Northwest Power and Conservation Council

April 27, 2006

MEMORANDUM

TO: Power Committee

FROM: Jeff King

SUBJECT: NTAC Wind Energy Work Group assessment of the response of Northwest hydro and thermal generation to wind generation

The Northwest Transmission Assessment Committee (NTAC) has organized several study groups to identify and conduct preliminary assessments of transmission upgrades and additions needed to deliver power from promising but remote potential generating resources to western load centers. For the past two years Staff has served on NTAC study groups and, in November briefed the Power Committee regarding ongoing NTAC studies.

One of the three NTAC study groups reported in November is the Wind Integration Work group. This group is comprised of representatives of Bonneville, Northwest utilities, the Council, state agencies and other parties with an interest in wind development. Participation in the workgroup and contributions of data, analysis and reports is voluntary. The objective of this group is to identify transmission and system operation requirements needed to support integration of large-scale Northwest windpower development, including bulk transmission upgrades, wind integration (shaping) capability and cost and delivered cost of energy. The work of this group will contribute to the implementation of several 5th Plan actions including TX-1, GEN-8 and GEN-9.

The Wind Integration Work group has developed a draft study plan to achieve its objectives (first attachment). Study 2 of the five proposed studies would employ the Council's GENESYS model and would be led by Council staff. Staff has prepared a more detailed plan of study for Study 2 (second attachment). Staff proposes to discuss the plan of study with the Committee at its May meeting and seeks Committee approval to proceed with this work.

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Northwest Transmission Assessment Committee
Wind Integration Workgroup

Draft Study Plan

March 2006

Study 1

Study full production/transmission model (SSG-WI) with and without wind generation. Our understanding is that Northwest hydro was modeled as fixed historically dispatched generation. Therefore the combination of existing hydro generation with the avoided cost economics of wind generation versus thermal generation should create maximum stress on the transmission system in the vicinity of the wind generation.

Step 1 Review the chronological results of SSG_WI 2008 & 2015 base case run with wind.

a) Gas Thermal generation output located in Washington and Oregon
b) Colstrip, Boardman, Centralia, Valmy, and Bridger output
c) Tie Lines chronological – BC, COI, PDCI, Idaho-Northwest, Montana-Northwest
d) Internal Northwest Paths (small set) N&S Cascades, South of Paul, West of McNary, West of Slatt, North of Hanford

If after reviewing the results we have an acceptable answer to our questions then we're done.

Step 2 Depends on above

Goal: Determine if the wind generation modeled in the SSG_WI data base indicates that the amount of generation that is located within Northwest was successfully integrated on a physical basis ignoring institutional and sub-hourly issues. Identify transmission impacts

Lead Study Participants: Phil, Roger, Chris,

Specific Task: Contact Doug Larson, Donald Davis, Dennis Phillips, or Sherman Chen to see if we can obtain the necessary SSG_WI results

Study 2

Study existing Northwest generation interaction, specifically hydro generation, with incremental wind generation using the Genesys Model. We would be ignoring transmission requirements. A comparison would be made to the operation Northwest generation without the addition of wind generation.

Step 1 Wind/Hydro interaction ignoring transmission constraints, report:

a) Gas Thermal generation output within Washington and Oregon by plant with and without wind additions
b) Hydro Output & delta Hydro (with and without wind additons
c) Coal Plants: Colstrip, Boardman, Centralia, Valmy, and Bridger output

Goal: Estimate the change in NW Hydro operation and thermal generation with the integration of 3000-6000 wind generation located within Northwest ignoring institutional and sub-hourly issues.

Lead Study Participants: Phil, Jeff King,

Study 3

Study existing Northwest generation interaction, specifically hydro generation, with incremental wind generation using a full production cost model. We model transmission constraints transmission. A comparison would be made to the operation Northwest generation without the addition of wind generation. Also identify additional transmission.

Load Variation: Washington, OR, ID

Generation: Only variable generation responding to loads in above states must be located within above states. Also include Colstrip, Jim Bridger in the generation pool

Ties: BC (including downstream benefits), COI as Gen, PDCI could be modeled as fixed generation inputs

Goal Identify transmission impacts, generation changes

Lead Study Participants: Future Effort

Study 4

This study is a load flow study to examine the maximum cross-Cascades flows that could be attributed to the addition of wind resources. This study would be a check on the timing of additional cross-cascade transmission.

Base Cases:	e12cy06r5 and j12cyo6r5
Load:	Puget Sound Area, Willamette Area at winter peak
Wind Generation:	15% of Peak loads
Displaced Generation:	Thermal units located on the west side of the Cascades would be redispatched
Transfers:	COI at xxx MW export

NW-BC at 1200 MW export

Goal: Estimate the maximum transmission impact of the addition of wind generation load located within Northwest equal to 15% of peak load ignoring institutional and sub-hourly issues.

Lead Study Participants: Joe Seabrook and Chris Reese

Study 5

One of the open questions is whether the addition of wind generation in the vicinity of the PACI and PDCI will cause a reduction in transfer capacity. Since these paths are voltage and stability limited a straight forward check comparing the results with the current generation with the addition of the wind generation could be made. PSE has usable stability models for wind generators. Setting up the case will take some effort but it should address the issue.

Case:	Current NOPSG stability case
Case Modifications:	Add wind generation to selected buses Add stability models for wind generation Reduced thermal generation
Contingencies:	2PV, DC outage, etc.
Lead Study Participants:	Joe Seabrook and Chuck Matthews?

NTAC WIND INTEGRATION WORKGROUP STUDY 2

ASSESS RESPONSE OF NORTHWEST HYDRO AND THERMAL GENERATION TO WIND GENERATION

Lead Organization: Northwest Power & Conservation Council

Purpose and Objective: The purpose of this work is to achieve a better understanding of: (1) transmission flows resulting from increased development of Northwest windpower and (2) the wind shaping capabilities of existing hydropower and thermal generating units. This will be achieved by estimating the change in hourly hydro operation and thermal dispatch with the integration of 3000-6000 MW of wind generation located within the Northwest.

Background: Because of the central role of windpower in the 5th Power Plan, the Council included actions in the Plan to resolve uncertainties associated with large-scale development of windpower. One objective of these actions is to plan for long-distance transmission needs for resource development (TX-1). A second is to assess the cost of firming and shaping (GEN-8, part). A third action (GEN-9) calls for an assessment of the effects of shaping windpower on other functions of the hydropower system. This study will contribute to achieving each of these objectives.

Approach: Study the response of existing hydro and thermal generation to incremental additions of wind generation, using the GENESYS model.

1. Set up GENESYS to run increments of new wind power, modeled to represent the synchronized hourly output of the principal wind resource areas of eastern Washington and Oregon. The National Renewable Energy Laboratory will supply hourly wind data.

2. Run a base case (existing windpower only) for selected year(s), reporting hourly:
    a) Gas thermal generation output (combined-cycle plants and simple-cycle units)
    b) Hydro output
    c) Coal output (Colstrip, Boardman, Centralia, Valmy, and Bridger)
    d) Imports and exports

3. Repeat for incremental additions of wind power with imports and exports held constant and for exports and imports allowed to vary.

Because GENESYS uses a simplified representation of the transmission system, large load-resource areas and a “one-dam” hydropower model, sub-regional transmission constraints cannot be fully identified. Institutional (e.g., limitations of control area level dispatch) and sub-hourly issues would also not be considered. Sub-regional transmission constraints might be identified in proposed load-flow and stability studies (WIWG Studies 1, 4 and 5), and by a study employing a full production cost model with “bus-level” transmission modeling and improved hydro dispatch (possible future Study 3).

Schedule: Approximately 4 months.