

POINT OF INTERCONNECTION ENGINEERING

POI & Grid Interconnection through every queue in North America

Interconnection studies, EMT and RMS models, POI substation design, protection and settings, and NERC compliance — for generation, storage, hybrid and large-load projects in every ISO, RTO and vertically integrated utility footprint.

Every queue in the country changed between 2023 and 2026. The study is no longer the hard part — the process is.

FERC Order No. 2023 replaced first-come, first-served with first-ready, first-served clustering across every jurisdictional transmission provider. PJM rebuilt its queue as a three-phase Cycle Process, SPP replaced DISIS with the Consolidated Planning Process, MISO capped annual queue volume, CAISO added intake scoring that eliminated four out of five megawatts submitted to Cluster 15, and FERC has now put all six RTOs on notice over large-load rules. Meanwhile NERC registered hundreds of previously unregistered inverter-based resources and is writing a new standards family for computational load. Keentel Engineering works the technical side of all of it.

8	6	4–765 kV	30+
ISO / RTO MARKETS PLUS THE NON-RTO FOOTPRINT	NERC REGIONAL ENTITIES COVERED	STUDY VOLTAGE RANGE AT THE POI	YEARS ACROSS TRANSMISSION, GENERATION & STORAGE

THE PATH WE RUN WITH YOU

01 Site screen POI selection, capacity screening and go/no-go before a deposit is at risk.	02 Application Models, data forms, site control evidence and readiness package to the queue.	03 Cluster study Independent shadow analysis and review of every phase result.	04 EMT gate Model usability, weak-grid and ride-through testing to the ISO checklist.	05 Agreement Cost review, decision-point support and GIA technical exhibits.	06 Energization Settings, commissioning, as-built models and NERC handover.
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START A SCOPE ›› Send your POI, MW, technology and the queue you are in — we return a scoped fee and schedule, and can start from a partial data set.

THE LANDSCAPE, AS OF AUGUST 2026

What Actually Changed

Five structural shifts now decide whether a project energizes on schedule — none of them are about running a better power flow.

1 Clustering replaced the serial queue

- **FERC Order No. 2023 and 2023-A.** First-ready, first-served cluster study is now the rule for every jurisdictional transmission provider — RTOs, investor-owned utilities and, by adoption, most federal and public power systems.
- **Readiness beats queue date.** Site control, commercial-readiness deposits and escalating withdrawal penalties replaced the old practice of holding a position cheaply while the project matured.
- **Cost allocation is shared and provisional.** A neighbor's withdrawal can change your network upgrade cost between phases, and each decision point is a real commercial decision on incomplete information.

2 The EMT model became a gate

- **Model quality now controls schedule.** PJM requires an EMT model at Decision Point II for bulk-system projects under guidelines issued in March 2026; MISO requires a PSCAD model for every inverter-based resource with model-quality tests; SPP triggers EMT from its short-circuit-ratio and critical-clearing-time screen.
- **Usability screening is standardized.** PJM publishes eighteen test cases — flat start, P/f/V steps, ride-through, stepped short-circuit-ratio reduction, phase-angle jump and ROCOF — with a default test grid and weak-grid cases well below it.
- **A model that will not initialize is a schedule problem, not a modeling problem.** Rejected models cost a cycle, not a revision.

3 Volume is being rationed

- **MISO** caps each annual cycle at a share of regional peak load, ranked by submission time, with over-cap requests rolled to the next cycle.
- **CAISO** scores requests on commercial interest, project viability and system need, and admits only those ranking within a defined multiple of available transmission capability.
- **SPP** now designates Planned Interconnection Locations and publishes a standardized per-MW development charge before the window opens.

4 Expedited tracks appeared — and filled

- **PJM.** The Reliability Resource Initiative ran once in 2025 and closed; the Expedited Interconnection Track was accepted by FERC in June 2026 as a new tariff part, capped at ten projects a year and sunseting at the end of 2027.
- **MISO.** The Expedited Resource Addition Study was rejected once, refilled, approved in July 2025 and later expanded — and its request pool filled during 2026.
- **SPP.** The Expedited Resource Adequacy Study runs on load-responsible-entity nomination rather than developer application.
- **The lesson.** These tracks are narrow, time-limited and heavily conditioned on readiness. Eligibility is an engineering and documentation problem before it is a commercial one.

5 Large load became its own regulatory track

- **FERC put all six RTOs on notice.** On 18 June 2026 the Commission issued FPA section 206 show cause orders to PJM, SPP, NYISO, MISO, CAISO and ISO-NE, directing each to justify or reform its large-load rules across five areas including study process, cost transparency, co-location and flexible service.
- **NERC is writing standards.** A new computational-load standards family and two new functional entity types are in development, with FERC directing a filing by the end of 2026.
- **ERCOT and SPP moved first.** ERCOT replaced single-project large-load studies with a batched process in July 2026; SPP's High Impact Large Load framework took effect in January 2026.

What this means for a developer

The technical work that used to follow the queue now gates entry to it. Models, site control evidence, readiness documentation and a defensible cost position have to exist before the window opens — and the window is measured in weeks.

SCOPE

What We Do at the POI

From the first capacity screen to the as-built model handover — the analysis, the drawings, the settings and the compliance record.

Screening & Queue Strategy

- **POI selection & capacity screening.** Candidate points of interconnection screened for thermal and voltage headroom, short-circuit strength, and known constraint exposure before a deposit is committed.
- **Grid strength pre-check.** Short-circuit ratio, weak-grid exposure and likely EMT scope identified early, so the model budget and schedule are known at bid time.
- **Application readiness.** Data forms, models, one-lines, equipment data and site control evidence assembled to the specific queue's checklist.
- **Expedited-track eligibility review.** Honest assessment of whether a project can meet an expedited pathway's readiness, schedule and site-control conditions.
- **Portfolio queue management.** Tracking phases, decision points and deliverable deadlines across multiple projects and multiple markets.

Interconnection Studies

- **Power flow & contingency.** Base case construction from ISO and transmission owner models; N-1 and N-1-1 thermal and voltage screening.
- **Stability.** Transient stability, critical clearing time, voltage recovery, damping, and PV/QV reactive margin at the POI.
- **Short circuit & equipment duty.** Fault duty for breaker adequacy, POI fault current and X/R for equipment specification.
- **Shadow & restudy analysis.** Independent reproduction of the ISO's result before a decision point, so the cost allocation can be challenged on facts.
- **Affected system review.** Neighboring system impacts and the seams issues that surface late and cost the most.

POI Substation & Protection

- **POI substation configuration & design.** Bus arrangement, equipment layout and the complete electrical package through Issued-for-Construction.
- **Protection & settings.** POI protection elements, transfer trip, anti-islanding, and settings written to the transmission owner's fault model.
- **Metering & telemetry interfaces.** Revenue metering, SCADA and telemetry to the ISO's data and interval requirements.

Modeling & Model Quality

- **EMT model build & validation.** OEM black-box and encrypted inverter model integration, initialization, time-step and snapshot testing against the governing ISO checklist.
- **Model usability test reports.** Prepared in the ISO's own template, with plots at the point of interconnection and the point of connection.
- **Weak-grid & ride-through testing.** Stepped short-circuit-ratio reduction, phase-angle jump, ROCOF, LVRT/HVRT and repeat-fault recovery.
- **RMS dynamic models.** Generic converter, electrical control and plant controller stacks, storage state-of-charge logic, user-written OEM models and flat-run verification.
- **Cross-platform reconciliation.** EMT benchmarked against the positive-sequence case so both tell one story, with the divergence explained rather than left for the reviewer.
- **As-built model updates.** Tuned models and parameter records delivered after commissioning to close the compliance loop.

NERC & Grid Code Compliance

- **Registration support.** Assessment against the Generator Owner and Generator Operator registration criteria, including the inverter-based resource category.
- **Ride-through & protection settings.** Frequency and voltage ride-through performance and protection setting compliance demonstrated by study and by test.
- **Model verification.** Step-response test planning, oscillography-to-model comparison and recalibration to satisfy the model verification standards.
- **Data submittal & facility ratings.** Modeling data packages to the Transmission Planner and Planning Coordinator, and facility ratings support.
- **Disturbance monitoring.** Recording, retention and reporting capability designed in at the POI rather than retrofitted.
- **Grid code demonstration.** IEEE 2800 and regional performance requirements mapped clause by clause.

Commissioning & Handover

- **Commissioning & test support.** Test planning, witness support and reconciliation of measured behavior against the model.
- **Settings & parameter records.** Everything programmed on site captured against what was modeled.
- **Compliance handover package.** The record a compliance auditor, lender or transmission owner can follow end to end.

MARKET PROCESS REVIEW — PART ONE

PJM & MISO

PJM

 MID-ATLANTIC
& GREAT LAKES

Cycle Process — first-ready, first-served, three study phases and three decision points.

STRUCTURE

Application review, then **Phase I** aggregate power flow, **Phase II** stability and short circuit, and **Phase III** facilities study run concurrently with agreement negotiation. A customer decision point follows each phase.

READINESS

Tiered study deposit by project size, a per-MW readiness deposit at application, and site control evidenced by a real possessory interest — a memorandum is not accepted.

EMT

EMT model required at **Decision Point II** for bulk-system projects under the March 2026 EMT Model Development Guidelines; eighteen standardized usability test cases; as-built tuned model due one year after commercial operation.

EXPEDITED

Expedited Interconnection Track accepted by FERC in June 2026 as a new tariff part — ten projects a year, large accredited capacity, a short commercial operation deadline, full site control, and the project pays 100% of network upgrades. Sunsets end of 2027.

Where it stands. Transition Cycle 1 studies completed in 2025. Transition Cycle 2 entered Phase III in July 2026. Cycle 1 drew over 800 applications and roughly 220 GW; PJM announced in August 2026 that more than 700 projects were accepted into study.

MISO

 MIDCONTINENT
& MISO SOUTH

Definitive Planning Phase — three phases, two decision points, annual cycles named by year.

STRUCTURE

Application review, then **DPP Phase 1**, **Phase 2** and **Phase 3** with a customer decision point after Phases 1 and 2, followed by generator interconnection agreement negotiation. The reformed target cycle is roughly a year from kickoff to agreement.

VOLUME CAP

Each cycle is capped at a share of regional non-coincident peak load. Requests are ranked by submission timestamp and over-cap requests roll to the next cycle in the same region — a regional cap can be met before the window closes.

READINESS

Non-refundable application fee, sliding-scale study deposit, per-MW readiness milestone, and escalating site control — partial at application, more before Phase 2, and **100% of all land before the agreement** with no financial substitute.

EMT

PSCAD model required for **all** inverter-based resources, with the deadline set at the Phase 1 kickoff. Newer cycles apply an expanded modeling appendix: generic positive-sequence model, stability-tool user model, PSCAD model, model quality test results and a benchmark report.

Where it stands. Several cycles run concurrently, with older cycles in agreement negotiation and newer ones in Phase 2. The expedited pathway — the Expedited Resource Addition Study, approved in 2025 and later expanded — filled its request pool during 2026 and sunsets in 2027.

WHERE PROJECTS LOSE TIME IN THESE TWO QUEUES

- **Placeholder models at application.** Generic models in place of OEM-specific data draw a deficiency notice and can cost a validation window.
- **Site control that does not satisfy the tariff.** The evidence standard tightened under reform, and a document that worked in an earlier cycle may not qualify now.
- **Decision points taken without an independent cost view.** A network upgrade allocation accepted or rejected on the ISO's number alone, without a shadow study, is a commercial decision made blind.
- **EMT models delivered late in the phase.** The model has to survive someone else's environment, not just run locally — and there is no time to iterate at a decision point.
- **Neighbor withdrawals between phases.** Cost allocations move; the projects that plan for a restudy result absorb it, the ones that budgeted the Phase 1 number do not.
- **Expedited-track applications that cannot document readiness.** Independent-engineer schedules and full site control are engineering deliverables with lead time of their own.

MARKET PROCESS REVIEW — PART TWO

SPP & ERCOT

SPP

 CENTRAL US
 REBUILT IN 2026

Consolidated Planning Process — interconnection and transmission planning merged into one framework.

STRUCTURE

FERC accepted the Consolidated Planning Process in March 2026, replacing the legacy DISIS cluster. A long-horizon assessment designates **Planned Interconnection Locations**; a ten-year assessment carries the **Interconnection Cluster Study**. The cluster window is short, the study period consolidated, and there is a **single decision point**.

COST MODEL

A standardized per-MW development charge is published before the window opens, in place of project-specific upgrade allocation. Connecting at a Planned Interconnection Location carries that charge with stricter readiness; an unplanned location adds directly assigned upgrade cost.

READINESS

Application requires technical models, **100% site control** and financial security. After the single decision point, security is largely non-refundable.

EMT

Triggered by the short-circuit-ratio and critical-clearing-time screen rather than applied universally. SPP's EMT model requirements specify PSCAD compatibility, weak-system testing and a submission deadline well ahead of first energization.

LARGE LOAD

High Impact Large Load study process effective January 2026, with a generation assessment pathway for resources built to serve one, plus a conditional service option added in mid-2026.

Where it stands. Legacy DISIS clusters are still working through study and agreement phases alongside the expedited study, while the first Consolidated Planning Process cluster moves toward its study start. Development charge values are being set.

ERCOT

 TEXAS
 NOT FERC-JURISDICTIONAL

Generation Interconnection or Change Request — serial, connect-and-manage, energy-only.

STRUCTURE

Governed by the ERCOT Planning Guide rather than a FERC pro forma procedure. **ERCOT** performs the Security Screening Study; the **lead Transmission Service Provider** performs the Full Interconnection Study — steady state, system protection, dynamic and transient stability, and the facility study — followed by the reactive study and the quarterly stability assessment.

WHAT IS DIFFERENT

No cluster and no deliverability construct. ERCOT studies the facilities needed to connect and manages the rest through dispatch, so the generator carries congestion and curtailment risk instead of network upgrade cost. The request terminates if the full study is not requested within the tariff window after screening results.

PERFORMANCE RULES

Inverter-based ride-through requirements have been in force since late 2024, with high-resolution data requirements alongside them and advanced grid support requirements for inverter-based storage added at the end of 2025 with a companion model-quality-test rule.

LARGE LOAD

Large Load provisions sit in their own Planning Guide section at a 75 MW threshold. A **batched** large-load interconnection process took effect in July 2026, replacing single-project studies, and large computational load ride-through requirements took effect in August 2026 alongside a definition of large electronic load.

Where it stands. ERCOT reported roughly 410 GW of large-load interconnection requests in 2026, the great majority data centers — the driver behind the batching reform, the computational-load ride-through rule and the 2025 state legislation on co-location and curtailment.

WHAT THESE TWO MARKETS ASK FOR THAT OTHERS DO NOT

- **SPP — location is now a commercial decision.** Connecting at a designated Planned Interconnection Location changes both what you pay and what readiness you must demonstrate. That choice has to be made with a study behind it, before the window.
- **SPP — one decision point, not three.** There is no second chance to reprice the project against a revised allocation. The cost position has to be understood going in.
- **SPP — site control at application.** Full site control is an entry condition, not a later milestone.
- **ERCOT — the TSP runs the study, not the ISO.** The lead Transmission Service Provider scopes and performs the full interconnection study, so coordination with that utility is the critical path.
- **ERCOT — congestion risk instead of upgrade cost.** Connect-and-manage means the economics live in curtailment exposure, which is a study question at the POI selection stage.
- **ERCOT — performance rules bite continuously.** Ride-through capability reporting, model quality tests and post-event performance reviews are ongoing obligations, not one-time filings.

MARKET PROCESS REVIEW — PART THREE

CAISO & the Western Interconnection

CAISO

**CALIFORNIA
SCORED INTAKE**

Resource Interconnection Standards — cluster study with a scored intake gate.

STRUCTURE

Transmission-level requests from Cluster 15 forward are governed by the Resource Interconnection Standards appendix, with the legacy deliverability procedures still governing earlier requests. A further round of process enhancements was accepted by FERC in August 2026 and applies from the next cluster.

SCORED INTAKE

Requests are scored on **commercial interest**, **project viability** and **system need**, and must rank within a defined multiple of available capability for their constraint or portfolio zone to enter study. In Cluster 15 this eliminated roughly four of every five megawatts submitted.

DELIVERABILITY

Full-capacity deliverability and energy-only are distinct products with different study paths and different zonal competition — the choice is a study and commercial decision, not a form field.

IMPLEMENTATION

New Resource Implementation runs as sequenced milestone groups tied to the network model release schedule — model data, agreements, market preparation, trial operations approval, trial operations and commercial operation — with telemetry gateway certificates and metering validation on their own lead times.

MODELS

EMT modeling requirements specify PSCAD format with fully detailed inner control loops, all protections modeled, accuracy across the full operating range, and validation by fault, voltage, reactive and frequency step tests.

Where it stands. Cluster 15 studies and reassessments have run through 2026; the next cluster request window opens in the fourth quarter of 2026 under the amended standards.

Non-ISO West

**WECC FOOTPRINT
BPA & THE IOUS**

Utility-run cluster study under Order 2023, over a WECC modeling obligation that applies to everyone.

STRUCTURE

Vertically integrated utilities across the West moved from serial study to annual cluster windows under Order 2023, each with its own window date, deposit schedule and study sequence. BPA adopted an equivalent cluster procedure for facilities above 20 MW, with a transition cluster followed by a recurring two-phase process.

WHAT DIFFERS

Every utility runs its own window. Application fees, study deposits, commercial readiness demonstrations and model format requirements are set utility by utility — some require EMT models on every request, some require GE PSLF format for planning models.

WECC OBLIGATION

Independent of the queue, the project must land correctly in the Western base cases: steady-state and dynamic data per the **Data Preparation Manual**, individual modeling above the manual's unit and aggregate thresholds, explicit step-up transformer representation, and dynamic data into the **Master Dynamics File** using approved library models.

SUBMITTAL CHAIN

Data flows from the facility to the Transmission Planner or Planning Coordinator, to the **Area Coordinator**, to WECC staff. Each handoff is a validation gate, and a model that will not initialize stops at the first one.

PRE-COD

WECC's generating facility data, testing and model validation requirements call for baseline testing before commercial operation, with model behavior reproduced within stated tolerances.

Where it stands. The West's first cluster cycles are working through transition studies, redemonstration windows and restudy decisions — the same growing pains the RTOs went through, on a utility-by-utility calendar.

THE WESTERN DATA CHAIN

01 Facility data As-built equipment data, generic and OEM models, explicit step-up transformer representation.	02 Transmission Planner Data validated against the interconnection agreement and the utility's own modeling requirements.	03 Area Coordinator Regional model compiled to the Data Preparation Manual and submitted upward.	04 WECC staff Assembly into interconnection-wide base cases and the Master Dynamics File.	05 Pre-COD testing Baseline tests with model behavior reproduced within stated tolerances.	06 Model verification Step-response testing and recalibration under the NERC model standards.
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Each handoff is a validation gate. A model that will not initialize, a reactive footprint that will not flat-run, or an as-built configuration that no longer matches the studied case stops at the first gate and comes back as a deficiency — usually with the commercial operation date already committed.

HOW WE HELP Scored-intake positioning and viability documentation · Deliverability versus energy-only analysis · Implementation milestone management · PSLF base case and dynamic file builds · Master Dynamics File readiness · Area Coordinator and WECC staff review support · Pre-commercial-operation testing and as-built submittal

MARKET PROCESS REVIEW — PART FOUR

NYISO, ISO-NE & the Southeast

NYISO

 NEW YORK
 CLASS YEAR RETIRED

Cluster study — the Class Year construct has been replaced.

STRUCTURE

The final Class Year closed in 2024. The transition cluster runs a long **Phase 1** technical and cost analysis, a longer **Phase 2** detailed assessment gated by a readiness deposit, and a short final decision period on cost allocation.

SERVICE PRODUCTS

ERIS is the baseline energy service. **CRIS** is required to sell into the capacity market and is what deliverability upgrades buy — and Phase 1 results do not yet resolve it, which complicates comparing projects on Phase 1 numbers alone.

2026 CHANGES

A package of process enhancements filed in 2026 shortens the application window, tightens infeasibility screening, aligns cure periods and restricts commercial operation date extensions, with a blackout period around the window.

LARGE LOAD

Load interconnection study thresholds are voltage-dependent, and today there is no aggregate or resource-adequacy assessment across projects. NYISO is developing reform with a filing targeted for late 2026, against a queue that grew from a handful of projects to dozens.

ISO-NE

 NEW ENGLAND
 FIRST FULL CLUSTER

Cluster study accepted on compliance in 2025, with a longer study period than the pro forma.

STRUCTURE

Cluster request window, customer engagement window for validation, a **270-day cluster study** covering stability, power flow and short circuit, a restudy window when triggered, then the interconnection facilities study and agreement execution — roughly a year end to end.

READINESS

Full site control in the interconnection customer's name at the qualifying deadline, commercial readiness deposits, and material withdrawal exposure once the study is entered.

WHERE IT STANDS

The transitional cluster began in late 2025 with a small, storage-dominated set of requests and produced interim results in mid-2026. The first full cluster request window opens in the fourth quarter of 2026.

LARGE LOAD

No tailored large-load provisions today — loads run through existing network service and generator interconnection procedures. Reform is being developed under the FERC show cause proceeding.

OUTSIDE THE RTOS

The Southeast and Other Vertically Integrated Utilities

Roughly half the country interconnects outside an RTO. Order 2023 moved these utilities onto cluster study too, but each runs its own annual window, its own deposit and readiness schedule, and its own technical standards — and the large-load rules that FERC imposed on the RTOs do not automatically reach them, so the governing requirements are often at the state commission instead.

Annual cluster request window, utility by utility	Customer engagement and validation window	Cluster study — power flow, stability, short circuit
Restudy gate when the cluster changes	Interconnection facilities study	Agreement negotiation and execution
Non-refundable application fee plus study deposit	Commercial readiness deposit, escalating	Site control, or security in lieu up to a cap
Withdrawal penalties tied to upgrade cost	Utility-specific model formats and data forms	State-level large-load and cost-allocation rules

Windows across the Southeast and the West open on fixed calendar dates spread through the year — a portfolio spanning several utilities is really a portfolio of several separate deadlines, each with its own document set.

ONE PAGE, EVERY QUEUE

The Markets Side by Side

Same objective, eight different processes — and the differences are where portfolios lose years.

MARKET	PROCESS	STRUCTURE	EMT TRIGGER	EXPEDITED PATH
PJM	Cycle Process	Three phases, three decision points; Phase III concurrent with agreement	Required at Decision Point II for bulk-system projects; 18 usability test cases	Expedited Interconnection Track, capped and sunsetting 2027
MISO	Definitive Planning Phase	Three phases, two decision points; annual cycles; regional MW cap	PSCAD required for every IBR; model quality tests and benchmark report	Expedited Resource Addition Study — pool filled
SPP	Consolidated Planning Process	Short window, consolidated study, single decision point; Planned Interconnection Locations	Triggered by short-circuit-ratio and clearing-time screen	Expedited Resource Adequacy Study — LRE-nominated
ERCOT	Generation Interconnection or Change Request	Serial; ERCOT screening study then TSP-led full study; connect-and-manage, energy-only	Sub-synchronous and co-located cases; expanding for large load	None — the process is already serial
CAISO	Resource Interconnection Standards	Cluster study behind a scored intake gate; deliverability versus energy-only	PSCAD with fully detailed controls and protections; validation test set	None — intake scoring is the filter
NYISO	Cluster study (Class Year retired)	Phase 1 technical and cost, Phase 2 detailed, short final decision period	Project- and system-strength dependent	None identified
ISO-NE	Cluster study	Request window, engagement window, 270-day study, restudy gate, facilities study	Project- and system-strength dependent	None identified
Non-RTO	Utility LGIP cluster	Annual window per utility; two- or three-stage study; utility-specific deposits	Utility-specific — some require EMT on every request	Utility-specific

WHAT THE EMT GATE ACTUALLY TESTS

- **Initialization and flat start.** The model has to reach its setpoint and sit there, in the reviewer's environment, at the reviewer's time step.
- **Step response.** Active power, reactive power, voltage and frequency steps, with the response damped and settling inside the stated window.
- **Fault ride-through.** Balanced and unbalanced faults at defined depth and duration, with recovery ramp and repeat-fault behavior.
- **System strength sweep.** Stepped reduction of short-circuit ratio to identify where the controller becomes unstable — not merely whether it survives one case.
- **Phase-angle jump and ROCOF.** Phase-locked-loop and control behavior through the disturbances that expose converter interaction.
- **Protection representation.** All plant and inverter protections modeled in detail, so the model trips when the real plant would.
- **Operating range coverage.** Accurate behavior from minimum stable output to full installed capacity, not just at rated output.
- **Cross-validation.** Agreement with the positive-sequence model, with any divergence explained in the report.

READING THIS TABLE Process names, phase counts and expedited pathways are current as of August 2026 and change frequently. Treat this as an orientation map, not a compliance reference — the governing tariff and business practice manual control.

RELIABILITY COMPLIANCE

NERC, the Regional Entities & What Attaches to You

Interconnection ends at the agreement. Compliance obligations start at registration and never end.

THE SIX REGIONAL ENTITIES

The delegated regional bodies are formally **Regional Entities** — the successors to the older Regional Reliability Organization structure, which is legacy terminology. Together with NERC they form the ERO Enterprise, and it is your Regional Entity that audits you.

MRO — Midwest Reliability Organization; central US and Canada

NPCC — Northeast Power Coordinating Council; New York, New England, eastern Canada

RF — ReliabilityFirst; Mid-Atlantic and Great Lakes

SERC — SERC Reliability Corporation; the Southeast, including Florida

Texas RE — Texas Reliability Entity; the ERCOT region

WECC — Western Electricity Coordinating Council; the Western Interconnection

Boundaries are approximate and overlap exists — a load-serving entity may sit in one Region while its transmission owner sits in another. Two former Regional Entities were consolidated into MRO and SERC. Confirm your Region before assuming which regional variances and standards apply.

REGISTRATION — INCLUDING THE IBR CATEGORY

Bulk electric system resources

The traditional Generator Owner and Generator Operator thresholds follow the bulk electric system definition — an individual unit above 20 MVA, or a plant aggregating above 75 MVA, connected at 100 kV or higher, including dispersed power producing resources.

Inverter-based resources below the BES threshold

A second registration category captures non-BES inverter-based resources at 20 MVA or more in aggregate nameplate rating behind a single point of interconnection at 60 kV or above. Aggregation is by gross MVA across all inverter-based resources at the facility; operating limits and ownership structure do not change the test.

NERC's multi-year initiative to identify and register previously unregistered inverter-based resources reached its registration date in **May 2026**. Several hundred facilities were identified and the great majority are now registered, each inheriting a defined set of reliability standards from that date — including modeling data, protection, operations and voltage control obligations that many owners had not previously carried.

WHAT A NEWLY REGISTERED RESOURCE INHERITS

Modeling data submittal to the Transmission Planner and Planning Coordinator

Protection system maintenance and coordination obligations

Voltage and reactive power control requirements

Real-time data and operating information to the Reliability Coordinator

Disturbance monitoring, recording and reporting

Ride-through performance and its documentation

Event analysis and corrective action planning

Facility ratings methodology and ratings

Model verification and periodic revalidation

Event and emergency reporting

Vegetation and facility management where applicable

Cyber security obligations where applicable

Evidence is created early

Most compliance evidence — models, test records, settings, data submittals — is produced during study, design and commissioning. An audit years later cannot recreate it.

Regional variances are real

Standards apply nationally but variances, interpretations and audit approach differ by Regional Entity. Confirm which Region governs before assuming a requirement.

Registration follows the facility

Aggregation at the point of interconnection, not corporate structure, decides whether a facility registers. Phased build-outs can cross a threshold mid-project.

THE PRACTICAL POINT Registration is not a paperwork event. It converts study assumptions into auditable obligations — and the evidence has to have been created during design, commissioning and model validation, not reconstructed afterward.

THE STANDARDS THAT FOLLOW THE PROJECT

Ride-Through, Models & Monitoring

STANDARD	WHAT IT OBLIGATES	STATUS AND TIMING
PRC-024 Protection settings	Frequency and voltage protection set so the resource does not trip inside the defined no-trip envelope; documentation of limitations and settings on request	Latest version approved in 2025; scope narrowed so it now covers synchronous machines, synchronous condensers and older wind types — inverter-based ride-through moved to PRC-029
PRC-029 IBR ride-through	Performance-based obligation for inverter-based resources to remain connected and continue operating through defined voltage and frequency excursions, with a documented exemption path for genuine hardware limits	Enforcement begins 1 October 2026 for bulk-system IBRs; a successor version adds accommodations for long-lead projects and phases non-BES resources in from 1 January 2027
PRC-028 Disturbance monitoring	High-resolution disturbance and sequence-of-event recording with precise time synchronization, retention, and submission on request	Compliance date already passed; phased build-out with roughly half of applicable facilities by 2028 and full coverage by 1 January 2030
PRC-030 Unexpected IBR events	Analysis of an unexpected real-power change above a defined threshold within 90 days, a corrective action plan within a further 60 days, and notification of the Reliability Coordinator	Enforcement begins 1 October 2026
MOD-026 Model verification	Dynamic models whose behavior reasonably reflects actual facility performance — controller verification, validation against disturbance data, periodic review, and EMT models where required	Consolidated version effective April 2026 , absorbing and retiring the separate turbine-governor standard; requirement compliance phases in through 2027 and 2029
MOD-032 / 033 Modeling data	Steady-state, dynamics and short-circuit data to the Transmission Planner and Planning Coordinator; system-level validation of the interconnection-wide model against actual response	Current versions approved in February 2026 ; the data standard became applicable to newly registered IBRs in May 2026
MOD-025 Capability verification	Periodic verification and reporting of real and reactive power capability	In effect for registered generators; IBR applicability was still being worked through NERC's revision process
FAC-001 / 002 Interconnection	Documented facility interconnection requirements, and study of the reliability impact of new interconnections and qualified changes to existing ones	Current versions in force; both flagged by NERC for modification to address inverter-based resource applicability
FAC-008 Facility ratings	A documented facility ratings methodology and ratings consistent with equipment ratings for owned facilities	In force; ratings must survive the transition from study assumption to as-built equipment

Ride-through is a design decision

Programmed inverter parameters, plant controller behavior and protection settings all have to agree with the ride-through obligation — and with the model that was studied. Divergence between the three is the most common finding after an event.

Monitoring has lead time

Disturbance recording capability, time synchronization and data retention are procurement and design items at the POI. Retrofitting them after energization costs an outage.

Models are a standing obligation

Model verification does not end at commercial operation. Tuned as-built models, periodic revalidation and resubmission after equipment or settings changes are recurring obligations.

NOTE Standard numbers are shown without version suffixes because versions change. Dates reflect the position as of August 2026. Applicability, effective dates and regional variances must be confirmed against the current NERC standard and your Regional Entity before relying on any of it.

THE FASTEST-MOVING PART OF THE WHOLE PICTURE

Large Load & Computational Load

Data center interconnection is being written into the rules right now — by FERC, by NERC, by every RTO and by the states.

JUNE 2026

FERC Put All Six RTOs on Notice

The Commission issued Federal Power Act section 206 show cause orders to PJM, SPP, NYISO, MISO, CAISO and ISO-NE, preliminarily finding each tariff deficient on large load. Each was directed to justify its existing rules or file reforms across five areas:

An efficient application and study process for large-load transmission service, with short study deadlines

Cost transparency and binding cost recovery to prevent cost shifting onto other customers

Rates, terms and conditions for co-location arrangements

New and flexible transmission services for loads willing to curtail

Generator interconnection treatment for generation serving electrically proximate or co-located load

A resource adequacy informational report on serving existing and new large loads

FERC declined to issue a single nationwide rule, choosing six regional proceedings instead — which means the obligations do **not** automatically reach non-RTO utilities, where large-load rules are set by state commissions and individual utility tariffs.

NERC's Computational Load Standards

- **A new standards family.** Three standards are in development covering computational load interconnection, studies and modeling data; operational data and communications; and protection coordination and disturbance monitoring — with conforming changes to the facility interconnection standards to avoid duplication.
- **Two new functional entity types.** Computational Load Owner and Computational Load Operator, each with independent registration and compliance exposure.
- **A hard federal deadline.** FERC directed NERC in July 2026 to file the standards, the glossary definitions and the registry criteria by **31 December 2026**, with a work plan for further standards in early 2027.
- **Thresholds are still moving.** Draft registry criteria drew heavy comment and were revised upward in August 2026. Do not design to a threshold until it is final.
- **Registration is expected to begin in 2027**, with implementation phasing after that.

Why this reaches the engineering, not just the legal team

The obligations being written are modeling data, study participation, instrumentation, commissioning, protection coordination and disturbance monitoring — all of them design decisions made at the service entrance and the campus MV system, years before a compliance date.

What NERC Has Already Told the Industry

- **A Level 3 alert in May 2026** — NERC's most urgent tier — directing planners, transmission owners, balancing authorities and operators to develop computational-load modeling data requirements, study operating limits and instability vulnerability, capture load changes in qualified-change definitions, establish commissioning processes, install dynamic fault recording and set up direct communications with computational load operators.
- **A reliability guideline in May 2026** on risk mitigation for emerging large loads — voluntary, but explicitly aimed at load developers, owners, operators and equipment manufacturers as well as utilities.
- **The driver.** Customer-initiated large load reductions and oscillations occurring within seconds, leaving very little real-time response margin.

Where the Markets Already Moved

- **ERCOT.** Large load provisions at a 75 MW threshold, a batched interconnection process replacing single-project studies from July 2026, ride-through requirements for large computational load from August 2026, and 2025 state legislation on co-location and curtailment.
- **SPP.** A High Impact Large Load study process effective January 2026 with voltage-dependent thresholds, a generation assessment pathway for resources built to serve one, and a conditional service option.
- **MISO, PJM, NYISO, ISO-NE, CAISO.** Flexible and non-firm service constructs, co-location rules and large-load study processes all in active development under the show cause proceedings.

DELIVERABLES, PLATFORMS AND THE FIRMS WE WORK FOR

What You Receive

- ▶ Application package — data forms, models, one-lines, equipment data and readiness evidence assembled to the specific queue's checklist
- ▶ Native study files in the platform the market uses, delivered clean and library-clean
- ▶ Independent shadow study report at each phase, with the ISO result reproduced and reconciled
- ▶ Decision-point memorandum — what the cost allocation means, what could still move, and what the exposure is either way
- ▶ EMT model package with a usability test report in the ISO's own template
- ▶ Weak-grid, ride-through and control interaction results with waveform evidence
- ▶ Reactive capability and POI compliance demonstration
- ▶ POI protection settings, native settings files and coordination records
- ▶ Metering, telemetry and SCADA interface documentation
- ▶ NERC registration assessment and standard-by-standard applicability matrix
- ▶ Commissioning parameter and settings record, reconciled against the model
- ▶ As-built model update and compliance handover package

INDUSTRY-STANDARD ENGINEERING PLATFORMS



ENGAGEMENT MODELS

Single project, end to end

Screening through energization on one project — one scope, one schedule, one point of accountability across studies, design and compliance.

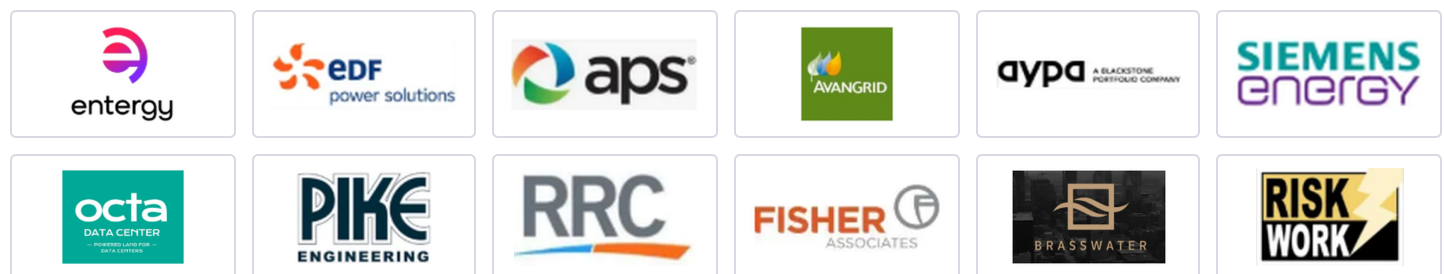
Portfolio queue support

Retained support across a pipeline in several markets — deadline tracking, per-window document sets, decision-point reviews and restudy response.

Owner's engineer & diligence

Independent review of another firm's study, model or cost position — for a lender, an acquirer or a board that needs a second opinion.

OUR CLIENTS



NOTE Client marks are shown to identify organizations Keentel Engineering has provided services to. Keentel is independent of, and not affiliated with, endorsed by or sponsored by any of these companies.

START HERE

Four Things and We Can Scope It

The POI — interconnection point, voltage and the transmission owner

The project — MW, MVA, technology, inverter or turbine OEM

The queue — which market, which cycle, and your position in it

The driver — the study requirement, comment letter or milestone date

WHY KEENTEL ENGINEERING

01 Every market, one team

Eight ISO and RTO processes plus the non-RTO footprint, tracked as they change — so a portfolio spanning several markets is not several separate engagements.

03 Model quality as a discipline

EMT and RMS models built to survive someone else's environment and someone else's checklist, with cross-platform reconciliation documented for the reviewer.

05 P.E.-sealed and defensible

Florida-registered firm (Reg. No. 36853) with multi-state licensure. Written to survive transmission owner, ISO, independent engineer and lender review.

02 Studies and design in one scope

The interconnection study, the POI substation design and the protection settings come from the same team, so the drawings reflect the study and the settings reflect the fault model.

04 Compliance built in, not bolted on

Registration, ride-through, model verification, monitoring and data submittal designed into the project rather than reconstructed for an audit.

06 We stay through energization

Comment response, relay settings, commissioning support, as-built model updates and compliance handover — not a report and a handshake.

PRIMARY AUTHORITIES BEHIND THIS FLYER

FERC. Order No. 2023 and Order No. 2023-A, Improvements to Generator Interconnection Procedures and Agreements, Docket RM22-14. Order No. 901, IBR reliability standards, Docket RM22-12.

FERC large load. Section 206 show cause orders of 18 June 2026, Dockets EL26-67 (PJM), EL26-68 (SPP), EL26-69 (NYISO), EL26-70 (MISO), EL26-71 (CAISO), EL26-72 (ISO-NE); rulemaking Docket RM26-4; computational load directive Docket RD26-7.

PJM. Open Access Transmission Tariff; Manual 14H, New Service Requests Cycle Process; PJM EMT Model Development Guidelines for Inverter-Based Resources.

MISO. Open Access Transmission Tariff Attachment X, Generator Interconnection Procedures; Business Practice Manual 015 and its IBR modeling appendix.

SPP. Open Access Transmission Tariff, generator interconnection procedures and Consolidated Planning Process provisions; SPP EMT Model Requirements; High Impact Large Load provisions.

ERCOT. Planning Guide Sections 5, 6 and 9; Nodal Operating Guide Section 2; Nodal Protocols; the associated NOGRR, NPRR and PGRR revision requests and PUCT project dockets.

CAISO. Tariff Section 25 and the Resource Interconnection Standards and deliverability appendices; CAISO Electromagnetic Transient Modeling Requirements; New Resource Implementation materials.

WECC. Data Preparation Manual for interconnection-wide cases; WECC Generating Facility Data, Testing and Model Validation Requirements; Generator Unit Model Validation Guideline.

NYISO / ISO-NE. Open Access Transmission Tariff interconnection sections and Order 2023 compliance filings and orders.

NERC. Reliability Standards PRC-024, PRC-028, PRC-029, PRC-030, MOD-025, MOD-026, MOD-032, MOD-033, FAC-001, FAC-002, FAC-008; Rules of Procedure registration criteria; the inverter-based resource registration initiative; the computational load standards project; the Large Loads Action Plan, the May 2026 Level 3 alert and the emerging large loads reliability guideline.

IEEE. IEEE 2800, IEEE 1547, IEEE 519, IEEE 80, IEEE 1584 and the IEEE C37 series.

Positions described are current as of August 2026 and are provided for orientation only. Interconnection procedures, cluster schedules, thresholds and reliability standards change continuously; the governing tariff, business practice manual and standard revision in force for a given project control.

START A SCOPE ›› contact@keentelengineering.com · 813-389-7871 · keentelengineering.com

NSPE
D-U-N-S REGISTERED
IEEE SENIOR MEMBER
BBB ACCREDITED A+

TAMPA — HQ

400 N Ashley Dr, Ste 2600
Tampa, FL 33602
813-389-7871

AUSTIN

5900 Balcones Dr, Ste 100
Austin, TX 78731
512-591-0752

SACRAMENTO

1401 21st St, Ste R
Sacramento, CA 95811
916-913-4524

BALTIMORE

306 W Redwood St, Ste 200
Baltimore, MD 21201
410-225-2181

contact@keentelengineering.com · keentelengineering.com · 813-389-7871 · Florida Firm Reg. No. 36853

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