EMERGING TRENDS IN THE U.S. SOLAR MARKET

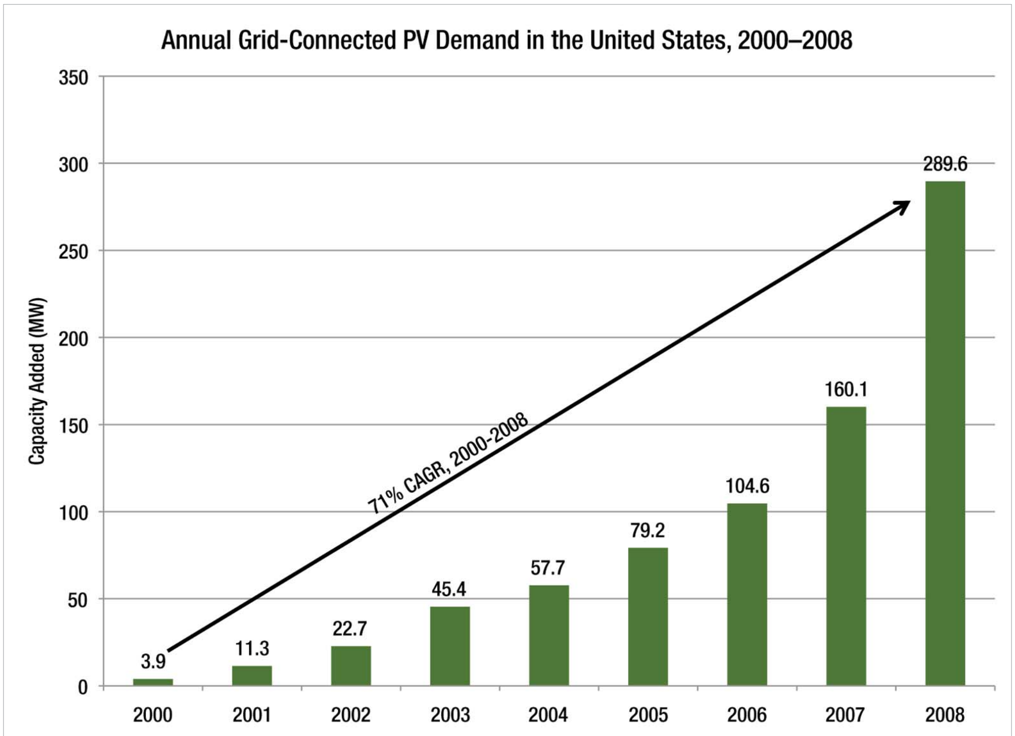
A WHITE PAPER FROM ENTERPRISE FLORIDA AND GTM RESEARCH | SHAYLE KANN GTM RESEARCH

Photo courtesy Florida Power and Light

1 INTRODUCTION

The United States is rapidly emerging as one of the world's leading markets for solar power. Installed costs for PV systems have fallen on average 3.6 percent per year for the past decade, making solar more affordable by the day. Simultaneously, electricity prices have been rising and acknowledgement of the external costs of fossil fuel-based generation have been growing. As a result, the U.S. PV market has grown at an average rate of 71 percent per annum since 2000, significantly outpacing global PV demand growth of 51 percent per annum.

FIGURE 1: ANNUAL PV DEMAND IN THE UNITED STATES, 2000-2008



Source: IREC

This rapid growth has placed the U.S. as the third-largest global demand center for PV, trailing only Germany and Spain. However, while demand is beginning to stabilize in the historical demand centers, the U.S. market is only beginning to ramp up. With high insolation, the largest electricity demand in the world, and ample available land for solar development, the U.S. presents an attractive long-term growth opportunity for developers, installers, financiers, and other solar service providers.

The solar market is evolving as rapidly as it is growing. Local and state governments throughout the U.S. are increasingly considering new policies and incentives to support solar deployment, utilities are beginning to consider solar a valuable component of their portfolios, and technological innovations are increasing the effectiveness and value of solar power. The trends that emerge today will determine the nature, and fate, of the solar market in the U.S.

The rapid growth of the U.S. solar market has resulted in many new entrants, market strategies and regulatory structures. Thus, numerous trends are already shaping today's market. In this paper, however, we look forward in order to highlight trends that share two particular characteristics. First, they remain nascent in the U.S., with negligible historical impact on the U.S. market. Second, they have the potential to transform their respective market segments if adopted on a broader scale. We discuss three such trends: the emergence of the European-style feed-in tariff in municipalities and states, the disruptive growth of the utility-scale PV market and the combination of solar thermal with biomass generation in order to provide baseload power.

2 EMERGENCE OF THE COST-BASED FEED-IN TARIFF

A feed-in tariff (FIT) is a standard offering from a utility of a fixed-price contract for the electricity produced from a renewable energy generator for a specified term length. Feed-in tariffs can either be offered as a comprehensive rate or as a fixed premium in addition to spot market electricity prices. By providing a stable, known rate, feed-in tariffs attract capital investment in solar projects with little revenue risk.

The key element of a feed-in tariff is the rate provided to generators. There are two basic designs to set feed-in tariff rates. The first sets rates based on the “value” of renewable energy generation to the utility. The value of the generation, which can include the utility’s avoided costs and/or the external costs of conventional generation, is highly subjective and administratively complex to determine. As a result, value-based feed-in tariff policies often result in rates that are insufficient to support significant demand. The second method sets the FIT rate based on the estimated levelized cost of energy generation for renewable energy plants, offering a stable, fixed return to investors on top of project generating costs. This “cost-based” method ensures that project investors see attractive returns and supports greater investment in solar projects.

Already implemented in over 40 countries, feed-in tariffs have been the single most important incentive driver for global solar power development over the past decade. Most notable among these policies have been those of Germany and Spain, where attractive cost-based feed-in tariff rates and stable long-term contracts have vaulted the two nations into becoming the top two global demand centers. As a result of its feed-in tariff, which offers projects installed in a given year fixed rates for 20 years of operation, Germany’s PV market grew from 44 MW in 2000 to 1260 MW in 2007, the largest in the world. In Spain, a 2007 feed-in tariff revision caused a solar demand boom, but has since been reduced.

While the U.S. lacks a national feed-in tariff, many utilities as well as local and state governments have either implemented a feed-in tariff or are considering doing so over the next two years. The first among these was Gainesville, Fla., which introduced the first cost-based feed-in tariff in the U.S. in February 2009. Gainesville Regional Utilities (GRU), local municipal electric utility, offers 20-year fixed-rate contracts at rates as high as $0.32/kWh. The program’s introduction immediately created a flurry of demand. The program contains an overall program cap of 4 MW per year, and GRU announced in March 2009 that it had received enough applications to meet the program caps through 2014.

FIGURE 2: GAINESVILLE FEED-IN TARIFF

CALENDAR YEAR CONTRACT ENTERED	FIXED RATE $/KWH OVER LIFE OF CONTRACT (20 YRS) FOR BUILDING/PAVEMENT MOUNTED OR GROUND MOUNTED (<25 KW) SYSTEMS	FIXED RATE $/KWH OVER LIFE OF CONTRACT FOR FREE STANDING SYSTEMS
2009	$0.32	$0.26
2010	$0.32	$0.26
2011	$0.30	$0.25
2012	$0.28	$0.23
2013	$0.27	$0.22
2014	$0.26	$0.21
2015	$0.25	$0.20
2016	$0.23	$0.19

Source: GTM Research

California has the largest-scale feed-in tariff in the U.S., supporting up to 750 MW of total demand, but the rate calculation is value-based according to the state's Market Price Referent, the estimated cost of a long-term contract with a combined cycle gas turbine facility. However, there are a number of proposals in front of the California legislature that could significantly improve and expand the California feed-in tariff. Included among these is a proposal from the California Public Utilities Commission to create a reverse auction mechanism in which renewable energy generators would bid to provide power at particular prices, with the lowest bidders winning utility contracts. A ruling on this proposal is expected to be forthcoming in early 2010.

FIGURE 3: U.S. FEED-IN TARIFF BREAKDOWN

FEED-IN TARIFFS						
State	Utility	FIT Payment Type	Price ($/kwh)	Contract Duration	Project Size Cap	Program Size Cap
California	IOUs	Avoided-Cost. Note: alternative to California Solar Initiative	$.08-$.19	10, 15, or 20 years	3 MW	478 MW
	Sacramento Municipal Utilities District (SMUD)	Based on Cost of Alternative Generation	Off peak minimum: $.082/kWh. On-peak maximum: $.29/kWh	20 years	5 MW	100 MW
Florida	Gainesville Regional Utilities (GRU)	Based on Cost of Generation	Systems under 25 kw, $.32/kWh. Free-standing systems over 25 kW, $.26/kWh	20 years	None	4 MW/year
Oregon	Eugene Water & Electric Board	Fixed-Price Incentive	$.12/kWh	10 years	Minimum project size: 10 kW	None
Texas	CPS Energy (San Antonio)	Fixed-Price Incentive	$0.27/kWh	20 years	Systems Between 25 kW and 500 kW	5 MW per year for two years
Vermont	All utilities	Based on Cost of Alternative Generation	$.30/kWh	20 years	2.2 MW	50 MW
Washington	Most Utilities (60+)	Fixed-Price Incentive	$.15/kWh	Through 6/30/2014, regardless of project start date	None, but $2,000 maximum annual payment per system	None, but $2,000 maximum annual payment per system
Wisconsin	WE Energies	Fixed-Price Incentive	$.225/kWh	10 years	1.5 kW-100 kW	1 MW - Program suspended due to full subscription
	Madison Gas & Electric	Fixed-Price Incentive	$.25/kWh	10 years	1 kW-10 kW	300 kW

Source: GTM Research

Since Gainesville's feed-in tariff began operation, a number of other states and utilities have passed cost-based feed-in tariff policies. Among these are the state of Vermont and two municipal utilities: CPS Energy in San Antonio, Texas and Sacramento Municipal Utilities District (SMUD) in California. The state of Hawaii recently passed a statewide cost-based FIT, for which rates are currently being determined. In upcoming legislative sessions, the states of Washington, Michigan and New York will all consider cost-based feed-in tariff policies, and many municipalities are expected to follow. As has been proven in Germany, effective feed-in tariff policies can provide the backbone for rapid, sustained solar market growth. Thus, the more the U.S. implements cost-based FITs, the stronger the demand market for solar will become.

3 GROWTH OF UTILITY-SCALE PV SYSTEMS

Utility-scale PV is a relatively new phenomenon in the U.S. However, it is widely acknowledged to have the potential to disrupt the market, as announcements for larger and larger projects seem to arrive weekly. Demand for utility-scale projects is generated primarily by state Renewable Portfolio Standards (RPS). Sixteen states currently have an RPS with specific provisions supporting solar power. An RPS with a solar provision sets a required capacity or percentage of solar power that utilities must bring within their generating portfolio, increasing incrementally over time. Utilities in these states are recognizing that the customer-sited PV market will ultimately be insufficient to support the demand required by the state's RPS targets. As a result, utilities are beginning to seek large-scale PV projects from which to purchase power, and in some cases to own themselves. In addition, some utilities in states that lack an RPS have begun to evaluate utility-scale PV as an alternative to other peak generators. For example, Florida Power & Light has taken a leading role in utility-scale PV development (discussed below) despite Florida not having a state RPS. As the utility-scale market continues to ramp up, PV will increasingly become an equal alternative to natural gas plants and other peak electricity generators throughout the U.S.

FIGURE 4: STATE RPS STANDARDS

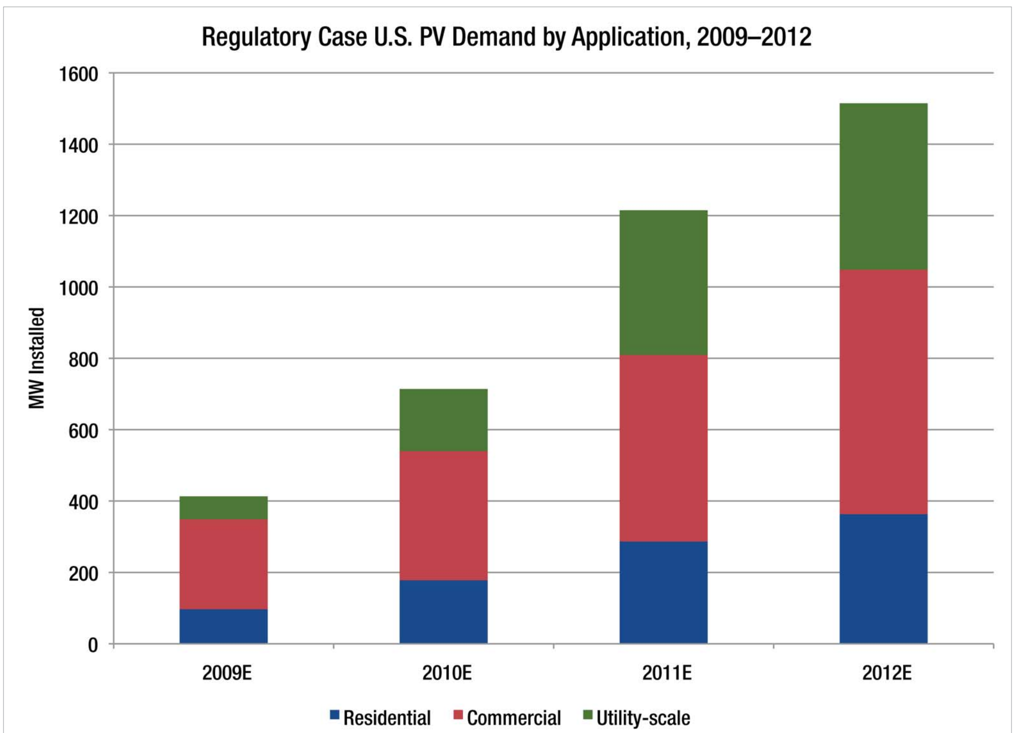
STATE	GOAL	SOLAR CARVE-OUT OR SPECIAL TREATMENT
Arkansas	15% by 2025	4.5% distributed generation by 2025
Colorado	20% by 2020 (IOUs), 10% by 2020 (co-ops and large munis)	0.8% solar-electric by 2020
California	20% by 2010	
Connecticut	23% by 2020	
Delaware	20% by 2019	2.005% solar PV by 2019, triple credit for PV
Hawaii	20% by 2020	
Illinois	25% by 2025	
Iowa	105 MW	
Kansas	20% by 2020	
Maine	New RE: 10% by 2017	
Maryland	20% by 2022	2% solar-electric in 2022
Massachusetts	15% by 2020	
Michigan	10% + 1,100 MW by 2015	Triple credit for solar
Minnesota	25% by 2025 (Xcel: 30% by 2020)	
Missouri	15% by 2021	0.3% solar-electric by 2021
Montana	15% by 2015	
Nevada	25% by 2025	1% solar by 2015, 2.4 to 2.45 multiplier for PV
New Hampshire	23.8% by 2025	0.3% solar-electric by 2014
New Jersey	22.5% by 2021	2.12% solar-electric by 2021
New Mexico	20% by 2020 (IOUs), 10% by 2020 (co-ops)	4% solar-electric by 2020
New York	24% by 2013	0.1542% customer-sited by 2013
North Carolina	12.5% by 2021 (IOUs), 10% by 2018 (co-ops and munis)	0.2% solar by 2018
Ohio	25% by 2025	0.5% solar by 2025

Oregon	25% by 2025 (large utilities), 5%-10% by 2025 (smaller utilities)	
Pennsylvania	18% by 2020	0.5% solar PV by 2020
Rhode Island	16% by 2020	
Texas	5,880 MW by 2015	Double credit for non-wind
Washington	15% by 2020	Double credit for distributed generation
Wisconsin	Varies by utility (10% by 2015 goal)	

Source: GTM Research

Over the next four years, the utility-scale market will leapfrog the residential market and gain market share on the commercial sector. In addition, falling PV system costs and increasing electricity prices are resulting in the gradual achievement of price convergence between utility-scale PV systems and wholesale peak electricity prices. In the most attractive markets such as California, this convergence will occur as soon as 2010. As generation costs continue to fall, the utility-scale PV market will emerge as the largest, and most stable, demand segment in the U.S.

FIGURE 5: PROJECTED U.S. PV DEMAND BY APPLICATION, 2009-2012



Source: GTM Research

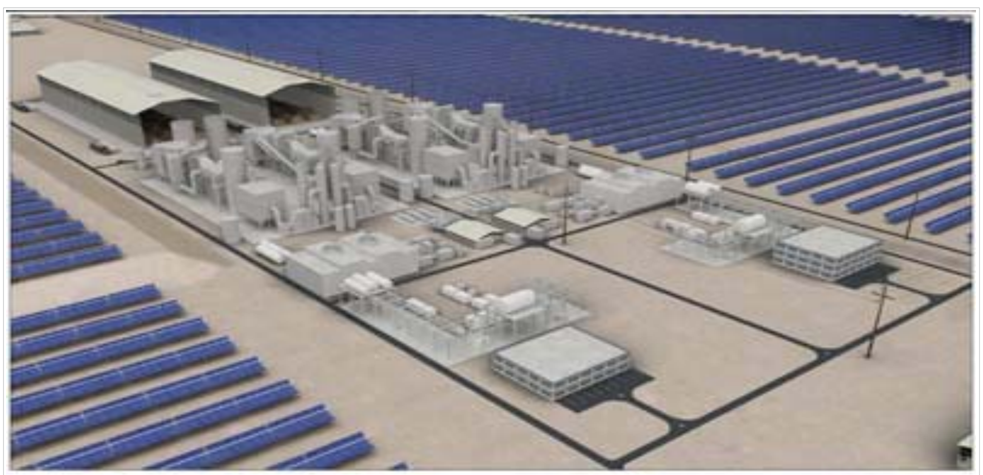
In December 2007, a 14 MW PV project at the Nellis Air Force Base in Nevada began operation as the largest PV system in the U.S. Despite growth in the U.S. PV market, the Nellis system remained the largest until this year, indicating the slow growth of the utility-scale PV sector. But in October 2009, Florida Power & Light Company (FPL) announced the operation of its 25 MW Desoto Next Generation Solar Energy Center in Arcadia, Fla. This system replaced the Nellis project as the largest in the U.S. A number of even larger projects are on the horizon. Utilities in California have contracted for power from a number of projects that, if completed, will each provide over 100 MW of capacity. The largest of these is the planned 550 MW Topaz Solar Farm in California, to be developed by First Solar Inc. through a long-term power purchase agreement with Pacific Gas & Electric. This trend remains in its infancy; however, the utility-scale PV market shows extraordinary growth potential, and with sufficient regulatory support can become a critical component of a thriving U.S. solar market.

4 SOLAR THERMAL/BIOMASS COGENERATION FOR BASELOAD POWER

Despite the many benefits that solar power offers over conventional fossil fuel-based generation, its primary detriment remains its intermittency. By failing to generate power during cloudy days and at night, solar power can ultimately be limited in its use until economically efficient, trustworthy energy storage becomes available. However, some developers have found a way to alleviate this concern by creating combined solar thermal/biomass plants. The solar thermal plant continues to generate electricity while the sun is shining, but is supplemented by power from the biomass generator while solar power is not available. By creating such a hybrid facility, developers are able to provide baseload power through two abundant, renewable resources. In addition, the facility provides resource efficiency through dual use of steam turbines, which are employed by both the biomass and solar thermal generators.

The scale of solar/biomass hybrid facilities varies by project. In 2008, California's Pacific Gas & Electric contracted for the power from two large hybrid plants totaling 106.8 MW in total. Still under development, these two identical facilities will be constructed by Portugese conglomerate Martifer near Coalinga, Calif., and are known as San Joaquin Solar Plants I and II. The biomass portion of the San Joaquin plants will be sourced from agricultural and residential green waste, such as tree branches and grass, which are available in large quantities in the agricultural region surrounding the facilities.

FIGURE 6: SAN JOAQUIN SOLAR DESIGN



Source: Martifer

Solar/biomass hybrid systems are available on a smaller community scale as well. The environmentally friendly community of Harmony, Fla., in partnership with Florida State University's Energy & Sustainability Center, plans to build a 5 MW solar thermal/biomass hybrid plant. Financing and construction on the facility will begin in late 2009, with completion following within 24 months. Biomass material for the plant will come from slash pine, but will ultimately expand to other experimental non-edible crops. Since the project is of a smaller scale, biomass feedstock will be easily obtained from local sources. Developers are optimistic that the plant will be both more efficient and more affordable than conventional solar power generation.

These plants will be among the first solar/biomass hybrids in the U.S. If successful, the market potential for more plants will be high, particularly in areas of the Southeastern U.S. with large quantities of underutilized biomass feedstock. However, the long-term economics of these plants, as well as other solar/biomass hybrids, will become clearer as demand for biomass feedstock increases and prices stabilize.

5 CONCLUSION

Like most sectors of the economy, the solar power market in the U.S. has been heavily handicapped by the global recession. The lack of available project financing, equipment oversupply and drops in demand from end customers have hit manufacturers and developers alike. This has resulted in a market-wide shakeout in which the less stable companies have been forced to sell operations or exit the market. However, as financial conditions begin to improve, the future of solar in the U.S. appears increasingly bright. Demand is already beginning to ramp up, and foreign solar companies are seeking operational experience in the U.S. in order to gain access to its large potential demand market.

As the market evolves, innovation in every sector will be necessary to drive further growth. Already, the face of the solar industry is changing as a result of emerging trends in the private and public sectors, led by early-adopter states such as California and Florida. At the local and state government level, regulatory innovation is taking the form of adapting the cost-based feed-in tariff model that has been so successful in Europe to the U.S. market. The increasing popularity of these feed-in tariffs will support attractive returns for investors in solar projects, channeling financing back into the market. At the project development level, the increasing utility interest in large, ground-mounted PV systems is presenting a valuable opportunity to expand the scope of solar PV in our generation mix. If the trend continues, utility-scale projects may soon supplant the commercial sector as the primary solar demand driver in the U.S. As a result, manufacturers, developers, and financiers are all seeking innovative products, structures and strategies to fit this market need. Finally, at the technology level, combining solar thermal power with biomass generation is affording the opportunity to support large-scale solar without facing intermittent generation issues.

These trends should be monitored closely as they develop. As the U.S. garners more international attention as a leading solar demand market, the success of individual companies, localities and researchers will hinge on the ability to anticipate and support these areas of growth and innovation.