Northwest **Power** and **Conservation** Council

July 2, 2024

MEMORANDUM

TO: **Council Members**

FROM: **Dor Hirsh Bar Gai, Power System Analyst**

SUBJECT: **2029 Adequacy Assessment Final Results**

BACKGROUND:

Presenters: Dor Hirsh Bar Gai, John Ollis

Summary: Staff will present the final resource adequacy assessment results for the 2029 operating year using the Council's multi-metric adequacy approach.

The 2029 assessment indicates that keeping on track with the implementation of the 2021 Power Plan resource strategy – including acquiring the high end of the cost-effective energy efficiency target, acquiring at least 6,600 MW of renewables, and holding 6,000 MW of balancing up reserves – alongside system changes in the region of announced non-retirements of thermal plants and expanded transmission capability, will result in an adequate power supply in 2029, despite forecasted load growth from transportation electrification and data centers.

However, areas of risk remain. Pursuing the same resource strategy, but only acquiring the low end of cost-effective energy efficiency target, would not provide for an adequate system. Furthermore, if data center load growth will be in the higher range of the forecast, the region will have insufficient resources to maintain adequacy – signaling the importance of analyzing such futures in the next Power Plan.

Relevance: Resource adequacy is a critical component of the Council's mandate to develop a regional power plan that "ensures an adequate, efficient, economic and reliable power supply." To test the efficacy of the plan's resource strategy, the Council – in cooperation with regional stakeholders – annually assesses the adequacy of the power supply with planned resource additions. The annual assessment is based on a multi-metric adequacy approach to categorize the risk of frequency, duration, and magnitude of events that is currently under evaluation by the Council since 2022 and approved in 2023, evolving past the resource adequacy standard of Loss of Load Probability (LOLP) metric used since 2011.

Workplan: A.2.4 Conduct the regional Adequacy Assessment and prepare report detailing the analysis and findings.

Background: An adequate power supply can meet the electric energy requirements of its customers within acceptable limits, considering a reasonable range of uncertainty in resource availability and in demand. Resource uncertainty includes forced outages, early retirements and variations in hydro, wind, solar and market supplies. Demand uncertainty includes variations due to temperature, economic conditions, and other factors. Resource availability and demand are also affected by environmental policies, such as those aimed at reducing greenhouse gas emissions.

In January 2023 the Council approved a transition towards a multi-metric adequacy approach with the completion of the 2027 Adequacy Assessment to 1) prevent overly frequent use of emergency measures, (2) limit the risk of long duration shortfall events, (3) limit the risk of big capacity shortfalls, and (4) limit the risk of big energy shortfalls. Frequency, duration, and magnitude metrics are used in combination of expected and tail-end event statistics, known as value at risk (VaR).

2029 Adequacy Assessment: Final Results

July 9, 2024 Council Meeting

Dor Hirsh Bar Gai
John Ollis

Agenda

- Background
- Assessment Setup
- Results
- Executive Summary

Background

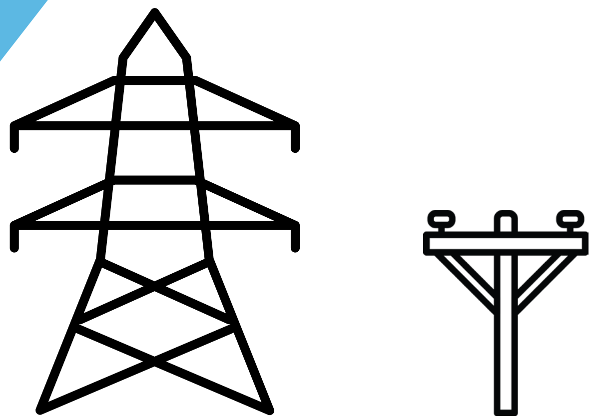
What Are Adequacy Assessments?

Testing Plan strategy on bulk power system…

over potential risk scenarios to signal…

system adequacy

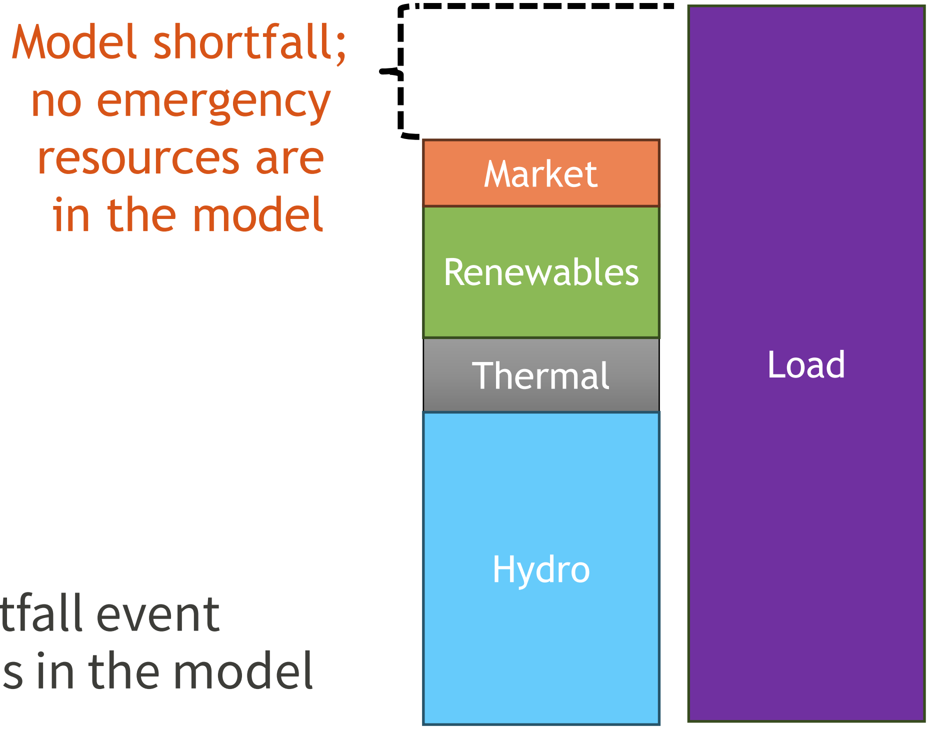
<u>Purpose of presentation:</u>
Asking for a head nod to Council agreement on key takeaways for executive summary



Transmission level ✓

Distribution level ✗

Adequacy 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

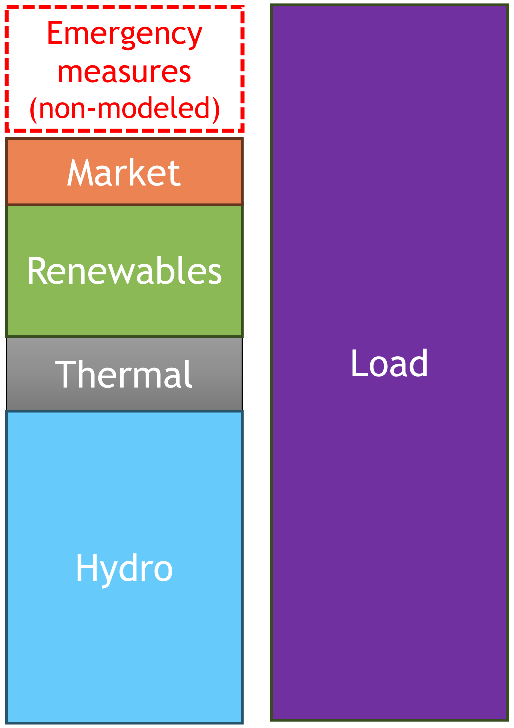
What are Emergency Measures?

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



The Metrics and Thresholds

Protection against frequent deficits

Protection against tail-end (extreme) deficits

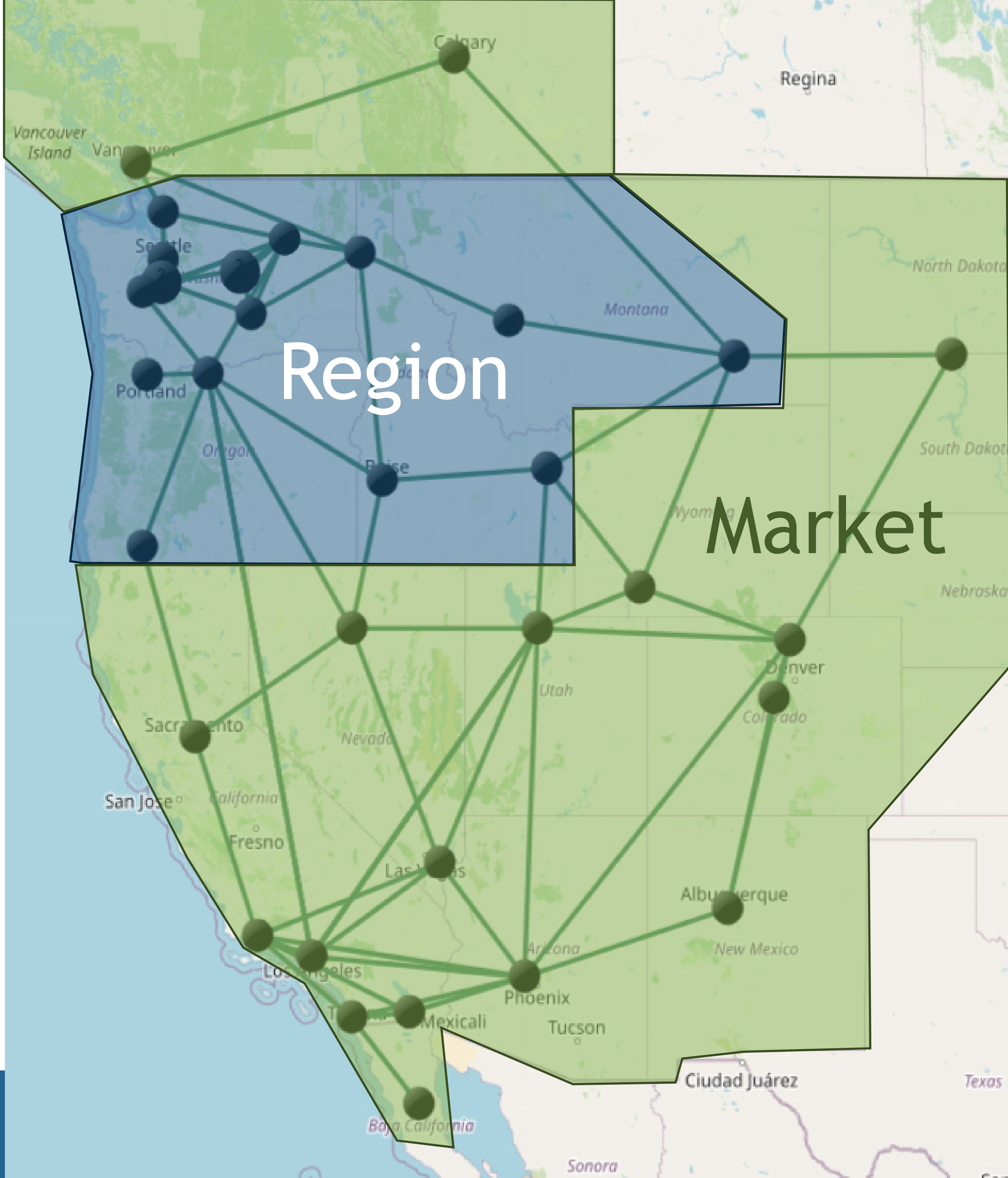
LOLEV	Duration VaR 97.5	Peak VaR 97.5	Energy VaR 97.5
0.1 in summer 0.1 in winter + report annual	8-hour	1,200 MW + report NVaR	9,600 MWh + report NVaR

Rephrasing the adequacy perspective:

Let's make sure emergency measures aren't used too often (satisfying LOLEV) and 39-out-of-40 years let's make emergency measures are not used too long or are too big (satisfying duration, peak and energy VaR)

Region & WECC Market Fundamentals

- Out of Region Market Buildout Update
- 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



Assessment Setup

Scenarios

- Reference
- Higher data center load (in region)
- Alternative Trajectories within Resource Strategies (achieving low range of EE target)

2029 Assessment Studies

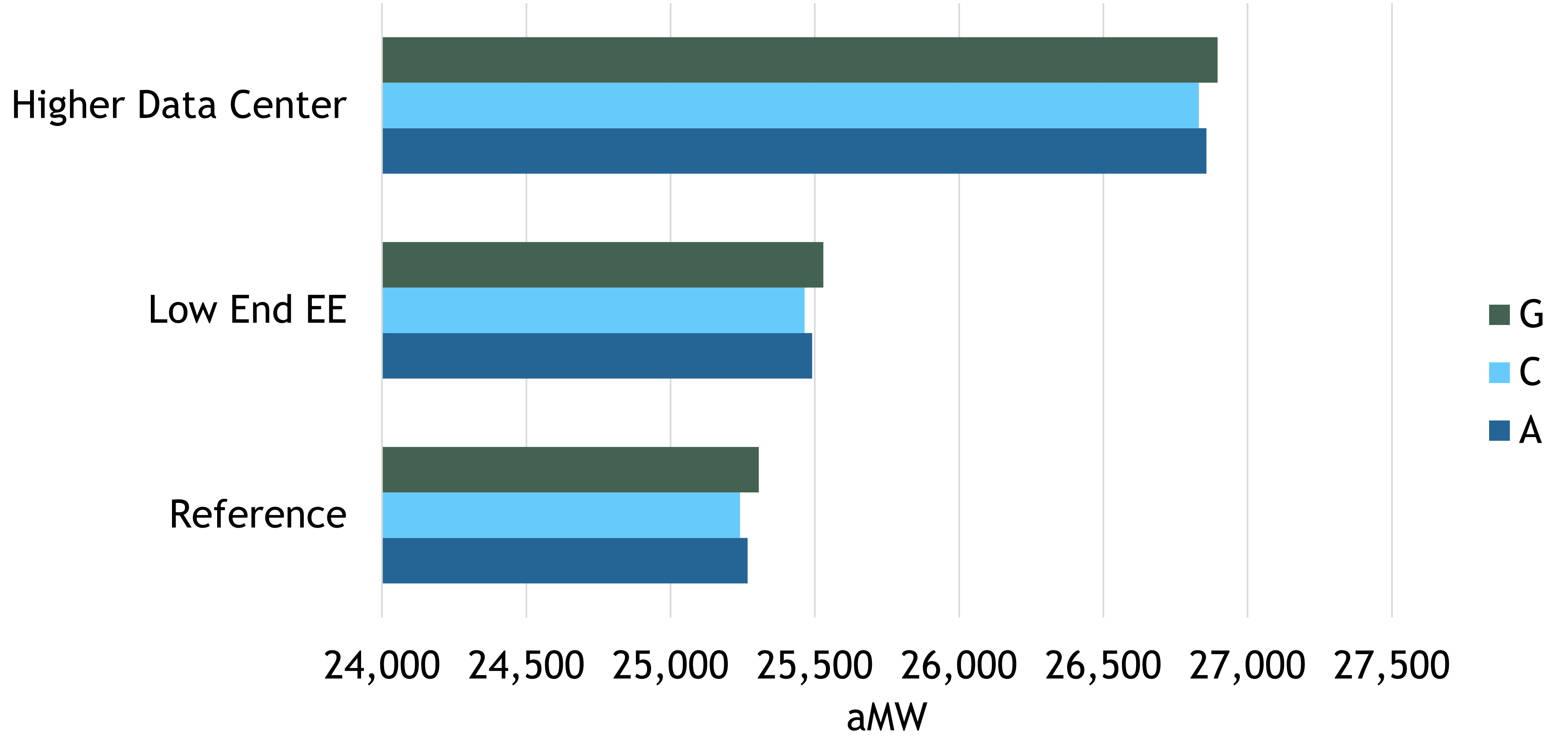
- In-region gas supply limitations
- Earlier availability of transmission (reconductoring in region)
- Delayed availability of transmission and emerging tech in WECC
- Emission pricing

Pushed to 9th Plan

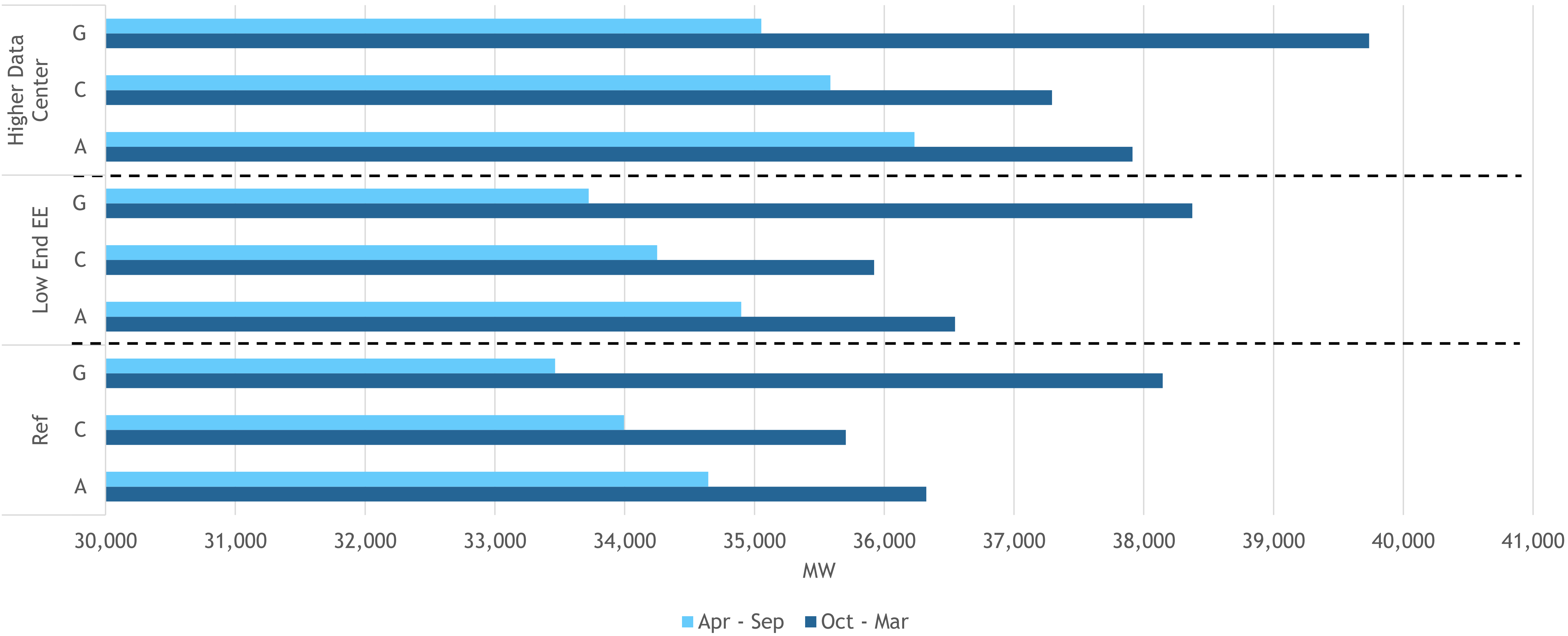
Incremental Load Differences in 2029

	EE Savings aMW	EV Loads aMW	Data Center Loads aMW
2029 Reference scenario	1,300	1,048	2,386
2029 Low End EE scenario	1,000	1,048	2,386
2029 High Data Center scenario	1,300	1,048	3,976

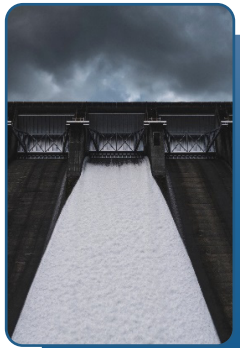
Average Loads by Climate Scenario



Seasonal Average Peak Loads

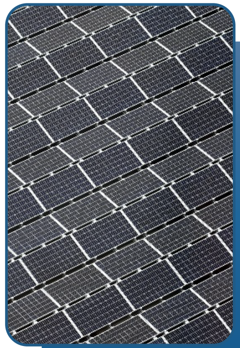


2021 Power Plan Resource Strategy reminder



Existing System: Increase Reserves

To reduce regional needs and support integration of renewables, the region needs to double the assumed reserves. This can most cost-effectively be done through more conservative operation of the existing system (both thermal and hydro units).

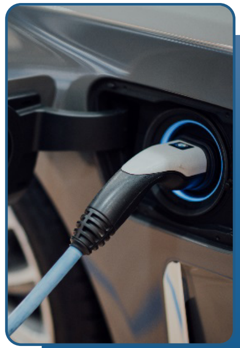


Renewables: At least 3,500 MW by 2027

Renewables are recommended due to their low costs, interruptibility, and carbon reduction benefits. Long-term build out will impact the transmission system and should be done mindful of the cumulative impacts of the new resources.

Energy Efficiency: 750-1,000 aMW by 2027

Significantly less acquisition than prior plan due being less cost-competitive, a slower build resource, not inherently dispatchable, and sensitive to market prices. Efficiency that supports system flexibility is most valuable.



Demand Response: Low-Cost Capacity

Highest value products are those that can be regularly deployed at a low-cost and with minimal to no impact on customer. The Council identified demand voltage regulation and time of use rates as two products, estimating 720 MW of potential.

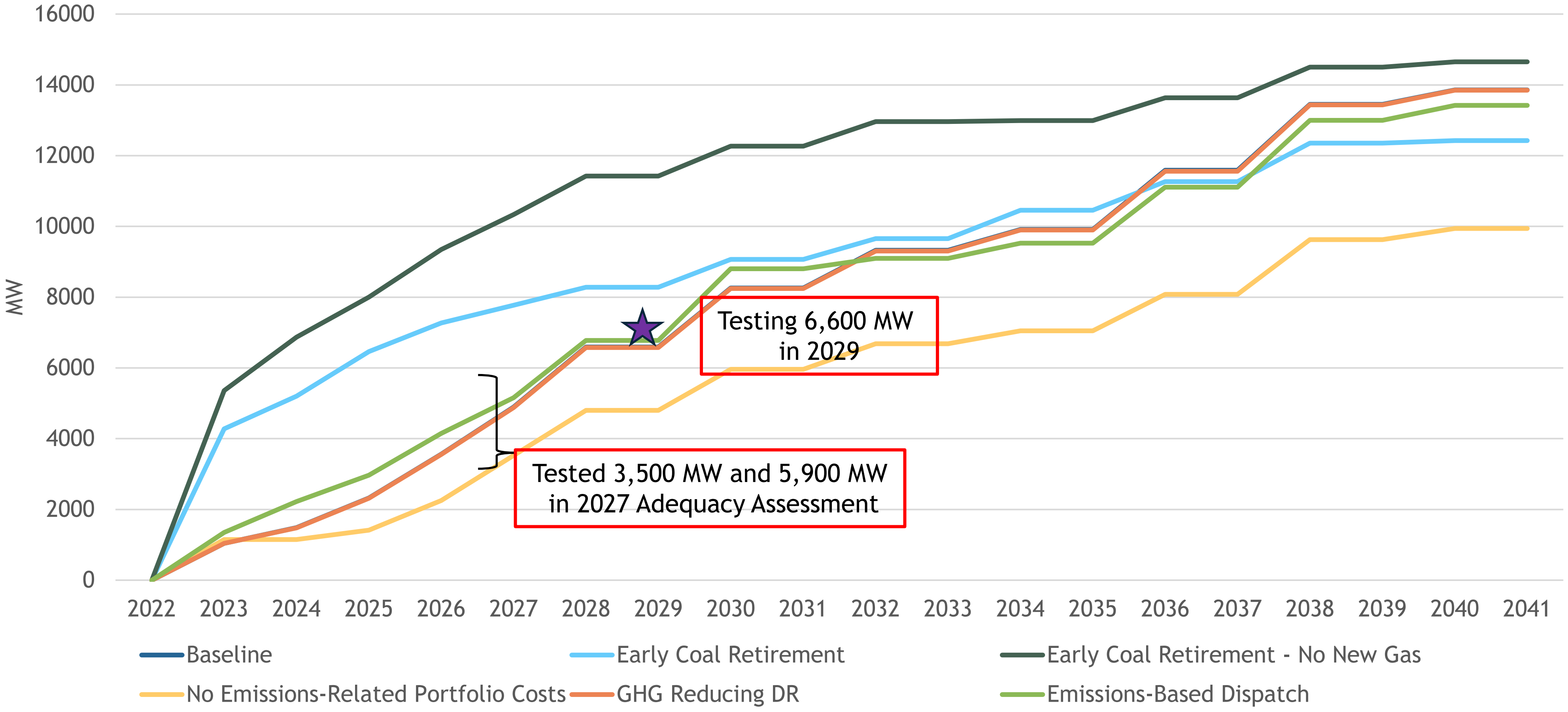
The 2029 Resource Strategy – the Reference

- Our goal for this assessment was to assume the same trajectory of the strategy used in the reference case for the 2027 Adequacy Assessment

Portfolio	2029 Adequacy Assessment	2027 Adequacy Assessment
Renewables	6,600 MW	5,900 MW
EE	1,300 aMW	1,000 aMW
DR	720 MW	720 MW
Reserves	6,000 MW	6,000 MW

2021 Plan Buildout Trajectories

Not shown here: Early coal retirement, with limits on gas, and the deep decarbonization scenario resulted in the highest builds (~36 GW in 2041)



Other System Changes

Thermal generation

Announced changes to several thermal plants converting to gas units and not retiring (~1,480 MW)

- Valmy 1 & 2 (138.6 & 134 MW)
- Bridger 1 & 2 (~1,200 MW)

Transmission expansion

12,700 MW of added transmission capacity throughout the WECC;

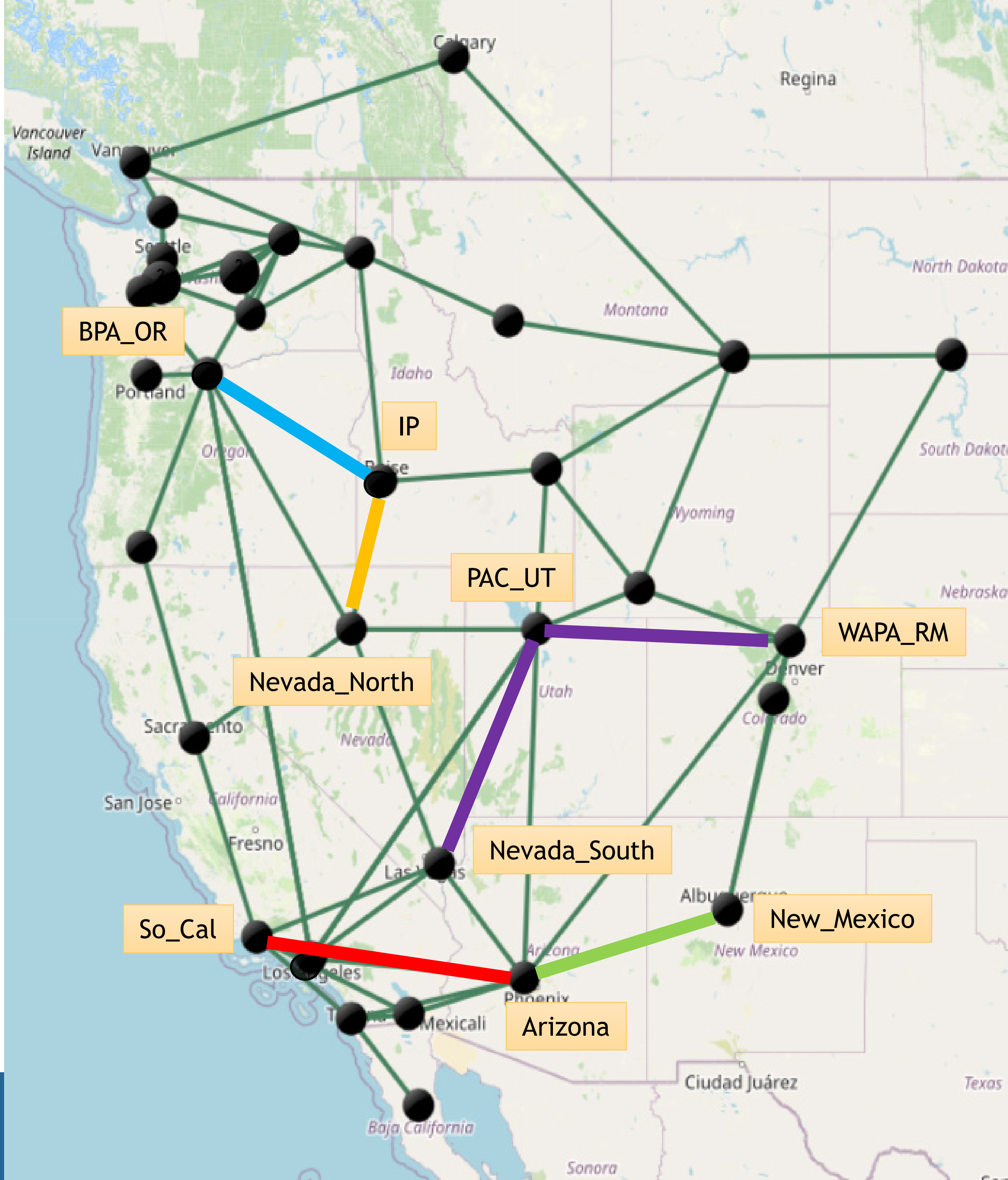
1,000 MW in region (B2H)

Modified hydro operations

Changes to spill operations in Lower Snake and Lower Columbia projects (Resilient Columbia Basin Agreement (RCBA, Appendix B)

New Transmission

Planned Transmission	New Capacity (MW)	Path	Online Date	GENESYS Buses	Existing Today (MW)	New 2029 capacity (MW)
Ten West Link	3,200	SCE to APS	2024	So_Cal to Arizona	1,400	4,600
SunZia	3,000	PNM to APS	2026	New Mexico to Arizona	1,700	4,700
Transwest Express	3,000	WAPA Wyoming to PACE UT	2027	wapa RM to PAC_UT	650	3,650
	1,500	PACE UT to Nev South	2027	PAC_Ut to Neveda South	250	1,750
SWIP North	1,000	IP to North Nevada	2027	IP to north Nevada	350 | 185	1,350|1,185
B2H	1,000	IP to BPA_OR	2026	IP to BPA_OR	2,000	3,000



Out-of-Region Market Update Observations

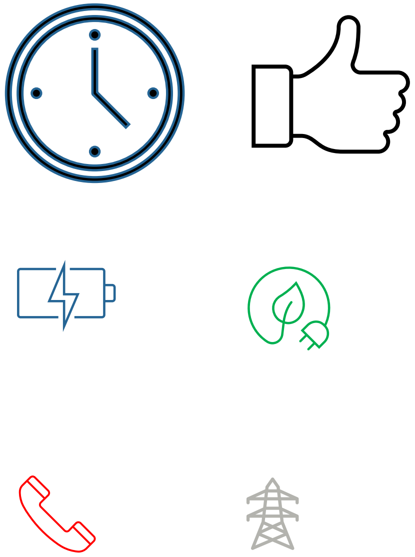
Forecasted out-of-region market availability has been updated, including updates to out of region market loads, resources and policy implementation.

A few notes:

1. Despite the market resource availability assessment not being final, it is sufficient for an adequacy assessment.

2. More storage than energy resources added in early years.

3. Some coal to gas plant conversions seems to be deferring the need for additional on-call fuel resources (like new gas plants) to maintain planning reserve margins.



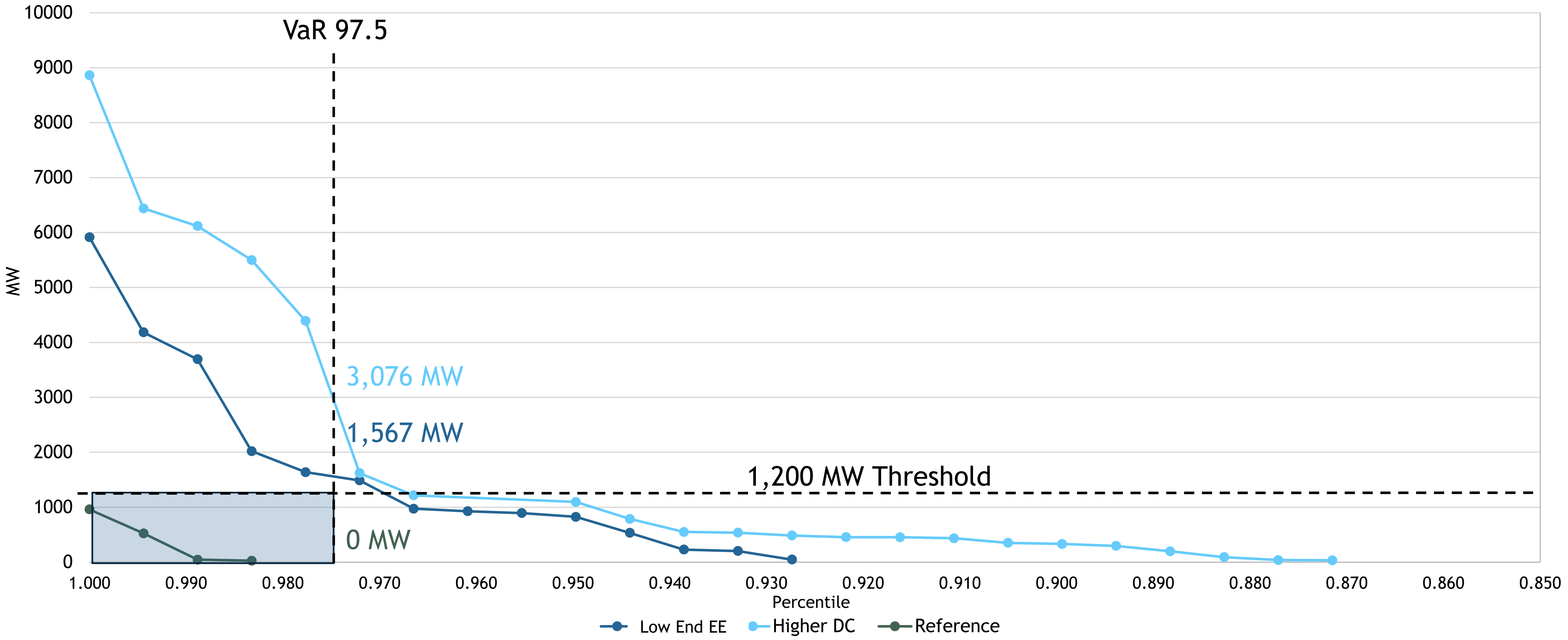
Assessment Results

Final Results

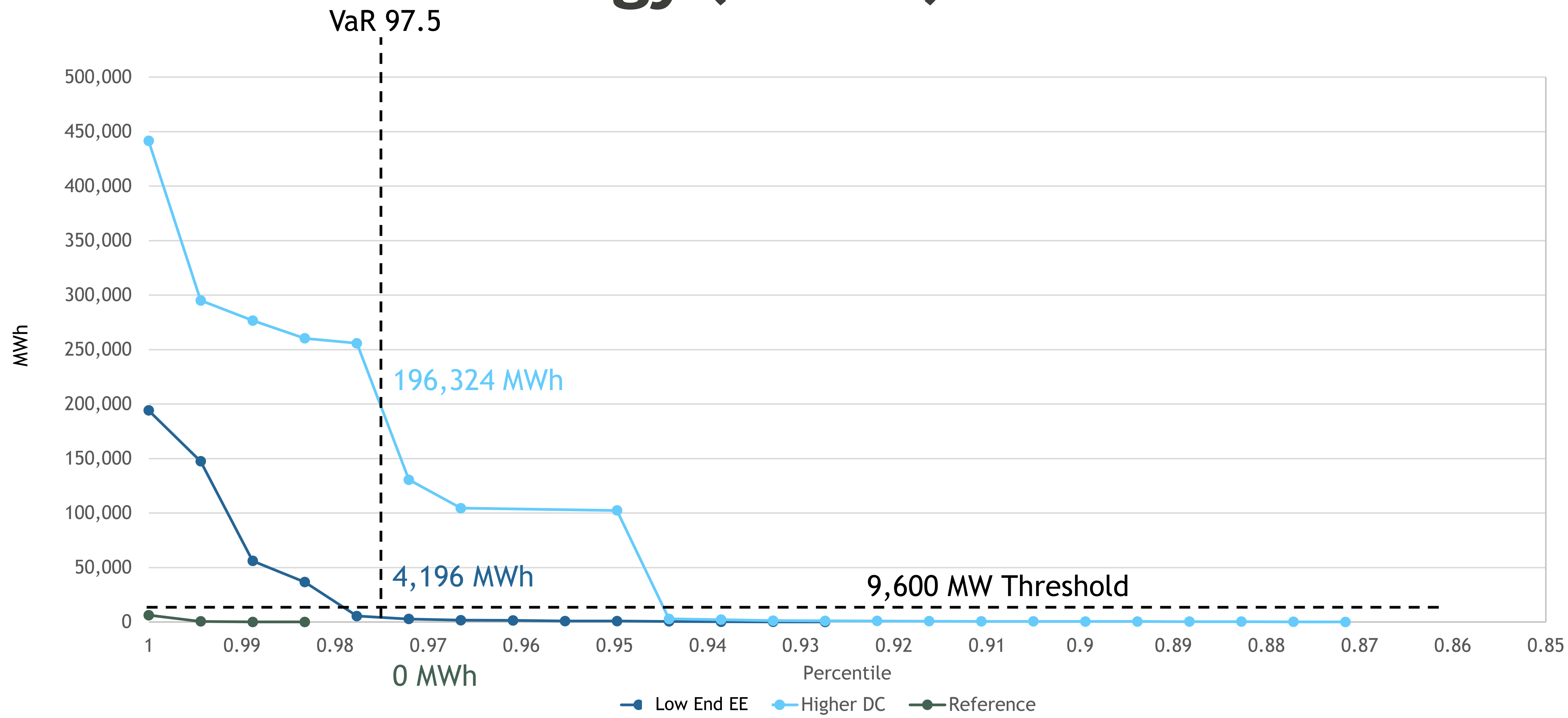
	Metric	Threshold	Reference 4 event-years 2.2% LOLP Adequate	High Data Center 24 event-years 13.3% LOLP Non-Adequate	Low End EE 14 event-years 7.8% LOLP Non-Adequate
Frequency	Winter LOLEV	0.1	0.022	1.294	0.350
	Summer LOLEV	0.1	0.017	0.3	0.033
Duration	Duration VaR 97.5	8 hours	0	20.6	1.5
Magnitude	Peak VaR 97.5	1,200 MW	0	3,076	1,567
	Energy VaR 97.5	9,600 MWh	0	196,324	4,196
Reported metrics (non-binding)	Annual LOLEV	0.1	0.05	1.644	0.444
	Peak NVaR 97.5	~3%*	0	9%	4.2%
	Energy NVaR 97.5	~0.0052%*	0	0.09%	0.002%

* Approximate

Peak (deficit) Curve



Energy (deficit) Curve



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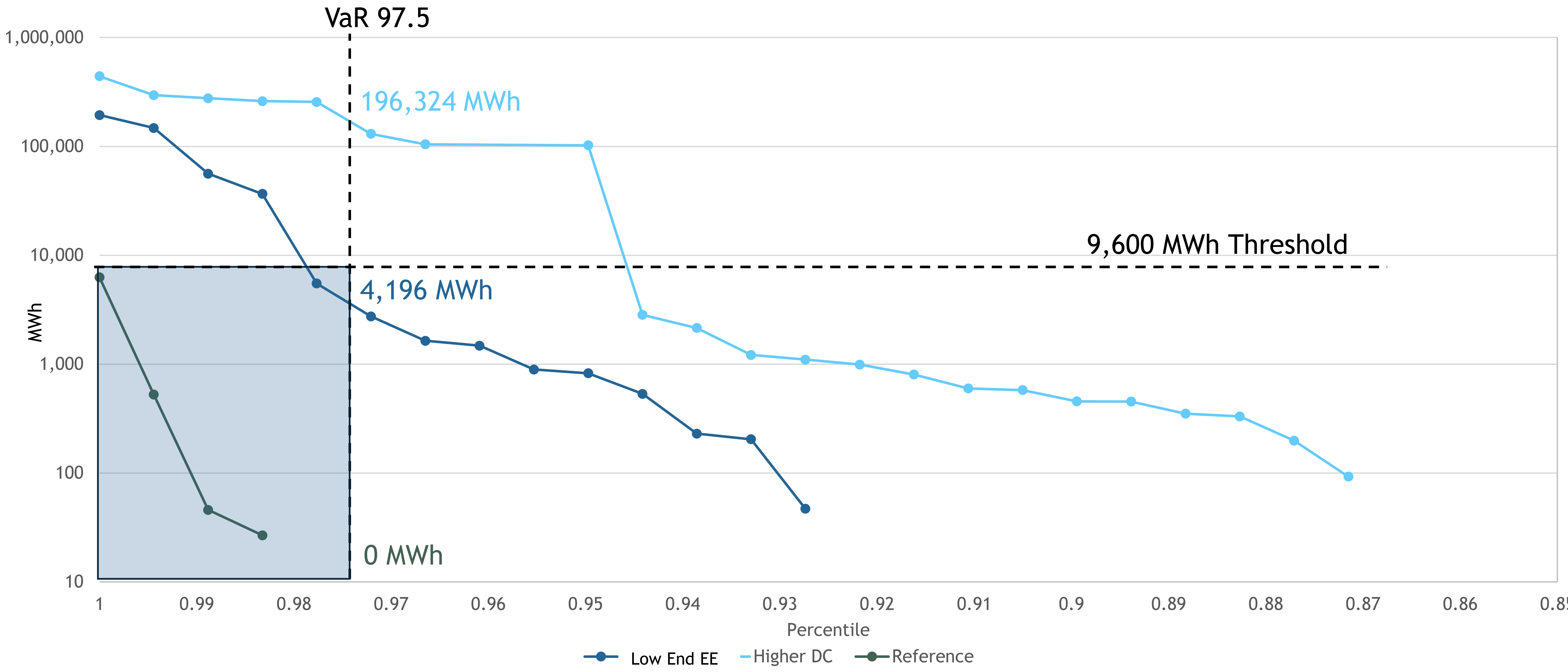
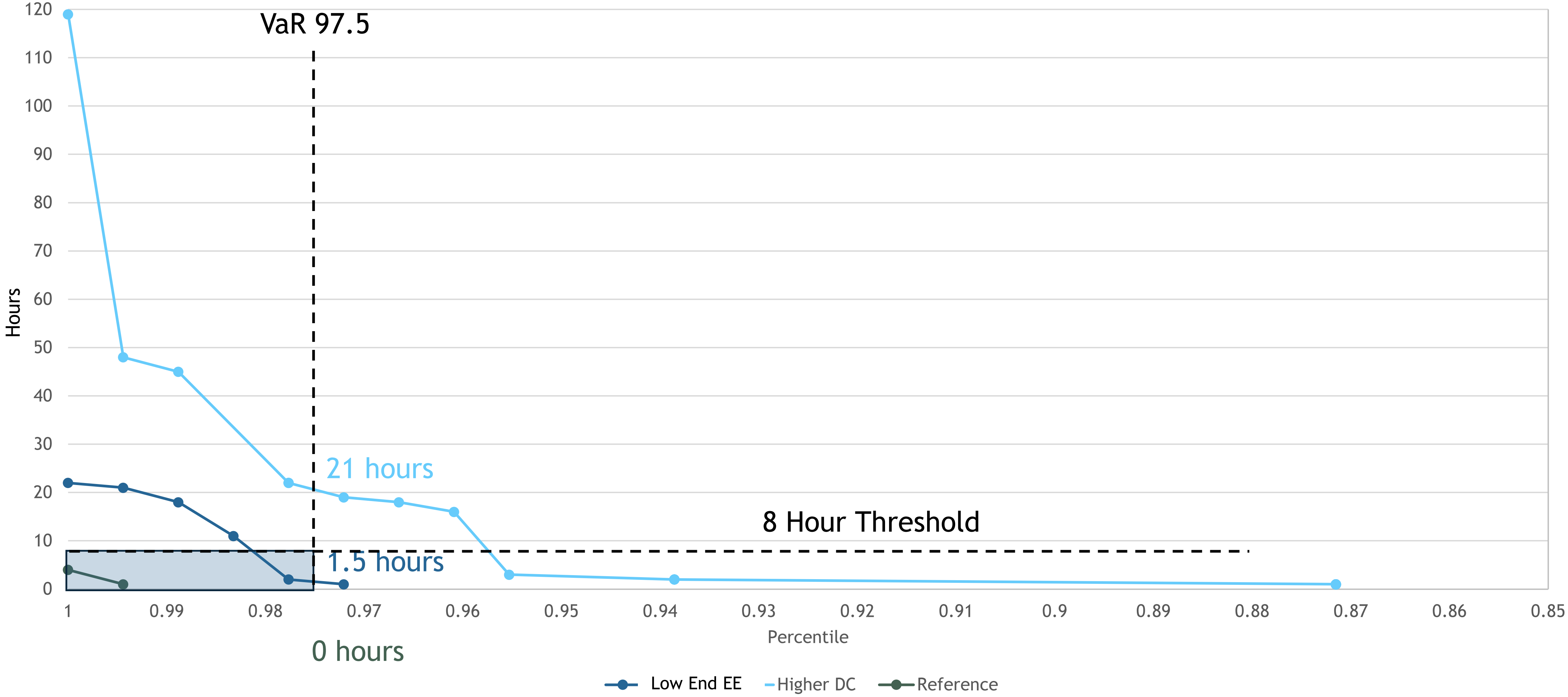
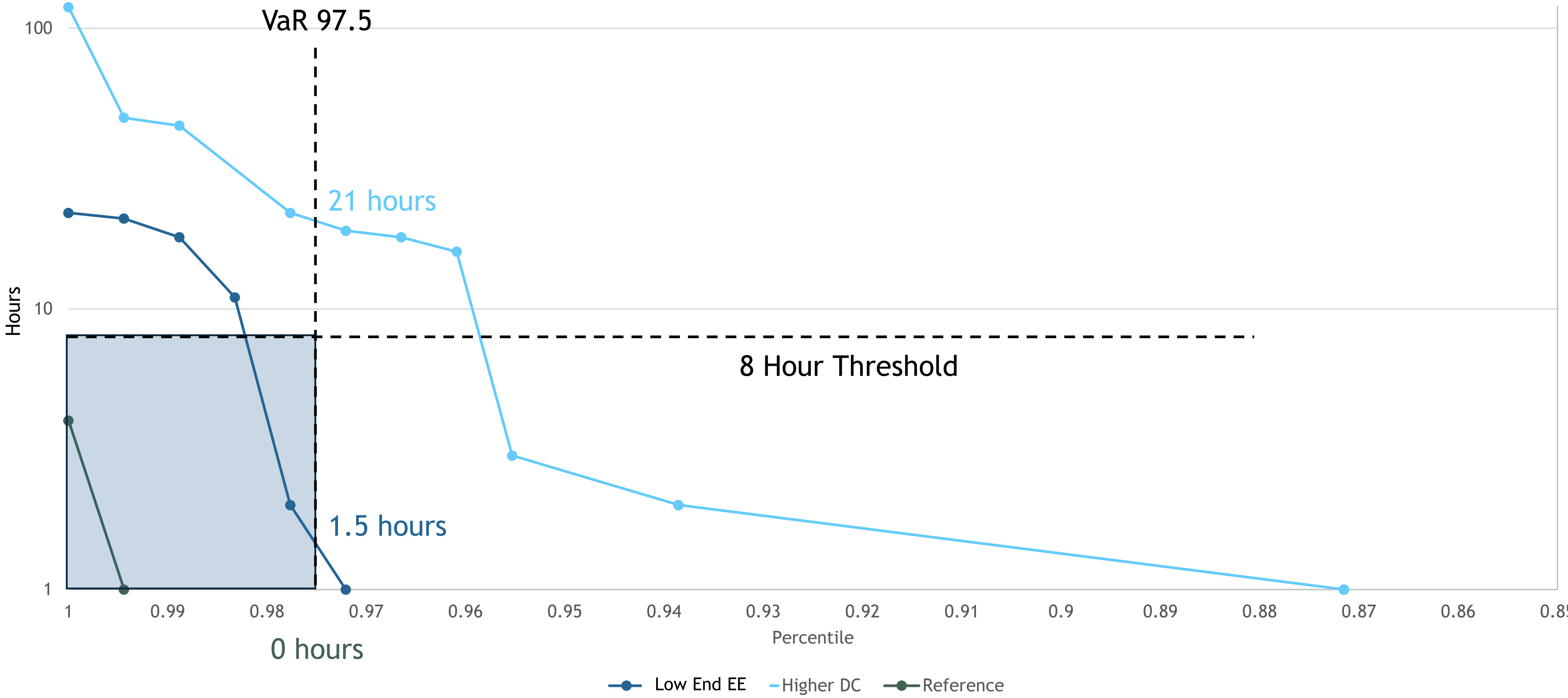


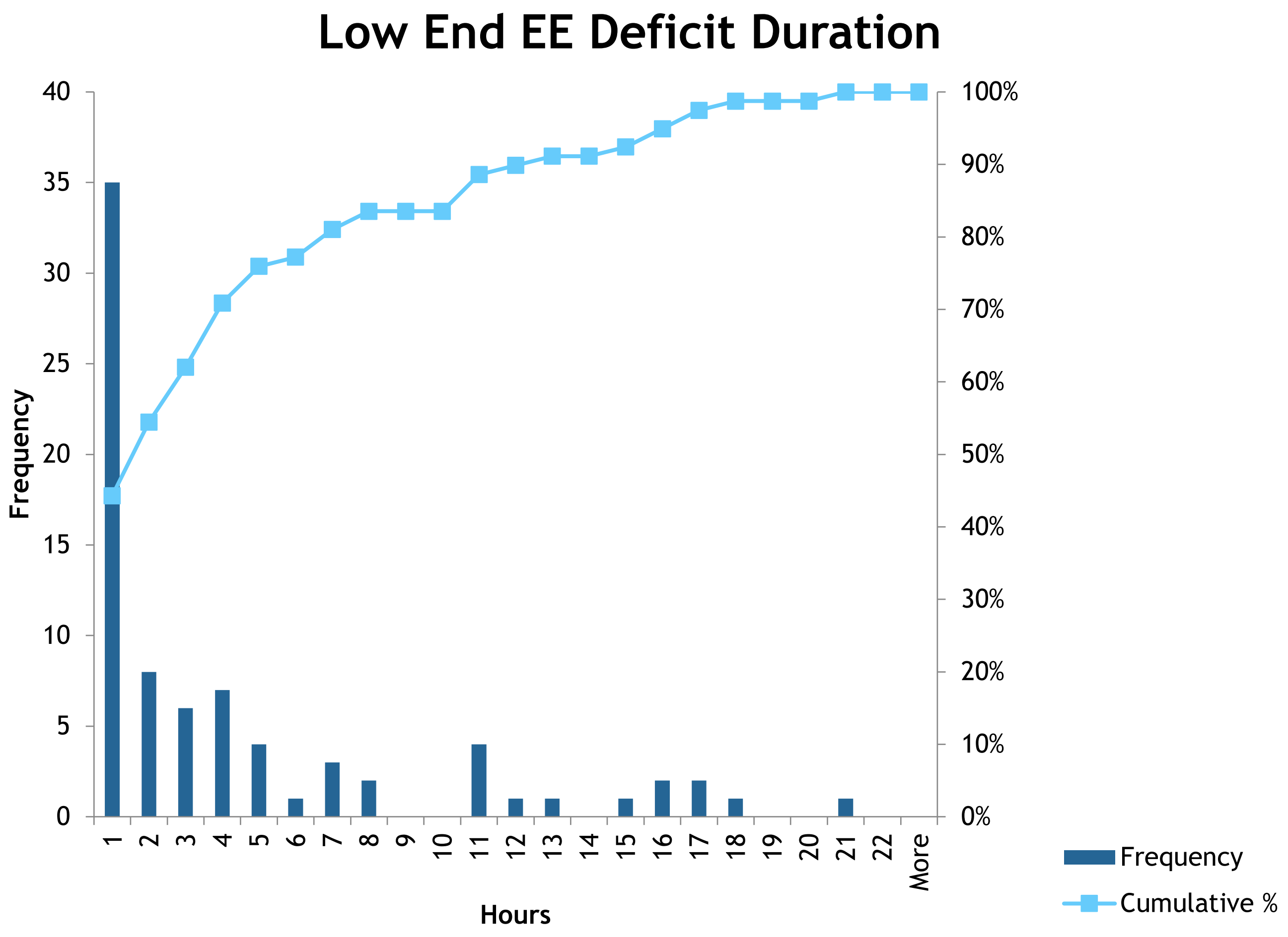
Duration (deficit) Curve

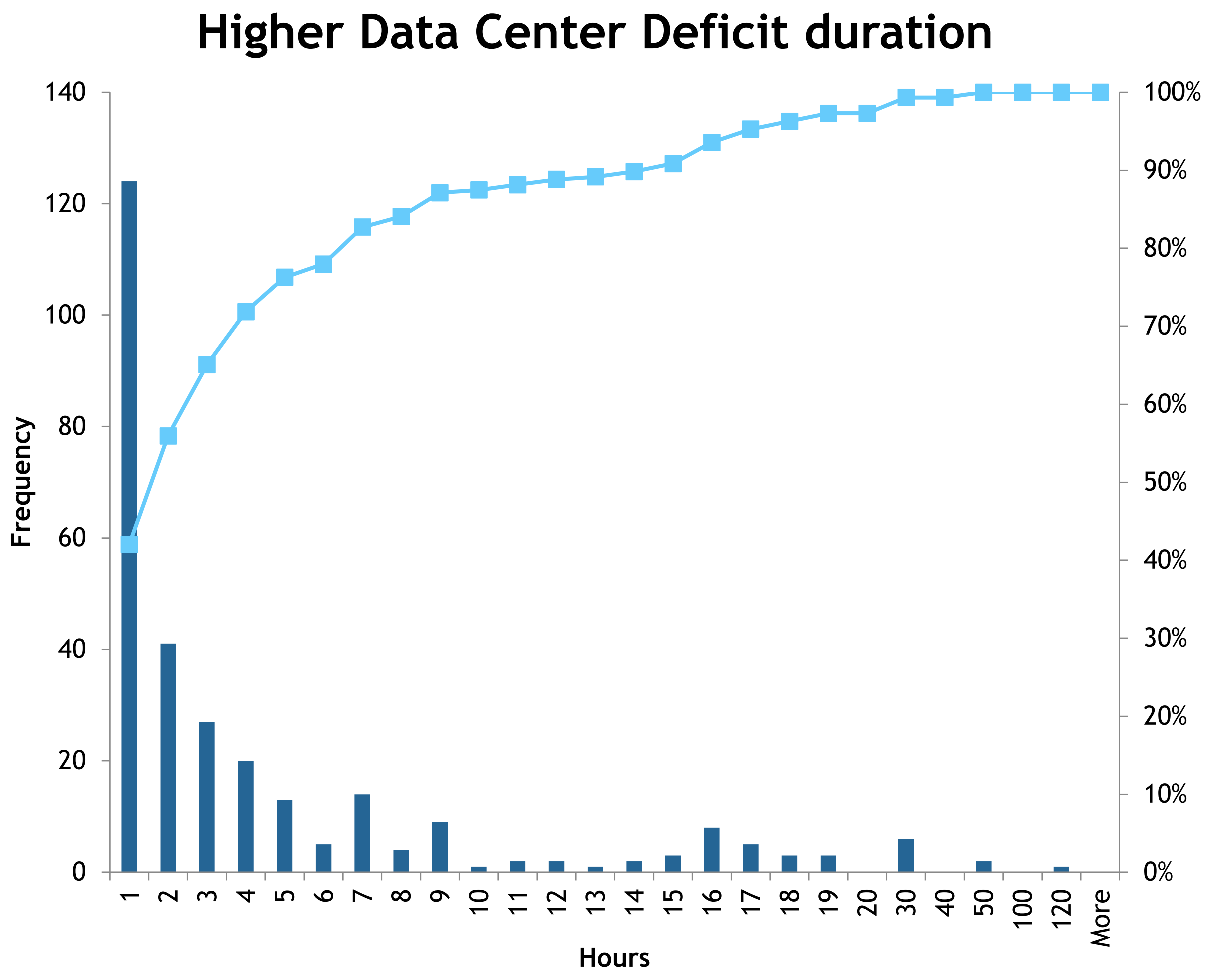


Duration (deficit) Curve

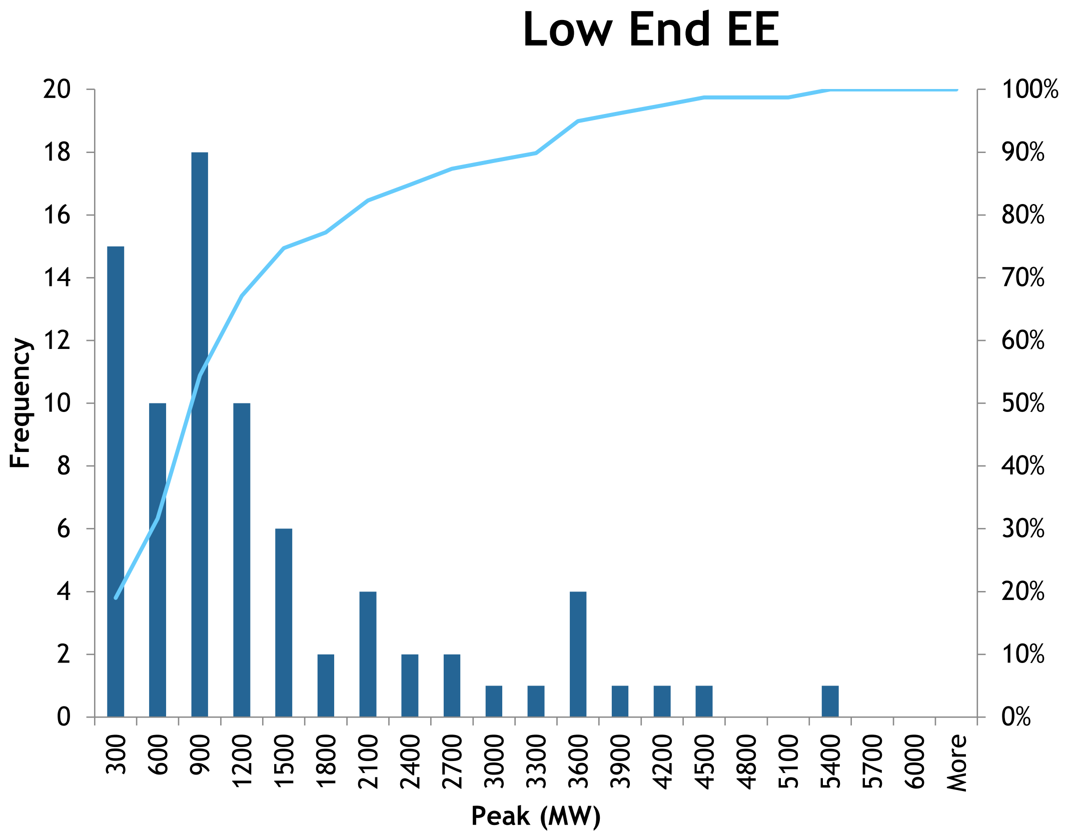


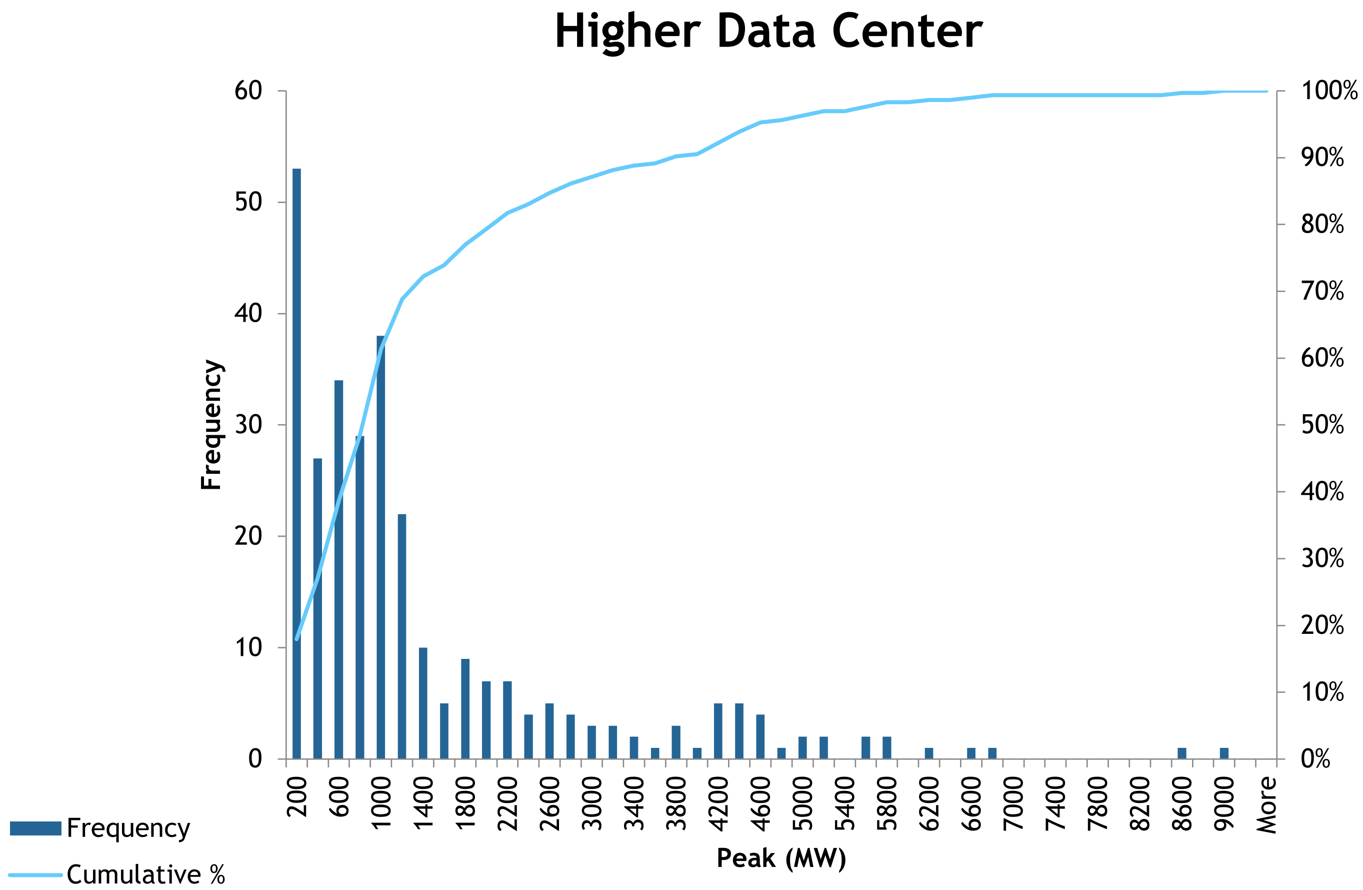
Majority of deficits are Short even in Low End EE and Higher Data Center scenarios





~67% of Shortfalls in Low End EE and Higher Data Center have a peak below 1,200 MW





Timing of Shortfalls

- Reference:
  - Evening ramp / early night (20:00-23:00) (mostly winter)

- Low End EE target
  - Morning and evening ramp / early night biggest deficits (Feb in G and Dec/Jan in A)
  - Large deficits throughout the day as well (across winter, scenario A)
  - Mid day and late evening ramp (spring, scenario C)

- High DC
  - Deficits throughout the day (Feb in G and Dec-Feb in A)
  - Evening ramp in summer
  - Large deficits throughout the day as well (across winter, scenario A)
  - Spring at 23:00 and summer during day and evening ramp (scenario C)

Timing and Magnitude of Shortfalls - Reference

Month / Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Jan																					689	844	960	924
Feb																								
Mar																							46	
Apr																								
May																								359
Jun																								
Jul																			27					525
Aug																								
Sep																								
Oct																								
Nov																								
Dec																								

Timing and Magnitude of Shortfalls – Low End EE

Month / Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Jan		219			620	1394	2524	3855	5346	4414	3431	1220	336	450	768	521	1491	2785	2767	2972	542			413
Feb	726	658	618	612	652	730	1147	3694	1606	835	1223	1026	262	461	936	1200	1643	2162	2681	3455	2798	1259	1714	3511
Mar																								
Apr																							894	609
May						1159		224	347	98						2020	817							1489
Jun																							1426	825
Jul																								230
Aug																				576	635			975
Sep																						533		504
Oct																								
Nov																								
Dec	1184	1571	693	743	1560	2327	3203	4179	5328	5915	3383	3136	2461	2060	2241	2225	1972	3694	5100	4208	3549	2433	67	

Timing and Magnitude of Shortfalls – Higher DC

Month / Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Jan	925	900	876	871	894	1146	3986	6117	5586	3963	3684	1726	1558	1431	1433	1326	2121	1910	2759	3043	1501	1022	981	1621
Feb	1144	653	613	607	647	1094	3062	5684	5138	4762	3648	1059	1059	947	888	1303	803	1856	1790	2433	1346			
Mar																		45						1217
Apr														38.439										
May																							69	199
Jun													978			193		550	551	533		208	141	
Jul																				34			368	1026
Aug														278	623	616	1479	1978	1865	1981	1820	539	1277	1680
Sep																								788
Oct																								
Nov																								
Dec	3999	1527	685	697	724	1541	3213	8090	8863	8407	7561	5121	3306	2700	4068	4414	6688	6440	5563	4829	3521	2547	1404	

Nod to Executive Summary

Key Messages

Discussion Time

- Assuming the reference case is the trajectory:
  - Continued implementation of the strategy, including ensuring sufficient reserves and acquiring another two years of energy efficiency and renewables, not retiring thermal plants, and expanded transmission capacity offset the adequacy challenge of increased loads of anticipated data centers and EV electrification

- The low end of EE target offers more risk to maintain regional adequacy
  - The low end of EE, alongside the resource strategy, does not fully mitigate challenges of increased loads in 2029 despite alleviating circumstances of not retiring thermal plants and expanded transmission
    - Shortfalls occur throughout the days in winter (thought greatest magnitudes in morning/evening ramp hours
    - Additional challenges in spring and summer

- If the higher data center load case is more likely:
  - The ~1,600 MW of increased load associated with additional data center load growth above the reference case causes adequacy challenges resulting in an inadequate system
  - The plan is to study the impact and resource strategy associated with increased load uncertainty in the upcoming Power Plan.

Questions?

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