SUCCESSFULLY INTEGRATING DISTRIBUTED ENERGY RESOURCES

NYSERDA’S ON-SITE RESILIENT POWER CONFERENCE

JUNE 27, 2019

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RESEARCH DIRECTOR
WHY ARE WE HERE?

- Solar
- Storage
- Controls/Analytics/Operations
- CHP
- DR
AGENDA

Traditional DER Silos, the Goal of Integrated DER, and Customer Needs
Barriers to Integrated DER Implementation
Software Platforms Can Help Overcome the Barriers
New DER Business Models
TRADITIONAL DER SILOS
Which will be the most **prevalent** DER in terms of capacity by 2025?

- Solar PV
- Generator sets (e.g., diesel or natural gas-fueled)
- Energy storage
- Microgrids
- Vehicle electrification & charging services
- Demand response
- Energy efficiency

Which DER will be the most **useful** to utility operations by 2025?

- Solar PV
- Generator sets (e.g., diesel or natural gas-fueled)
- Energy storage
- Microgrids
- Vehicle electrification & charging services
- Demand response
- Energy efficiency

C&I customers (including Multi-Family) seek cost-effective, customized, and comprehensive energy solutions that can guarantee energy use reduction and savings without capital expenditures or impact to their day-to-day operations.

### Emerging Trends for large C&I customers:
- Move to lower carbon energy and DER
  - Onsite distributed generation, solar PV
  - Demand response, energy storage, microgrids

Many evolutions are taking place in the current C&I energy services market on both the supply side and the demand side.

<table>
<thead>
<tr>
<th>DELIVER COST REDUCTIONS</th>
<th>IMPROVE SUPPLY QUALITY</th>
<th>IMPROVE SUSTAINABILITY</th>
<th>DRIVE SCALABLE SOLUTIONS</th>
<th>SIMPLIFY OPERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>C&amp;I customers under pressure to reduce total energy expenditures with minimal capital expenditures (i.e. financing flexibility)</td>
<td>An increased focus on resiliency and redundancy of supply requires dependable solutions</td>
<td>An increased focus on sustainability and regulatory compliance (e.g. renewables, GHG) requires a comprehensive energy strategy</td>
<td>Large customers seek scalable enterprise-wide solutions to monitor, benchmark, and optimize energy costs</td>
<td>Corporate energy management functions have become complex and customers seek to simplify operations and refocus on core business</td>
</tr>
</tbody>
</table>
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Traditional DER Silos and the Goal of Integrated DER

Barriers to Integrated DER Implementation

Software Platforms Can Help Overcome the Barriers

New DER Business Models
DER SILOS: VENDORS, PLATFORMS, AND BUYERS

- Distributed Generation
- Distributed Storage
- Microgrids
- Solar
- Demand Response
- Energy Efficiency
- Electric Vehicles
## DER Finance Risk by Instrument Class

<table>
<thead>
<tr>
<th>FINANCE INSTRUMENT CLASS</th>
<th>DESCRIPTION</th>
<th>RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Lease/Loans</td>
<td>Fixed payments for use or purchase of system, often with bundled O&amp;M and performance guarantees</td>
<td>🟢</td>
</tr>
<tr>
<td>Power Purchase Agreement</td>
<td>Fixed service payments based only on actual kilowatt-hours of onsite energy supply provided</td>
<td>💚</td>
</tr>
<tr>
<td>Efficiency Savings Agreement</td>
<td>Fixed service payments based only on actual avoided kilowatt-hours of electricity or kilowatts of demand</td>
<td>💚</td>
</tr>
<tr>
<td>Shared Savings Agreement</td>
<td>Customer savings and DER deployment financed from savings</td>
<td>🟢</td>
</tr>
<tr>
<td>‘As a Service’ Subscription</td>
<td>A fixed subscription contract for the deployment of software, technology, and services</td>
<td>🟢</td>
</tr>
</tbody>
</table>

### LEGEND

- **High Risk**: Requires complex pre-project analytics and M&V to manage savings performance risks
- **Moderate Risk**: Uses mature pre-project analytics and proven M&V to manage saving performance risks
- **Low Risk**: Customer credit risk; no pre-project analytics or ongoing M&V required to manage savings risks
DER PROJECT TRANSACTION OPTIONS

### New DER Solutions

<table>
<thead>
<tr>
<th>Portfolio Advisory Services</th>
<th>Energy Efficiency &amp; Building Optimization</th>
<th>Offsite Energy Supply</th>
<th>Onsite Energy Supply</th>
<th>Load Management &amp; Optimization</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Strategic Guidance</td>
<td>• Lighting</td>
<td>• Retail choice procurement</td>
<td>• Onsite solar PV</td>
<td>• DR Capacity Market Participation</td>
</tr>
<tr>
<td>• Portfolio Benchmarking</td>
<td>• C&amp;I ECM Retrofits</td>
<td>• Offsite LFGE procurement</td>
<td>• Combined heat and power (CHP)</td>
<td>• Energy storage, Microgrids, EV charging</td>
</tr>
<tr>
<td>• DER technology feasibility, real-time EM&amp;V</td>
<td>• Industrial Energy Management</td>
<td>• Large offsite wind, solar procurement</td>
<td>• Onsite diesel &amp; natural gas gensets</td>
<td>• Intelligent BEMs &amp; BACs</td>
</tr>
<tr>
<td>• DER Financing models</td>
<td>• Building Optimization &amp; Retrocommissioning</td>
<td></td>
<td>• Microturbines, Fuel cells</td>
<td></td>
</tr>
</tbody>
</table>

### Range of Transaction Options

- Fee for Service (upfront payment)
- Bundled Financed Project Transaction
- Equipment Purchase (+/- O&M)
- Energy Savings Performance Contract
- Lighting as a Service Agreement
- Energy Savings Agreement
- Building Optimization as a Service
- Retail choice procurement
- Large offsite wind or solar PPA
- LFGE procurement agreement
- Equipment Purchase (+/- O&M)
- Solar PPA
- Solar + Storage PPA
- Equipment Lease or Loan
- Equipment Purchase (+/- O&M)
- DR Capacity Agreement
- Equipment Lease or Loan
- Energy Storage Demand Savings Agreement
- Intelligent Buildings Energy Management as a Service
The deployment of these new portfolio-wide solutions across a broad set of financing transaction options to complement fee for service options enables new business models.

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Transaction Financing</th>
<th>Business Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Advisory Solutions</td>
<td>Equipment Leases/Loans</td>
<td>Turnkey, Portfolio-wide EaaS Agreement</td>
</tr>
<tr>
<td>Onsite Energy Supply</td>
<td>PPAs</td>
<td>Managed Energy Services Agreement</td>
</tr>
<tr>
<td>Offsite Energy Supply</td>
<td>Efficiency Savings Agreements</td>
<td>Asset Monetization (Sale/Leaseback)</td>
</tr>
<tr>
<td>Energy Efficiency &amp; Building Optimization</td>
<td>Shared Savings Agreements</td>
<td>Public Private Partnership</td>
</tr>
<tr>
<td>Load Management &amp; Optimization</td>
<td>EaaS Subscriptions</td>
<td>Integrated Facilities + Energy Management Agreement</td>
</tr>
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</table>
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Traditional DER Silos and the Goal of Integrated DER
Barriers to Integrated DER Implementation
Software Platforms Can Help Overcome Barriers
New DER Business Models
Digital technologies have evolved from single points of control to intelligent platforms that allow optimization across buildings, campuses, and enterprise portfolios.

**Approach**

- **POINT**
- **SYSTEM**
- **PLATFORM**

**Business Impact**

- Energy Efficiency and operational improvement in silos
- Cohesive management strategies across systems for building-wide optimization
- Facilities become business assets, integrating corporate-wide DER optimization across portfolios and campuses

**Technology Foundation**

- Automation and Controls
- Analytics
- IoT Integrated Management

**Software Platform Needs**

- Pre-Build Business Analytics
  - Estimate and Demonstrate Value
  - Calculate System Sizes
- Control and Operate Installed Systems
- Optimize System Performance

Integrated site-level software analytics are needed to deliver improved customer savings, lower cost M&V, and support DER project finance.
NEW SOFTWARE PLATFORM CAPABILITIES NEEDED TO SUPPORT INTEGRATED DER PROJECTS

<table>
<thead>
<tr>
<th>DER Software Platform Needs</th>
<th>DER PROJECT ANALYTICS</th>
<th>DER SYSTEM OPERATION</th>
<th>DER SYSTEM OPTIMIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUSINESS ANALYTICS</td>
<td>Predictive project analysis across multiple DER across a portfolio of sites</td>
<td>Interact with load, power markets, energy efficiency, and DR signals across a portfolio</td>
<td>Real-time optimization based on external inputs (weather, power markets)</td>
</tr>
<tr>
<td>Estimate and Demonstrate Value</td>
<td>Predict energy supply &amp; power market participation opportunities</td>
<td>Interact with battery energy storage technologies</td>
<td>Integrated, real-time predictive optimization algorithms across a portfolio</td>
</tr>
<tr>
<td>Calculate System Sizes</td>
<td>Analyze onsite supply, energy efficiency, storage, DR deployment scenarios</td>
<td>Interact with onsite supply and EV charging infrastructure</td>
<td>Integrated, real-time battery warranty status and/or upgrade forecasts</td>
</tr>
<tr>
<td>Control and Operate Installed Systems</td>
<td>Analyze building load, weather, net metering and tariff scenarios</td>
<td>Interact with building automation systems and BEMs</td>
<td></td>
</tr>
<tr>
<td>Optimize System Performance</td>
<td></td>
<td></td>
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NEW BUSINESS MODELS WILL REQUIRE NEW VENDOR CAPABILITIES

Vendors will need to develop new in-house or partnership capabilities across the full spectrum of portfolio-wide solution delivery options.

Traditional Vendor Single Site Project Delivery Capabilities
- Energy Audit
- Design & Engineering
- Equipment
- Installation
- Financing
- O&M
- Facilities Management
- Traditional Energy Sales

New Vendor DER Portfolio-wide Delivery Capabilities
- Portfolio Benchmarking and DER Technology Expertise
- DER Project Development
- DER Equipment Supply
- DER Engineering, Procurement, and Construction
- Turnkey DER and Business Model Financing & Investment Expertise
- Integrated DER & Intelligent Building O&M Capabilities
- Integrated Energy & Intelligent Building Facilities Management
- Onsite and Offsite Energy Procurement
DER PROJECT DELIVERY VALUE CHAIN

Each step in the value chain is critical to the successful implementation of the project, and each step presents its own unique set of challenges and financial risks that DER financiers must assess and manage.
# EVOLUTION OF DER BUSINESS MODELS

<table>
<thead>
<tr>
<th>Business Model</th>
<th>PRODUCT-ORIENTED</th>
<th>SUBSCRIPTION-BASED</th>
<th>SOLUTIONS PROVIDER</th>
<th>NETWORK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Examples</strong></td>
<td>HVAC Lighting</td>
<td>BEMS SaaS offerings</td>
<td>Software plus IoT, bundled services</td>
<td>Building-to-grid, integrated DER</td>
</tr>
<tr>
<td><strong>Approach</strong></td>
<td>Point</td>
<td>System</td>
<td>Platform</td>
<td>Ecosystem</td>
</tr>
<tr>
<td><strong>Business Impact</strong></td>
<td>Efficiency and operational improvements in silos</td>
<td>Cohesive management strategies for buildingwide optimization</td>
<td>Facilities become flexible business assets that meet core business challenges of specific customers</td>
<td>Two-way, leveraged value across and between the network platforms</td>
</tr>
<tr>
<td><strong>Technology Foundation</strong></td>
<td>Automation and controls</td>
<td>Analytics</td>
<td>Integrated management and services</td>
<td>Network communications</td>
</tr>
<tr>
<td><strong>Pre-2005</strong></td>
<td>2005-2012</td>
<td></td>
<td>2012-2018+</td>
<td></td>
</tr>
</tbody>
</table>
A MOVE TOWARDS ORCHESTRATED DER CREATES VENDOR VALUE

Delivery of business model options can drive improved customer retention and improved margins due to long term, higher margin recurring revenue service contracts towards more digitalized platform solutions.