Selecting Deferral Projects, DER Operational Requirements, and Smart Inverters to Meet Grid Services

March 26, 2019
Distribution Investment Deferral Process

Annual capacity planning within the Distribution Planning Process (DPP) (Sub trans lines, substation, circuit)

Traditional wires solutions identified

September 1
Distribution Deferral Opportunity Report

Planned Investments
Deferral Screens
• Technical
• Timing

Candidate Deferrals

Prioritization Metrics
• Cost Effectiveness
• Forecast Certainty
• Market Assessment

June 1
Grid Needs Assessment

Candidate Deferral Shortlist (Prioritized)

Q3
External Stakeholder Review and Advisory Process

Q4
Public Utilities Commission Approval Process (Advice Letters)

Q1
Launch Competitive Solicitation

Energy for What’s Ahead™
Initial Deferral Screens

Projects in SCE’s Planned Investments list will be considered Candidate Deferral opportunities if they satisfy the following deferral screens:

**Technical Screen**
- Identifies whether a DER solution can provide the distribution service(s) required: capacity, reactive power (VAR), voltage, reliability (back-tie), resiliency (microgrid)

**Timing Screen**
- Ensures sufficient time to evaluate, procure, deploy, and begin commercial operation of a DER solution prior to the projected need (4 – 5 years in the future)
- Consider timing of Solicitation, Interconnection Processes, Commission Approvals, Contingency Plans in case DER process unsuccessful
### SCE 2018 Prioritization Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>High Priority</th>
<th>Low Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost Effectiveness</strong></td>
<td>Higher cost-per-MWh of traditional capital projects</td>
<td>Lower cost-per-MWh of traditional capital projects</td>
</tr>
</tbody>
</table>
| **Forecast Certainty** | • **Nearer-term** needs  
• **Less** historical volatility with load growth driving project need and required in-service date | • **Longer-term** needs  
• **More** historical volatility with load growth driving project need and required in-service date |
| **Market Assessment**  | Integration (Hosting) Capacity within project footprint provides **sufficient opportunity** to defer need | Integration (Hosting) Capacity within project footprint is **insufficient** to defer need |

- **Cost Effectiveness** \((CE) = \frac{\text{Cost of Traditional Solution}}{\text{Maximum 10 Year Energy Need}}\)

- **Forecast Certainty** seeks to evaluate the volatility of the driver, the scope of the affected assets, and the timeframe of the needs

- **Market Assessment** reviewed distribution feeders and substations with higher ability to accept generation will be considered better candidates while those with less ability to accept increased generation will be ranked lower
Smart Inverter Whitepaper
The structure of the white paper outlines the following six (6) key messages

1. Location and volume of Smart Inverter-enabled DERs on the distribution grid is important
   - For most distribution grid services, the distribution system will require location-specific services to address specific system constraints or needs. Significant distribution service needs that require investment do not exist everywhere.

2. Timing of Smart Inverter-enabled DER response should align with distribution grid need
   - The distribution system has dynamic needs that can occur at various times within a day, month, or season which customer-sited DER is not currently coordinated.

3. Availability and assurance of Smart Inverter-enabled DERs to provide grid response is needed
   - For Smart Inverter-enabled DERs to successfully provide distribution services, they must be readily available to provide distribution services with a comparable level of certainty as traditional utility “wires” infrastructure.
The structure of the white paper outlines the following six (6) key messages

4. Coordination between the utility and DERs or DER aggregators is important
   • Smart Inverter-enabled DERs and their data must be visible and available to the utility and/or aggregator for these resources to be fully utilized by the Distribution Operator.
   • Standardization is necessary between utilities and DER providers to ensure instructions are received, interpreted and executed consistently by different aggregators.

5. Grid modernization initiatives are necessary for Smart Inverter-enabled DERs to provide distribution grid services beyond autonomous Smart Inverter functions
   • Utility operational capabilities and systems that automatically analyze grid conditions, determine optimized solutions, and communicate signals to aggregators and DER assets are needed to enhance the value of DERs to the grid and required to utilize DERs for distribution reliability
The structure of the white paper outlines the following six (6) key messages:

6. Unified standards, comprehensive testing and certification, and training for DER installers are needed to ensure consistent Smart Inverter operation, communication and cybersecurity:

- Separate standards for certifying and testing different Smart Inverter functions have created additional complexity for manufacturers in getting Rule 21-compliant SIs to market and for Nationally Recognized Testing Laboratories (NRTLs) to certify SIs.

- Manufacturers should standardize Smart Inverter feature names and user interfaces and improve documentation to facilitate proper configuration during field installation.

- Cybersecurity standards must be adopted by the industry and integrated into relevant communication standards for Smart Inverter interconnection. Existing methods to ensure end-to-end cybersecurity between the utility and Smart Inverter-enabled DERs need significant improvement.

Enabling Smart Inverters for Distribution Grid Services:
Underlying Technical and Operational Requirements
Aerial View: Newbury 66/16kV Substation & Circuit(s)
### DER Attribute Requirements: Newbury 66/16kV

#### Hooligan Requirement(s)

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity (MW)</th>
<th>Energy Need (MWH)</th>
<th>Time of Year</th>
<th>Monthly Frequency</th>
<th>Yearly Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>1.68</td>
<td>4.92</td>
<td>Summer</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>2021</td>
<td>1.79</td>
<td>5.35</td>
<td>Summer</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>2022</td>
<td>2.00</td>
<td>6.32</td>
<td>Summer</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>2023</td>
<td>2.21</td>
<td>7.65</td>
<td>Summer</td>
<td>15</td>
<td>40</td>
</tr>
<tr>
<td>2024</td>
<td>2.42</td>
<td>9.07</td>
<td>Summer</td>
<td>15</td>
<td>40</td>
</tr>
<tr>
<td>2025</td>
<td>2.63</td>
<td>10.64</td>
<td>Summer</td>
<td>15</td>
<td>40</td>
</tr>
<tr>
<td>2026</td>
<td>2.84</td>
<td>12.22</td>
<td>Summer</td>
<td>15</td>
<td>40</td>
</tr>
</tbody>
</table>

- One (1) new circuit out of Newbury 66/16 Substation is planned to relieve three (3) circuits out of Newbury 66/16: Belpac 16kV, Hooligan 16kV, and Intrepid 16kV.
**LEGEND**

Interconnection Priority Based on Conductor Size
- Green: 1st
- Yellow: 2nd
- Orange: 3rd
- Red: 4th

**Disclaimer:**
Interconnection Priority is relative to the circuit. This map does not identify OH conductors or UG cables. This map does not guarantee that additional distribution upgrades are not be needed.

Newbury Substation

Minimum Interconnection Starting Point: Wendy Dr. and Delacoso Ave.
AMS – Company Description

AMS is a SaaS company with an A.I. software platform that uses deep learning algorithms to enable optimized trading of complex energy assets in wholesale energy markets.

Founded
2013

Headquarters
San Francisco

Employees
80

Equity Capital Raised
$52.7 M

Project Capital
$200 M

The AMS Platform can optimize hardware from any manufacturer owned by any party.
SCE Grid Modernization Project
Groundbreaking 2.2 GW Modernization Project

1. Closure of San Onofre Plant stressing grid
2. AMS selected out of 3,000 participants for BTM
3. AMS focused on providing fleet optimization and grid services

Local Capacity Requirement (LCR)
1. Instant, remote, dispatchable energy to SCE
2. AMS awarded 50 MW LCR contract

© 2019 AMS, Inc. | Proprietary and Confidential
Distributed energy resource platform that combines advanced analytics with continuous optimization, delivering maximum financial performance from distributed energy resource portfolios, from both retail revenue streams and grid services.
AMS’ NOC and NOC operators use best-in-class Armada™ software to optimize and monitor assets 24/7

- Early detection of issues and escalation protocols
- Responds to event-based utility programs
- Monitors and ensures optimal DCM performance
- Remotely controls batteries and conducts manual overrides
- Automatically creates service tickets as needed
AMS VPP Shatters World Record – Delivering 2 GWh of Grid Services

AMS’ virtual power plant project in Southern California has hit major milestone, breaking an industry record and delivering over 2 GWh of grid services to the California Independent System Operator (CAISO) in its first year of operation.

AMS will continue building out the virtual power plant through the end of 2019 for a total portfolio of:
- 27 Customers
- 91 Sites
- Total 62 MW / 352 MWh
LCR Lessons Learned

➢ **Things that worked well**
  - Very robust market response to utility solicitation
  - Market participants were very engaged throughout the process
  - Structure of solicitation resulted in Innovative product offerings
  - Although time consuming, flexibility to negotiate one-off contracts was critical to the success

➢ **Challenges**
  - Lack of clarity on how the new products would be treated under existing tariffs or market rules
    ▶ Requires significant collaboration between supplier and utility (and CAISO)
  - Lack of clarity on how the existing interconnection process would work for energy storage
    ▶ Requires close coordination between procurement team and T&D employees working on interconnections
  - Process created customer confusion with many developers offering competing solutions
    ▶ Requires significant upfront customer education and perhaps a more customer friendly procurement process
  - Lack of transparency on where relative value of asset on the grid at one location vs another
    ▶ Suggest providing a heat map or LNBA up front so developers know where to focus their effort
  - Accounting concerns created challenges for the utility
    ▶ Spend time up front thinking about contract implications and draft contracts that avoid lease treatment
Con Edison Distribution Planning and the use of NWS

March 26th, 2019
Overview
Consolidated Edison (NYC + Westchester)

Features of NY regulation:
- Focus on Transmission and Distribution
  - Divested generation in mid-1990’s
- Collaborative process
- Reforming the Energy Vision proceeding is at the forefront of the evolving industry

CECONY
- 3.4 million electric customers
- 1.1 million gas customers
- 1,700 steam customers

O&R
- 0.3 million electric customers
- 0.1 million gas customers
2018 DSIP Overview – Steady Progress

Highlighting achievements and planning for future success

**Significant DER growth**
- Doubling of solar since Jan 2016 with 650 MWAC expected by 2023
- Ramp-up of storage, EE, CHP
- **50 MW NWS + > 100 MW IN RFPs**

**Grid modernization**
- Phased investment in foundational and enabling technologies
- Evolution of capabilities in line with grid and market needs

**Implementation of DSP capabilities**
- capacity maps
- Improved interconnection process and incorporation of storage
- More granular load/DER forecasting
- **Formalized NW identification**
- More detailed and comprehensive hosting

**Expanded data sharing**
- Implementation of GBC Phase I with Phase II by end of 2018
- Published 8,760 load forecasts
- Better data visualization and downloadable files

**Enhanced customer engagement**
- AMI-enabled tools to educate and engage customers
- Demonstration projects to test new outreach strategies

**Continued market enablement**
- **More NW solicitations**
- Access to VDER and innovative pricing
- Coordination with NYISO to enable value stacking
- EV and storage facilitation
CECONY Electric System Historical Peak Demand

- **Oil Embargo (1973)**
- **NYC Fiscal Crisis (1975)**
- **Iran-Iraq War (1979)**
- **Stock Market Crash (1987)**
- **9/11 (2001)**
- **Declines (2009-2012; 2016)**
- **The Great Recession (2008-2009)**
- **Beginning of CECONY Energy Efficiency Portfolio Standards (2009)**

Megawatts

--- | --- | --- | --- | --- | --- | --- | --- | --- | ---
7,000 | 8,000 | 9,000 | 10,000 | 11,000 | 12,000 | 13,000 | 14,000
NWS is another tool to provide granular load following optionality – ESPECIALLY IF LOAD DECREASES

Acceptable for consistent growth

Provides optionality

...Other benefits of NWS may include customer contribution and capacity reductions that migrate upstream
NWS as both a customer choice and a utility tool is another resource to help defer, complement or avoid traditional builds.

<table>
<thead>
<tr>
<th>Traditional Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Station</td>
</tr>
<tr>
<td>New Substation</td>
</tr>
<tr>
<td>Add or Upgrade components (transformers)</td>
</tr>
<tr>
<td>Reconfigure NW (existing headroom)</td>
</tr>
<tr>
<td>Increase equipment cooling (water spray)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feeder Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Feeder</td>
</tr>
<tr>
<td>De-load feeder</td>
</tr>
<tr>
<td>Upgrade section(s)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>New or Upgrade Transformer(s)</td>
</tr>
<tr>
<td>Reinforce mains</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>REV/DER Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility Sided Solutions</td>
</tr>
<tr>
<td>Energy Storage</td>
</tr>
<tr>
<td>Voltage/VAR Optimization</td>
</tr>
<tr>
<td>Microgrids</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Customer Sided Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Response</td>
</tr>
<tr>
<td>Energy Efficiency</td>
</tr>
<tr>
<td>CHP</td>
</tr>
<tr>
<td>Solar &amp; Wind</td>
</tr>
<tr>
<td>Energy Storage</td>
</tr>
</tbody>
</table>
Suitability Criteria for NWS

NWA suitability criteria lays solid foundation for the success of NWA solicitation and BCA evaluation.
Suitability Criteria for NWAs

NWA suitability criteria lays solid foundation for the success of NWA solicitation and BCA evaluation.
Target NWS for System Expansion at Substation

Source: Con Edison Distributed System Implementation Plan (DSIP), June 30, 2016
Suitability Criteria for NWAs

NWA suitability criteria lays solid foundation for the success of NWA solicitation and BCA evaluation.
Non-Wires Solutions (NWS)

- Stakeholder collaboration provided suitability criteria
- NYS Benefit Cost Analysis (BCA) handbook describes BCA methodology
- Con Edison has identified and put out RFP for 7 projects in addition to BQDM and BQDM extension
Suitability Criteria for NWAs

NWA suitability criteria lays solid foundation for the success of NWA solicitation and BCA evaluation.
## Current Opportunities

<table>
<thead>
<tr>
<th>Projects</th>
<th>Current Status</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Feeder Relief - Chelsea</td>
<td>RFP in development</td>
<td>Project Description</td>
</tr>
<tr>
<td>Parkchester No. 1 Cooling Project</td>
<td>RFP in development</td>
<td>Project Description</td>
</tr>
<tr>
<td>Newtown Transformer Installation Project</td>
<td>No longer accepting proposals</td>
<td>RFP</td>
</tr>
<tr>
<td>Primary Feeder Relief - Williamsburg</td>
<td>No longer accepting proposals</td>
<td>RFP</td>
</tr>
<tr>
<td>Water Street Cooling Project</td>
<td>No longer accepting proposals</td>
<td>RFP</td>
</tr>
<tr>
<td>Plymouth Street Cooling Project</td>
<td>No longer accepting proposals</td>
<td>RFP</td>
</tr>
<tr>
<td>Primary Feeder Relief - Columbus Circle</td>
<td>No longer accepting proposals</td>
<td>RFP</td>
</tr>
<tr>
<td>Load Transfer W 42st</td>
<td>No longer accepting proposals</td>
<td>RFP</td>
</tr>
</tbody>
</table>
Hosting Capacity Maps Also Display NWS

NWS Layer

Non-Wires Solutions Network

Borough: Brooklyn
Network: Williamsburg

Non-Wires Solutions Project
Water Street Cooling Project
Solicitation status: RFP closed
Needed By: 2019-2027
Project Description

Zoom to
BQDM: System Expansion Project: Brooklyn-Queens Demand Management Program

Deferral of $1 billion in traditional network upgrades with distributed solutions

- Identify Target Area
- Identify load curve (BQDM was a long duration, night peaking network)
- For substations, the effective DER contribution can be located anywhere within the footprint
Lessons Learned from Solicitations

- Bidder screening
- Contractual milestones
- Contractual incentives/penalties
- Descriptive (but not prescriptive) RFP
- Measurement and Verification
Suitability Criteria for NWAs

NWA suitability criteria lays solid foundation for the success of NWA solicitation and BCA evaluation.
BQDM 2018 ILLUSTRATIVE PORTFOLIO
Summer 2018 Outlook

BQDM Program 2018 Portfolio

Load Relief (MW)

Hour Ending (Design Peak Day)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Thermostat Anticipated
Thermal Storage Anticipated
Battery Storage Anticipated
CHP Anticipated
Utility Solar Anticipated
Solar Anticipated
Utility Fuel Cell Anticipated
Fuel Cell Anticipated
Energy Efficiency Anticipated
DMP Committed
Thermostat Committed
CVO Committed
Utility Storage Committed
Battery Storage Committed
DR Committed
CHP Committed
Solar Committed
Fuel Cell Committed
Energy Efficiency Committed
Target (High Case)
Committed (Low Case)
TOTAL 2018 NEED
Portfolio Development focuses on Societal Benefits while considering bill impact

- New York State Benefit Cost Analysis Handbook
  - Specifies SCT approach
  - Identifies benefits including carbon (~$24/MWh plus escalation)

- DER offerings are significantly varied
  - Energy Efficiency can include adders to existing programs
  - Resources like generation may have carbon benefits plus energy benefits

- Multiple portfolio approaches are reviewed
Closing thoughts and next Steps

• Integrating NWS into the planning process has actually been the easiest step

• Providing the proper incentives to everyone is key
  – Regulated asset treatment for NWS (earn rate base)
  – Shared savings 70% customer/30% utility
  – Targeted customers benefit from offset capital costs + O&M savings
  – All customers benefit from deferred system needs

• We will continue developing our NWS approach
  – Water Street and Plymouth Street has 2019 need
  – Other NWS discussed in rate case testimony
“The electric industry is in a period of momentous change. The innovative potential of the digital economy has not yet been accommodated within the electric distribution system. Information technology, electronic controls, distributed generation, and energy storage are advancing faster than the ability of utilities and regulators to adopt them, or to adapt to them. At the same time, electricity demands of the digital economy are increasingly expressed in terms of reliability, choice, value, and security.”

Opening Paragraph:
ORDER ADOPTING REGULATORY POLICY FRAMEWORK AND IMPLEMENTATION PLAN
New York Public Service Commission- February 26, 2015
Locational Value of Storage

Centralized

Substation

Community

Commercial & Industrial

Storage Value

Centralized

Distributed

VALUE PROPOSITION:
- Reduces Transmission Congestion
- Substation Overloading
- Power Quality

VALUE PROPOSITION:
- Reduces Distribution Congestion
- Conductor Upgrades
- Support Distributed Generation
- Mitigates Outages

VALUE PROPOSITION:
- Leverage TOU Pricing
- Demand Charge Reduction
- Demand Response
- Firms Distributed Solar
- Critical Load support

VALUE PROPOSITION:
- Ramping
- Spinning Reserve
- Supports Wind Farm Integration
- Frequency Control
- Black Start
PSC-Con Edison Performance Based Rates

Company Financial Motivations
Earnings Adjustment Mechanisms

Specific Programs
- BQDM-Brooklyn Queens Demand Management
- NWA-Non Wire Alternatives
- DMP II- Demand Management Program.

Programmatic EAMs:
- Incentives based on Company achievement
- More direct Company influence

Outcome-Based EAMs:
- Incentives based on territory-wide outcomes
- Less direct Company influence
Trapped Value in Peak Demand

“If, for example, the 100 hours of greatest peak demand were flattened, long term avoided capacity and energy savings would range between $1.2 billion and $1.7 billion per year.”
-NY PSC Order Adopting Regulatory Policy Framework and Implementation Plan [REV], 2/26/15

NY ISO Load Duration Curves, 2011 - 2013

Top 100 hours = 3GW

Cost of NYS Peak Demand

<table>
<thead>
<tr>
<th>Year</th>
<th>Low Peak Load (GW)</th>
<th>High Peak Load (GW)</th>
<th>Number of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>22.9</td>
<td>28.8</td>
<td>50</td>
</tr>
<tr>
<td>2012</td>
<td>22.4</td>
<td>28.8</td>
<td>50</td>
</tr>
<tr>
<td>2013</td>
<td>24.0</td>
<td>30.0</td>
<td>50</td>
</tr>
</tbody>
</table>

Low Average @ $1.2 billion
- $400 / kW
- $0.40 / kWh

High Average @ $1.7 billion
- $567 / kW
- $0.57 / kWh

Source: 2013 NYISO DMM Report, Potentials Economics.
Time Variable Distribution “Cost”

Marginal Line losses are exponential and are dynamic based on the $I^2R$ Losses. Average losses are measured over an extended time period overlook the benefits of load reduction at Peak periods.

Graph Courtesy of the Regulatory Assistance Project
Con Ed Brooklyn Locational Peak Periods

- Borough Hall, Bay Ridge & Park Slope
  2 PM to 6 PM

- Ocean Parkway
  4 PM to 8 PM

- Williamsburg, Prospect Park, Flatbush, Sheepshead Bay, Brighton Beach
  7 PM to 11 PM

- Ridgewood & Crown Heights
  BQDM Non Wires Solution
  8 to 12 PM
Rate Evolution

We can’t build a digital power grid based on an analog rate design.
## A Move to Daily Demand Charges

Convert from a monthly structure to a daily structure with TOU Locational value

<table>
<thead>
<tr>
<th><strong>Typical Commercial Utility Bill</strong></th>
<th><strong>Standby - Con Edison Rider Q</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply - Flat Rate</strong></td>
<td><strong>Supply - Day-Ahead Hourly</strong></td>
</tr>
<tr>
<td>€/kWH</td>
<td>€/kWH/H</td>
</tr>
<tr>
<td><strong>Delivery</strong></td>
<td><strong>Delivery</strong></td>
</tr>
<tr>
<td><strong>Customer Charge (Fixed)</strong></td>
<td><strong>Customer Charge (Fixed)</strong></td>
</tr>
<tr>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td><strong>Energy Charge</strong></td>
<td><strong>Contract Demand</strong></td>
</tr>
<tr>
<td>€/kWH</td>
<td>$/kW</td>
</tr>
<tr>
<td><strong>Demand Charge</strong></td>
<td><strong>Demand Charge</strong></td>
</tr>
<tr>
<td>$/kW (based on highest peak in the billing period)</td>
<td>$/kW Daily Period 8 am to 10 PM (M-F) Locational 4 hour period based on Substation Peak</td>
</tr>
<tr>
<td><strong>Monthly Adjustments</strong></td>
<td><strong>Monthly Adjustments</strong></td>
</tr>
<tr>
<td>€/kWH</td>
<td>€/kWH</td>
</tr>
<tr>
<td><strong>Taxes</strong></td>
<td><strong>Taxes</strong></td>
</tr>
<tr>
<td>$</td>
<td>$</td>
</tr>
</tbody>
</table>
Load shaping for improving grid performance and lower energy costs
BQDM Load Reduction

Demand Profile

Preset Range: Custom range...

Start Date: 7/2/18
End Date: 7/4/18

Apply Range

Display times in:
Site time zone (America/New_York)

Storage, Solar, Fuel Cell
Load Shaping Example-
Briar Hill, Bronx NY

Blue Line- Load as seen by the utility
Yellow Shade- Load Reduced by solar
Green Shade-
Below the line, storage of excess solar
Above the line, load reduced by Storage

Standby Daily
Demand pricing
8 am to 10 pm
Thank you

Doug Staker
Vice President, Utility Business Development
Flexibility Solutions
EnerNOC, an Enel Group Company
Hawaii Energy Connection Demonstration Phase Project for Provision of Grid Services Using Demand-Side Resources

IGP Soft Launch Presentation
March 26th 2019

Presented by:
Chris DeBone
Managing Partner
Hawaii Energy Connection
Project overview

The purpose of the Demonstration Projects was to identify and mitigate potential technology, operational, and market risks associated with the delivery of the specified grid services.

To help the Companies and Respondents better understand the true costs associated with the delivery of the grid services via the aggregation of customer-sited devices.

There were 3 grid services targeted for these demonstration projects:

1) Regulation
2) Fast Frequency Response (FFR)
3) Capacity / Load Shift
Hawaii Energy Connection (HEC) offered systems in all 3 project areas utilizing E-Gear’s Energy Management Controller (EMC) and Battery Energy Storage System (BESS) in the residential segment.

### Regulating Reserves Participant Locations

<table>
<thead>
<tr>
<th>Location</th>
<th>Tariff</th>
<th>Power Capacity</th>
<th>Energy Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aiea, Oahu</td>
<td>Net Energy Metering</td>
<td>5 kWh</td>
<td>12.8 kWh</td>
</tr>
<tr>
<td>Kaneohe, Oahu</td>
<td>Customer Grid Supply</td>
<td>10 kW Total</td>
<td>32 kWh Total</td>
</tr>
</tbody>
</table>

### FFR Participant Locations

<table>
<thead>
<tr>
<th>Location</th>
<th>Tariff</th>
<th>Power Capacity</th>
<th>Energy Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaneohe, Oahu</td>
<td>Customer Grid Supply</td>
<td>5 kW</td>
<td>12.8 kWh</td>
</tr>
<tr>
<td>Ewa Beach, Oahu</td>
<td>Customer Grid Supply</td>
<td>5 kW</td>
<td>19.2 kWh</td>
</tr>
</tbody>
</table>

10 kW Total 32 kWh Total

### Capacity / Load Shift Participant Locations

<table>
<thead>
<tr>
<th>Location</th>
<th>Tariff</th>
<th>Power Capacity</th>
<th>Energy Capacity</th>
</tr>
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<tbody>
<tr>
<td>Honolulu, Oahu</td>
<td>Net Energy Metering</td>
<td>2.5 kW</td>
<td>12.8 kWh</td>
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<tr>
<td>Kailua-Kona, Hawaii</td>
<td>Customer Grid Supply</td>
<td>2.5 kW</td>
<td>19.2 kWh</td>
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<tr>
<td>Ewa Beach, Oahu</td>
<td>Customer Grid Supply</td>
<td>2.5 kW</td>
<td>19.2 kWh</td>
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<tr>
<td>Kaneohe, Oahu</td>
<td>Customer Self Supply</td>
<td>2.5 kW</td>
<td>19.2 kWh</td>
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<tr>
<td>Honolulu, Oahu</td>
<td>Customer Self Supply</td>
<td>2.5 kW</td>
<td>19.2 kWh</td>
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<tr>
<td>Honolulu, Oahu</td>
<td>Customer Self Supply</td>
<td>2.5 kW</td>
<td>19.2 kWh</td>
</tr>
</tbody>
</table>

15 kW Total 108.8 kWh Total
Locational diversity of pilot participants

9 Participants
island of Oahu

1 Participant
island of Hawaii
Description of enabling technology employed
Project 1: Regulating Reserves

Regulation Reserves are maintained to respond to supply/demand imbalances over short time frames, typically on the order of one to several seconds. Resources that provide Regulation Reserves adjust their generation or load levels in response to automatic generation control (AGC) signals provided by the system operator.
Phase 1 – Initial Flat File Testing

Initial testing was based on a sample “flat file” supplied by Hawaiian Electric. A sample of the setpoint signal file is shown below. An event was run for a 2 hour portion of the supplied 24-hour resource file at the HEC BESS demonstration center located in Aiea, Oahu.

<table>
<thead>
<tr>
<th></th>
<th>time</th>
<th>setpoint</th>
<th>response</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5/3/17 12:00:00</td>
<td>550</td>
<td>448.536</td>
</tr>
<tr>
<td>3</td>
<td>5/3/17 12:00:01</td>
<td>550</td>
<td>448.824</td>
</tr>
<tr>
<td>4</td>
<td>5/3/17 12:00:02</td>
<td>550</td>
<td>538.533</td>
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<tr>
<td>5</td>
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<td>5/3/17 12:00:07</td>
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<td>10</td>
<td>5/3/17 12:00:08</td>
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<td>11</td>
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<td>12</td>
<td>5/3/17 12:00:10</td>
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<tr>
<td>13</td>
<td>5/3/17 12:00:11</td>
<td>750</td>
<td>749.039</td>
</tr>
</tbody>
</table>
Phase 2A – Performance Verification - Lab Tests

setpoint and response 12:00:00 to 12:04:59
Phase 2B – Performance Verification - Field Tests

<table>
<thead>
<tr>
<th></th>
<th>Test #1</th>
<th>Test #2</th>
<th>Test #3</th>
<th>Test #4</th>
<th>Test #5</th>
<th>Test #6</th>
<th>Test #7</th>
</tr>
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<tbody>
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<td>0.8626</td>
<td>0.8458</td>
<td>0.8429</td>
<td>0.8258</td>
<td>0.8625</td>
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<tr>
<td>Accuracy</td>
<td>0.8135</td>
<td>0.9362</td>
<td>0.9458</td>
<td>0.9418</td>
<td>0.8929</td>
<td>0.8643</td>
<td>0.9473</td>
</tr>
<tr>
<td>Delay</td>
<td>0.8296</td>
<td>0.9615</td>
<td>0.9625</td>
<td>0.9625</td>
<td>0.9267</td>
<td>0.9214</td>
<td>0.9625</td>
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<tr>
<td>Precision</td>
<td>0.3789</td>
<td>0.6119</td>
<td>0.6794</td>
<td>0.6329</td>
<td>0.7091</td>
<td>0.6917</td>
<td>0.6776</td>
</tr>
<tr>
<td>Date</td>
<td>Oct 10</td>
<td>Oct 12</td>
<td>Oct 27</td>
<td>Nov 15</td>
<td>Nov 16</td>
<td>Nov 21</td>
<td>Nov 23</td>
</tr>
</tbody>
</table>

- **Accuracy**
- **Delay**
- **Precision**
- **Composit**
Project 2: Fast Frequency Response (FFR)

**Fast Frequency Response** (“FFR”) is needed to reduce the rate of change of frequency (“RoCoF”) to help stabilize system frequency immediately following a sudden loss of generation or load.
FFR Program Parameters

Using the aggregated controls available through the E-Gear PowerTools interface, participating DER’s were programmed with an initial set of program parameters. We tested for under frequency events only.

<table>
<thead>
<tr>
<th>FFR parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Ramp (%W/sec.)</td>
<td>Percentage absolute AC Watts ramp rate of rated PCS power for increase in operating power in both directions (export and import)</td>
</tr>
<tr>
<td>Power Level (W)</td>
<td>Minimum delta rise in operating power in AC watts for FFR function. Used for both low frequency and high frequency regulation</td>
</tr>
<tr>
<td>Min. Active Time (min.)</td>
<td>Minimum time that AC battery will operating in FFR mode even if the frequency recovers. The function can be deactivated at any time by EMC</td>
</tr>
<tr>
<td>Start Frequency Low (Hz)</td>
<td>Deviation value from nominal frequency that determines the frequency low trigger point to start FFR</td>
</tr>
<tr>
<td>Start Frequency High (Hz)</td>
<td>Deviation value from nominal frequency that determines the frequency high trigger point to start FFR (will be disable)</td>
</tr>
</tbody>
</table>
Project Program Parameters

Power Ramp (%W/sec.): 100
Power Level (W): 4,500
Min. Active Time (min.): 30
Start Frequency Low (Hz): 59.9 (Minimum setting)
Start Frequency High (Hz): (Disabled)
FFR Live Event #1

45 Minute Window

Full 30 Min.

1 min. Event Detail

Ramp Rate

Event Trigger

Active Time: 30 min.
FFR Live Event #2

45 Minute Window

Full 30 Min.

Event Trigger

Active Time: 30 min.

Ramp Rate

Event Trigger

1 min. Event Detail
Capacity can be derived from either generation resources or controlled load. Capacity for dispatch-able generation is defined as the MW rating of the unit. Capacity for variable generation is defined as the amount of capacity that can be assured in the next four hours of the resource.
Initial TOU Test Plan

Interim TOU-RI (Daily) (Approximate Differentials)

- Residential Rate
  - Off-Peak Period
  - Mid-Day Period
  - Priority-Peak Period

Energy Costs

Time of Day

Weekends

Weekdays

0:00 - 08:59
- Off-Peak

09:00 - 16:59
- Mid-Day

17:00 - 23:59
- Priority-Peak

08:59 - 09:00
- Off-Peak

16:59 - 17:00
- Off-Peak

23:59 - 08:59
- Off-Peak
Default Solar Self-Supply vs. TOU

Minimal impact

BESS Hit High SOC Limit

PC State of Charge (%)

Load Power (W)

Net Import / Export Power (W)
Alternate Scheme (PowerLock)

- Generation Power (W)
- Measured Battery Charge / Discharge Power (W)
- PCS State of Charge (%)
- Load Power (W)
- Net Import / Export Power (W)
Lessons Learned
Lessons Learned

As a general lesson learned, customer internet is not a reliable source due to intermittent bandwidth limitations and the fact that customers have control over their equipment (passwords, routers, modems, extenders, etc...). This issue is very critical for successful deployment of assets participating in grid services.

Solid communication and security to grid edge devices is key. Based on data captured during this pilot program, under a live grid services program, devices will need to be configured to have redundant communication pathways.

The inherent nature of most reserve grid services do not provide a defined schedule and must be available 24/7. Therefore, the asset must be available at the time of an unexpected event to 1) perform for the system operator and 2) to back up the commitment by the aggregator and minimize performance penalties.

Participants were more engaged with the online interface once they signed up under a program and would check it on a regular basis.
APS DER and Non Wires Alternative

HECO IGP Soft Launch
Daniel Haughton, Scott Bordenkircher
03/26/2019
Content Overview

- APS Overview
- APS DER Profile
- DER Integration Projects
- Energy Storage and NWA Projects
APS Service Territory

- 11 of Arizona’s 15 counties
- 34,646 square mile service area
- 1.2 M meters, 2.7 M people
- Over 35,000 transmission and distribution line miles
- 430 substations; 300,000 transformers; over 550,000 poles and structures
- Operating voltages 500, 345, 230, 115, 69, 21, 12.47 kV
- System Peak Load 7,350MW
### APS Resource Diversity

- Renewable energy resources are the second largest piece of the APS system
- 50% Carbon-Free Fleet

#### 2018 Resources (MWs)

<table>
<thead>
<tr>
<th>Name</th>
<th>Nameplate Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear</td>
<td>1,146</td>
</tr>
<tr>
<td>Coal</td>
<td>1,672</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>4,959</td>
</tr>
<tr>
<td>Microgrid/ESS (Quick Start)</td>
<td>34</td>
</tr>
<tr>
<td>Renewables</td>
<td>1,838</td>
</tr>
<tr>
<td>Customer-Based DSM</td>
<td>854</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10,503</strong></td>
</tr>
</tbody>
</table>
APS Renewable and DER Profile

- **Renewable profile**
  - 769 MW utility scale solar and wind
  - 1030 MW customer owned solar
    - Average 1400 applications/mo.
- **Energy storage**
  - Solana (solar thermal)
    - 250 MW
  - Battery energy storage (utility scale)
    - 8 MW/12 MWh
  - Battery energy storage (residential)
- **Anticipated DER Forecast**
  - 4100 MW by 2032
  - Most from customer DER
• APS ranks 2\textsuperscript{nd} in large utility residential per customer

• AZ ranks 3\textsuperscript{rd} nationally for population as production

• APS ranks 5\textsuperscript{th} in highest solar PV installed capacity all utilities nationally

https://www.eia.gov/electricity/data/state/
Punkin Center Non-Wires-Alternative

• Use Case
  – Distribution line reconductor deferral
  – Over 20 miles of small wire
  – Remote region
  – 21 kV, 174 A limitation
Feeder Characteristics

- Long, radial, small-wire circuit
- Low forecasted load growth
- Load concentrated at end of line
- Primary residential loads
- Multiple stages of voltage regulation – VVO circuit
Lessons Learned

• Procurement
  – Understand and define specific requirements
  – Size, duration, configuration, validation, testing
  – Long-term sustainable solutions required

• Planning
  – Robust studies and analysis required
  – New technologies present unanticipated challenges

• Operations
  – The battery is a useful asset when operational
  – Plan to operate thru abnormal and emergency condition, with loss of grid, and loss of NWA solution
APS Solar Partner Program with EPRI

- **Phase 1 - initiated 11/2014**
  - 10 MW, 1600 residential customers
  - External Advisory Council
- **Rooftop solar PV**
  - Residential systems (4-8 kW)
  - West-facing, with advanced inverters
  - 20 year contract
  - APS controls inverters (grid side of meter)
- **Centralized communications and control**
  - Utility communications, control, and central dispatch
- **Phase 1 EPRI Report 05/2017**
  - Product ID: 3002011316
Solar Partner Program Lessons Learned

**Planning & Operations**
- Feeder demand reduction from aggregated systems (5-8 %)
- West-facing coincident to system needs (66 vs 20 %)
- No negative VVO impacts
- No transformer or customer demand reduction

**Advanced Inverters**
- Respond to commands
- Ideal settings vary by feeder (Volt/VAR, PF, unity)
- Aggressive voltage settings caused no kW curtailment
- Secondary voltage impact dominates

**Interoperability & Communications**
- Need for standards and protocols (nascent industry)
- Inverters do not talk at night (solar PV)
- Interaction with VVO seen but managed
- Tradeoffs abound – thoughtful consideration required
Solar Partner Program Lessons Learned

• Phase 2 – initiated 01/2017
  – BESS (2MW/2MWh), 2 feeders
  – Interoperability with VVO and advanced inverters
• Phase 2 [EPRI Report] 11/2018
  – Product ID: 3002014455
Using AI to Unlock Energy Storage Value for Grid Services

HECO Grid Services Workshop
March 26, 2019

Jim Baak, Senior Manager for Regulatory Affairs, West
Jim.Baak@stem.com
Stem Overview

Stem operates the world’s smartest and largest digital energy storage network

Founded: 2009
Headquarters: Millbrae, CA
Employees: 150+
Operations In: CA, HI, NY, TX, MA, Japan, ONT
Pipeline & Installed: 900+ sites, 250+ MWh
Installed: 400+ sites, 3.5M+ device hours
8 utility contracts: 350 MWh
Project Finance: $650 MM

High Caliber Global Investors

Distinguished Honors & Awards

Greentech Media: 2018 Grid Edge Innovation Award
SEPA Power Player 2017: Innovative Partner of the Year
Stem’s Solution Components

Athena™ Artificial Intelligence
Automatically controls when energy storage charges and discharges to optimize timing, maximize savings, and create virtual power plants.

Energy Storage Systems
Modular options for all facility sizes and locations. Batteries from leading global manufacturers.

- Medium indoor 132 kW modules
- Small indoor 18 kW modules
- Large outdoor scalable from 100 kW to 5+ MW
Virtual Power Plants

- Stem’s network of storage systems can be dispatched as a “Virtual Power Plants” for utilities and grid operators.
- Cloud-based AI software automatically optimizes each system to help the customer and the grid at the same time.
- Machine learning and big data processing allow software to learn from each event and grow smarter.
The Stem Energy Platform – Athena

- Real-time telemetry and multiple external data services stream information to Stem's predictive analytics and optimization engine.
- Stem's machine learning algorithms optimize the asset’s operations to deliver value for customers.
- Provides grid assets for the utility’s needs.

![Diagram showing data acquisition and cleansing, partner integration layer, and various data sources including utility tariff & rates, market & price data, smart meter data, local weather data, and grid connection data.](image-url)
Al-driven optimization of customer & grid benefits

- Stem is currently monetizing 7 of the 13 energy storage value streams as identified by the Rocky Mountain Institute in their report “The Economics of Battery Energy Storage”.

- In the future, Stem intends to co-optimize and stack these revenue streams as well as expand the scope of available offerings and services.

- Only behind-the-meter solutions can address all 13 value streams.

Source: Rocky Mountain Institute.
Stem’s Current Grid Services Offerings

- **Local Capacity Requirements**
  - 20-min RT dispatch

- **Demand Response Auction Mechanism (DRAM)**
  - Aggregated DR bid into DA and 5-min RT markets
  - System, local and/or flexible Resource Adequacy

- **Retail Demand Response**
  - Reliability and peak capacity
  - Event-based responses

- **Distribution Deferral**
  - Stand-alone storage or portfolios of DER to meet grid deferral needs
On August 28, 2017 Stem simultaneously dispatched 14 VPPs (over 100 systems)

Reliability and Resilience Needs
- Unprecedented heat waves
- Ongoing wildfires disrupting transmission
- Southern CA gas supplies

Stem’s VPPs are working
- Contract for SCE local capacity
- Wholesale market since 2014
- 1,000+ dispatches over 3 years
- Hundreds of real-time market calls – no manual intervention

“That’s awesome. Wish all “DR” would respond like this!” – CAISO Staff
Win-Win-Win Partnerships With Customer and Utility

- Promote LCR program
- Educate customers on benefits
- Customer satisfaction

- Capacity and energy payments for performance
- Support customer acquisition

- $0 money down
- Load management
- Automated bill savings

- VPP of firm, local, dispatchable capacity
- Fatigue-less Resource Adequacy resource
- Performance based contract

Athena™ Artificial Intelligence
Automatically controls energy storage charge/discharge to optimize timing, maximize savings, and create VPPs.

- Energy storage system subscription payment
Lessons Learned – Grid Services RFOs

• Information is key
  • Good data on loads, load shapes, grid needs, hosting capacity, forecasted growth, etc. is essential to successful performance

• Contracts need to be longer term (> 1-2 years)
  • Shorter-term contracts make it difficult to sign up customers and harder to finance, negatively impacting economics
  • Prefer 10-year contracts, which correspond to many incentive program requirements

• Reasonable & consistent performance measurement & evaluation
  • Evaluate performance against capacity deployed versus contracted capacity to account for permitting and construction delays beyond the developer’s control

• Common-sense rules for dual participation/incrementality
  • Focus on providing appropriate compensation for the value of services provided
Lessons Learned (Cont’d)

• Reasonable metering and interconnection requirements
  • Consistent treatment for energy storage across RFOs/IOUs
  • Length of time it takes to interconnect
  • Don’t treat non-export like export

• Avoid baselines wherever possible
  • Baselines are more difficult for storage due to the variability of customer loads
  • Prefer direct metering with an MGO

• Fire/Building code restrictions
  • Significantly limits potential size of resource portfolio

• Think outside the box
  • Evaluate portfolios of DERs rather than just individual resources
Residential Solar+Storage for Non-Wire Alternatives

Nathan Wyeth
March 2019
Sunrun Overview

**Who We Are**

- Formed in 2007 and headquartered in San Francisco, CA, Sunrun pioneered the residential solar service product

- Largest residential solar, storage, home energy services company, with more than 233,000 customers

- Sunrun has deployed 1.6GW of residential solar and currently operates in 23 states, plus DC and Puerto Rico

- In 2017, Sunrun expanded its offering to battery storage (installed over 5,000 units to date) and is the leading residential grid services provider

- In 2019, Sunrun won a bid to provide 20MW of capacity from home solar and battery systems to ISO New England beginning in 2022 – a first for residential resources

**Market Coverage**

- Solar service
- Solar & Brightbox service

**Value to customer**

- Save on electricity
- Little or no upfront cost
- Backup power, no fuel or pollution
- Bill management

**Value to the Grid**

- Peak capacity
- Resiliency
- Dispatchable Virtual Power plant
- Ancillary Services
Key Points

Based on engagement with non-wires procurements in New York, California and elsewhere, Sunrun highlights the following key factors for maximizing NWA success with residential storage.

1. Residential storage can be a fully dispatchable resource for distribution capacity and other distribution services.

2. For residential-heavy distribution infrastructure, solar+storage delivers high potential per home.

3. Solar paired with storage can serve long-duration needs.


5. Demand for residential solar+storage creates a growing fleet available for utilization for distribution value as needs arise.

6. For optimal results:
   - Enroll / engage assets at point of sale as they are deployed.
   - Keep it simple and seamless for customers even as grid needs evolve.
   - Leverage aggregators to manage complexity.
   - Work through existing customer relationships to deepen technology deployment.
Residential storage can be fully dispatchable

Residential batteries can be managed to deliver a fully shapeable profile for impact on net load. (In this case, ramp rate reduction and peak shaving)

An aggregator can deliver a desired overall outcome by delivering asset-level dispatch. Pricing signals need not be translated with this granularity to a customer level.
Solar+storage delivers large impact per home

Storage sized to manage solar self-consumption results in 18+ kWh today; with future battery cost declines, sizing has room to grow. Depending on distribution capacity need duration, net difference between non-solar+storage home and solar+storage could be 5+ kW / home or more.
Passive solar + dispatchable battery is a long-duration solution

- Siting generation within constrained areas helps address long-duration needs. Midday needs are supported by passive PV generation, while storage shifts generation to cover hours outside solar production.

- Rooftop solar can be sited within dense, constrained areas and solar and battery sizing can address varying duration needs.

- Local generation supports battery charging when even “charging window” to draw power from outside constrained area is limited i.e. solar exports from BTM, if “capturable” by other storage within constrained area, can have value even outside target hours.

A 7kW solar array in Honolulu directly reduces load starting 12:00 and charges 18.8 kWh of storage @ 88% RTE to provide 2.75 kW load reduction through 24:00
Data-rich communication of needs enables smart responses

- **Leverage utility knowledge of customers & load characteristics**
  BTM approaches require canvassing a broad customer base for potential. Data on # of meters by customer class is the starting point - additional detail is helpful.

- **Share 8760 data for smartest design of solutions with variable resources**
  Annual peak day need may not be only factor

- **Accurate and granular maps enable planning**
  GIS shapefiles enable overlay with other mapping tools and market datasets.

- **Show drivers of load forecasts**
  BTM solutions deploy in direct relationship to load. If we understand what you’re expecting will show up (e.g. new homes, EVs, added cooling load, etc), we can consider how to meet with specific solutions.

- **Descriptions of grid topography**
  The more clear the description of the grid, the better developers can propose customized solutions to balance across substations, address contingencies, etc. not just solve for X MWs.
Data-rich communication of needs enables smart responses

Hour by hour MWh need enables dispatch modeling

Even better: “8760” view of needs over seasons

Annual MW need + visual interpretation of graph prevents certainty of modeling
Growing fleet of solar+storage is an opportunity today

- Deployment of prospective resources for distribution capacity services is happening on an ongoing basis - act ahead of time with a programmatic approach with customer (pre-)enrollment to increase NWA success
- This simplifies marketing and customer education for mass market, avoiding “one pitch on one side of the street and a different pitch on the other side of the street”
- Can provide a framework to enable utility / developer collaboration for initial customer engagement and seamless, “evergreen” structure for customer engagement around ongoing distribution and other needs.

For a hypothetical circuit, in 2021 a potential 1MW overloading scenario is identified in the summer of 2024. This can be met by **200 homes** with storage delivering **5 kW** of battery discharge load over 3 hours.

If a 12-month procurement results in deployment starting in Q1 2022 - Q2 2024, **116 units** are deployed and the need is not addressed.

If an programmatic enrollment approach is initiated in 2019, an additional **84 units** are available for utilization for distribution capacity services. This reaches the threshold of **200 units** total.

Available during procurement / implementation window: **116 units**
Available via programmatic approach + targeted density after need identified: **200 units**
To achieve success:

1. **Enroll / engage assets at point of sale as they are deployed**
   The time to engage assets for future distribution is as far in advance of grid needs as possible - i.e. now. Creating a structure that can layer on customer tariffs and around which DER customer value proposition can be built, enables context specific details to be filled in if / when needed. Point of sale is the time to establish this - not 1, 3, or 10 years later.

1. **Keep it simple and seamless for customers even as grid needs evolve.**
   Residential customers are open to sharing use of assets for grid and community benefit if they understand how they also benefit. Nothing kills this openness faster than complexity that customers struggle to understand. A simple customer value structure should be “evergreen” to accommodate sequential and stacked services.

1. **Coordinate for customer engagement & leverage aggregators to manage complexity.**
   Residential assets’ responses to distribution needs can be guaranteed, and the overlay with existing customer tariffs managed, by aggregators who enroll customers in programs and manage DERs. Doing so in partnership with the utility facilitates the targeted deployment sought.

2. **Work through existing customer relationships to deepen technology deployment.**
   Solar+storage is the beginning, not the end, of distribution services potential. Coordinate with aggregators to add technology (EV charging (G2V -> V2G), water heating, etc.) into this equation.
IGP SOFT LAUNCH
Best Practices for NWS RFPs and Contracting

March 26, 2019
Jason Prince
Rocky Mountain Institute
## Summary of key findings

### RFP design and processes are critical for success
- RFPs should maximize technically acceptable, cost-effective bids
- Developer feedback can help prevent ‘garbage RFP out, garbage responses in’

### Existing contract templates can be adapted for NWS
- Utilities have a long history contracting for third-party services
- Standard contract clauses should be adjusted to better suit the NWS context

### RMI’s NWS Playbook provides procurement guidelines
- The Playbook contains best practices distilled from 65+ interviews
- It includes guidelines for RFP development and contracting considerations
The Non-Wires Solutions Implementation Playbook

A practical guide for regulators, utilities, and developers
Playbook contains best practices and practical guidelines

**SECTION 1: BEST PRACTICES**

1. Establish a supportive regulatory environment
2. Integrate NWS within standard utility operating procedures
3. Employ a holistic process for NWS procurement

**SECTION 2: IMPLEMENTATION GUIDELINES**

1. Screening Criteria
2. Competitive Solicitation Processes
3. Proposal Evaluation
4. NWS Contracting Considerations
How to make a NWS RFP the best it can be?
RFP feedback loops can help animate the NWS marketplace

**Process Enhancements**
- Engage stakeholders before, during, and after RFP
- Consider the role that 3rd parties can play as solution integrators or procurement managers

**Technical Approaches**
- Provide data-rich needs descriptions
- Elaborate solution performance attributes
- Provide clear evaluation criteria
- Allow for participation in wholesale markets
- Include pro forma contracts
Received a compelling bid, now what?
Standardizing contract terms will help scale the NWS market

<table>
<thead>
<tr>
<th>Category:</th>
<th>Key Risks:</th>
<th>Mitigation Strategies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dispatchability</td>
<td>• Control of assets</td>
<td>• Pay-for-priority utilization rights</td>
</tr>
<tr>
<td></td>
<td>• Limited account visibility</td>
<td>• Maintain operational parameters</td>
</tr>
<tr>
<td>2. Payment</td>
<td>• Fixed</td>
<td>• Performance guarantees</td>
</tr>
<tr>
<td></td>
<td>• Variable</td>
<td>• Aligned incentives</td>
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<tr>
<td>3. Performance</td>
<td>• Termination</td>
<td>• Metrics on rolling basis</td>
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<td></td>
<td>• Maintenance</td>
<td>• Portfolio flexibility</td>
</tr>
<tr>
<td></td>
<td>• Multiple Accounts</td>
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<tr>
<td>4. Construction</td>
<td>• Milestones</td>
<td>• Pay-for-delay</td>
</tr>
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<td>• IE certification</td>
<td>• Representative designs</td>
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</table>

1. Dispatchability
2. Payment
3. Performance
4. Construction

1. Dispatchability
2. Payment
3. Performance
4. Construction
Thank you!
Questions?

jprince@rmi.org