Utility Solar Business Models

“Grid parity and beyond...”

IEA PVPS Workshop – 23rd EUPVSEC
4th September
Valencia, Spain

SEPA Project Lead
John Nimmons, J.D.

Presented By - Christy Herig
SEPA Regional Director - East
About SEPA

- Focus is utilities
- US-based membership organization
- 400 members, including 100+ utilities
- Bridge between utility and solar industries
- Resource for unbiased solar information
About SEPA

Projects
- Solar Incentive Program Survey
- Solar Capacity Methodology Project
- Utility Metering and Interconnection Survey
- Decoupling White Paper
- Utility Solar Case Studies
- Utility Solar Year in Review
- Utility Business Models

Ongoing Activities
- Online Resource Library
- Solar Programs Options Tool
- Peer Match Tool
- One-on-One Utility Support
- Monthly Phone Seminars
- Utility Travel Scholarships to Solar Power Conference and Expo
- Solar Power Conference and Expo
- Bi-Weekly Electronic Newsletter and Email Alerts
- Membership Directory
- FindSolar.com
- PowerClerk Software Discount
What is Grid Parity?
What is SAI’s projected impact?

Cost Reductions From System Advances

**Projected Cost Reductions for Solar PV**

- Market Sector: Residential, Commercial, Utility
- Current U.S. Market Price Range (¢/kWh): Residential 5.8-16.7, Commercial 5.4-15.0, Utility 4.0-7.6
- Benchmarks:
  - Residential: Cost (¢/kWh) Benchmark 2005 23-32
  - Commercial: Cost (¢/kWh) Benchmark 2005 16-22
  - Utility: Cost (¢/kWh) Benchmark 2005 13-22
- Targets:
  - Residential: Cost (¢/kWh) Target 2010 13-18, Target 2015 8-10
  - Commercial: Cost (¢/kWh) Target 2010 9-12, Target 2015 6-8
  - Utility: Cost (¢/kWh) Target 2010 10-15, Target 2015 5-7

Market Value increases rapidly once system price drops below ~$4/Wp, with some delay in market expansion as manufacturing capacity increases to meet demand.
NEDO Roadmap to 2030
(~100 JPY/$)

[Diagram showing the roadmap for electricity cost reduction and technology advancement from 2002 to 2030.]

[Table showing PV System Deployment Images:]
- **Residential:** Conventional Grid-Connected, Community PV-Clustered, Broader Area Clustered PV
- **Industrial:** In-Factory High Voltage-Connected/Captive Load/Building Integrated PV, Renewable Energy Network, Hydrogen Production
- **Overseas:** Solar Home System (SHS), Very Large Scale PV (VLS-PV)
<table>
<thead>
<tr>
<th></th>
<th>1980</th>
<th>Today</th>
<th>2015 / 2020</th>
<th>2030</th>
<th>Long term potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical turn-key system price</td>
<td>&gt;30</td>
<td>5</td>
<td>2.5 / 2.0</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>(2006 €/Wp, excl. VAT)</td>
<td></td>
<td>(range 4~8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical electricity generation costs</td>
<td>&gt;2</td>
<td>0.30</td>
<td>0.15 / 0.12</td>
<td>0.06</td>
<td>0.03</td>
</tr>
<tr>
<td>S Europe (2006 €/kWh)</td>
<td></td>
<td></td>
<td>(competitive with retail electricity)</td>
<td>(competitive with wholesale electricity)</td>
<td></td>
</tr>
<tr>
<td>Typical commercial flat-plate module efficiencies</td>
<td>up to 8%</td>
<td>up to 15%</td>
<td>Up to 20%</td>
<td>up to 25%</td>
<td>up to 40%</td>
</tr>
<tr>
<td>Typical commercial concentrator module efficiencies</td>
<td>(-10%)</td>
<td>up to 25%</td>
<td>Up to 30%</td>
<td>up to 40%</td>
<td>up to 60%</td>
</tr>
<tr>
<td>Typical system energy pay-back time Southern Europe (yrs)</td>
<td>&gt;10</td>
<td>2</td>
<td>1</td>
<td>0.5</td>
<td>0.25</td>
</tr>
</tbody>
</table>
Market penetration begins - 2007 residential PV and electricity price differences with existing incentives

Currently PV is financially competitive where there is some combination of high electricity prices, excellent sunshine and/or state/local incentives.
Solar acceleration in a conservative forecast - 2015 residential without incentives and moderate increase in electricity prices

Attractive in about 250 of 1,000 largest utilities, which provide ~37% of U.S. residential electricity sales.

85% of sales (in nearly 870 utilities) are projected to have a price difference of less than 5 ¢/kWh between PV and grid electricity.

In large areas, PV is cheaper than grid electricity
2015 residential installations without incentives and aggressive increase in electricity prices

Attractive in about 450 of 1,000 largest utilities, which provide ~50% of U.S. residential electricity sales. 91% of sales (in nearly 950 utilities) have a price difference of less than 5 ¢/kWh between PV and grid electricity. Across most of the highest U.S. population areas, PV is cheaper than grid electricity.
Grid parity in Europe – 2007
(lines to guide the eye)


The Strategic Research Agenda 11 2nd General Assembly 2007, Berlin
Grid parity in Europe – 2010
(lines to guide the eye)
Grid parity in Europe – 2015
(lines to guide the eye)

The Strategic Research Agenda 13
2nd General Assembly 2007, Berlin
Grid parity in Europe – 2020
(lines to guide the eye)

Irradiation (kWh/m²·yr) | PV generation cost (€/kWh)
--- | ---
500 | 0.33
1000 | 0.20
1400 | 0.14
1800 | 0.11
Utility Business Models - Primary Objectives

1. Explore business approaches that will enable utilities to turn what some view as the ‘threat’ of *customer-sited solar generation into an opportunity* – by creating new value in the solar value chain; capturing some share of that value for utility stakeholders; and finding ways to sustain it over time.

2. Explore innovative legal and regulatory strategies to help utilities apply their strengths to advance opportunities for *large-scale solar*, driven by increasing resource constraints and climate change concerns.
<table>
<thead>
<tr>
<th>System Purpose:</th>
<th>Utility-Centric Group</th>
<th>Customer-Centric Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>primarily bulk system supply,</td>
<td>service to defined customer(s) or faciltie(s)</td>
</tr>
<tr>
<td></td>
<td>customers independent</td>
<td></td>
</tr>
<tr>
<td>Physical location:</td>
<td>centralized, community-scale systems rarely on customer</td>
<td>distributed, near loads served; mostly</td>
</tr>
<tr>
<td></td>
<td>premises</td>
<td>customer sited, dedicated community-scale</td>
</tr>
<tr>
<td>System size:</td>
<td>multi-MW;</td>
<td>several kW – several MW (for larger customers or applications)</td>
</tr>
<tr>
<td>Side of meter:</td>
<td>typically utility side</td>
<td>typically customer side now, but could also be utility side</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in some models</td>
</tr>
<tr>
<td>Technologies:</td>
<td>all technologies suitable for large-scale solar</td>
<td>PV, small concentrating, hybrid thermal/electric, rooftop,</td>
</tr>
<tr>
<td></td>
<td>(PV, concentrating solar, etc.)</td>
<td>ground-mounted, and BIPV,</td>
</tr>
</tbody>
</table>
Business Model Definition

- a focusing device that mediates between technology development and economic value creation.

Harvard Business School scholars Henry Chesbrough and Richard S. Rosenbloom
• start with solar technology inputs (i.e., resource, technology, performance and environmental characteristics, and application types);

• consider where and how utilities could add distinct value for various target markets;

• begin to identify cost allocation, pricing, regulatory and other mechanisms that can deliver this value to utility owners, participating and non-participating customers, and society at large, while expanding solar industry and investment opportunities.
The Important Goal

Cost-effective for all stakeholder groups

– i.e., approaches whose net benefits equal or exceed their net costs for each group.

– laymen’s terms, the goal is to find ‘win/win/win’ solutions

– outcomes where multiple stakeholders benefit, and none are harmed.

Beyond the customer–shareholder–societal stakeholders normally considered by utility regulators and management, the Working Groups looked for business approaches that could benefit the solar industry and investors whose contributions are critical to long-term success.
Emerging* Models Considered

- Utility ownership of solar assets
- Utility financing solar assets
- Utility purchasing solar output

* The report also describes existing state, regional and utility solar programs, and how these differ from the business models considered here.
Utility ownership of solar assets

- **Ratebasing Solar on Customer Sites**
  - Southern California Edison (2008)

- **Ratebasing Solar at Utility Facilities**
  - Potomac Electric Power Company
  - Delmarva Power & Light Company

- **Owning Community Solar Equipment**
  - City of Ellensburg, WA

- **Owning Inverters on Customer Sites**
  - Chelan Public Utility District
Utility ownership of solar assets

- Acquiring Solar Projects from Developers
  - turnkey acquisition, or purchase and sale agreement
    PG&E (2008)
  - power purchase agreement with buy-out option,
  - acquisition of sites for development,
    Land is easily ratebased
  - ‘flip’ transactions that could take various forms
    Like wind
Utility financing solar assets

- Ratebasing Solar Loans and Recovering ‘Lost Revenues’
  - Public Service Gas and Electric, (approved 2008)
  - Supporting Turnkey Installations and Ratebasing shareholder Loans
    - Potomac Electric Power Company
    - Delmarva Power & Light Company
- Supporting a Feed-in Tariff with Solar Revenue Streams and Ratebased Shareholder Loans
Utility Purchase of Solar Output

- Valuing Solar Purchases to Avoid RPS Noncompliance
  - Recommended for further investigation
- Equalizing Buying and Building
  - Open regulatory docket in Oregon -
- Achieving Economies and Expanding Solar Access through Community-Scale Systems
  - SMUD 20 year PPA — resale to customers as “SolarShares”
<table>
<thead>
<tr>
<th>Utility</th>
<th>Type</th>
<th>Site</th>
<th>MW</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duke Energy - NC</td>
<td>Centralized PV</td>
<td>TBD</td>
<td>21.5</td>
<td>end of 2010</td>
</tr>
<tr>
<td>Duke Energy - OH</td>
<td>Centralized PV</td>
<td>TBD</td>
<td>12.35</td>
<td>2012</td>
</tr>
<tr>
<td>Florida Power &amp; Light</td>
<td>Centralized PV</td>
<td>Utility</td>
<td>25</td>
<td>2009</td>
</tr>
<tr>
<td>Florida Power &amp; Light</td>
<td>Centralized PV</td>
<td>Utility</td>
<td>10</td>
<td>2010</td>
</tr>
<tr>
<td>Sempra Generation</td>
<td>Centralized PV</td>
<td>Developer</td>
<td>10</td>
<td>end of 2008</td>
</tr>
<tr>
<td>FL Municipal Power Auth.</td>
<td>Centralized PV</td>
<td>TBD</td>
<td>10</td>
<td>end of 2009</td>
</tr>
<tr>
<td>Xcel Energy</td>
<td>Centralized PV</td>
<td>Developer</td>
<td>8</td>
<td>2007</td>
</tr>
<tr>
<td>Nevada Power</td>
<td>Centralized PV</td>
<td>Customer</td>
<td>14</td>
<td>2007</td>
</tr>
<tr>
<td>CPS Energy</td>
<td>Centralized PV</td>
<td>Developer</td>
<td>100</td>
<td>end of 2010</td>
</tr>
<tr>
<td>Arizona Public Service</td>
<td>Centralized PV</td>
<td>Customer</td>
<td>125</td>
<td>2009-2013</td>
</tr>
<tr>
<td>Pacific Gas &amp; Electric</td>
<td>Centralized PV</td>
<td>Developer</td>
<td>550</td>
<td>2011-2013</td>
</tr>
<tr>
<td>Pacific Gas &amp; Electric</td>
<td>Centralized PV</td>
<td>Developer</td>
<td>250</td>
<td>2010-2012</td>
</tr>
<tr>
<td>Pacific Gas &amp; Electric</td>
<td>Centralized PV</td>
<td>Utility</td>
<td>5</td>
<td>2009</td>
</tr>
<tr>
<td>Pacific Gas &amp; Electric</td>
<td>Centralized PV</td>
<td>Utility</td>
<td>2</td>
<td>2009</td>
</tr>
<tr>
<td>Portland General Electric</td>
<td>Centralized PV</td>
<td>Government</td>
<td>0.104</td>
<td>2009</td>
</tr>
<tr>
<td>Southern California Edison</td>
<td>Distributed PV</td>
<td>Customer</td>
<td>250</td>
<td>2008-2012</td>
</tr>
<tr>
<td>Duke Energy - NC</td>
<td>Distributed PV</td>
<td>Customer</td>
<td>20</td>
<td>TBD</td>
</tr>
<tr>
<td>Long Island Power</td>
<td>Distributed PV</td>
<td>Customer</td>
<td>50</td>
<td>2009-2011</td>
</tr>
<tr>
<td>San Diego Gas &amp; Electric</td>
<td>Distributed PV</td>
<td>Customer</td>
<td>80</td>
<td>TBD</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>1543</strong></td>
<td></td>
</tr>
</tbody>
</table>
Conclusions

1. Utility business models must serve the interests of multiple stakeholders with diverse, sometimes competing interests – and be sustainable.
2. Most existing solar programs are designed to support preferred resource development, but not to enhance utility earnings or business prospects.
3. Many utility models have emerged recently but with very little commonality.
4. Current proposals are constrained by today’s market conditions, policy and regulatory framework. Innovation opportunities are immense!
5. Various structured financing may enhance stakeholder benefits of tax-advantaged transactions,

6. With or without tax benefits, utilities can bring other values to the solar table, such as long-term stability, negotiating strength, economies of scale, volume discounts, expertise in grid integration, coordination with energy efficiency and green building initiatives, and the ability to leverage ratepayer funds, reduce risk premiums, and fill market gaps such as financing and ‘one-stop shopping’ needs. POUs are freer to apply these strengths to pursue community environmental and social goals, and to reallocate costs and benefits among stakeholders to support solar development in the public interest.

7. Apart from tax issues utilities, and IOUs in particular, can benefit from owning solar assets may be ratebased and prevents "lost revenue"

8. For utilities, owning solar assets carries different costs, risks and rewards than purchasing power from others. Regulators may need to revisit the treatment of utility power purchases to remove disincentives and reward utilities for entering into PPAs that support cost-effective solar expansion.
Thank-You!

SEPA Project Lead
John Nimmons, J.D.
Mill Valley, CA
415.381.7310
jna@speakeasy.org

Presenter - Christy Herig
SEPA Regional Director-East
cherig@solarelectricpower.org
1-727-543-1285