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April 12, 2011

MEMORANDUM

TO: Power Committee Members

FROM: John Fazio, Senior System Analyst

SUBJECT: Summary of Resource Adequacy Methodology Review

In March of this year, the Council was briefed on the adequacy of the Northwest's power supply. That current assessment indicated that the supply would continue to be adequate through 2015. Nonetheless, staff continues to work with utilities and others to review key assumptions regarding loads and resources and plans to reassess supply adequacy on an annual basis.

In addition to crosschecking data, the Council and BPA have contracted with a consulting firm, PSRI (Power Systems Research, Inc.), to review the methodology used to assess adequacy. That review is nearly complete, with a final report due early in April. The purpose of the review is threefold; 1) to critique the current method, 2) to suggest alternative methods, if appropriate, and 3) to describe ways to incorporate the assessment into our long-term resource planning tools.

The report indicates that, in general, the current methodology is appropriate. Similar methodologies are used across the nation and in other parts of the world. However, the NW method only assesses the likelihood of curtailment and does not contain any measure of the size or magnitude of potential problems. PSRI suggests that the NW replace its current metric with one that contains both a probability and magnitude measure. The report also suggests that separating the assessment into winter and summer components is not necessary – an annual assessment is all that is required. PSRI did, however, agree with our current method of separating energy and capacity needs and having a measure of adequacy for each.

PSRI suggested an alternative metric, which incorporates both a probability and magnitude measure. The suggested metric is known as the Conditional Value at Risk (CVaR), which measures the average magnitude of a certain percentage of worst curtailment events. The Resource Adequacy Forum is currently investigating if CVaR would be a better measure of adequacy for the Northwest. The Forum is also examining suggested methods for integrating adequacy measures directly into its resource planning model.

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Power System Research, Inc. Review of the PNW Adequacy Standard

Power Committee Meeting
April 12, 2011

Outline

- Methodology review
- Example of how resource adequacy is assessed
- Next steps

Primary Purposes of Review

1. Critique the region's current adequacy assessment methodology
2. Provide an alternative method, if appropriate
3. Suggest ways to incorporate the adequacy measure into our long-term resource planning tools

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1. Critique of Current Method

- Generally OK, similar methods are used by many other regions
- Only looks at **probability** of curtailment
- Not clear how threshold is set (currently 5%)
- Better if **magnitude** of curtailment could also be incorporated
- Assessing adequacy separately for energy and capacity needs is appropriate
- But, no need to separate winter and summer periods, i.e. assess for entire year

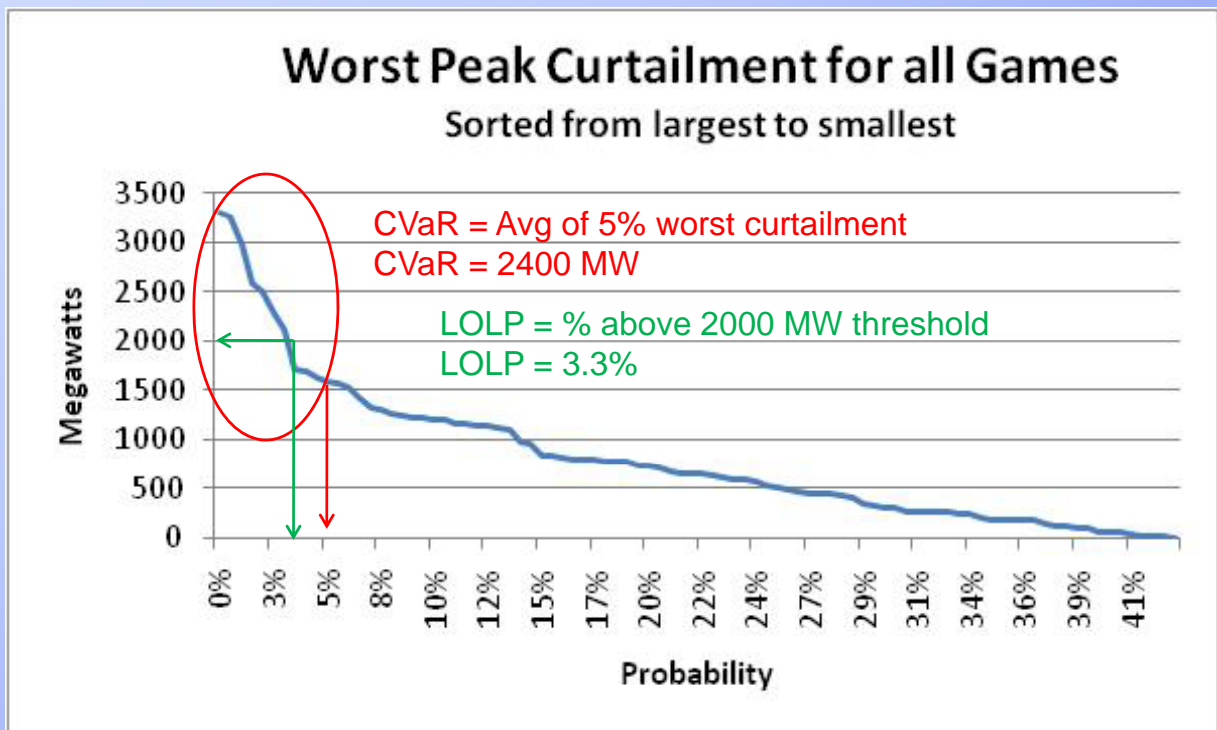
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2. Proposed Alternative

- Conditional Value at Risk (CVaR)
 - The average magnitude of the worst curtailment events in the simulation (say worst 5%)
 - Combines probability and magnitude into one measure
 - Similar to the TVar90 metric used in the Regional Portfolio Model
- Can be used in conjunction with LOLP
- Forum is evaluating if CVaR would improve our assessment

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CVaR vs. LOLP



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3. One Method of Incorporating Adequacy into Planning Models

1. Start with a system that is just barely adequate (using LOLP, CVaR or a combination of both)
2. Calculate static measures
 - Annual **load/resource balance**
 - Winter and summer **sustained peaking reserves**
3. Values for the “just adequate” case become the minimum adequacy limits
4. Make sure minimum adequacy limits are not violated in planning models
5. We are currently doing this with RPM

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Example of How Resource Adequacy is Assessed

For a simple system with some thermal and hydro

Simulate 100 games with varying load and varying hydro

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Steps to Assess Adequacy

1. Simulate the operation of the supply over many futures with uncertain conditions
2. Keep track of resource use and of curtailments
3. Calculate likelihood and magnitude of curtailment

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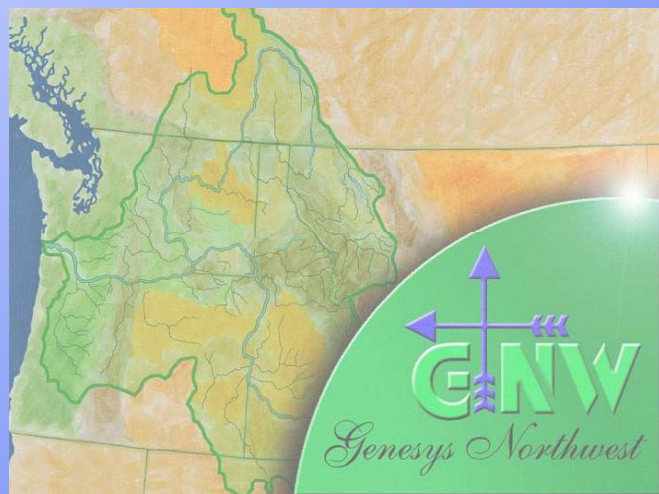
GENESYS – a Monte Carlo Simulation Program

Detailed NW hydro simulation
Hourly economic dispatch
Inter-regional transmission capacity
(but no transmission outages)

Random Variables:

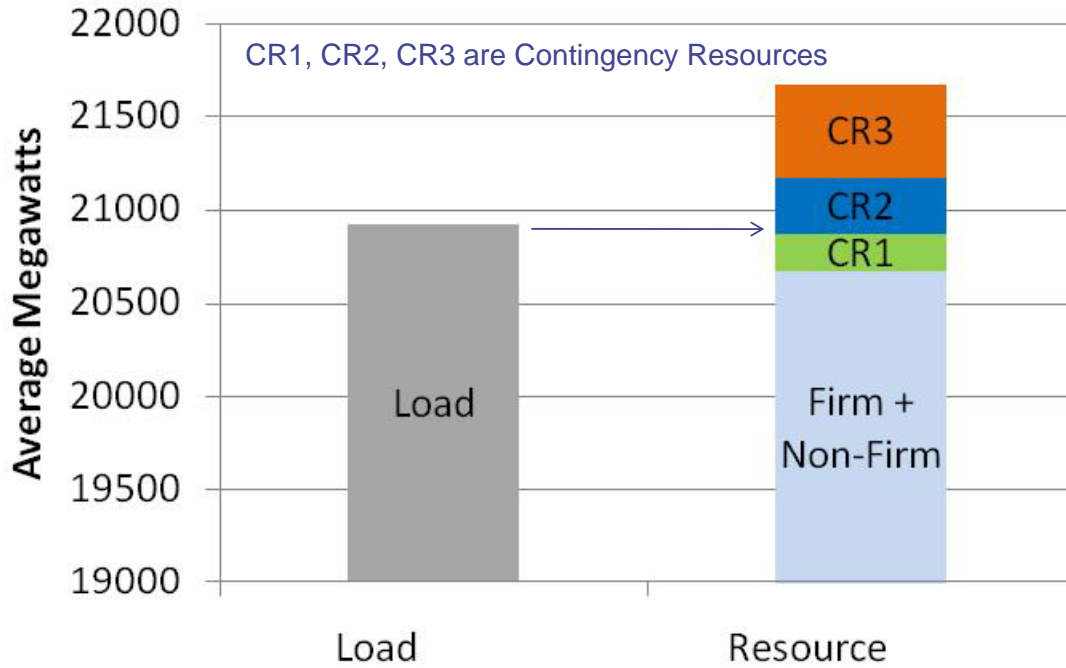
- > Water conditions
- > Temperature/Loads
- > Thermal forced outages
- > Wind Generation

www.nwcouncil.org/genesys



April 27, 2010

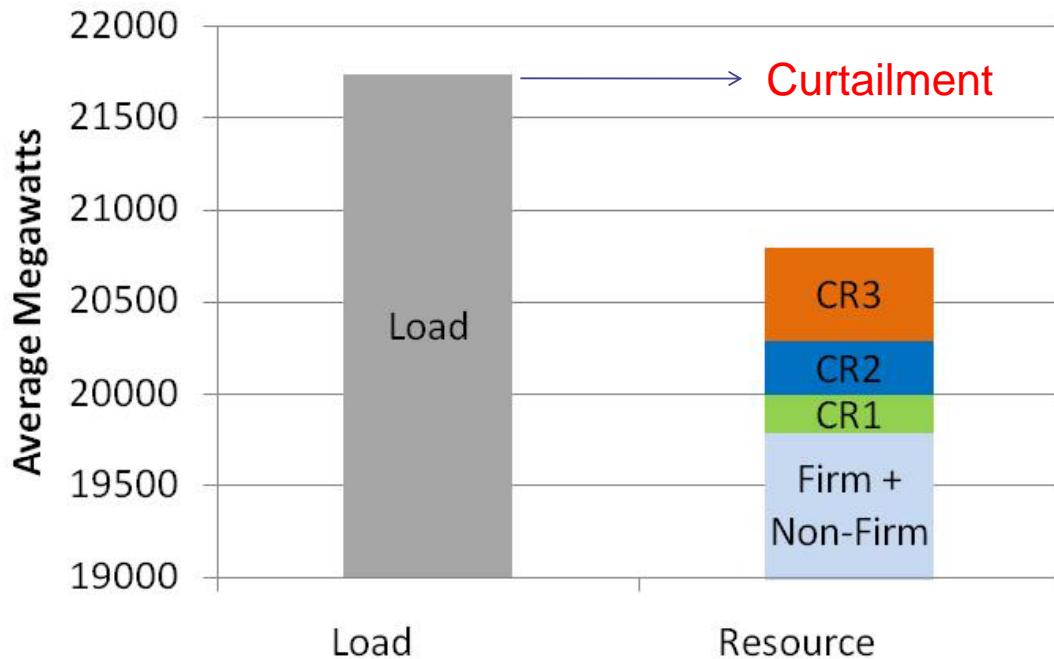
Resources and Loads for this Game



Result: No curtailment but had to use some contingency resources

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Resources and Loads for this Game

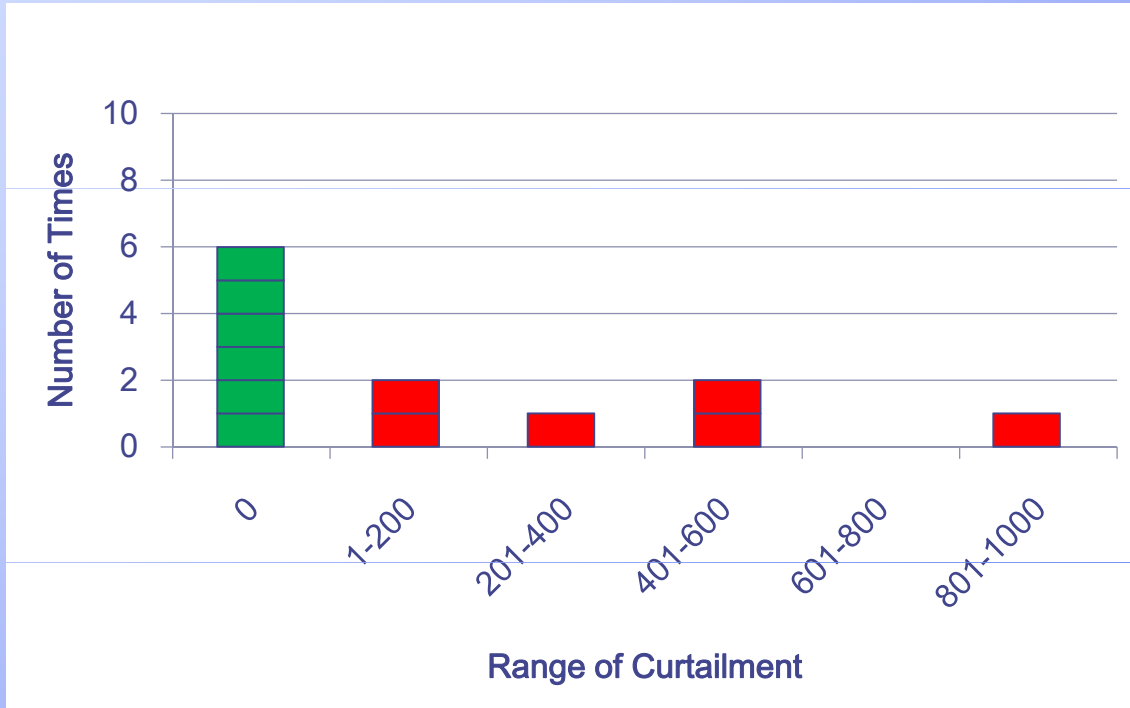


Result: Curtailment after using all contingency resources

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Curtailment Histogram

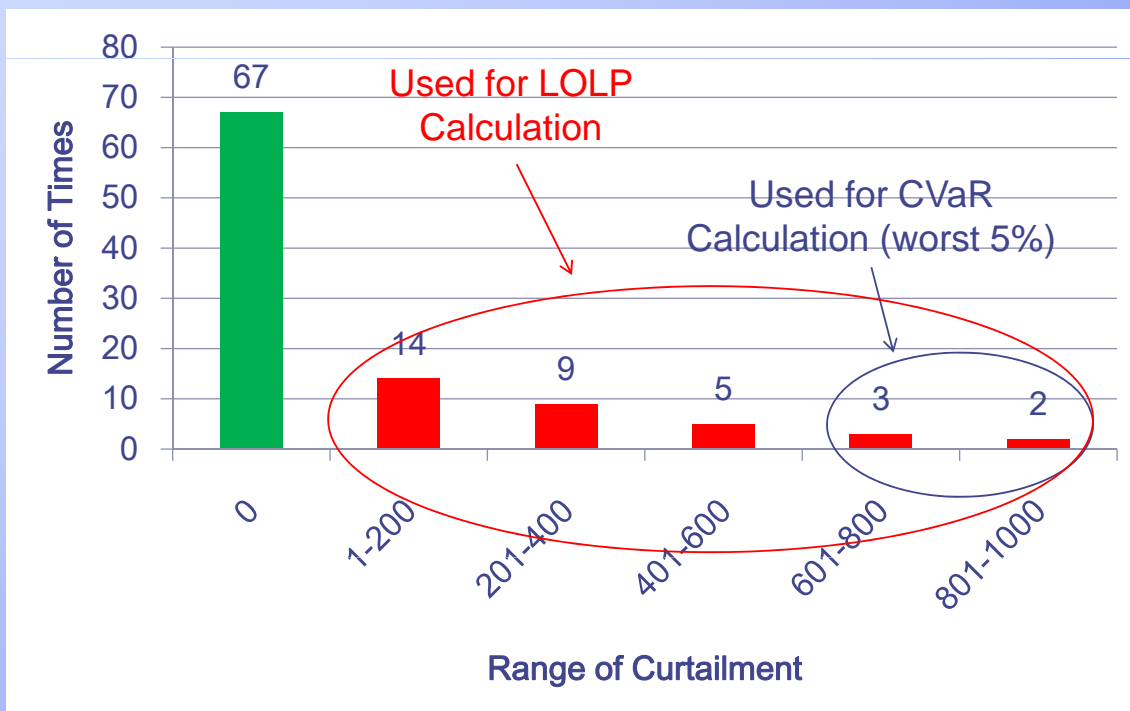
First Few Games



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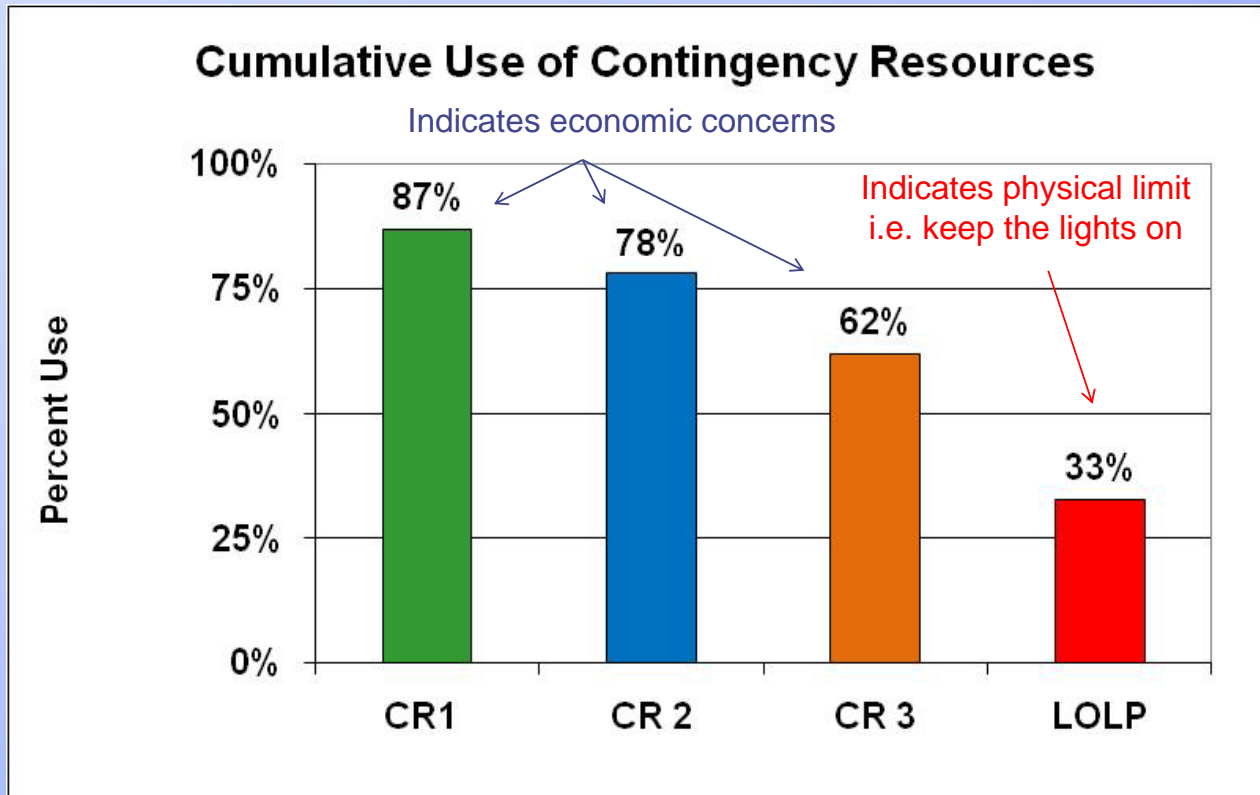
Curtailment Histogram

100 Games



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Also keep track of Contingency Resource Use



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Summary for Simple Example

- LOLP = 33%
(current limit is 5%)
- Contingency resources are used a lot
 - CR 1 = 87%
 - CR 2 = 78%
 - CR 3 = 62%
- Very inadequate supply

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Comparison to PNW Supply (2015)

- Energy LOLP = 1.9%
- Capacity LOLP = 3.3%
- Contingency resources are used 43% of the time
- Supply is deemed to be adequate but may not be economic (assessment includes new conservation but only existing resources)

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Resource Dispatch Order

Resource	Description	Tolerance for Use
Firm Hydro and Thermal	From lowest to highest operating cost	OK, normal operations
Non-firm	In-region and out-of-region markets, surplus hydro, borrowed hydro	OK, normal operations
Contingency 1	Non-declared utility resources (diesel generators, etc.)	Once every 10 years?
Contingency 2	Buy-back provisions on load	Once every 10 years?
Contingency 3	More expensive non-declared resources or contract provisions	Once every 15 years?
Emergency Action 1	Governor's call for conservation	Once every 20 years?
Emergency Action 2	Rolling black outs or brown outs	Once every 30 years?

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What might new standard look like?

- Will probably keep some form of LOLP
- Add CVaR to assess size of problem
- Will have to rethink how to set adequacy limits for LOLP and CVaR
- Use percentage of contingency resource dispatch to assess region's economic exposure

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Next Steps (tentative schedule)

- **Spring 2011**
Revise current adequacy standard
- **Summer 2011**
Get Forum approval for new standard
- **Fall 2011**
Present new standard to Council
Release for public comment
- **Winter 2011**
Council adoption of new standard

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