

Planning for Operational Flexibility

Grid Transformation Workshop
March 20, 2013

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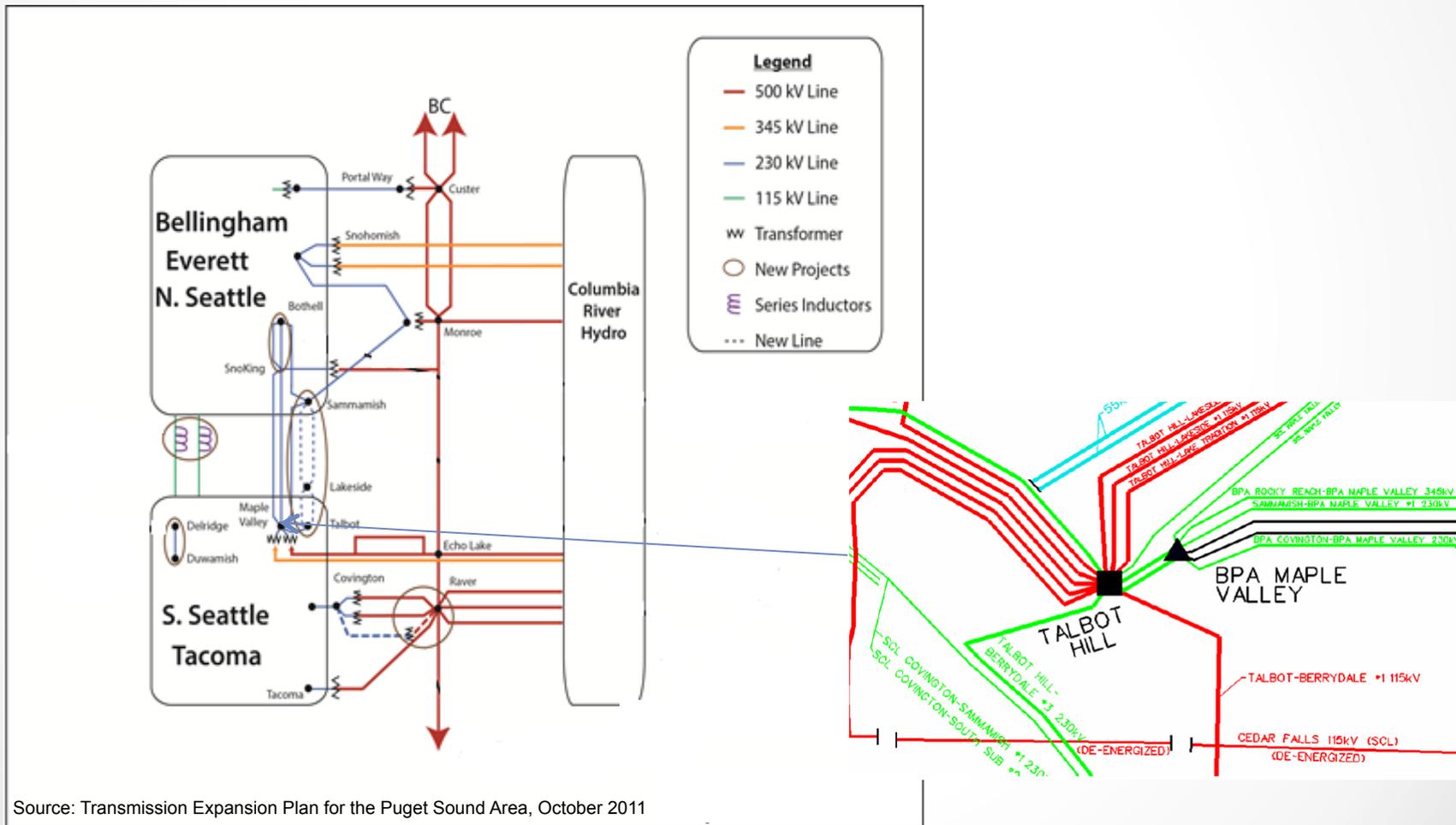
Presentation Outline

Purpose: Share a good news story from Puget Sound Area

1. Context of Discussion: PSA – thermally limited system
2. Challenge: Reduce risk of firm transmission curtailments
3. Solution: New planning tool adapted from BPA Operations tool
4. Probabilistic Analysis: Weighting for millions of N-1-X scenarios
5. Results: Comparison of Transmission Plans

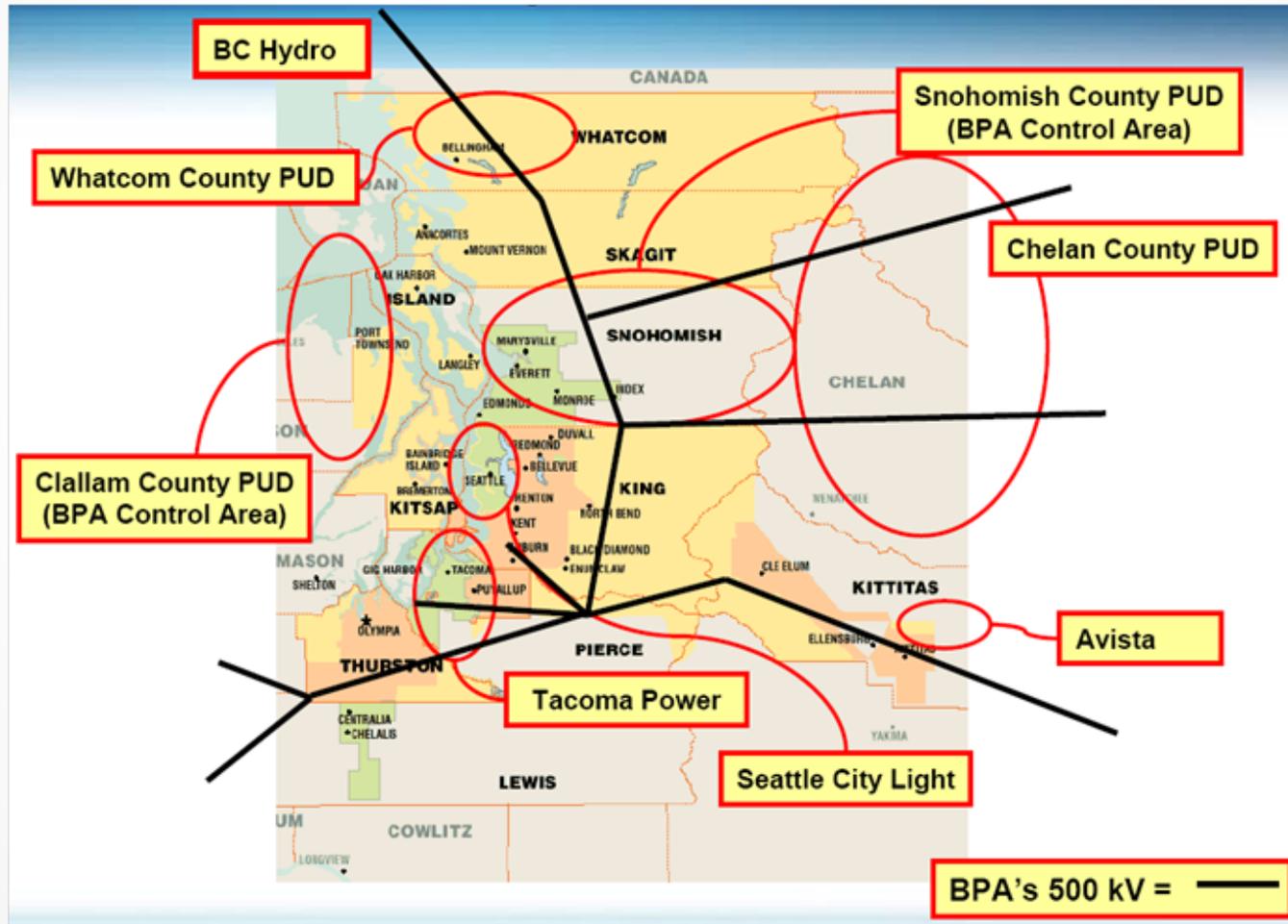


Context: PSA has parallel 115 kV, 230 kV and 500 kV Transmission



Map is the courtesy of PSE:
http://www.oatioasis.com/PSE/PSE/docs/WUTC-Transmission_Issues_Workshop-July_14-2005_-FINAL.pdf

Context: PSA has Multiple TOs



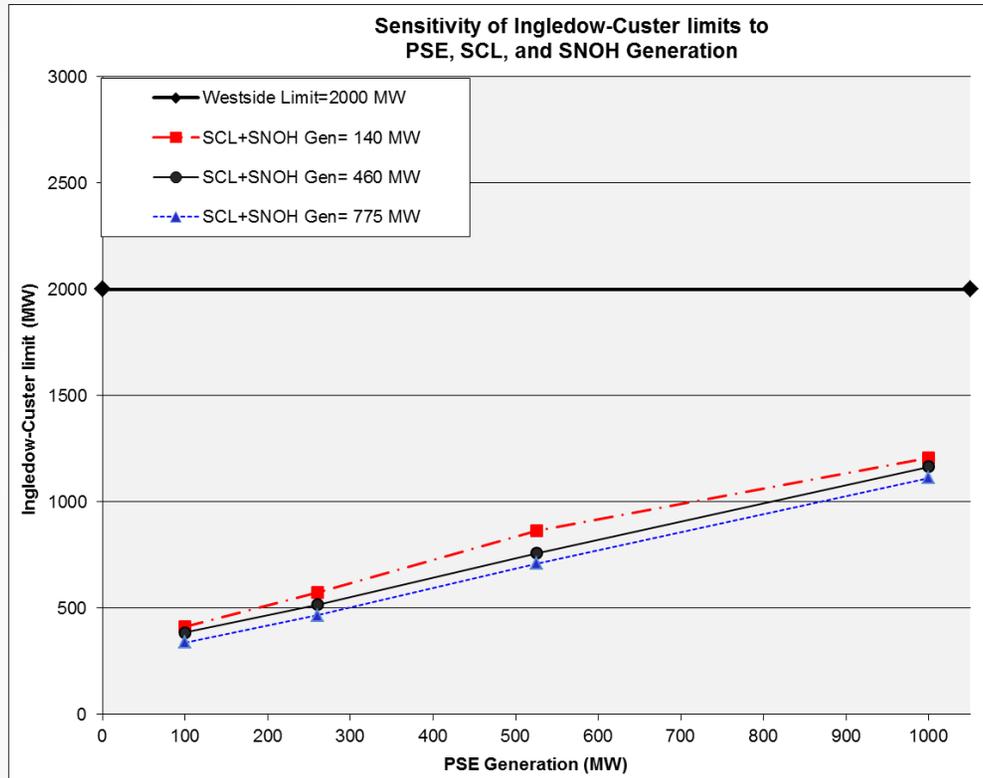
Challenge: Reduce Curtailment Risk

1. Planning Criteria met for the Puget Sound Area
2. Operators faced scenarios where firm transmission curtailments could be required and as a result Firm Load curtailments in the PSA might ensue:
 - Events in Jan 2004 & Nov 2009 heightened concerns
3. Directive for Columbia Grid's Puget Sound Area Study Team:
Identify transmission reinforcements to reduce risk of transmission curtailments in Puget Sound Area



Solution: Adaptation of BPA's Operations

Planning Tool



Chief Joe-Monroe #1
500 kV Line

Summer 2011
Heavy Loads
South-to-North
Temperature: 45F

			Average Puget Sound Net Area Load = 5613	
Gen Level		Trans Limit	Worst Contingency	Limiting Facility
PSE	SCL/SNOH			
100	140	414	BFR: 5111 Monroe-EchoLK-SnoKing #1 500kV & Echo Lk Caps	Branch BROAD ST (46409) TO UNION T (46451) CKT 1 [115.00 - 115.00 kV]
100	460	385	BFR: 5111 Monroe-EchoLK-SnoKing #1 500kV & Echo Lk Caps	Branch SNOH S3 (41329) TO SNOH S4 (41330) CKT 1 [230.00 - 230.00 kV]
100	775	339	BFR: 4522 Echo Lk-Mon-SnoK #1 500kV & Mon Caps	Branch SNOH S3 (41329) TO SNOH S4 (41330) CKT 1 [230.00 - 230.00 kV]

Solution: A New Planning Tool

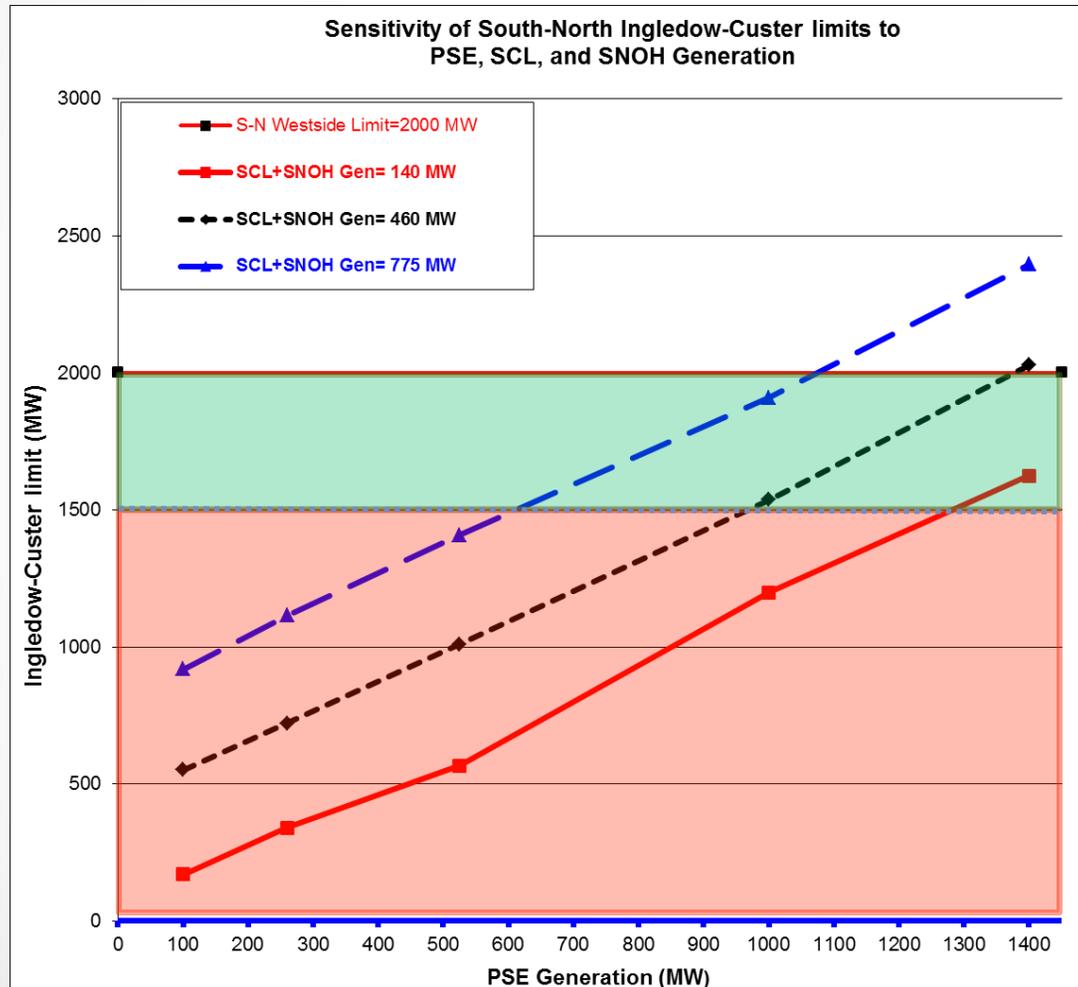
- Need for a planning tool to evaluate the full range of credible operating scenarios and contingencies
 - Seasons: Summer & Winter (2)
 - Temperatures: five temps (Winter: 25F to 75F; Summer: 35F to 85F) (x5)
 - Load Levels: Heavy & Light Load (x2)
 - Generation: PSE/SCL/SNPD Gen mapped to 15 Generation levels (x15)
 - Outage Scenarios: 70 critical primary contingencies (x70)
 - Next worst Contingency: ~1000 secondary contingencies (x1000)

$$2 \times 5 \times 2 \times 15 \times 70 \times 1000 = 21 \text{ million scenarios}$$

- New Tool: Combines ATC tool with results database
- Developed a meaningful way to summarize results:
 - TCRM: Transmission Curtailment Risk Measure



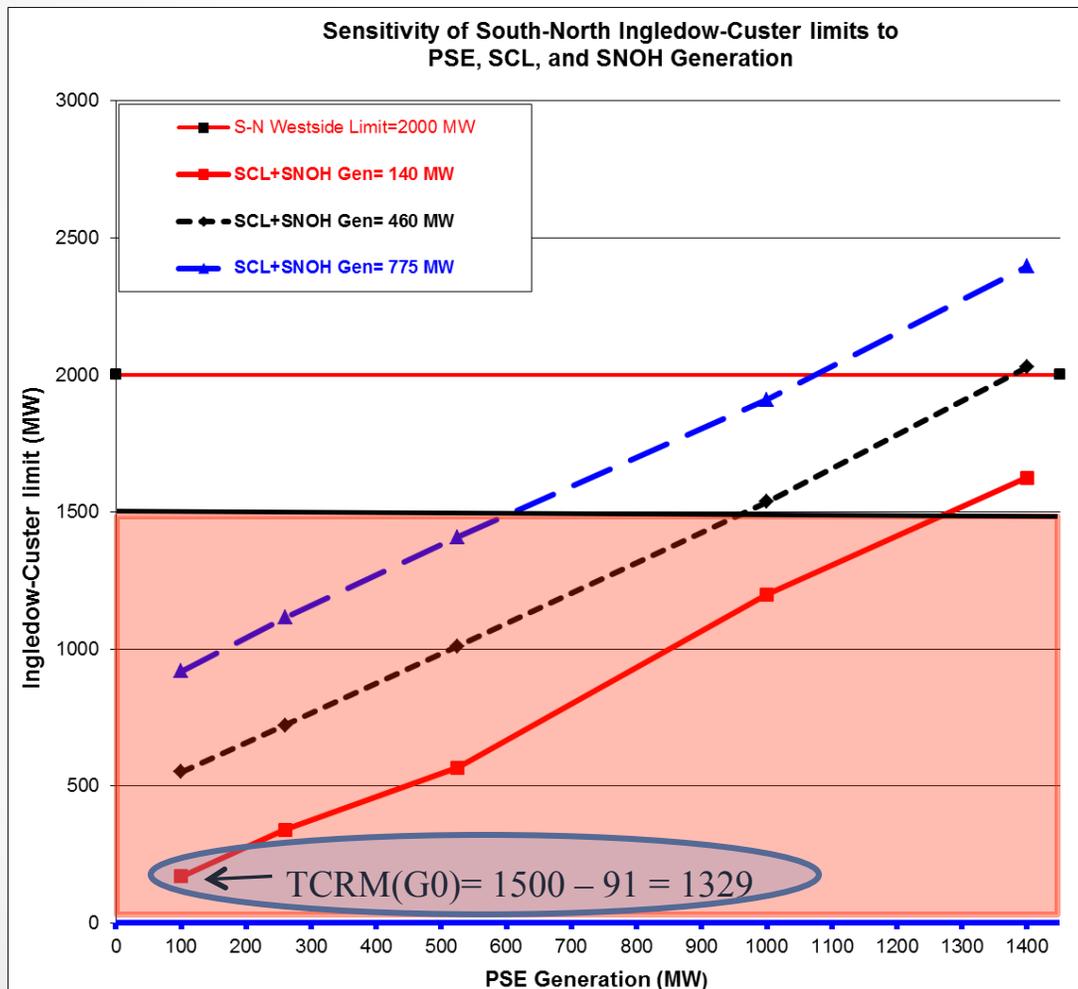
Solution: TCRM a new planning term



Chief-Jo Monroe #1
500kV
Winter 2020
Heavy Load
Temperature 45F

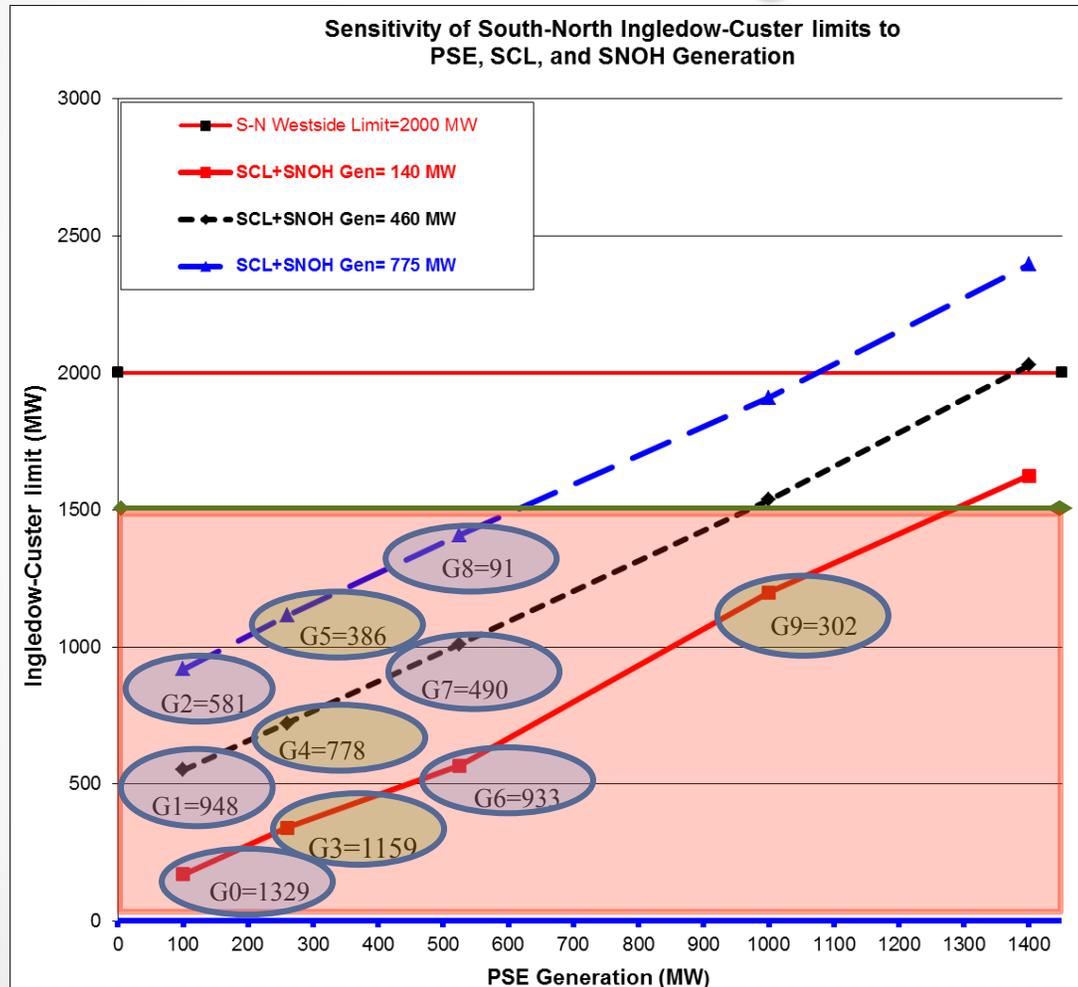
1500 MW Firm
Transmission Rights

Solution: Calculating TCRM for G0 pt



Chief-Jo Monroe #1
500kV
Winter 2020
Heavy Load
Temperature 45F

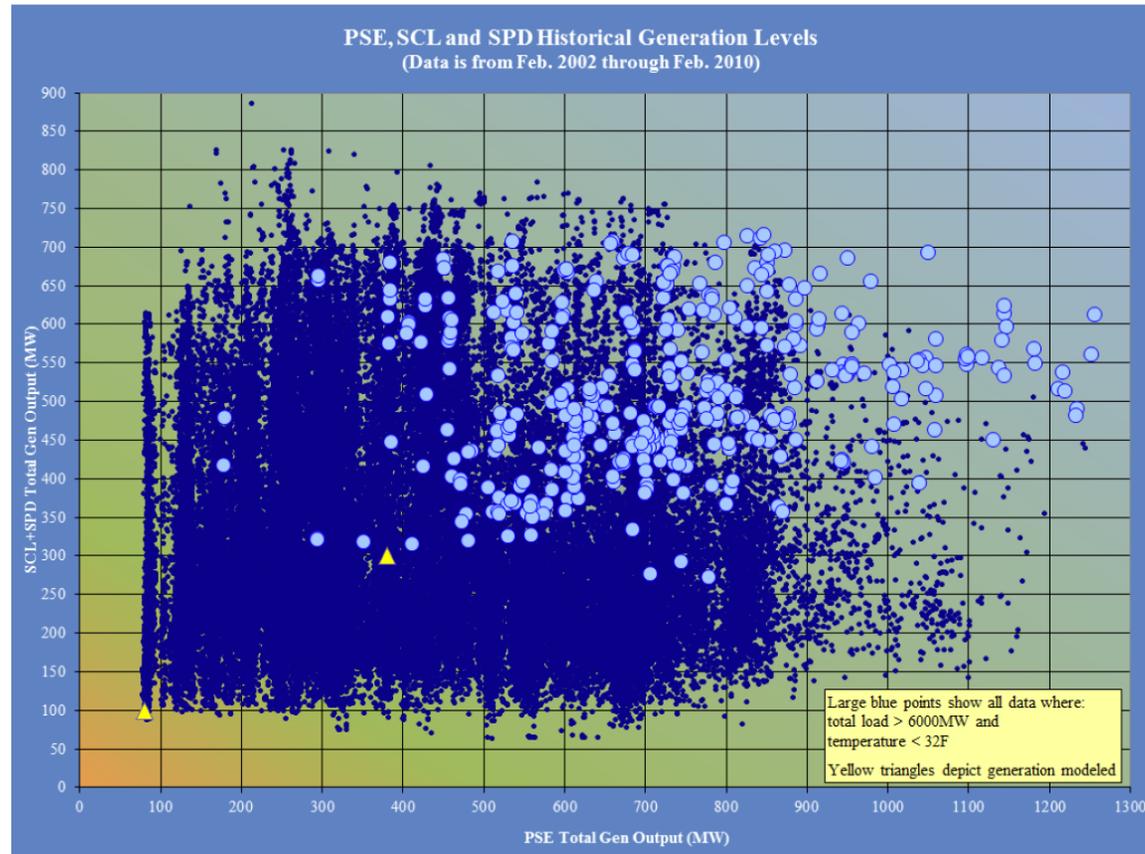
Solution: Calculating TCRM for the primary outage at 45F



Unweighted TCRM
 Sub-total =
 1329 + 948 + 581 +
 1159 + 778 + 386 +
 933 + 490 + 91 +
 302
 = 6997

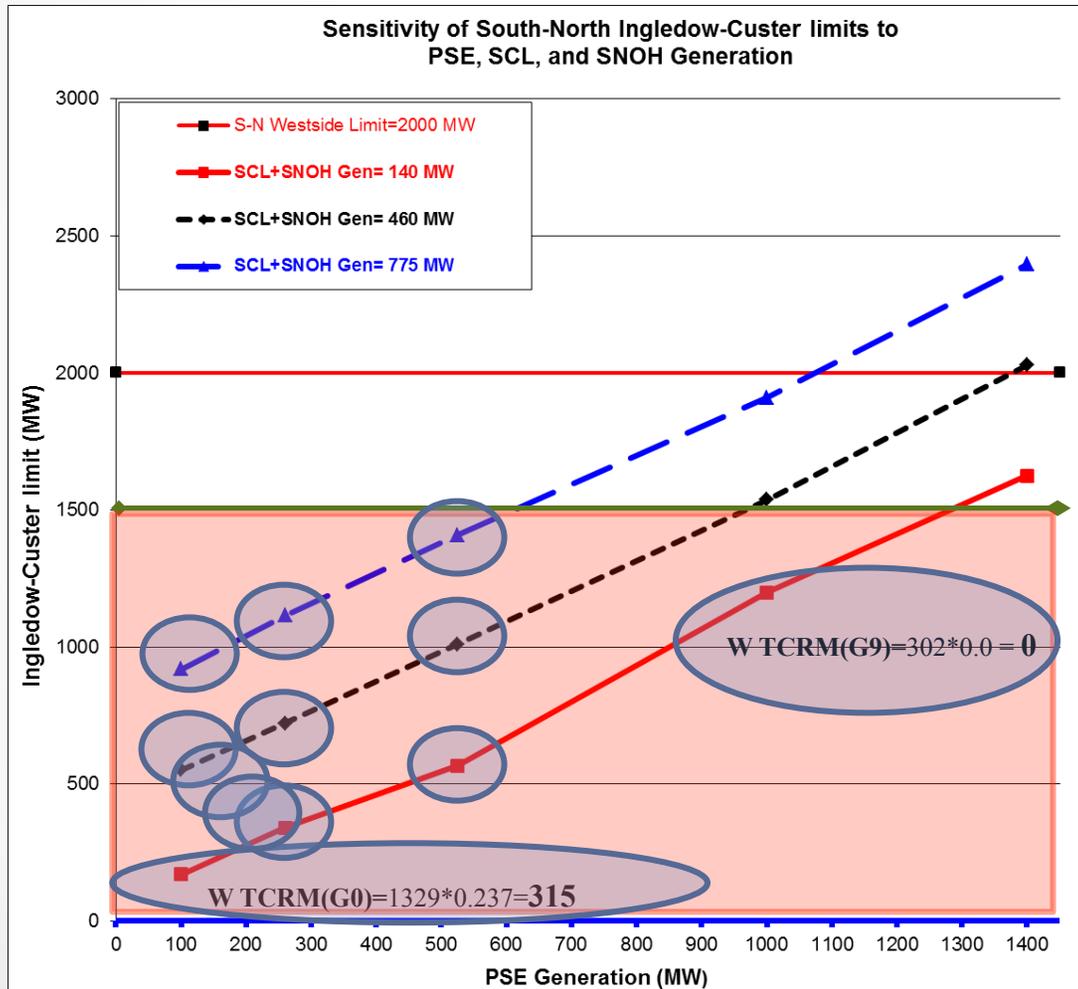
Probabilistic Analysis: Gen Points

Chart 1: Puget Sound Area Historical Generation



Source: Transmission Expansion Plan for the Puget Sound Area, October 2010, p. 128

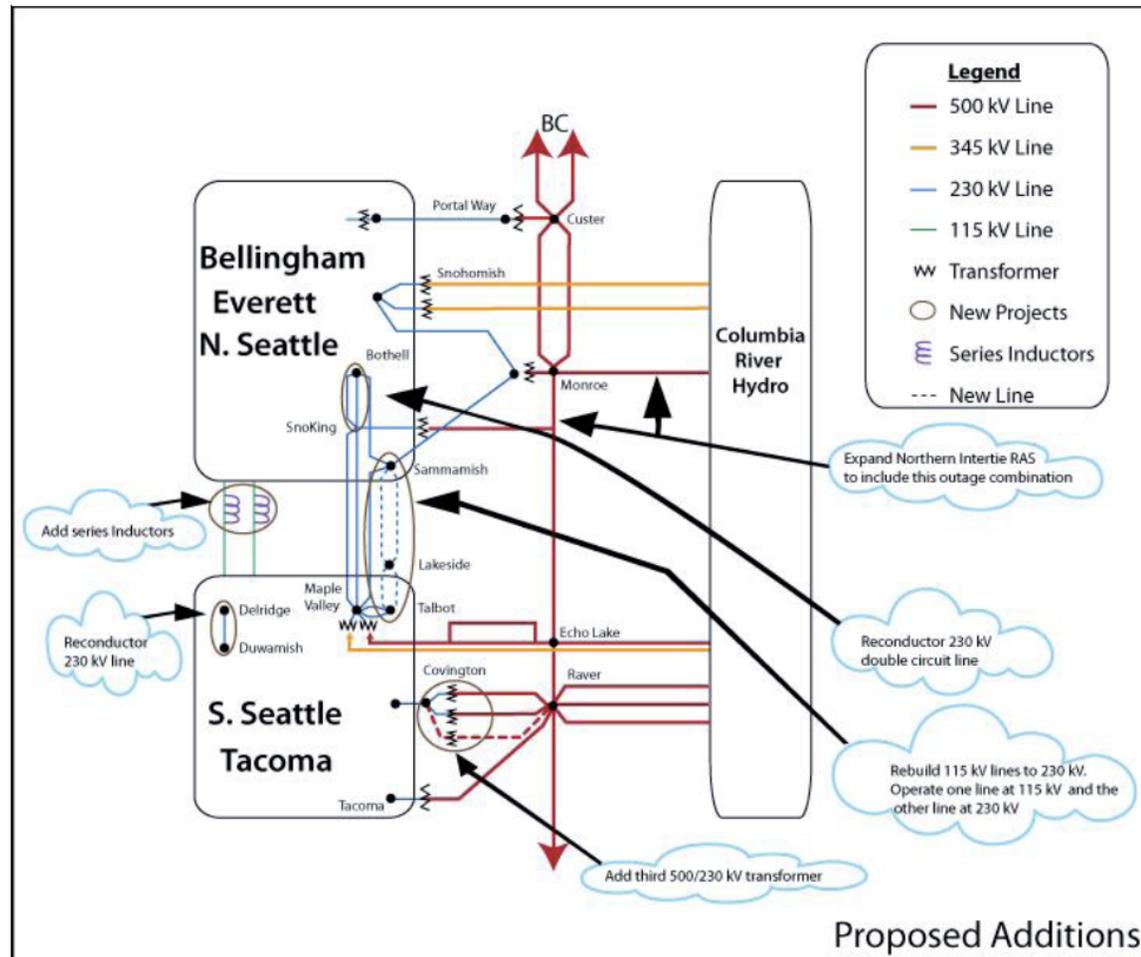
Probabilistic Analysis: Weighted TCRM



Unweighted TCRM
 Sub-total =
 1329 + 948 + 581 +
 1159 + 778 + 386 +
 933 + 490 + 91 +
 302
 = 6997

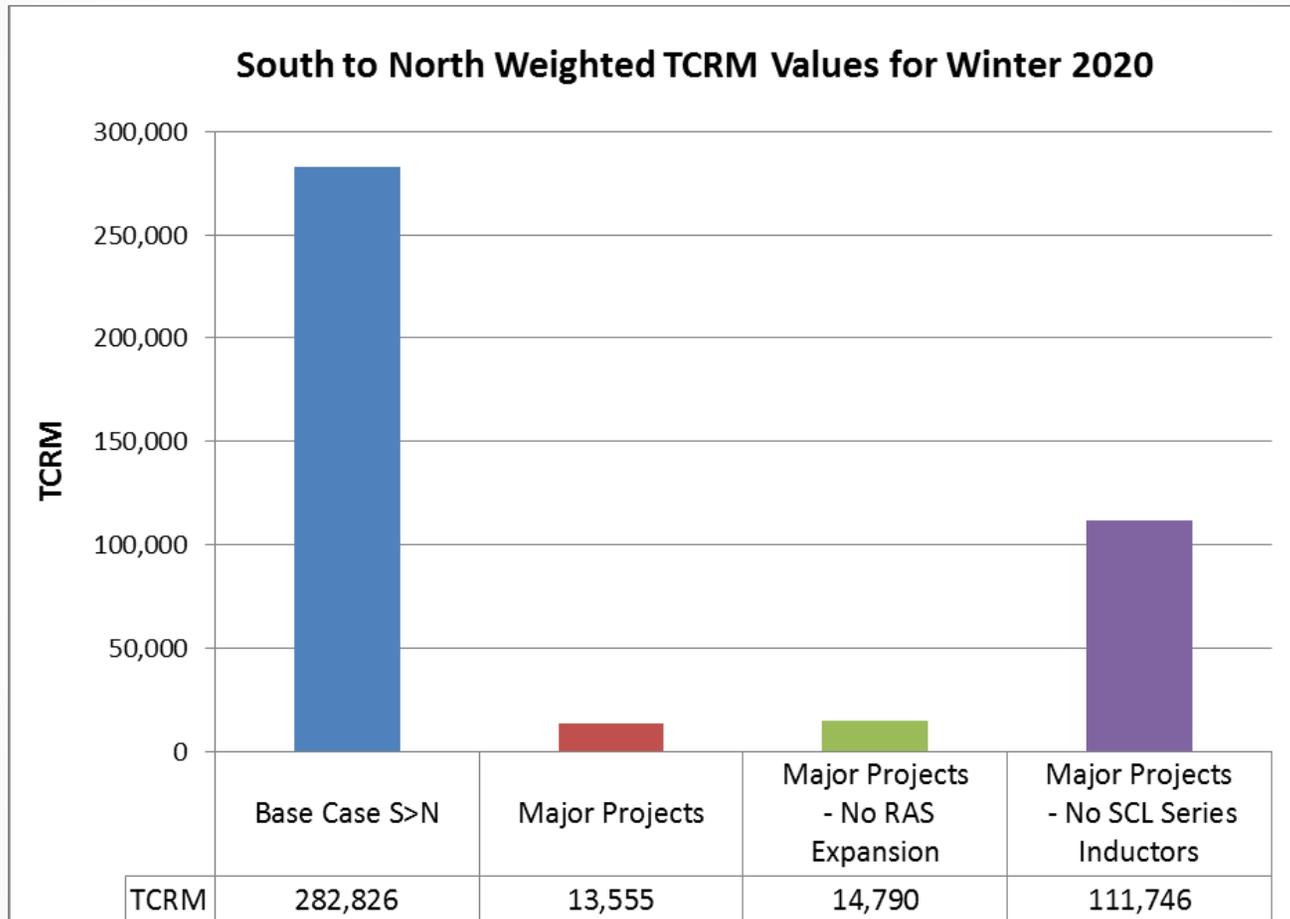
Weighted TCRM
 Sub-total =
 315 + 411 + 10 +
 189 + 778 + 42 +
 16 + 194 + 6 +
 0
 = 1962

Results: Proposed S to N Plan



Source: Transmission Expansion Plan for the Puget Sound Area, June 2011

Results: TCRM Analysis



* 2010 Transmission Expansion Plan for PSA , Extract from Chart 1

Summary: TCRM Analysis

- PSAST developed a tool to evaluate transmission plans for millions of possible scenarios:
 - Full body MRI
- TCRM analysis helped identify PSA transmission reinforcements that are being included in cap plans
 - South-to-North: October 2011 and October 2010
 - North-to-South: February 2013
 - <http://columbiagrid.org/planning-expansion-overview.cfm>
Then click on the Puget Sound Area Study Team Tab
- Next steps:
 - Managing gap between present and planned transmission system;
 - Adapting TCRM to new flowgates
 - Determining appropriate TCRM targets going forward

Questions

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