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Pacific Northwest SMART GRID DEMONSTRATION PROJECT

PNSGD Project Overview & Transactive Energy

Presented to PNWER Summit – Energy and Environment Working Group Session

Ron Melton, Ph.D., Project Director

Pacific Northwest National Laboratory

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Pacific Northwest Demonstration Project

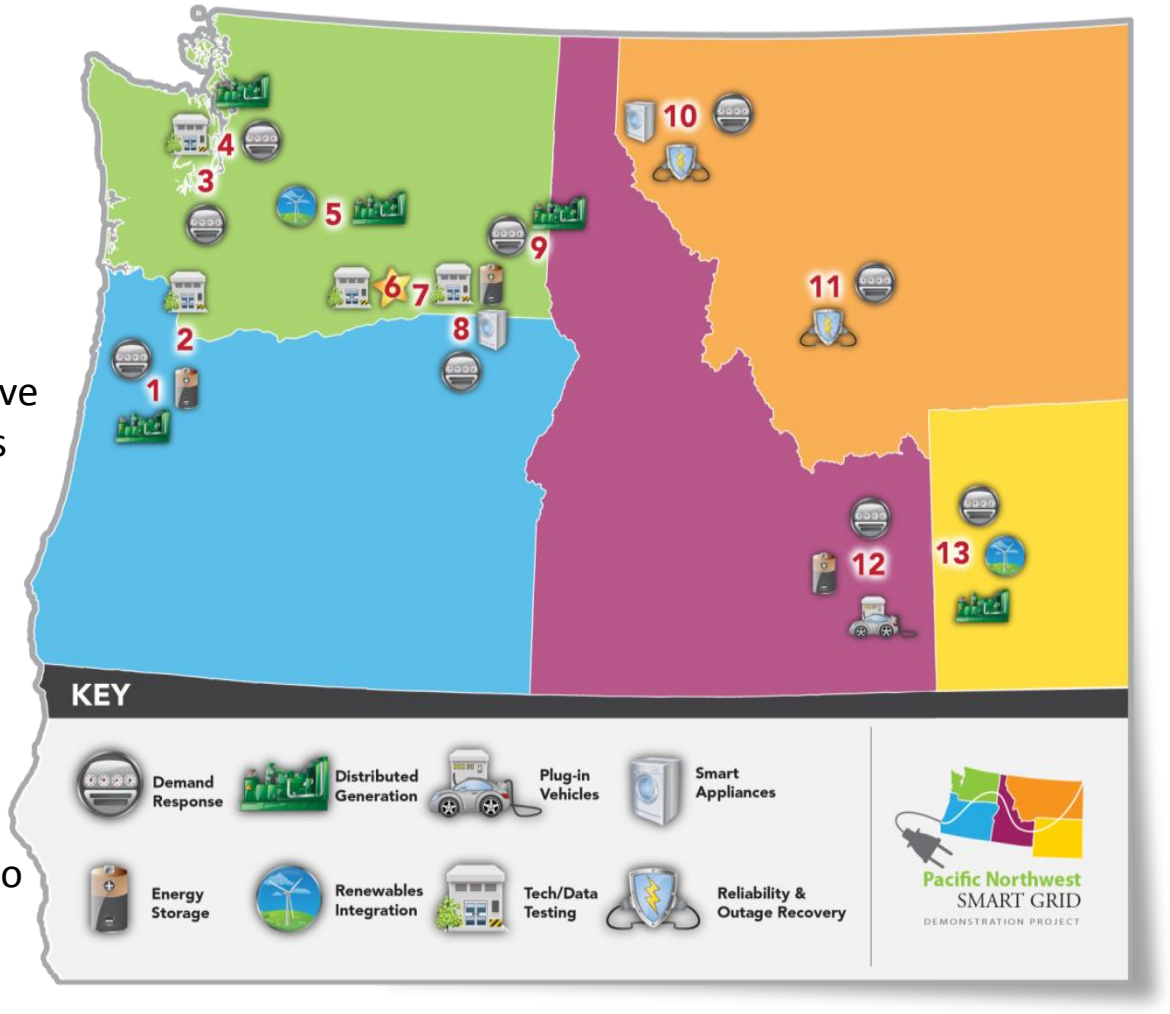
What:

- $178M, ARRA-funded, 5-year demonstration started in 2010
- 60,000 metered customers in 5 states

Why:

- Develop communications and control infrastructure using incentive signals to engage responsive assets
- Quantify costs and benefits
- Contribute to standards development
- Facilitate integration of wind and other renewables

Only project of its kind integrating resources across multiple utilities to achieve regional benefits.



Project Objectives

Lay the foundation for a regional Smart Grid

Develop Standards for interoperable Smart Grid

Develop communications and control infrastructure using incentive signals

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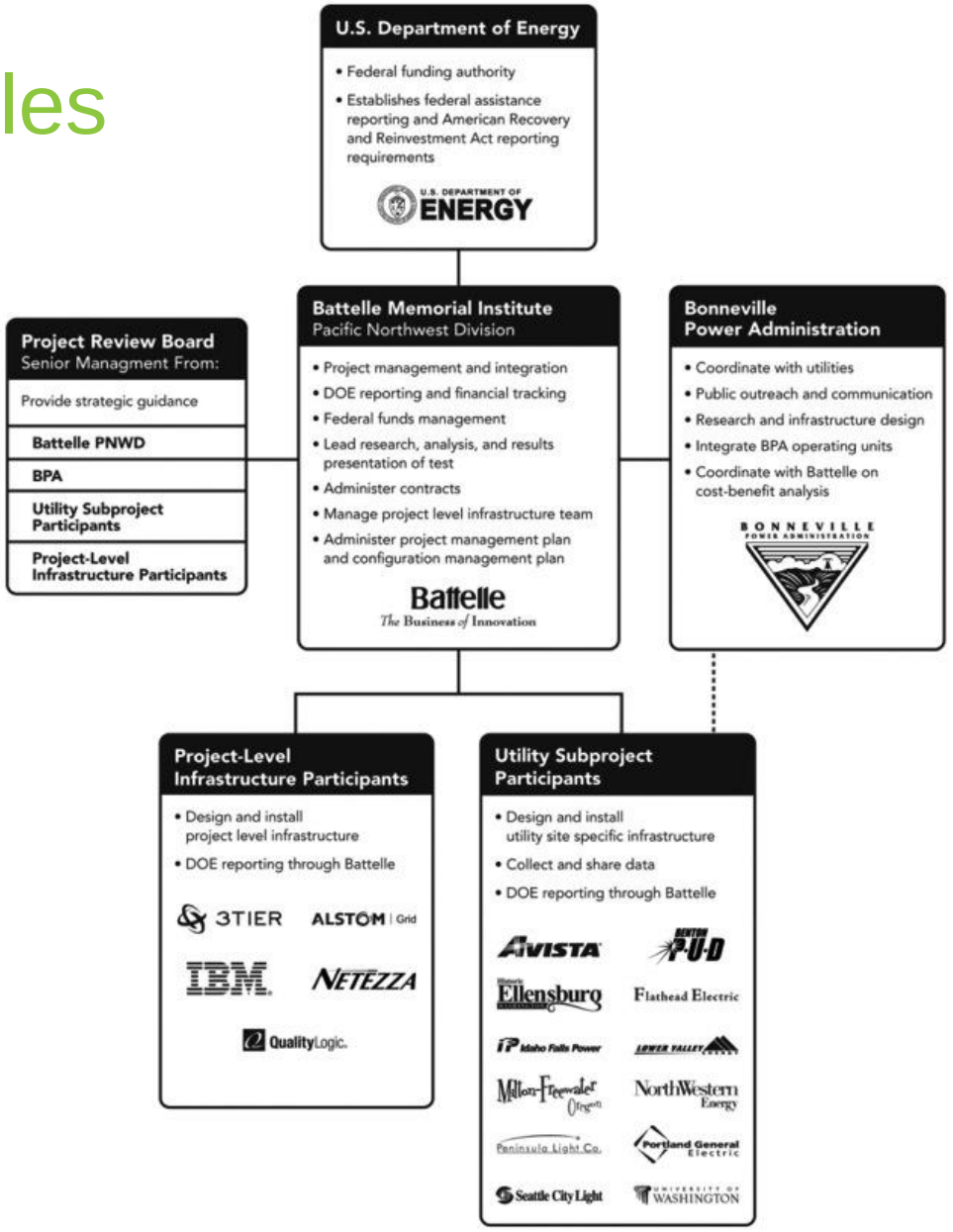
Measure and validate costs and benefits

Integrate renewable Energy

Project Structure / Roles

- Battelle Memorial Institute, Pacific Northwest Division
- Bonneville Power Administration
- 11 utilities (and UW) and their vendors
- 5 technology infrastructure partners



Transactive Control 101

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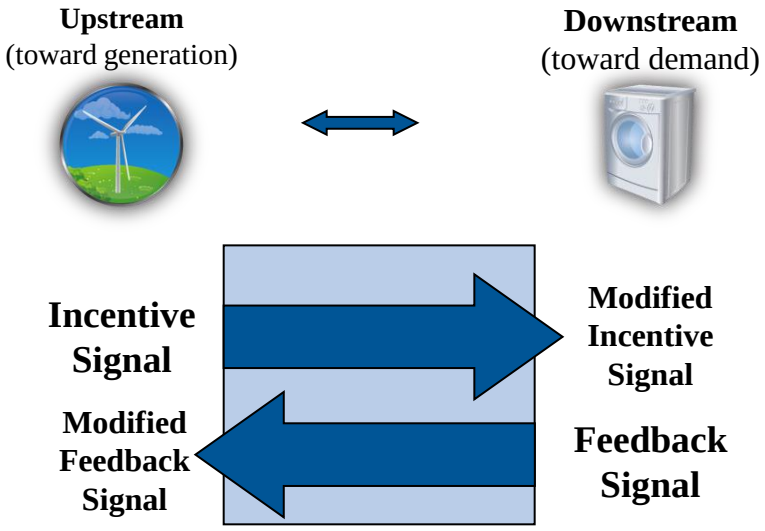
What is it?

- Transactive control is a distributed method for coordinating responsive grid assets wherever they may reside in the power system.

Incentive and feedback signals

- The incentive signal sends a synthetic price forecast to electricity assets
- The feedback signal sends a consumption pattern in response to the incentive.



Project Basics

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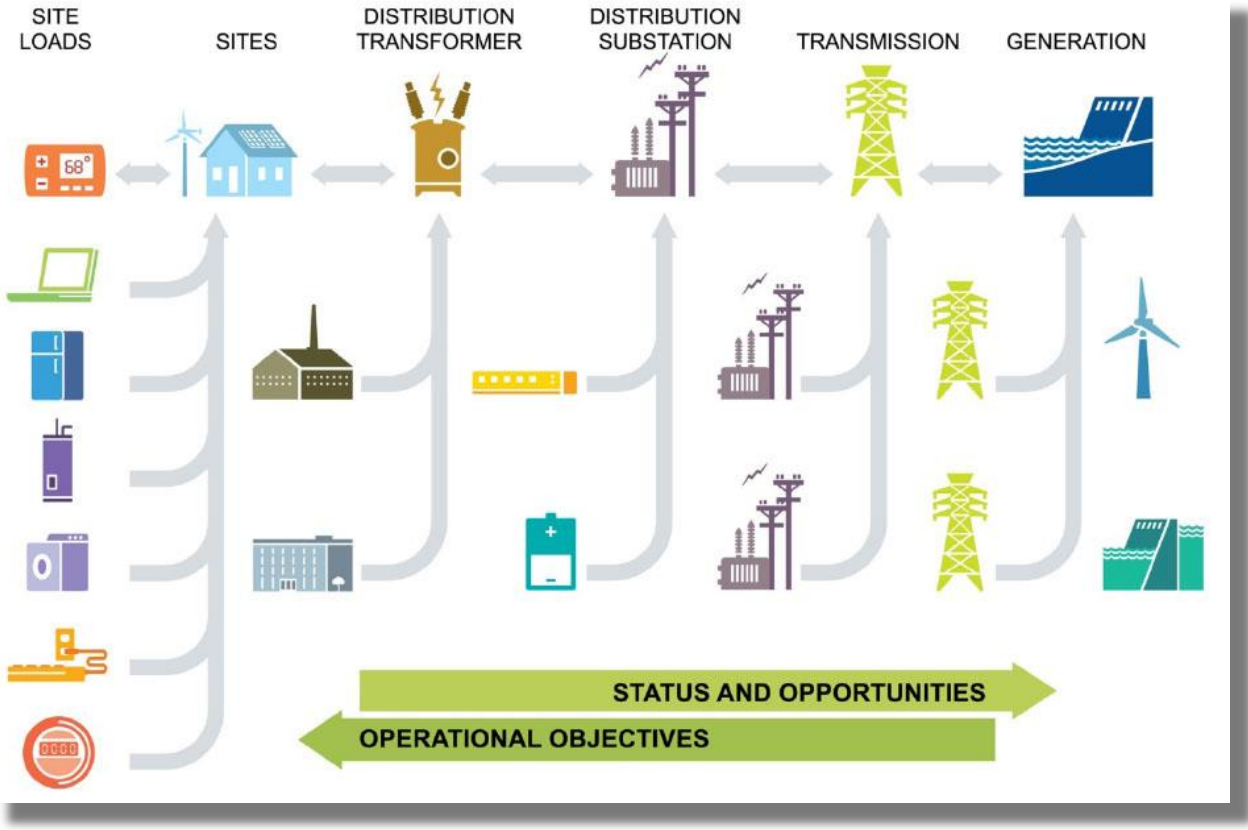
Transactive Control Operational objectives

- Manage peak demand
- Facilitate renewable resources
- Address constrained resources
- Improve system reliability and efficiency
- Select economical resources (optimize the system)



Aggregation of Power and Signals Occurs Through a Hierarchy of Interfaces

Project Successes

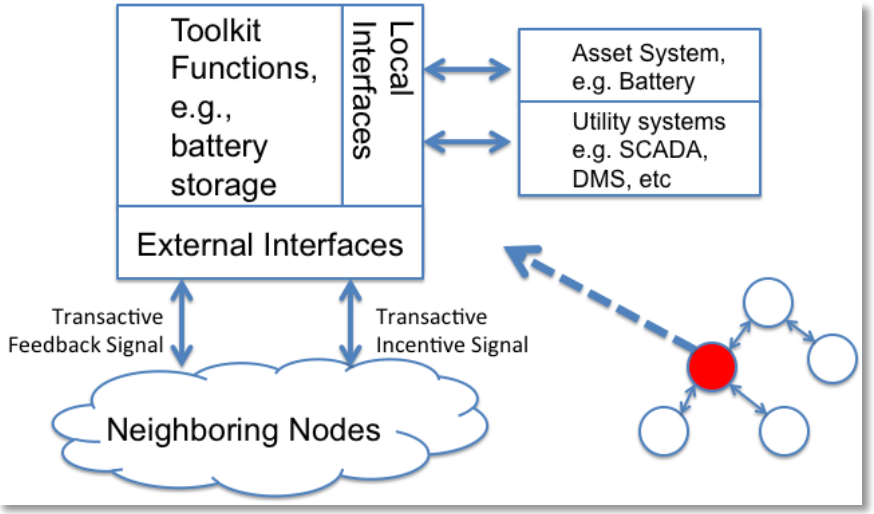
Pacific Northwest SMART GRID DEMONSTRATION PROJECT

Developed and demonstrated ability to coordinate incentive signal response across 11 utilities in five states using transactive control technology

Transactive control system design and reference implementation suitable for standardization

At the end of the project:

- ~ 80 Megawatts of distributed responsive assets engaged
- ~ $80M Base of smart grid equipment installed at 11 utilities



Selected Future Research Needs

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- Interoperability – improved standards and distributed energy resource integration architectures
- Improved load modeling and forecasting techniques
- Methodology for consistent valuation of operational objectives and asset systems
- Tools to support operation of smart grid sensors and systems – in particular to improve data quality and consistency

Acknowledgement & Disclaimer

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- Acknowledgment: "This material is based upon work supported by the Department of Energy under Award Number DE-OE0000190."

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Summary of Avista Activities in Pullman, WA

Avista - Pullman Smart Grid & Energy Storage

Energy Efficiency

- Voltage drop 2.1%, 7.8 GWh of energy saved/yr
- $111,000 savings/yr with smart transformers
- 3.5 MW of load reduction and generation at WSU

Reliability (August 2013 thru December 2014)

- 353,336 avoided customer outage minutes
- 17 percent fewer outages
- 12 percent shorter outages

Customer Experience

- 9.5% average annual savings with smart thermostat
- High satisfaction with smart thermostat
- Web portal with consumption data had no measurable impact on consumption
- Texting of expected usage and thresholds had positive impact with customers

Energy Storage

- Largest vanadium flow battery in North America and Europe
- Providing ride through for SEL and backup for Avista Customers
- Stores renewable energy for dispatch at peak
- And much more.....

For further information

Dr. Ron Melton

ron.melton@pnnl.gov

509-372-6777

Summary of Technology Performance Report:

http://www.pnwsmartgrid.org/docs/PNW_SGDP_AnnualReport.pdf

Full Technology Performance Report:

https://www.smartgrid.gov/document/Pacific_Northwest_Smart_Grid_Technology_Performance.html