Meeting Consumer Demands for Clean Energy - Market & Regulatory Trends

The Future of American Electricity Policy Academy
September 22, 2016
Washington DC

Tanuj Deora
Chief Strategy Officer
SEPA
About SEPA

SEPA’s mission is to facilitate the utility industry’s smart transition to a clean energy future through education, research, and collaboration.

COMMUNITY
Members, Events, USC, Fact Finding Missions, Partnership Opportunities, Power Player Awards

DATA
USD, Solar Calculators, Mapping Tools, Research Reports, Project and RFP News, Custom Research Solutions

INSIGHTS
Advisory Services, Webinars, Workshops, Case Studies, SEPA Publications, Blog, Expert Commentary

www.sepapower.org
The power sector today

• We All Want Safe, Reliable, Affordable, and Clean Power

• Renewables Have Closed the Cost Gap

• We Have Plenty of Power Generation

• Deliverability (Transmission, Distribution, and Integration) is the Constraint
Solar has grown, and utilities respond

**Mainstream Utility Solar Strategies:**

- Large Scale Solar PV in IRPs
- Redesigning Rate Structures
- Exploring Community Solar

**U.S. SOLAR CAPACITY**

**MEGAWATTS BY YEAR, 2011–2015**

- **RESIDENTIAL**
- **NON-RESIDENTIAL**
- **UTILITY SUPPLY**
- **CUMULATIVE CAPACITY**

**SOURCE:** 2015 SEPA Solar Market Snapshot
Looking forward, new strategies may be needed

Emerging Utility DER Strategies:

- Next-Level Customer Insight & Engagement
- Evaluating DER as Grid Assets
- Rewiring Utility Operating Practices

Source: GTM Research/SEIA U.S. Solar Market Insight
A fundamental challenge

**Grid Perspective:**

System = Value  
DGPV = Cost  
Measured Expectation of Change

**Consumer Perspective:**

System = Cost  
DGPV = Value  
Rapid Expectation for Change
1. The goal of the market should be to promote efficiencies in the production, consumption, and investment in energy and related technologies.

2. The role of the utility, as a public service corporation, should be clearly defined so that all market participants have open access to enable customer options in a fair, transparent, and non-discriminatory manner.

3. Rate structures should provide a transparent revenue model and associated cost allocation for utility services; needs-tested investments that support and promote grid modernization, reliability, and flexibility should come with surety of recovery, subject to prudence review.

4. Customers should be presented with a variety of rate and programmatic options that expand the choice of and access to energy-related products and services that are simple, transparent, and create stable value propositions.
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HEADQUARTERS

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@sepapower
# Who We Are

## Membership

- 570 Utilities (IOU, Coop, Muni, PMA)
- 381 Corporate (Technology Providers, Developers, Consultants)
- 156 Other (Gov't Agencies, Commissions, Universities, Labs, NGOs)

## Board

- PG&E
- PSEG
- CPS Energy
- NYPA
- SMUD
- TVA
- Siemens
- STEM
- EnergyHub
- FirstSolar
- SunPower

## Advisory Council

- Edison Int’l
- Nest
- PJM
- ISO-NE
- Duke Energy
- BGE
- Nexant
- DTE
- Navigant
- Southern Co
SEPA’s transition from “Solar” to “Smart”

The term “smart” typically refers to advanced technology. But smart transition will require…

- Proactive consumer engagement
- Enhanced system planning
- Strategic commitment across the utility organization
Understanding utility-scale solar economics

UTILITY-SCALE SOLAR: THE PATH TO HIGH-VALUE, COST-COMPETITIVE PROJECTS
How to Optimize the Economics of Utility-Scale Solar Photovoltaic (PV) Facilities

- Clipped Energy
- Added Production
- Standard Project Design

Impact of Inverter Clipping

<table>
<thead>
<tr>
<th>BASE CASE FINANCING</th>
<th>NORMALIZED ITC</th>
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<tbody>
<tr>
<td>DEBT</td>
<td>50% @ 6% return</td>
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<tr>
<td>EQUITY</td>
<td>50% @ 10% return</td>
</tr>
<tr>
<td>DEPRECIATION</td>
<td>Immediately monetized</td>
</tr>
<tr>
<td>LCOE (FIXED TILT)</td>
<td>$63/MWh</td>
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<tr>
<td>LCOE (SAT)</td>
<td>$55/MWh</td>
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IMPACT OF TRACKING

SOUTH- VS. WEST-FACING
Utilities thinking “Beyond the Meter”

Source: Beyond the Meter: The Potential for a New Customer-Grid Dynamic, SEPA
Drivers for rooftop solar market growth

**Economics**
- Upward pressure on utility costs (& rates) improves economics
- Declining PV costs

**Policy**
- RPS policies, targets, and solar carve-outs
- Policy- and program-driven incentives

**Market**
- Innovation in customer financing (leases, PPAs)
  - Transforming customer investment drivers from ROI to cash flow-based investments
  - Securitization and public funding
- Increasing demand by customers for choice
All-in turn-key costs for solar PV in the US, 2015

- Residential pricing has been quoted as low as $2.50/W
- FirstSolar expects $1/W for large scale by 2017

US pricing varies significantly by state, and is generally higher than many countries by as much as 50% in the residential market

# Comparing Residential Customers’ Solar Options

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<thead>
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<th>More</th>
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<tbody>
<tr>
<td>Catalogizes green energy</td>
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<tr>
<td>Available to broad audience</td>
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<td></td>
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<tr>
<td>Provide financial benefit</td>
<td></td>
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<tr>
<td>Can move with owner</td>
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<td>Low O&amp;M concerns</td>
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<th><strong>Community Solar</strong></th>
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<tr>
<th><strong>Rooftop</strong></th>
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<table>
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<tr>
<th><strong>Green Pricing Program</strong></th>
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What is community solar?

Customer Benefits
- Increase customer access
- Ability to hedge costs
- Portability within utility service area
- Leverages economies of scale
- Can be strategically sited
- Proactive customer engagement
- Support the local PV industry
- Opportunity to gain understanding of solar resource

Utility Benefits
- Participants pay for a share of the solar farm.
- Participants are credited for their share of generated electricity.
- Electricity is distributed to the grid.

Smart Electric Power Alliance

SOLAR PANELS

PARTICIPANTS

UTILITIES

16

www.sepapower.org
Community solar programs across the US

Source: Smart Electric Power Alliance, 2016
Community solar market research

SEPA & The Shelton Group Surveyed 2,000 residential customers across the nation
2.2% margin of error / 95% confidence interval

58% are interested in rooftop, but 59% seriously underestimate costs

Once exposed to costs and financing/leasing options, serious consideration for rooftop increases from 16% to 24%

When community solar is explained, interest grows from 14% to 47%
Untapped market today

• Median program is 102.5 kW
• 75% of programs leverage systems less than 800 kW
• Largest programs are around 20 MW (TEP, SRP, Xcel, RMP)

Cumulative Installed US Capacity (2014 MW)

Rooftop Solar

Community Solar

Utility-Scale Solar

Source: SEPA Analysis
Competitiveness of distributed rooftop PV

Source: GTM Research
Distributed solar value proposition

Stakeholders often want to discuss the value proposition delivered by distributed solar as part of any discussion regarding cost shifting.
Primary utility response to NEM is fixed charges

**SELECT UTILITY FIXED SERVICE CHARGE INCREASE REQUESTS IN 2015**

(CHARGE PER MONTH)

- Public Service of Oklahoma (OK)
- Santee Cooper (SC)
- Wisconsin Public Service (WI)
- Portland General Electric (OR)
- Westar Energy (KS)
- Omaha Public Power Districts (NE)
- Northern States Power Co. (WI)
- Northern States Power Co. (MN)
- Public Service of New Mexico (NM)
- PSEG Long Island (NY)
- Hawaiian Electric Light Co. (HI)

- ORIGINAL
- PROPOSED, ACCEPTED IN FULL
- PROPOSED, RECEIVED LESS
- PROPOSED, DENIED
- APPROVED

Source: Smart Electric Power Alliance, 2016; data and information from North Carolina Clean Energy Technology Center 50 States of Solar 2015 Q1, Q2, Q3 and Q4 reports.
Position statement on net energy metering
August 2013

• Customer-sited solar generation will play an increasingly important role in the energy mix for utilities and consumers.

• Net energy metering (NEM) policies promote the deployment of customer-sited distributed solar generation in many markets.

• However, NEM and rate design, inherently linked, need to evolve to transparently allocate costs and benefits, compensating all parties for their value contribution.

• This transition will only be effective when utilities, the solar industry and customers collaborate to create a sustainable solar distributed generation marketplace.
## Rate reform options

<table>
<thead>
<tr>
<th>RATE CONSTRUCT</th>
<th>Retain NEM, Reform Rate Structure</th>
<th>NEM Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODEL</td>
<td>Increased Fixed Charge and/or Minimum Bill</td>
<td>Demand Charge</td>
</tr>
<tr>
<td>ATTRIBUTES</td>
<td>• Add or increase basic service charge ($/month)</td>
<td>• Add or increase customer fee for demand ($/kW/month)</td>
</tr>
<tr>
<td></td>
<td>• Raise minimum bill requirements ($/month)</td>
<td></td>
</tr>
</tbody>
</table>

- **Value of Solar**
- **Feed-in Tariff**
Distributed rooftop price vs. retail price today

Impact of Rate Design
How different rate structures impact cost efficacy
Assumes EIA U.S. average data and $3/watt

Solar LCOE Range varies by orientation and location

<table>
<thead>
<tr>
<th>Standard Rate</th>
<th>Increased Fixed Charge</th>
<th>Demand Charge</th>
<th>Full Fixed Cost Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5 Fixed, 10.9¢ variable</td>
<td>$20 Fixed, 9.2¢/kWh variable</td>
<td>$5 Fixed, $10/kW demand, 7.4¢/kWh variable</td>
<td>$55 Fixed, 5.9¢/kWh variable</td>
</tr>
</tbody>
</table>

Solar LCOE Range varies by orientation and location.
Distributed rooftop price vs. retail price in 2020

Solar Efficacy in 2020 - 30% ITC
Assumes $1.5/watt rooftop install cost & rate inflation at utility retail rate average from 1990-2013

- Standard Rate: $5 Fixed, 12.3¢ variable
- Increased Fixed Charge: $20 Fixed, 10.4¢/kWh variable
- Full Fixed Cost Recovery: $5 Fixed, 5.9¢/kWh variable
- Demand Charge: $5 Fixed, $10/kW demand, 8.3¢/kWh variable

Solar LCOE Range varies by orientation and location
Where is this going? HI self supply economics

A bundled package – aka “nanogrid” – replacement for grid supplied power may be closer than we think

- Allows customers to avoid both energy & demand charges
- Flips the paradigm – DER as primary, grid as the back-up
- HI program does not leverage DER for any system benefits
- Implications more interesting for microgrids

### Potential Self-Supply Technology Package Options

<table>
<thead>
<tr>
<th>Technology</th>
<th>Function</th>
<th>Constraint(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>Generate power during day</td>
<td>Decrease size to optimize on-site consumption and battery capacity</td>
</tr>
<tr>
<td>Battery Storage</td>
<td>Store excess power during day</td>
<td>Expensive; avoid excess capacity</td>
</tr>
<tr>
<td>Smart Electric Water Heater</td>
<td>Shift morning reheating to afternoon; heat to higher temperature</td>
<td>Some homes have solar hot water; usage varies daily</td>
</tr>
<tr>
<td>Thermostat</td>
<td>Cool house to a lower temperature than normal during day</td>
<td>Many homes use ductless mini-split AC units, which don’t have a central thermostat</td>
</tr>
<tr>
<td>Electric Vehicle</td>
<td>Charge during the day</td>
<td>Less common: EV may not be at the home during the day</td>
</tr>
<tr>
<td>Other Appliances, e.g. laundry, dishwasher, etc.</td>
<td>Increase or shift usage to daytime</td>
<td>Combination of intermittent use and/or not readily available control integration</td>
</tr>
</tbody>
</table>

### Self-Supply Economic Scenarios on OAHU (3 KW)

<table>
<thead>
<tr>
<th></th>
<th>Solar only</th>
<th>Self-supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price Increment</td>
<td>$0</td>
<td>+$1,500</td>
</tr>
<tr>
<td>System Cost</td>
<td>$4.00/watt</td>
<td>$4.50/watt</td>
</tr>
<tr>
<td>Initial Cost</td>
<td>$12,000</td>
<td>$13,500</td>
</tr>
<tr>
<td>Incentivized Cost</td>
<td>$5,460</td>
<td>$6,510</td>
</tr>
<tr>
<td>Simple Payback</td>
<td>4 years</td>
<td>5 years</td>
</tr>
</tbody>
</table>

Assumptions: 23% capacity factor; 35% Hawaii solar-only and 30% Federal Solar Tax Credit (less Hawaii tax credit, but including storage costs); $15/kW/yr O&M; 25¢/kWh HECO rates w/ 2% escalation; doesn’t include discount rate or tax implications; 10% kwh penalty for charging and excess solar losses
Key issues to track

1. Sustainability of the third party community solar model:
   - Continuation of virtual net metering policies
   - Consumer protection concerns

2. Competitiveness with alternative deployment models:
   - Validation of market size
   - Grid/system benefits

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FERC gets another PURPA complaint, but this one is a little different

Wisconsin utility has some unfamiliar allies in solar case
Key accounts

World Resources Institute Buyer’s Principles Participants:

Bloomberg  BD  Sprint  ebay inc  VOLVO
Cisco  ARUP  HP  Digital Realty  Adobe
Johnson & Johnson  P&G  Staples  Novo Nordisk  Walmart
EMC  REI  Salesforce  Yahoo!  Aditya Birla
Unilever  Target  GM  Intel  Autodesk
Workday  io  Mars  3M  Genentech

Source: www.buyersprinciples.org
MGM agrees to pay $86.9mm exit fee to leave NV Energy

- Company claims motivation stems from their customers’ desires for green vacation destinations
- MGM represents 5% of NV Energy’s load
- At least two additional other casino companies looking to follow suit
Key accounts

UTILITY DIVE

FERC greenlights Apple's petition to sell electric power

VS.

GREENTECH MEDIA

Amazon and Dominion Power Forge a New Renewable Energy Path in Virginia

Proactive utility responses may include:

• Green riders
• Sleeved transactions
• Bespoke generation projects
• Bundled EPC approaches
Customers Crave More Options…

Which new and emerging revenue streams is your regulated utility pursuing? Choose all that apply.

- **66%** | Offering energy management and efficiency services to customers
- **56%** | Offering community solar to customers
- **52%** | Deploying electric vehicle charging infrastructure
- **47%** | Offering green pricing programs to key accounts
- **40%** | Deploying distributed energy storage

...And Utilities Want to Provide Them.

Source: Accenture, Utility Dive
But integration is not straightforward

Perceived Challenges to Integrating High Levels of DER

- System stability or protection: 49.0%
- Inability to model DER in planning load flows: 33.7%
- Lack of control over DER: 32.7%
- Lack of visibility (status & forecast): 30.6%
- Other: 9.2%
- Don’t see a challenge: 7.1%
- Don’t know: 17.3%

Source: Black & Veatch
Utility rooftop solar programs

- Leasing roof from customers ($30/month for 20 years)
- 10 MW = 3,000 customers

- Fixed monthly rate for 25 years
- 3.5 MW = 600 customers

- Leasing roof from customer ($0.03/kwh for 20 years)
- 10 MW cap - 4,000 applications in first month
- Third party owns systems & sells power to CPS

- Marketing solar to customers
- Screening and advising customers
- Offering list of qualified installers, including Southern Company subsidiary
A fundamental challenge

Grid Perspective:
System = Value
DGPV = Cost

Consumer Perspective:
System = Cost
DGPV = Value

Measured Expectation of Change

Rapid Expectation for Change

- Obligations under the regulatory compact
- Dynamic societal expectations
- Requirements to add generation
- Flat demand
- Pace of regulatory processes
- Concerns about portfolio diversity & stranded assets

- Trade between equity and efficiency
- Uncertainties on definitions of fairness
- Inadequate valuation tools (incl markets)
- Rapid technological advances
- Limited consensus about the nature and role of the regulated monopoly
- Lack of clarity on conflicting expectations
51st State’s phased approach

CHOOSING THE DESTINATION
Phase I
Hypothetical electricity marketplace

THE DESIGNING THE ROADMAPS
Phase II
Journey from current state to future state

STARTING THE JOURNEY
Phase III
Creation of customized roadmaps & implementation of “no-regrets moves”

Crowdsourced visions for the future, starting from a blank slate
Crowdsourced roadmaps that articulate how we get from “here” to “there”
Stakeholder-guided development of bespoke plans for electric power sector transformation
1. The goal of the market should be to promote efficiencies in the production, consumption, and investment in energy and related technologies.

2. The role of the utility, as a public service corporation, should be clearly defined so that all market participants have open access to enable customer options in a fair, transparent, and non-discriminatory manner.

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