GridSolar, LLC

The GridSolar Pilot Project for Grid Reliability

National Academy of Sciences

Electricity Use in Rural and Island Communities: A Workshop Supporting the Quadrennial Energy Review's Public Outreach

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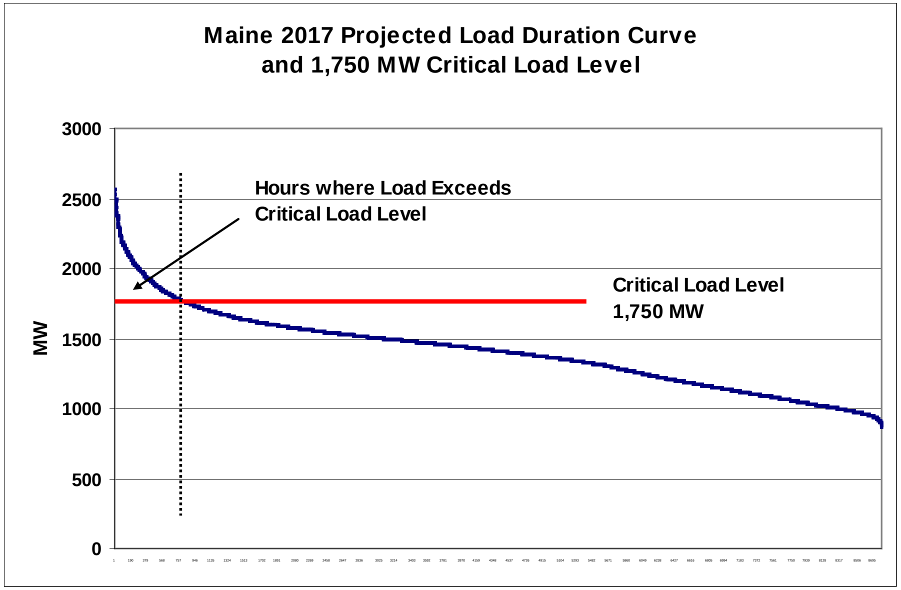
Electric Grid Reliability: The Problem

- **Grid Reliability is generally a Peak Load Problem**

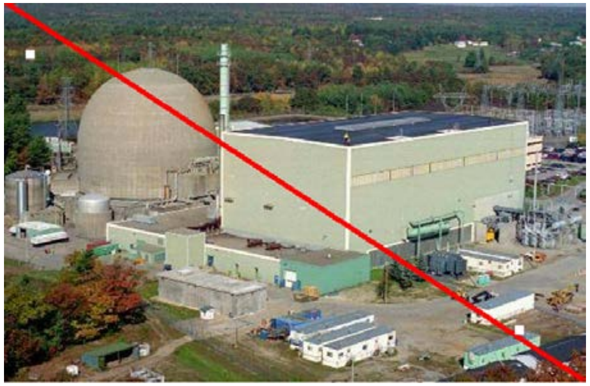


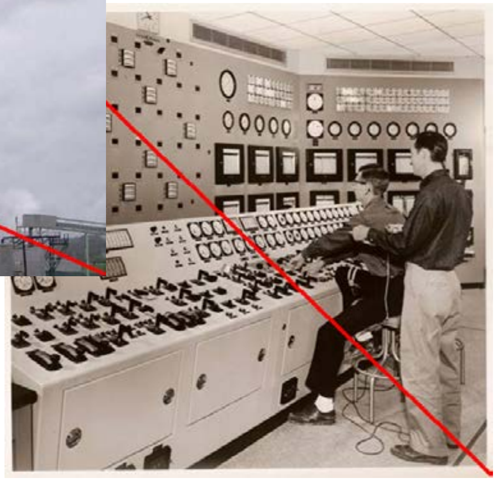
- **ME Turnpike Analogy**

Electric Grid Reliability: Potential Solutions

- **Transmission Solution** – Build more Transmission to bring power from away into the Region
- **Non-Transmission Alternative or "NTA" Solution** - Manage Load and develop new Distributed Generation within the Region

Yesterday's Electric Grid





Large Central Generating Stations designed to serve 24 x 7 industrial loads using high voltage transmission lines and centralized dispatch control

Tomorrow's Electric Grid

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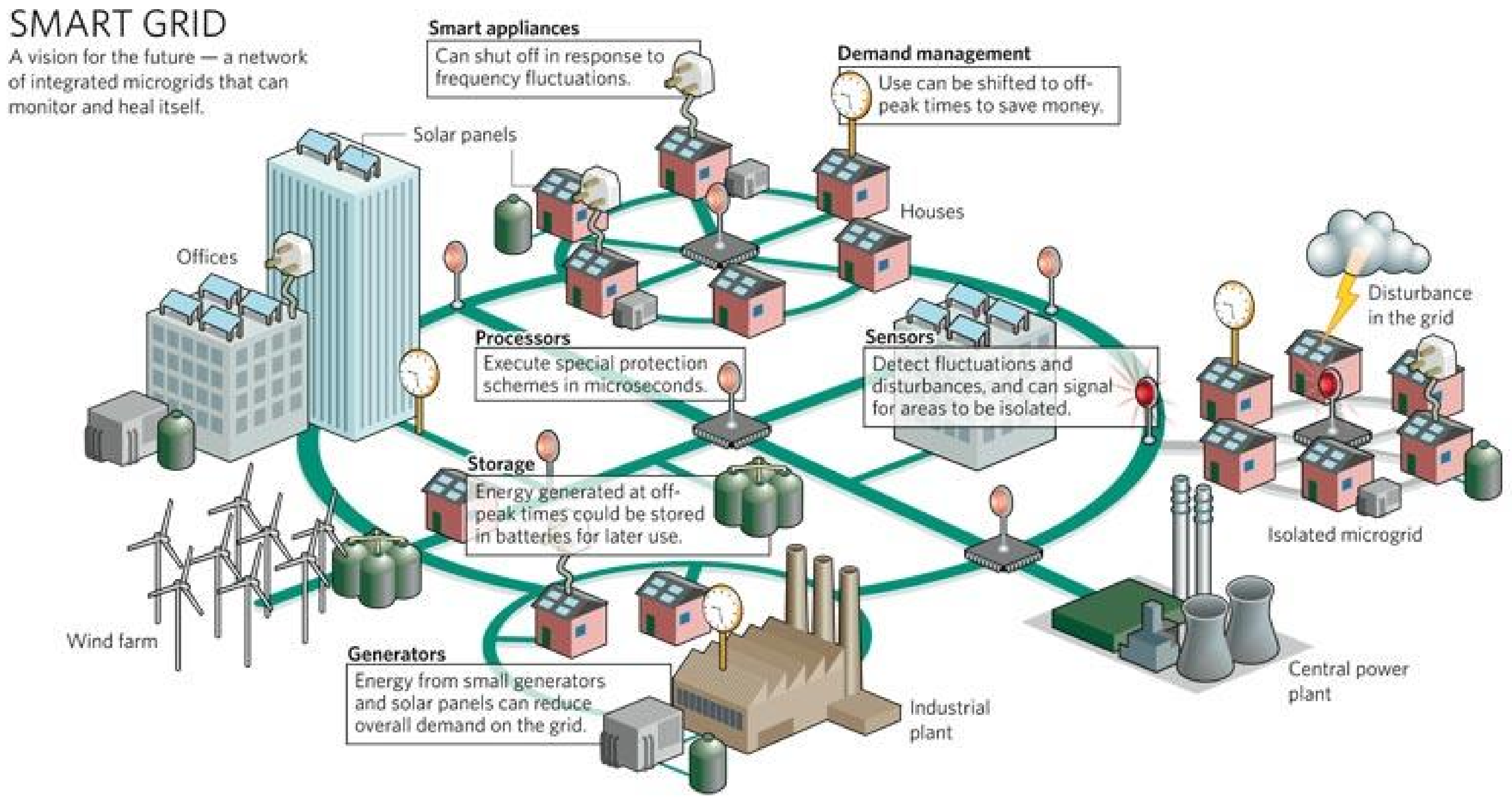
Distributed Generation located near commercial loads that are weather sensitive (more peaked) using distributed control technologies

Smart Electric Grids

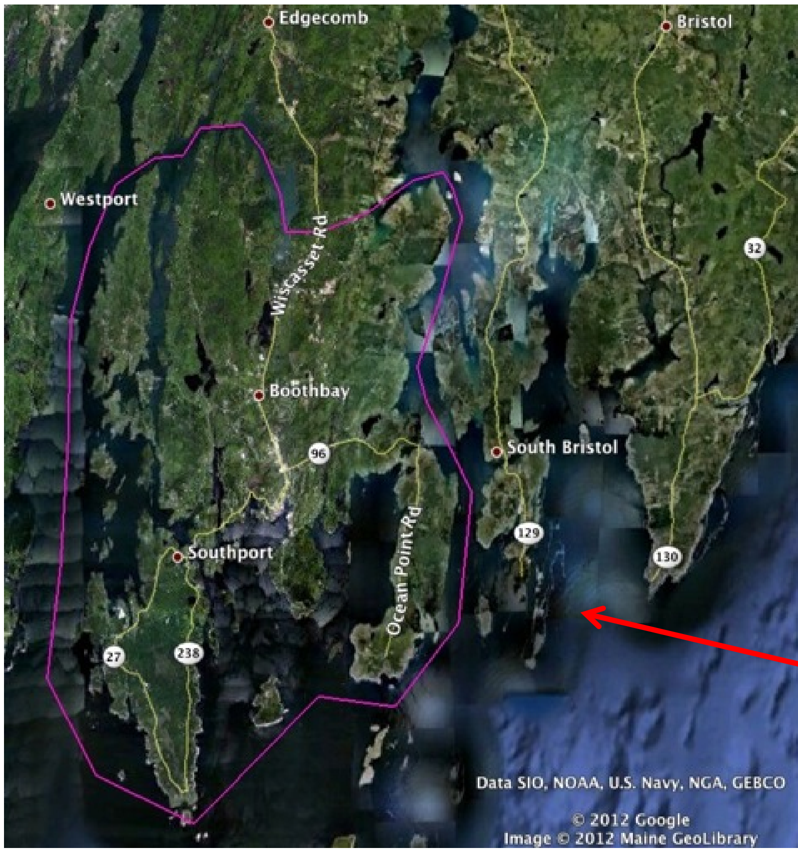


Contrasting Visions

Utility Vision in which peak load is met by large generating facilities located far from load requiring expensive transmission systems

GridSolar Vision in which peak load is met through a smart electric grid using energy efficiency, DR, small-scale distributed solar generation and other resources located close to load

Boothbay Pilot



Radial nature of electric service and local distribution circuits on the Boothbay peninsula defines the electrical region for the Pilot Project – Total Peak load – Approx. 30 MW.

Boothbay Harbor, Maine

Shock and Sag

- **When a Reliability Event Occurs, the electric grid has two responses:**
  - "SHOCK" – frequency and voltage responds immediately, which can cause power failure.
  - "SAG" – power flows on specific lines and circuits exceeds carrying capacity causing them to overheat and sag. If sag exceeds clearance, they will short causing power failure.

Boothbay Pilot

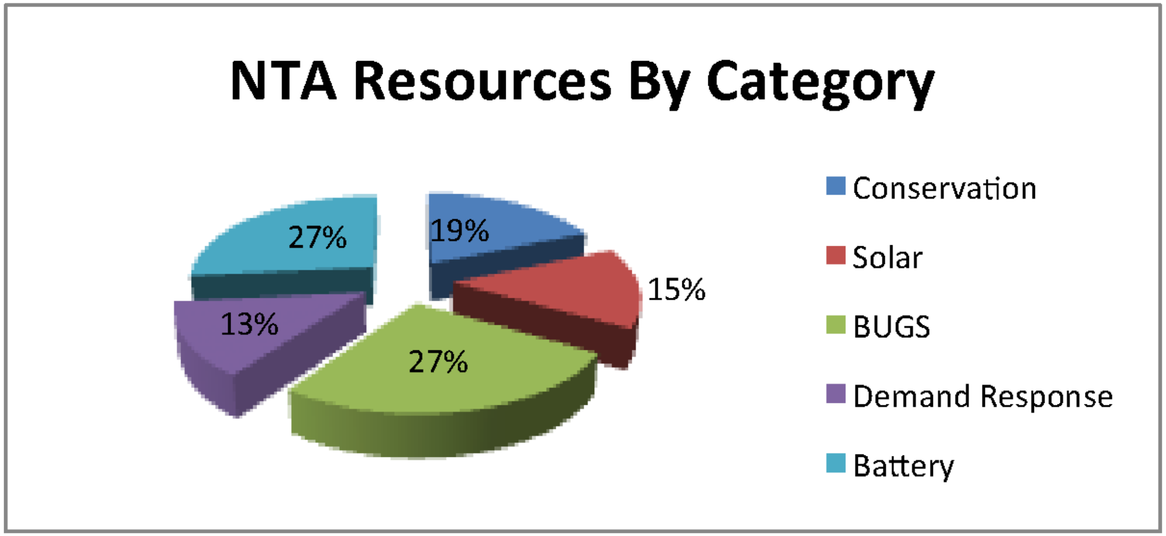
- **Hybrid Solution**
  - CMP – Voltage Support investments to address instantaneous response issues – “SHOCK”
  - NTA Options – Manage thermal conditions on conductor feed into the region – “SAG”
- **Benefit** – Avoid $18 million upgrade to CMP Sub-Transmission Line serving the region.

Pilot Design

- Term – 3 Years, option to 10 Years
- Need – up to 2 MW of NTA Resources
  - modular, can scale with load
- NTA Types – Target 250 kW each
  - Efficiency
  - Renewable DG (125 kW Solar)
  - Non-renewable DG (preference net zero CO_2)
  - Demand Response
- Competitive Bids - PUC approves all contracts
- Cost are recoverable in utility rates

NTA Resources

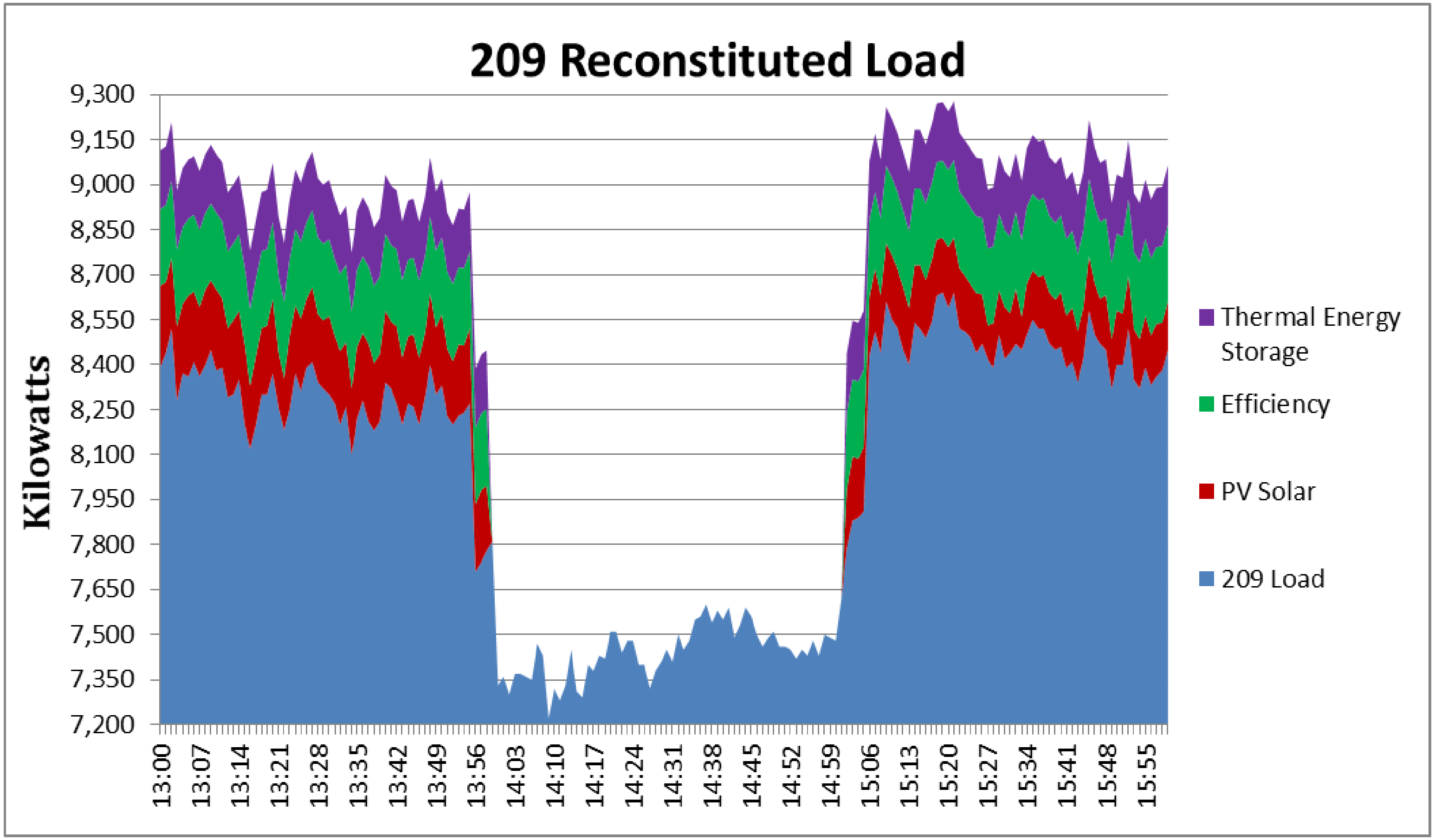
kW	RFP I	RFP II	Totals	Pct.	$/kW M
Conservation	237.0	111.3	348.3	19%	$ 10.47
Solar	168.8	106.8	275.6	15%	$ 13.19
BUGS	500.0	0.0	500.0	27%	$ 20.63
Demand Response	0.0	250.0	250.0	13%	$ 57.65
Battery	0.0	500.0	500.0	27%	$ 75.99
Totals	905.8	968.0	1,873.8	100%	



GridSolar Ops Center - Portland

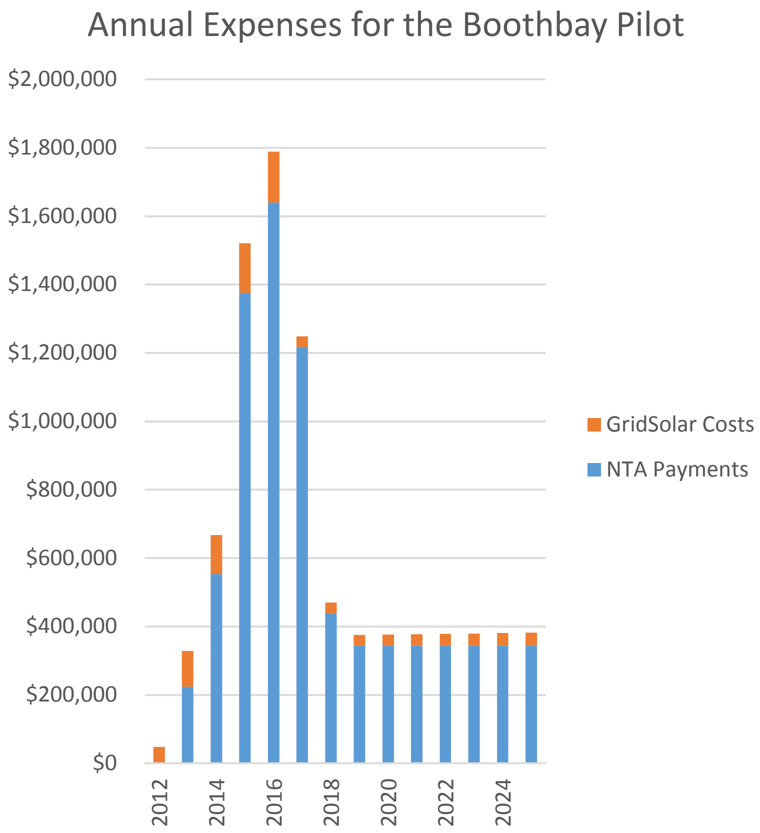
- Dispatch (SCADA) System
  - Direct/Cellular Link to Active NTAs
  - Data loggers at Passive NTAs
- Command Interface
  - CMP dispatch: load, location, duration
  - GridSolar: define & issue dispatch order
    - Automated, failsafe backup
  - Real time monitoring & data logging
  - CMP collect data at substations

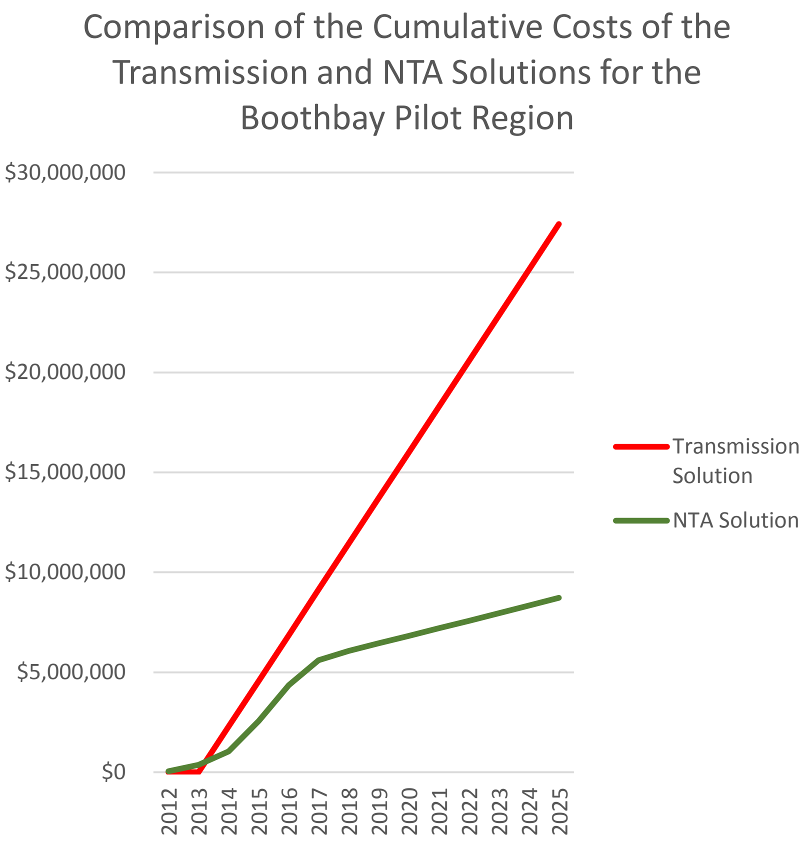
Boothbay Pilot – Audit Test



Audit Test was performed – Friday, July 10, 2015, 2 pm
Weather Conditions –Sunny, Temperature mid 80s – Highest YTD

Comparative Costs





Continuing Activities

- Improve Utility/GridSolar Interface and communication protocols
- Develop dispatch algorithms to optimize NTA deployment
- Explore additional benefit potential of DG resources – voltage regulation, VAR support – sited on distribution circuits

Develop and Implement additional NTA Solutions where Utilities identify reliability needs.

DOE/FERC Policy Actions

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T&D Grid Design – reverse power flow issues.

Distributed Generation pushes energy back through the grid. Need more/better thinking about how to accommodate these flows on the existing grid, including better methodologies for undertaking system impact studies to facilitate interconnection of DG and other NTA resources.

DOE/FERC Policy Actions

Transmission Cost Allocation – asymmetric treatment of transmission costs compared to NTA resource costs

FERC needs to revisit its Western Grid decision to put into rule the policy statement in that decision that defines an ad hoc separation between devices, equipment and technologies that are "generation" from those that are "T&D".

DOE/FERC Policy Actions

Utility Revenue erosion concerns that stem from archaic utility rate designs

Today, utility rate design is all about raising revenues to support utility revenue requirements and very little about sending economically correct price signals. This needs to change – otherwise, all support for DG will be characterized as subsidies to specific technologies and a threat to the financial well-being of the utility.

DOE/FERC Policy Actions

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Distribution Level ISO Structure

There needs to be an **<u>independent</u>** entity whose function is to procure and control (**but not own**) NTA resources to provide grid reliability service – just like what ISOs are doing at the transmission level. This is precisely the function that GridSolar is playing in the Boothbay Pilot.

Former FERC Chair, Jon Wellinghoff, has called this a D-ISO.

Last Thought …

DO NOT underestimate difficult it will be to take these Policy Actions and effect the types of transformations required.

The barriers – while not insurmountable - are very formidable … e.g. NYS REV

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