Residential Solar + Storage Systems
Betty Watson, Deputy Director
Annual NECPUC Symposium 2015
SolarCity Corporate Overview

- Publicly traded with $5B+ in total funds to deploy renewables
  - (NASDAQ:SCTY)

- Booked projects with 218,000+ customers
  - Largest solar installer in US

- 10,000+ Employees

- Building 1GW panel factory in Buffalo, NY
  - Largest in W. Hemisphere
SolarCity in New England

- Serving over 5,500 customers
- Employs more than 700
- 6 Warehouses

Connecticut
Maine
Massachusetts
New Hampshire
Rhode Island
Vermont

SolarCity in New England
Served by SolarCity
SolarCity Provides An Integrated Approach

- SolarCity provides a single source for financing, engineering design, installation, monitoring and maintenance
- Better customer experience with single point of contact
- Multiple financing options: Power Purchase Agreement, Lease, MyPower loan program, Direct Purchase
SolarCity & Tesla Motors

- 5 year collaboration on energy storage development / deployment
- Over 300 batteries deployed by SolarCity throughout California
- DemandLogic uses solar + storage systems to reduce costs for commercial and industrial customers
SolarCity Residential Backup

- 9.2 kWh energy capacity
- 100% solar charging (battery does not charge from grid)
- PV and battery utilize a single inverter
- MySolarCity monitors system 24/7 and suggests future savings for eligible customers
- 9-year warranty
- Final installed cost to customer of $5,000 after credits and incentives
Backup Power Service

- Provide backup power for up to four electrical circuits up to 1,900 watts (120 V / 20 Amps)
- Can function indefinitely while battery charges from solar panels, even during grid outages

During the day, solar energy charges your battery while it powers your home.

As day transitions to night, your battery backup system keeps things running smoothly, so if the grid goes down, the essential devices in your home will not.
## Solar + Storage Backup Power Service

<table>
<thead>
<tr>
<th></th>
<th>Solar power with battery backup</th>
<th>Gas-powered portable generator</th>
<th>Natural gas or liquid propane stationary generator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Convenience</strong></td>
<td>• Wall-mounted, indoors or outdoors</td>
<td>• Must be rolled out and plugged in every time it's used</td>
<td>• Must be placed outdoors</td>
</tr>
<tr>
<td></td>
<td>• System turns on seamlessly to power your backup loads immediately after an outage occurs</td>
<td>• Requires manual start-up when an outage occurs</td>
<td>• Must be tied to home's gas line (or run a new gas line)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Automatic transfer switches start the system immediately when an outage occurs</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>Energy comes from solar – no need to refuel as power supply is renewable.</td>
<td>Must be refueled every few hours.</td>
<td>Energy comes from natural gas or propane – may need to refuel if the power supply is interrupted.</td>
</tr>
<tr>
<td><strong>Environmental Impact</strong></td>
<td>• Powered by clean, renewable energy</td>
<td>• Emits noxious fumes</td>
<td>• Emits noxious fumes</td>
</tr>
<tr>
<td></td>
<td>• Quiet operation</td>
<td>• Makes considerable noise</td>
<td>• Makes considerable noise</td>
</tr>
<tr>
<td><strong>Additional Savings</strong></td>
<td>Time-of-use energy-shifting algorithm automatically suggests ways your battery can save you money.</td>
<td>No additional savings.</td>
<td>No additional savings.</td>
</tr>
</tbody>
</table>
What is the value of residential batteries?

- “For utilities and grid operators, the technology is designed to enable remote-aggregated control of solar battery systems.”
  -Peter Rive, SolarCity Co-Founder and CTO
- “SolarCity’s customer contract explicitly contemplates future market opportunities and creates a revenue-sharing opportunity for customer.”

![Diagram: Today vs. Tomorrow]

*Your energy comes from centralized - and often dirty - sources and your money goes directly to the utility.*

*Clean energy is shared between you and your neighbors, and each home has the potential to earn money for what they produce.*

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SolarCity Confidential  Slide 9
Potential Value of Energy Storage Systems

RTO/ISO Level
• Capacity
• Energy
• Frequency regulation

Utility Level
• Enable customers to take advantage of time-differentiated rates in order to utilize least-cost resources
• Improve utilization of transmission and distribution assets by improving overall load factor
• Voltage support
How can regulators help customers extract the maximum value from solar + storage systems?

- Clarify application of existing rules to solar+storage systems
  - Net energy metering
  - Interconnection procedures
- Ensure the possibility of participation in multiple programs
  - Net energy metering and provision of grid services
- Ensure that programs value *services*, not specific resource parameters
- Programs for specific resource types should contemplate the range of services provided by that resource and design incentives to meet balanced program objectives
Let the Digital Revolution Work for Customers

• Make requirements for data, not hardware
  • Identify necessary information
  • Ensure accuracy
  • Do not require specific hardware (e.g., meters)

• Companies already collect these data and rely on its accuracy to be fairly compensated by customers

• Meter requirements are expensive for customers and could be prohibitive for single-inverter systems that otherwise reduce costs and improve efficiency
Example Distributed Storage Programs

CA Self-Generation Incentive Program
- Provides incentives to support distributed energy resources
- 144 MW of storage projects reserved, in progress, or completed
- 2-hour minimum runtime
- Incentive for “Advanced Energy Storage” of $1.46/W
- Key part of achieving CA Storage Mandate goals
  - Similar proposal at federal level

NY Proposed Tax Credit
- Personal income tax credit
- 25% of installed cost of storage system

Resiliency Rebate
- Consider system duration
  - Rebate based on kWh, or
  - Include 2-hour minimum runtime
- Step down incentive levels over time to reduce reliance on rebates as industry gains experience
Questions?

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DemandLogic: PV + Battery Solution

- Battery system installed in conjunction with new solar PV system
- SolarCity finances the combined system at no upfront cost to customer
- Customer saves on both energy ($ / kWh) and demand ($ / kW)

**12 PM**
Your system is at full production, charging your battery and reducing your need for utility power.

**5 PM**
As solar production decreases, the battery is intelligently discharged to reduce peak demand charges.

**10 PM**
You draw power from the utility company at night at lower off-peak demand rates.
DemandLogic Overview

- Solar PPA only addresses “energy” ($/kWh) charges from the grid
- Tariffs also have demand charges with varying $/kW costs
- Solar alone is unreliable for peak demand reduction due to intermittency
- Battery supplements solar to provide firm power and reduce peak demand
- **Customer pays SolarCity a lower $/kW than the utility demand charge – and saves money**
Example SCE Customer
(K-12)
Original Load Profile
Load Profile after DemandLogic
## K-12 – Economic Overview

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoided Energy Cost ($/kWh)</td>
<td>$0.145</td>
</tr>
<tr>
<td>Solar PPA Rate ($/kWh)</td>
<td>$0.125</td>
</tr>
<tr>
<td>Avoided Demand Cost ($/kWh)</td>
<td>$10.25</td>
</tr>
<tr>
<td>SolarCity Demand Rate ($/kWh)</td>
<td>$8.00</td>
</tr>
</tbody>
</table>

### Demand and Energy Overview

<table>
<thead>
<tr>
<th>Month</th>
<th>MAX Demand Reduction (kW)</th>
<th>Demand Payments to SolarCity</th>
<th>Utility Demand Cost Reduction</th>
<th>Solar Production (kWh)</th>
<th>Energy Payments to SolarCity</th>
<th>Utility Energy Cost Reduction</th>
<th>Total Project Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>98</td>
<td>$784</td>
<td>$1,005</td>
<td>26,238</td>
<td>$3,280</td>
<td>$3,805</td>
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<td>February</td>
<td>98</td>
<td>$784</td>
<td>$1,005</td>
<td>30,583</td>
<td>$3,823</td>
<td>$4,435</td>
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<td>March</td>
<td>98</td>
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<td>41,152</td>
<td>$5,144</td>
<td>$5,967</td>
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<td>98</td>
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<td>$1,005</td>
<td>29,347</td>
<td>$3,668</td>
<td>$4,255</td>
<td>$807</td>
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<td>May</td>
<td>98</td>
<td>$784</td>
<td>$1,005</td>
<td>55,983</td>
<td>$6,998</td>
<td>$8,117</td>
<td>$1,340</td>
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<td>98</td>
<td>$784</td>
<td>$1,005</td>
<td>55,847</td>
<td>$6,981</td>
<td>$8,098</td>
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<td>July</td>
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<td>54,156</td>
<td>$6,770</td>
<td>$7,853</td>
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<td>August</td>
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<td>52,782</td>
<td>$6,598</td>
<td>$7,653</td>
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<td>$6,940</td>
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<td>18,593</td>
<td>$2,324</td>
<td>$2,696</td>
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<tr>
<td><strong>Annual Totals</strong></td>
<td><strong>1,176</strong></td>
<td><strong>9,408</strong></td>
<td><strong>12,054</strong></td>
<td><strong>472,908</strong></td>
<td><strong>59,114</strong></td>
<td><strong>68,572</strong></td>
<td><strong>12,104</strong></td>
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</table>

**Savings from DemandLogic:** $2,646

**Savings from Solar:** $3,458
Example SDGE Customer (Industrial)
Industrial – Original Load Profile
Industrial – Load Profile with DemandLogic

Industrial - Load Profile After PV + DemandLogic


3,000 - 3,300 | 3,300 - 3,600 | 3,600 - 3,900
3,900 - 4,200 | 4,200 - 4,500

kW Demand
## Industrial – Economic Overview

<table>
<thead>
<tr>
<th>SolarCity Demand Rate ($/kWh)</th>
<th>$ 9.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoided Demand Cost ($/kWh)</td>
<td>$ 12.05</td>
</tr>
<tr>
<td>Solar PPA Rate ($/kWh)</td>
<td>$ 0.093</td>
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<tr>
<td>Avoided Energy Cost ($/kWh)</td>
<td>$ 0.100</td>
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</table>

<table>
<thead>
<tr>
<th>PV System Size (kW)</th>
<th>11,400</th>
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</thead>
<tbody>
<tr>
<td>Storage System Size (kW)</td>
<td>2,000</td>
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<tr>
<td>Storage System Size (kWh)</td>
<td>4,000</td>
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</table>

### Monthly Demand and Energy Savings Summary

<table>
<thead>
<tr>
<th>Month</th>
<th>MAX Demand Reduction (kW)</th>
<th>Demand Payments to SolarCity</th>
<th>Utility Demand Cost Reduction</th>
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<th>Utility Energy Cost Reduction</th>
<th>Total Project Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>1,208</td>
<td>$10,872</td>
<td>$14,556</td>
<td>922,820</td>
<td>$85,822</td>
<td>$92,282</td>
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<tr>
<td>February</td>
<td>1,208</td>
<td>$10,872</td>
<td>$14,556</td>
<td>1,075,625</td>
<td>$100,033</td>
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<td>$10,872</td>
<td>$14,556</td>
<td>1,447,352</td>
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<td>$10,872</td>
<td>$14,556</td>
<td>1,032,165</td>
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<td>May</td>
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<td>$10,872</td>
<td>$14,556</td>
<td>1,968,942</td>
<td>$183,112</td>
<td>$196,894</td>
<td>$17,467</td>
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<td>$10,872</td>
<td>$14,556</td>
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<td>$14,556</td>
<td>1,904,705</td>
<td>$177,138</td>
<td>$190,471</td>
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<tr>
<td>August</td>
<td>1,208</td>
<td>$10,872</td>
<td>$14,556</td>
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<td>$172,641</td>
<td>$185,636</td>
<td>$16,679</td>
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<tr>
<td>September</td>
<td>1,208</td>
<td>$10,872</td>
<td>$14,556</td>
<td>1,683,353</td>
<td>$156,552</td>
<td>$168,335</td>
<td>$15,468</td>
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<tr>
<td>October</td>
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<td>$10,872</td>
<td>$14,556</td>
<td>1,206,591</td>
<td>$112,213</td>
<td>$120,659</td>
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<td>1,208</td>
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<td>$14,556</td>
<td>653,927</td>
<td>$60,815</td>
<td>$65,393</td>
<td>$8,262</td>
</tr>
</tbody>
</table>

**Annual Totals**

- **MAX Demand Reduction (kW):** 14,496
- **Demand Payments to SolarCity:** 130,464
- **Utility Demand Cost Reduction:** $174,677
- **Solar Production (kWh):** 16,632,438
- **Energy Payments to SolarCity:** $1,546,817
- **Utility Energy Cost Reduction:** $1,663,244
- **Total Project Savings:** $160,540

*Savings from DemandLogic: $44,213*  
*Savings from Solar: $116,427*