Item 7.1: System Planning and Weatherization Update

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Reliability and Markets Committee Meeting

ERCOT Public
October 16, 2023

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**
  - Weatherization and inspection program remains on track to PUC rule requirements as the first summer of inspections under the final rule is completed.
  - Battery Energy Storage continues to be the most active type of Resource requesting interconnection studies.
  - Revision Requests will be forthcoming to implement the recommended congestion cost savings test for an economically-driven transmission projects evaluation.
  - ERCOT continues to track nearly 40 GW of Large Load interconnection requests and has submitted four Revision Requests and proposed a schedule to address issues.
  - ERCOT posted its final Seasonal Assessment of Resource Adequacy (SARA) and transitioned to a Monthly Outlook of Resource Adequacy (MORA).
  - ERCOT is leading the modeling approach used for grid operators.

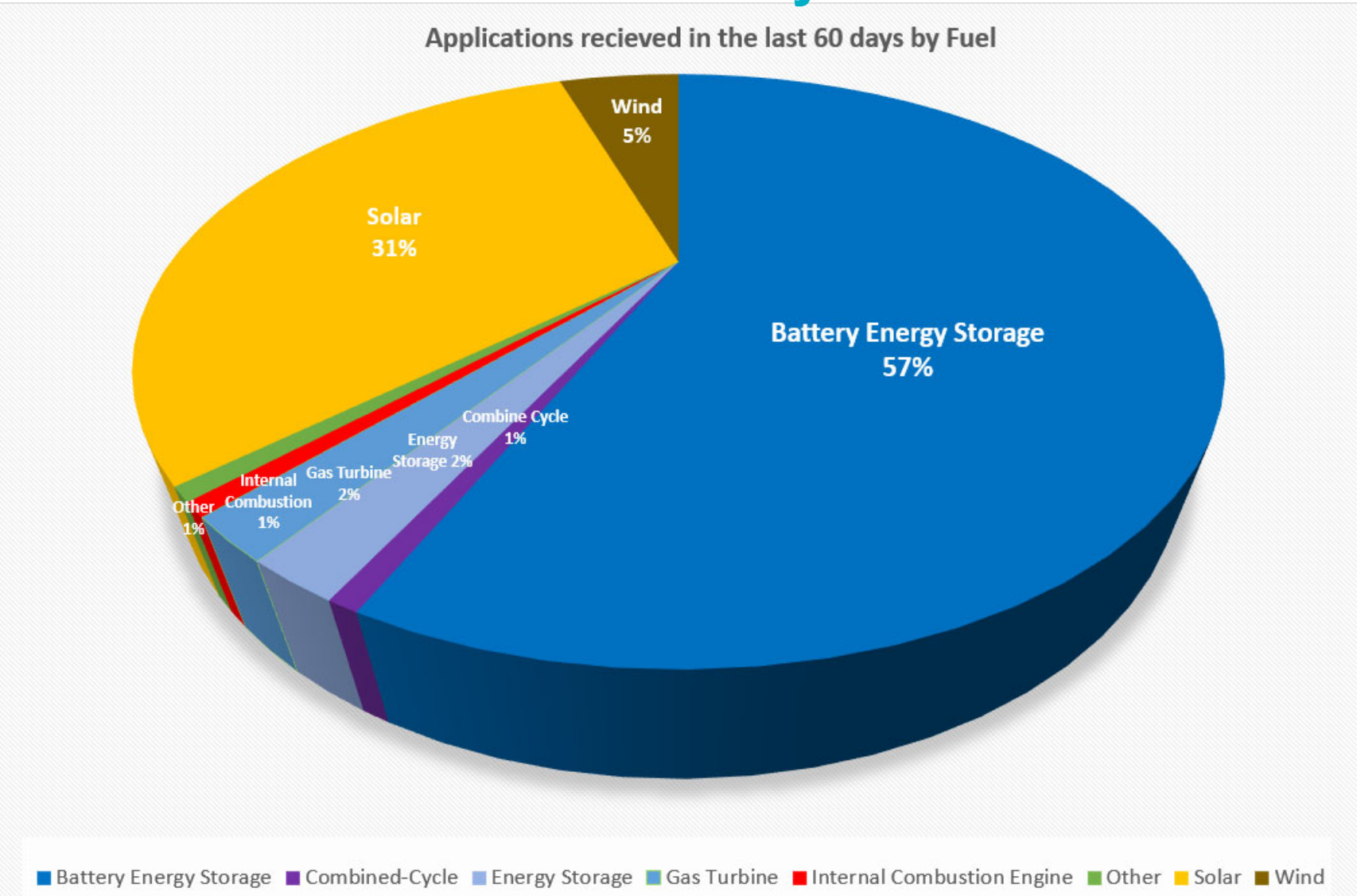
Weatherization and Inspection – Summer Lookback

- 550 Generation Resources and Transmission facilities were inspected June through September during the first year of Summer Weatherization Inspections.
- Almost all facilities were compliant with PUC requirements.
- 11 Generation Resources and 2 Transmission Facilities required cure periods to address issues such as reviewing staffing plans, training, or creating hot weather critical components lists.

	Generation Resource Inspections	Transmission Facility Inspections
June	58	44
July	56	98
August	52	99
September	42	101
TOTAL	208	342

Key Takeaway: Weatherization and inspection program remains on track to PUC rule requirements as the first summer of inspections under the final rule is completed.

Generation Interconnection Activity



Key Takeaway: From recent applications, Battery Energy Storage is the most active type requesting interconnection studies.

Economic Transmission Planning Criteria

- Amendments to PUC Substantive Rule 25.101 via Project No. 53403, Review of Chapter 25.101 Certification Criteria, require ERCOT, in consultation with commission staff, to develop a congestion cost savings test for an economically-driven projects evaluation.
- ERCOT hired Energy+Environmental Economic (E3) as an independent consultant for the development of the congestion cost savings test.
- E3 has completed the work and recommended a System-Wide Gross Load Cost Test as the best option for the rules and structure of the ERCOT market.
  - The test calculates the change in the energy cost charged to customers based on the sum of the energy used in each location times the locational marginal price for location. A transmission line that reduces prices at load locations will create savings in the Gross Load Cost Test.
- ERCOT in consultation with the commission staff is working to submit a Planning Guide Revision Request (PGRR) to implement this new congestion cost saving test.

Key Takeaway: Revision Requests will be forthcoming to implement the recommended congestion cost savings test for an economically-driven projects evaluation.

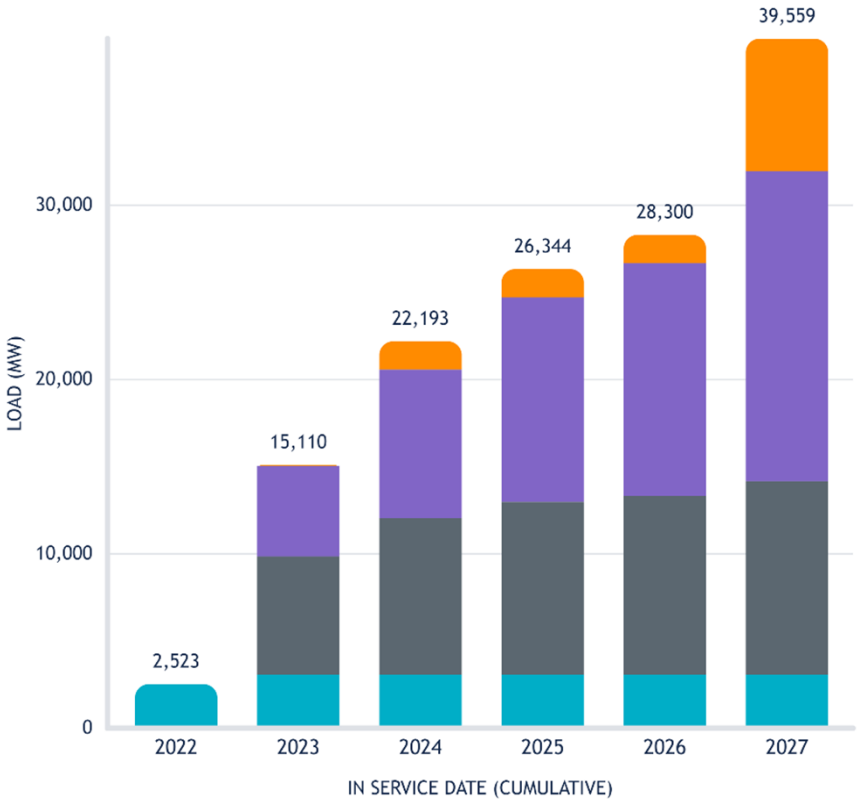
Percentage of Applications That Have Commissioned

Year Applied	Applied MW	Commissioned MW*	Productivity %
2014	4,125.5	3,709.6	89.9
2015	4,410.5	3,015.0	68.4
2016	6,756.1	2,987.7	44.2
2017	12,915.5	6,707.5	51.9
2018	21,423.0	8,871.8	41.4
2019	37,596.3	9,632.8	25.6
2020	41,697.8	1,734.2	4.2
2021	62,453.7	1,560.7	2.5
2022	75,986.3	862.2	1.1
2023	92,816.2	102.0	0.1

Key Takeaway:
The number of generation applications that have commissioned into service has decreased over time.

*For a MW that started an interconnection request, it is shown in the year started. If that MW was commissioned in the same or later years, it is shown as commissioned in the same year it started.

Large Load Integration Overview



Project Status	2022	2023	2024	2025	2026	2027
No Studies Submitted	-	62	1,628	1,628	1,628	7,600
Under ERCOT Review	-	5,192	8,520	11,745	13,345	17,790
Planning Studies Approved	-	6,779	8,968	9,894	10,250	11,092
Approved to Energize	2,523	3,077	3,077	3,077	3,077	3,077
Total (MW)	**2,523**	**15,110**	**22,193**	**26,344**	**28,300**	**39,559**

- **Approved to Energize –** Projects that have received Approval to Energize from ERCOT Operations. NOTE: not all MWs in this category have been observed to be operational (see next slide)
- **Planning Studies Approved –** Projects that have received ERCOT approval of required interconnection studies. Any MWs that were not approved are reclassified as No Studies Submitted.
- **Under ERCOT Review –** Projects that have studies under review by ERCOT
- **No Studies Submitted –** Projects that are tracked by ERCOT but that have not yet provided sufficient information for ERCOT to begin review. Additionally, MWs that were not approved by ERCOT after review of planning studies are included in this category until a path to interconnect these MWs is identified or the customer cancels the interconnection request.

Key Takeaway: ERCOT continues to track nearly 40 GW of Large Load interconnection requests

- Since January 2022, 3,077 MW approved to energize.
- Another 8,968 MW with proposed energization dates on or before December 31, 2024 have had planning studies reviewed and approved.

Large Load Integration – Reliability Risks and Proposals

1. Large Loads want to interconnect faster than existing planning processes can study for reliability.
   - *Implement a formal Large Load Interconnection process.*
2. ERCOT cannot currently identify individual large loads and lacks visibility needed to predict their sensitivity to price and other factors.
   - *Require loads 25 MW or greater to provide some additional information to ERCOT.*
3. ERCOT has experienced multiple events where large amounts of load have unexpectedly disconnected during low voltage events, creating frequency disturbances.
   - *Establish a voltage ride-through standard for loads 75 MW or greater.*
4. Some large loads can vary their consumption rapidly enough to exhaust available frequency Regulation service.
   - *Encourage loads to register as CLRs and limit ramping behavior of large loads that are not CLRs.*
5. Large loads have exhibited inconsistent behavior during Resource scarcity events.
   - *Create a new Registered Curtailable Load category that ERCOT may curtail prior to shedding firm load.*

Key Takeaway: ERCOT has submitted four Revision Requests and developed a schedule to address issues and resolve outstanding comments to the ERCOT proposal.

Fall Seasonal Assessment of Resource Adequacy (SARA) Report Risk Scenario Summary

		Base & Moderate Risk Scenarios				Extreme Risk Scenarios		
Load and Resources	Total Installed Capacity	Base	High Peak Load	High Unplanned Thermal Outages	Low Wind and Solar	Extreme Peak Load	Extreme Peak Load Extreme Unplanned Thermal Outages	High Peak Load High Unplanned Thermal Outages Extreme Low Wind
Peak Demand		69,654	73,509	69,654	69,654	75,685	75,685	73,509
Resources, Fall-rated Capacity								
Thermal (outage-adjusted) and hydro	79,068	54,263	54,263	48,222	54,263	54,263	44,774	48,222
Capacity from Private Use Networks*	9,592	2,517	2,517	2,517	2,517	2,517	2,517	2,517
Wind	37,802	12,686	12,686	12,686	3,810	12,686	12,686	182
Solar	18,375	11,663	11,663	11,663	4,848	11,663	11,663	11,663
Storage	3,992	1,053	1,053	1,053	1,053	1,053	1,053	1,053
Non-Synchronous Ties	1,220	720	720	720	720	720	720	720
Total Resources	150,049	82,901	82,901	76,860	67,211	82,901	73,412	64,357
Emergency Resources		0	0	0	4,782	0	4,782	4,782
Capacity Available for Operating Reserves (Less than 1,000 MW indicates risk of EEA3 Load Shed)		13,247	9,392	7,206	2,339	7,216	2,509	(4,370)

* Reflects only the installed capacity used to deliver power to the ERCOT grid.

Key Takeaway: Low wind generation is a risk factor for experiencing energy emergency conditions during the fall season of October and November.

Yellow highlights indicate key driver(s) of projected scenario impact.

Monthly Outlook on Resource Adequacy (MORA)

- With the December report released on October 2nd, we have transitioned to probability-based analysis of the hourly risk of experiencing emergency conditions
- A Winter Storm Elliott type scenario fixes the peak load expectation to a value reflecting weather and outages comparable to that experienced during the storm

	EMERGENCY LEVEL		
	Chance of Normal System Conditions	Chance of an Energy Emergency Alert	Chance of Ordering Controlled Outages
Hour Ending	Probability of CAFOR being above 3,000 MW	Probability of CAFOR being less than 2,500 MW	Probability of CAFOR being less than 1,500 MW
7 a.m.	94.46%	3.27%	2.59%
8 a.m.	91.43%	5.38%	4.34%
9 a.m.	96.08%	2.20%	1.55%
10 a.m.	99.01%	0.59%	0.47%
11 a.m.	99.34%	0.41%	0.32%
12 p.m.	99.54%	0.24%	0.17%
1 p.m.	99.72%	0.10%	0.09%
2 p.m.	99.85%	0.06%	0.05%
3 p.m.	99.91%	0.04%	0.00%
4 p.m.	99.91%	0.02%	0.00%
5 p.m.	99.73%	0.15%	0.08%
6 p.m.	98.92%	0.65%	0.53%
7 p.m.	98.62%	0.83%	0.63%
8 p.m.	98.76%	0.81%	0.60%
9 p.m.	98.00%	1.14%	0.91%
10 p.m.	98.48%	0.92%	0.74%

Note: Probabilities are not additive.

Storm Scenario Based on Winter Storm Elliott Weather Conditions

	EMERGENCY LEVEL		
	Chance of Normal System Conditions	Chance of an Energy Emergency Alert	Chance of Ordering Controlled Outages
Hour Ending	Probability of CAFOR being above 3,000 MW	Probability of CAFOR being less than 2,500 MW	Probability of CAFOR being less than 1,500 MW
7 a.m.	81.11%	10.88%	8.17%
8 a.m.	72.71%	17.89%	14.40%
9 a.m.	86.56%	6.59%	4.58%
10 a.m.	98.51%	0.52%	0.35%
11 a.m.	99.59%	0.18%	0.13%
12 p.m.	99.78%	0.13%	0.11%
1 p.m.	99.88%	0.08%	0.06%
2 p.m.	99.92%	0.03%	0.01%
3 p.m.	99.95%	0.00%	0.00%
4 p.m.	99.97%	0.00%	0.00%
5 p.m.	99.91%	0.03%	0.01%
6 p.m.	99.27%	0.38%	0.24%
7 p.m.	96.97%	0.87%	0.53%
8 p.m.	95.95%	1.54%	0.98%
9 p.m.	94.20%	2.18%	1.40%
10 p.m.	94.56%	2.03%	1.22%

Note: Probabilities are not additive.

CAFOR is Capacity Available for Operating Reserves

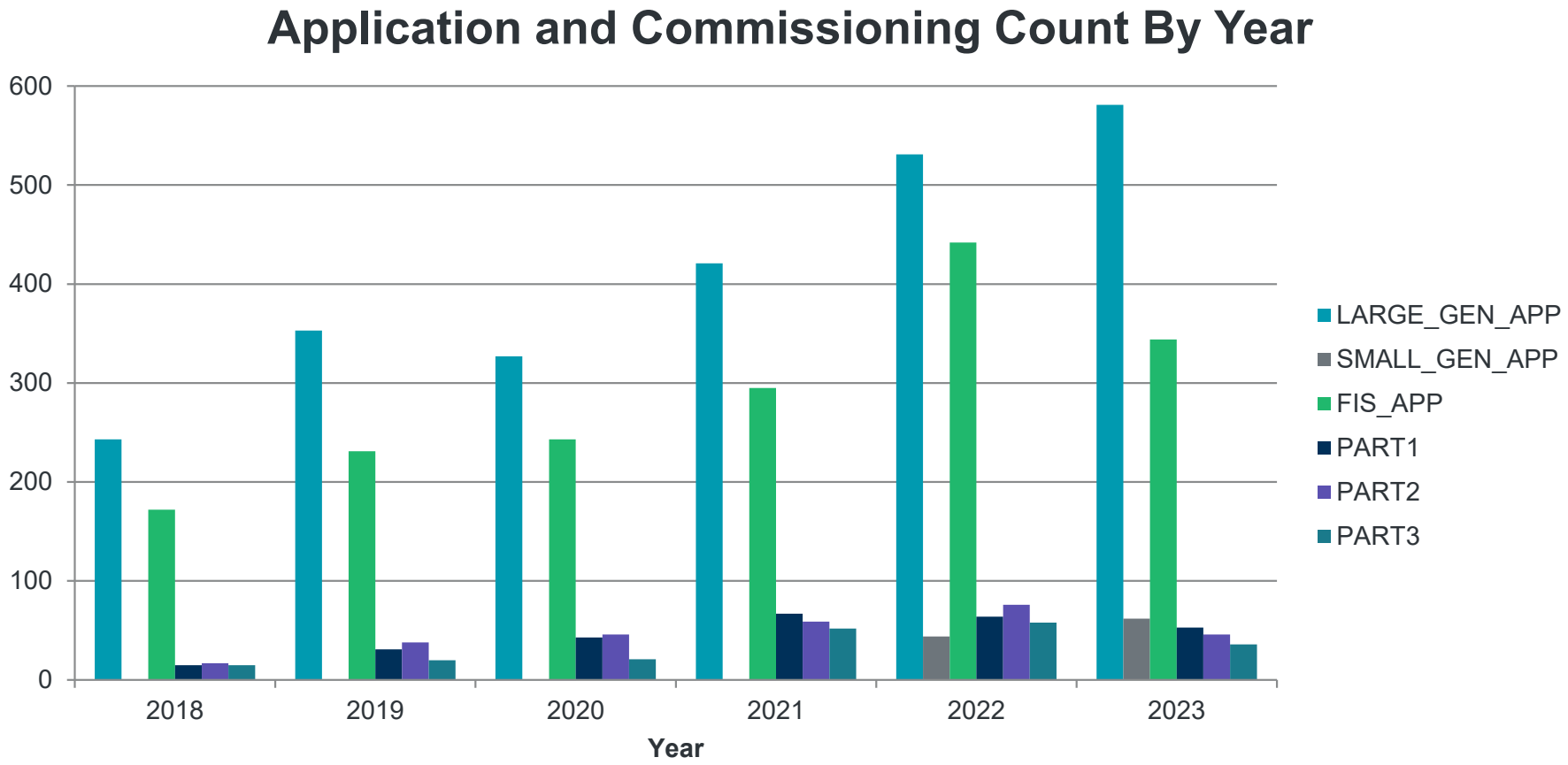
Network Modeling

- This month, ERCOT will host the North American Common Information Model (CIM) users conference which sets the standards for Common Information Models used by reliability market and planning systems.
- ERCOT modeling is publishing new Node Breaker Models for planning cases. This transition will aid to develop more detailed Planning models and create more similarity to the Operations Models used in daily operations.

Key Takeaway: ERCOT is leading the modeling approach used for grid operators.

Appendix

Large & Small Generator Interconnection Commissioning Activity

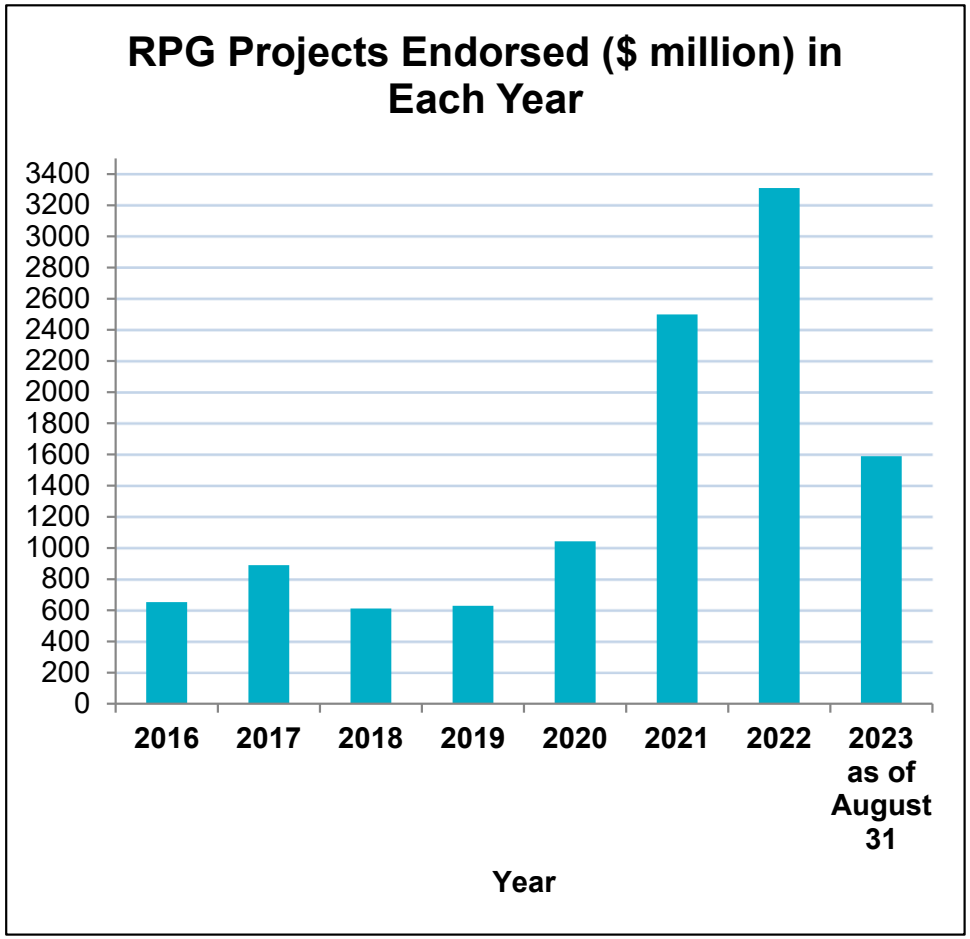


FIS_APP: Full Interconnection Study (FIS) Applications submitted to request appropriate studies by Transmission Service Provider.
Part 1: Resources that have submitted necessary info to energize their new equipment which allows equipment to be connected to the grid. Generators cannot discharge or charge yet.
Part 2: Resources submitted necessary info to start discharging/charging.
Part 3: Resource has completed all testing requirements and is approved for participation in ERCOT market operations.

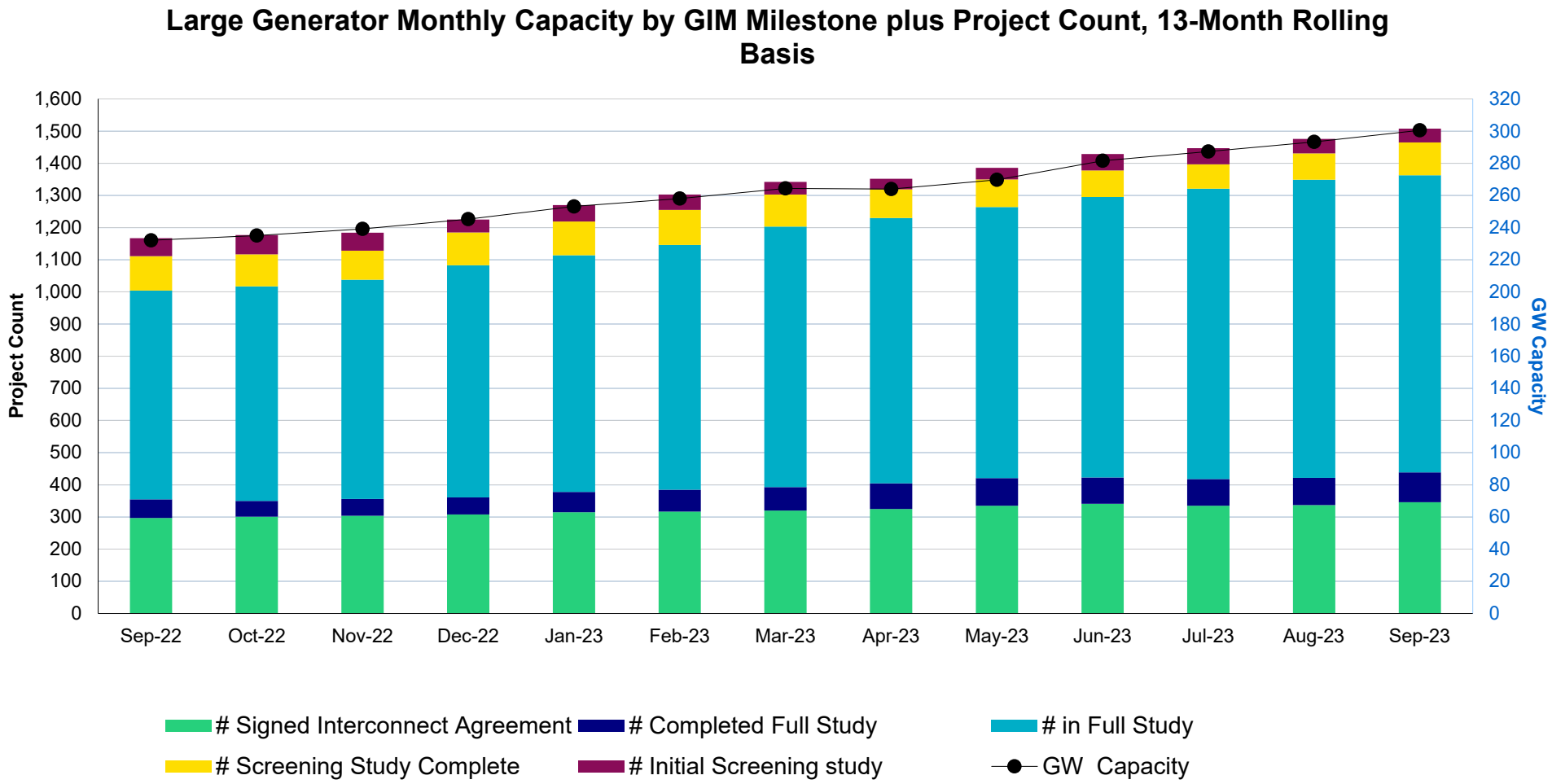
Key Takeaway: The number of interconnection requests continues to increase.

Transmission Planning Summary

- As of May 12, 2023, projects energized in 2023 total about $442 million.
  - $1.567 billion energized in all of 2022
- As of August 31, 2023, ERCOT has endorsed transmission projects totaling $1.589 billion.
  - Total endorsed transmission projects in 2022 equaled $3.311 billion
- As of May 12, 2023, projects in engineering, routing, licensing, and construction total about $12.469 billion.



Future Generation Interconnection Projects by Stage



Key Takeaway: The number of interconnection request studies active and completed is increasing but the studies are increasing faster than the completions are.