U.S. DEPARTMENT OF ENERGY
LOAN PROGRAMS OFFICE
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INVESTING *in* AMERICAN ENERGY

# POWERING NEW MARKETS: UTILITY-SCALE PHOTOVOLTAIC SOLAR

## NOTE FROM THE EXECUTIVE DIRECTOR

The Department of Energy's Loan Programs Office (LPO) was instrumental in launching the utility-scale photovoltaic (PV) solar industry in the United States.

In 2009, there was not a single PV solar facility larger than 100 megawatts (MW) operating in the United States. Despite growing demand for this clean, renewable energy source, developers faced challenges securing the financing necessary to build these large projects.

LPO stepped in to address this market barrier by providing more than $4.6 billion in loan guarantees to support construction of the first five utility-scale PV solar facilities larger than 100 MW in the United States. These loan guarantees helped transform U.S. energy production and paved the way for the fastest growing sector of the solar industry.

Today, utility-scale PV solar has the capacity to produce more than 8,100 MW of electricity – which is enough clean energy to power nearly 1.4 million average American homes. The rapid growth of solar energy is lowering costs for consumers, creating jobs, and cutting the harmful emissions that cause climate change.

In 2011, LPO issued loan guarantees to the first 5 PV projects larger than 100 MW in the United States. Since 2011, an additional 17 PV projects larger than 100 MW have been financed without DOE loan guarantees.

Peter W. Davidson
**Executive Director**

*February 2015*

Credit: NRG Energy, Inc. & NRG Solar LLC

## THE DAWN OF UTILITY-SCALE PV SOLAR

Utility-scale PV solar was not a significant contributor to our nation's energy mix just a few years ago. Most installations using PV—which converts sunlight directly into electricity—were small and located on the roofs of homes or businesses to provide electricity on-site.

In 2008, just 22 MW of utility-scale PV solar projects—large-sized projects that sell their electricity to electric utilities—were installed in the United States. At the time, most experts expected growth in PV solar to remain primarily in the residential and commercial sectors. Even the U.S. Energy Information Administration (EIA) projected just 140 MW of utility-scale PV solar capacity nationwide by 2015.

No PV solar projects larger than 20 MW were operating in the United States prior to 2009.

However, a number of solar developers wanted to build utility-scale PV solar projects at a larger scale—greater than 100 MW—to meet the growing demand for clean energy from electric utilities in the American Southwest which had recently been bolstered by several policies to promote renewable and solar generation.

At the federal level, the 30% solar investment tax credit that was implemented in 2006 had become a key factor in lowering the cost of solar. The credit was set to expire at the end of 2008, but instead was extended until the end of 2016. This extension provided developers with more time to utilize this federal credit for utility-scale PV solar projects.

## BRIDGING THE COMMERCIAL FINANCING GAP

By 2009, the pipeline for utility-scale PV solar projects had reached more than 6,000 MW in announced projects, including several greater than 100 MW capacity. Project sponsors were prepared to invest equity and had signed long-term agreements with electric utilities to purchase the power, but could not get commercial lenders to provide all of the loans necessary to fully finance construction of the projects.

In 2011, LPO helped finance the first five utility-scale PV projects in the U.S. larger than 100 MW.

Commercial lenders are often unwilling or unable to take on the risk of supporting the deployment of a new technology until it has a solid history of commercial operation. In this case, commercial lenders were hesitant to take the technology risk of building large-scale PV facilities, simply because no projects had ever been executed at that scale in the United States.

LPO played a crucial role in bridging this financing gap by issuing loan guarantees available under Title XVII – specifically the Section 1705 program authorized by the American Recovery and Reinvestment Act. Specifically, LPO helped address this market barrier by financing the first five utility-scale PV projects larger than 100 MW in the United States.

Since 2011, 17 additional PV projects larger than 100 MW have been financed without DOE loan guarantees.

For the first four projects, LPO provided a loan guarantee that allowed the project to be financed exclusively through the U.S. Treasury's Federal Financing Bank. For the fifth project, Desert Sunlight, LPO worked with a group of 14 financial institutions to jointly finance the project through its Financial Institution Partnership Program (FIPP). This approach helped bring new lenders into the market to gain experience financing these types of clean energy projects.

## LPO-FINANCED UTILITY-SCALE PHOTOVOLTAIC PROJECTS >100MW

| Name | Location | Owner(s)/Partners | MW Capacity | Loan Guarantee Amount (Millions) | Loan Issuance Date | Project Completion Date |
|---|---|---|---|---|---|---|
| **Agua Caliente** | Yuma County, Arizona | NRG Solar LLC & MidAmerican Renewables LLC | 290 | $967 | August 2011 | March 2014 |
| **Antelope Valley Solar Ranch** | Lancaster, California | Exelon | 242 | $646 | September 2011 | April 2014 |
| **California Valley Solar Ranch** | San Luis Obispo, California | NRG Energy Inc. & NRG Solar LLC | 250 | $1,237 | September 2011 | October 2013 |
| **Desert Sunlight** | Riverside County, California | NextEra Energy, GE & Sumitomo of America | 550 | $1,460 | September 2011 | February 2015 |
| **Mesquite Solar** | Maricopa County, Arizona | Sempra Energy, Sempra Generation & Consolidated Edison Development | 170 | $337 | September 2011 | June 2013 |
| **LPO FINANCED TOTAL** | | | **1.502 GW** | **$4.647 Billion** | | |

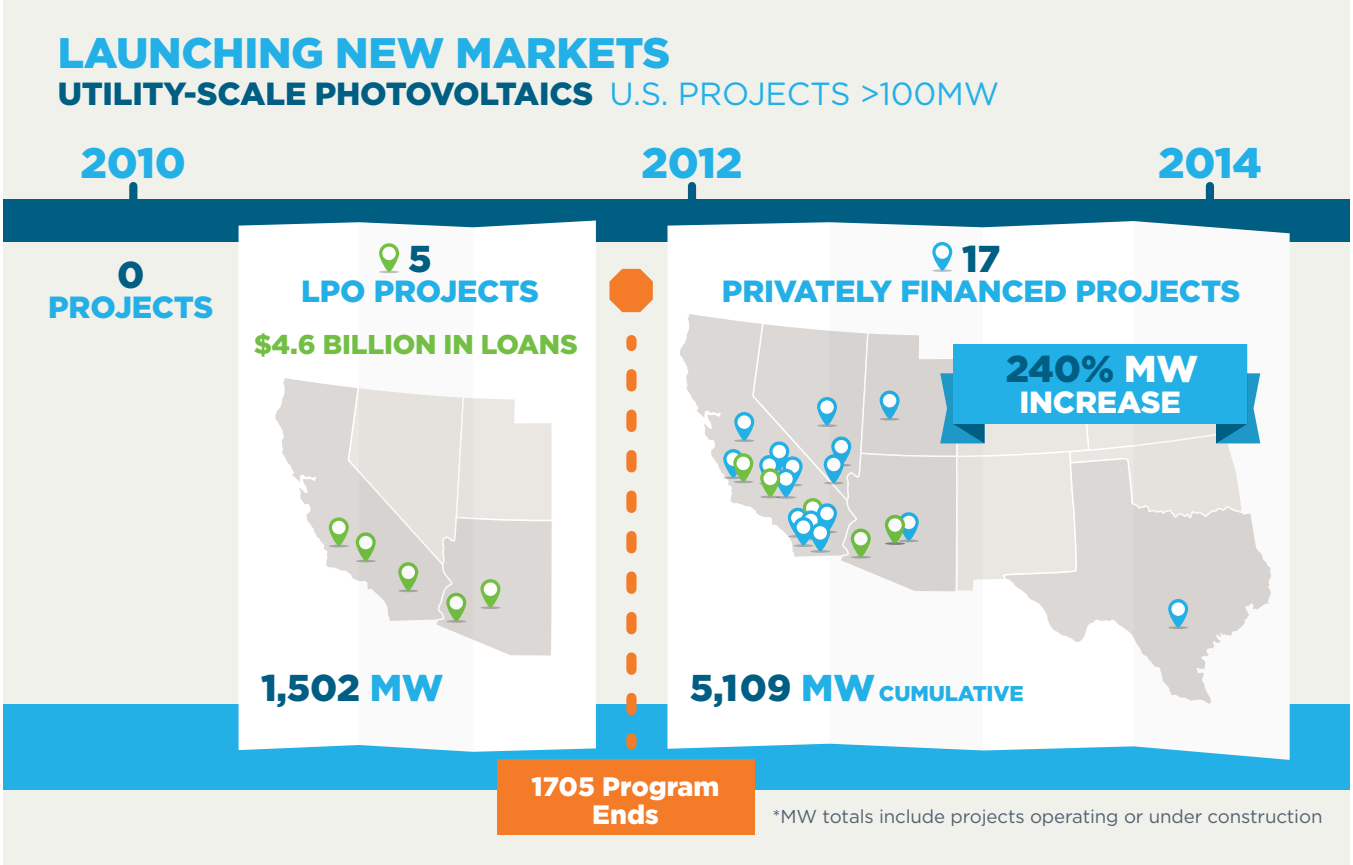
## CREATING A NEW MARKET

As required by law, LPO stopped issuing new loan guarantees under the Section 1705 Program on September 30, 2011. However, the initial investments made by LPO built a market that subsequently financed an additional 17 PV projects larger than 100 MW in the United States – all financed without DOE loan guarantees and many of them by banks that LPO had worked with through FIPP.

These projects represent a cumulative total of over 3,600 MW of additional electric capacity—more than double the capacity financed by LPO. In total, over 8,100 MW of utility-scale PV solar have been installed in the United States through the first three quarters of 2014. This is 57 times more installed utility-scale PV solar than the EIA had projected just seven years prior.

LPO's work on the nation's first five utility-scale PV solar projects laid the foundation for what has become a robust market that is now purely commercially financed.

5,000 MW of utility-scale PV solar are predicted to be installed in 2015.



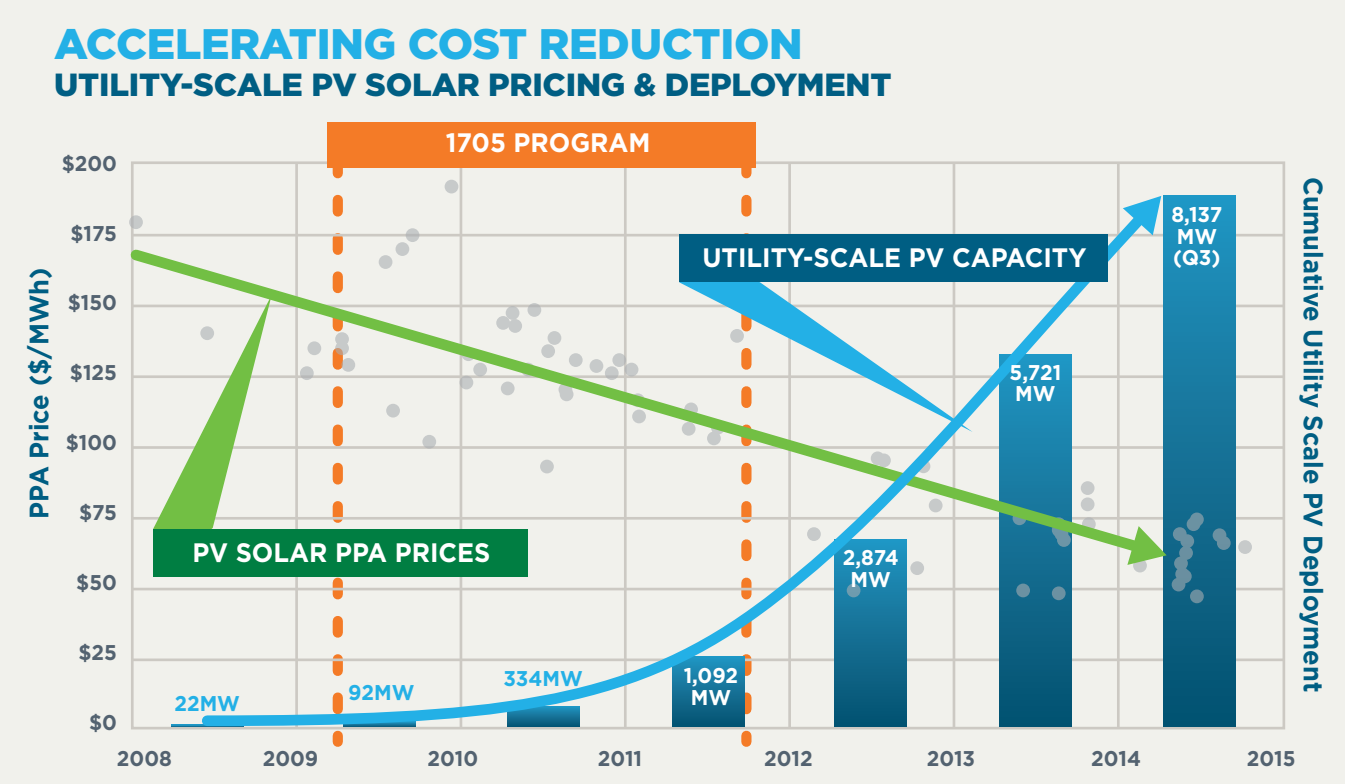
## EXPANDING SOLAR AND DRIVING DOWN COSTS

While the first utility-scale PV solar projects were located in the Southwest, the continued growth of the sector has not been confined to large-scale projects in that region. Utility-scale PV projects in non-traditional solar markets such as Utah, Indiana, Missouri, and Rhode Island represent a large growth sector. Overall, the U.S. utility-scale PV solar market set a record in 2013 by installing 2,300 MW of new capacity.

Through November 2014, utility-scale PV solar generated more than 15,000 gigawatt-hours of electricity for the year, which is more than double the amount generated during the same period in the previous year. Analysts expect this trend to continue with an estimated 5,000 MW of utility-scale PV solar predicted to be installed in 2015.

In addition to generating clean electricity and helping the nation meet its low-carbon energy goals, the increased deployment of utility-scale PV solar also has helped drive down the cost of power. Between 2008 and 2014, the cost of power purchase agreements (PPAs)—effectively the price a utility pays a solar power plant for its energy—for utility-scale PV solar projects has decreased by more than 60%. In the first half of 2014, PPA prices ranged between $50 and $70 per megawatt-hour, down from 2008 averages of nearly $175. These energy cost savings are passed on to U.S. consumers.

Cost of PPAs for utility-scale PV solar have decreased by more than 60% between 2008 and 2014.




**As deployment of utility-scale photovoltaic solar has increased, delivered costs to consumers has decreased by more than 60%**

Source: GTM Research, SEIA

Credit: NextEra Energy Resources

Reaching a final capacity of 550 MW in early 2015, Desert Sunlight Solar Energy Center is one of the world's largest PV solar power stations, and is one of five LPO-financed utility-scale PV projects that helped create and expand the private market while driving down prices for consumers.

## IMPORTANCE OF UTILITY-SCALE PV SOLAR GROWTH

The history of utility-scale PV solar in the U.S. shows how LPO can launch a new market, work with lenders to understand and expand the market, and then step aside to let the private markets take over.

Early investments by LPO helped to prove that utility-scale PV solar worked in the marketplace. Moreover, the PV solar utility market has been an important driver of the overall U.S. solar industry, which is now a robust commercial market and represents the fastest growing source of energy in the United States. As of January 2015, the U.S. solar industry employs more than 173,000 workers, which is an increase of 80,000 since 2010.

The growing utility-scale PV solar industry is good for business and for consumers. By increasing deployment and dramatically driving down the cost of solar energy, American consumers are benefitting from cleaner—and cheaper—energy.

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