The Impact of Energy and Electricity System Trends on RPS Implementation
Utility Planning for the Future

Tanuj Deora
November 30, 2016
About SEPA

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

Policy & Regulation

Flat Electricity Demand

Falling Technology Costs

Rising Customer Expectations

Abundance of Fuelstock

ELECTRIC POWER UTILITIES
Drivers for rooftop solar market growth

Falling Cost

• Upward pressure on utility costs (& rates) improves economics

• Declining PV costs

Policy & Regulation

• RPS policies, targets, and solar carve-outs

• Policy- and program-driven incentives

Customer Expectations

• 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

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

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

Solar has grown, and utilities respond

**U.S. SOLAR CAPACITY**
MEGAWATTS BY YEAR, 2011–2015

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

**Mainstream Utility Solar Strategies:**

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

**SOURCE:** 2015 SEPA Solar Market Snapshot

**24,035 MW TOTAL**

**2011: 0.681 MW**
**2012: 1.356 MW**
**2013: 2.156 MW**
**2014: 3.111 MW**
**2015: 3.490 MW**

**6,428 MW added in 2015**
Primary utility response to NEM is fixed charges

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.
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
Potential Model for Utilities’ Future: The Distribution System Operator
Valuation of DER of Distribution Assets

Source: Addressing the Locational Valuation Challenge for Distributed Energy Resources, SEPA and Nexant
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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.
The Utility’s role in DER deployment & integration

July 2016

• Optimal deployment of DER will require proactive engagement and cooperation.

• Whether in front of or behind the meter, allocation of costs and benefits should be transparent.

• Utilities possess unique technical & operational knowledge of the grid, critical for optimizing the benefits for customers both individually and as a system.

• Utilities bring additional benefits for deployment based on utilities’ access to and cost of capital, rate stability, customer relationships, and holistic experience with DER.

• Customer and third party ownership can provide additional including expanded choice, cost stability, additional streams of capital, expanded consumer education, innovative customer acquisition models, and provision of complementary goods and services.

• Safeguards are needed to ensure a competitive DER market evolves ensuring open access to the interconnection processes, clear direction from grid operators on deployment, and transparency.
Where is this going? HI self supply economics

### 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>
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<td>$5.67/watt</td>
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<tr>
<td>Initial Cost</td>
<td>$12,000</td>
<td>$17,000</td>
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<td>$5,460</td>
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<td>Price Increment</td>
<td>$0</td>
<td>+$10,000</td>
</tr>
<tr>
<td>System Cost</td>
<td>$4.00/watt</td>
<td>$7.33/watt</td>
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<tr>
<td>Initial Cost</td>
<td>$12,000</td>
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<tr>
<td>Incentivized Cost</td>
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<td>$12,460</td>
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<tr>
<td>Simple Payback</td>
<td>4 years</td>
<td>9 years</td>
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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

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
Utilities thinking “beyond the meter”

**Integrated Customer Insights**
Increased segmentation of load profiles, propensity to adopt, & behavioral drivers combined to better evaluate economic, & achievable potentials.

**Incorporating DER as Grid Assets**
Increasing sophistication of grid planning & operations tools to account for potential system benefits from DER on a temporal & locational basis.

**Rewiring Standard Operating Practices**
Opening up planning processes across functional areas (system planning, resource planning, marketing, regulatory) to incorporate more robust & holistic deployment strategies.
Community solar programs across the US

COMMUNITY SOLAR FAST FACTS:

- 83 ACTIVE PROGRAMS AS OF THE END OF 2015
- MORE THAN 100 MW ONLINE
- 79 PROGRAMS IN DEVELOPMENT
- 14 STATES AND D.C. ENACTED COMMUNITY SOLAR POLICIES

Source: Smart Electric Power Alliance, 2016
Designing a Successful Community Solar Program

Key Considerations

<table>
<thead>
<tr>
<th>Utility</th>
<th>Customer</th>
<th>Regulator</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Alignment with investment strategy</td>
<td>• Value proposition economics &amp; structure</td>
<td>• Cross subsidization</td>
</tr>
<tr>
<td>• Coordination between functional groups</td>
<td>• Education and outreach</td>
<td>• Cost-effectiveness</td>
</tr>
<tr>
<td></td>
<td>• Brand expectations</td>
<td>• Consumer protection</td>
</tr>
</tbody>
</table>

Potential Design Features:

• Structure (rate vs. capacity)
• Terms (pricing, contract lengths, penalties)
• Ownership – utility vs. third party vs. customer
• Amortization of administrative costs (billing system, etc.)
• Siting for distribution system benefit
• Inverter functionality
• Cross-program marketing (key accounts, DSM, etc.)
• Cost allocations (subscriber vs. rate base)
• Risk allocation (subscription, O&M, production)
The Fundamental Challenge

Grid Perspective:
System = Value
DGPV = Cost

Measured Expectation of Change

Consumer Perspective:
System = Cost
DGPV = Value

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
# Phase II Roadmap Lanes

<table>
<thead>
<tr>
<th>Retail Market Design</th>
<th>Describe how customers participate (opt-in versus opt-out) of the future state technology enablement provisions, what assets are at their disposal, and how those assets interact with the grid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wholesale Market Design</td>
<td>Describe impacts and modifications, if any, to wholesale markets, central station generation, transmission assets and services, etc.</td>
</tr>
<tr>
<td>Utility Business Model</td>
<td>Describe how the utility industry needs to evolve from current to future state in order to support the new market while maintaining safe, reliable, and cost-effective service</td>
</tr>
<tr>
<td>Asset Deployment</td>
<td>Address any required technologies (e.g., AMI, smart inverters, load tap changers, etc.) that utilities will need to deploy to support the future state, the timing/triggers for those deployments, and how costs would be recovered</td>
</tr>
<tr>
<td>IT</td>
<td>Describe the software and communications platforms needed for all parties to enable the grid of the future, including those needed for the utility, the firmware required for devices, etc.</td>
</tr>
<tr>
<td>Rates &amp; Regulation</td>
<td>Discuss how regulatory bodies, rules, and regulations must adapt from current to future state, and how retail rates must transform over time to allow for the continued economic health of the system and its participants</td>
</tr>
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