Final Adequacy Criteria Recommendation for the 9th Power Plan

RAAC Steering Committee

March 27, 2025

Northwest **Power** and
Conservation Council

Agenda

The Journey

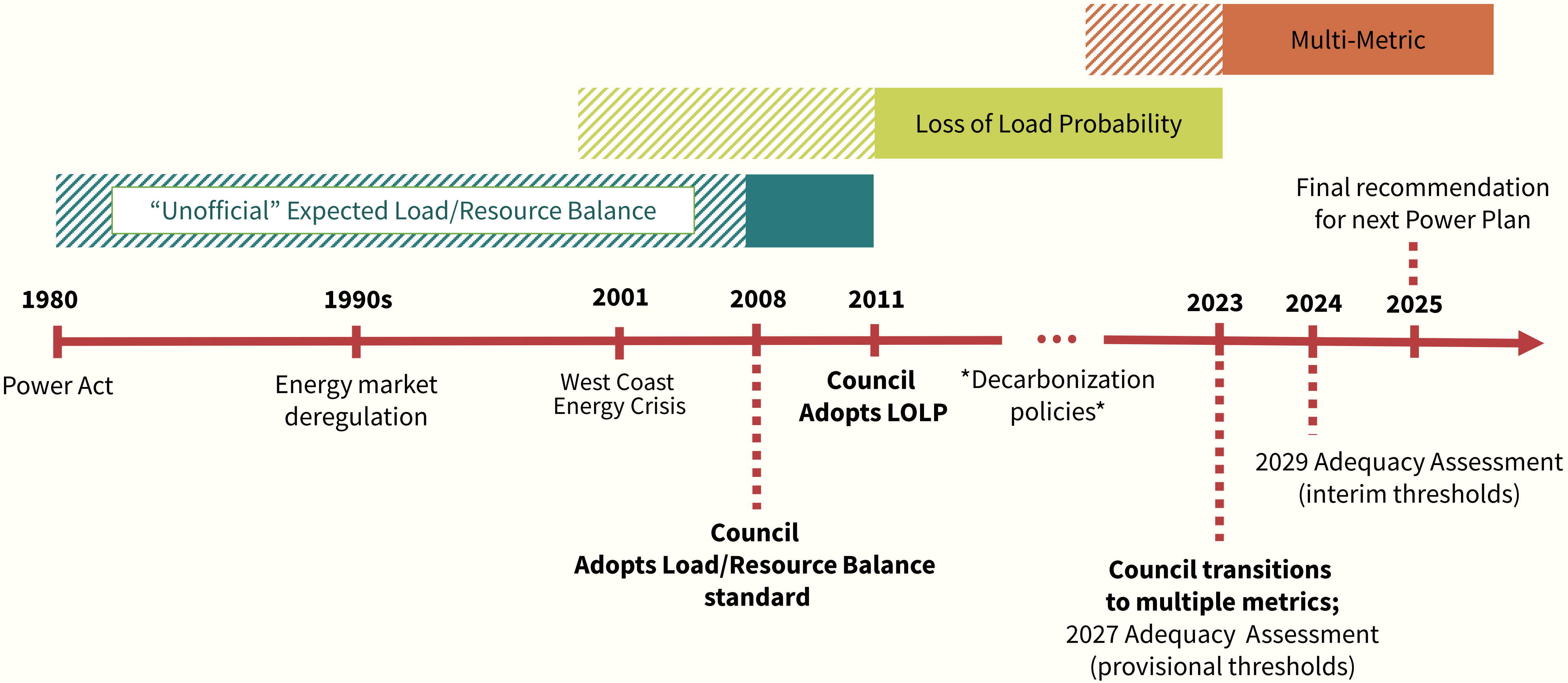
Course Corrections?

The Destination

RAAC Steering Recommendation

The Journey

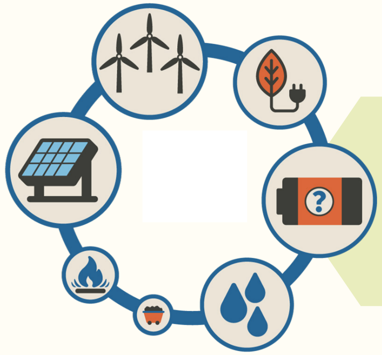
Evolving Approach to Adequacy



Drivers of Change

Previously, the main risk we worried about was high loads coincident with low water.

Loss of Load Probability was a sufficient risk representation



Now we have added risks, including coincidence of fuel availability for resources.

Risk is no longer just a question of frequency, but also duration and magnitude

Adequacy Standard Evaluation Process

Concept Development with RAAC

Data Collection & stakeholder meetings

Synthesize with RAAC

Final Criteria recommendation

June 2022

January 2023

March 2023

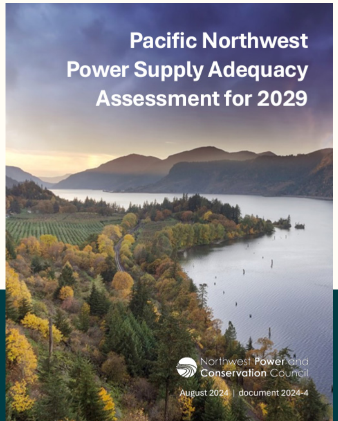
January 2024

June 2024

Mid-2025

Provisional limit for

2027 Adequacy Assessment



Interim limit for

2029 Adequacy Assessment

Criteria Recommendation for Power Plan

Metric Decision-Making Process

- Ask about adequacy goals – what do we want to protect against?
  - Excessively high use of emergency measures
  - Long duration shortfalls
  - Big capacity shortfalls
  - Big energy shortfalls
  - Protect against spending too much on loss of load mitigation

Removed From Consideration

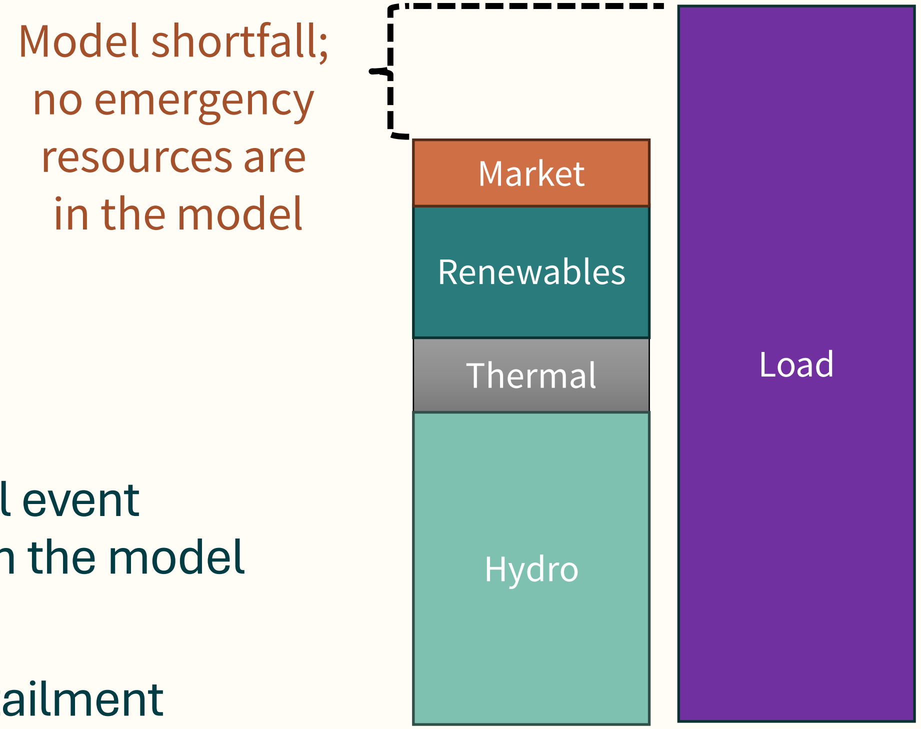
Economic risk based of Value of Lost Load (VoLL).However, VoLL estimations are subjective and tend to be less restrictive. Instead, economic risk determined through Portfolio Expansion Model

- User-friendliness
  - Easily calculated using adequacy models
  - Easily implemented into system expansion models

Metric Consideration

Option	RA Metric	Big Capacity Shortfall	Big Energy Shortfall	Frequent use of emergency measures	Long shortfall event-duration
Event-based Metrics	Frequency Duration Magnitude		✓		✓
Annualized Metrics	LOLEV LOLH (duration) EUE/NEUE			✓	
Tail-end Metrics	$VaR_{97.5}$ $CVaR_{97.5}$	✓	✓		✓
Hybrid	LOLEV $VaR_{97.5}$ Energy/Peak/ Duration	✓	✓	✓	✓

Redefining Risk Approach



- Adequacy studies simulate the NW power system to meet NW load
- In each simulation, representing one year, a simulated model shortfall event occurs over a time period when load cannot be served by resources in the model
- However, a shortfall in the model **does not** necessitate an actual curtailment
  - Rather, it signals non-modeled emergency measures are necessary to avoid curtailment:
- Adequacy metrics evaluate shortfalls to inform risk of using emergency measures

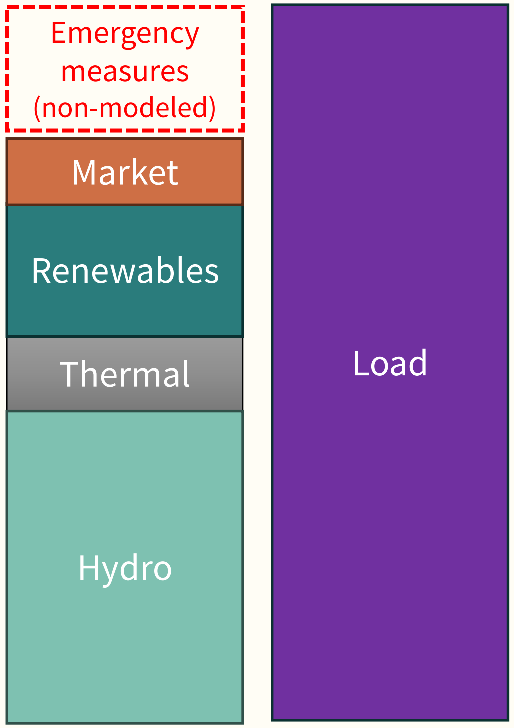
What are Emergency Measures?

Staff engaged with the RAAC on approximating regional aggregate emergency capabilities to inform adequacy framework.

There is no clear line in the sand between magnitude of Type I and Type II measures

- **Within utility control (“Type I”)**
  - 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

- **Extraordinary measures (“Type II”)**
  - 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



Philosophical Approach to Thresholds

Emergency Capabilities

Available emergency capabilities for the region is the main driver for the initial provisional limits

Risk Tolerance

What level of risk is the aggregate emergency capabilities of the region able to protect?

Collaborated with regional utilities and stakeholders to evaluate and determine **precise and appropriate** regional adequacy thresholds.

2029 Adequacy Assessment Criteria

Protection against frequent deficits	Protection against extreme (tail-end) deficits		
Frequency (LOLEV)	**Duration**	**Peak**	**Energy**
0.1 in summer 0.1 in winter *(also report annual)*	8-hour	1,200 MW	9,600 MWh
Limit to 1 in 10 years (summer and winter events)	39 out of 40 years, protecting against events that are too big or too long		

Recap of Jan 2024

Engagement Process

Regional Organizations

- WPP
- PNUCC
- PNGC
- CRITFC

Interviews

Utilities

- BPA
- Idaho Power
- Avista
- Northwestern Energy
- Tacoma Power
- SCL
- PGE
- PSE
- Chelan PUD

Surveys / Interviews

PUCs

- Idaho
- Oregon
- Washington

Interviews

High Level Feedback – part 1

- Supportive of multi-metric approach that captures frequency, duration, and magnitude
- Provisional limits seem reasonable, but difficult to quantify magnitude
- Risk tolerance (97.5th percentile) is up for discussion
- Consideration of different seasonal thresholds for summer and winter
- Consideration of Value-of-Lost-Load (VOLL) / other financial measures

High Level Feedback – part 2

- Need to understand relationship of metrics to other planning measures
- Influence of WRAP
- Sensitivity/Caution with setting thresholds
  - Influencing decision on right-sizing portfolios
  - Considerations of customer impacts
    - Rate implications
    - Impact of magnitude and duration on customers

Threshold Seasonality for Peak and Energy?

- Possible to set one threshold for winter and one for summer
- However, different temporal resolution could change the distribution and therefore the tail-end values
- Currently, not enough data to suggest seasonal peak and energy values:
  - All studies with the resource strategy have mitigated summer shortfalls and reduced winter shortfalls
  - Stakeholders may experience different seasonal challenges → can be an on-going conversation

Interim Recommendation: implement seasonal threshold only for LOLEV

Reconsider as more guidance is provided.

Overall Interpretation of Feedback: Apply Conservative Assumptions

Frequency (LOLEV)

Protect against frequency of events **at least** in alignment with the WRAP

Duration

Shorter longest duration

Peak

Aggregate peak capability based on **at least** the emergency resource available (per data)

Energy

Aggregate annual energy based on **longest** allowed duration at the **peak** capability

Reason for Meeting Today

	2027 Adequacy Assessment	2029 Adequacy Assessment
LOLEV	0.1-0.2 event/year	0.1 in summer 0.1 in winter + report annual
Duration VaR 97.5	8-12 hours	8-hour
Peak VaR 97.5	2,000-3,000 MW	1,200 MW + report NVaR
Energy VaR 97.5	4,000-8,000 MWh	9,600 MWh + report NVaR
	Provisional Range	**Interim Threshold**

Recap of Jan 2024

For upcoming Power Plan

1. Revisit thresholds post 2029 adequacy assessment
2. Provide final metric and threshold recommendation for the next Power Plan

Course Correction?

Northwest **Power** and
Conservation Council

Course Correction?

To season or not to season …
that is the question.

Change market reliance limit?

Protecting Against Events Throughout the Year

- Staff recommend **reincorporating annual LOLEV** into adequacy criteria **alongside** winter and summer
  - Maintain 0.1 summer and 0.1 winter LOLEV
  - Set annual LOLEV to 0.2

- Significance:
  - Protect against the **same level** of adequacy from the **WRAP perspective** of winter and summer
  - Protect / **monitor** against the risk of frequent **shortfalls in spring and fall**
    - Risk of shortfalls occurring during spring maintenance or wildfires in shoulder seasons

Seasonal Peak, Energy, and Duration?

- Staff recommend **maintaining** the Peak, Energy and Duration as **annual metrics**
  - Seasonal thresholds require different risk assumptions to align with annual risk
  - Different temporal resolution could change the distribution
  - Consider examples from 2029 Adequacy Assessment:

Higher Data Center

Threshold	8 hours	1,200 MW	9,600 MWh
Type	Var_d_EV	Var_p	Var_e
Annual	20.6	3,076	196,324
Winter	20.6	3,076	194,223
Spring	1	34	34
Summer	2	680	2,393
Fall	0	0	0

Scenario would still be deemed **inadequate** under seasonal considerations

Low EE

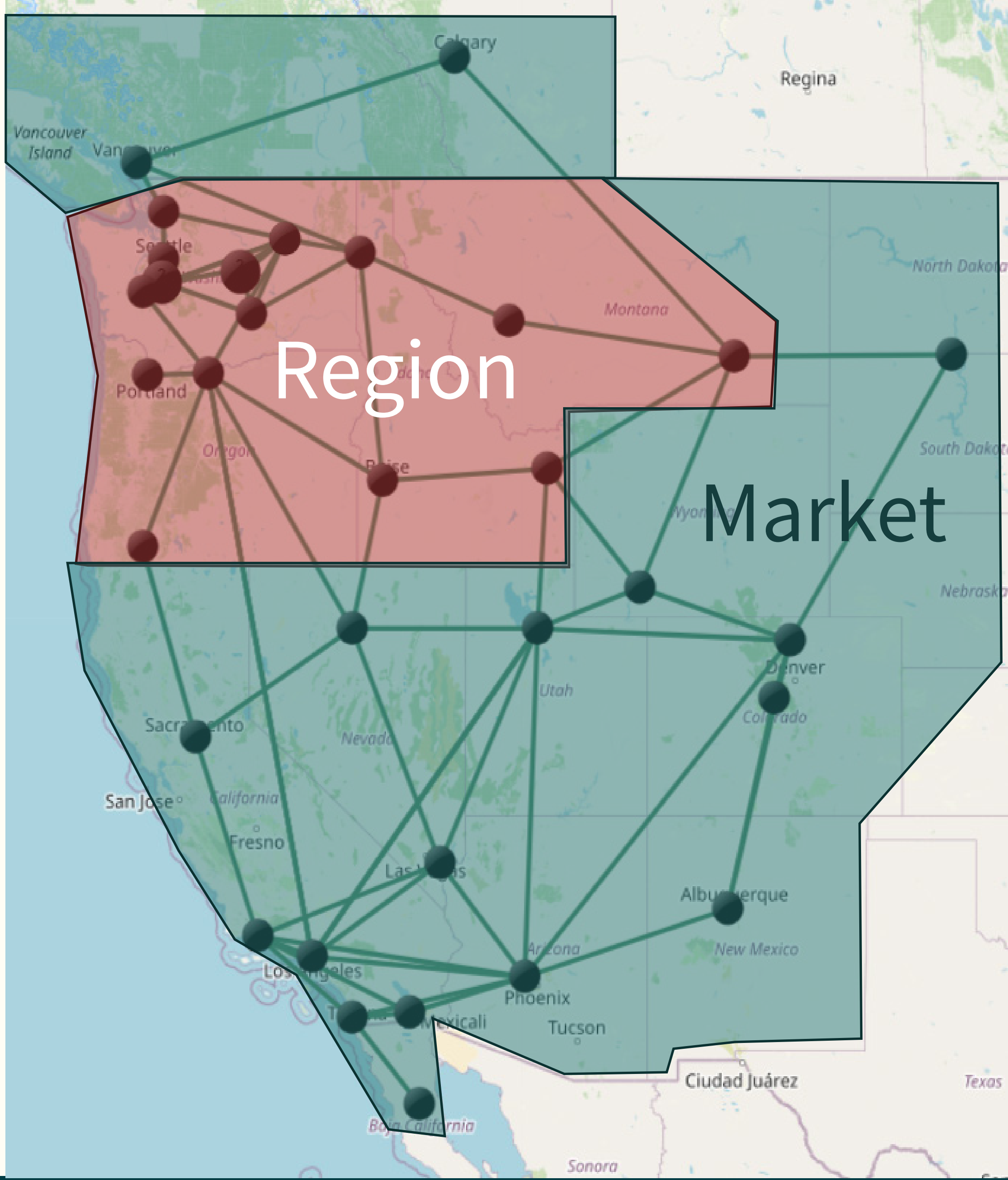
Threshold	8 hours	1,200 MW	9,600 MWh
Period	**Var_d_EV**	**Var_p**	**Var_e**
Annual	1.5	1,567	4,196
Winter	1	683	1,056
Spring	0	0	0
Summer	1	143	143
Fall	0	0	0

Scenario would be deemed **adequate** under seasonal considerations despite being **inadequate annually**

Role of Market Reliance

- Adequacy results are informed by market fundamentals (capability and price) per outside the region market resources with buildout from AURORA
- Council uses a market (import) reliance limit in the winter (2,500 MW) and summer (1,250 MW) to limit market exposure risk

Changing the Market Reliance Limit will influence the Adequacy Signal



Market Reliance

- Staff recommend **maintaining the current market reliance limit** for the 9th Plan
  - This is an important topic that is often discussed in the Resource Adequacy and System Analysis Advisory Committees
  - Changing the reliance limit would require re-evaluating the adequacy thresholds
  - A separate process would be needed to determine the new market reliance limit
    - The higher the limit the easier it is to achieve regional adequacy, with the tradeoff of increased market exposure risk

The Destination

RAAC Steering Recommendation?

Adequacy Criteria for 9th Power Plan

Protection against frequent deficits

Protection against extreme (tail-end) deficits

Frequency (LOLEV)

0.1 in summer
0.1 in winter
0.2 annual

Limit to 1 in 10 years summer and winter events, Limit to 1 in 5 years overall

Duration

8-hour

Peak

1,200 MW

Energy

9,600 MWh

39 out of 40 years, protecting against events that are too big or too long

Maintain current market reliance limit

Linking Multiple Adequacy Metrics to Adequacy Reserve Margins

- Using LOLP provided a single measure on required pure capacity
  - i.e. how much pure capacity is needed to reach 5% LOLP

- However, with multiple metrics, there are multiple measures that might require different amounts of pure capacity:
  - Required pure capacity to satisfy VaR Peak
  - Required energy to satisfy VaR Energy
  - Required pure capacity/energy to satisfy VaR Duration
  - Required pure capacity/energy LOLEV

Currently Testing Methodology

- Step 1
  - Identify individual pure capacity needed to satisfy each metric (or energy for Energy VaR)
- Step 2
  - Test lowest pure capacity needed on sample representative study
    - Uncertainty in categorizing unserved load in each period as either caused by a lack of capacity or energy. The interaction of both is likely, and therefore a conservative approach is tested first.
  - Iterate to the next pure capacity needed until all metrics are satisfied
- Step 3
  - Derive annual/seasonal/monthly expected load-resource balance
    - Include pure capacity and energy from Step 2 in the annual signal
    - Determine season/monthly signal via expert judgement
      - (art and science in representing annual metrics)

Under development, will be discussed in upcoming SAAC/RAAC

Questions?

- Any concerns with the recommended criteria?
- Additional open questions to address?
- Other?

Thank you!

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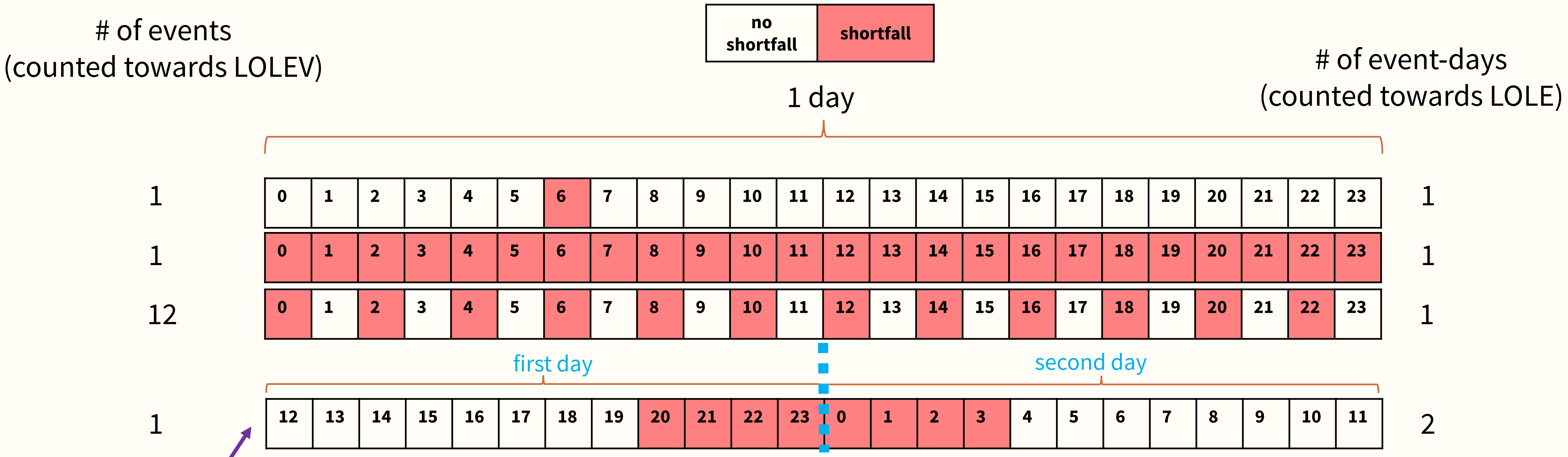
Appendix

LOLEV vs LOLE

Recap of Jan 2024



However, another difference is when a shortfall crosses into the following day, such as this theoretical 8-hour shortfall from 8pm-4am.

LOLEV (expected event/year) works well in combination with duration and magnitude metrics

Recap of January 2024
RAAC Summary of Stakeholder Feedback

LOLEV of 0.1?

TOO CONSERVATIVE
(can be >0.1)

TOO RELAXED
(should be <0.1)

JUST RIGHT!
(0.1)

LOLEV

- 0.1-0.2 is acceptable range
- However:
  - For some, 0.1 is overly conservative (preference for 0.2)
  - For others, 0.1 is not stringent enough (preference for < 0.1)
  - And lastly, some found it just right
- WRAP context*:
  - LOLE of 0.1, but allowed per season (summer and winter)
- National context:
  - Most utilities use LOLE of 0.1

Country or Region	RA Metrics/Criteria
North America [20,21]	
MISO	LOLE ≤ 0.1 days/year
MRO-Manitoba Hydro	LOLE ≤ 0.1 days/year
NPCC-Maritimes	LOLE ≤ 0.1 days/year
NPCC-New England	LOLE ≤ 0.1 days/year
NPCC-New York	LOLE ≤ 0.1 days/year
NPCC-Ontario	LOLE ≤ 0.1 days/year
NPCC-Québec	LOLE ≤ 0.1 days/year
PJM Interconnection	LOLE ≤ 0.1 days/year
SERC-C	LOLE ≤ 0.1 days/year
SERC-E	LOLE ≤ 0.1 days/year
SERC-FP	LOLE ≤ 0.1 days/year
SERC-SE	LOLE ≤ 0.1 days/year
SPP	LOLE ≤ 0.1 days/year
TRE-ERCOT[3]	LOLE ≤ 0.1 days/year
WECC-AB	LOLP[4] ≤ 0.02%
WECC-BC	LOLP[4] ≤ 0.02%
WECC-WPP-US & RMRG [22]	LOLE ≤ 0.1 days/year
WECC-SRSG	LOLP ≤ 0.02%
WECC-CAMX [23]	PRM ≥ 15% Additional local and flexible RA requirements
Hawaii [24]	ERM ≥ 30% (3 islands), 60% (2 islands)

(EPRI) Resource Adequacy for a Decarbonized Future:
A Summary of Existing and Proposed Resource Adequacy Metrics

Food for thought:
Annual LOLEV of 0.1 is more stringent than seasonal LOLE 0.1

Interim recommendation: seasonal 0.1 LOLEV in summer and winter to be more aligned with WRAP

Reconsider 0.2 if future studies have acceptable duration and magnitude metrics but LOLEV between 0.1-0.2

Duration VaR 97.5

Country or Region	RA Metrics/Criteria
Europe [18,25]	
Belgium [26]	LOLH ≤ 3 hours/year LOLH95[5] ≤ 20 hours/year
France [27]	LOLH ≤ 3 hours/year
Great Britain [28]	LOLH ≤ 3 hours/year
Ireland and Northern Ireland [29]	LOLH ≤ 8 hours/year (Ireland) LOLH ≤ 4.9 hours/year (Northern Ireland)
Netherlands [30]	LOLH ≤ 4 hours/year
Poland [31]	LOLH ≤ 3 hours/year
Portugal [27]	LOLH ≤ 5 hours/year
Spain [27,32]	PRM ≥ 10% (Mainland) LOLE ≤ 1 day in 10 years (Island grids)

(EPRI) Resource Adequacy for a Decarbonized Future:
A Summary of Existing and Proposed Resource Adequacy Metrics

- Some suggest 8-12 hours is reasonable, but:
  - The question of duration was closely raised to timing of shortfall during extreme weather conditions
  - Desire to understand societal (value-of-lost-load) and incremental system cost for reducing durations
  - Some had no duration-specific feedback
- However:
  - If region wants to include value-of-lost-load, additional extensive research is required
  - In Europe, the duration metric is on an expected value (LOLH), mostly for shorter durations
  - Consider life-threatening implications of long duration to avoid.

Interim recommendation: Duration VaR 97.5 of 8 hours.

Reconsider if (1) duration of concern changes, or (2) future studies have acceptable frequency and magnitude metrics but Duration VaR substantially divergent

Peak and Energy VaR 97.5

- Most difficult to currently quantify – minimal guidance from feedback
- Consideration of normalizing the metric to percent of system load:
  - Normalized Peak VaR 97.5th (normalized to annual peak load)
  - Normalized Energy VaR 97.5th (normalized to annual total load)
- Closest sibling for energy metric is Normalized Expected Unserved Energy (NEUE)
  - Substantial difference however: expected (average) vs tail-end (high percentile) approach.
- For peak, early industry consideration, but no established application yet
- Examples from some utilities around the world using NEUE
  - Australia 0.002%
  - India 0.05%

What would these values suggest for PNW with average load of 21,000 MW?

21,000 aMW x 8760 hours = 184,960,000 MWh / year

Impact on threshold:
if 0.002% = 3,680 MWh annual energy
If 0.05% = 91,980 MWh annual energy

Limited Peak Magnitude Feedback

- Estimated ~1,200 MW:
  - From 2001 BPA dry year tools, ~900 aMW of measures could be considered type I emergency measures (excluding DSI , modeled market purchases, and fish operation reductions).
  - Banks Lake emergency capability of 300 MW
- Assuming <u>at least</u> similar measures exist today, confidence in 2,000-3000 MW of provisional range.
- However, without additional quantitative peak magnitude feedback, it may be beneficial to use 1,200 MW as a conservative floor.

VaR 97.5 MW	NVaR 97.5 (AVG peak load 40,000 MW)
1,200	3.0%
1,500	3.8%
2,000	5.0%
2,500	6.3%
3,000	7.5%

Interim recommendation: Peak VaR 97.5 of 1,200 MW & report NVaR
Reconsider if future studies have acceptable duration and frequency metrics but Peak VaR 97.5 between 2,000-3,000 MW

Extrapolating Annual Energy Threshold

8-hour event × 1,200 MW-hour Peak = 9,600 MWh Energy

VaR 97.5 MWh	Average Annual Energy MWh 183,960,000
4,000	0.0022%
6,000	0.0033%
8,000	0.0043%
9,600	0.0052%
10,000	0.0054%
12,000	0.0065%

Recall AUS and IND NEUE
0.002% = 3,680 MWh annual energy
0.05% = 91,980 MWh annual energy

Interim recommendation: Energy VaR of 9,600 MWh & report NVaR
Reconsider if future studies have acceptable duration and frequency metrics but energy substantially over threshold

Interpretation: assume a conservative outlook that the peak VaR would last as long as duration VaR

NVaR 97.5 Energy?

VaR 97.5 MWh	Average Annual Energy MWh 184,960,000
4,000	0.0022%
6,000	0.0033%
8,000	0.0043%
9,600	0.0052%
10,000	0.0054%
12,000	0.0065%