Northwest Power and Conservation Council

April 2, 2009

MEMORANDUM

TO: Power Committee

FROM: Maury Galbraith and Wally Gibson

SUBJECT: Draft of Chapter 11 - Capacity and Flexibility Issues

Increasing constraints placed on the Northwest hydroelectric system to meet fish requirements and the region's increasing use of wind turbines to generate electricity are driving an in-depth consideration of capacity and flexibility issues in the Council's Sixth Power Plan. Capacity, the ability to meet peak hour loads, and flexibility, the ability rapidly increase or decrease generation output, have not been significant issues in the past largely because of the dominance of the Northwest hydro system. Chapter 11 describes how capacity and flexibility are used in power system operations, provides a framework for incorporating these concepts into power system planning, explains why the need for system flexibility is growing, and provides recommendations on how the region should respond to the challenge of increasing power system flexibility.

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Sixth Northwest Conservation & Electric Power Plan

Draft Chapter 11
Capacity and Flexibility

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Chapter Outline

- Introduction:
  - Meeting instantaneous loads over all time scales
- Power system requirements:
  - Energy, capacity, flexibility
- Power system operations:
  - Within-hour regulation and load-following
- Wind generation increases the need for flexibility
  - Institutional changes
  - Flexible capacity additions
- Recommendations for action plan

Introduction

- Northwest power system planning:
  - Historically focused on energy
  - Hydro system has provided ample capacity and flexibility
  - Shift in focus towards capacity and energy
- Power system operation remains the same:
  - Continuously match generation to load

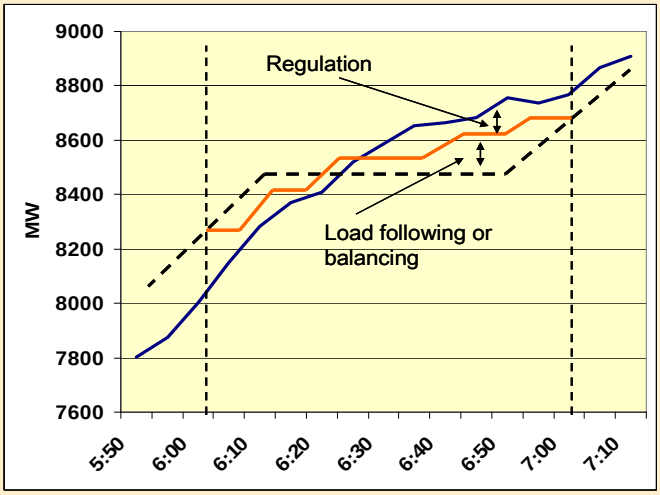
Power System Requirements

- Capacity: Meeting peak hour demand
  - Maximum output level of generators
  - Hydro has limited sustained peaking capability
  - Wind has limited peak contribution
- Energy: Meeting annual demand
  - Total output of generators in a year
  - Thermal only limited by installed capacity and outages
  - Hydro and wind limited by "fuel" conditions
- Flexibility: Providing within-hour balance
  - Ability to rapidly change output level across a wide range
  - New focus due to need to offset changes in wind output

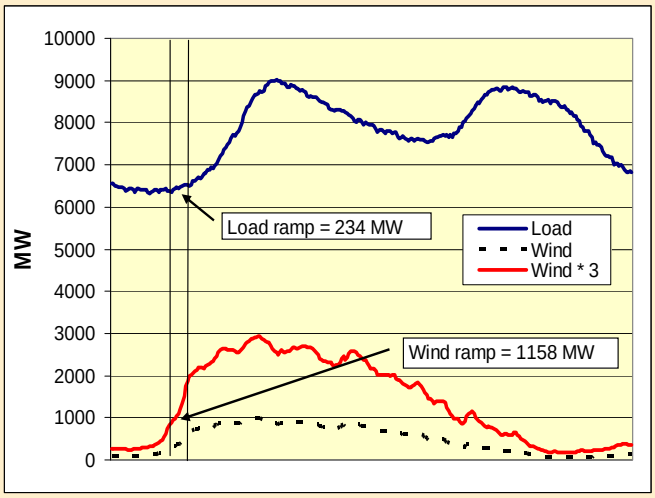
Power System Operations

- Balancing authorities:
  - continuously balance loads and resources
- Ancillary services:
  - Contingency reserves held for plant outages
  - Regulating reserves held for instantaneous variation in load and resource output
  - Balancing reserves held for within-hour variation in load and resource output (often called load following)

Balancing Services



Increased Need for Flexibility



Meeting the Need for Flexibility – Institutional Changes

- Changes in operating procedures and business practices
- Improve wind forecast accuracy
  - Decreases amount of balancing reserve that must be held
- Standardize within-hour schedule changes
- Increase market for balancing resources
  - Both increase ability to draw on most efficient sources of flexibility
- Increase availability and ease of dynamic scheduling
  - Increase ability to draw on wider set of resources
  - Increase ability to transfer problem to wind generation user
- Joint Initiative parties engaging these problems

Meeting the Need for Flexibility – New Flexible Capacity

- Flexible duty resources:
  - Capable of quick starts (~10 minutes)
  - Operate over a wide range of output levels
  - Capable of quickly ramping up and down
  - Economic to operate in stand-ready mode
- Rapid response natural gas-fired turbines and reciprocating engines
- Pumped storage hydro
- Demand response options
  - Hot water heaters
  - PHEV

Recommendations for the Action Plan

- First priority is to continue to pursue changes in operating procedures and business practices
  - Likely to be inexpensive
  - Can be achieved quickly
- Second priority is to further develop planning framework to include system flexibility
  - Flexibility metrics
  - Forecast future demand for resource flexibility
  - Quantify flexibility of existing resources
  - Assess best options for meeting future need