



Load Following from Demand Response: Developments in the Pacific NW

National Action Plan on Demand Response Workshop

Washington D.C. July 12, 2011

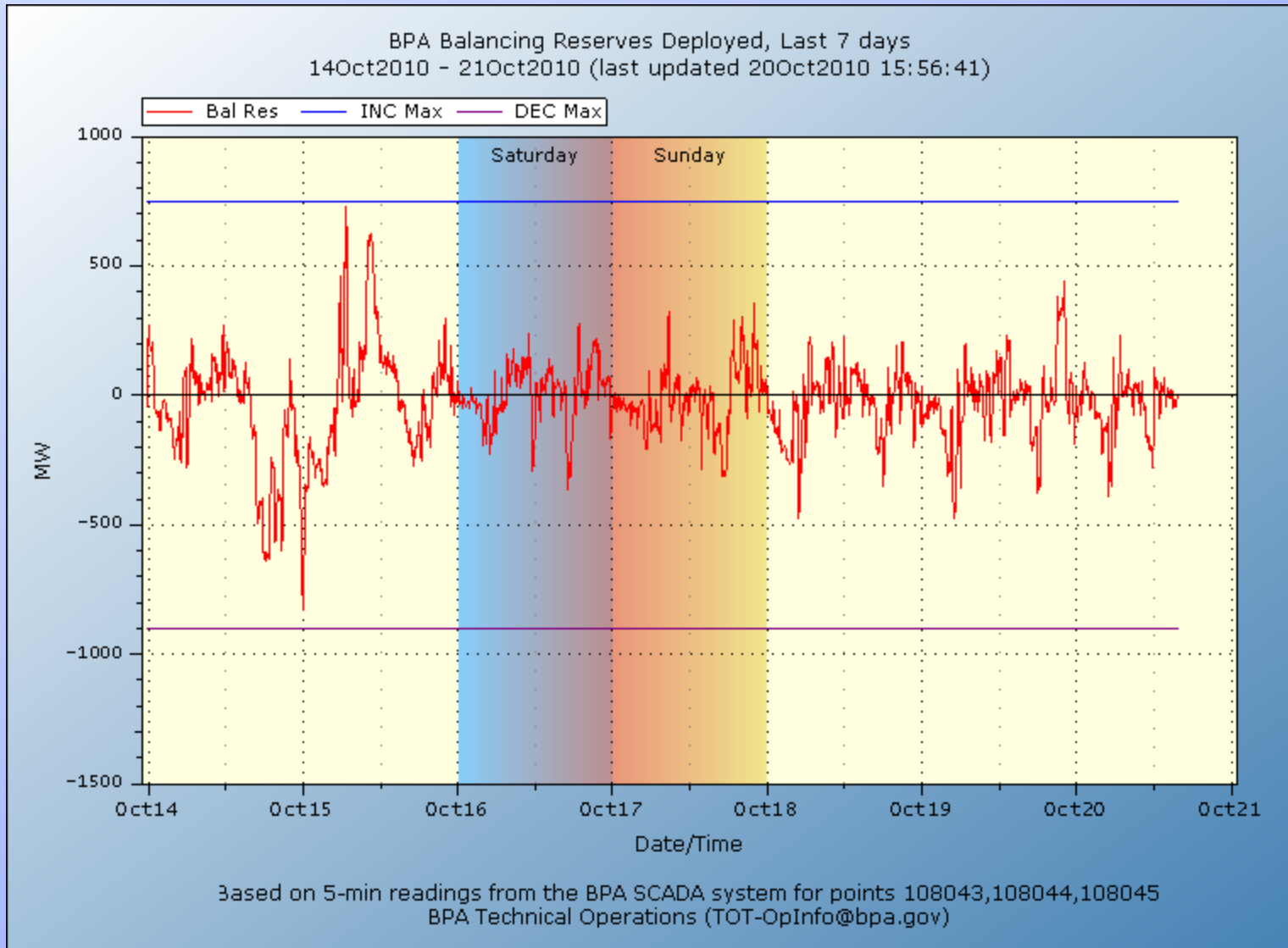
Ken Corum

NW Power and Conservation Council

System Operators' Job in the Operating Hour

- Given forecast load and scheduled generation,
- Match actual load, actual generation
 - Loads are uncertain and volatile
 - Generators, transmission are not perfectly reliable
 - Wind and solar are variable, increasing share of system

Balancing Services Deployed – BPA



Historically, Generation Provides Load Following

- But some DR can too:
 - Must increase as well as decrease load
 - Needed every hour of year
 - Quick response (<10 minutes)

For Example:

- Water heaters
- Refrigerated warehouses
- Pumping into reservoirs
- Some electrochemical processes
- Ice storage for HVAC
- Loads with energy or other storage

PNW Pilot

- Water heaters
- Space heaters w/ heat storage
- Refrigerated warehouses
- BPA main funder
 - Ecofys
 - EnerNOC
 - Steffes Corporation
 - Pacific NW National Lab, Spirae, individuals

Thermal Storage Water Heaters



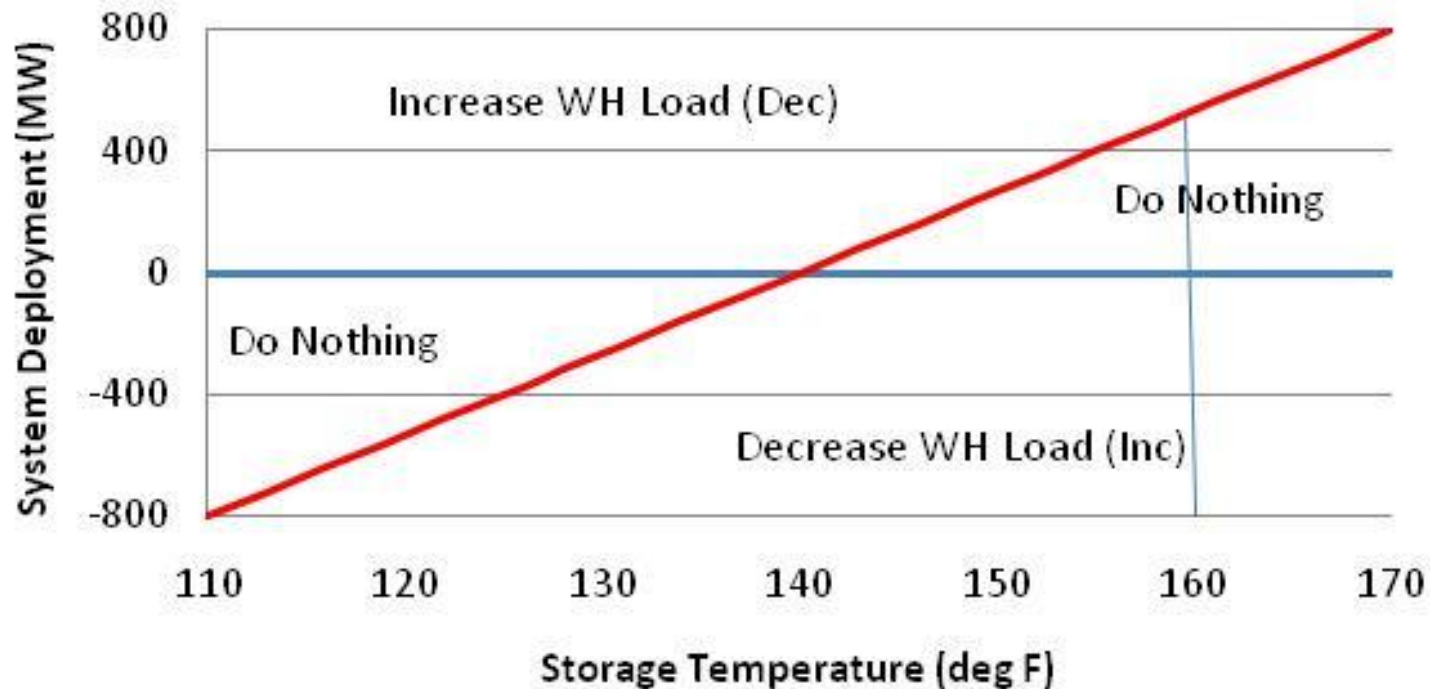
Source: Steffes Corporation

Constraints on Control Strategy for WH

- Incs and decs not necessarily balanced in
 - Frequency of deployment or
 - MW of reserve needed
- Energy storage limited (~10 kWh for 50-gallon unit)
- Priority – maintain available reserve

Deployment Rules

Balancing Reserve Deployment Strategy for Water Heaters



Results – 2 Weeks' Simulation* (illustrative of 12 weeks' data)

| Inc reserve | Dec reserve | % of total Inc deployments | % of total Dec deployments | Δ Standby losses |
|-------------|-------------|----------------------------|----------------------------|------------------|
| 0.5 kW/unit | 1.0 kW/unit | 77% | 35% | + 84 kWh/yr |
| 0.5 kW/unit | 4.0 kW/unit | 91% | 11% | + 105 kWh/yr |

* August 16-31, 2010

From here?

- Early days – pilots to prove concept
- Costs of water heaters w/ mass production?
- Optimal mix of services from resource?
- > 3 million electric water heaters in PNW
=> thousands of potential MW Inc and Dec reserves

Questions?

➤ kcorum@nwcouncil.org