



Item 6.1: System Planning and Weatherization Update

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Reliability and Markets Committee Meeting

ERCOT Public

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System Planning and Weatherization Update: Overview

- **Purpose**

- Provide an update on recent activity related to planning, modeling, generation interconnection, resource adequacy, and weatherization

- **Voting Items / Requests**

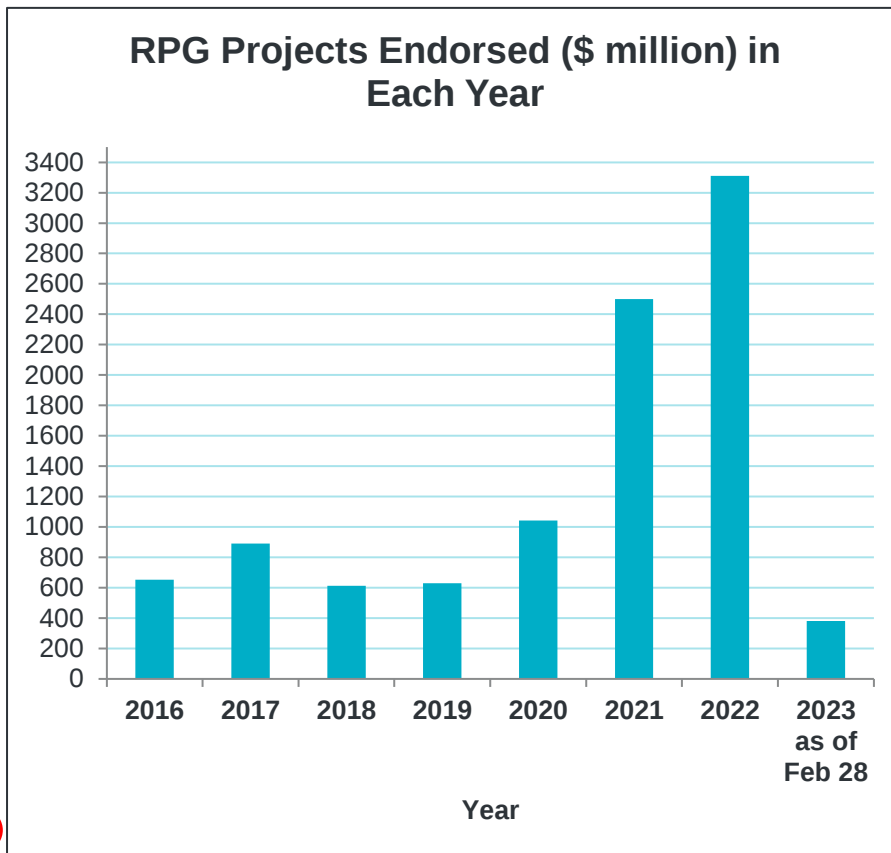
- No action is requested of the R&M Committee or Board; for discussion only

- **Key Takeaways**

- Transmission projects in engineering, routing, licensing, and construction decrease slightly from February report
- Two additional thermal units added to grid in March
- Generation Interconnection project lists now exceeds 1,300
- SARA will move to a monthly report later this year
- Reliability Standard and VOLL work continues to progress
- ELCC produces a more conservative estimate of wind capacity
- ELCC for wind varies by geographic region
- Weatherization Cure Periods help improve reliability
- Many practical weatherization measures exist for wind and solar
- Some anti-icing technologies are not practical in ERCOT for wind generation

Transmission Planning Summary

- As of February 1, 2023 projects energized in 2023 total about \$149 million.
 - \$1.567 billion energized in all of 2022
- As of February 28, 2023, ERCOT has endorsed transmission projects totaling \$380.9 million.
 - Total endorsed transmission projects in 2022 equaled \$3.311 billion
- As of February 1, 2023, projects in engineering, routing, licensing, and construction total about \$11.643 billion.



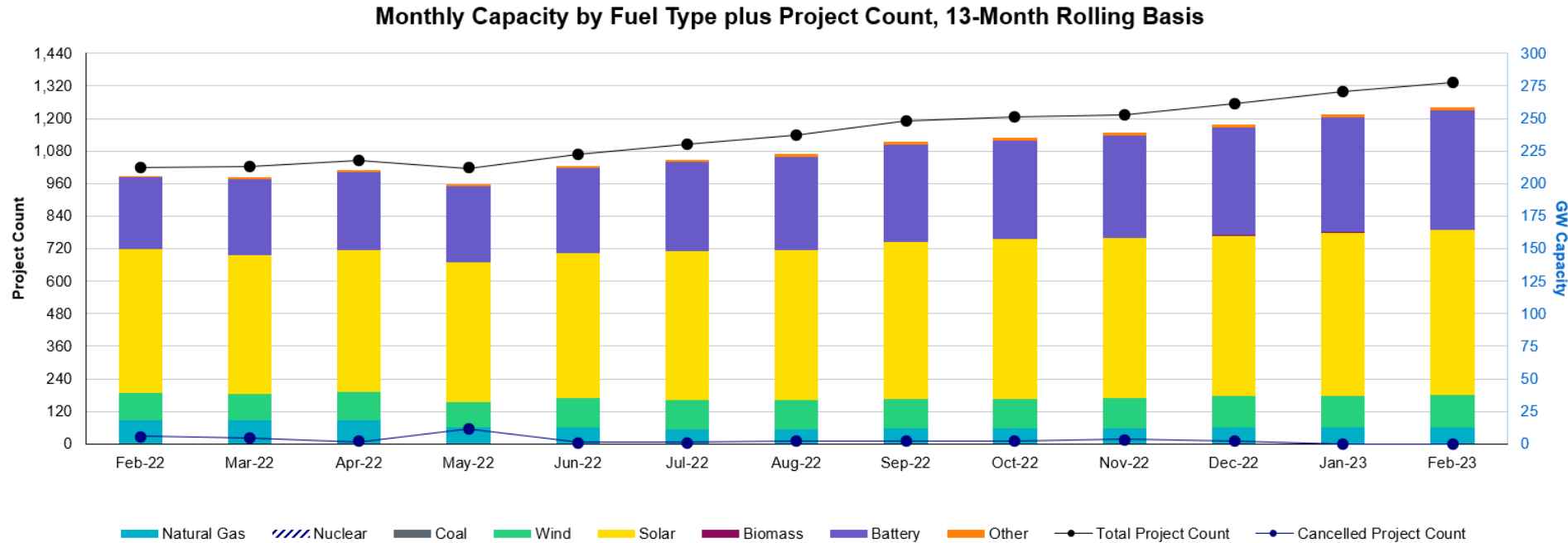
Key Takeaway: Slight decrease from January 2023

Elements Submitted for Operational Modeling (Monthly)

March 2023	April 2023	Rolling Average <i>Previous 12 Months</i>
Resources – 4 (<i>net*</i>) • 2 Thermal • 0 Wind • 2 Solar • 3 DESR conversions* Transmission • 9 Transformers • 105 Breakers • 25 Lines Contingencies • 67	Resources – 2 • 0 Thermal • 0 Wind • 1 Solar • 1 ESR Transmission • 10 Transformers • 63 Breakers • 16 Lines Contingencies • 30	Resources – 9 • 1 Thermal • 2 Wind • 4 Solar • 2 ESRs Transmission • 6 Transformers • 65 Breakers • 17 Lines Contingencies • 61

Key Takeaway: Two more small thermal units added in March

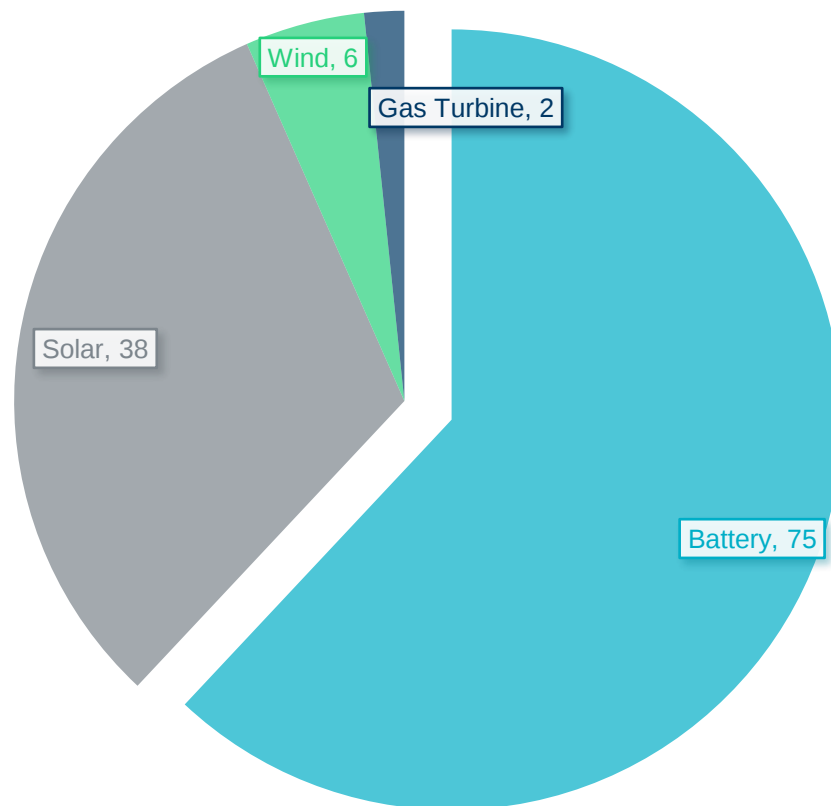
Future Generation Interconnection Projects by Fuel Type



Key Takeaway: Generation Interconnection interest continues to increase with over 1,300 projects now being processed

Interconnection Projects from the Last 60 Days

APPLICATIONS RECEIVED IN THE LAST 60 DAYS BY FUEL



Key Takeaway: Most new interconnection projects continue to be batteries

Seasonal Assessment of Resource Adequacy (SARA) to Monthly Outlook Resource Adequacy (MORA) Transition: Timeline for Releases

- Propose posting the reports two months prior to the reporting month, per the schedule at right
- Initially planning to release the first monthly report in early September (for the November reporting month)
 - Dependencies on PUC coordination and implementing automated reporting process; risk of significant delays can be mitigated by rolling out features over several months
- Planning in the works for an accompanying on-line dashboard

Key Takeaway: SARA will move from a quarterly report to monthly report later this year

Initial Release Schedule		Off-Cycle Reports for NERC 2/	
Release Date 1/	Reporting Month	Release Date 1/	Reporting Month
1-Sep	Nov	1-Sep	Jan
2-Oct	Dec		
1-Nov	Jan		
1-Dec	Feb		
2-Jan	Mar		
1-Feb	Apr		
1-Mar	May		
1-Apr	Jun	18-Mar	Aug
1-May	Jul		
1-Jun	Aug		
1-Jul	Sep		
1-Aug	Oct		

1/ Target the first of each month, or the next business day if the 1st falls on a weekend or holiday. These dates are for 2023-24.

2/ Preliminary MORA reports are needed to meet NERC deadlines for their Winter and Summer Reliability Assessments.

Update on Reliability Standard and VOLL Work

- **Reliability Standard Study**

- March 15 workshop on ERCOT's proposed reliability standard study framework
- Received go-ahead by the Commission, at the March 23 Open Meeting, to start conducting initial model runs to study reliability metrics and their impacts on loss-of-load outlier events surfaced by the reliability assessment model
- Memo from Commission staff that synthesizes public comments on staff questions expected for second April PUC Open Meeting (April 27)
- Initial model run results, industry outreach and Commission direction will lead to study refinement; Board briefings April, June and August

- **Value-of-Lost-Load (VOLL) Study**

- Received go-ahead by the Commission at the Open Meeting to proceed with issuing a study Request-for-Proposals (on-boarding a consultant estimated to take eight weeks)
- Key elements of the Statement of Work to consist of review of other VOLL studies and customer surveys to estimate VOLL by customer type

Key Takeaway: Both efforts are on track and making progress



Forecasted Wind Comparison for the Spring SARA

The following table compares the forecasted wind production in the Spring SARA report with values derived from alternative methods

- The SARA methodology, but using net peak load hours (gross peak load minus wind and solar production) rather than gross peak load hours
- Effective Load Carrying Capability (ELCC)

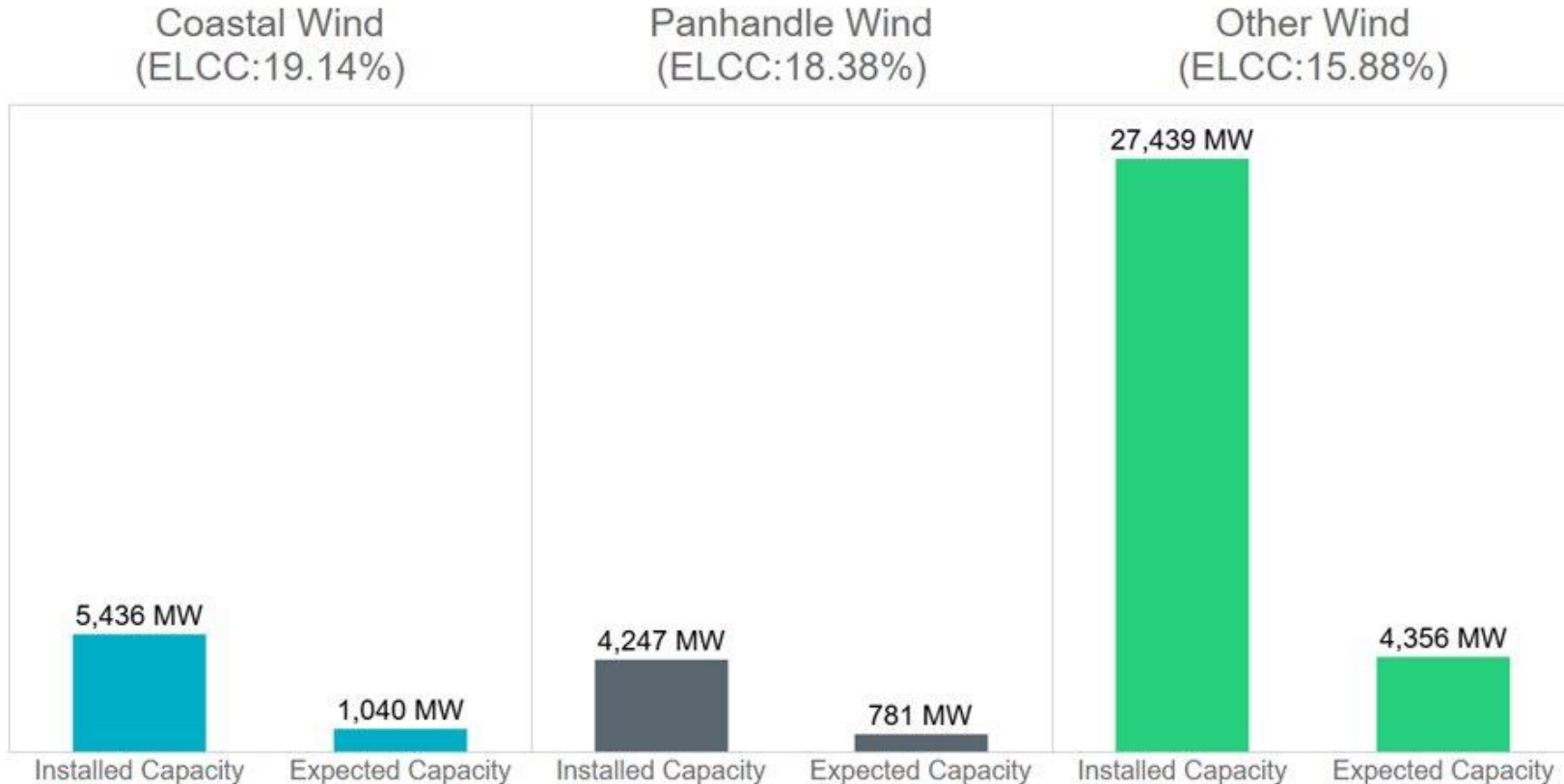
Spring 2023 SARA, Wind Forecast Comparisons, MW				
Wind Zone	Installed Capacity Rating	Expected Capacity (Highest Gross Peak Load Hours*)	Expected Capacity (Highest <u>Net</u> Peak Load Hours*)	Expected Capacity (ELCC Method**)
Coastal	5,436	3,475	2,767	1,664
Panhandle	4,247	1,655	798	697
Other	27,439	10,700	5,159	4,088
Total	37,123	15,830	8,724	6,449

* Based on the 10-year average of the highest 20 gross and net peak load hours for the spring seasons.

** Reflects the average of winter and summer ELCC percentages, which were the seasons included in the 2022 ELCC study.

Key Takeaway: ELCC method produces a more conservative estimate of Wind capacity

Wind ELCCs by Region for the 2023 Summer Season



Installed capacity totals for the wind fleet is from the Spring 2023 SARA report. Expected Capacity is based on the Installed Capacity multiplied by the summer Effective Load Carrying Capability percentage (ELCC) for wind resources. ELCC is the amount of wind capacity, relative to theoretical 100% available capacity, that can serve load without reducing system reliability, that is, not increase the expected occurrence of unserved load. ELCC will always be less than 100 percent.

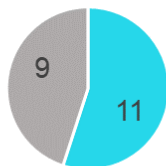
Key Takeaway: ELCC values for wind vary substantially by geographic region

Weatherization - Winter 2022-2023 Cure Periods

- 774 Inspections (both Generation and Transmission) completed since December 2022 resulting in 69 cure periods
- Cure Periods are assigned windows of opportunity to correct compliance deficiencies
- They vary in duration based upon site specific circumstances
- Deficiencies not corrected on time will be reported to the PUCT

Generation Resources with Cure Periods	20
Completed	11
In Progress	9

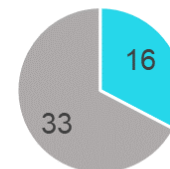
Generation Resources with Cure Periods



■ Completed ■ In Progress

TSP Facilities with Cure Periods	49
Completed	16
In Progress	33

Transmission Service Provider Facilities with Cure Periods



■ Completed ■ In Progress

Key Takeaway: Cure periods are an effective way to collaboratively drive system reliability enhancing changes

Appendix

Reliability Standards Using in Other Areas

North America ^{[3][4]}		
System/Region	Metrics/Criteria	Responsible Entity
MISO	LOLE $\leq$ 0.1 days per year	MISO
MRO-Manitoba Hydro	LOLE $\leq$ 0.1 days per year	Manitoba Public Utilities Board
NPCC-Maritimes	LOLE $\leq$ 0.1 days per year	Maritimes Sub-areas and NPCC
NPCC-New England	LOLE $\leq$ 0.1 days per year	ISO-NE and NPCC
NPCC-New York	LOLE $\leq$ 0.1 days per year	NYSRC and NPCC
NPCC-Ontario	LOLE $\leq$ 0.1 days per year	IESO and NPCC
NPCC-Québec	LOLE $\leq$ 0.1 days per year	Hydro-Québec and NPCC
PJM	LOLE $\leq$ 0.1 days per year	PJM Board of Managers
SERC-C	LOLE $\leq$ 0.1 days per year	Member Utilities
SERC-E	LOLE $\leq$ 0.1 days per year	Member Utilities
SERC-FP	LOLE $\leq$ 0.1 days per year	Florida Public Service Commission
SERC-SE	LOLE $\leq$ 0.1 days per year	Member Utilities
SPP	LOLE $\leq$ 0.1 days per year	SPP TRO Staff and Stakeholders
RTE-ERCOT	LOLE $\leq$ 0.1 days per year ^[5]	ERCOT Board of Directors
WECC-AB	LOLP $\leq$ 0.02%	WECC
WECC-BC	LOLP $\leq$ 0.02%	WECC
WECC-NWPP-US & RMRG	LOLE $\leq$ 0.1 events/year	WECC
WECC-SRSG	LOLP $\leq$ 0.02%	WECC
WECC-CAMX ^[6]	PRM $\geq$ 15%	CPUC
Hawaii ^[7]	ERM $\geq$ 30% (3 islands), 60% (2 islands)	HECO

Hawaii: ERM is the Energy Reserve Margin, defined as “the percentage of system load in which the system capacity must exceed the system load in each hour.”

Reliability Standards Using in Other Areas, Continued

Europe ^{[8][9]}		
System/Region	Metrics/Criteria	Responsible Entity
Belgium ^[10]	LOLH $\leq$ 3 hours per year LOLE95 ^[11] $\leq$ 20 hours per year	Elia Group
France ^[12]	LOLH $\leq$ 3 hours per year	RTE
Great Britain ^[13]	LOLH $\leq$ 3 hours per year	National Grid ESO
Ireland and Northern Ireland ^[14]	LOLH $\leq$ 8 hours per year (Ireland) LOLH $\leq$ 4.9 hours per year (Northern Ireland)	EirGrid and SONI
Netherlands ^[15]	LOLH $\leq$ 4 hours per year	TenneT
Poland ^[16]	LOLH $\leq$ 3 hours per year	PSE
Portugal ^[12]	LOLH $\leq$ 5 hours per year	REN
Spain ^{[12][17]}	PRM $\geq$ 10% (mainland) LOLE $\leq$ 1 day in 10 years (island grids)	REE
Oceania		
System/Region	Metrics/Criteria	Responsible Entity
Australia-NEM ^[18]	NEUE $\leq$ 0.002% per region	AEMO
Australia-NT ^[19]	NEUE $\leq$ 0.002%	AEMO
Australia-WEM ^[20]	PRM $\geq$ WEM ^[21] metric, NEUE $\leq$ 0.002%	AEMO
New Zealand ^{[22][23]}	WEM $\geq$ 14-16% (New Zealand) WEM $\geq$ 25.5-30% (South Island) WCM ^[24] $\geq$ 630-780 MW (North Island)	Transpower

Australia/New Zealand: WEM/WCM (winter energy margin/winter capacity margin).

Reliability Standards Using in Other Areas, Continued

Africa		
System/Region	Metrics/Criteria	Responsible Entity
South Africa ^[25]	EUE < 20 GWh/year OCGT capacity factor < 6%/year Baseload stations capacity factor < 50%/year	Eskom
Asia		
System/Region	Metrics/Criteria	Responsible Entity
India ^[26]	LOLP $\leq$ 0.2%, NEUE $\leq$ 0.05%	CEA
Indonesia ^[27]	PRM (2019-2028) $\geq$ 30% (national)	Ministry of Energy and Mineral Resources
Japan ^[28]	PRM (2020-2029) $\geq$ 8% per region	OCCTO
Laos ^[29]	PRM (2020-2030) $\geq$ 15%	Ministry of Energy and Mines
Malaysia ^[30]	LOLE $\leq$ 1 days/year	TNB
Philippines ^[31]	PRM (2017-2040) $\geq$ 25%	DOE
Singapore ^{[32][33]}	LOLH $\leq$ 3 hours/year	EMA
Thailand ^{[34][35]}	PRM (2015-2036) $\geq$ 15%	EGAT
Vietnam ^[36]	LOLH $\leq$ 12 hours/year per region	MOIT
Middle East		
System/Region	Metrics/Criteria	Responsible Entity
Saudi Arabia ^[37]	PRM (2016) $\geq$ 8-10%	SEC
Oman ^[38]	LOLH $\leq$ 24 hours/year	OPWP
Qatar ^[39]	PRM (2019) $\geq$ 6%	KAHRAMAA

- Countries with multiple metrics:
 - Belgium – LOLH, LOLE95
 - Spain – PRM, LOLE
 - South Africa – EUE, Capacity Factor exceedance for backup capacity