PNM 2023-2042 IRP: Modeling for Reliability, Resource Adequacy and Resiliency

TECHNICAL SESSION #1

JUNE 8, 2022

Talk to us.

DISCLOSURE REGARDING FORWARD LOOKING STATEMENTS

The information provided in this presentation contains scenario planning assumptions to assist in the Integrated Resource Plan public process and should not be considered statements of the company's actual plans. Any assumptions and projections contained in the presentation are subject to a variety of risks, uncertainties and other factors, most of which are beyond the company's control, and many of which could have a significant impact on the company's ultimate conclusions and plans. For further discussion of these and other important factors, please refer to reports filed with the Securities and Exchange Commission. The reports are available online at www.pnmresources.com.

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MEETING GROUND RULES

THE FOCUS OF THE MEETING IS THE DEVELOPMENT OF THE 2023 IRP

01
- Questions and comments are welcome – One Person Speaks at a Time

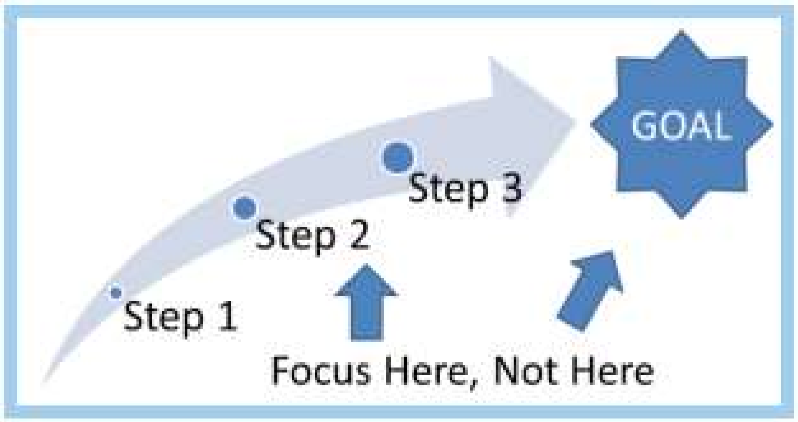
02
- Reminder; today's presentation is not PNM's plan or a financial forecast, it is an illustration of the IRP process

03
- When asking a question, please speak clearly and slowly as all questions will be logged and labeled with the person and organization responsible for asking the question

04
- These meetings are about the 2023 IRP, questions and comments should relate to this IRP. Any questions or comments related to other regulator proceedings should be directed towards the specific filing.

TECHNICAL SESSION

THE FOCUS OF THE MEETING IS THE DEVELOPMENT OF THE 2023 IRP



The technical sessions are about discussing the advantages and disadvantages regarding the application of different technical methodologies within the IRP modeling framework.

We are not here to focus on the results or drive towards a specific result. **We all know where we are going: 100% Carbon Free by 2040. The focus in the IRP development is how do we get there in the best way possible for PNM's customers and New Mexico.**

TENTATIVE MEETING OUTLINE

- Welcome and Introductions
- Any follow up questions from the previous presentation now that stakeholders have had some additional time with the presentation materials or other questions / updates of topics of interest
  - This could include more information on the presentations to clarify the materials
  - A deeper dive into the studies and how they were performed
  - Etc.
- A quick review of the results and key findings of presentations
- A quick review of the modeling framework utilized in the 2020 IRP
- Open forum for any stakeholder discussion / presentation / examples / kickoff into thoughts on how we incorporate key findings / lessons learned from these studies into the 2023 IRP Development (Some ideas below but not limited to just these ideas, again PNM wants to be one participant of this process, but we want the process to be stakeholder driven/workgroup/workshop like – not a PNM presentation)
  - Different Risk Metrics, what they are, what the capture, how to use them in planning, etc.
  - ELCC Study for the 2023 IRP, methods of analysis, ways to capture synergies of resources, etc.
  - ELCC by risk metrics
  - Setup of the SERVM model for calculating ELCC and how to use the results within EnCompass
  - Baselines for different risk metrics
  - Other questions on Slides 84 and 85 of the 5/25 meeting slides
- Next steps and Near-Term Schedule

MAY 25TH PRESENTATION FOLLOW UP

Are there…

- Any follow up questions to the materials presented in the last meeting?
- Any additional clarifications that would help before diving into the technical discussion?
- Any additional details about the studies, how they were performed, data used, etc. that would be useful to better inform the technical discussions?

Resource Adequacy in the Desert Southwest – Key Findings

Key Finding #1: Load growth & resource retirements are creating an urgent need for new resources in the Southwest

Key Finding #2: Utilities' current resource plans have identified sufficient capacity additions to maintain reliability

Key Finding #3: A large share of the region's long-term needs will be met with solar, storage, and other "non-firm" resources

Key Finding #4: Even as solar and storage grow, the region's remaining firm resources will be needed for reliability

Key Finding #5: Substantial reliability risks remain as the region's electricity resource portfolio transitions

Maintaining reliability will require immediate and sustained action over the next decade

Supply Resilience in PNM Planning Key Takeaways

+ **Portfolios planned with a reliability standard in mind vary in performance during extreme events**
+ **Stress testing candidate portfolios for resilience is important to understand differences in their performance**
+ **Winterization helps reduce outages and firm up generation reducing the severity of extreme event impacts**
+ **During ice storms, broader southwest dynamics will have significant impact on PNM's ability to avoid outages under extreme events**
  - PNM can weather localized ice storms by relying on external markets, but region-wide events almost certainly lead to outages.
  - Market support is limited in summer and PNM's system can avoid outages during a heat wave unless load reaches 1-in-20 levels or significant level of generation is forced out.
+ **PNM should continue to monitor risk profile in winter season. Resource accreditation should continue to match the risk profile PNM is presented with**
+ **As PNM increases its storage portfolio, its operational limits and utilization should be understood and considered in resource adequacy modeling**

PNM RESILIENCY STUDY

PNM RESOURCE ADEQUACY GOING FORWARD AND KEY QUESTIONS TO ANSWER (SUBSEQUENT MEETINGS)

Traditional systems designed around a LOLE standard (such as 1 day in 10 years) have similar performance if a loss of load event occurred (traditional portfolios did not vary much in the severity of event – EUE)

This study shows that focusing solely on LOLE can lead to portfolios that do vary significantly in the severity of an event if an event occurs.

1. Moving forward, should portfolios be designed to meet both a LOLE and an EUE requirement (Essentially should a decarbonized system should focus on providing the same attributes as a traditional system, just without carbon emissions)?

2. Along with bringing EUE into portfolios evaluations along with LOLE, should portfolios be further stress tested to gauge performance under adverse conditions as done in this study?

3. Finally, should the value of loss of load (which conceptually increase as a function of the duration of loss of load) be compared to the perceived cost of GHG?

PNM RESILIENCY STUDY

RESILIENCY STUDY PHASE II SCOPE OF WORK IDEAS, QUESTIONS TO ANSWER, ETC.

Given the limited data of actual events, what other ways do we have to synthesize extreme weather data?

How can we establish a (or what is a reasonable) baseline for portfolio metrics such as EUE?

What alternatives do we have for improving resiliency of the system aside from only utility scale resources?

What is the most cost-effective way of improving both summer and winter resilience?

What would be necessary to assess transmission within this current framework?

Is storage duration critical, or is storage volume more important and what is the cost tradeoff?

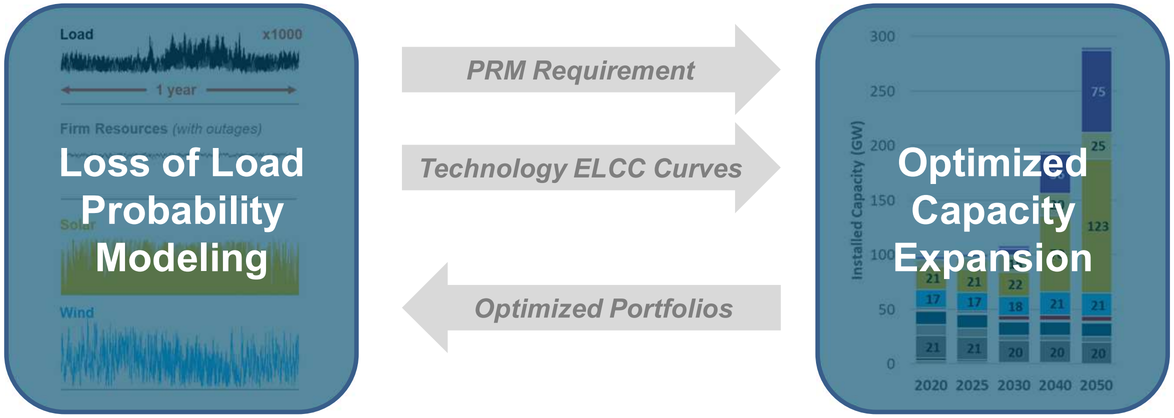
OPEN FORUM

Stakeholders with ideas, slides/examples to share, etc.

2020 IRP MODELING FRAMEWORK

The 2020 IRP modeling framework paired the EnCompass capacity expansion and production costing model with the SERVM loss-of-load-probability model to generate optimized portfolios that adhered to establish reliability metrics while meeting clean energy goals and minimizing cost.

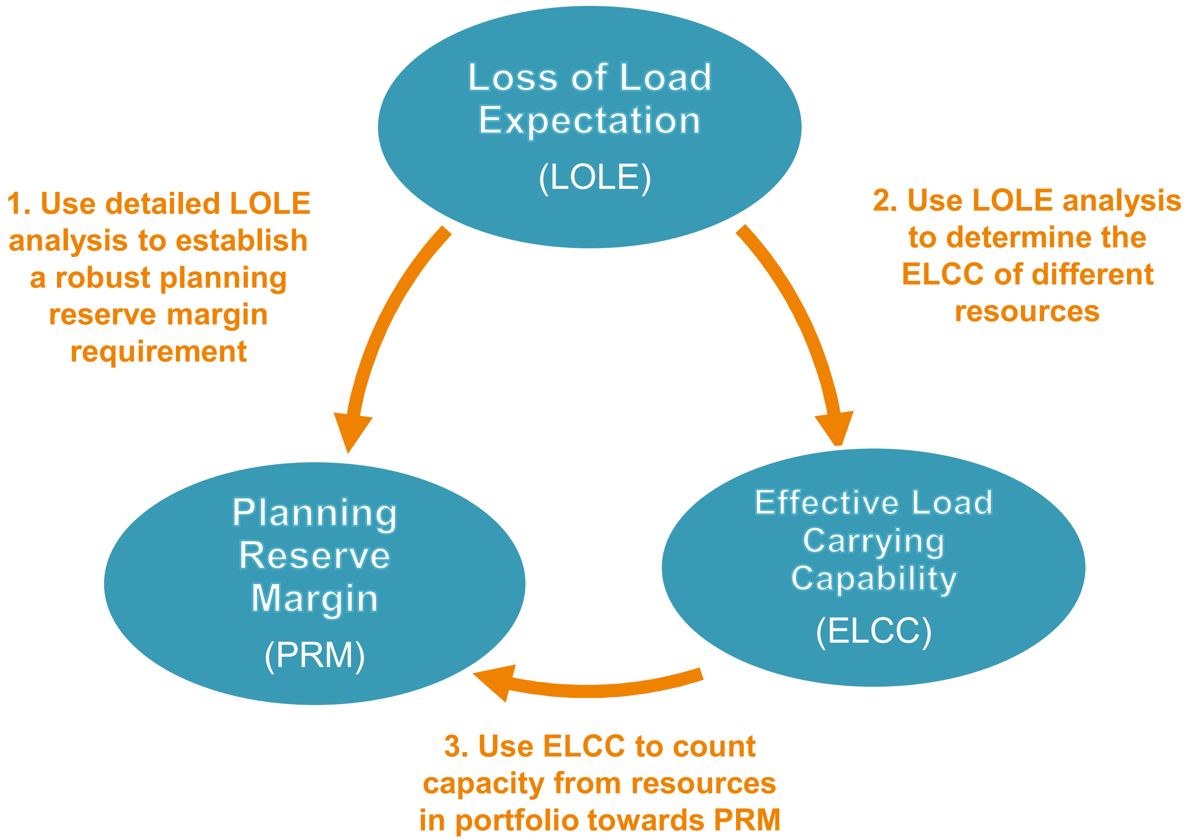
1. Use LOLP model to quantify PRM requirement and “effective load carrying capability,” which measures contribution of each resource-to-resource adequacy across 1000s of years



3. Use LOLP model to simulate performance of resulting portfolios across wide range of conditions, validating resource adequacy

2. Use capacity expansion to optimize future portfolios to meet PRM requirement and clean energy goals while minimizing cost

RESOURCE ADEQUACY MODELING



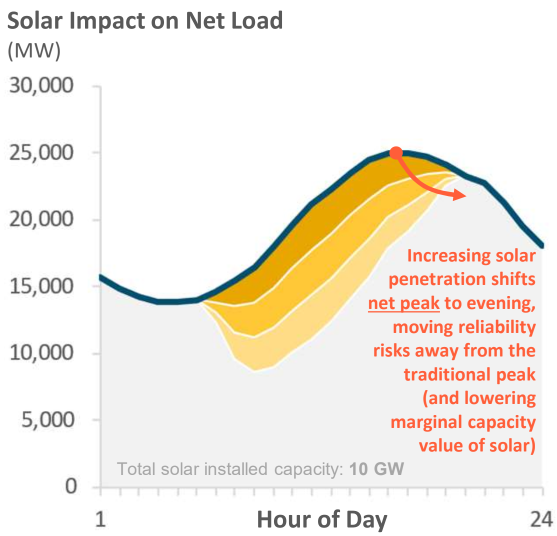
OPEN FORUM

Stakeholders with ideas, slides/examples to share, etc.

Variable and energy-limited resources contribute to resource adequacy, but also add complexity

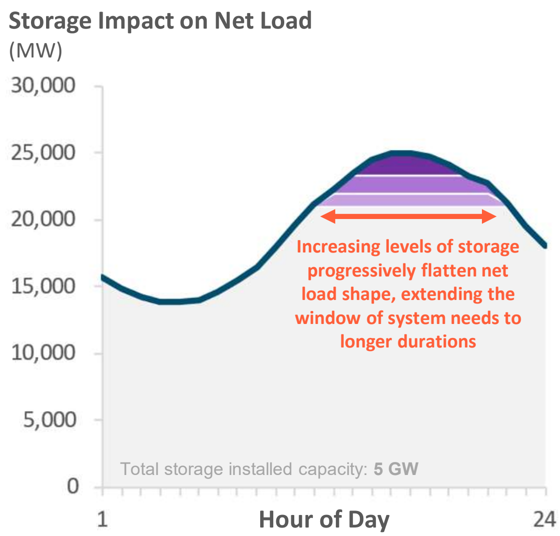
1

"Variable" resources shift reliability risks to different times of day



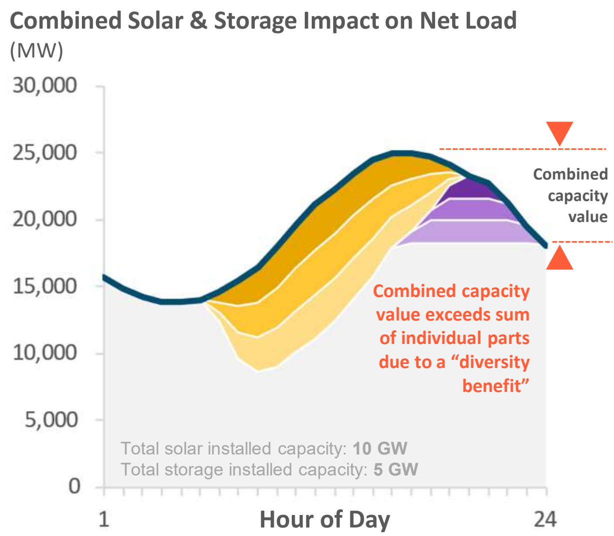
2

"Energy-limited" resources spread reliability risks across longer periods



3

A portfolio of resources exhibits complex interactive effects, where the whole may exceed the sum of its parts

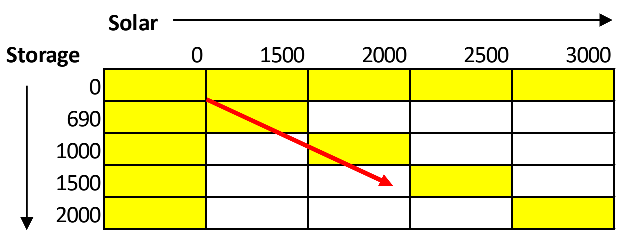


ELCC Synergistic Value

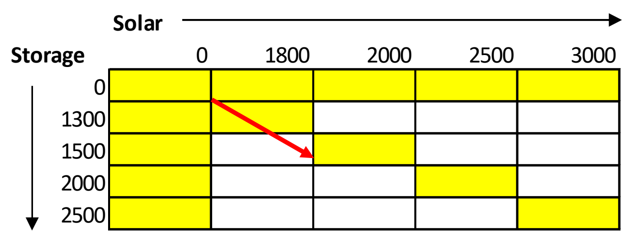
Installed Capacity – PVNGS NNC

Sum of Capacity (MW)	Column Labels																			
Row Labels	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Coal:Conventional	697	697	200	200																
Demand:Distributed Generation	33	48	48	15	15	15	15	15	15	15		15	15	15	15	15	15	15	15	15
Demand:Energy Efficiency	20	39	60	83	107	114	121	128	134	141	148	155	142	130	117	124	107	90	92	95
Gas/Oil:Combined Cycle	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	
Gas/Oil:Combustion Turbine	416	416	416	416	416	416	416	416	267	267	267	267	267	267	267	267	267	267	267	126
Gas/Oil:Steam Turbine	146	146	146	146	146	146	146	146	146	146										
Nuclear:Nuclear	402	402	298	288	288	288	288	288	288	288	288	288	288	288	288	288	288	288	288	288
Renewable:Geothermal	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Renewable:Solar PV	378	1025	1521	1687	1771	1755	1743	1732	1720	1709	1698	1686	1675	1664	1663	1723	1713	1701	1770	3080
Renewable:Wind	658	658	658	658	658	658	658	658	658	658	658	658	658	658	556	556	556	556	556	956
Storage:Battery		300	590	690	846	937	959	1129	1136	1136	1304	1304	1320	1341	1382	1395	1421	1449	1569	2390

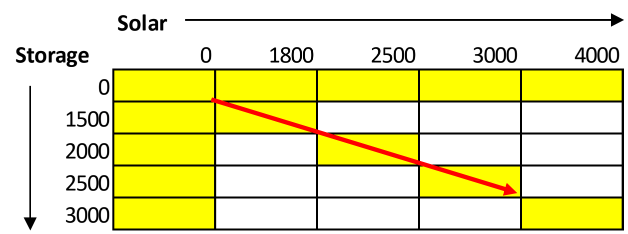
2025 Study Year **Use 2025 - 2031**



2032 Study Year **Use 2032 - 2039**



2040 Study Year **Use 2040-2043**



- **Evaluate resources individually**
- **Evaluate resources as a portfolio**
- **Appropriately allocate synergistic benefit**

Note this is a two dimensional illustrative example

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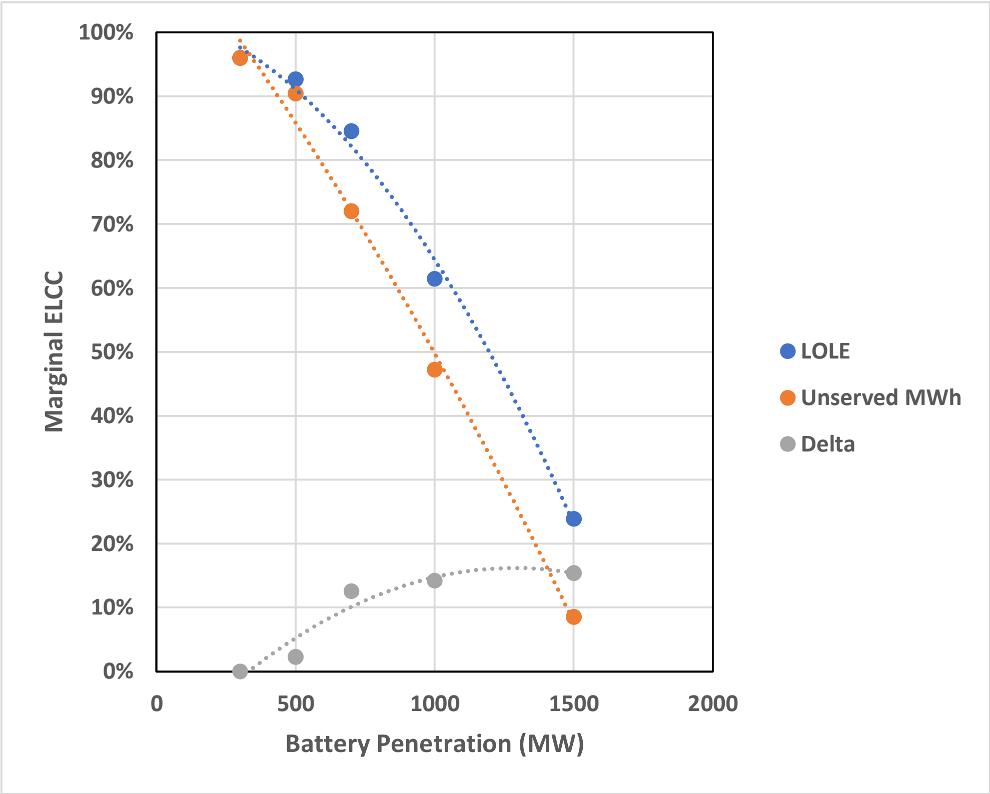
OPEN FORUM – MODELING OF RESOURCE SYNERGISTIC EFFECTS

Stakeholders with ideas, slides/examples to share, etc.

2020 IRP ELCC (LOLE vs EUE Metric)

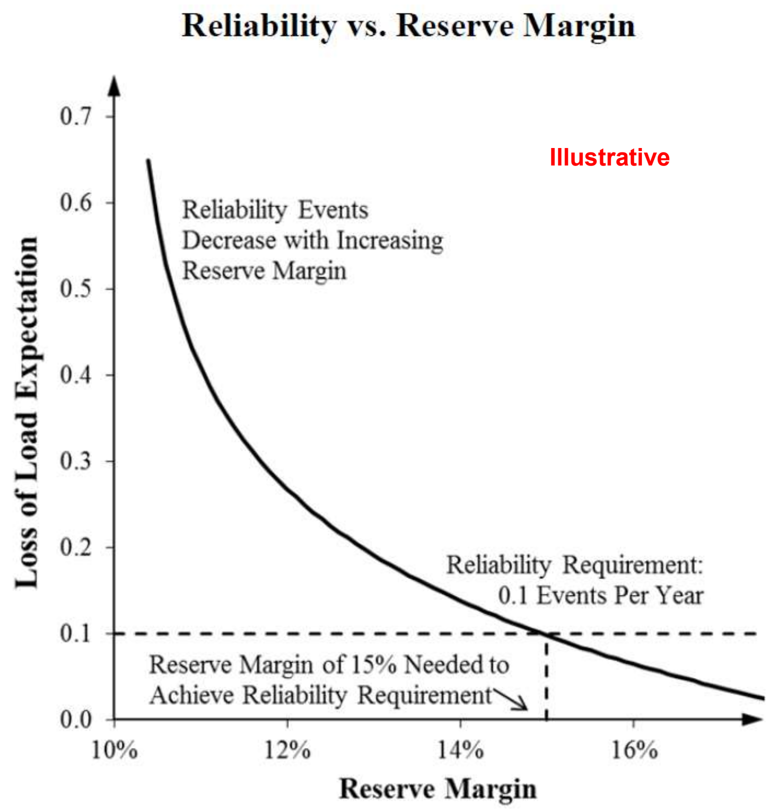


Compounding the complexity of the previous slide is when do we switch from LOLE ELCC curves to EUE ELCC curves… or do we?

Physical Reliability Metrics

- **Loss of Load Expectation (LOLE)**
  - Counts the number of days load was not met
  - 1-day-in-10-year Standard
    - Most used metric by RTOs, Utilities, and Commissions
    - Equates to 0.1 days per year for modeling purposes
    - Allows 1 day (1 event) every 10 years

- **Additional Metrics**
  - Loss of Load Hours (LOLH)
    - Counts the number of hours load was not met
  - Expected Unserved Energy
    - The amount of load in MWh not met



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Survey Summary

Survey of Resource Adequacy Criteria Across U.S. and Canadian Power Systems

Region	Standard	Model	Notes
PJM[a]	0.1 LOLE	PRISM and GE-MARS	The LOLE based target reserve margin and various other calculations provide key inputs into the PJM capacity market.
MISO[b]	0.1 LOLE	SERVM	Performed Annually by the ISO. Regional reserve margin of 16.7% but after diversity allows its load serving entities to carry an 11.3% reserve margin.
NYISO[c]	0.1 LOLE	GE-MARS	Resulted in a reserve margin of 16.1% for the period May 2012 to April 2013. Reserve Margin calculation includes nameplate of all resources including wind. Results are adapted to derated UCAP for implementation in the NYISO capacity market.
ISO-NE[d]	0.1 LOLE	GE-MARS	2012 ICR report calculates the requirement needed to meet its 1 day in 10 year standard, load uncertainty considers weather but not economic forecast error. Results used capacity market.
SPP[e]	0.1 LOLE	SERVM	Capacity margin criterion of 12% for RTO members that are steam based and 9% for hydro based; results in capacity margin criterion above the 1 day in 10 year definition.
Maritimes [f]	20% RM and 0.1 LOLE	NPCC uses MARS	Maritimes uses a 20% reserve margin criterion for planning purposes but at the same time adheres to the NPCC requirement of not shedding firm load more than 1 day in 10 years.
Quebec[g]	0.1 LOLE	NPCC uses MARS	Based on an LOLE of 0.1, Quebec requires a 10% reserve margin for the 2012/2013 winter peak. By the 2015/2016 winter peak, Quebec requires a 12.2% reserve margin. Because of its dependence on hydro generation, Quebec also imposes an energy requirement to withstand 2 consecutive years of low water inflows.
IESO[h]	0.1 LOLE	NPCC uses MARS	The target for 2013 to meet the one day in 10 year target is 19.7% in which the region meets easily with an anticipated reserve margin of 40.1%.
Saskatchewan[i]	EUE Standard		Sask Power uses a 13% RM based on probabilistic analysis of Expected Unserved Energy.
Manitoba[j]	Both RM and energy standards due to hydro dependence		The energy criterion requires adequate energy resources to supply firm energy demand in the event that the lowest recorded coincident river flow conditions are repeated. The capacity reserve margin is at least 12%.
MAPP[l]	1 day in 10 years (LOLE of 0.1)		Some MAPP members self-impose a planning reserve margin of 15% based on the results of an LOLE study performed in 2009.
SERC/ General	No mandatory requirement		RA targets set by individual load serving members subject to regulatory review. With this approach, the criteria and final reserve margins vary across the region.
SERC/SoCo[k]	0.1 LOLE/ Economics	SERVM	The target is based on analyzing LOLE and customer costs

https://www.ferc.gov/sites/default/files/2020-05/02-07-14-consultant-report.pdf
Survey was performed in 2014 and has been updated for known changes

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Survey Summary

Region	Standard	Model	Notes
SERC/Duke Energy Carolinas[l]	0.1 LOLE and Economic Assessment	SERVM	Set minimum RM based on LOLE values but base target RM on an economic assessment, which is slightly higher than the LOLE target.
SERC/ Progress Energy Carolinas[m]	1 day in 10 years (LOLE of 0.1) and Economic Assessment	SERVM	Set minimum RM based on LOLE values but base target RM on an economic assessment, which is slightly higher than the LOLE target.
SERC/TVA[n]	Economics	SERVM	The target is based on minimizing customer costs.
SERC/Santee Cooper[o]	Economics	SERVM	The target is based on minimizing customer costs.
SERC/ LGE&KU[p]	Economics	SERVM	The target is based on minimizing customer costs.
SERC/ Entergy[j]	1 day in 10 years (LOLE of 0.1)	ERAILS	
SERC/ SCE&G[q]	12–18% RM		
FRCC[r]	0.1 LOLE	Tiger	"The FRCC has a resource criterion of a 15% minimum Regional Reserve Margin based on firm load. The FRCC assesses the upcoming ten-year summer and winter peak hours on an annual basis to ensure that the Regional Reserve Margin requirement is satisfied. Since the summer of 2004, the three Investor Owned Utilities (Florida Power & Light Company, Progress Energy Florida, and Tampa Electric Company) are currently maintaining a 20% minimum Reserve Margin planning criterion, consistent with a voluntary stipulation agreed to by the FPSC. Other utilities employ a 15% to 18% minimum Reserve Margin planning criterion."
ERCOT[s]	0.1 LOLE target (not mandatory)	Internal Model	ERCOT operates as an energy-only market and so does not mandate a RM; but performs one day in 10 year standard assessment to inform ERCOT and
WECC/ General[t]	No mandatory requirement		Individual balancing areas within WECC determine their own resource adequacy requirements in various ways and are subject to review by state regulators
CAISO[u]	15% RM		In January 2004, the CPUC established a long-term Resource Adequacy framework (D.04-01-050). This decision adopted a 15% to 17% planning reserve margin (PRM) and directed that each LSE is responsible for acquiring sufficient reserves to meet its own customer load. CAISO has since performed LOLE studies but the studies have not impacted the decision made in 2004 to maintain at a minimum 15% reserve margin

https://www.ferc.gov/sites/default/files/2020-05/02-07-14-consultant-report.pdf

Survey was performed in 2014 and has been updated for known changes

Survey Summary

Region	Standard	Model	Notes
Northwest/ BPA[v]	Loss-of-Load Probability (LOLP) of 5%; and conditional value at risk (CVaR) to evaluate energy not served (ENS) events	Genesys Model	A completely different method from 1 day in 10 years. Method was developed in cooperation with the Northwest Council to take into account the predominantly hydro resource mix of the Northwest. For this use, LOLP is not defined as hours per year. It is instead a percentage of iterations that contain any EUE. The target allows no more than 5% of all iterations to contain EUE.
Southwest/ APS[w]	0.1 LOLE		APS 2012 IRP states that at 15% planning reserve margin criterion, LOLE is less than 1 day in 10 years.
Southwest/ PNW[x]	NM State Commission set target at 13%		Notes that reserve margin would likely increase if a one day in 10 year standard were used.
Southwest/ NV Energy[y]	1-in-10		Definition of 1 day in 10 years is not reported.
Alberta	No RA requirement		Intervention possible if expected EUE over a two-year outlook increases above 1,600 MWh.

https://www.ferc.gov/sites/default/files/2020-05/02-07-14-consultant-report.pdf
Survey was performed in 2014 and has been updated for known changes

2023 IRP ELCC (LOLE vs EUE Metric)

- **Premise: Maintain reliability the system has seen historically during the decarbonization transition**
  - Maintain 0.1 LOLE – 1 day in 10 year standard
  - Explore EUE or LOLH metrics for a current or historical PNM configuration to set a baseline target
    - SJ Coal not retired
    - Remove renewable/storage

- **Force future portfolios to meet 0.1 LOLE and EUE/LOLH secondary constraints**
  - It is expected at some point that the system will be able to meet the 0.1 LOLE metric and not meet the EUE/LOLH metric as significant energy limited resources are include on the system.
  - ELCCs would reflect EUE/LOLH constraints

OPEN FORUM – RELIABILITY METRICS

Stakeholders with ideas, slides/examples to share, etc.

2023 IRP PUBLIC ADVISORY PROCESS

WE WOULD LIKE TO HEAR FROM YOU

We did not receive any feedback to these questions posted during the last public meeting:

1. What did we do well in the last (2020) IRP and where can we improve?
2. Any additional ideas for technical discussions?
3. What is the proper way to balance reliability, customer cost and accelerating the transition to clean energy?
4. How can we be more collaborative throughout the process with our public stakeholders?

We would also like to hear your ideas on the How we incorporate key takeaways and lessons learned from the Resiliency Study Phase I into the 2023 IRP so we can begin these discussions at our June 8, 2022 meeting.

We would also like to hear your ideas on the Resiliency Study Phase II Scope of Work / Questions to Answer.

NEAR TERM SCHEDULE

FUTURE MEETING TIME & LOCATION

When: June 22, 2022

Topic: Public Advisory Steering Mini Session (Energy Efficiency Potential Study SOW) & Technical Session #2 (Modeling for Reliability, Resource Adequacy and Resiliency Continued)

Start Time: 9:00 AM

Location: Virtual

Due to the vast majority of participants for the first two meetings attending virtually, we have decided to make the second technical session a virtual meeting. If there is strong interest to resume in person meetings for future sessions, please email us at IRP@pnm.com. We will continue to notify everyone through the email service list regarding upcoming meeting dates, topics and locations (virtual or in person).

NEAR TERM SCHEDULE

FUTURE MEETING TIME & LOCATION

When: July 6, 2022

Topic: Public Advisory Technical Session #3: Load Forecast Scope of Work / Methodology & Candidate Resource Pricing Methodology

Start Time: 9:00 AM

Location: Virtual

Due to the vast majority of participants for the first two meetings attending virtually, we have decided to make the third technical session a virtual meeting. If there is strong interest to resume in person meetings for future sessions, please email us at IRP@pnm.com. We will continue to notify everyone through the email service list regarding upcoming meeting dates, topics and locations (virtual or in person).

NEXT MEETING

We encourage you to send in your thoughts ahead of time to IRP@pnm.com so that we can summarize them and distribute them for the next meeting. Please have your submissions in by June 16, 2022.

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