RMS ENERGY

EXPERTISE IN ERCOT REGION

Vast experience in supporting generation and load developers in ERCOT region

Decades of support provided to developers and Transmission and Distribution Service Providers (TDSPs)

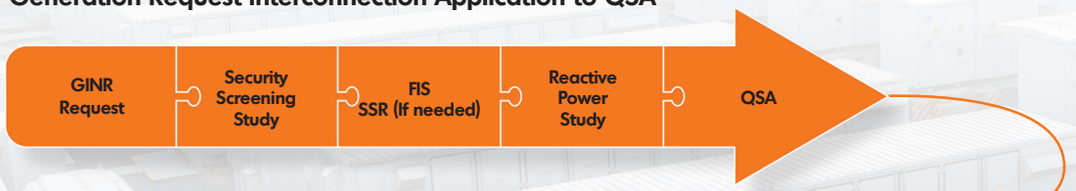
Expertise in interconnection studies from developers and TDSPs perspective, accurate model development, tuning, testing, post commissioning compliance and regulatory support

GENERATION INTERCONNECTION PROCESS

The ERCOT generation interconnection process can be structured into three high-level stages. RMS Energy provides comprehensive services covering all stages of interconnection plus pre-application and post-COD services. The comprehensive generation interconnection stages are:

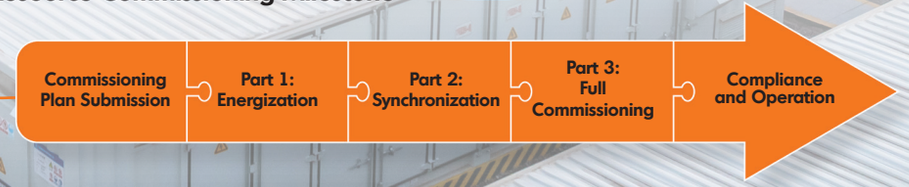
- Pre-Application Stage
- Stage 1: Generation Interconnection Request Application (GINR) to QSA
- Stage 2: Resource Registration and Modeling
- Stage 3: Resource Commissioning and Compliance
- Post-COD stage

Generation Request Interconnection Application to QSA



Resource Registration and Modeling

Resource Commissioning Milestone



MAJOR ERCOT SUPPORT EXPERIENCE OF RMS ENERGY'S EXPERTS

INTERCONNECTION SUPPORT
Applications, including all technical data, SLD, Site Plans, PSS/E, PSCAD, TSAT, and ASPEN models
PSS/E vs PSCAD vs TSAT Model Quality Tests (MQT) known as the model benchmarking study
As-built Modeling and NERC MOD and PRC studies
Complete support for FIS, QSA, Commissioning, and Compliance
STUDY SUPPORT
Feasibility Studies, including injection and withdrawal studies
System Impact Studies, short-circuit, load flow, transient stability, facility study
Sub-Synchronous Resonance (SSR) Screening Studies
Reactive Power Study, Pre- and Post-Energization Harmonic studies
EMT Studies such as TOV, TRV, Lightning, and insulation coordination
Equipment duty, arc flash, and grounding studies

TECHNOLOGICAL VARIETY IN RMS ENERGY'S EXPERIENCE IN THE ERCOT

EXPERIENCE	TYPES
Generation	Onshore Wind, Offshore Wind, Battery Energy Storage System (BESS), Solar/PV, Hydroelectric, Thermal, Synchronous
Large Load	AI Data Center, Cryptocurrency, Green Hydrogen (GH2)
Transmission and FACTS	AC Overhead, Underground, HVDC Overheard and Submarine, STATCOMs and SVCs
Sample OEMs	Inverters: SMA, Sungrow, Power Electronics, Tesla, Ingeteam, Sineng, Gamesa Electric, EPC Power, TMEIC Wind Turbines: GE, Vestas, Siemens Gamesa, Acciona/ Nordex, HVDC and FACTS: ABB, Siemens

ERCOT GENERATION INTERCONNECTION PROCESS

Pre-Application Stage

Initial Studies: Security Screening Study (SSS)

RMS Energy provides the following services to support new and existing developers before entering the interconnection application process:

- Conducting system-wide screening analysis for feasible points of interconnection (POIs) in the ERCOT Network
- Conducting POI-specific injection analysis for maximum MW injection without violating network constraints

The services provided for pre-application stage are to act as shadow studies to ERCOT's evaluation and provide decision-making inputs to developers before committing to interconnection application process.

Stage 1: Generation Interconnection Request Application (GINR) to QSA

RMS Energy provides the following services to support developers in providing the models and applications required to pass ERCOT's FIS and QSA requirements. As such, the following are the services offered:

- Interconnection application support to provide the requirements needed for submitting an INR in ERCOT's RIOO
- ERCOT FIS package to initiate the interconnection studies by the TSP
- Providing preliminary collector and project substation design drawings
- Developing aggregated and detailed PSSE models of the proposed project
- Developing plant-level PSCAD model of the proposed project
- Conducting Model Quality Test (MQT) for PSSE, TSAT*, and PSCAD models as outlined in the Dynamic Working Group (DWG) Guideline
- Benchmarking PSSE, TSAT, and PSCAD MQT results
- Conducting a detailed reactive power study as specified in ERCOT's Reactive Study Guide

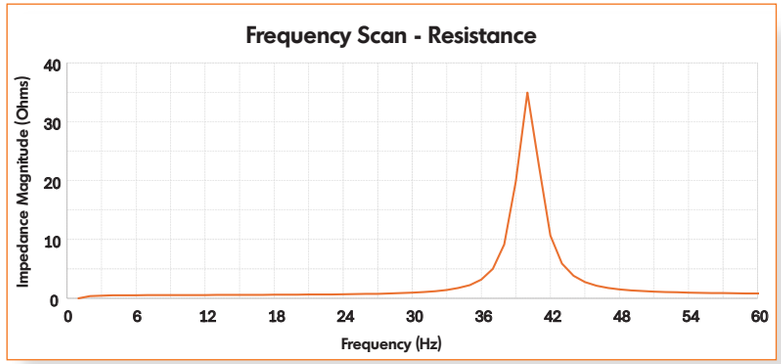
* TSAT model is required only if a User-Defined Model (UDM) is used for any dynamic device model

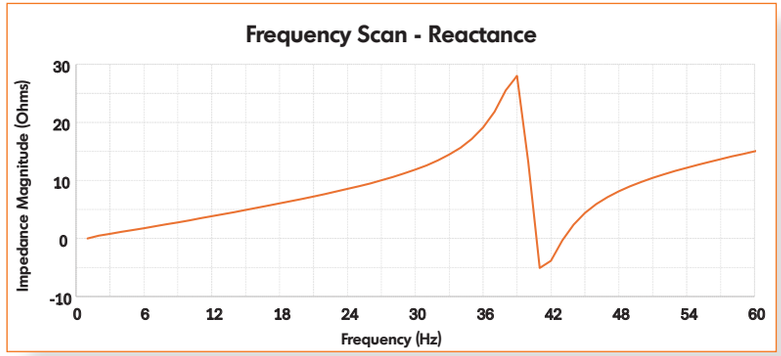
Sub-Synchronous Resonance (SSR) Study

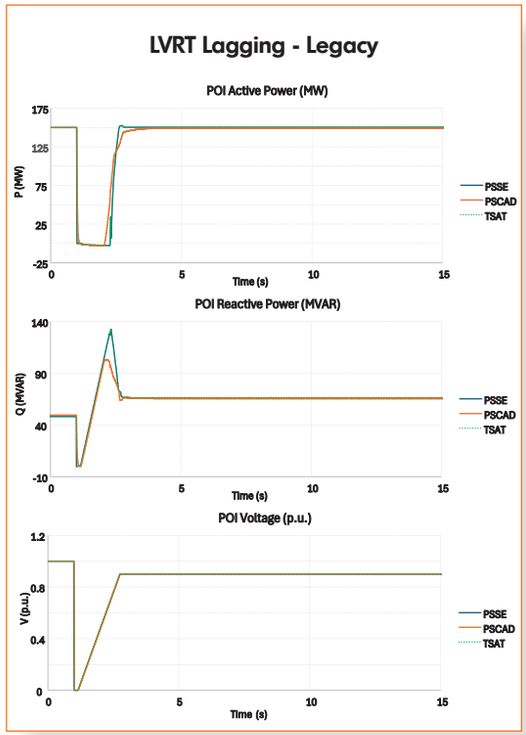
- If an SSR risk is identified during security screening, the lead TSP will conduct a SSR study. At this stage, RMS Energy provides expertise to determine a solution to alleviate the SSR issue. RMS Energy will coordinate and collaborate with all stakeholders including ERCOT, TSP, OEM, and Developer to determine the best approach in addressing the SSR issue
- Once a mitigation plan is identified, the IE must implement SSR countermeasures or a mitigation plan approved by ERCOT

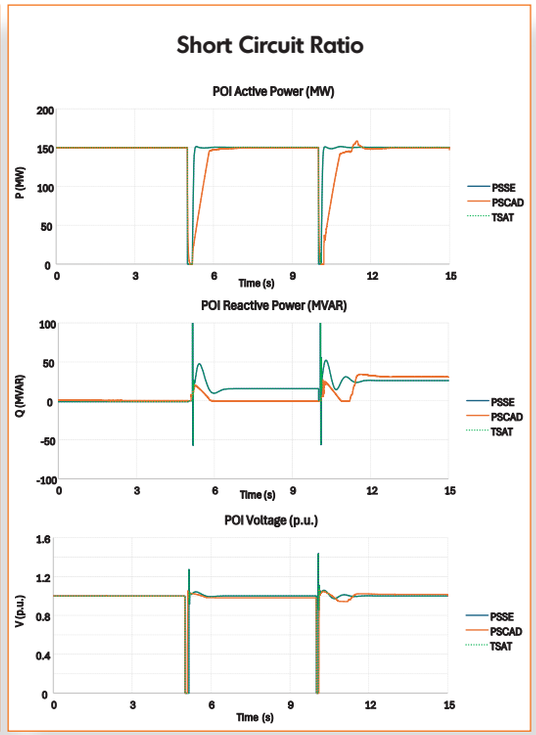
ERCOT MODEL QUALITY TEST (MQT)

TEST #	TEST NAME	TEST #	TEST NAME
1	Flat Run	7	LVRT Leading - Legacy or preferred Profiles
2	Voltage Up 3%	8	LVRT Lagging - Legacy or preferred Profiles
3	Voltage Down 3%	9	HVRT Leading - Legacy or preferred Profiles
4	Frequency Up 0.3 Hz – With headroom	10	HVRT Lagging - Legacy or preferred Profiles
5	Frequency Down 0.3 Hz - With headroom	11	Angle Jump +/- 30° (PSCAD only)
6	Frequency Down 0.3 Hz – No headroom	12	SCR Test (10, 5, 3, 1.5, 1.2)









Stage 2: Resource Registration and Modeling

As part of the resource registration process, the RE is required to secure a Production Load Date (PLD) prior to energization. The PLD is for the inclusion of the new RE in ERCOT's Network Operations model.

Full registration data that captures all details of the plant is required for securing a PLD. The full registration data needs to be approved by ERCOT months ahead of PLD.

ERCOT-Polled Settlement (EPS) meter design from the TSP needs to be implemented before commissioning of the plant. Moreover, the Qualified Scheduling Entity (QSE) points list needs to be communicated and verified before commissioning. Additionally, the Electric Service Identifier ID (ESIID) needs to be assigned to the project before moving to the commissioning phase.

RMS Energy has extensive background and expertise to support developers in navigating through the rigorous ERCOT resource registration and modeling process.

Stage 3: Resource Commissioning

RE is required to submit certain documents, requests, and readiness milestones to obtain the energization permit from ERCOT. The new resource commissioning checklist comprises of three parts that coordinate the energization, synchronization, and commissioning of new or modified generators in ERCOT. The following are the steps required for resource energization:

Part 1 Checklist: Request for energization of resource entity equipment
Part 2 Checklist: Request for initial synchronization
Part 3 Checklist: Request to commission a resource
In order to complete Part 3 Checklist, the RE is required to conduct Part 3 Testing as outlined below:

- IRR Curtailment test
- Reactive power capability test
- Voltage Support Services (VSS) test – calculated
- Automatic Voltage Regulator (AVR) test
- Primary Frequency Response (PFR) test
- Power System Stabilizer (PSS) test

Post-COD Stage

Once the generator completes the interconnection process, there are tasks associated with as-built modeling, NERC MOD tests, and NERC PRC compliance. RMS Energy is uniquely positioned by leveraging its extensive experience to support developers with all compliance aspects after COD.

SPECIALIZED SERVICES IN ERCOT

① NOGRR245

Nodal Operating Guide Request Revision (NOGRR245), titled "Inverter-Based Resource (IBR) Ride-Through Requirements," was approved by ERCOT and became effective on October 1, 2024. This revision establishes mandatory ride-through capabilities for inverter-based resources to enhance grid stability during disturbances. The revision incorporates IEEE 2800 requirements into ERCOT's nodal operating guides. Key provisions of the revision request include deadlines for resource entities to maximize their ride-through capabilities, submit compliance reports, and procedures for handling performance failures. RMS Energy has extensive experience and resources to help developers navigate through the requirements and mandates of NOGRR245. RMS Energy's approach to evaluating compliance with NOGRR245 is comprehensive and comprises of EMT modeling using PSCAD™, setting evaluation according to NOGRR245 and IEEE2800, and coordination with the OEM. NOGRRR245 requires RE or IE, to maximize the ride-through capability of the inverters no later than December 31, 2025, or at resource's synchronization date.

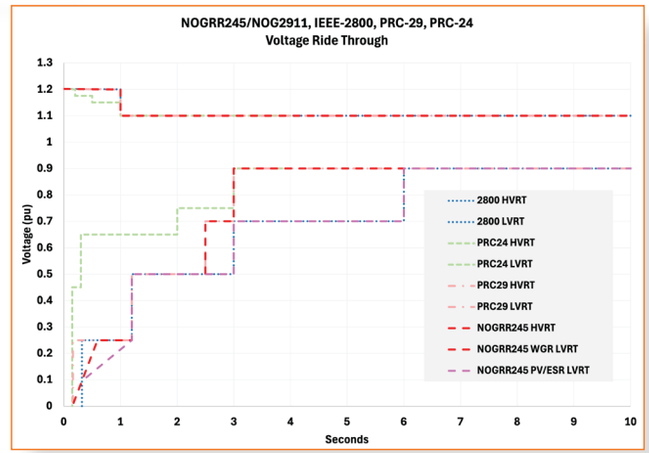
② Repowering

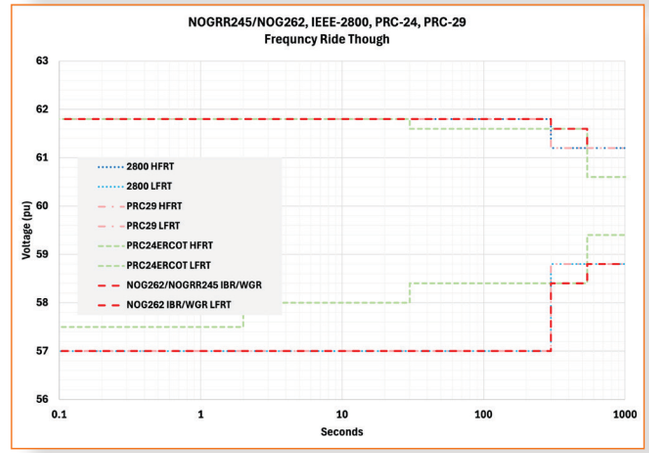
Repowering existing solar or wind power plants has become a growing priority in the renewable energy industry. While the infrastructure often remains durable, the power electronics and PV panels tend to have shorter lifespans. Renewing key components of a plant can extend its operational life and maintain efficiency.

Legacy renewable sites are typically located in areas with high energy yield, making repowering critical for continued power generation from these prime locations. However, it is important to determine whether the current Balance of Plant (BoP) can accommodate newer turbines or inverters. This requires various system studies, such as cable ampacity, short-circuit analysis, load flow, and reactive power evaluations, to assess the feasibility and limitations of repowering. RMS Energy has unique capabilities to make any repowering project as seamless as possible by taking advantage of its interconnection experts.

③ Large Load Interconnection

Large Load Interconnection (LLI) have been one of the main topics in power system communities as a large number of applications are being submitted to Transmission Service Providers (TSP). RMS Energy has supported numerous applications and model development activities for Giga-scale AI Data Centers. As interconnection of centralized large loads that are larger than 1 GW is a new topic to the whole system, RMS Energy has been in forefront of discussions with utilities, ISOs, and developers. By leveraging advanced modeling and collaboration with stakeholders, RMS Energy ensures that large load applications and modeling requirements are met.





- Instantaneous protection should have a time delay or use filtered quantities
- AC instantaneous OV should use a measurement cycle of at least 1 cycle (at 60 Hz)
- Rate of Change of Frequency or Phase Angle Jump that reduces real power or trips the plant should not impede on ride through requirements in NOG2.9.1.1(1)