Value in the Balance:
Solar, Storage, and DR Options

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Jon Hawkins, PNM Resources
April 20, 2016
CSVP Driving
Net Solar Cost
Reduction

Strategic solar design/specifications
Best-practice project financing/procurement
Utility-driven target market development & a more customized offer
DR and storage companion measures add net solar value
Solar + Demand Response

Solar-Plus or Solar Triple Play Strategies defy mass-market research, which puts emphasis on the simplicity of the offer. However, particular market segments seem likely to find that the easy attraction of the solar opportunity makes the more difficult “pitch” for DR acceptable—even attractive!

Image source: health.howstuffworks.com
Among those who have some knowledge of smart-grid, both solar and DR/energy management are strong options
Batteries &/Or DR Can Provide Energy **Source** and **Sink**
PNM Project highlights:

• Online since fall 2011; first of 16 DOE smart grid storage projects
• Successfully demonstrating true storage/PV integration with utility operations
• 500 kW PV (fixed C-Si panels) – not DOE funded
• Advanced lead acid battery for 1 MWh shifting
• “Ultra” battery system for 500 kW smoothing
• Data acquisition and control system
• Operational experience had led the utility to consider DR to expand capabilities at lower cost
PNM experience w/ operational flexibility

…based on Price Signals, Forecasting, Storage/DR Technologies, and Vision
Prosperity: Demonstrating Flexible Grid Operations

Using Set Thresholds, System optimizes functionality based on priorities to perform:
- Emergency peak shaving
- Peak shaving
- Arbitrage (wind and PV)
- PV firming

All while simultaneously smoothing PV and optimizing for battery life

228 Data Points from Prosperity:
- Met data
- System data
- Meter data

SCADA Data
Currently monitoring 3 feeders; ~6 sec polling

Market Pricing:
Currently using CAISO
- Real-time price
- LMP Forecast price
Jon Hawkins, PNM Resources at Control Cabinet
PNM’s New Concept Uses Solar + Storage + DR

- Storage systems charged at night to take advantage of cheap resource (e.g. wind) or to offset predicted solar under-production.
- System peak must be addressed for solar reduce utility infrastructure.
- Reduced ramping rate at end of solar day by managing energy storage and use.
- Better use of PV energy using storage and energy shifting from peak.
- Reduced evening peak load by shifting opportunistic energy use to daylight hours.
Important Points:

1. Geographic Diversity With Quality Forecasting Minimizes Short-Term Variability Impacts
2. PNM Suggests VAR Support Can Replace Battery Storage for Smoothing
3. Many DR 2.0 Strategies Function Essentially Like a Battery (This is Often Overlooked)

Central CA Mitigation Case Study

“...showed that, in a plausible operational context, the cost of mitigating variability across time scales ranging from one minute to a couple of hours could be kept below 25-35 cents per installed PV kW”

The cost of mitigating short-term PV output variability (with forecasting and generic buffer storage excluding DR)
Incorporating Demand Response Into Community Solar Programs

A Module of the CSVP High-Value Community Solar Program Design Guide

Erich Huffaker, Olivine Inc.
John Powers, Extensible Energy LLC

April 2016

www.communitysolarvalueproject.com
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<th>Integration Issue</th>
<th>&quot;Duck Curve&quot; Issues</th>
<th>Intra Hour Fast Ramps</th>
<th>X&gt;2-Hour Forecast Error</th>
<th>X&gt;24-Hour Forecast Error</th>
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<td>11 Residential Load Curtailment (Behavioral)</td>
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The Presenters and the Project

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**The Community Solar Value Project** is focused on improving community-solar program value, through solar + storage + demand-response and other strategies, at electric utilities in Sacramento and beyond. The project is led by Extensible Energy, LLC with support from Cliburn and Associates, Navigant Consulting, and Olivine. See more at www.CommunitySolarValueProject.com.