Demand Response: A BPA Perspective

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Presentation overview

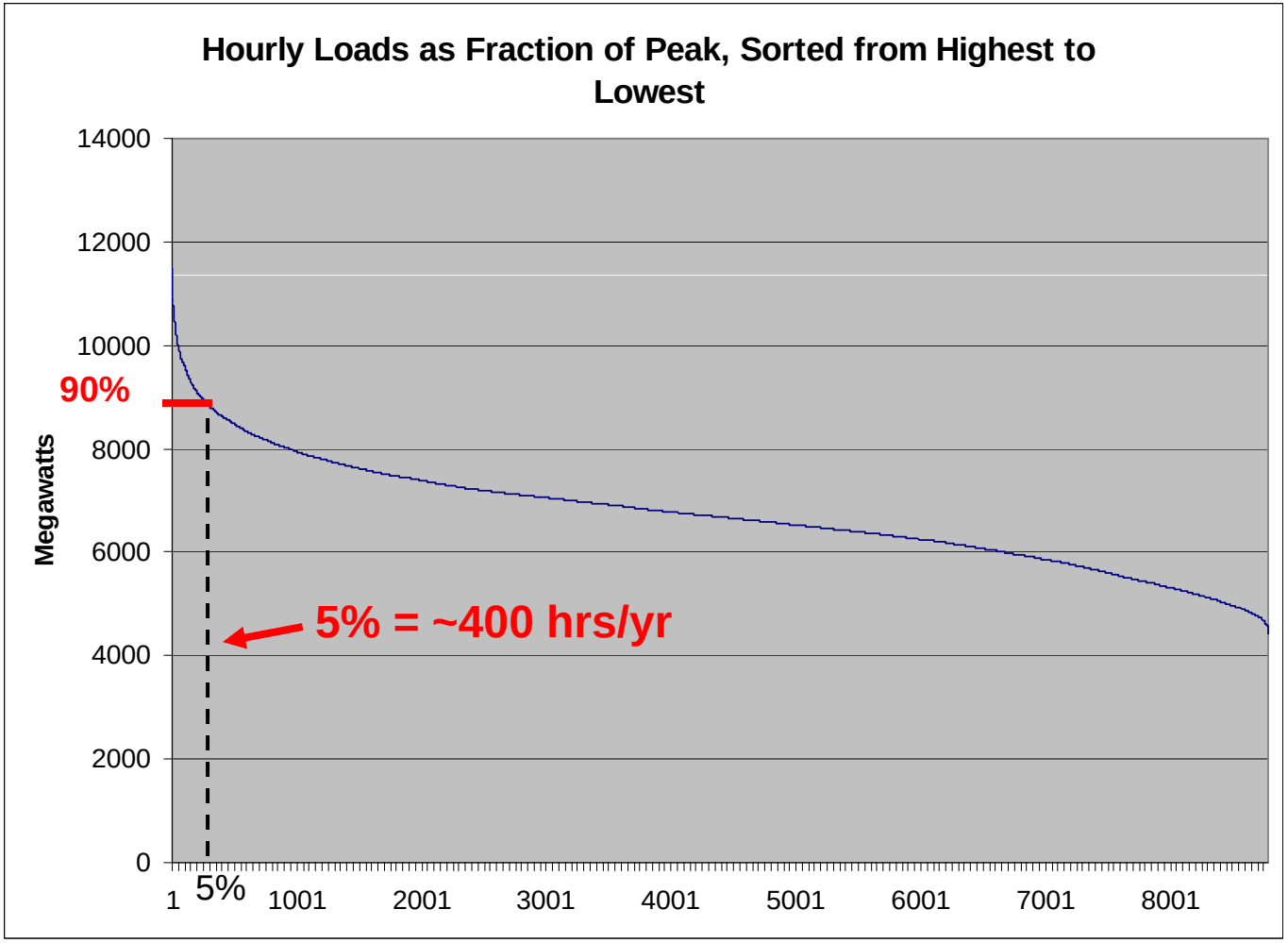
- What is Demand Response (DR)?
- How does DR relate to the Smart Grid?
- How does DR relate to Energy Efficiency?
- Why is DR important now?
- Benefits of DR
- Current DR Pilot Projects

What is Demand Response?

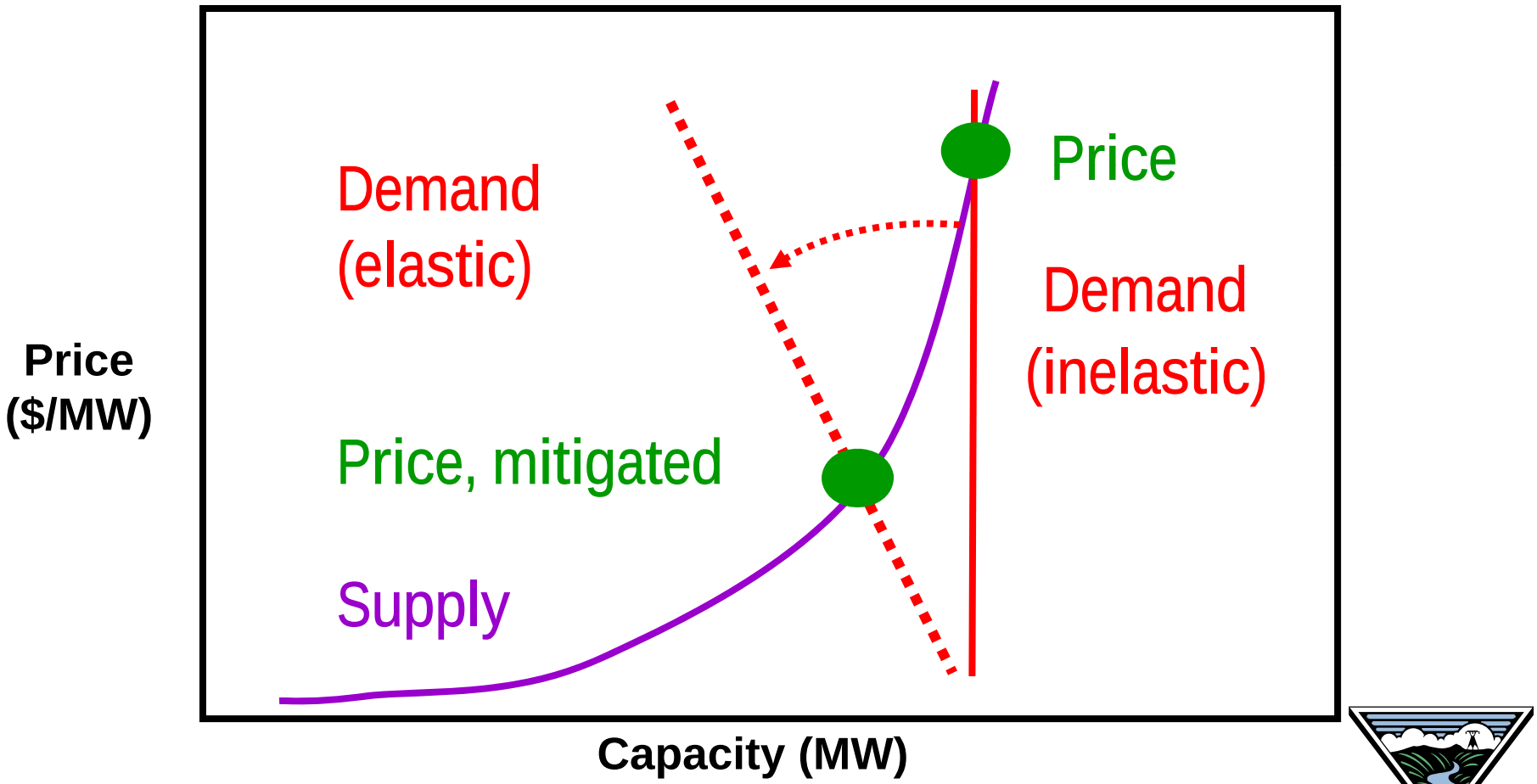
Changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized.

-Demand Response Research Center, Lawrence Berkley National Lab

Potential impact of DR on peak



Potential economic impact of DR



Key drivers

- Peak Demand is expected to continue to grow at an average rate of 1.7% annually.
- Load growth, wind integration and fish operations are testing the capacity of the Federal Columbia River Power System.
- The costs of building and permitting new resources is increasing.
- Legislation, including I-937, renewable portfolio standards, and cap-and-trade are limiting the types of new resources that utilities can acquire.
- The Northwest Power and Conservation Council's draft Sixth Power Plan calls for research and demonstration of Demand Response through pilot projects and technology demonstrations.

What is the Smart Grid?

- A communications and IT overlay on the existing grid infrastructure
- Creates a network to utilize demand side assets such as DR and distributed generation to meet demand and increase grid reliability
- Empowers customers to choose to control their energy usage
  - Smart Meters
  - Home/building/industrial energy management/control systems
  - User information interfaces & support tools

Benefits of the Smart Grid

- Enables active participation by consumers
- Accommodates all generation and storage options
- Enables new products, services and markets
- Provides power quality for the digital economy
- Optimizes assets & operates efficiently
- Anticipates and responds to system disturbances (self-heals)
- Operates resiliently against attack and natural disaster

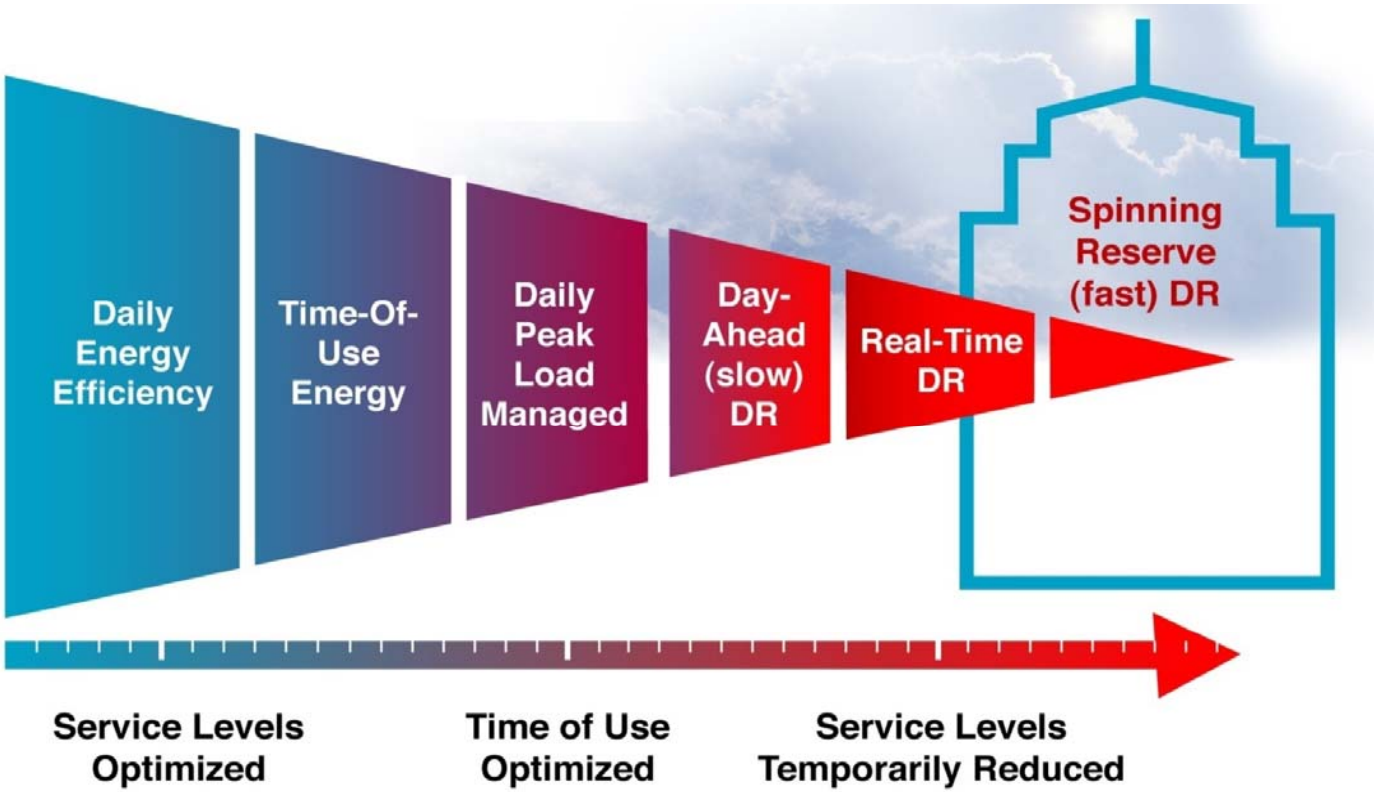
Demand Response and the Smart Grid

- DR is the primary demand side resource of the Smart Grid
- Smart Grid provides the capability to better utilize DR
- Smart Grid allows utilities to harness other benefits (ancillary services, etc) of DR
- Smart Grid gives operators increased confidence in DR as a resource due to greater visibility
- DR is an important component of the Pacific Northwest Regional Smart Grid Demonstration Project

Demand Response and Energy Efficiency

- Energy efficiency provides ongoing energy savings; DR provides event-driven demand savings
- Energy savings that occur during hours of peak demand can contribute to demand savings
- More analysis needed to substantiate if DR provides efficiency savings
- From the end customer's perspective, there is little distinction between EE and DR
- People who participate in EE are more likely to participate in DR and vice-versa
- Best practices for program marketing, especially towards residential customers, addresses EE and DR simultaneously

Role of Demand Response in electric power systems



Demand Response Research Center, “Demand Response Best Practices, Design Guidelines and Standards, Work Papers”, presentation to California Public Utilities Commission, December 2008.

Why Demand Response now?

Until recently BPA has been able to meet peak capacity needs for Northwest Public Power customers through the flexibility of the hydro system. However, load growth and other constraints are pointing to a forecasted peak capacity deficit in the near future.

Demand Response can be an important tool for BPA and regional utilities to:

- address emergency events
- save money (costs) by offsetting demand charges
- harness the environmental benefits of DR
- support system reliability
- utilize DR as a wind matching resource for enhanced wind integration

Regional benefits

- Reduces amount of generation and transmission assets required to provide electric service
- Long-term avoidance of building expensive peak generation and additional transmission capacity
- Reducing peak demand reduces the overall marginal and average costs of electricity thereby controlling price volatility and market power in electricity markets
- Flexible demand, capable of responding to system reliability problems can enhance the grid operators' management of electric grid
- Reduces the potential for forced outages, full-scale blackouts and brownouts
- Regulation capabilities provides a balancing resource for wind integration
- Enables end-use customers to control their energy purchases, gives the consumer choice

Benefits to Northwest utilities

- Ability to lower future BPA demand charges
- Ability to meet peak load with a clean, low-impact resource
- A new tool to address system contingencies and improve reliability
- Opportunity to inform local, regional and national energy consumption and DR standards
- Opportunity to deploy leading-edge technology to customers
- A new communication channel to engage customers in ongoing dialogue around energy consumption and cost

Demand Response event scenarios

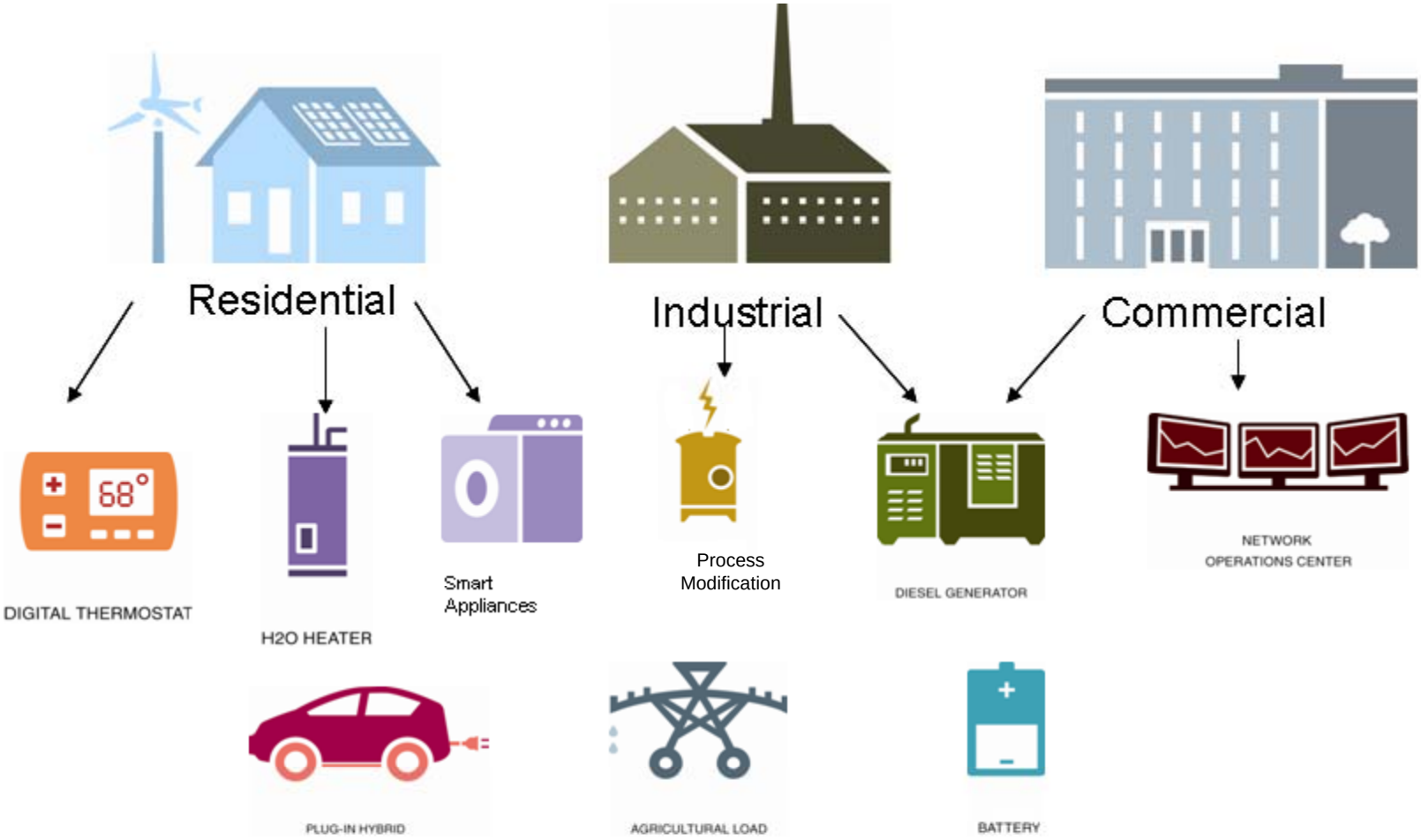
BPA has identified Capacity Constraint Scenarios where DR can increase reliability and system flexibility.

	Scenario 1 Summer Heat Wave	Scenario 2 Winter Cold Spell	Scenario 3 Increased Reliance on Wind	Scenario 4 Large Unit Outage	Scenario 5 Difficulty Managing the System
Season	Summer heat wave	Winter cold spell	Any	Any	Shoulder
Continuous event days	Three days	Three Days	Year round	Two days	One day
Timing	Afternoon (2-9pm)	Morning (6am-9am) Evening (5pm-9pm)	Intermittent	All day	All day
Frequency	Once per day; 3 events per summer	Twice Per Day; 0-1 Events per winter	Many deviations from expected output per day	Constant throughout day	Constant throughout day
Foresight	2 to 5 Days	1 to 2 Days	less than 1 hour	Less than 1 hour	1 day
Trigger	Reliability/Price	Reliability/price	Reliability	Reliability/price	Reliability/price
Relevant region	Pacific Northwest	Pacific Northwest	Pacific Northwest	BPA control area	BPA control area
Size of peak impact	1,000-2,000 MW	1,000-2,000 MW	1,000-4,000 MW	1,100 MW	1,000 MW

Some Demand Response technologies & strategies

- Residential
  - Direct Load Control (Water Heaters, A/C, Pool Pumps) Programmable Communicating Thermostats
  - Smart Appliances
  - Dynamic Pricing
  - Plug-in vehicles
  - Storage
- Commercial/Industrial
  - OpenADR
  - Aggregators (Curtailment Service Providers)
  - Process modification
  - Back up Generation
  - Energy Management System controls
  - Dynamic Pricing
  - Storage (Thermal or Chemical)
- Irrigation
  - Irrigation pump timers/ modulation or curtailment
  - Load Shifting

What DR technology is right for my utility?



Current regional projects

BPA DR Projects:

- Residential Direct Load Control
- Open-Automated Demand Response

Regional Projects:

- Pacific Northwest Regional Smart Grid Demonstration Project
- Milton-Freewater Direct Load Control
- Other utility programs

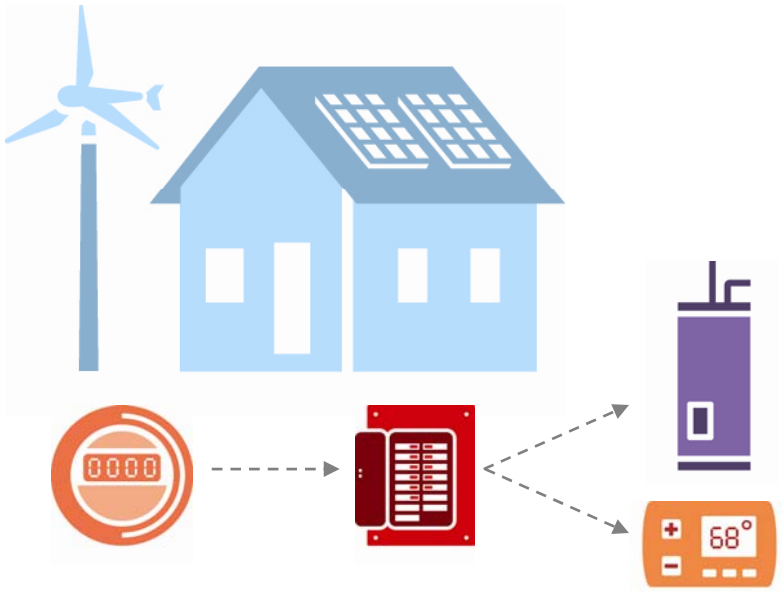
Residential Pilot Project Goals

- Develop strategies for BPA and utilities to work collaboratively to achieve effective DR in the Northwest
- Test the integration of DR technologies with AMI systems in the residential sector through a Direct Load Control (DLC) program
- Test residential customer recruitment strategy, education and program participation persistence
- Quantify costs and impacts of leading DR technologies in the residential sector

How does it work: Residential?

UTILITY ISSUES A DEMAND RESPONSE EVENT

Event transmitted via power line carrier to meter and water heater.



Meter translates power line carrier to Zigbee for communication with thermostat

Residential DLC pilot marketing research

- BPA and Kootenai Electric are conducting marketing research as part of residential DLC pilot:
  - Baseline survey (residential customers) level of DR concepts understanding
  - Marketing efforts to test messaging and delivery channels for recruitment
  - Test education and communication efforts for participant persistence
  - Segment program participants (and non-participants) tied into current regional Residential Segmentation research
- Efforts will be tracked, messaging and education optimized during program.
- Survey will be repeated after one year to determine shift in knowledge and attitudes towards DR

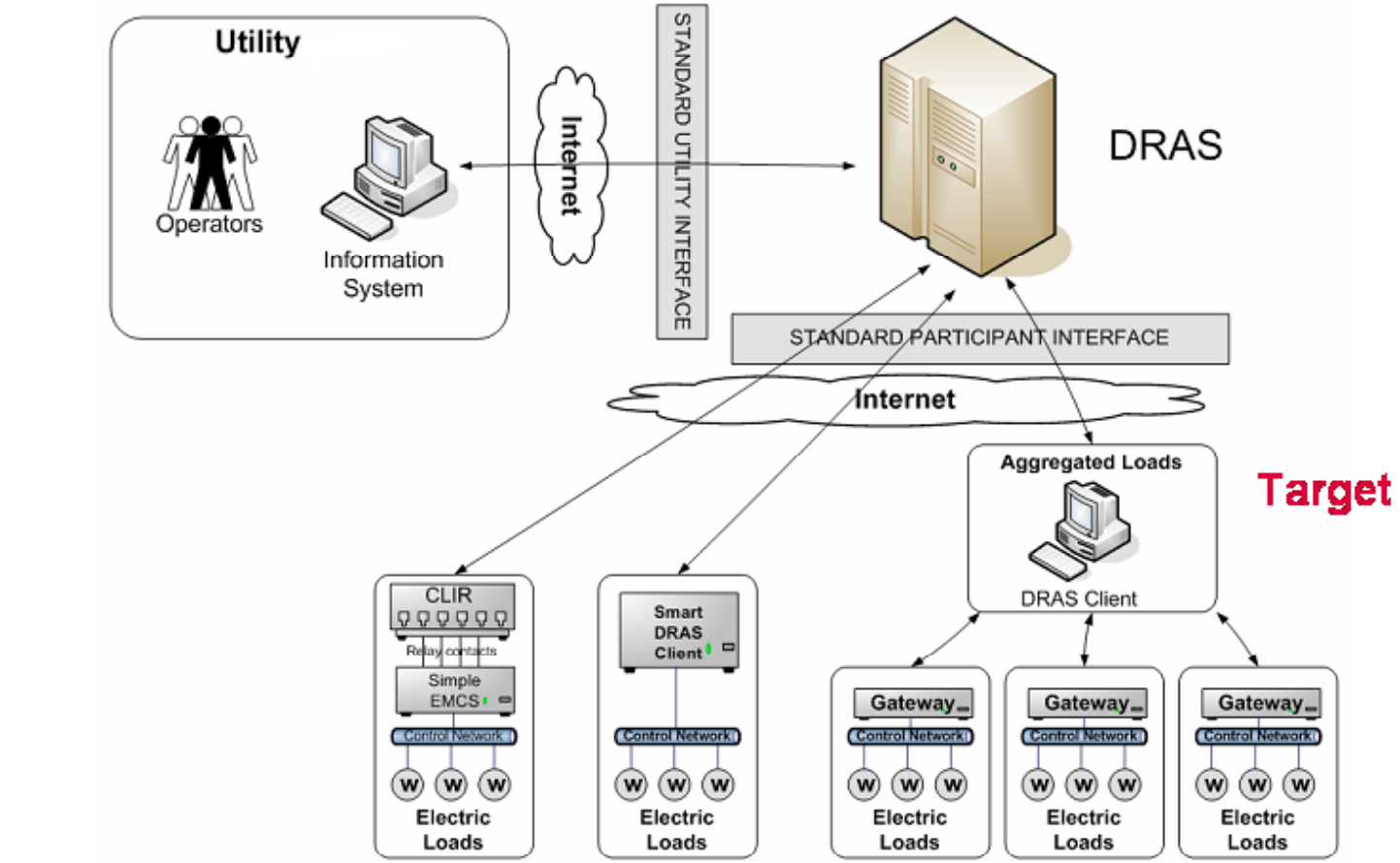
Residential DLC pilot marketing research

- Marketing approach for the residential pilot emphasizes EE and DR together
- Leverage knowledge of regional EE residential segments to promote DR pilot and recruit participants
- Pilot offers free Home Energy Audit and Programmable Thermostat as an incentive to participate, additional information on Kootenai's EE and DR programs upon enrollment

Commercial Demonstration Project Goals

- Develop strategies for BPA and utilities to work collaboratively to achieve effective DR in the Northwest
- Demonstrate how Open Auto-DR communication signaling infrastructure works with commercial facilities during winter and summer peaks
- Evaluate DR building control strategies for winter and summer peaking commercial facilities

How does it work: Commercial?

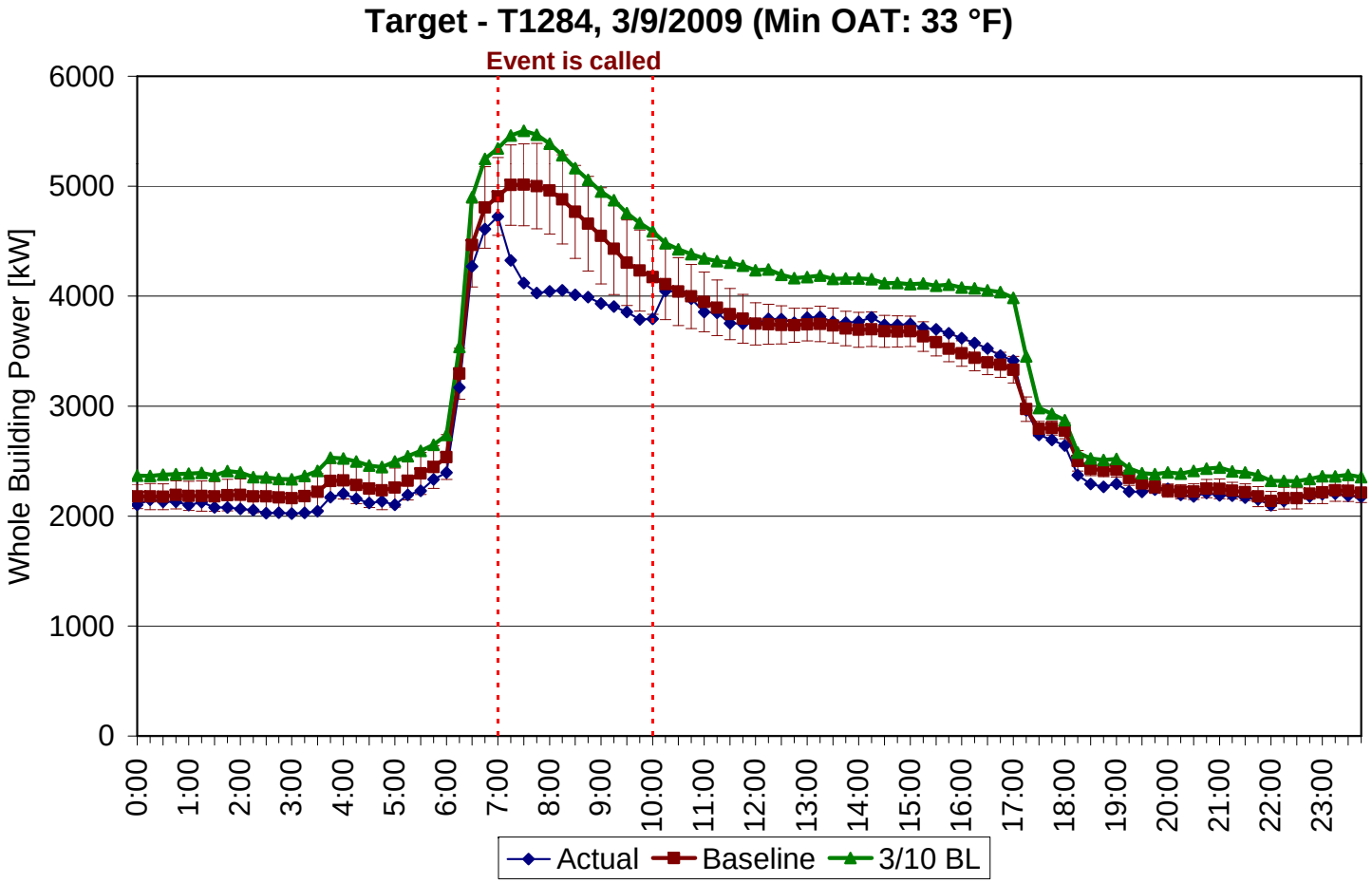


Seattle University
Seattle Municipal Tower

McKinstry

What you can expect: Winter

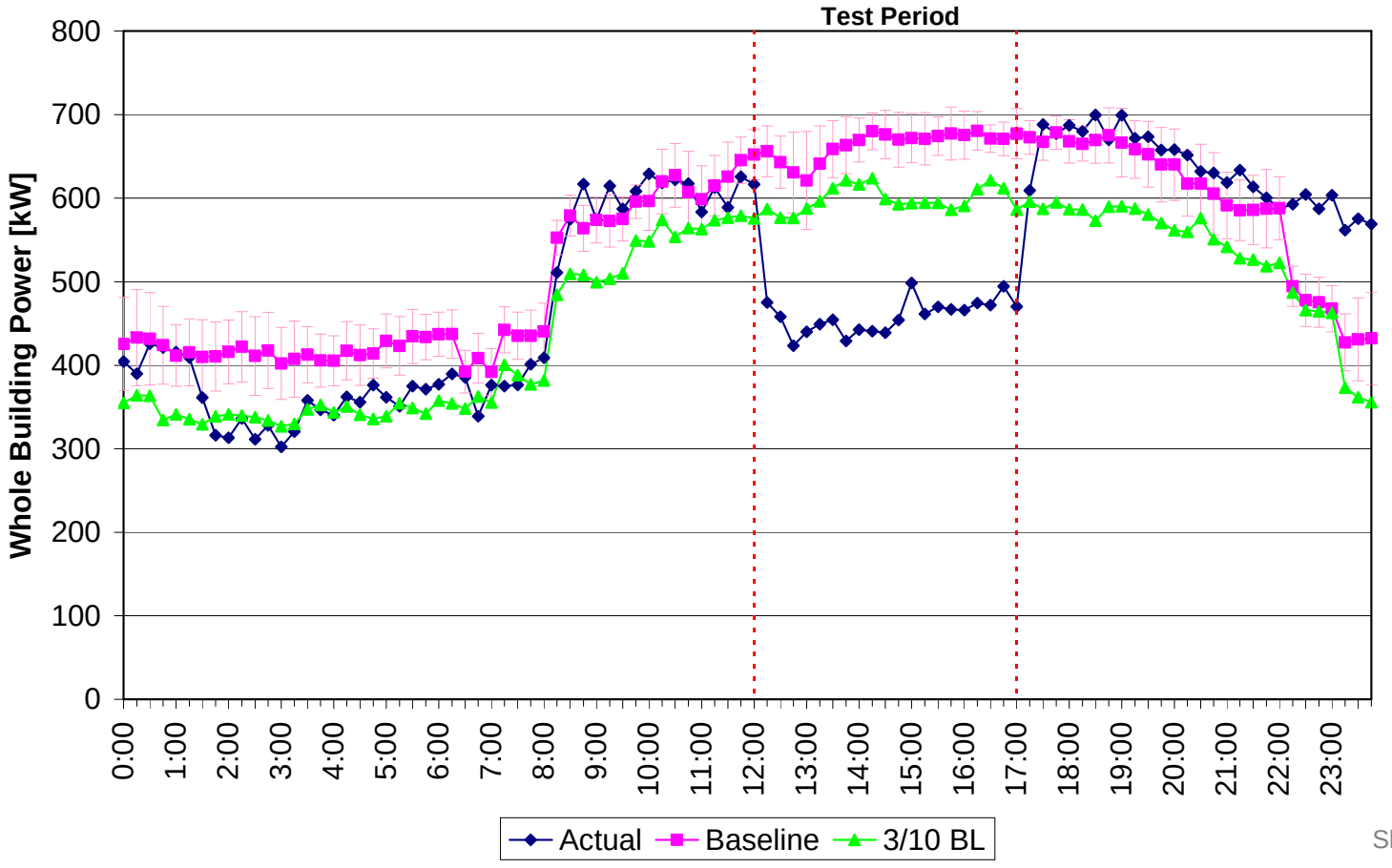
Example of a real-life BPA Demand Response test event: Large Office



What you can expect: Summer

Example of a real-life BPA Demand Response test event: Big-Box Retail

Target - T1284, 8/19/2009 (Max OAT: 86 °F)



Open-Auto DR results

- Recruitment of consumers is potentially challenging
- A large potential pool of customers enabled us to achieve the targeted number of participants
- Lighting provides year-round DR
- Winter: all-electric heating systems are the low hanging fruit; systems with natural gas heating have limited savings opportunities
- Auto-DR concepts work for dual peaking DR in commercial buildings.

Long-Term Demand Response Goals

- Develop Demand Response as a significant resource to meet regional capacity needs
- Incorporate DR as an integral part of overall EE efforts
- Test the impacts of dynamic pricing
- Integrate Demand Response into the Smart Grid
- Utilize Demand Response as a tool for wind integration

Additional resources

- E-Source:
  - All public utility staff have access to E-Source Efficiency & Demand-Response Programs Service. Contact your EER or Carol Lindstrom for more information.
- BPA Staff
  - Lee Hall, Smart Grid Program Manager
  - Carol Lindstrom, EE Marketing

Questions?