

Sixth Northwest Conservation & Electric Power Plan

## Cost and Availability of Wind Integration on the Northwest Power System

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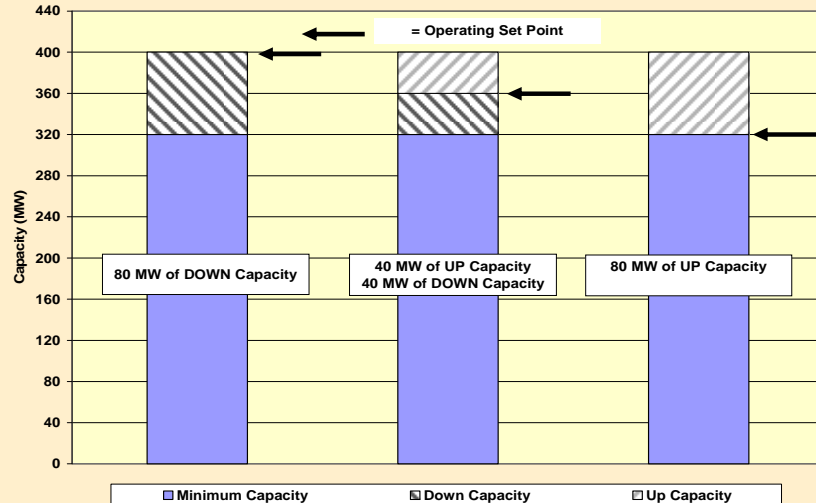


### Outline

- Wind Integration Costs – Modeling Assumptions
  - Current methodology
  - Proposed revision
- Long-term Flexibility Planning
  - Untapped flexibility in existing power system
  - First priority is to access and allocate existing flexibility
  - Next step is to incorporate consideration of resource flexibility into long-term capacity planning



## Recap: Illustration of Reserving Capacity for Within-hour Balancing (400 MW CCCT)



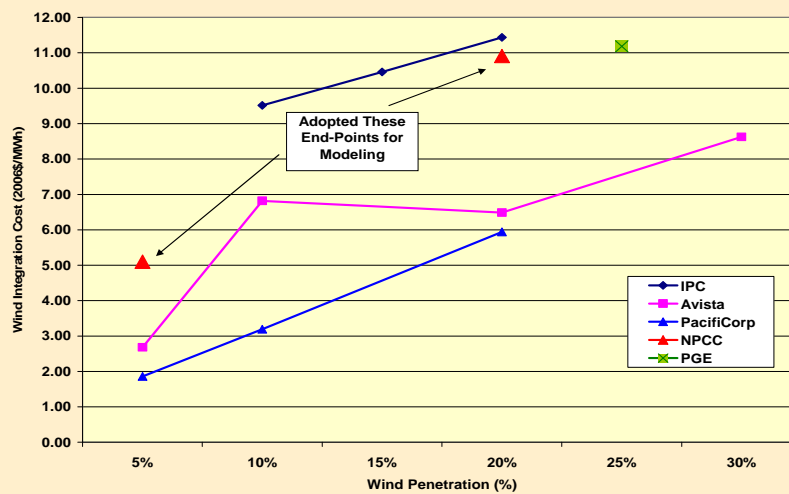
## Wind Integration Costs

- Reserving capacity for within-hour balancing is costly:
  - Generating capacity that would have been dispatched “without wind” ends up being withheld from the energy market; and/or
  - Generation that would not have been dispatched “without wind” ends up being committed into the energy market
- Wind integration costs are “opportunity costs”
  - Foregone benefits of operating the system without the need to reserve flexible capacity for within-hour balancing of wind generation

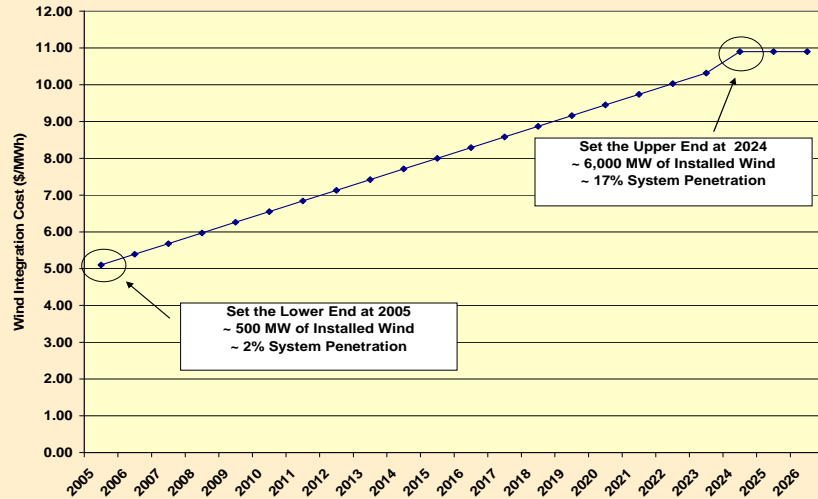
## Wind Integration Costs (continued)

- Cost estimation requires a system impact study:
  - Comparison of variable system cost with and without the reservation of capacity for within-hour balancing due to wind generation
  - Study Case: With Reserved Capacity Due to Wind
  - Base Case: Without Reserved Capacity Due to Wind
  - The difference in system cost is Cost of Wind Integration
- Wind integration costs are sensitive to wholesale power market price assumptions

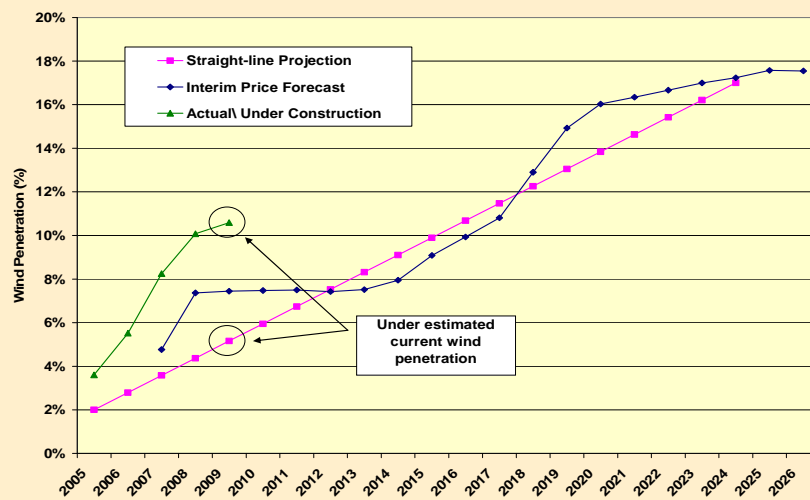
## Northwest Wind Integration Studies



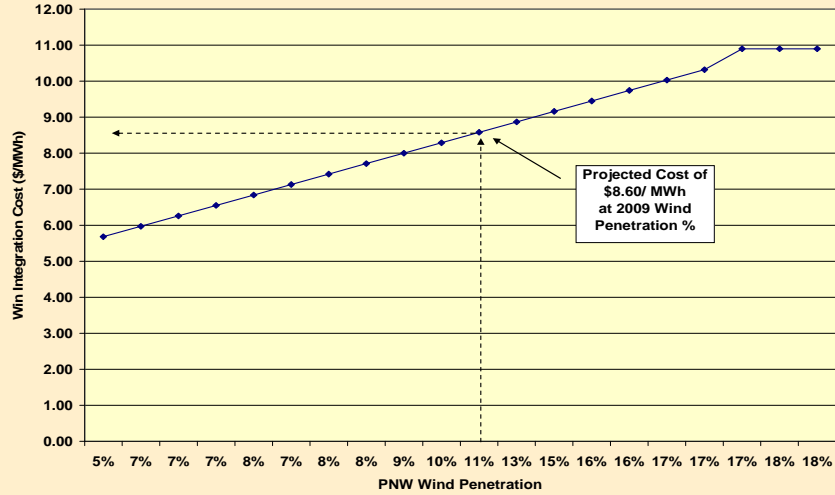
## Wind Integration Costs -- Current Modeling



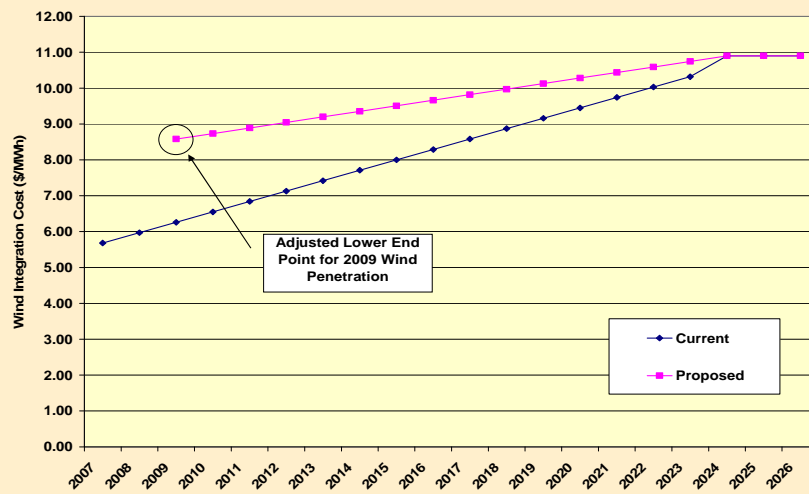
## Under Estimated Wind Penetration in 2009



## Reset the Lower End Point to \$8.60/ MWh for 11% Wind Penetration in 2009



## Reset the Wind Integration Cost Projection



## Wind Integration Costs

### *Conclusions*

- Continue to rely on Northwest Wind Integration Studies
- Retain integration cost of \$10.90/MWh at the high-end of system penetration (17% in 2024)
- Use integration cost of \$8.60/MWh at the low-end of system penetration (11% in 2009)

## Increasing Power System Flexibility

### *Short-term vs. Long-term*

- Significant untapped flexibility in the existing power system
  - Improve wind forecasting and scheduling
  - Change scheduling practices and procedures
  - Implement dynamic scheduling of wind generation
  - Improve automatic generation control (AGC)
  - Develop marketable ancillary services products
  - Establish wind ramping limits
  - Others...
- Short-term priority is to tap these sources of flexibility

## Considering Flexibility in Long-term Resource Planning

- How much flexible capacity will Balancing Authorities need to set aside for within-hour regulation and load following?
  - How much is attributable to load growth?
  - How much is attributable to increased wind generation?
- How much flexible capacity for within-hour regulation and load following will be available from the existing (more efficient) system?
  - Which resources are currently used for within-hour balancing?
  - Are there other existing resources that could be used?
  - How will constraints on hydro system operations impact the availability of capacity for within-hour balancing?

## Considering Flexibility in Long-term Resource Planning (Continued)

- How much flexibility will resources added to meet utility energy and peak load requirements provide?
  - Flexibility (i.e., ramping measured in MW/min.) is a resource attribute
  - Utilities should consider flexibility concurrent with their evaluation of resources alternatives in Integrated Resource Planning

## Putting the Pieces Together

1. If the flexibility of the existing system is tapped in the short-run, **and** flexibility is considered when utilities add resources to meet their load obligations in the long-run, ...
2. Then in most cases, the regions utilities should be able to avoid adding physical capacity **solely** for the purpose of augmenting system flexibility.
3. That is, flexibility can be added to the system as the region adds capacity to meet peak demand.

## Conclusions

- Draft Flexibility Augmentation Action Item for the 6<sup>th</sup> Power Plan: The Council will work with Bonneville, utilities, and regulatory boards and commissions, to develop long-term planning methodologies for power system flexibility