Solar Technical Assistance Team (STAT) Summer Webinar Series

Webinar 2: Solar Economics for Policymakers: Non-Hardware Costs of PV Systems

Transcript

July 25, 2012

*[Courtney Kendall]* **Slide 1:** Good afternoon, my name is Courtney Kendall from the National Renewable Energy Laboratory and I’d like to welcome you to today’s webinar. We’re excited to have you with us today.

Before we get started, I have a few items that I would like to cover.

First, I want to mention that this webinar will be recorded, and everyone today is on listen-only mode. You have two options for how you can hear today’s webinar. In the upper right corner of your screen, there is a box that says “Audio Mode” – this will allow you to choose whether or not you want to listen to the webinar through your computer’s speakers or a telephone. As a rule, if you can listen to music on your computer, you should be able to hear the Webinar. Select either “Use telephone” or “Use Mic and speakers”. If you select “Use telephone” the box will display the telephone number and specific audio PIN you should use to dial in. If you select “Use Mic and speakers” you might want to click on “Audio Setup” to test your audio first.

We will have a Q&A session at the end of the presentation. You can participate by submitting your questions electronically during the webinar. Please do this by going to the questions pane in the box showing on your screen. There you can type in any question that you have during the course of the webinar. Our speakers will address as many questions as time allows after the presentation.

And now I would like to introduce Kristen Ardani. Kristen is a solar analyst with the National Renewable Energy Laboratory.

*[Kristen Ardani]*Thanks, Courtney! Hello and welcome to our second webinar in the US DOE SunShot Summer Webinar Series. Today’s presentation, “Solar Economics for Policymakers: The soft cost of PV systems,” will provide policymakers with information on solar costs and pricing. The presentation includes detailed discussion of both residential and commercial solar costs based on a recent SunShot survey.

**Slide 2:** The U.S. Department of Energy (DOE) Solar Program, in coordination with the National Renewable Energy Laboratory (NREL) is hosting the Solar Technical Assistance summer webinar series for state and local policymakers and staff.

There will be a total of 6 webinars held between July and September. The series aims to provide policymakers with the information necessary to support increased adoption of Solar PV and reduce the cost of solar energy systems. I’d like to highlight that the webinars on August 15th and September 5th will be particularly beneficial to those seeking further information on the policy concepts and practices introduced in today’s discussion.

**Slide 3:** The DOE SunShot Initiativeis a collaborative national initiative to make solar energy technologies cost-competitive with other forms of energy by reducing the cost of solar energy systems by about 75% between 2010 and 2020. For more information about the broader initiative visit the DOE SunShot website at [www.energy.gov/sunshot](http://www.energy.gov/sunshot).

The Solar Technical Assistance Team, or “STAT” as we commonly refer to it, is a team of solar technology and deployment experts who ensure that the best information on policies, regulations, financing, and other issues is getting into the hands of state government decision makers when they need it. State legislative or regulatory bodies and their staff can request technical assistance by emailing [stat@nrel.gov](mailto:stat@nrel.gov) - requests are reviewed on a rolling basis.

**Slide 4:** Here’s just a brief overview of today’s presentation. First, I will highlight the learning objectives of today’s presentation, and I will provide you with an overview of solar deployment and pricing trends, before diving into a discussion of NREL’s recent data collection and analysis on the non-hardware costs, or soft cost, of residential and commercial PV systems in the U.S. Lastly, I want to provide examples of best practices in soft cost reduction, before concluding with a few key tools and resources for policy makers that can inform the adoption of streamlined permitting, inspection, and interconnection procedures at the local and state levels. The focus of today’s webinar is to present results from NREL’s recent soft cost benchmarking analysis, while providing an introduction to the policies and best practices aimed at increasing PV deployment in the webinars to come. Specifically, **AUGUST 22** Policy for Distributed Solar 101: What Makes a Solar DG Market? And SEPT 5th **SEPTEMBER 5** Regulatory Strategies for Driving the Distributed Solar Market will be more policy focused and build off information presented today.

**Slide 5:** So with the learning objectives for this session, we hope to increase your familiarity with the cost breakdown for residential and commercial PV systems in the U.S., paying particular attention to soft cost benchmarks (based on a recent SunShot survey conducted by NREL). You will learn what costs go into the overall price of a solar system including customer acquisition costs as well as installation labor costs -which make up a large amount of the total price for solar. We will wrap up by highlighting best practices in soft cost reduction and point you in the direction of available tools and resources to help reduce permitting, inspection, and interconnection costs.

**Slide 6:** Since 2005 the solar market has exhibited rapid growth, with annual Global demand for PV increasing from less than 5GW to more than 20GW.

In 2010 alone, global installed PV capacity grew 131% compared to 2009, bringing the installed total to 40 gigawatts (GW). With approximately 24 GW added PV capacity in 2011, the global installed total now stands at approximately 64 GW

In looking at demand projections through 2014, U.S. demand is expected to grow as European demand declines- notice the green bar in 2014 and how Europe’s share of total demand decreases over time.

**Slide 7:** Let’sdo our first poll. With the U.S. market projected to grow, let’s take a poll on current U.S. solar demand. Do you know which two states have the greatest combined installed PV capacity?

It seems from the results from today’s poll that the audience today has a pretty firm grasp that California and New Jersey have the most robust solar markets in the U.S. today.

Perhaps we can take a look at the U.S. installation breakdown in the United States based on the next slide.

**Slide 8:** From the pie chart on the right, you can see that in Q1 2012 California and New Jersey installed the greatest amount of PV capacity at the state level; they are the two states with the greatest cumulative installed PV capacity (as of the end of 2011 CA had 1.5 GW cumulative PV capacity, and New Jersey 601 MW)

On the left, you see a breakdown of U.S. PV installations by Sector, from the beginning of 2010 through Q1 2012. The last quarter of 2011was a particularly strong quarter as many non-residential and utility project developers sought to meet eligibility deadlines for the 1603 cash grant in lieu of tax credit program.

**Slide 9:** Here we have the average selling price for modules (in red) and global installed module capacity (in blue). As you can see, the large increase in installed capacity has been largely driven by declining module prices. To illustrate, the ASP for modules was approximately $4/W in 2005 and fell to $2.40/W in 2010 and are priced at $1.14/W in 2012.

**Slide 10:** Now that we have examined module prices, let’s take a look at total installed PV system prices in the United States. Just please note the data depicted here is sourced from the California Solar Initiative database for systems installed in California.

With module price declines from 2005 to 2010 of approximately 4 dollars a watt to 2, and PV system price declines from approximately 8 dollars a watt to 6, module price declines account for approximately 96% of the decline in total installed PV system price. That is to say non-module components account for a significant, and increasing, portion of average installed PV system prices in the U.S

**Slide 11:** With module price declines driving reductions in total system price, non-hardware costs have remained relatively constant, and that is because there is more to a system than hardware. Soft costs are also significant. For example, as a consumer, I must go through the process of choosing an installer (though as an installer, I must go through the process of customer acquisition). Then financing must be arranged, the system must be properly permitted, inspected, and interconnected, and then over the life of the system there are costs associated with monitoring performance.

The main point here is that in the US, the *process* of selecting an installer can add significant **time** and **cost** to project completion. Inefficient supply chains, operation and maintenance and delays can also increase system cost.

**Slide 12:** We know that soft costs are significant. But let’s take another poll.

Of a residential PV system’s total installed cost, what portion do you think represents the hardware components?

Approximately half of our audience has guessed correctly – that hardware components make up anywhere from 40 to 55% of overall cost.

**Slide 13:** Germany is an example of how more streamlined processes can bring down overall system costs. Minimal and streamlined processes in Germany have lead to significant price reductions.

The y axis here shows total system price, while the x axis shows residential system prices for Germany and the United States, and commercial system prices in the U.S, as well. How can we explain Germany’s $2/W price advantage over the U.S.?

Given the globalized market for hardware and that hardware costs are relatively constant across countries; non-hardware costs are driving the differential in system prices across national markets.

It’s not just the cost, but the time it takes to install where we are well behind. A quick example, average timeframe from accepting a proposal to completion of a residential solar project in New York State is one year. We are currently working with them to get this timeframe down to 100 days.

By comparison, Photon magazine just had an article about a German family that installed solar panels on their home and had them up and running in just 8 days. This includes permitting, interconnecting to the utility, receiving all of the necessary regulatory approvals, and installation in 8 days.

**Slide 14:** With rapid decline in hardware costs, reducing soft-cost is becoming increasingly important. Certain policies and regulations pose barriers to the wide scale deployment of solar technologies adding cost to PV systems. Jurisdiction restraints are often cited as one of the barriers to rapid deployment.

By improving policy and regulatory frameworks we can essentially “unlock” the market leading to decreased cost and increased market potential and size.

**Slide 15:** To date, there has been very little data collected on non hardware, soft costs, - also referred to as non-hardware balance of system costs, or BOS for PV systems

NREL recently benchmarked 2010 soft costs and integrated those findings into a bottom up PV system price model, based on ongoing cost modeling research at NREL. Data was collected through an online survey distributed to residential and commercial PV installers. The data collected was used to estimate the cost per Watt for soft costs including: customer acquisition, permitting, inspection and interconnection, labor costs of arranging 3rd party financing and installation costs.

Installers were asked the number of labor hours used to complete discrete stages of the PV business process, then those labor hours reported were translated into cost/w benchmarks based on average system size, fully burdened labor rates and labor class proportion assumptions. (For customer acquisition, labor hours were not used. Instead total annual costs were translated to cost/w)

For the residential benchmark, we calculated a volume weighted average cost per watt. A 5 kilowatt system size was assumed for all cost categories except installation labor. For installation labor the average system size was calculated from reported installs and megawatts.

For the commercial benchmark, we generated a median cost per watt to account for a wide distribution in reported cost and average system size. Two subgroups of commercial installers were surveyed and distinguished by a system size threshold of 250 kilowatts.

**Slide 16:** Now, I’m going to discuss the breakdown between hardware and soft cost components of total PV system price, as informed by NREL’s data collection activities. Including, profit, sales tax, and additional overhead, soft costs are roughly half of residential PV system prices, 44% of small commercial prices and 41% of large commercial prices. As you can see here, soft costs exhibit economies of scale in that the larger the system, the smaller the percentage of total soft costs.

* *Profit is separated out from all other non-hardware*
* *Soft BOS Cost is $3.33 for residential 5kW systems, $2.64 for commercial systems under 250kW, and $2.16 for commercial systems over 250kW.*

**Slide 17:** Now we’ve narrowed in on the breakdown of just those soft BOS costs depicted in the previous slide.

* Here, all other non-hardware, includes profit, sales tax, and additional costs of financing not explicitly benchmarked by NREL’s survey

Of the 4 cost categories we benchmarked, the permit fees are based on averages typically seen in the market, though they vary widely across jurisdictions and permitting fees greatly impact total soft costs.

**Slide 18:** Here I thought it would be interesting to look at the residential data in a little more detail.

This graph shows the total soft BOS costs for residential PV systems. Total soft BOS (including profit) averages $3.33/W – or approximately 50% of the total price.

With customer acquisition costs, including system design of .67/W and installation labor cost of .59/w, one can see that these two cost categories are the most significant of the soft cost categories explicitly benchmarked by our survey. However, the costs of permitting, inspection, and interconnection should not be ignored, as those also present significant cost reduction opportunities.

**Slide 19:** Just taking an example of inconsistent permitting, inspection and interconnection requirements, delays and lengthy wait times are costly. Permitting gets tricky because jurisdictions and utility territories differ in their requirements. There are over 18,000 local jurisdictions many with different PV permitting requirements and over 5,000 utilities with varying interconnection standards and net metering programs.

What that means as an installer is that permitting fees also vary widely across the U.S. For example, for a 5kW system, typical permitting fees are $200 to $450 per install and can get as high as $2,000/install. Currently in the U.S. permitting, inspection and interconnection costs range from 15 cents per watt to 25 cents per watt, and can be as high as 50 cents per watt depending on the jurisdiction.

**Slide 20:** When looking at the different stages of the permitting, inspection, and interconnection process, permit preparation has the highest median reported labor hours per installation at 8 hours. More streamlined permitting processes can lead to time and cost reductions.

Permitting processes overall can be very costly. The plot chart on the left shows that the total permitting, inspection and interconnection labor hours remain in the 15 to 25 hours range regardless of the number of PV systems installed. This indicates that labor hours per install may be more dependent on jurisdictional factors than economies of scale. One would expect that larger volume installers would exhibit lower number of hours required for installation, but that is not what the data suggest.

**Slide 21:** The goal of the DOE SunShot Initiative is to reduce PV price by approximately 75% - this would mean bringing non-hardware costs down from $3.33 per watt to .65 cents per watt. Granted, the .65 cents per watt goal is based on a 20/20 PV system price of $1.50.

Through decreased wait times, standardization across jurisdictions, use of remote technologies for site assessment and system design, there are several cost reduction pathways to achieve the SunShot soft cost reduction goals.

From the existence proof of Germany, we know soft cost reductions are achievable in the U.S. However, soft costs (especially permitting, inspection, and interconnection) are largely driven by policy and regulation.

**Slide 22:** However, it is important to highlight who regulates what, if policy driven soft cost reductions are to be achieved.

This slide addresses policies and programs that have a healthy level of overlap and complementary nature at the state and local level. Local programs can be designed to build off of or supplement existing state programs or can fill gaps in existing state policies. For instance, Texas does not have a state level solar rebate program, but a number of local rebates (usually through municipal utilities) have created local solar clusters in the state.

**Slide 23:** Now let’s review a few municipal level options for reducing soft costs, though policy and regulatory strategies for driving solar markets will be covered in much more detail during the August 22nd webinar “Policy for Distributed Solar” and the September 5th webinar “Regulatory Strategies for Driving the Distributed Solar Market.”

Many local jurisdictions have seen success in implementing one or more of these strategies to streamline permitting:

* Replace valuation method for permit fee assessment with flat fee structure
* Over the counter/online permitting
* Standardize permitting/interconnection requirements across jurisdictions
* Fast track permit processes for installers with reliable track records
* Allow document exchanges to be conducted by company representatives, not just the licensed electrician

**Slide 24:** As an increased number of cities adopt similar, best practice permitting models greater cost reductions can be achieved. Each of these examples highlights how to make permitting cheaper and faster.

In VERMONT- there is a registration program for systems 10kW and under, in which solar installations have a simple pre-determined process that reduces paperwork and uncertainty. A single basic registration form that outlines the system components, configuration and compliance with interconnection requirements has replaced a much lengthier process. Now, a PV system can be expediently approved simply by registering it. The local utility has 10 days to raise any interconnection issues; otherwise, a permit known as a Certificate of Public Good is granted and the project may be installed.

In COLORADO

There is a statewide cap for PV permits for systems under 2 MW-DC. Counties and municipalities can charge no more than the lesser of the local government's actual cost to issue a permit, or $500 for a residential application and $1,000 for a nonresidential application. For systems 2 MW-DC or larger, the local government can charge no more than what it actually costs the government to issue the permit. City and county permits combined may be larger than these limits, but cannot separately exceed the limits.

In PHILADELPHIA

If the contractor meets predetermined installation conditions, the City will waive the requirement for a separate building permit. Some of those conditions include,

* Installation must be on the roof of a one- or two-family dwelling.
* Installation is 10 kW or less
* Installation may not occur on roof systems comprised of engineered trusses
* Property is not designated historical
* Electrical Contractor must agree to accept responsibility for the structural installation of the roof-top equipment

At present the DOE is making a concerted effort to support the streamlining of the PV business process. But,

**Slide 25:** Before moving on, we have one last poll for you… How familiar is the audience with the Solar Resources for Policymakers listed here: Solar Powering Your Community; SunShot Resource Center; Solar ABCs; and Freeing the Grid?

We can see here that more than half of the audience is familiar with more than one or two of these resources.

I will briefly review a few helpful resources for policymakers that will help streamline the costs in your area.

**Slide 26:** The Solar Powering Your Community Guide is a comprehensive resource developed by the Department of Energy to assist local governments and stakeholders in building local solar markets.

**Slide 27:** The SunShot Resource Center is a DOE SunShot online resource which provides a comprehensive list and links to case studies, fact sheets, how-to guides, model ordinances, technical reports, and sample government documents.

**Slide 28:** The Solar America Board for Codes and Standards – the Solar ABCs – is a resource for local governments interested in implementing solar codes and standards.

**Slide 29:** Freeing the Grid is a state-specific resource which provides a “report card” for state policy on net-metering and interconnection.

**Slide 30:** Lastly, this last slide provides the full links to each of the resources we’ve just discussed.

**Slide 28:** And that concludes our second presentation in the SunShot webinar series. I would like to thank you all for your time and participation. I encourage you to attend all of our webinars in the SunShot webinar series. The next webinar “Solar Technology Options and Resource Assessment” will be held on August 15th from noon to 1:00 mountain time, or 2:00 to 3:00 eastern.

All of the presentations in the SunShot webinar series will be recorded and posted on the DOE SunShot website: [www.energy.gov/sunshot](http://www.energy.gov/sunshot)

For more information or to request technical assistance on technology, programs and policy options through the solar technical assistance team, please email us at [stat@nrel.gov](mailto:stat@nrel.gov)

Again, I want to thank you for your participation today. We welcome you to ask questions by typing them in the appropriate window using the webcast software box on your screen.

*[Courtney Kendall]*We are concluding today’s webinar. We appreciate your time! Thank you for attending.