



# Successfully Navigating the ERCOT Interconnection & Telemetry Process for BESS & Photovoltaic Plants

White Paper Executive Summary

# Key Insights



The Electric Reliability Council of Texas (ERCOT) oversees the Texas power grid, ensuring stability and reliability. However, the integration of large-scale photovoltaic (PV) solar and battery energy storage systems (BESS) presents challenges due to unclear interconnection guidelines, technical complexities, and regulatory requirements. Without a structured approach, projects face delays, telemetry issues, and non-compliance risks.

## 1. ERCOT-Specific Interconnection Procedures

- Step-by-step guidance on connecting PV & BESS assets while ensuring compliance with ERCOT protocols.

## 2. Technical Integration Challenges

- Best practices for system modeling, telemetry setup, and validation to prevent common failures.

## 3. Regulatory Compliance Framework

- Overview of ERCOT rules, Qualified Scheduling Entity (QSE) responsibilities, and key compliance factors.

## 4. Operational Pitfalls & Gray Areas

- Real-world examples of data submission errors, improper Phasor Measurement Units (PMU) configurations, and commissioning delays.

## 5. Ancillary Services Contributions

- How PV and BESS enhance grid reliability through frequency regulation, spinning reserves, and load shifting.

## 6. Commissioning Checklist

- A structured approach to ensure smooth and timely project deployment.



# ERCOT Interconnection & Compliance Overview

The ERCOT interconnection process is governed by strict protocols to ensure grid stability, reliability, and market fairness. Understanding and complying with these regulations is crucial for PV and BESS developers to avoid delays and technical issues.

## Key Governing Documents

- **ERCOT Protocols:** Define rules for interconnection, telemetry, and market participation.
- **ERCOT Planning Guide:** Details transmission system development and integration.
- **Resource Integration Guide (RIG):** Provides step-by-step procedures for connecting renewable energy assets.

## Telemetry & System Performance

- ERCOT requires real-time telemetry for voltage, current, power output, frequency, and system status.
- Pre-commissioning tests verify fault ride-through, voltage flicker, and protection coordination.
- Post-commissioning monitoring ensures ongoing compliance with operational standards.

## Interconnection Studies

- **Feasibility Study:** Assesses potential issues and costs.
- **System Impact Study:** Analyzes grid stability and reliability.
- **Facility Study:** Determines necessary transmission upgrades.

## Key Testing Standards, Ranges, & Limits Summary

Test	ERCOT Reference Documents	Range/Limit	Testing Timeframe
Fault Ride-Through (FRT)	ERCOT Operating Guide Section 2.9.1, Protocols Section 3.15	Voltage dips as specified in the interconnection agreement	A few seconds per fault
Frequency Response	ERCOT Operating Guide Section 2.9.2	Output adjustments as required by ERCOT to maintain frequency stability	10-30 minutes
Voltage Flicker	IEEE 519, ERCOT Protocols	Compliant with IEEE 519 standards for voltage flicker	Continuous, under-load variation
Protection System Coordination	ERCOT Protocols, TSP requirements	Settings coordinated with TSP protection schemes, relay settings as specified	1-3 seconds per fault
Telemetry Data Transmission	ERCOT Operating Guide Section 6	Minimum 4-second interval	Continuous 24/7
Interconnection Studies	ERCOT Resource Integration Guide, Planning Guide Section 6.9	As defined per ERCOT Protocols and Planning Guide	Variable, dependent on complexity and scope



# ERCOT Interconnection & Compliance Overview

Connecting PV and BESS systems to the ERCOT grid requires compliance with strict interconnection protocols, technical standards, and operational guidelines. This section outlines the key steps and requirements for a utility-scale project, such as a 100MW facility connected at >100kV. By adhering to ERCOT protocols and conducting rigorous testing, developers can ensure a smooth interconnection process and long-term operational success.

## Interconnection Process & Compliance Stages

- 1. Application Submission:** Developers submit an Interconnection Request, including project specifications and diagrams.
- 2. Feasibility Study (Optional):** Assesses potential grid impact and major constraints.
- 3. Full Interconnection Study:** Evaluates steady-state, dynamic, and short-circuit impacts.
- 4. Facility Study:** Determines necessary infrastructure upgrades.
- 5. Interconnection Agreement & Construction:** Finalizes obligations before construction begins.
- 6. Commissioning & Operation:** System tests are conducted before the plant is operational.

## Voltage & Frequency Regulation Requirements

**Voltage Range:** Must stay within  $\pm 5\%$  of nominal voltage.

**Voltage Ride-Through:** Systems must remain online during voltage sags (down to 0.15 pu for 0.15s) and swells (up to 1.2 pu for 500ms).

**Frequency Regulation:** BESS must maintain frequency between 59.9-60.1 Hz and respond to deviations within 2 seconds.

## Ancillary Services & Testing Protocols

**Spinning Reserve:** BESS must provide full power within 10 minutes and sustain it for 10 minutes.

**Non-Spinning Reserve:** Must discharge 60% of rated power within 30 minutes.

**Pre-Commissioning Tests:** Ensure compliance with voltage, frequency, and harmonic distortion standards.

**Post-Commissioning Monitoring:** Real-time data transmission to ERCOT for ongoing compliance.



# Common Pitfalls in ERCOT Process

Navigating the ERCOT interconnection process can be complex, with several challenges that can delay projects, increase costs, and create compliance risks. Below are key pitfalls and strategies to mitigate them.

## 1. Delays in Interconnection Studies

- **Challenge:** Extended timelines for feasibility, system impact, and facility studies can disrupt project schedules.
- **Solution:** Submit complete applications, respond promptly to ERCOT requests, and engage experienced consultants.

## 2. Meeting Reactive Power Requirements

- **Challenge:** Ensuring compliance with ERCOT's reactive power requirements can be costly.
- **Solution:** Conduct early-stage reactive power studies, install necessary compensation equipment, and optimize system design.

## 3. Telemetry Integration Challenges

- **Challenge:** Ensuring proper telemetry system integration and compliance with ERCOT protocols can be complex.
- **Solution:** Use ERCOT-approved communication protocols, perform rigorous system testing, and collaborate with ERCOT's technical team.

## 4. Securing Site Control

- **Challenge:** Failing to establish long-term site control can jeopardize project feasibility.
- **Solution:** Secure leases or ownership early, confirm compliance with ERCOT requirements, and mitigate potential land use conflicts.



# Key Takeaways



**Seamless Integration** – Properly integrating PV and BESS into ERCOT ensures grid stability and supports Texas' growing energy needs.

**Regulatory Compliance** – Understanding ERCOT's interconnection framework, technical standards, and operational rules is essential for success.

**Avoiding Pitfalls** – Adhering to best practices helps streamline the interconnection process and prevent costly delays.

**Grid Services Contribution** – BESS/PV projects play a crucial role in frequency regulation, voltage support, and grid resilience.

**Maximizing Value** – Planning, compliance, and collaboration with ERCOT and QSEs unlock the full potential of BESS/PV investments.

Full white paper available via request.

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