Northwest Power and Conservation Council

February 25, 2009

MEMORANDUM

TO: Council Members

FROM: Terry Morlan

SUBJECT: Bonneville Presentation on Smart Grid Pilot Program

At the March Council meeting in Boise, Terry Oliver, Bonneville's Chief Technological Innovation Officer, will brief the Council on a planned smart grid pilot program. Smart grid is a term used for technologies that could be deployed to improve the management of the power grid with the potential to greatly improve efficiency on both the utility and customer sides of the meter.

Many of the basic technologies with potential to enable the smart grid system already exist. However, relatively little deployment of smart gird systems has occurred. The long-term potential appears to be large, with benefits for acquiring customer and utilities system efficiency, demand response, and system operational improvements. A fully deployed smart grid system could potentially revolutionize current approaches to achieving improved efficiency of electricity use. However, deploying smart grid technologies is complicated, both technically and financially. It is not likely to be a short-term solution, but rather the next large step forward in modernizing the electricity system in the long-term.

To reach the long-term vision, steps need to be taken now to advance our knowledge and obtain experience with smart grid deployment. Bonneville's smart grid pilot appears to be an important step in that direction.

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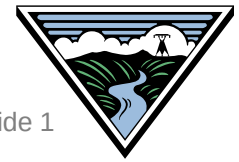
BPA Smart Grid Overview

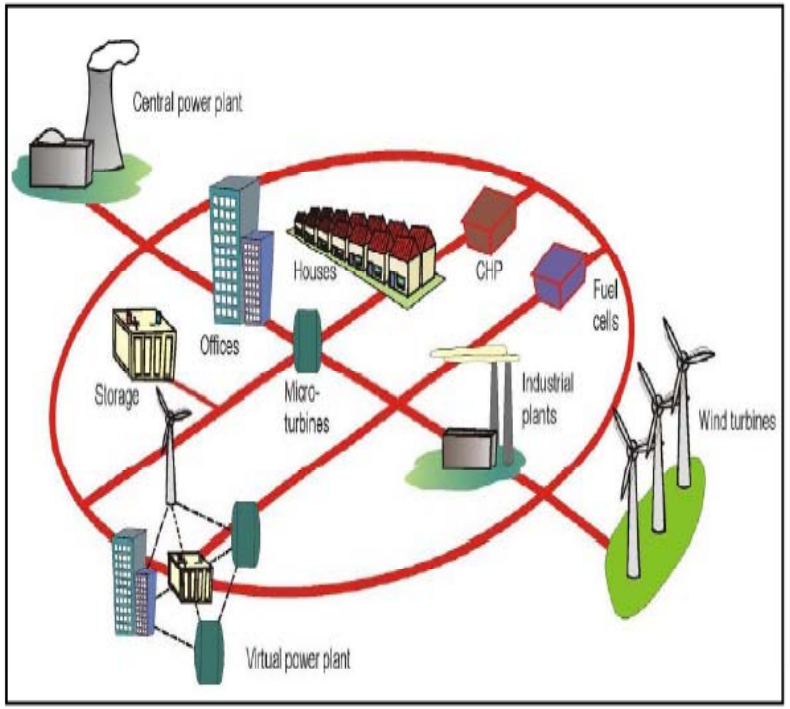
Terry Oliver
Chief Technology Innovation Officer

Northwest Power & Conservation Council
Boise, ID
March 11, 2009



Smart Grid
What is it?

US DOE SmartGrid Vision

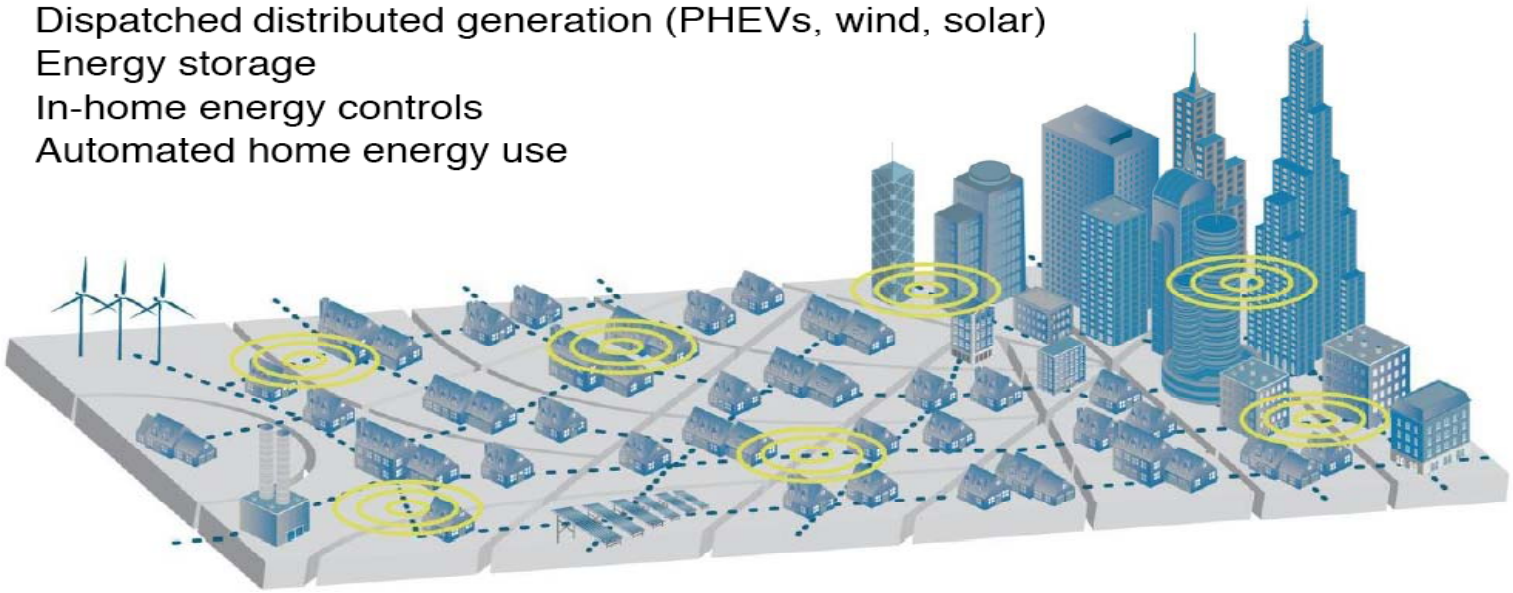


EU SmartGrid Vision

- The term "smart grid" represents a vision for a digital upgrade of distribution and long distance transmission grids to both optimize current operations, as well as open up new markets for alternative energy production.
- Use of robust two-way communications, advanced sensors, and distributed computing technology will improve the efficiency, reliability and safety of power delivery and use.
- One United States Department of Energy study calculated that internal modernization of US grids with smart grid capabilities would save between 46 and 117 billion dollars over the next 20 years.
- If smart grid technologies made the United States grid just 5% more efficient, it would equate to eliminating the fuel and greenhouse gas emissions from 53 million cars.

The Smart Grid Can be defined by it components

- Involves the entire energy pathway from the power source to the home and all points in between
- Rich in IT
- High-speed, real-time, two-way communications
- Sensors enabling rapid diagnosis and corrections
- Dispatched distributed generation (PHEVs, wind, solar)
- Energy storage
- In-home energy controls
- Automated home energy use

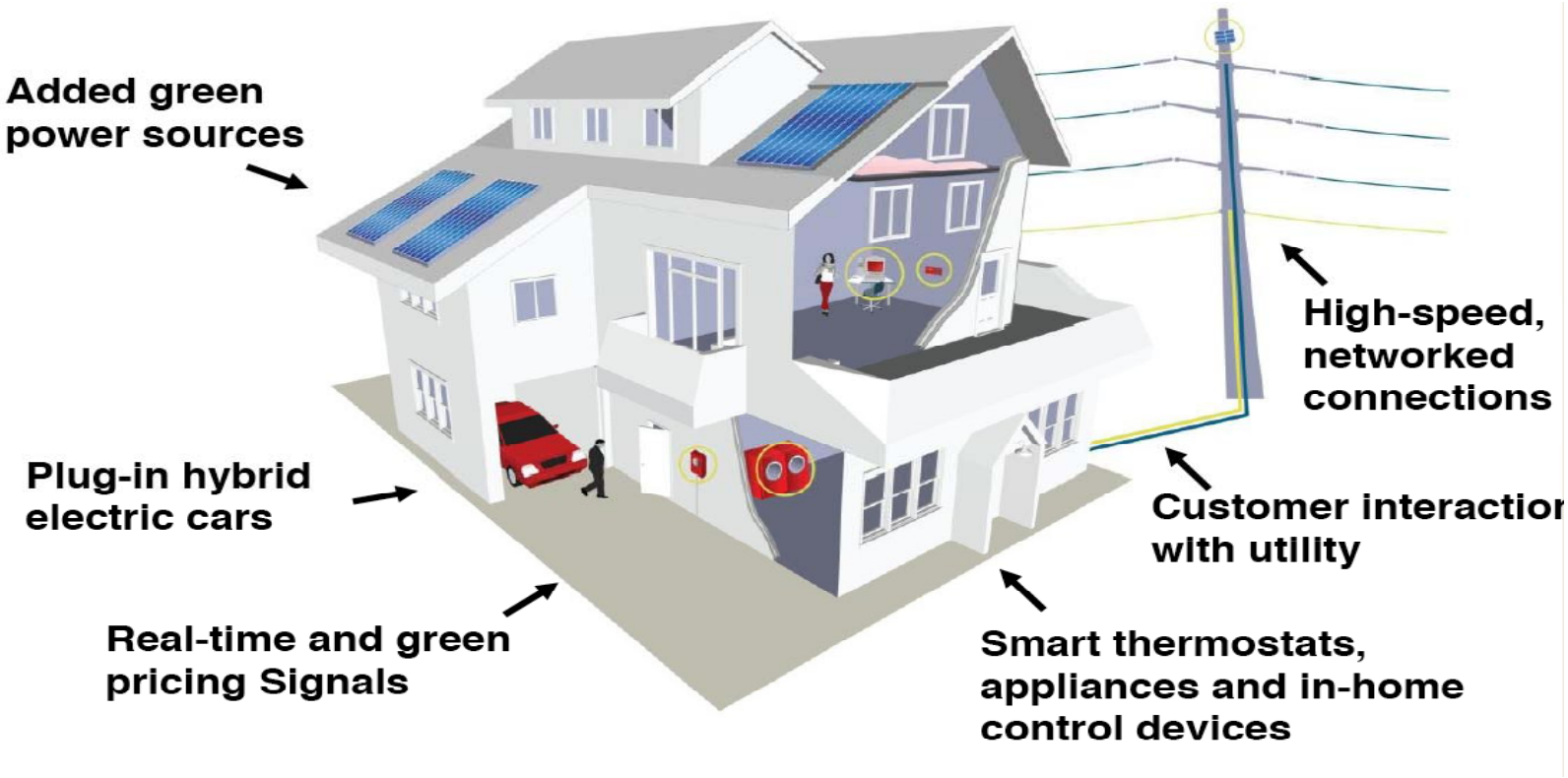


- “Smart Grid" is an aggregate term for a set of related technologies rather than a name for a specific technology.
- Some of the benefits of such a modernized electricity network include the ability to reduce power consumption at consumer side during peak hours (Demand side management); enabling grid connection of distributed generation power (with photovoltaic arrays, small wind turbines, micro hydro, or even combined heat power generators in buildings); incorporating grid energy storage for distributed generation load balancing; and eliminating or containing failures such as widespread power grid cascading failures (self-healing grid).
- The increased efficiency and reliability of the Smart grid is expected to save consumers money and help reduce CO2 emissions.
- Smart grid is referred to by other names including "Smart Electric Grid," "Smart Power Grid," "Intelligrid," and "FutureGrid".

Drivers of the Smart Grid

- Peak capacity supplies power only a few hours per year
  - 20% of MW supplies 0.34% of MWh
  - 30% of MW supplies 1.6% of MWh
- Cost of peaking capacity
  - A simple cycle gas turbine costs about $81/kW·y [2-4]
  - $94/kW·y once accounting for 8% T&D losses and15% reserve margin [5-6]
- Cost of capacity per unit
  - If the peaking unit runs only 1 hour, then the capacity cost per unit is $94,000/MWh
  - If the peaking unit runs all 8760 hours, then the cost per unit is $10.70/MWh

The End-user is the center piece of the Smart Grid



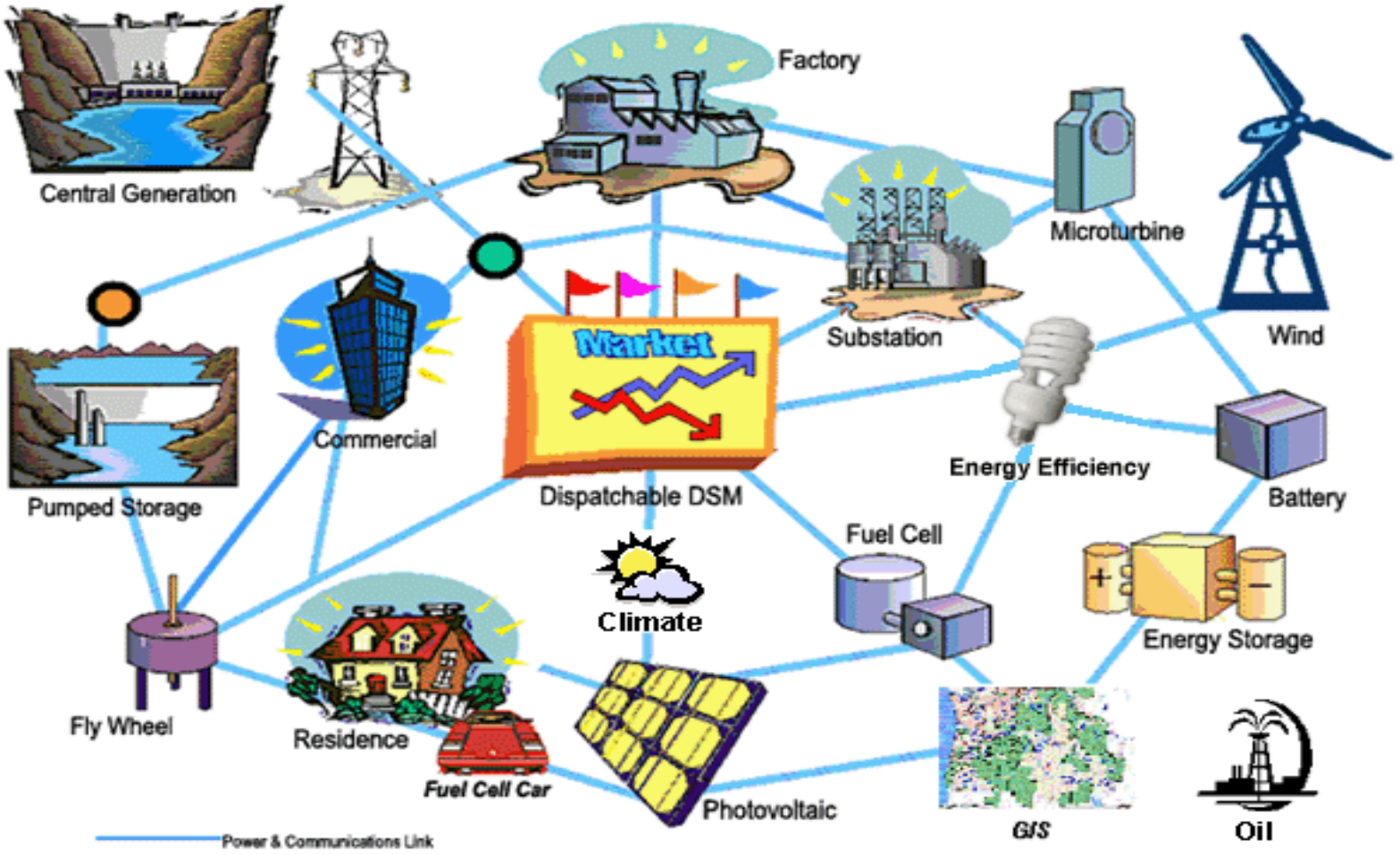
BPA's Role

- BPA seeks to enable a smarter more efficient Pacific Northwest Power Delivery System.
- BPA seeks to promote the Pacific Northwest as forerunner in Smart Grid technology.
- BPA seeks to empower customers to make smart energy usage choices while lowering the cost of energy and the customers overall bill.
- BPA seeks to take advantage of distributed generation resources.
- BPA seeks to find ways of integrating wind power

BPA's Smart Grid History

- BPA was the first to introduce the idea of an Energy Web. Whereby all resources of the grid are intelligent and communicate with one another.
- The integration of the utility electrical system, telecommunications system, and the energy market to optimize loads on the electrical network, reduce costs to consumers and utilities, facilitate the integration of renewable resources, increase electrical system reliability and reduce environmental impacts of load growth.

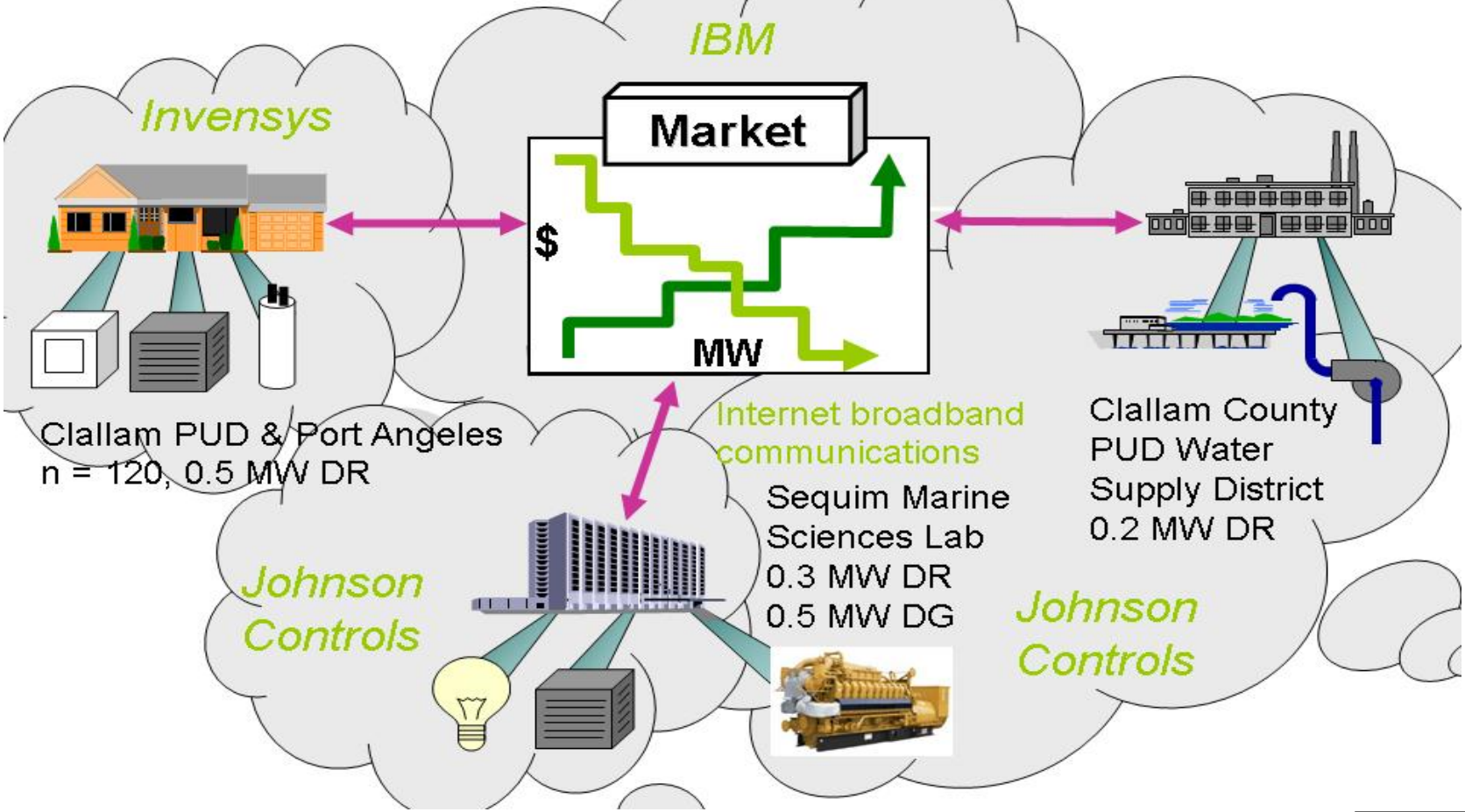
BPA: The Energy Web a New Kind of Network



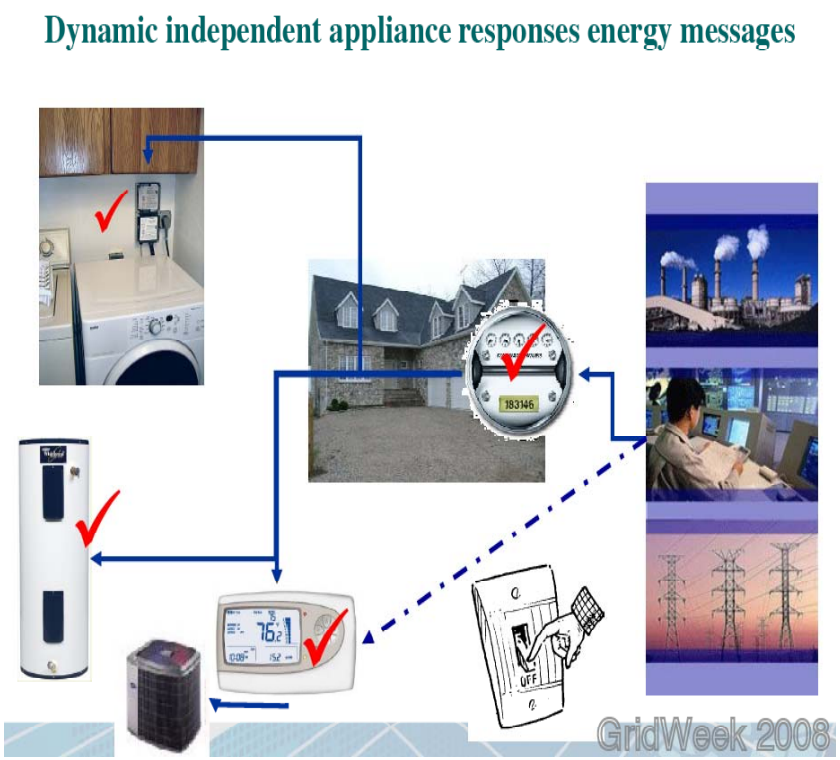
Recent BPA Advancement of Smart Grid

- BPA partnered with PNNL and DOE to conduct the GridWise™ Demonstration Project to test the notion that smart grid technologies and consumers can play an active role in managing the gird.

Olympic Peninsula Demonstration



Grid Friendly™ Appliance Project



BPA's Smart Grid Demonstration Project

- Follows the success of the Grid Wise Demonstration Project
- Seeks to incorporate the technology and lessons learned in the Grid Wise demonstration project.
- Looks to augment the size and scope of the Grid Wise Demonstration Project

Project Goals

- Pilot the future electricity network, a network made more reliable, more flexible, and less costly using autonomous controls, advanced sensors, and distributed intelligence.
- To actively test and demonstrate the benefits, issues and opportunities associated with the coming Smart Grid, on a scale that allows confidence in the results, while providing a robust learning environment which will help Pacific Northwest and North American utilities move appropriately from current grid configuration to the Smart Grid required for the coming wide-spread use of variable and decentralized generating resources.

Project Scope

- Six vertical slices of the system from source to sink.
- Will upgrade “smarten up” six distribution feeder lines and their substations in three sets of 2. Each pair of feeders in close geographic proximity to each other, each feeder within an individual utility’s territory.

Project will Create

- Scalable Hierarchical Communications and Controls Pathway.
- Nodal Information, control and valuation system.
- Distribution Automation System for each feeder line.
- Communication protocol between nodes, utility service territories, transmission operations, generation operations, and market operations.
- Energy management systems at the end-users site.
- Pricing and signaling system down to the end-user and up to the systems operator.

Questions?