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January 25, 2011

MEMORANDUM

TO: Power Committee Members

FROM: John Fazio, Senior System Analyst

SUBJECT: Status of Joint Council/PNUCC Wind Study

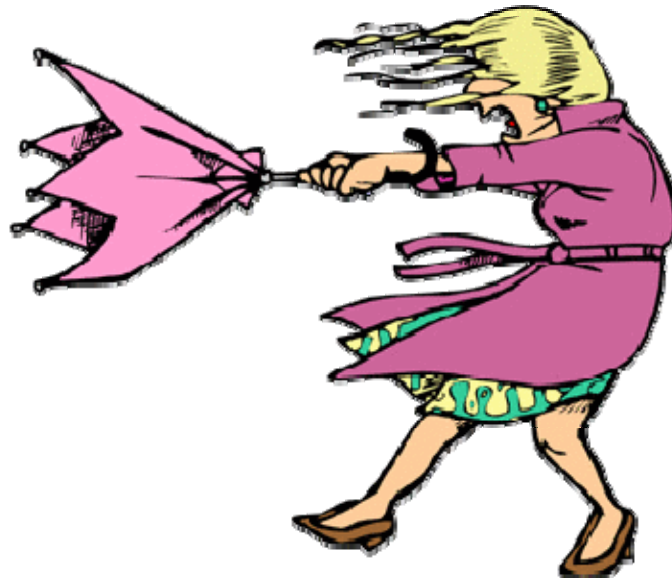
Action items GEN-5 and GEN-10b in the Council's 6th Power Plan call for an examination of power system flexibility and for an assessment of the potential impacts of a future unbundled REC market, respectively – both issues involving analysis of wind resources.

The Council is working on a paper entitled "The Effects of an Increasing Surplus of Energy Generating Capability in the Pacific Northwest," which will address some aspects of these issues. At the same time, Council staff is working with the Resource Adequacy Forum and the Pacific Northwest Utilities Conference Committee (PNUCC) to address issues relating to system flexibility. In particular, the latter effort will focus on three questions:

1. What is the effective load carrying capability (ELCC) of wind resources and does it change with added wind capacity?
2. How does increased wind penetration affect light-load-hour overgeneration?
3. How does increased wind penetration affect thermal resource dispatch?

Preliminary analysis is complete for the first two issues. Results of that analysis were presented to the PNUCC System Planning Committee for review. Because the studies were based on somewhat outdated hydroelectric data (last year's BiOp assumptions), the consensus was that preliminary results should not be distributed for public review. However, providing a description of the studies and a general indication of the expected results will be beneficial to Power Committee members.

BIG WIND STUDY



Power Committee Meeting
February 8, 2011

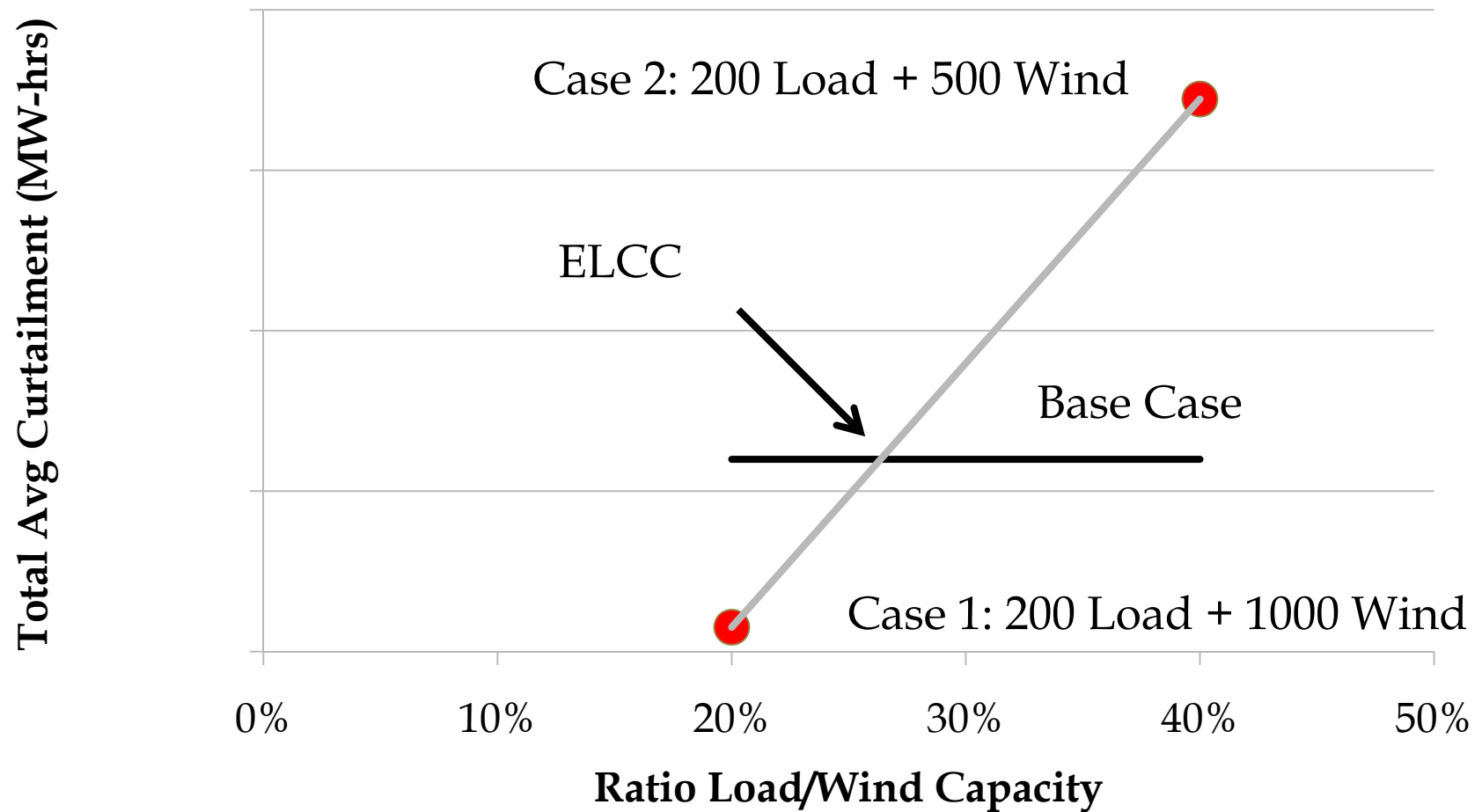
Joint Council/PNUCC Study

1. Estimate the Effective Load Carrying Capability (ELCC) for NW wind
2. Examine the effects of wind on light-load-hour overgeneration
3. Examine the effects of wind on thermal resource dispatch

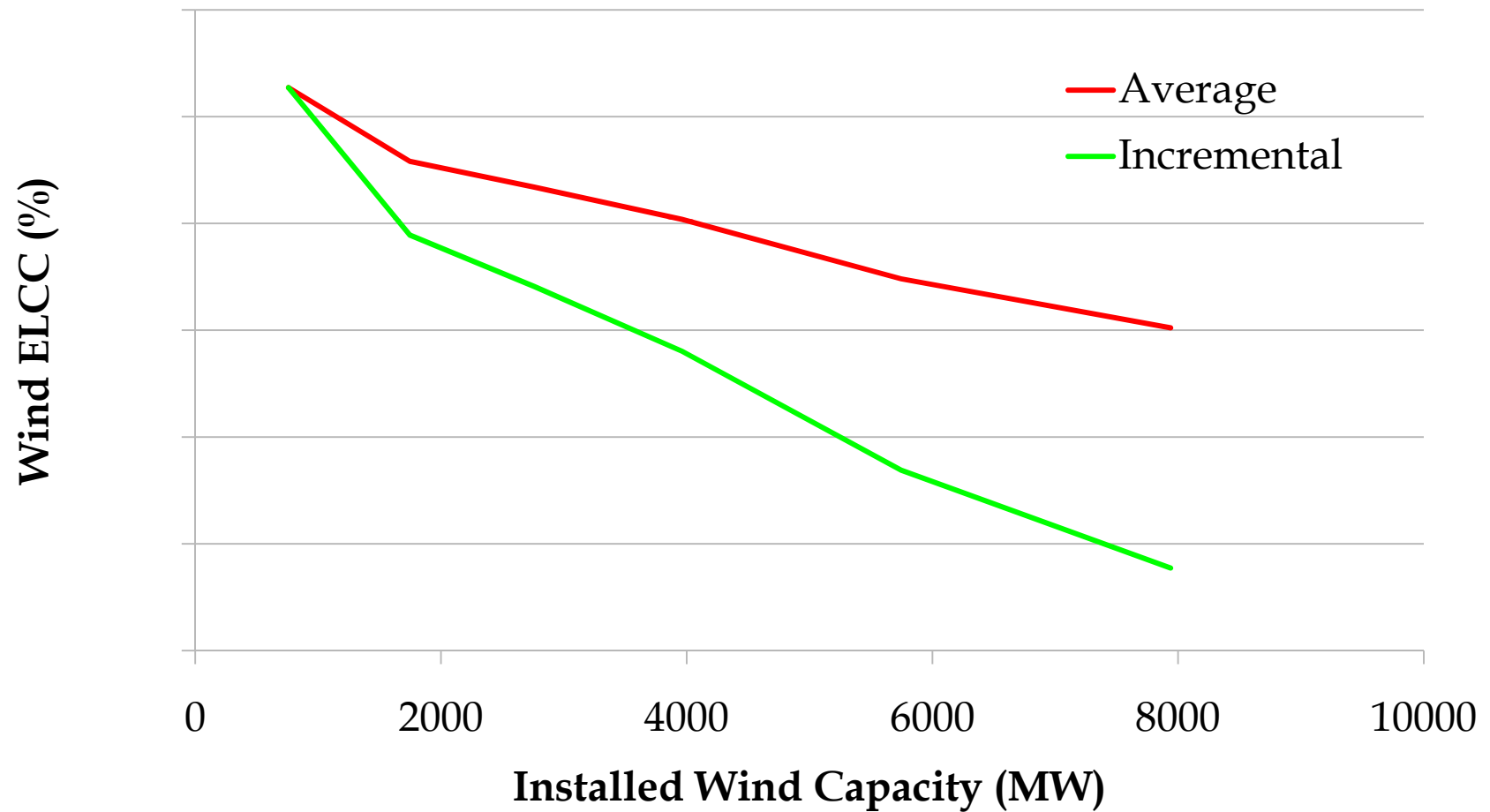
Wind ELCC Method

1. Remove all wind from power supply
2. Calculate total expected curtailment
3. Add an increment of load and measure curtailment
4. Add enough wind capacity so that total curtailment equals that in the base case
5. Repeat steps 3 and 4 for different load increments

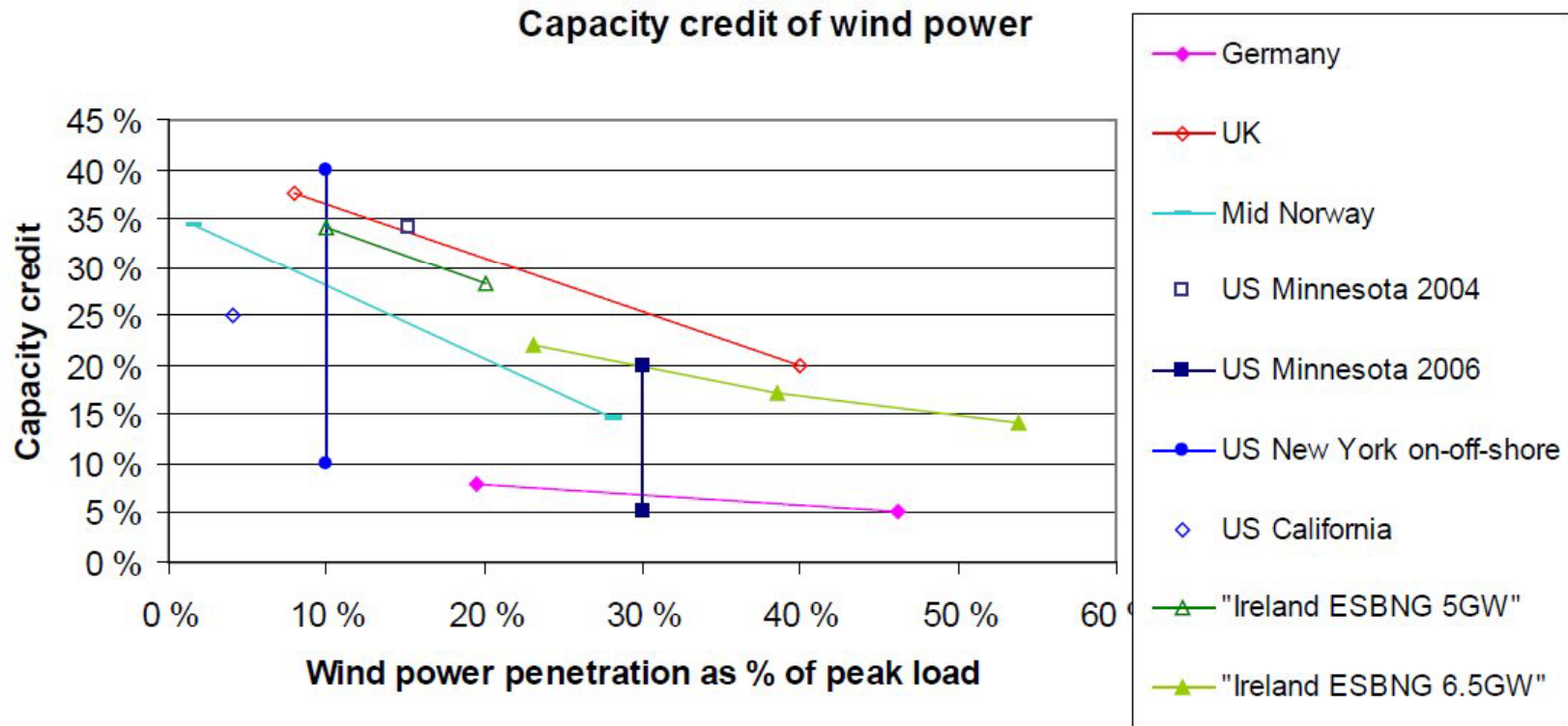
Example Result for Steps 3 & 4



Example of Wind ELCC Study Results



International Examples



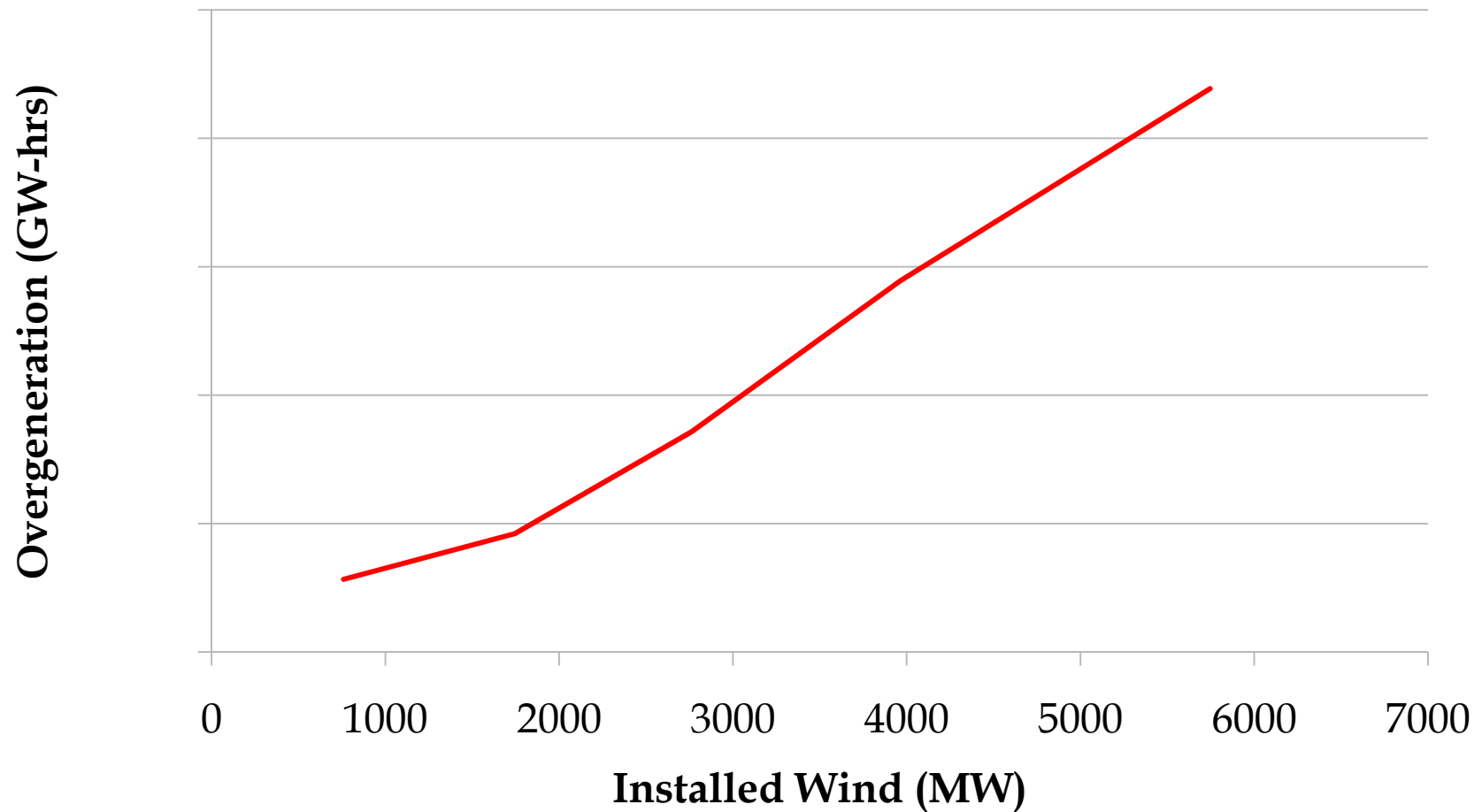
Observations

- ▣ Average and incremental wind ELCC declines with increases in wind penetration
- ▣ Adding wind diversity should reduce the ELCC decline
- ▣ Adding storage devices should also reduce the ELCC decline

Overgeneration Study

- ▣ How does LLH overgeneration change as wind penetration increases?
- ▣ Same method as for the ELCC study but instead of curtailment, measure LLH overgeneration

Example of Overgeneration Study Results



Next Steps

- ▣ Update BiOp data and redo studies
- ▣ Estimate **monthly** ELCC values
- ▣ Estimate **monthly** impacts to overgeneration
- ▣ Examine change in dispatch patterns for various thermal resources as wind penetration increases