IEEE Generator Interconnection Workshop in the ERCOT region: Part 2 Generator Interconnection Studies
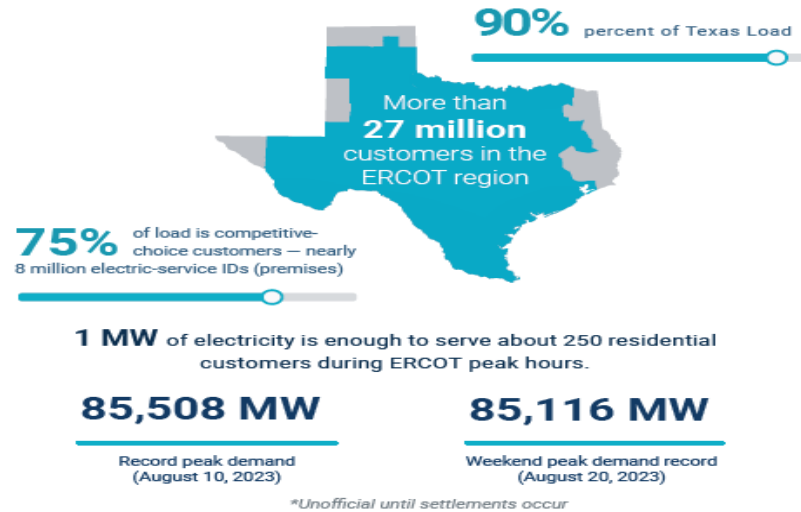
Jenifer Fernandes
Manager, Resource Integration

November 4th, 2024

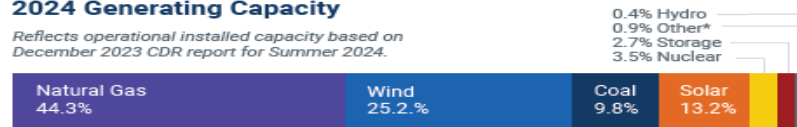# ERCOT Quick Facts

ercot
Your Power. Our Promise.

The Electric Reliability Council of Texas (ERCOT) is a nonprofit organization that ensures reliable electric service for 90 percent of the state of Texas. The grid operator is regulated by the Public Utility Commission of Texas and the Texas Legislature.

90% percent of Texas Load

More than **27 million** customers in the ERCOT region

75% of load is competitive-choice customers — nearly 8 million electric-service IDs (premises)

1 MW of electricity is enough to serve about 250 residential customers during ERCOT peak hours.

85,508 MW
Record peak demand (August 10, 2023)

85,116 MW
Weekend peak demand record (August 20, 2023)

Unofficial until settlements occur

2024 Generating Capacity

Reflects operational installed capacity based on December 2023 CDR report for Summer 2024.

0.4% Hydro
0.9% Other*
2.7% Storage
3.5% Nuclear

| Natural Gas 44.3% | Wind 25.2.% | Coal 9.8% | Solar 13.2% | |

The sum of the percentages may not equal 100% due to rounding.
*Other includes biomass and DC Tie capacity.

2023 Energy Use

*Other includes solar, hydro, petroleum coke (pet coke), biomass, landfill gas, distillate fuel oil, net DC-tie and Block Load Transfer imports/exports and an adjustment for wholesale storage load.

7.6% Other*
9.2% Nuclear

| Natural Gas 45.1% | Wind 24.3% | Coal 13.9% | | |
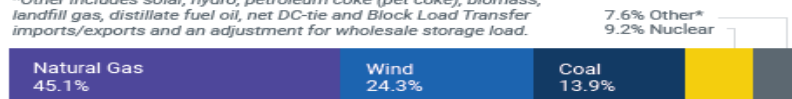
Fact Sheet
October 2024

1,873+
active market participants that generate, move, buy, sell or use wholesale electricity

1,250+
generating units, including PUNs

54,100+
miles of high-voltage transmission

103,609+ MW
expected capacity for Summer 2024 peak demand

39,450 MW
of installed wind capacity as of June 2024, the most of any state in the nation

25,333 MW
of utility-scale installed solar capacity as of June 2024

7,702 MW
of installed battery storage as of June 2024

27,881 MW
wind generation record (June 17, 2024)

69.15%
wind penetration record (April 10, 2022)

21,667 MW
solar generation record (September 8, 2024)

42.98%
solar penetration record (March 28, 2024)

$3.3 billion
transmission projects endorsed in 2022

ercot

ERCOT Interconnection Process

ERCOT Interconnection process slightly different than most of the country

- Not a Queue, each project moves on its own, but may seem like a queue at crunch points where staff limitations are pronounced.
- Deliverability not guaranteed. Only "Driveway" is built during Interconnection Process, "Highway" determined through Planning Process.
- "Connect and Manage" process where generation is connected and managed by congestion management during real time operations.
- Studies are done to ensure reliability, but not to build transmission.

ERCOT process is 18 to 30 months for Large Generation (>=10 MW) and 8 to 12 months for Small Generation (<10 MW) not including construction/supply delays.

Interconnection Information on ERCOT.com

Resource Integration page

ercot.com/services/rq/integration

SharePoint Home | G Google | Electric Reliability C... | GINR Dashboard Pr... | GINR Dashboard IT... | DEV14 GINR Dashb... | GINR Prod Cognos | Grid Geo ~ Log In | Siebel Energy | Res

MIS LOG

ercot

About ERCOT   Services   Committees and Groups   Market Rules   Market Information   Grid Information

Home > Services > Registration and Qualification > Resource Integration

Resource Integration

This section offers steps to guide Interconnecting Entities (IEs) and Resource Entities (REs) through the interconnection process for new or modified generation interconnections within the ERCOT system. Entities wishing to interconnect new generation or modify existing generation should refer to Planning Guide, Section 5.1.1 - Applicability, to determine if the proposed resource or modification must go through the Generation Resource Interconnection or Change Request (GINR) process.

Transmission-connected resources not subject to the requirements of Planning Guide Section 5 must still submit appropriate Resource Asset Registration Forms (RARF) found in the Models section below. Guidelines for Distributed Generation can be found on the Distributed Generation page. Any questions on resource integration can be directed to ResourceIntegrationDepartment@ercot.com.

IEs wishing to submit or modify a GINR application must do so through the online Resource Integration and Ongoing Operations – Interconnection Services (RIOO – IS) application, following the processes described in Planning Guide, Section 5 and the RIOO–IS IE User Guide. Links to both guides can be found in the Guides section below.

Applicable fees are specified in the ERCOT Fee Schedule.

Once a planned Generation Resource has met the requirements of Planning Guide Section 6.9 - Addition of Proposed Generation to the Planning Models, it may be registered with ERCOT. The entity that will register with ERCOT and be responsible for the Resource is the RE. This may be the IE, or another entity.

Information is also provided for Transmission Service Providers (TSPs) to sign up for and use RIOO-IS, in order to perform tasks pertaining to the interconnection process.

Resource Interconnection Handbook

Guides

Model Quality Guide   Aug 12, 2022 - zip - 1.6 MB

Assists REs/IEs submit stability models per Planning Guide Section 6.2, including the new Model Quality Testing requirements. Also includes the UDM Model Guideline and PSCAD Model Guideline.

Self Limiting Facilities In the Interconnection Process   Mar 30, 2021 - docx - 161.6 KB

This document describes the process to submit Self-Limiting Facilities in the Generation Resource Interconnection or Change Request (GINR) Process prior to full implementation of NPRR1026.

Planning Guide

Section 5, Generation Resource Interconnection or Change Request (GINR), defines the requirements and processes used to facilitate new or modified generation interconnections.

Resource Interconnection Handbook   Jun 21, 2022 - docx - 1.4 MB

Provides an overview of the Generation Interconnection or Change Request (GINR) process that Interconnecting Entities/Resource Entities must follow in order to add new generation/modify existing generation connected to the ERCOT Transmission Grid.

Generation Interconnection Overview

The generation interconnection process can be divided into three stages for the purpose of defining the interactions between the developer/owner of the generation resource, ERCOT and TSPs:

- STAGE 1 – Interconnection Request Application to QSA

- STAGE 2 – Registration and Modeling

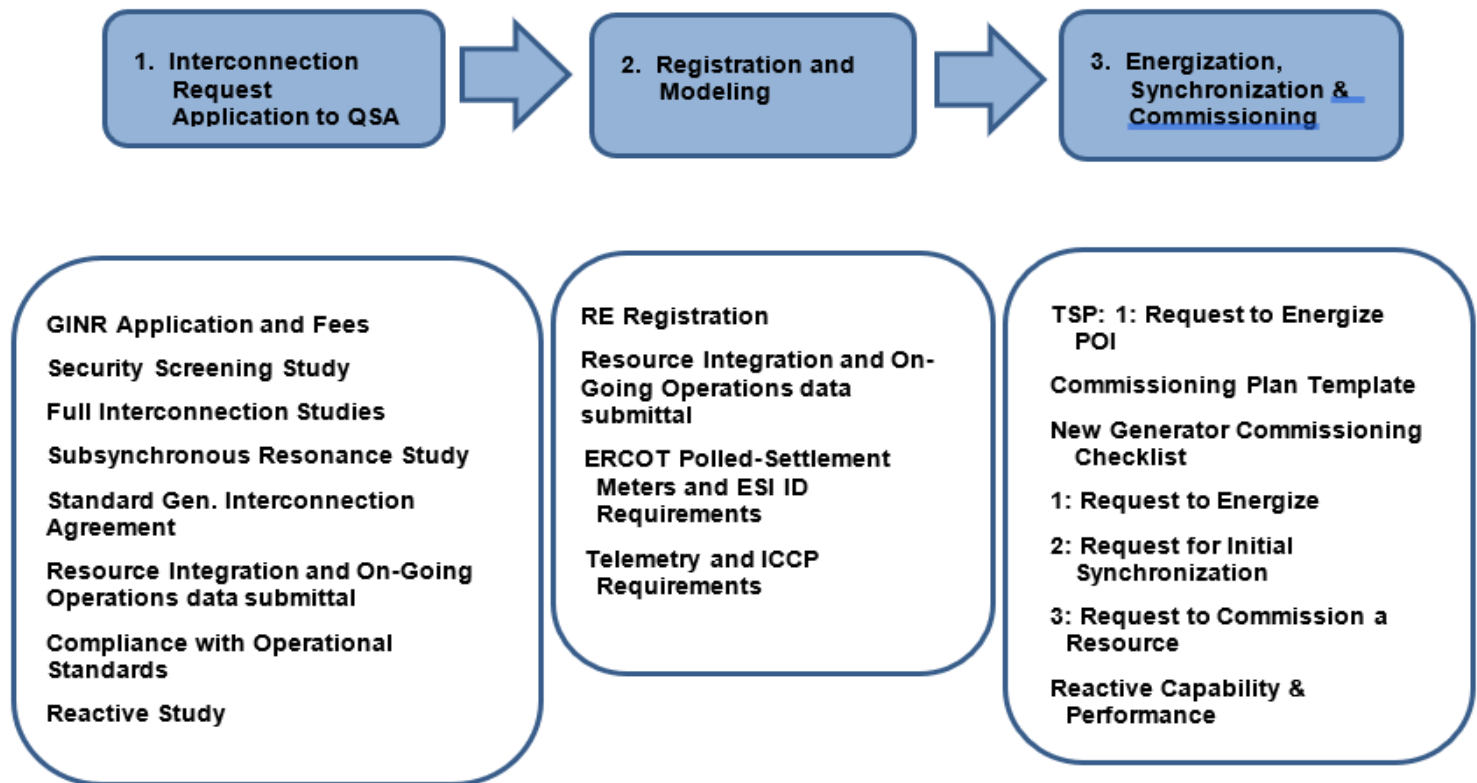- STAGE 3 – Energization, Synchronization and Commissioning

Resource Interconnection Process

Stage 1: Interconnection Request Application to Quarterly Stability Assessment

Stage 2: Registration and Modeling

Stage 3: Energization, Synchronization and Commissioning

Figure 1: Generation Resource Interconnection Process Flow

| 1. Interconnection Request Application to QSA | → | 2. Registration and Modeling | → | 3. Energization, Synchronization & Commissioning |

Stage 1:

- GINR Application and Fees
- Security Screening Study
- Full Interconnection Studies
- Subsynchronous Resonance Study
- Standard Gen. Interconnection Agreement
- Resource Integration and On-Going Operations data submittal
- Compliance with Operational Standards
- Reactive Study

Stage 2:

- RE Registration
- Resource Integration and On-Going Operations data submittal
- ERCOT Polled-Settlement Meters and ESI ID Requirements
- Telemetry and ICCP Requirements

Stage 3:

- TSP: 1: Request to Energize POI
- Commissioning Plan Template
- New Generator Commissioning Checklist
- 1: Request to Energize
- 2: Request for Initial Synchronization
- 3: Request to Commission a Resource
- Reactive Capability & Performance

Planning Guide Section 5 Small/Large Interconnections
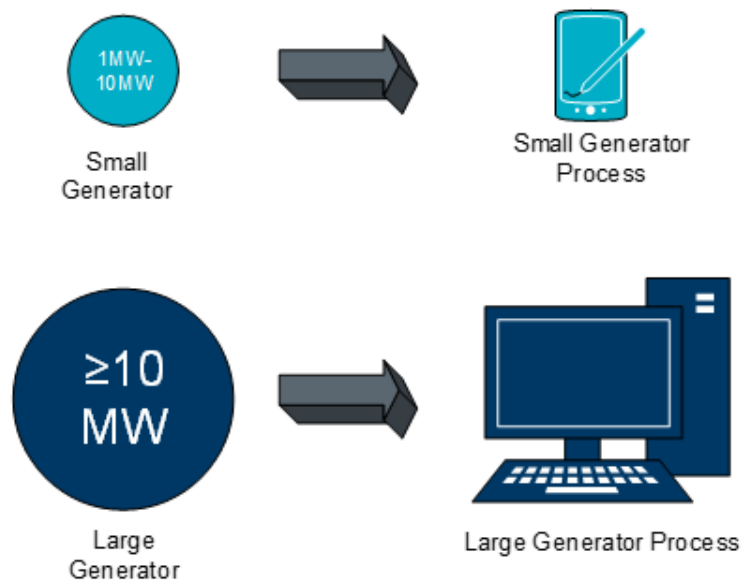
Changes to Existing Units

New Units

Current Process for Large Generation
Project Wanting Simultaneous Screening Study and Full Interconnection Study
(No Construction Bottleneck)
20 Months
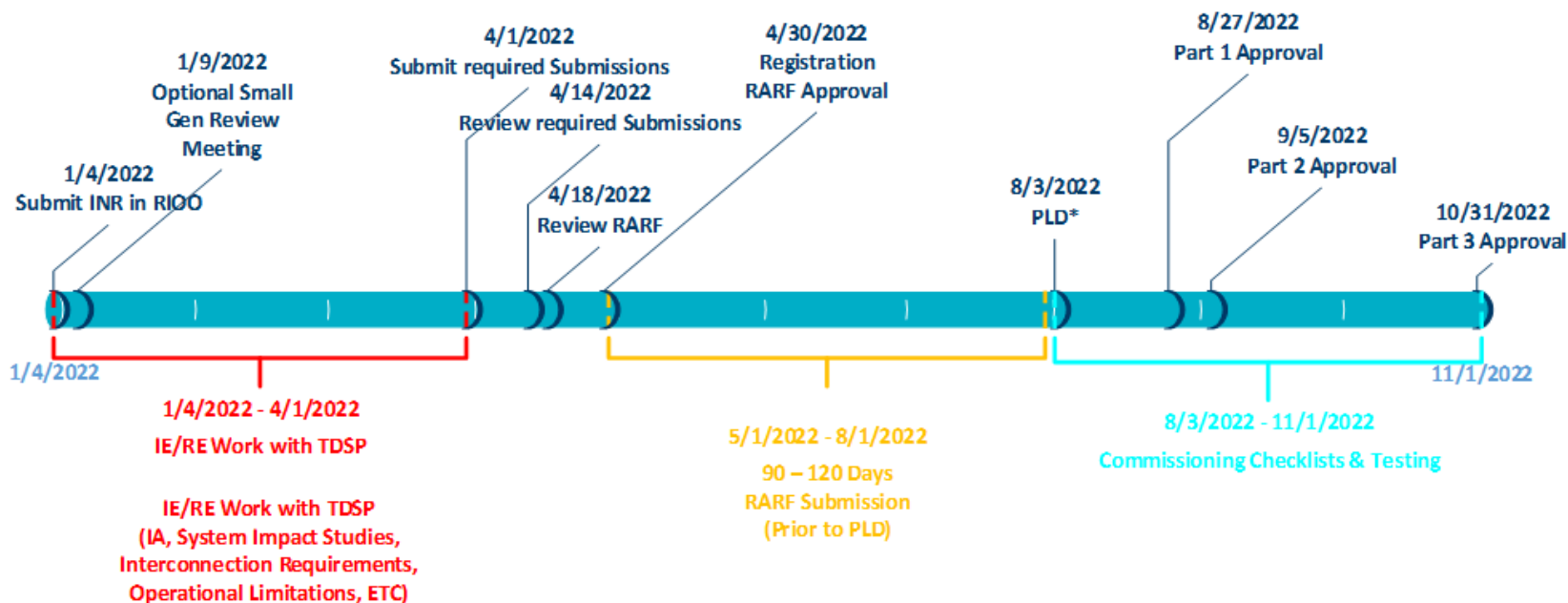
6/21/2020
Part 1 Approval

2/1/2020
QSA Deadline

5/1/2020
QSA Complete

7/1/2020
Part 2 Approval
Earliest Sync Based on QSA

1/1/2019
INR Request Initiated

4/1/2019
SS Complete

7/1/2019
Reactive Study

6/1/2020
PLD*

9/1/2020
Part 3 Approval

1/1/2019

9/1/2020

TSP Complete FIS (10 months)
Range 9 to 13 months
Kick-Off -2 weeks
Sign Study Scope – 2 months
Received Payment 1 month
SS Study – 3 months
SC – 1 month
Dynamic – 3 months
Facility – 3 months
ERCOT Approved

11/1/2019 - 2/1/2020
SGIA, NTP &
Financial Commitment

2/1/2020 - 6/1/2020
90 – 120 Days
RARF Submission

2/1/2020 - 7/1/2020
~5 months
SSR Study Completed and Approved

7/1/2020 - 9/1/2020
Testing

*Interim updates are not allowed for new units. Interim update requests must be approved by ERCOT Network Modeling. Construction time for TSP to construct needed facilities not shown. Start of construction dependent on RE giving TSP Notice to Proceed and providing the Funding to construct the interconnection facilities. Length of time needed for construction depends on facilities being constructed. The PLD shown above is normally after completion of construction.

New Process for Small Generators
RIOO Submittal Prior to TDSP Work
(8 to 10 Months Timeline for Projects after DGR Moratorium)

1/4/2022
Submit INR in RIOO

1/9/2022
Optional Small
Gen Review
Meeting

4/1/2022
Submit required Submissions
4/14/2022
Review required Submissions

4/18/2022
Review RARF

4/30/2022
Registration
RARF Approval

8/3/2022
PLD*

8/27/2022
Part 1 Approval

9/5/2022
Part 2 Approval

10/31/2022
Part 3 Approval

1/4/2022

11/1/2022

1/4/2022 - 4/1/2022
IE/RE Work with TDSP

IE/RE Work with TDSP
(IA, System Impact Studies,
Interconnection Requirements,
Operational Limitations, ETC)

5/1/2022 - 8/1/2022
90 – 120 Days
RARF Submission
(Prior to PLD)

8/3/2022 - 11/1/2022
Commissioning Checklists & Testing

*Interim updates are not allowed for new units. Interim update requests must be approved by ERCOT Network Modeling. Construction time for TSP/DSP to construct needed facilities not shown. Start of construction dependent on RE giving TSP Notice to Proceed and providing the Funding to construct the interconnection facilities. Length of time needed for construction depends on facilities being constructed. The PLD shown above is normally after completion of construction. RE should have all TSP/DSP studies and IA complete before requesting the scoping meeting.

STAGE 1 – Generation Interconnection Request Application to QSA

GINR Request → Screening Study → FIS / SSR* → Reactive Study → QSA
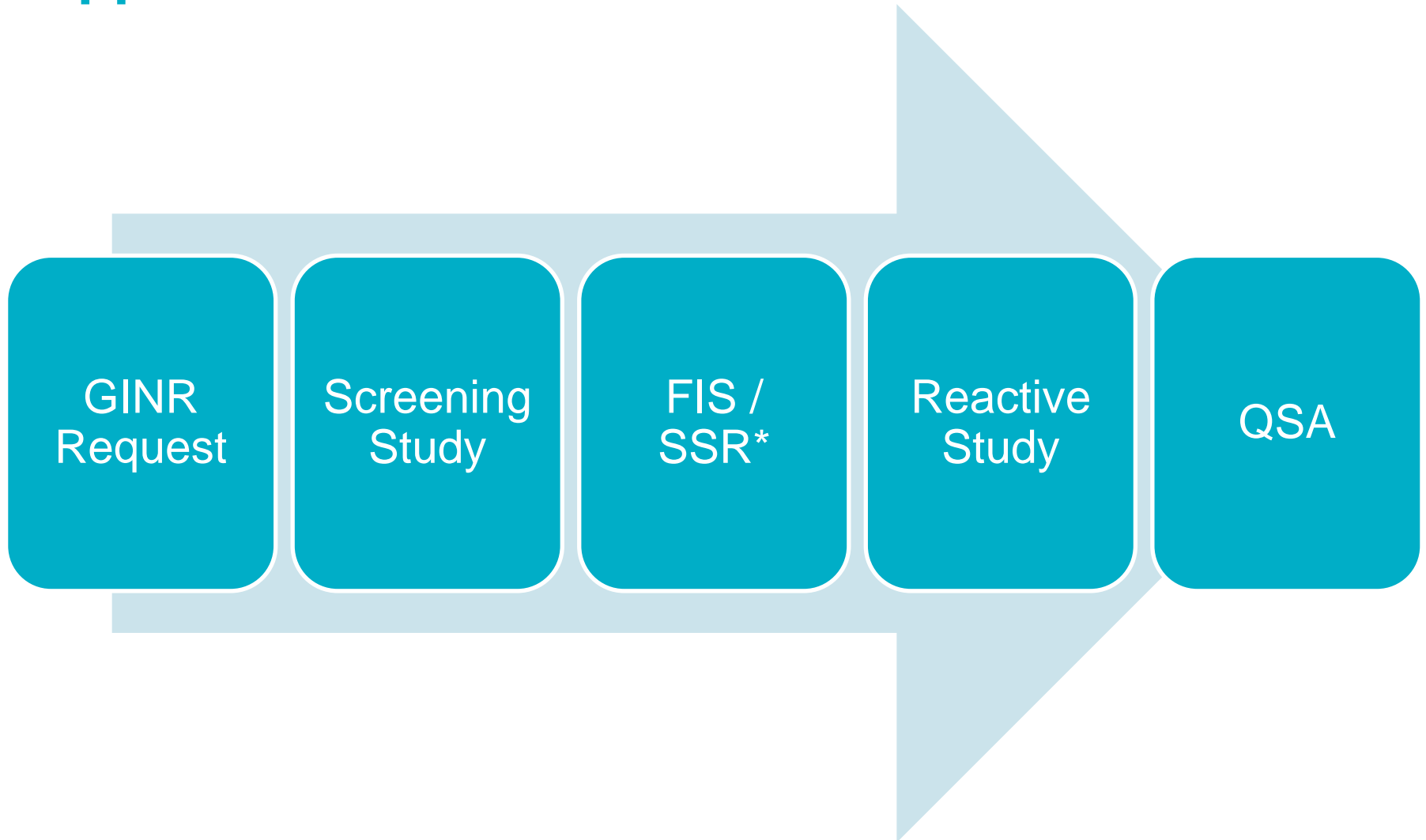
Security Screening Study (SSS)

- ERCOT conducts the Screening study for Interconnection Entity (IE) submitting SS applications.

- The SSS is a high-level, steady-state study which includes power-flow and transfer studies, based on the proposed Commercial Operation Date (COD) and a single Point of Interconnection (POI).

- Key Objective:

  - 1. It provides an indication of the likely operational limits on the real power output of the resource accounting for other known generation in the area, before significant transmission additions or enhancements may be required.

  - 2. It determines whether a sub-synchronous study will be needed.

Security Screening Study

- Contingency Analysis: Predicted loss of an element, or series of elements.
  - NERC TPL-001-4 https://www.nerc.com/pa/Stand/Reliability%20Standards/TPL-001-4.pdf
  - ERCOT-specific Reliability Performance Criteria per Planning Guide 4.1.1.2.
- In order to ensure electric reliability, ERCOT must maintain the bulk electric grid in a (N-1) secure status. This means that the system must be maintained in such a fashion that no single study contingency scenario that results in the loss of one or more pieced of electrical transmission causes an overload on any piece of equipment that remains energized.

Security Screening Study

- Shift Factor: A measure of the flow on a particular Transmission Element due to a unit injection of power from a particular Electrical Bus to a fixed reference Electrical Bus.

  – Component that determines the power flow over a given transmission line from the source node (generation) to the sink node (load).

Transfer Limit (MW)	Limiting Element	Limiting Contingency	Shift Factor (%)
0	999807 AUTO1 _78 138 11097 SANDLAKE_8 138_1	DB_ID_47812	4.22

- Shift factor of 100% is electrically close to the POI and contribution towards the congestion or problem on the transmission line.

Security Screening Study: Software

- Software required to conduct the study:
  - PSSE: Power Flow
  - PowerWorld: Shift Factor Analysis
    - Determine a list of generators that are electrically close to a GINRs proposed POI. This is important in determining which generators to turn on and re-dispatch.
  - TARA: Transfer Analysis

Security Screening Study – General Methodology

- ERCOT analyzes the ability of the pre- and post-interconnection models to accommodate energy transfers while maintaining security for "N-1" contingencies, which involve the outage of any one transmission element, such as a transmission line or generation facility.

- To simulate pre-interconnection grid conditions, the study constructs a "base case" using the most recent set of approved base cases developed by the ERCOT Steady State Working Group. This model includes anticipated substation loads and transmission facilities expected to be in-service in accordance with the Steady-State Working Group Procedure Manual. Generation included in these cases must meet the requirements of Planning Guide Section 6.9(1). **Based on this information, ERCOT identifies any transmission lines in the pre-interconnection N-1 contingency analysis that are expected to be vulnerable to overloads independently of the proposed project, so that these may be excluded from the post-interconnection analysis.**

Security Screening Study – General Methodology

- After modeling the pre-interconnection base case, ERCOT generally considers the effect of operating the proposed unit at 20% above its nominal capacity to ensure that plant's maximum generation can be accommodated. This analysis assumes that the proposed unit would displace output from generation units elsewhere on the transmission grid. For each study, ERCOT identifies overloads that may result from the proposed generation project.

- For Post-interconnection studies, two studies are preformed to evaluate the transfer capability.
  - Summer Peak: N-1 AC analysis of the system assuming summer peak load conditions. Based on COD, will use the year relevant to the project's interconnection (ex. for COD of 7/1/2027-SUM 2028, 5/1/2027-SUM 2027)
  - High Renewable/Minimum Load (HRML): N-1 AC analysis of the system assuming the latest high renewable and low load conditions.
  - Summer and High Renewable Post- Interconnection N-1 Analysis
    - 120% capacity of new generator, and associated transfer limits, limiting element, limiting contingency, shift factors

STAGE 1 – Full Interconnection Study

Full Interconnection Study (FIS)

•   Within **180 days** of the date ERCOT notifies the IE of the SSS results, the IE must submit a change request on the RIOO-IS system to indicate its desire to pursue a Full Interconnection Study, or the GIM (GINR) will be cancelled.

FIS Scope Meeting

•   Within **10 Business Days** of receiving the RIOO-IS change request to proceed with the FIS from the IE, ERCOT will designate the lead TSP for the FIS. The lead TSP will then arrange a FIS kick-off meeting with ERCOT, the IE and other TSPs desiring to participate in the study.

STAGE 1: FIS Scope Meeting

- The lead TSP will arrange a FIS kick-off meeting with ERCOT, the IE and other TSPs desiring to participate in the study. During the meeting, the IE will discuss the GIM application, and the TSP will discuss the overall scope, timetable of activities, studies being performed, anticipated facilities needed, etc. ERCOT will discuss the SSS results.

- The IE and TSP should reach an agreement on the FIS scope. ERCOT will attempt to mediate if an agreement cannot be reached within 60 days.

STAGE 1: Full Interconnection Study (FIS)

- The generator application will either be for a GINR app without FIS application (screening study only) or simultaneous GIM+FIS (Full Interconnection Study).

- In the case where the IE submits a GIM+FIS application, we may waive the full screening study.

- IE must provide sufficient data to the TSP to perform the FIS studies.

- FIS includes the following performed by the TDSP:
  - Steady-state
  - Short-circuit
  - Stability
  - Facility

Full Interconnection Study (FIS) – Steady State

- TSPs use the most recently approved Steady State Working Group (SSWG) base case depending on the project Commercial Operation Date (COD).
  - Nearby units dispatched at high output.
  - Applicable Planned Generators meeting PG 6.9.
  - July 1st is the cutoff date for selecting base cases.
    - COD 5/1/2024: 2024 Summer peak case, most recent HRML
    - COD 7/1/2024: 2025 Summer peak case, most recent HRML
- TSP(s) performs analysis on contingencies (P1-P7) and Outages that could result in a violation of NERC Reliability Standards, Protocols, Planning Guides and Operating Guides.

Full Interconnection Study (FIS) – Steady State

- TSP identifies any additional facilities/upgrades needed and identifies any system limitations preventing full output of the generator.

- TSP identifies new voltages or thermal loadings directly attributable to the proposed Plant.

Full Interconnection Study (FIS) – Short Circuit

- TSPs use System Protection Working Group (SPWG) base case based on the project COD.

- TSP will determine the maximum available fault currents at the interconnection substation for determining switching device interrupting capabilities and protective relay settings.

- If any of the required transmission system facilities identified in the FIS facility study associated with the GIM result in violations of the TSP's short circuit criteria, the TSP shall plan and provide facilities to address such violations.
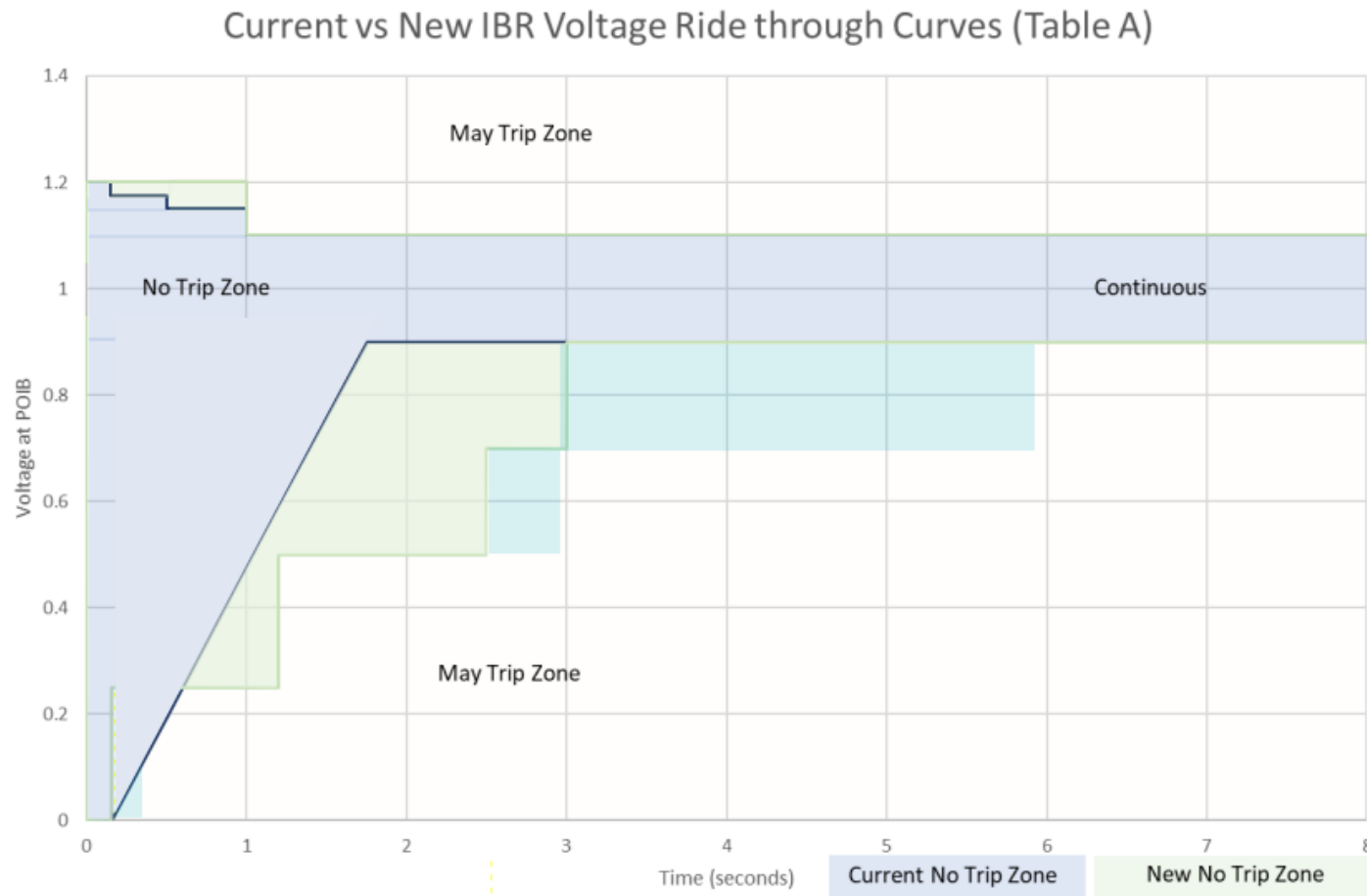
Full Interconnection Study (FIS) – Stability

- TSPs use the most recently approved ERCOT Dynamics Working Group ("DWG") stability base case.

- Study will analyze the performance of the proposed generator and the ERCOT System in terms of angular stability, voltage stability and excessive frequency excursions.

- Additional studies may include small signal stability or critical clearing time analyses where the number of cycles for which a transmission line can sustain a fault without causing loss of synchronism of any of the Resource is compared to the response of the protection systems.

- TSP will perform transient stability studies to meet NERC Reliability Standards, Protocols, Planning Guides, or Operating Guides

  - IE needs to provide TSP the needed data to start the FIS stability study (RIOO substation details, Dynamic files and MQT Report)

Full Interconnection Study (FIS) – Stability

- Case conditioning:
  - Latest DWG base case
  - Addition of Generators meeting PG 6.9.
  - Dispatch generators meeting PG 6.9 to full output. Dispatch generators in the study area to full output. Dispatch levels in the study area maybe reduced to respect any published stability limit or to reach a power flow solution.
- Voltage Ride-Through Analysis to verify the Generator is in compliance with Nodal Operating Guides, Section 2.9.

Full Interconnection Study (FIS) – Stability

- Voltage-Ride Through (NOGRR245) for IBR

Current vs New IBR Voltage Ride through Curves (Table A)

Full Interconnection Study (FIS) – Stability

- Stability Study Results:
  - Simulation plots showing stability or instability under certain contingencies.
  - Identify if the addition of the proposed generation causes any instability.
  - TSP identifies instability (other than instability identified for extreme events) after the stability study is finalized then then IE and TSP need to investigate alternative solution to resolve the instability.

Model Quality Test

- Per Planning Guide 6.2 (5): The IE is required to provide dynamic data which include a model with parameter that accurately represent the dynamics of the device and in compliance with Planning, Operating Guides and DWG procedure manual.

Check	Model Requirement [PG Section 6.2(5)(a) and Section 5.5]
	Consulted the Deliverables section at the end of this document for additional details?
	A PSS/e version 35 model (.raw, .dyr files and .dll file if a user-defined model)
	The model should not have been identified as unacceptable by NERC[2]
	The model should include switched shunt and on-load transformer tap initialization scripts (PSS/e Python format) and include dynamic control models
	The number, size, and name of units in PSS/e and TSAT should match registration and should not be aggregated differently. Unit definitions can be found in RIOO-RS under "Unit Attributes".
	IRR (wind and solar) models should be provided set up for "no-headroom" meaning that a dispatch less than Pmax does not result in a power increase to a frequency drop. The model manual should describe steps to place the model in a "headroom" state.
	PSS/e model in Excel Template format. Blank Templates are downloadable from: https://www.ercot.com/services/rq/re . For User-Defined Models (UDMs), email dynamicmodels@ercot.com with "*Template Request*" in the subject line.
	A TSAT model if submitting a user-defined PSS/E model (.raw, .dyr, .dll, and .tudm files)
	Two TSAT example cases, one set up using bus numbers matching the PSS/e case and the other set up using equipment names. Include a space in the generator node name(s) to confirm that the model is compatible with space characters. (include .pfb plus above files)
	The TSAT .dyr file should interoperate with the PSS/e .dyr file.
	The TSAT .tudm file should only define the structure of the model and shall not include any project-specific information
	Model manuals (okay to reference PSS/e manuals if using standard library models). PSCAD models must include manuals.
	PSCAD for IBRs, embedded in the PSCAD Template downloadable from Dynamic Templates at https://www.ercot.com/services/rq/re
	Completed PSCAD Guideline checksheet. Available in the Model Quality Guide package.
	Model Quality Test report per DWG Procedure Manual. Plots should overlay PSS/e, PSCAD, and TSAT models as required. [PG Section 6.2 (5)(c), PG Section 5.5(4)]
	Plant Verification Report if updating field settings or any time per PG 5.5(5)(c). Details on this report can be found in the About Verification Report included in this package.
	A Unit Model Validation ("Hardware Benchmark") report is required to enter the QSA. [PG Section 6.2(5)(d), DWG Procedure Manual Section 3.1.6]

Model Quality

Requirement	Applicable Facilities	Required Tests[4]	When to Update	Responsible Entity	Planning Guide Language
Model Quality Test for PSS/E, TSAT, and PSCAD Models (A single report should show the PSS/E, TSAT, and PSCAD model responses overlaid on the same plot axes.)	All Resources and Inverter-Based Transmission Elements • TSAT required if utilizing a user-defined model (UDM) • PSCAD generally required for Inverter-based Resources (IBRs) and Inverter-based Dynamic Transmission Elements	Flat start, small and large voltage disturbance, small frequency disturbance, and system strength tests (system strength test is only required for inverter-based devices) When running PSCAD MQT, also include: • Phase angle jump test	A new or updated PSS/E, TSAT, or PSCAD model. Model updates are required: 1. When there is a change at the facility (refer to flow chart on previous page). 2. To enter QSA. 3. Before requesting Part 3 approval. 4. Within 30 days of Part 3 approval. 5. Completing MOD-026/027 studies.	Facility owner (RE, IE, or TSP)	PG 6.2(5)(c), PG 6.2.1, PG 5.5(5)(b) PG 5.5(4), DWG Procedure Manual 3.1.5
Unit Model Validation for PSCAD Model[2]	Inverter-based Resources (IBRs)	Step change in voltage, large voltage disturbance, system strength, phase angle jump, and subsynchronous tests	A new PSCAD model provided after 3/1/21. (UMV reports should not need updating for model parameter updates.)	Facility owner (RE or IE)	PG 6.2(5)(d), DWG Procedure Manual 3.1.6
Model Parameter Verification ("Verification Report")	All Resources and Inverter-Based Transmission Elements	Provide evidence that tunable model parameters match what is implemented in the field. Evidence can take the form of screenshots, nameplate photographs, signed manufacturer commissioning reports, etc.	A report is required: 1. Within 30 days of Part 3 approval, 2. Within 12 to 24 months after Part 3 approval. (Projects built before March 1, 2021, required by March 1, 2023), 3. A minimum of every ten years, and 4. Within 30 days of implementing a change at the facility.	Facility owner (RE, IE, or TSP)	PG 5.5(4) PG 5.5(5)(c), PG 6.2(5)(b)

[Model Quality](#)

Full Interconnection Study (FIS) – Facility

- The facility study provides complete details of the transmission and substation facilities needed to connect a generator to a new or existing substation on the ERCOT Transmission Grid. These details include conceptual design descriptions, construction milestones, and cost estimates.

    - If the costs of the Transmission Facilities are expected to exceed $25,000,000, ERCOT shall perform an Economic Study. This study helps determine the annual production cost saving and annual generator revenue reduction resulting from the project addition.

FIS Report and Follow-up

- Once studies are approved, ERCOT will notify the TSP and the IE when each study element report is posted. The TSP shall provide a copy of each final report to the IE upon request.

- After completion of the FIS, if the IE wishes to proceed with any proposed transmission-connected project, the IE must execute a new or amended Standard Generator Interconnection Agreement (SGIA) with the appropriate TSP.

Other Studies

- Subsynchronus Resonance Study (SSR)
  - Provided by TSP. Required per NP section 3.22
  - SSS checks potential SSR vulnerability. If vulnerable to SSR, the IE shall be responsible for either installing SSR countermeasures or developing a SSR Mitigation Plan.

- Reactive study
  - Provided by IE. Required per NP section 3.15 & OG 2.7
  - Provides an analysis of the reactive capability of the proposed interconnected generation facilities. Includes equipment and systems that are to be installed to meet ERCOT reactive support requirements.

Quarterly Stability Assessment (QSA)

- ERCOT conducts a stability assessment every three months to assess the impact of planned new or modified generation proposing to synchronize to the ERCOT System five to seven months in the future as shown in PG 5.3.5.

Generation Resource Initial Synchronization Quarter	Last Day for an IE to meet prerequisites as listed below	Completion of Quarterly Stability Assessment
Upcoming January, February, March	Prior August 1	End of October
Upcoming April, May, June	Prior November 1	End of January
Upcoming July, August, September	Prior February 1	End of April
Upcoming October, November, December	Prior May 1	End of July

Quarterly Stability Assessment (QSA)

Requirement	Status
Completed and approved FIS	
Steady state study	
Short circuit study	
Dynamics study	
Facilities study	
Completed and approved reactive study	
Signed SGIA	
Financial commitment	
Notice to Proceed	
RIOO-Create substation details "Planning" commitment level complete?	
PSSE Dynamics Model	
TSAT Dynamic Data	
TSAT Dynamic Data Approved by ERCOT Operations?	
Model Quality Test Package for PSSE (PGRR075)	
Collector System Model [(.raw + .seq) OR .OLR files are accepted]	
Collector System Template	
PSCAD Model and PSCAD template (.psc or .pscx files are accepted)	
Model Quality Test Package for PSCAD received?	
PSCAD Unit Model Validation received?	
PSSE and PSCAD models and tests validated for usability by ERCOT DSD?	
Air permit from TCEQ (if required)	
Declaration of water adequacy (if not IRR)	

STAGE 2: Resource Registration and Modeling Milestones

Registration of RE → Identify MRD → Submit Full Registration Data → EPS Meter / Telemetry Set Up

Stage 2: Registration and Modeling

The Resource Integration and Ongoing Operations – Interconnection Services (RIOO-IS) is the application used to contain the generator and associated equipment modeling data needed for ERCOT systems. The contents of RIOO-IS are governed by the [Resource Registration Glossary](). Each field in RIOO-IS must be submitted at certain times during Stage 1, 2 and 3 as indicated by the following columns in the Glossary:

- Full Interconnection Study (FIS)
- Planning Model (to meet PG 6.9)
- Full Registration

The first Resource Data is due at FIS. This data is then expanded for the Planning Model. At Full Registration, all Resource data must be submitted in RIOO-IS. **The RE should reach out to ERCOT at least <u>30 days</u> prior to the deadline for their Production Load Date (PLD) to allow for calls and review of the resource data.**

For Full Registration, Resource data must be submitted **at least 15 days** prior to the *Deadline for Model Change Submit Before* date for the desired PLD. **Data submitted within 15 days of the deadline may not get processed in time to be included in the desired PLD!**

Once the data has reached the Production Load Date (PLD) where the generator(s) are modeled in the Network Operations Model and preparing for energization, the RE shall use RIOO-Resource Services (RIOO-RS) to submit any changes to that data.

Stage 3: Resource Commissioning Milestones

Submit Commissioning Plan

Part 1: Energization

Part 2: Synchronization

Part 3: Full Commissioning
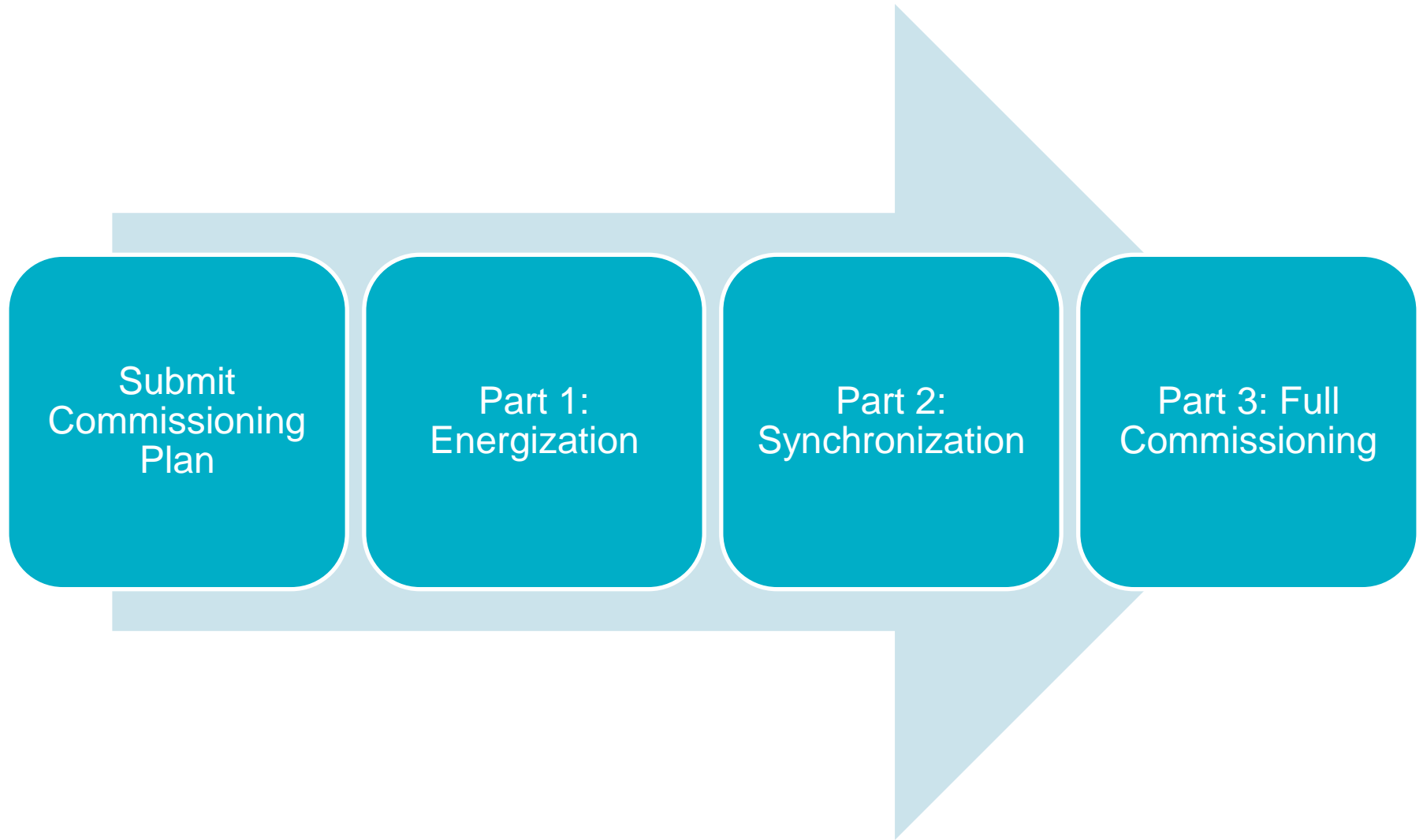
STAGE 3: Energization, Synchronization and Commissioning

ERCOT New Generator Commissioning Checklist

The three-part ERCOT New Generator Commissioning Checklist is designed to coordinate the energization, synchronization, and commissioning of a new or modified generator once all qualification measures have been met to the satisfaction of ERCOT.

- Part 1: Request for Energization of Resource Entity Equipment

- Part 2: Request for Initial Synchronization (up to 20 MVA, > 20 MVA)
    - IRR Curtailment Test
    - Reactive Power Capability Test
    - Voltage Support Service (VSS) Test (Calculated)
    - Automatic Voltage Regulator (AVR) Test
    - Primary Frequency Response (PFR) Test
    - Power System Stabilizer (PSS) Test

- Part 3: Request to Commission a Resource

- Generator has now completed the interconnection process.

Generation Interconnection Requests

1,881 active generation interconnection requests totaling 372 GW as of September 30th, 2024
(Solar 154 GW, Wind 35 GW, Gas 26 GW, and Battery 154 GW)

(Excludes capacity associated with projects designated as Inactive per Planning Guide Section 5.7.6)

Monthly Capacity by Fuel Type plus Project Count, 13-Month Rolling Basis
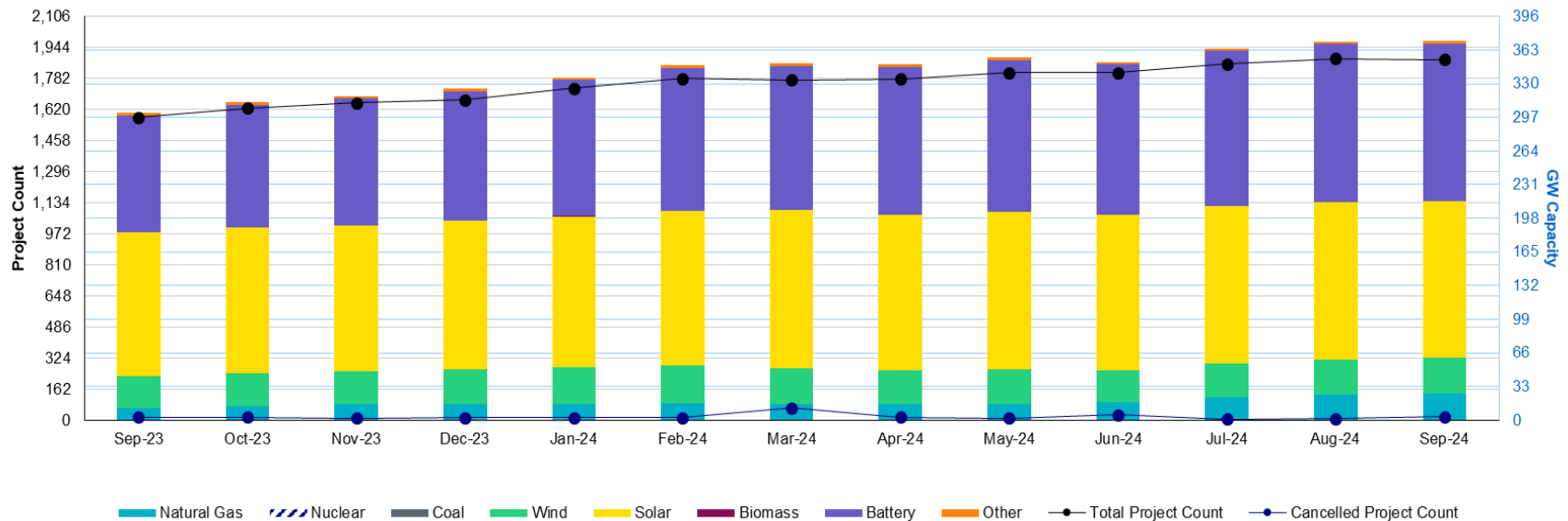
A break-out by zone can be found in the monthly Generator Interconnection Status (GIS) reports available on the ERCOT Resource Adequacy Page: http://www.ercot.com/gridinfo/resource
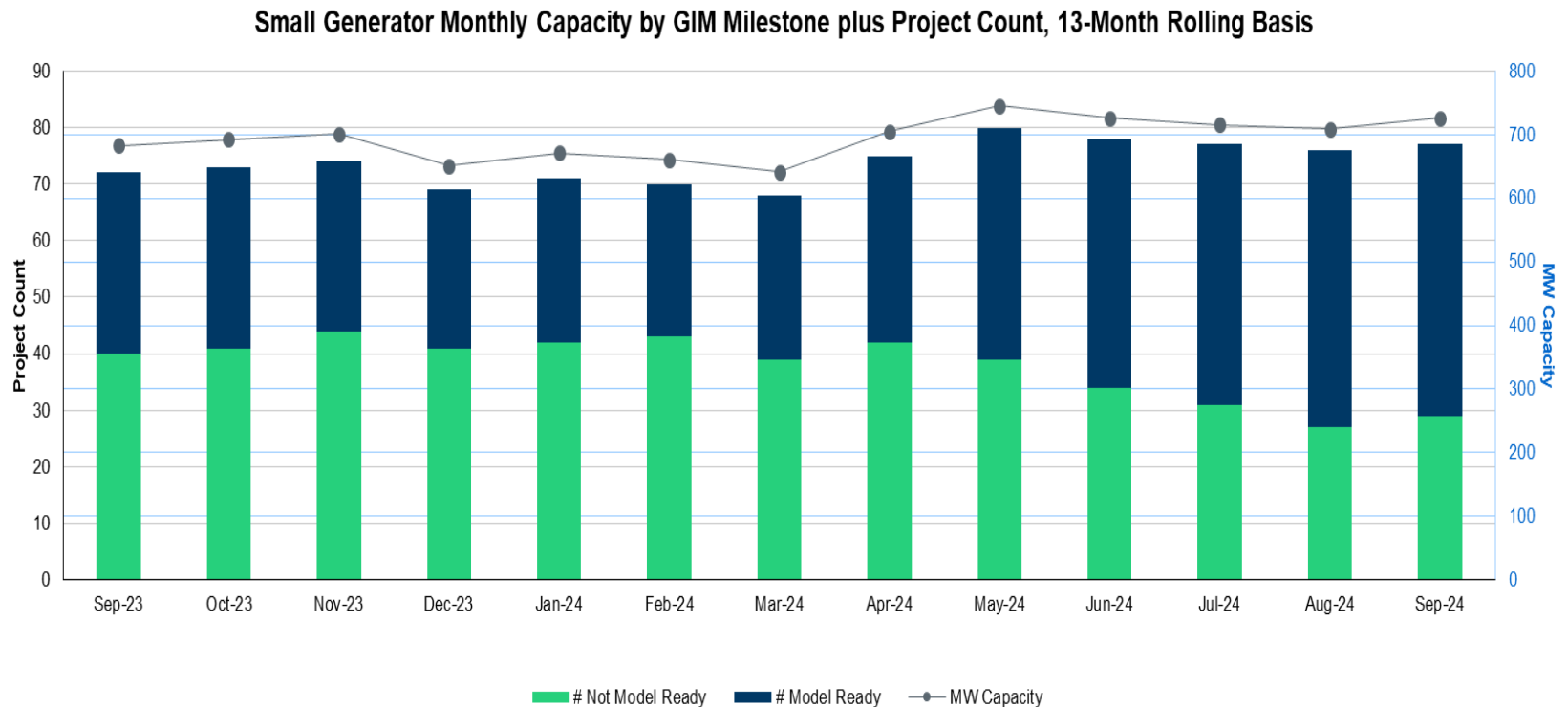
Generation Interconnection Capacity by Fuel type
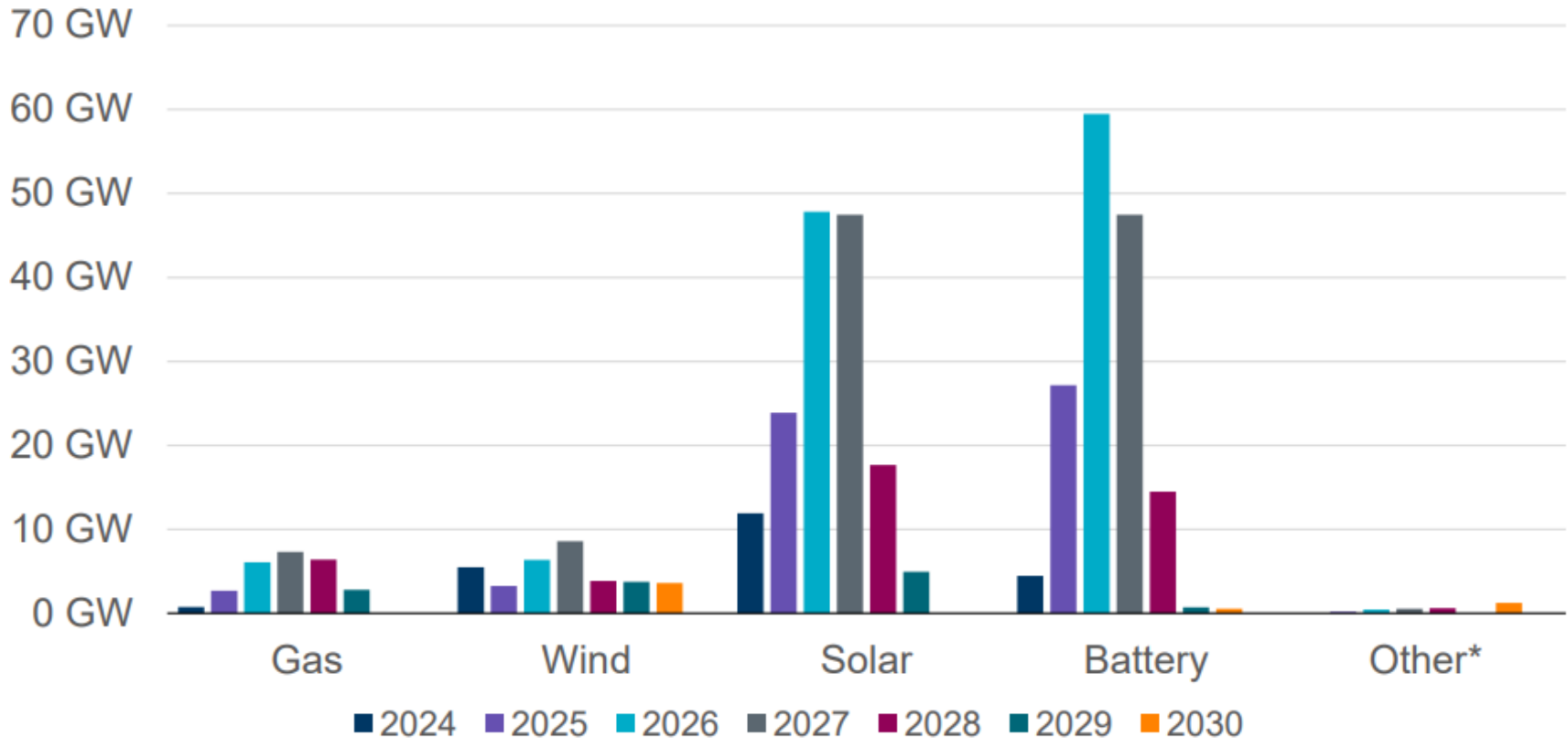
A break-out by zone can be found in the monthly Generator Interconnection Status (GIS) reports available on the ERCOT Resource Adequacy Page: http://www.ercot.com/gridinfo/resource

Generation Interconnection Requests

Small Gen- 29 projects Not Model Ready, 48 projects Model Ready

Small Generator Monthly Capacity by GIM Milestone plus Project Count, 13-Month Rolling Basis

A break-out by zone can be found in the monthly Generator Interconnection Status (GIS) rep available on the ERCOT Resource Adequacy Page: http://www.ercot.com/gridinfo/resource

Questions?