Oregon Public Utility Commission

RESOURCE ADEQUACY TECHNICAL CONFERENCE SPECIAL PUBLIC MEETING AGENDA

Research into Resource Adequacy in the West and Development of Metrics

John Fazio, Senior Power System Analyst
NW Power and Conservation Council
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Council's Resource Adequacy Assessment

- In 2011 the Council adopted a resource adequacy standard based on the Loss of Load Probability (LOLP) and *is now considering moving to a multi-metric standard*

- The purpose of the *annual* RA assessment is twofold:
  1. To provide an early warning should resource development fail to keep pace with demand growth and
  2. To ensure that the power plan's resource strategy will result in adequate future power supplies

Objectives for the New RA Standard

1. *Prevent overly frequent use of emergency measures*
2. *Limit occurrences of excessively long shortfall[1] events*
3. *Limit occurrences of big capacity shortfalls[1]*
4. *Limit occurrences of big energy shortfalls[1]*

[1]In the context of resource adequacy analyses, a *shortfall* indicates when simulated resources are insufficient to meet firm demand. A *curtailment* indicates when simulated insufficiencies cannot be fully mitigated by taking non-modeled emergency measures (see next slide).

Proposed New Adequacy Standard

- ***LOLEV*** *– Prevent overly frequent use of emergency measures*
  - Expected number of shortfall events/year, counting all shortfall events
  - Provisional limit range is 0.1 to 0.2 shortfall events/year

- ***Duration VaR$_{97.5}$*** *– Limit the risk of long shortfall events to 1/40 years*
  - Longest shortfall event for the 97.5th worst simulation year
  - Provisional limit range is 8 to 12 hours

- ***Peak VaR$_{97.5}$*** *– Limit the risk of big capacity shortfalls to 1/40 years*
  - Highest single-hour shortfall for the 97.5th worst simulation year
  - Provisional limit range is 2,000 to 3,000 MW

- ***Energy VaR$_{97.5}$*** *– Limit the risk of big energy shortfalls to 1/40 years*
  - Total annual shortfall energy for the 97.5th worst simulation year
  - Provisional limit range is 4,000 to 8,000 MW-hours

Examples of Non-modeled Emergency Measures

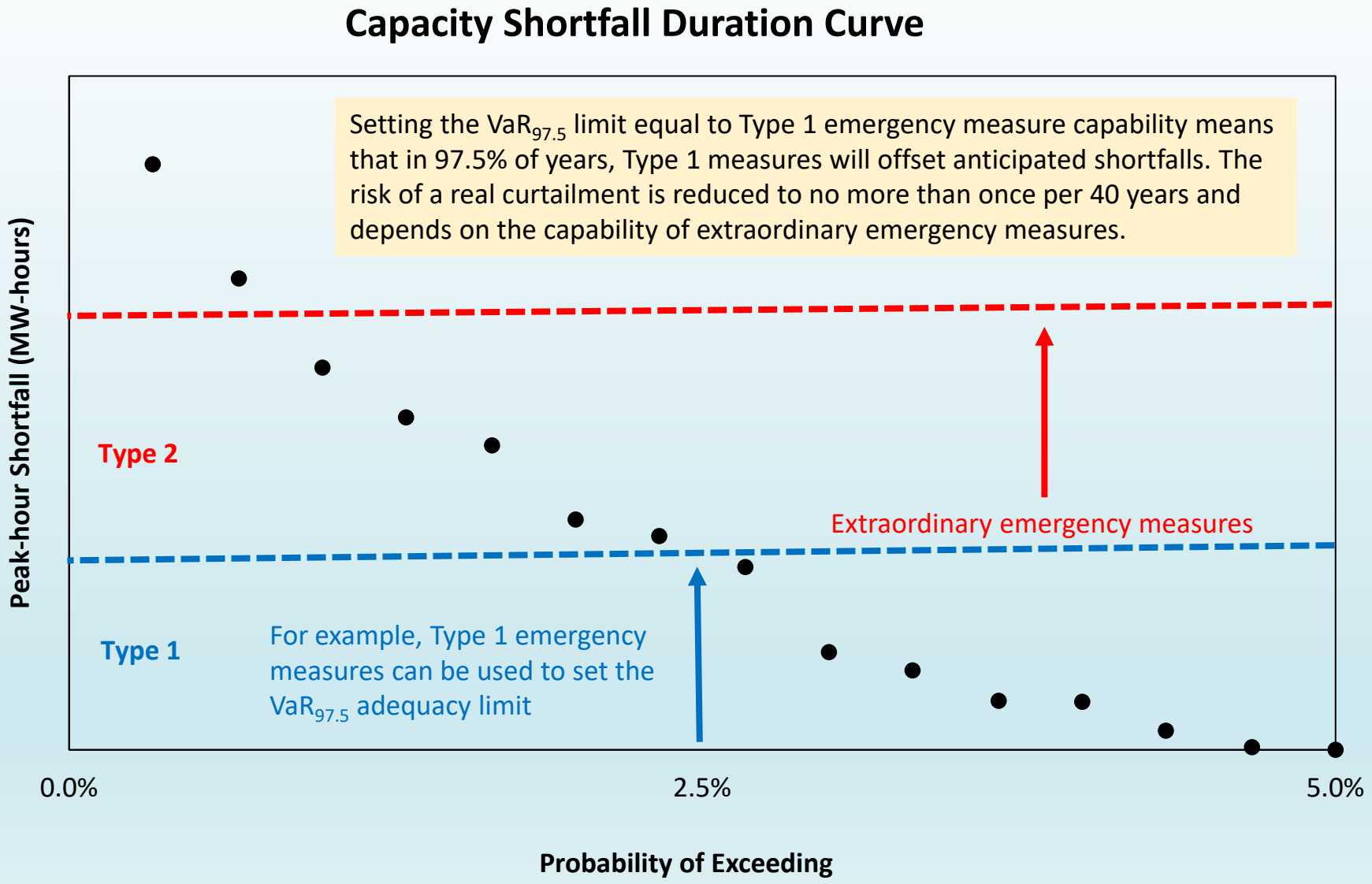
Quantifying Emergency Capability is Difficult

Type 1:

- High operating cost resources not in utility's active portfolio
- High-priced market purchases over max import limits
- Load buy-back provisions
- Industry backup generators
- Banks Lake emergency generation

Type 2:

- Official's call for conservation
- Reduce less essential public load (e.g., gov't buildings, streetlights, etc.)
- Utility emergency load reduction protocols
- Curtail F&W hydro operations



Power Plan Resource Strategy for 2027

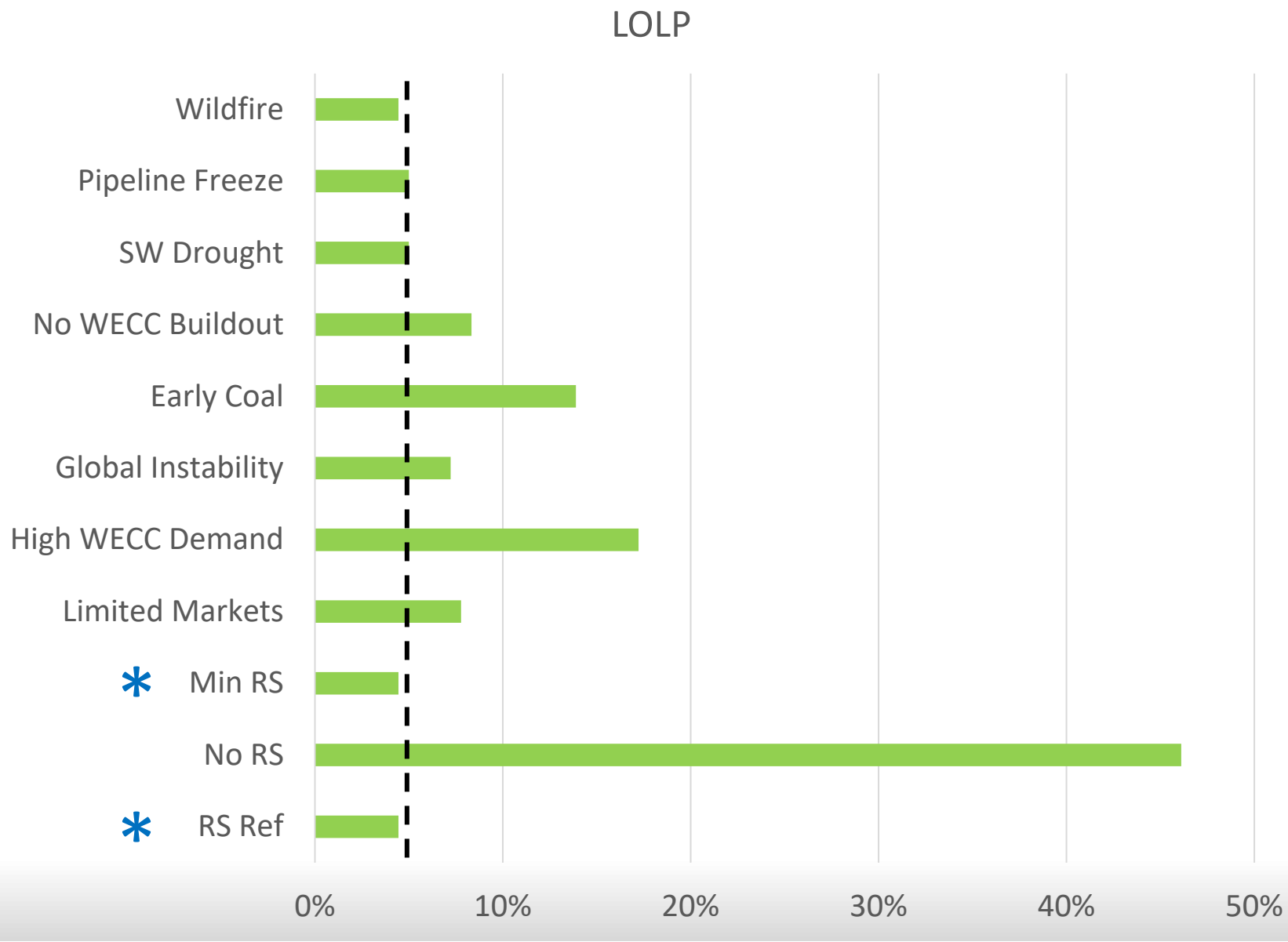
- *Minimum Resource Strategy (Min RS)*
  - 750 aMW of new EE
  - 720 MW of new DR
  - 2,910 MW of new Renewables
  - 6,000 MW of Up Reserves
  - 590 MW of renewable resource capacity built since the release of the plan
- *Reference Resource Strategy (RS Ref)*
  - 1,000 aMW of new EE
  - 720 MW of new DR
  - 5,410 MW of additional new Renewables
  - 6,000 MW of Up Reserves
  - 590 MW of renewable resource capacity built since the release of the plan
- *No Resource Strategy (No RS)*
  - Just 590 MW of renewable resource capacity built since the release of the plan

Scenarios Analyzed

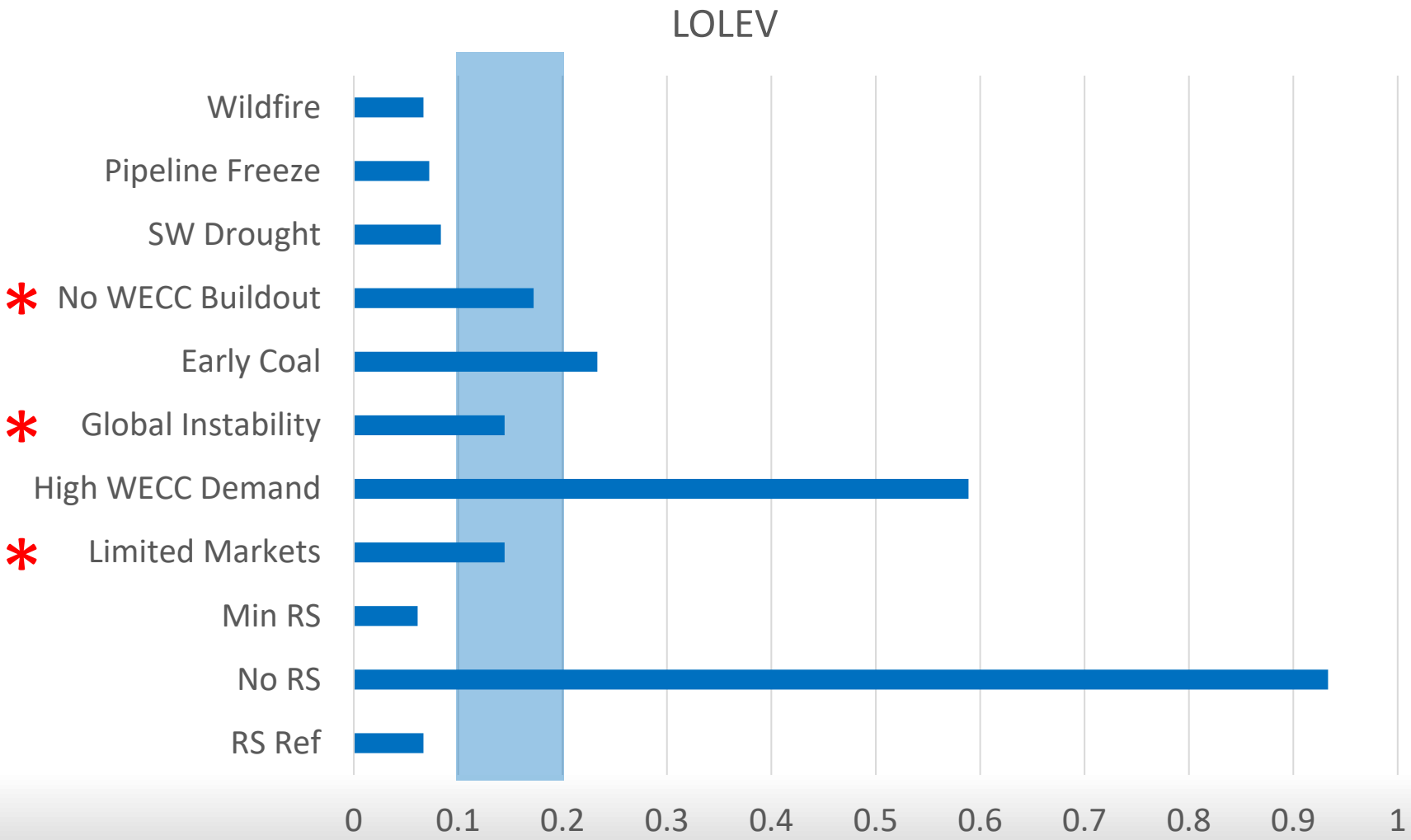
Plan Resource Strategy
- Resource Strategy Baseline (*RS Ref*)
- No Resource Strategy (*No RS*)
- Minimum Resource Strategy (*Min RS*)

Market Conditions
- Limited Markets (*RS Ref*)
- High WECC Demand (*RS Ref, +200 aMW EE*)
- Global Instability (*RS Ref*)
- Early Coal Retirement (*RS Ref*)

WECC Stress
- No WECC Buildout (*RS Ref*)
- SW Drought (*RS Ref*)
- Pipeline Freeze (*RS Ref*)
- Wildfire (*RS Ref*)


LOLP
Wildfire
Pipeline Freeze
SW Drought
No WECC Buildout
Early Coal
Global Instability
High WECC Demand
Limited Markets
Min RS
No RS
RS Ref
0%
10%
20%
30%
40%
50%

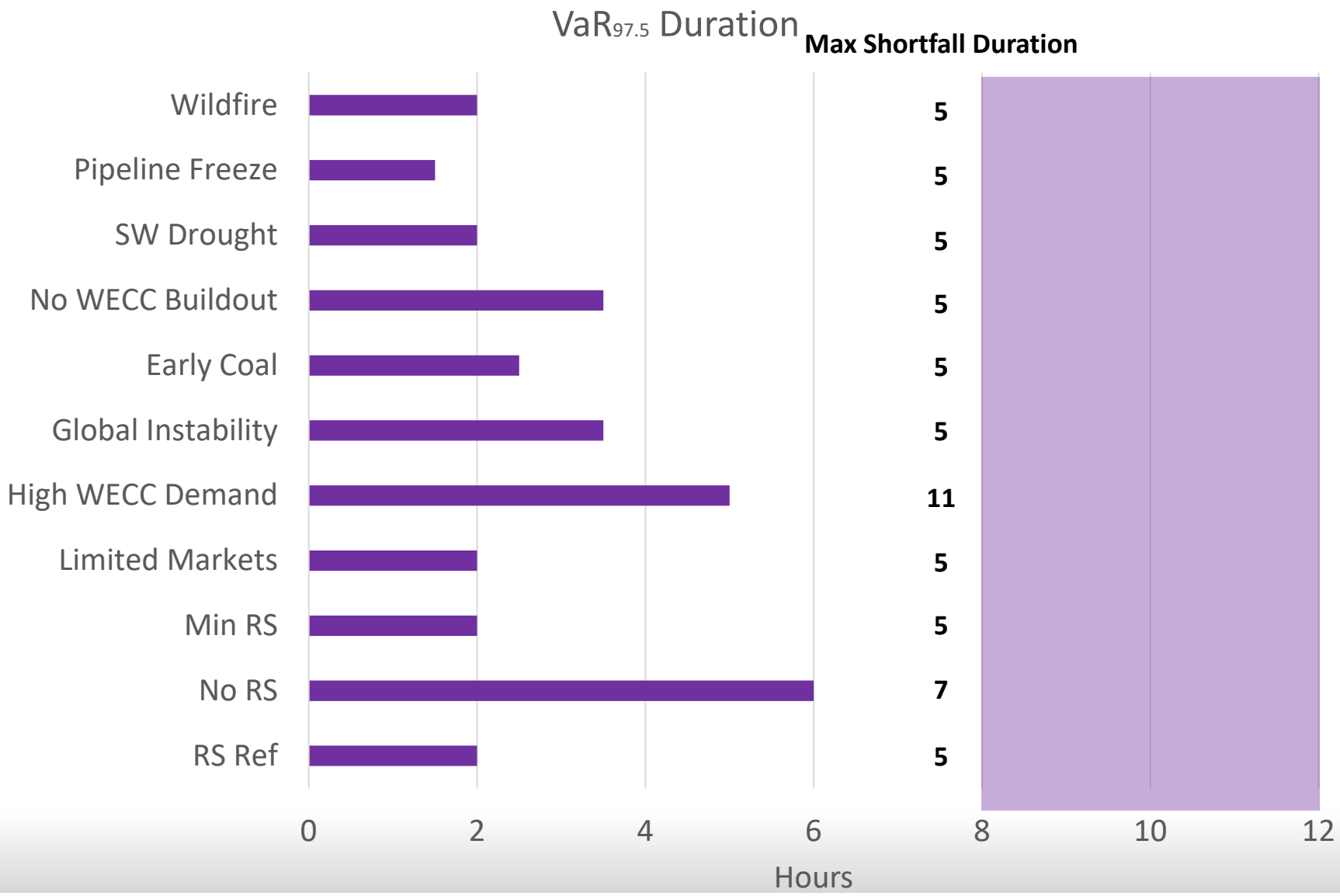
LOLEV limit range: WRAP uses 0.1 events/year and SCL and TAC both use 0.2 events/year, though defined differently: WRAP counts “event days” and not events, TAC counts all events and SCL counts only bad events.
Therefore, test a provisional limit range of 0.1 to 0.2 expected shortfall events/year.



* Borderline

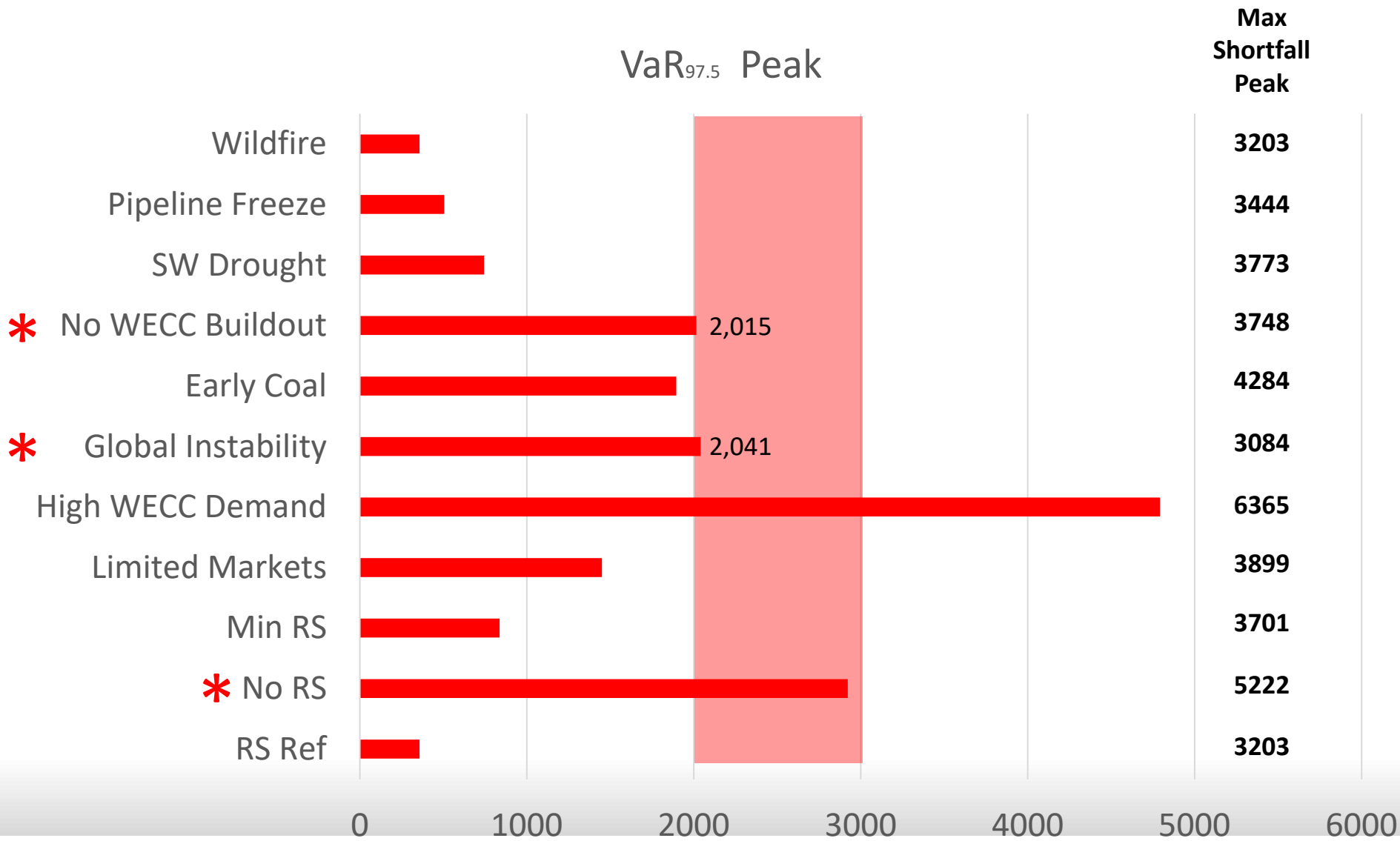
0.1 to 0.2 Events/Year Provisional Range

Duration VaR limit range: Minimum shortfall duration that could potentially cause severe harm.
Initial considerations suggest testing a range of 8 or 12 hours for the provisional limit.



8 to 12 Hours Provisional Range

Peak VaR limit range: Based on reliable amount of emergency peaking. SCL assumes 200 MW of reliable emergency peak supply – extrapolating to the entire region yields 4,000 MW but that would not be representative. Given our conservative market reliance assumptions in the model, a 2,000-3,000 peak range is tested for the provisional limit.



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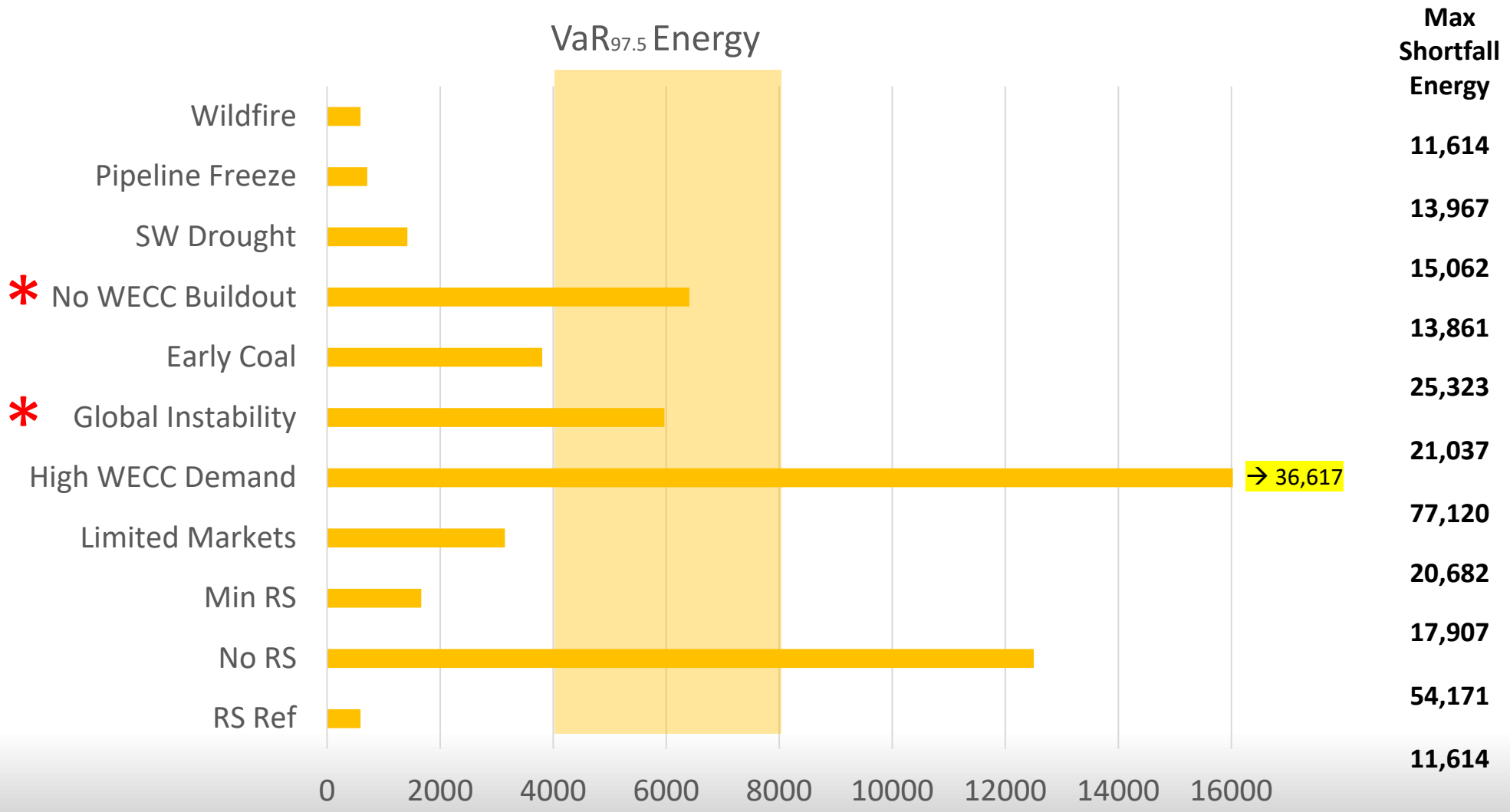
Energy VaR limit range: The amount of reliable emergency energy for the year but the provisional limit is set equal to the amount of energy that can be delivered over a contiguous shortfall period. 500 to 1,000 megawatts per hour is assumed to be deliverable over the minimum 8-hour duration VaR limit (but perhaps more for shorter events). Thus, a range of 4,000 to 8,000 MW-hours is tested as the provisional limit.



* Borderline

Acceptable
Borderline
Exceed

Preliminary Summary

Study	LOLEV	Duration	Peak	Energy
RS Ref	0.067	2	357	590
No RS	0.933	6	2922	12504
Min RS	0.061	2	837	1666
Limited Markets	0.144	2	1450	3147
High WECC Demand	0.589	5	4792	36617
Global Instability	0.144	3.5	2041	5969
Early Coal	0.233	2.5	1895	3807
No WECC Buildout	0.172	3.5	2015	6410
SW Drought	0.083	2	744	1421
Pipeline Freeze	0.072	1.5	505	710
Wildfire*	0.067	2	357	590

Maximum Shortfall Magnitude (MW) Heat Map

- Summer shortfalls are nearly eliminated
- Magnitude of winter shortfalls is greatly reduced

Reference - With Resource Strategy

Month	Hour in Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	0	0	0	0	0	1300	3203	2856	1915	792	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	402	443	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	173	0	0	0	0	0	0	0	0	0	1942	2160	0	0	0	0	0	0

Reference Without Resource Strategy

Month	Hour in Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	0	0	0	0	0	3149	5222	4964	4398	3699	496	0	0	0	0	0	119	0	0	0	0	0	0	0
2	0	0	0	0	334	2560	3010	3357	2011	1844	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	676	1780	1154	0	248	1189	1526	1174	979	1089	587	29	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	625	285	384	749	370	398	355	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	303	767	1153	888	697	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	782	780	94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	746	191	467	0	0	0	0	0	0	1323	4275	4496	1732	0	0	0	0	0

Conclusions and High Level Observations

- The 2027 regional power supply *would be greatly inadequate* if the region relied solely on existing resources, existing reserve levels, and with no new energy efficiency measures.
- The power supply *would be adequate* if resources and reserves identified in the Plan's resource strategy are added *and* demand growth remains consistent with the Plan's baseline forecast.
- Value of using multiple metrics: Both min and ref resource strategies yield adequate supplies, but the ref strategy reduces the size of infrequent but potentially impactful shortfalls
- However, new policies and market developments, as well as other significant uncertainties, could pose more serious adequacy challenges in the absence of additional resource development.
- Additional resources and reserves will be required (as detailed in the 2021 Power Plan):
  - If future electricity market supplies are significantly limited
  - If new policy commitments to electrification accelerate demand growth
  - If major resources are retired earlier than expected without replacement

Contact Information

John Fazio
Senior Power System Analyst
NW Power and Conservation Council
503-222-5161 (office)
jfazio@nwcouncil.org