# Item 6: Board Education – Thermal Generation Development in ERCOT

*David Maggio*
Principal, Market Design & Analytics

Board of Directors Meeting

ERCOT Public
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# Overview

- **Purpose**

  The intent of this presentation is to facilitate discussion on incentives for thermal generation development in ERCOT. While much of this material will be familiar, the intent of this presentation is to think about the topics presented in relationship to one another and in the context of a broader market design framework.

- **Voting Items / Requests**

  No action is requested of the ERCOT Board; for discussion only.

- **Key Takeaways**
  - While there has been incremental growth in some gas-powered technologies, recent historical and projected future growth is focused on storage and renewables.
  - There are several factors improving or impairing the outlook for generator development in the coming years.
  - It is crucial that we have a framework that allows us to evaluate changes to the market design relative to all the attributes that are needed to reliably operate the grid.

# Introduction

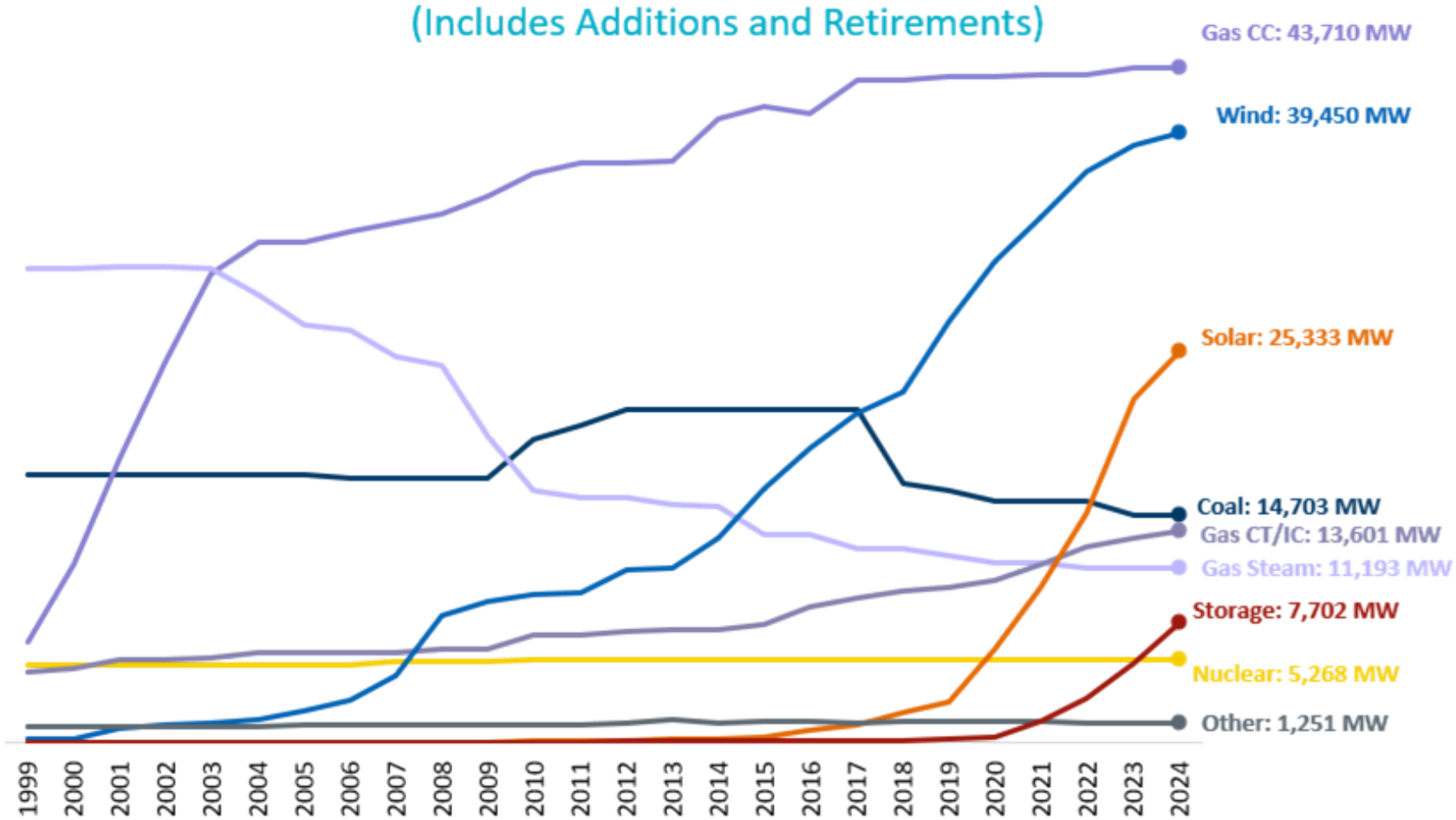
- In recent months, there have been several on-going discussions related to incentives for the development of dispatchable generation in ERCOT.

- Much of this has been related to market design changes that have been implemented over the last few years, are in the process of being implemented, or remain under consideration at the Public Utility Commission of Texas (PUCT) and Legislature.

- This material is a collection of thoughts and observations from both ERCOT staff and others regarding:
  - The current state of generator development;
  - Factors improving the outlook for development;
  - Factors impairing the outlook for development; and
  - Related topics for market design evaluation.

# Current State of Generator Development

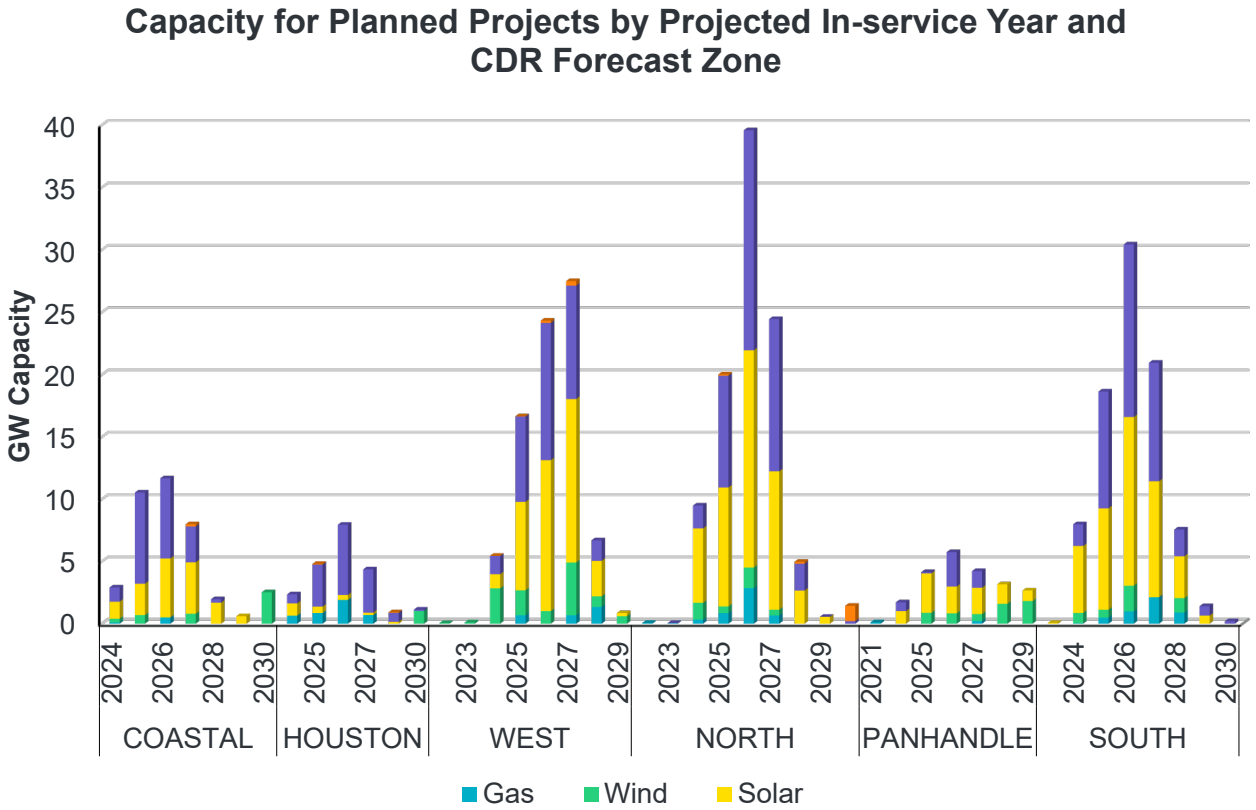
# ERCOT Installed Net Generation Capacity (as of 7/1/2024)




Notes: Capacity totals are based on the Installed Capacity Ratings for generating units. "Other" comprises of Biomass, Hydro, and Diesel.
- Planned generation projects are added to installed capacity after approval for synchronization to ERCOT Grid.
- Totals include Private-Use Network generators that export to the ERCOT grid, Distribution Generation Resources (DGRs), Settlement-Only Distribution Generators (SODGs), Unavailable Switchable Capacity, Extended Outage Units, and Mothballed Units.

# Current Generation Queue (as of 7/1/2024)

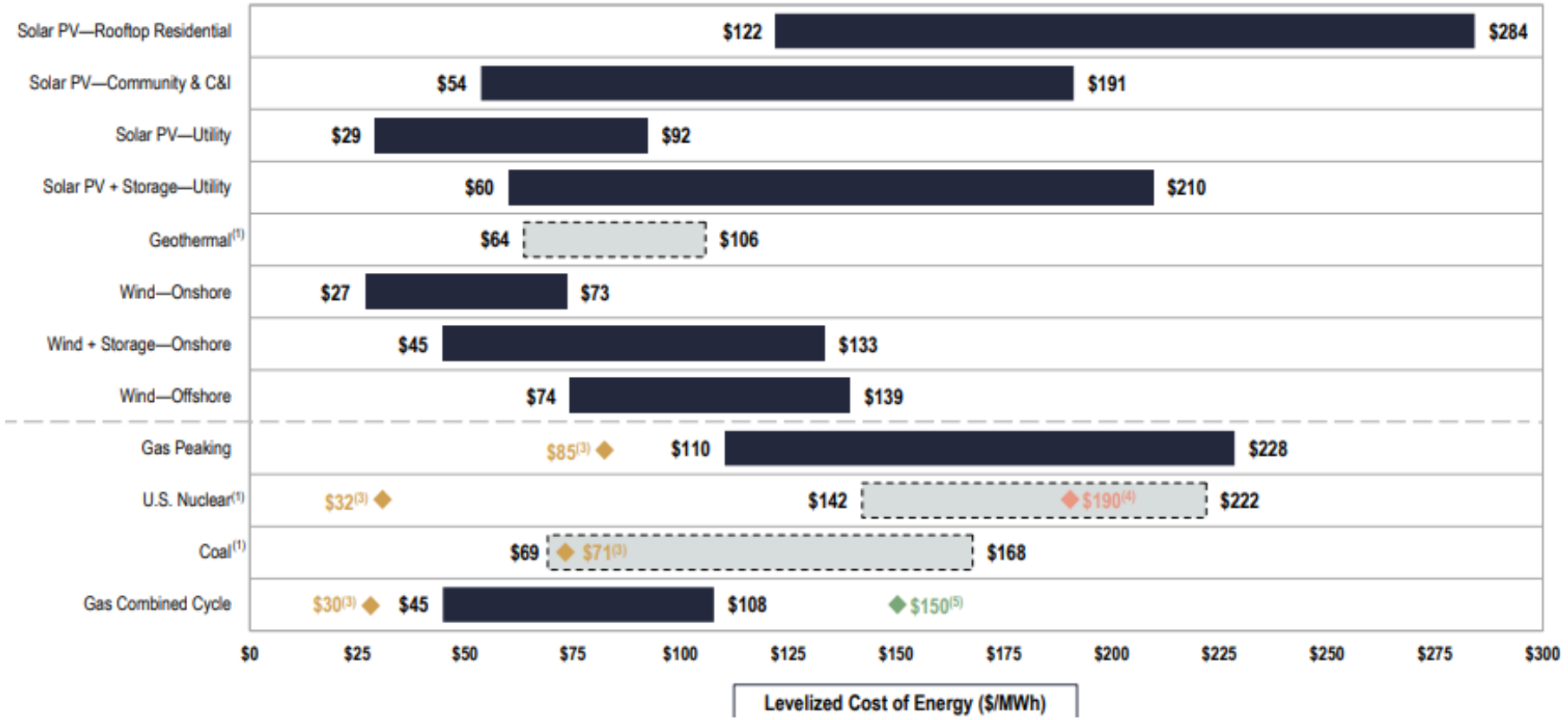
Storage and renewables are important to the fuel mix, but the system can experience renewable generation “droughts” for extended periods of time, making dispatchable thermal generation critical.




* Other includes petroleum coke (pet coke), hydroelectric, fuel oil, geothermal energy, other miscellaneous fuels reported by developers, and fuel cells that use fuels other than natural gas.

- **Key Takeaway:**
  - While there has been incremental growth in some gas-powered technologies, recent historical and projected future growth is focused on storage and renewables.

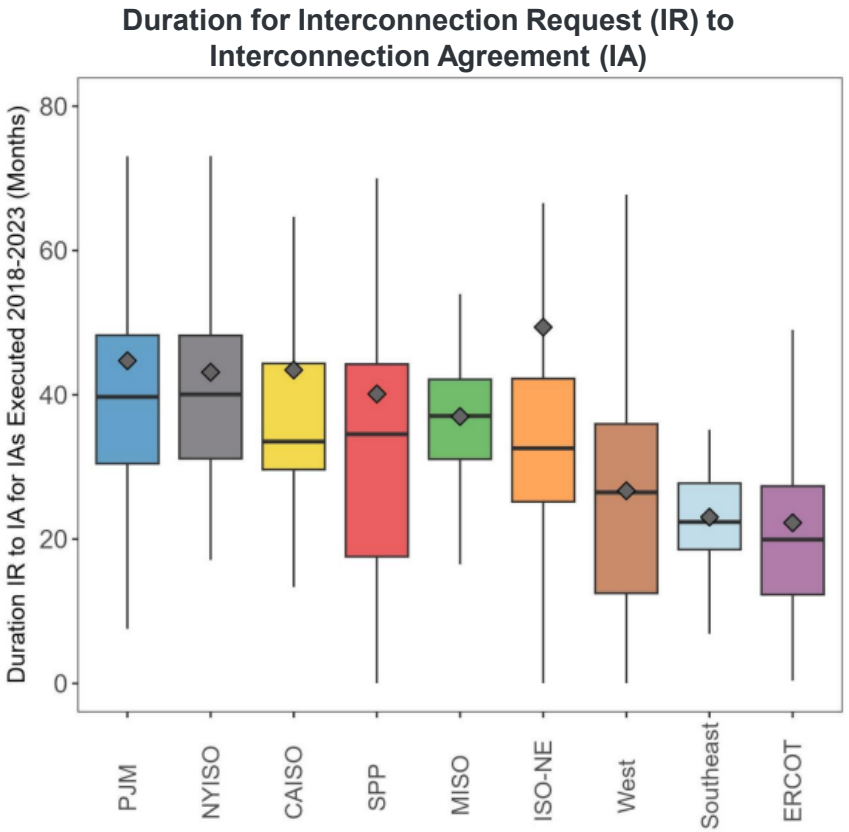
# Levelized Cost of Energy by Technology
## From Lazard – Version 17.0




Source: https://www.lazard.com/media/xemfey0k/lazards-lcoeplus-june-2024-_vf.pdf

- **Key Takeaway:**
  - While only part of the story, these resource trends generally align with what we see in terms of relative technology costs.

# The Importance of Timelines for Project Development




Source: https://emp.lbl.gov/sites/default/files/2024-04/Queued%20Up%202024%20Edition_1.pdf

- The Lawrence Berkeley National Laboratory (LBNL) has publicly available analysis looking at interconnection queues across the US ISOs/RTOs, including analysis on duration for various parts of the process.
  - This specific graph does not delineate between different resource technologies.
  - Shorter timeframes have been observed for the small generator interconnection process within ERCOT (typically 7-9 months).
- LBNL's data shows that this portion of the project development process takes ~2 years within ERCOT, and that's not including the time for a project to move from an IA to commercial operation.

- **Key Takeaway:**
  - It's important to remember the timeframe of the problem, from making changes in the market to that materializing into commercial projects.

# Improving the Outlook for Development

# The Texas Energy Fund (TEF)

- TEF was created by the Texas Legislature, through Senate Bill 2627, to provide up to $10 billion in grants and loans to finance the construction, maintenance, modernization, and operation of dispatchable electric facilities in Texas; specific programs including “In-ERCOT” Generation Loans and Completion Bonus Grants.
- The PUCT received 72 applications for an “In-ERCOT” loan totaling $24.41B in requests to finance 38,379 MW.
  - Legislation limits grants and loans for “In-ERCOT” generation to $7.2B (of the $10B total) and must support at least 10,000 MW of generation capacity.
- Some of these projects are starting to appear in the interconnection process and we’ll be continuing to provide regular updates on changes to the queue.
- The PUCT will determine which of the projects will proceed to due diligence at the PUCT’s Aug. 29 open meeting.

- **Key Takeaway:**
  - TEF appears to be very attractive for a least a subset of investors with many of the notices of intent and applications identifying thermal, dispatchable technologies.

# Setting of a Reliability Standard by the PUCT

ERCOT staff has been working with the PUCT on the development of a reliability standard.

**Three reliability criteria (values still under debate):**

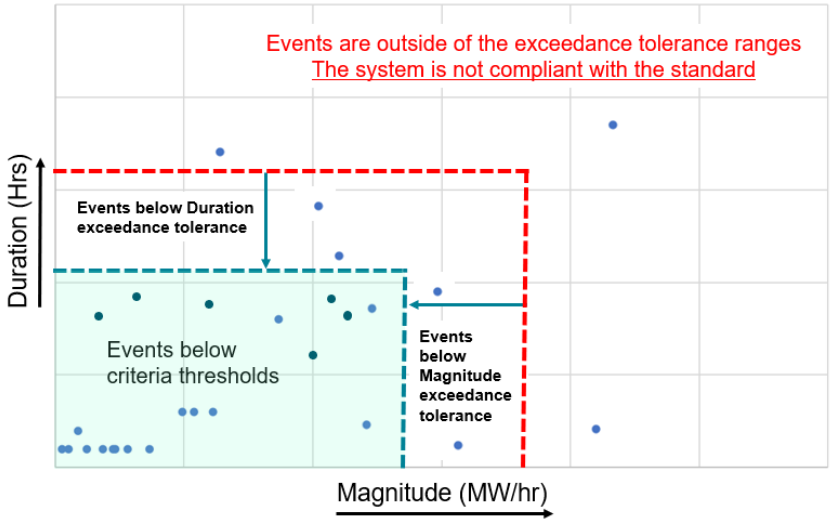
**Frequency**: Loss of Load Expectation must be less than 0.1 days per year

**Duration:** The maximum expected length of a loss of load event, measured in hours, must be less than 12 hours, with a one-percent exceedance tolerance

**Magnitude:** The amount of load shed during a loss of load event must be less than the maximum amount that can be safely rotated as determined by ERCOT, in consultation with PUCT staff and transmission operators, with a 0.25 percent exceedance tolerance

Exceedance tolerance is the maximum acceptable percentage of loss-of-load events that exceed the criteria thresholds based on a probabilistic simulation

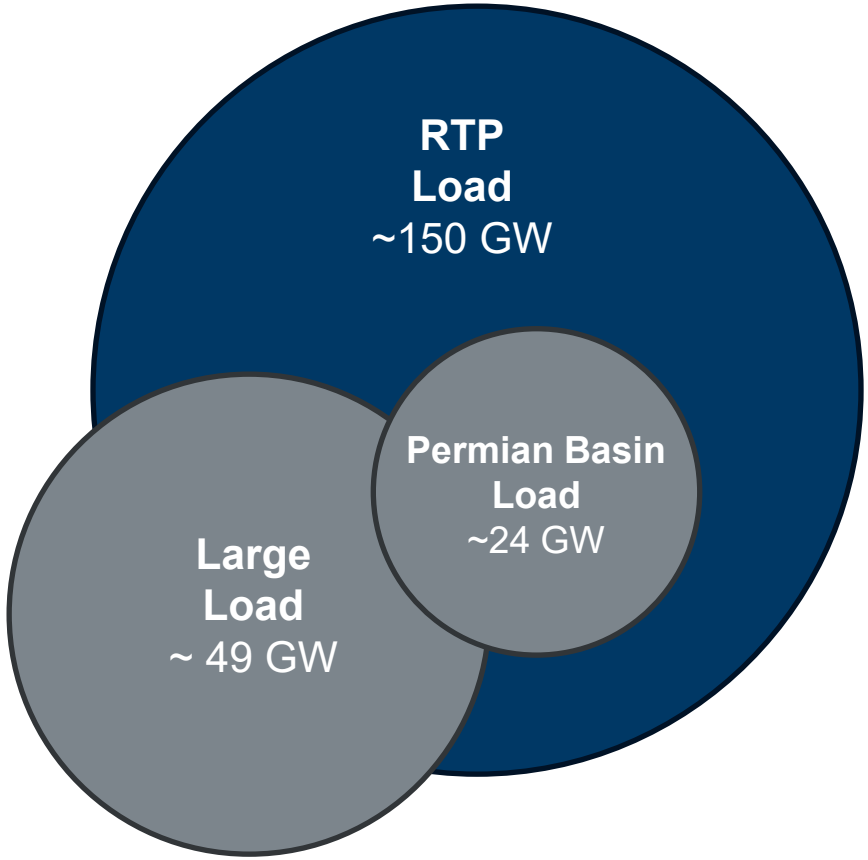
**ERCOT required to conduct periodic reliability assessment studies to determine if the standard is being met three years in the future and recommend market design changes if not met**




- **Key Takeaway:**
  - Having a defined reliability standard is valuable to investors regardless of the specific mechanisms used to achieve it.

# Potential for Load Growth in the ERCOT System

- As previously presented in April, ERCOT's processes have changed to consider prospective load identified by Transmission Service Providers (TSPs) in our planning processes.
- This has given us additional insights and has led to significant increases in large loads considered in studies (i.e., crypto mining, hydrogen and hydrogen-related manufacturing, data centers, and electrification).
- Open questions exist, but this new load creates opportunity for long-term arrangement with generation.




- **Key Takeaway:**
  - Significant load growth can create opportunities for long-term contracting to help with debt and risk management.

# Impairing the Outlook for Development

# Impact on Generation Development from the EPA Rules

- In June, we presented on EPA rules that were finalized in late April with the analysis focusing on the impact to **existing** installed capacity in the ERCOT region.
- These and other recent EPA rules also impact **new** thermal generation:
  - Greenhouse Gas Rule (new gas only—see chart at right)
  - Good Neighbor Plan (all new fossil)
  - Mercury & Air Toxics Standards (coal/oil)
  - Coal Combustion Residuals Rule (coal)
  - Effluent Limitations Guidelines (coal)
- Many rules are being challenged.

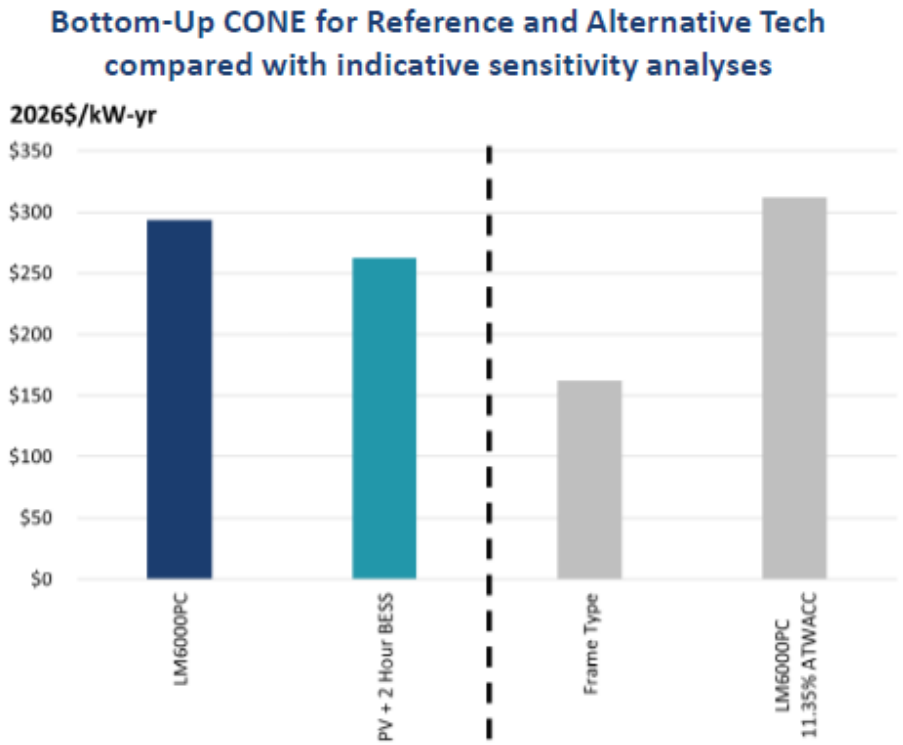
- **Key Takeaway**
  - While these EPA rules are being challenged, they continue to be important considerations for generation developers.

| New Source and Reconstructed 111(b) Stationary Combustion Turbines | |
|---|---|
| **Phase I**<br>Date of promulgation or initial startup | **Phase II**<br>Beginning in Jan 1, 2032 |
| **Low Load Subcategory (Capacity Factor <20%)** | |
| **BSER**: Use of lower emitting fuels (*e.g.*, hydrogen, natural gas and distillate oil)<br>**Standard**: less than 160 lb $CO_2$/MMBtu | EPA is not finalizing a Phase II BSER for low load units |
| **Intermediate Load Subcategory (Capacity Factor 20% to 40%*)**<br>*Source-specific upper bound threshold based on EGU design efficiency | |
| **BSER:** Highly efficient simple cycle technology with best operating and maintenance practices<br>**Standard:** 1,170 lb $CO_2$/MWh-gross | EPA is not finalizing a Phase II BSER for intermediate load units |
| **Base Load Subcategory (Capacity Factor >40%*)**<br>*Operation above upper-bound threshold for Intermediate Subcategory | |
| **BSER**: Highly efficient combined cycle generation with the best operating and maintenance practices<br>**Standard**: 800 lb $CO_2$/MWh-gross (EGUs with a base load rating of 2,000 MMBtu/h or more)<br>**Standard**: 800 to 900 lb $CO_2$/MWh-gross (EGUs with a base load rating of less than 2,000 MMBtu/h) | **BSER**: Continued highly efficient combined cycle generation with 90% CCS by Jan 1, 2032<br>**Standard**: 100 lb $CO_2$/MWh-gross<br><br>EPA's standard of performance is technology neutral, affected sources may comply with it by co-firing hydrogen. |

Source: [cps-table-of-all-bser-final-rule-4-24-2024.pdf (epa.gov)]

# Cost of New Entry (CONE)

- To support the PUCT, ERCOT has been working with the Brattle Group to perform a study of CONE.
- CONE is a critical input for evaluating the market and the potential for new investment.
- On July 25, the PUCT supported a move to a CONE of $140,000/MW-year for planning purposes
- Regardless of technology, we're seeing significant increases from our existing value of $105,000/MW-year.




Source: EIA, Capital Cost and Performance Characteristics for Utility-Scale Electric Power Generating Technologies, prepared by Sargent & Lundy, January 2024, Brattle Group analysis

- **Key Takeaway**
  - As we consider historical and future generator revenues and the potential for investment, we need to recognize that costs are increasing significantly relative to our historical reference point.

# Investment Options Competing with Thermal Generation Development

- There is considerable competition for capital both internal and external to the energy sector.

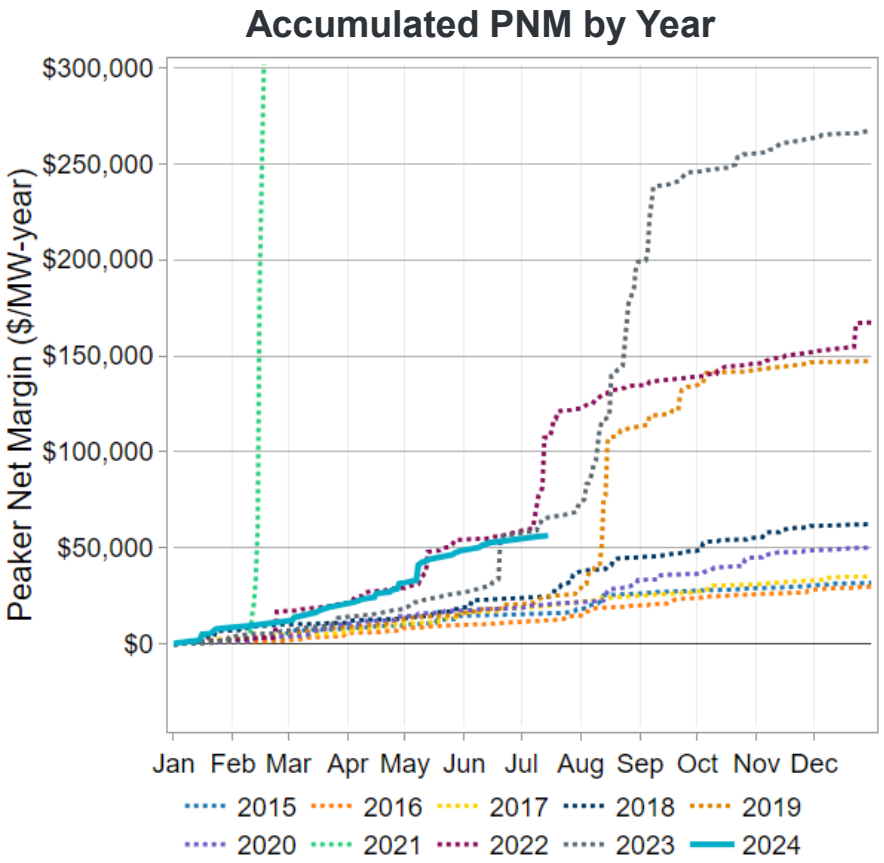
- Within the energy sector
  - Retail business
  - Transmission investment
  - Energy efficiency programs
  - Fuels
  - Development in other regions

- External to the sector
  - Health care
  - Pharmaceuticals
  - Transportation
  - Agriculture
  - Technology

- **Key Takeaway**
  - The “other” investment options are a much greater pool than simply other types of generator technologies.

# Related Topics for Market Design Evaluation

# Understanding Peaker Net Margin (PNM)

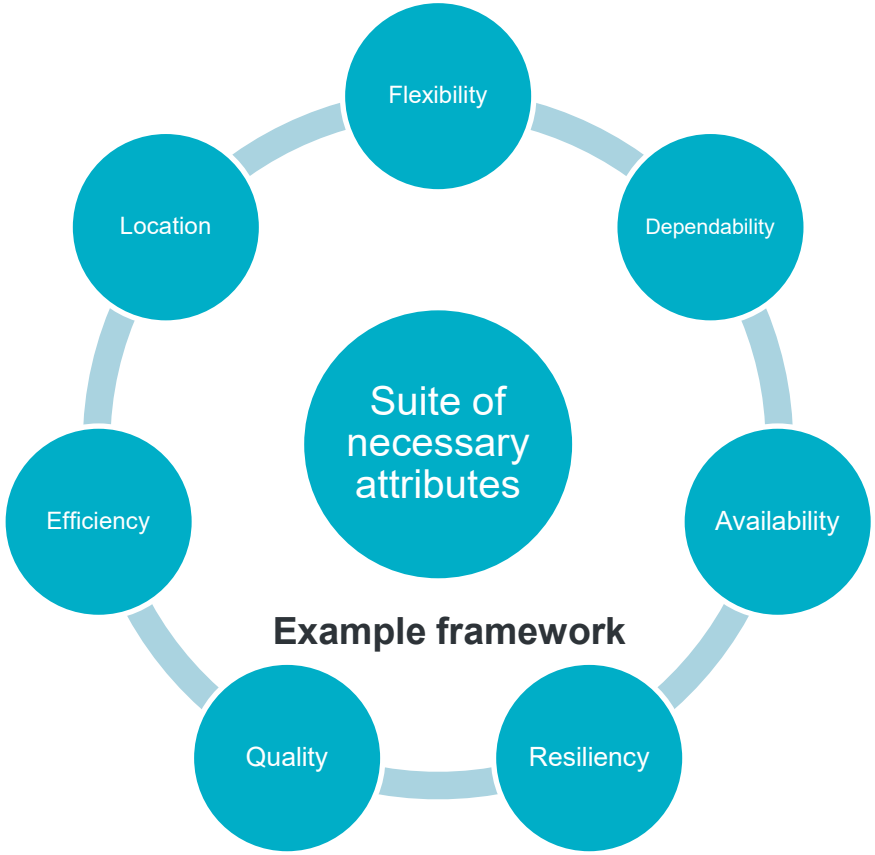



- PNM is a metric used to estimate real-time market energy revenues for a gas-fired peaking plant.
- While useful it does have its limitations:
  - It only provides a historical account of estimated revenues and does not address forward looking market conditions.
  - The calculation assumes perfect performance and foresight (i.e., always running when it's profitable and never running when it is not).

- **Key Takeaway**
  - PNM has value as a metric but is also has limitations as a single indicator of long-term investment signals.

# A Framework for Evaluating the Market Design

- As we consider these drivers for investment and the various levers available to us to provide investment signals, we need to be thinking about the full suite of attributes that are needed to reliably operate the grid.
- These attributes can then create a framework with which a market design can be evaluated.
- Development of a framework is being started and we expect this to be a future and on-going topic with the Board



Example framework

- **Key Takeaway**
  - It is crucial that we have a framework that allows us to evaluate changes to the market design relative to all the attributes that are needed to reliably operate the grid.

# Key Framework Attributes

| | |
|---|---|
| Flexibility | • Value resources that can be ramped up and down quickly |
| Dependability | • Value resources that can achieve instructed dispatch levels for required durations |
| Availability | • Provide incentives for resources to be available when needed |
| Resiliency | • Provide the grid with tools to manage and quickly recover from abnormal events |
| Quality | • Value attributes such as carbon free and inertia |
| Efficiency | • Design markets to achieve efficient results to benefit ratepayers |
| Location | • Enhance value of locating resources closer to demand |