovoltaic Systems (<http://www.ctsolarlease.com/documents/NRELSolarLeasePaperMarch2009.pdf>), which is a slightly difference approach than the SPPA.

- For either presenter. What is a reasonable time to expect to be able to obtain and negotiate a PPA?

Answer: [From EPA] Most SPPAs take 6-9 months from negotiation to completion.

- Does the building owner ever gain ownership of the solar energy system on the roof?

Answer: At the end of the contract term, most SPPAs allow the host to (1) renew the SPPA and continue to buy the power under new terms, (2) have the panels removed by the solar services provider, or (3) purchase the system at fair market value. Some SPPAs also include an early buyout option exercisable before the full term of the contract expires. The option allows the host customer to purchase the system for whichever is greater: (1) a pre-arranged price that will adequately compensate the project’s investors, or (2) the system’s fair market value at the time the option is exercised.

Questions Addressed to Staples

- Is Staples looking into requiring low-carbon commitments from their vendors?

Answer: [From Mark Buckley of Staples] We will be.

- Does staples only use PPAs, or do they purchase their own site-produced solar?

Answer: [From Mark Buckley of Staples] We use the PPA to purchase our on site produced solar and do not own any systems.

- Did Staples choose one supplier, or were there several regionally?

Answer: [From Mark Buckley of Staples] We have one national supplier, SunEdison, as our partner company. They provide a “turn key” service that we need to support a large portfolio program.