Helping Utilities Make Smart Solar Decisions

Why Utilities are Embracing Community Solar

Tanuj Deora
Chief Strategy Officer, SEPA
SEPA is a 501(c)3 research and education organization with over 900 members from across the solar industry with a mission to help utilities integrate solar into their portfolios.
Our Guiding Principles

• **Utilities are a critical part** of the equation for solar energy to live up to its full potential in serving the public good.

• The **regulatory compact must evolve** to support utility business models that encourage expanded deployment of central station and distributed solar resources.

• **Advancements in grid design, grid operations, and grid technology** are needed in order for solar energy to reach maximum potential.

• The long-term economic health of utilities, solar companies and their customers will be strengthened through **partnership**.
Helping Utilities Make Smart Solar Decisions

- Facilitate Utility Peer Learning
- Build Bridges between Utility & Solar Industries
- Develop Solutions
1. The Changing Landscape for the Modern Utility
   • Expectations of the Utility are Shifting
   • The Solar Market is Booming
   • The Challenge of Distributed PV is Not Going Away

2. Utilities are Responding
   • Reactive – Rate Reform, Grid Integration Strategies, Consumer Education
   • Proactive – Utility Scale Procurement, Rooftop Ownership, Community Solar

3. Community Solar Offers Particular Promise with Significant Consumer, System, and Utility Benefits
   • What is it?
   • How Does it Work?

4. But Community Solar isn’t a Panacea, and Utilities Will Need to Adapt Further

BONUS! - SEPA Can Help! (plus Appendix Slides)
1. The Changing Landscape for the Modern Utility
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The Public Expectations of the Utility are Increasing

Legacy Expectations

• Safe
• Reliable
• Low Cost
• Enabling Economic Development
• Stable and Predictable Costs
The Public Expectations of the Utility are Increasing

Legacy Expectations

- Safe
- Reliable
- Low Cost
- Enabling Economic Development
- Stable and Predictable Cost
- Resilient
- Support for DSM
- Proactive Environmental Stewardship
- Support for Consumer Choice, including Self Generation
- Support for Transportation Infrastructure

New Demands

- Safe
- Reliable
- Low Cost
- Enabling Economic Development
- Stable and Predictable Cost
- Resilient
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- Resilient
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- Proactive Environmental Stewardship
- Support for Consumer Choice, including Self Generation
- Support for Transportation Infrastructure

New Demands
- Obligation to serve
- Existing (& Unquestioned) Cross-Subsidization
- Impact on Capital Cost & Availability
- Data Availability, Security, & Ownership

Often Forgotten
Market Growth

Megawatts

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
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</thead>
<tbody>
<tr>
<td>MW</td>
<td>897</td>
<td>1,577</td>
<td>2,688</td>
<td>4,198</td>
<td>5,314</td>
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<tr>
<td>Cumulative MW</td>
<td>2,518</td>
<td>4,095</td>
<td>6,783</td>
<td>10,981</td>
<td>16,295</td>
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Number of installations

<table>
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<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems</td>
<td>68,846</td>
<td>85,993</td>
<td>111,515</td>
<td>137,056</td>
<td>182,262</td>
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<tr>
<td>Cumulative Systems</td>
<td>158,705</td>
<td>244,698</td>
<td>356,213</td>
<td>493,269</td>
<td>675,520</td>
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</table>

Helping Utilities Make Smart Solar Decisions
Helping Utilities Make Smart Solar Decisions

Market Segments

- Residential: 18% of capacity but slightly less than 96% of installations
- Nonresidential: 20% of capacity but 4% of installations
- Utility-scale: 62% of capacity but 0.05% of installations
Utility Scale Solar has Arrived

Announced Utility Scale Solar PPA Prices

Source: GTM Research

Helping Utilities Make Smart Solar Decisions
At today’s costs, modifying retail rate design can impact solar deployment economics.
Once solar costs level out, with typical utility rate inflation rooftop solar will be economic under virtually all rate designs – even with the ITC stepping down.
PV Competitiveness Will Soon be Widespread

How the LCOE of Energy from Residential Rooftop PV will Compare to Retail Rates in 2020

Source: GTM Research
## Comparison of Utility-Scale vs Distributed

<table>
<thead>
<tr>
<th></th>
<th>Utility-Scale</th>
<th>Distributed Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interconnection Point</td>
<td>Utility System</td>
<td>Behind the Meter</td>
</tr>
<tr>
<td>Intermittency</td>
<td>High - Single Site</td>
<td>Mitigated - Many sites</td>
</tr>
<tr>
<td>Transaction</td>
<td>Rate Base / Purchased Power</td>
<td>Net Energy Metering</td>
</tr>
<tr>
<td>Power Quality</td>
<td>Active - Utility Responsibility</td>
<td>Passive - Feeder Impact</td>
</tr>
<tr>
<td>Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource Need Decision</td>
<td>Utility</td>
<td>Customer</td>
</tr>
<tr>
<td>Penetration Concerns</td>
<td>NA</td>
<td>Yes</td>
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<tr>
<td>Resource Planning</td>
<td>Capacity Addition</td>
<td>Net Load Impact</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial</td>
<td>Rate of Return / Pass Through</td>
<td>Revenue Erosion</td>
</tr>
</tbody>
</table>

Source - DOE - Results from the DOE-CPUC High Penetration Solar Forum
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BONUS! - SEPA Can Help! (plus Appendix Slides)
Utilities Responses to New Expectations & Economics

WELL ESTABLISHED

Utility Scale Generation
• PPAs in the $40s - $60s /MWh in CA, TX, NM, CO, NV, AZ

Consumer Education
• General Information
• Program information
• Solar Rooftop Calculators

Standards
• Interconnection
• Inverter
INNOVATIVE APPROACHES

<table>
<thead>
<tr>
<th>Rate Reform</th>
<th>Grid Integration</th>
<th>Rooftop Ownership</th>
<th>Community Solar</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fixed Charges</td>
<td>• Locational Deployment</td>
<td>• Underserved Markets</td>
<td>• Utility Administered &amp; Third Party</td>
</tr>
<tr>
<td>• Value of Solar Tariffs</td>
<td>• Advanced Inverters</td>
<td>• Integration tie-ins</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Solar Production Forecasting</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Storage Integration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

More information at [www.sepatop10.org](http://www.sepatop10.org)
Utilities Responses to New Expectations & Economics

INNOVATIVE APPROACHES

- **Rate Reform**
  - Fixed Charges
  - Value of Solar Tariffs

- **Grid Integration**
  - Locational Deployment
  - Advanced Inverters
  - Solar Production Forecasting
  - Storage Integration

- **Rooftop Ownership**
  - Underserved Markets
  - Integration tie-ins

- **Community Solar**
  - Utility Administered & Third Party

More information at [www.sepatop10.org](http://www.sepatop10.org)
DGPV’s Limits Are Opportunity for Community Solar

Millions of US Households

- U.S. Households: 113
- That Own Their Home: 73
- In the 20 States With A Solar Market: 38
- With a FICO Score Over 680: 29
- With a Solar-Friendly Roof: 9

Source: GTM Research
Community Solar Growth

A depiction of utility-led community solar development, over time.

“Expanding Solar Access Through Utility-led Community Solar”, SEPA (September 2014)
Where are the Programs?

* Third-party initiated programs indicate that the utility is an active partner, but the program was not proposed or initiated by the utility.

“Expanding Solar Access Through Utility-led Community Solar”, SEPA (September 2014)
Overview

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BONUS! - SEPA Can Help! (plus Appendix Slides)
# What is **Utility** Community Solar?

## What is it…
- Voluntary, rooftop alternative for customers
- Utility controls supply, program design, and benefits decisions
- Supply is most often larger, ground-mounted PV system
- Customer receives immediate or anticipated economic benefit
- Benefits can include kWh offset, immediate or anticipated rate savings, return on investment

## What it isn’t…
- Bulk purchasing program for customer rooftops
- Green pricing program
- Charity program
- Utility as administrative agent with no supply or benefit decision-making authority
- Other?
1. Increase customer access to and participation in solar
2. Proactive customer engagement with the utility
3. More cost effective than smaller, distributed projects
4. Increase customer equity from solar projects
5. Support the local PV industry
6. Can be strategically sited
7. Minimal points of interconnection (vs rooftop)
8. Low-risk customer program
Benefits for Customers

Lower prices plus hedge benefits of fuel-free renewable energy

No (or limited) up-front costs and no responsibility for operations and maintenance.

Community Solar is portable within the utility’s service territory.
COMMUNITY SOLAR
DESIGN CONSIDERATIONS
Top tier design considerations consist of three major decisions.

Administrator

Transaction

Utility

3rd Party

Up Front

Ongoing

Production

Fixed / Guaranteed

Variable

Helping Utilities Make Smart Solar Decisions
### Key Questions and Programmatic Attributes

<table>
<thead>
<tr>
<th>Who runs the program?</th>
<th>Program Administrator</th>
<th>System Owner/Purchaser</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the value proposition?</td>
<td>Offer/Transaction</td>
<td>Production Guarantee</td>
</tr>
<tr>
<td></td>
<td>Economic Proposition</td>
<td>Target Customer Classes</td>
</tr>
<tr>
<td>What size system is appropriate?</td>
<td>Siting &amp; Scale</td>
<td>Participation Limit: Residential</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Participation Limit: Non-Residential</td>
</tr>
<tr>
<td></td>
<td>One-Time Sign-Up Fee</td>
<td>Fee Treatment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum Term</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsubscribed Energy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subscription Transferability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Program Length</td>
</tr>
<tr>
<td></td>
<td></td>
<td>REC Treatment</td>
</tr>
</tbody>
</table>

Helping Utilities Make Smart Solar Decisions
What should you charge participants?

Administration + Marketing + Supply + Operation + Maintenance + Integration

= Total Cost ($) over 20 years

\[
\begin{align*}
\text{Total Cost} & \quad = \frac{\$}{\text{kW}} \\
\# \text{kW} & \\
\text{Total Cost} & \quad = \frac{\$}{20 \text{ Years kWh}}
\end{align*}
\]

Final price could include additional incentives, similar to rooftop program.
Value Proposition

Compare your program offer to other customer options:

• Installed costs: $ / kW costs should be competitive today and in the near future

• Rates: ¢ / kWh rate should be competitive with retail rates or third-party provider PPAs now or in the near future

• Value can be a combination of price, risk management, financing, trust, and under-served parts of the market.

• Participation rates will be commensurate with customer value.
Major Staffing Needs

- Integrate the program into existing systems
- Minimize manual billing

- Cross-organizational effort

- Managed by utility or third-party
- Plan for recordkeeping

Billing/IT

Utility Responsibilities

Design Process

Program Administration

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Marketing & Communications

Develop clear uniform message

Target audience (economic vs. environmental)

Keep bill clear and simple

Engage external groups

Maintain communications with participants

Program Success
Tax and Securities Issues

- Maximize tax benefits to minimize cost
- Consult legal counsel
- Issues and requirements will vary for each utility

- Is it an investment of money?
- Is there an expectation of profit?
- Are the customers investing in a common enterprise?
- Is the return solely based on the efforts of others?
Program Example: Orlando Utilities Commission

Offer

• 1 kW blocks, up to 15 kW at $0.13/kWh fixed based on actual plant generation; net metered
  – $.025/kWh (residential) or $.015/kWh (commercial) more than current rates
• Term: 25 years
• No performance guarantee
• Customers pay a $50 deposit (refundable after 2 years)

Response

• Phase I: 400 KW
• Fully subscribed in 6 days; active waiting list for Phase 2
SEPA Resources

Public

• SEPA Community Solar Program Catalog
• Annual Solar Market Snapshot

Members

• Expanding Solar Access Through Utility-led Community Solar
• Utility Community Solar Handbook
• Utility Solar Database

Fee-for-Service

• Technical Assistance and Advising


Helping Utilities Make Smart Solar Decisions
SEPA’S SOLAR MARKET PATHWAYS PROJECT
Helping Utilities Make Smart Solar Decisions

Who is Involved?

**Funded By**
- US Department of Energy

**Executed By**
- SEPA
- The Shelton Group

**Working Group Participants**
- CPS Energy
- Duke Energy
- Hawaiian Electric
- Pacific Gas & Electric
- Portland General
- SMUD
- Salt River Project
- Orlando Utilities
- Pedernales Electric
- Clean Energy Collective
- Sunshare
- First Solar
- Vote Solar
- IREC
- Regulatory Ass’t Project
- Rocky Mountain Institute
- Clean Power Finance
- Community Power Network
- MA DOER
What are we trying to accomplish?

• Create several standardized community solar models (consumer tested)
• Develop tools/techniques for effective marketing to a variety of consumer groups
• Spur nationwide adoption of our models
• Ultimately, generate streamlined and lower cost adoption of community solar
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BONUS! - SEPA Can Help! (plus Appendix Slides)
Utilities Responses to New Expectations & Economics

LOOKING AHEAD

Distribution Market Reform

• New York’s Reforming the Energy Vision (REV)
• Minnesota’s e21
• California
• Hawaii

Integrated Offerings

• NRG and Green Mountain Power
• Fort Collins Utilities
• Arizona Public Service Residential Rooftop Program
• Tucson Electric Power Residential Solar Program
• Steele-Waseca Cooperative Electric’s Sunna Project
• Grand Valley Power and Grid Alternatives
### Emerging Ecosystem of Solar Plus

#### Solar + Storage
- SunEdison
- Solar Grid Storage
- SolarCity
- TESLA MOTORS
- enphase
- ELIIY Power
- SUNPOWER
- Sunrun
- Outback Power Systems
- KYOCERA
- STEM

#### Solar + EV
- SolarCity
- TESLA MOTORS
- SunEdison
- ChargePoint
- nrg
- EVgo
- green charge networks
- Panasonic
- POWER TREE

#### Solar + Energy Management/Load Control
- nest
- enphase
- ASTRUMSOLAR
- vivint
- NEXIA
- TENDRIL
- ETERNOC

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Helping Utilities Make Smart Solar Decisions
A Proactive Utility Strategy

Transitioning from a passive player ...

Passive Player  Trusted Energy Advisor  Trusted Energy Partner

...to a proactive partner for customers adopting solar and other DER

Helping Utilities Make Smart Solar Decisions
Thank You!

Tanuj Deora
Chief Strategy Officer
Solar Electric Power Association
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www.solarelectricpower.org
www.sepatop10.org
www.sepa51.org
2014 Top Solar States

Top 10 Solar States
MWs added in 2014 alone

See Appendix A-4 for a table of each state’s annual and cumulative solar capacity and project data.
# 2014 Utility Solar Leaders

**Source:** SEPA 2014 Solar Market Snapshot

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company/Co. (State)</th>
<th>Annual MW</th>
<th>Annual W/Customer</th>
<th>Annual Interconnections</th>
<th>Annual % of Net Metered Projects Per Customer</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Pacific Gas and Electric Company (CA)</td>
<td>1,504 MW</td>
<td>Pickwick Electric Cooperative (TN)</td>
<td>Pacific Gas and Electric Company (CA)</td>
<td>Maui Electric Company Ltd (HI)</td>
</tr>
<tr>
<td>2</td>
<td>Southern California Edison (CA)</td>
<td>1,043 MW</td>
<td>Farmers Electric Coop (IA)</td>
<td>Southern California Edison (CA)</td>
<td>Hawaii Electric Light Company (HI)</td>
</tr>
<tr>
<td>4</td>
<td>Duke Energy Progress (NC, SC)</td>
<td>161 W</td>
<td>Kauai Island Utility Cooperative (HI)</td>
<td>Arizona Public Service (AZ)</td>
<td>Kauai Island Utility Cooperative (HI)</td>
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<tr>
<td>5</td>
<td>National Grid (MA)</td>
<td>123 W</td>
<td>San Diego Gas &amp; Electric Company (CA)</td>
<td>Hawaiian Electric Company, Inc. (HI)</td>
<td>Electrical District No. 3 (AZ)</td>
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<tr>
<td>6</td>
<td>Arizona Public Service (AZ)</td>
<td>91 MW</td>
<td>Pacific Gas and Electric Company (CA)</td>
<td>Xcel CO - Public Service Co. of Colorado (CO)</td>
<td>San Diego Gas &amp; Electric Company (CA)</td>
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<tr>
<td>7</td>
<td>Jersey Central Power &amp; Light (NJ)</td>
<td>86 MW</td>
<td>Southern California Edison (CA)</td>
<td>National Grid (MA)</td>
<td>Roseville Electric (CA)</td>
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<tr>
<td>8</td>
<td>Tucson Electric Power Company (AZ)</td>
<td>73 MW</td>
<td>Hawaiian Electric Company, Inc. (HI)</td>
<td>Long Island Power Authority (NY)</td>
<td>Pacific Gas and Electric Company (CA)</td>
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<tr>
<td>9</td>
<td>NV Energy (NV)</td>
<td>71 MW</td>
<td>Maui Electric Company Ltd (HI)</td>
<td>Salt River Project (AZ)</td>
<td>Trico Electric Cooperative, Inc. (AZ)</td>
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<tr>
<td>10</td>
<td>El Paso Electric Co. (NM, TX)</td>
<td>63 MW</td>
<td>Tucson Electric Power Company (AZ)</td>
<td>Los Angeles Department of Water and Power (CA)</td>
<td>Southern California Edison (CA)</td>
</tr>
</tbody>
</table>

**Note:** The table lists the top 10 utility solar leaders based on the annual megawatts (MW) of solar generated, with additional details provided for select companies in terms of interconnections and percentage of net metered projects per customer.
Renewable Technology LCOE

“Lazard’s Levelized Cost of Energy Analysis – Version 8.0” (September 2014)

Helping Utilities Make Smart Solar Decisions
Retail rates alone are causing more and more transactions, even as incentives go away due to falling solar costs

Solar Compensation Equation

Impact of reduced technology costs and rising utility rates on solar economics

<table>
<thead>
<tr>
<th>Year</th>
<th>Retail rate</th>
<th>Incentive</th>
<th>Solar LCOE</th>
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<tbody>
<tr>
<td>2007</td>
<td>$9.1/watt</td>
<td></td>
<td>$7.9/watt</td>
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<tr>
<td>2008</td>
<td>$8.7/watt</td>
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<td>$7.9/watt</td>
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<td>2009</td>
<td>$8.3/watt</td>
<td></td>
<td>$8.7/watt</td>
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<tr>
<td>2010</td>
<td>$7.1/watt</td>
<td></td>
<td>$8.3/watt</td>
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<td>2011</td>
<td>$6.3/watt</td>
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<td>$7.1/watt</td>
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<tr>
<td>2012</td>
<td>$5.3/watt</td>
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<td>$6.3/watt</td>
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<tr>
<td>2013</td>
<td>$4.7/watt</td>
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<td>$5.3/watt</td>
</tr>
</tbody>
</table>

2007-2013
Utilities Responses to New Expectations & Economics

INNOVATIVE APPROACHES

Rate Reform
- Fixed Charges
- Value of Solar Tariffs

Grid Integration
- Locational Deployment
- Advanced Inverters
- Solar Production Forecasting
- Storage Integration

Rooftop Ownership
- Underserved Markets
- Integration tie-ins

Community Solar
- Utility Administered & Third Party

More information at www.sepatop10.org

Helping Utilities Make Smart Solar Decisions
## Rate Reform Strategies

### CAMP 1

**Continue NEM**

<table>
<thead>
<tr>
<th>RATE CONSTRUCT</th>
<th>Single Transaction (Rate) Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MODEL</strong></td>
<td></td>
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<tr>
<td>Current Rates</td>
<td>- Currently applicable rates result in an acceptable transaction</td>
</tr>
<tr>
<td></td>
<td>- Solar penetration does not warrant action</td>
</tr>
<tr>
<td><strong>ATTRIBUTES</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Increased Fixed Charge and/or Minimum Bill</td>
</tr>
<tr>
<td></td>
<td>- Demand Charge</td>
</tr>
<tr>
<td></td>
<td>- Stand-by or Solar Charge</td>
</tr>
</tbody>
</table>

### CAMP 2

**Reforming the Solar Customer Transaction (NEM reform)**

<table>
<thead>
<tr>
<th>RATE CONSTRUCT</th>
<th>Two or More Transactions (Rates)</th>
</tr>
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<tbody>
<tr>
<td><strong>MODEL</strong></td>
<td></td>
</tr>
<tr>
<td>Solar Rate</td>
<td>- Independent Energy Sale and Solar Purchase Rates</td>
</tr>
<tr>
<td>Reform All Rates</td>
<td></td>
</tr>
<tr>
<td><strong>ATTRIBUTES</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Retain existing rates for services provided from utility to cust.</td>
</tr>
<tr>
<td></td>
<td>- Establish second rate to purchase from customer</td>
</tr>
<tr>
<td></td>
<td>- Design rates to reflect itemized services from utility to cust. and from cust. to utility</td>
</tr>
</tbody>
</table>
Commonly-Discussed “Value of Solar” Elements

Generation Value Streams
• Avoided energy
• Generation capacity deferral
• Fixed and variable O&M
• Ancillary / grid support services impact

System Value Streams
• Transmission system impact
• Distribution system impact
• System losses

Societal Value Streams
• Environmental
• Economic development
• Disaster recovery
• Security Enhancement impact

Helping Utilities Make Smart Solar Decisions
Utilities Responses to New Expectations & Economics

INNOVATIVE APPROACHES

Rate Reform
- Fixed Charges
- Value of Solar Tariffs

Grid Integration
- Locational Deployment
- Advanced Inverters
- Solar Production Forecasting
- Storage Integration

Rooftop Ownership
- Underserved Markets
- Integration tie-ins

Community Solar
- Utility Administered & Third Party

More information at www.sepatop10.org
Grid Integration Strategies

Helping Utilities Make Smart Solar Decisions
Smart Inverters

- **Remote Dispatch**
  - Ability to control PV generation to a specified % of nominal power

- **Over Frequency Response**
  - Ability to automatically reduce active power with frequency deviations

- **PF Control Mode**
  - Ability to supply/absorb reactive power during PV operation
  - Ability to control Power Factor

- **Fault Ride-Through**
  - Ability to supply reactive current during fault ride-through period

- **Smart inverter standards are in development**
  - California Rule 21
  - IEEE 1547

- **Advanced functionality is similar to distribution system assets deployed today**
  - Load tap changers, voltage regulators, shunt capacitors, etc.

- **Business case can be made that utilities should own smart inverters and provide to customers going solar**

German Association of Energy and Water Industries (BDEW) Guidelines
## Grid Storage Services

### Types of applications under consideration today

<table>
<thead>
<tr>
<th>Electric Supply</th>
<th>Ancillary Services</th>
<th>Grid System</th>
<th>End User/Utility Customer</th>
<th>Renewables Integration</th>
</tr>
</thead>
</table>
| • Electric Energy Time-shift  
• Electric Supply Capacity | • Load Following  
• Area Regulation  
• Electric Supply Reserve Capacity  
• Voltage Support | • Transmission Support  
• Transmission Congestion Relief  
• Transmission & Distribution Upgrade Deferral  
• Substation On-site Power | • Time-of-Use Energy Cost Management  
• Demand Charge Management  
• Electric Service Reliability  
• Electric Service Power Quality | • Renewables Energy Time-shift  
• Renewables Capacity Firming  
• Wind Generation Grid Integration |
Helping Utilities Make Smart Solar Decisions

Utilities Responses to New Expectations & Economics

INNOVATIVE APPROACHES

<table>
<thead>
<tr>
<th>Rate Reform</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fixed Charges</td>
</tr>
<tr>
<td>• Value of Solar Tariffs</td>
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<td>• Integration tie-ins</td>
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<th>Community Solar</th>
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<tr>
<td>• Utility Administered &amp; Third Party</td>
</tr>
</tbody>
</table>

More information at [www.sepatop10.org](http://www.sepatop10.org)
Arizona Public Service

- 20 MW cumulative program size for about 3,000 customers
- Customers get a $30 monthly bill credit for 20 years (lease payment for rooftop real estate)

Tucson Electric Power

- 3.5 MW or about 600 customers
- Customers get a fixed monthly rate for 25 years
- Competitive process using local contractors
Utilities Responses to New Expectations & Economics

INNOVATIVE APPROACHES

Rate Reform
- Fixed Charges
- Value of Solar Tariffs

Grid Integration
- Locational Deployment
- Advanced Inverters
- Solar Production Forecasting
- Storage Integration

Rooftop Ownership
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Helping Utilities Make Smart Solar Decisions
### Attributes Defined

<table>
<thead>
<tr>
<th>Program Attribute</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Administrator</strong></td>
<td>Designs, markets, acquires customers, and responsible for tracking &amp; managing the program</td>
</tr>
<tr>
<td><strong>System Owner/Purchaser</strong></td>
<td>Entity that physically owns the project (directly or thru PPA)</td>
</tr>
<tr>
<td><strong>Offer / Transaction</strong></td>
<td>How the customer pays to participate</td>
</tr>
<tr>
<td><strong>Production Guarantee</strong></td>
<td>Who wears production risk; does customer receive fixed or variable kWh each month</td>
</tr>
<tr>
<td><strong>Economic Proposition</strong></td>
<td>What the customer receives in return for participating</td>
</tr>
<tr>
<td><strong>Target Customer Classes</strong></td>
<td>Which customer classes are eligible to sign up for the program</td>
</tr>
<tr>
<td><strong>Siting &amp; Scale</strong></td>
<td>Where the project is located, and how large the project can be</td>
</tr>
<tr>
<td><strong>Participation Limit: Res.</strong></td>
<td>Maximum subscription for any residential customer, as a % of average annual consumption</td>
</tr>
<tr>
<td><strong>Participation Limit: Non-Res</strong></td>
<td>Maximum subscription level aggregated across all non-residential customers</td>
</tr>
<tr>
<td><strong>One-Time Sign-Up Fee</strong></td>
<td>Subscription / administration / registration fee, paid once upon signing up for program</td>
</tr>
<tr>
<td><strong>Fee Treatment</strong></td>
<td>Whether or not the fee (if imposed) is refundable and if so, under what conditions</td>
</tr>
<tr>
<td><strong>Minimum Term</strong></td>
<td>Tied to one-time fee, the minimum amount of time a customer must stay on the program</td>
</tr>
<tr>
<td><strong>Unsubscribed Energy</strong></td>
<td>What occurs with the energy and associated costs for under-subscribed projects</td>
</tr>
<tr>
<td><strong>Subscription Transferability</strong></td>
<td>Defines how customers can move in and out of the program with their subscription</td>
</tr>
<tr>
<td><strong>Program Length</strong></td>
<td>The length of time the administrator guarantees the customer benefit</td>
</tr>
<tr>
<td><strong>REC Treatment</strong></td>
<td>How the RECs from the solar system are transferred, sold, or retired</td>
</tr>
</tbody>
</table>
## Program Attribute Matrix

### Generic Options to Consider

<table>
<thead>
<tr>
<th>Program Attribute</th>
<th>Typical Options in Program Design*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>System Administrator</td>
</tr>
<tr>
<td>System Owner/Purchaser</td>
<td>3rd Party Asset</td>
</tr>
<tr>
<td>Offer / Transaction</td>
<td>Up Front Payment (Panel Purchase / Lease)</td>
</tr>
<tr>
<td>Production Guarantee</td>
<td>Fixed or Guaranteed Output</td>
</tr>
<tr>
<td>Economic Proposition</td>
<td>Partial Bill Credit (kWh)</td>
</tr>
<tr>
<td>Target Customer Classes</td>
<td>Residential</td>
</tr>
<tr>
<td>Siting &amp; Scale</td>
<td>Community: Small Scale</td>
</tr>
<tr>
<td>Participation Limit: Res.</td>
<td>50% Avg. Consumption</td>
</tr>
<tr>
<td>Participation Limit: Non-Res</td>
<td>&lt;= 20% of Project</td>
</tr>
<tr>
<td>One-Time Sign-Up Fee</td>
<td>None</td>
</tr>
<tr>
<td>Fee Treatment</td>
<td>N/A</td>
</tr>
<tr>
<td>Minimum Term</td>
<td>None</td>
</tr>
<tr>
<td>Unsubscribed Energy</td>
<td>Socialized</td>
</tr>
<tr>
<td>Subscription Transferability</td>
<td>Portable &amp; Transferrable</td>
</tr>
<tr>
<td>Program Length</td>
<td>5 Years</td>
</tr>
<tr>
<td>REC Treatment</td>
<td>Retired</td>
</tr>
</tbody>
</table>

*Not meant to be all-inclusive, but representative of approaches that generally cover what has been pursued nationally*
Most Common Structures

Up Front Payment Model
- Customer pays up front to purchase or lease a panel and receives a credit on their bill tied to system production
- Bill credit reflects an allocation of actual system output based on proportionate share of system
  - kWh credit
  - Monetary ($/kWh) credit
- Mimics a rooftop ownership model in that up front capital is required
  - Economics based on a payback period analysis
- SEPA statistics:
  - 84% of programs in operation
  - Avg. system size: 700 kW
  - Avg. # participants: 150

Ongoing Payment Model
- Customer subscribes to program in either kW or kWh blocks and receives a credit on their bill tied to system production
  - kWh blocks: guaranteed output each month at fixed payment per block
  - kW blocks: variable output each month at fixed price per kWh or fixed payment per block
- Customer pays a premium on day one for solar blocks, but that price is fixed for a long term (e.g., 20 years) providing a rate hedge
- Mimics a rooftop lease model
  - Economics based on break-even analysis
- SEPA statistics:
  - 16% of programs in operation
  - Avg. system size: > 6 MW
  - Avg. # participants: 1,200
Buy or build?

• RFP process
  – Evaluating responses
  – Involve stakeholders

• Other considerations
  – Choosing a location
  – Managing risk of underperformance
  – Preparing for over and/or under subscription
  – Delegating maintenance responsibilities