ISTS Connectivity Studies for RE Projects in India 2026: Models, Timelines, Risk

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A practitioner guide to ISTS connectivity studies in India 2026: study scope, data, timelines, costs, risks and lender implications for RE projects.

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For renewable-energy projects in India, transmission connectivity is now shaped as much by study quality as by land, modules, turbines or offtake. In 2026, a solar park, wind cluster, hybrid project or FDRE portfolio can secure an in-principle transmission path yet still lose months because the connectivity study package is incomplete, outdated or inconsistent with actual plant design.

This matters across the market. Developers need realistic COD planning. C&I buyers under open access need certainty on injection infrastructure and scheduling readiness. Lenders need confidence that evacuation assumptions in the financial model will survive implementation. Utilities and policymakers need projects that do not create avoidable instability at the ISTS or STU boundary.

A common misconception is that “connectivity approved” means the technical work is largely done. In practice, the heavier technical diligence starts after the application stage and continues through detailed modelling, study iterations, bay integration, protection philosophy alignment, telemetry design and final commissioning evidence. For many projects, the hidden risk is not denial of connectivity but repeated study revisions triggered by design drift.

This article focuses on a different angle from curtailment, bay readiness, grid code and general power system study topics: the specific role of ISTS connectivity studies in 2026, what they cover, why they fail, what timelines and costs developers should budget, and how stakeholders can reduce approval and COD risk.

Why connectivity studies have become a financing issue in 2026

In 2026, the technical bar is higher because the Indian grid is handling:

- More inverter-based renewable generation on weak nodes
- Larger pooling substations with high instantaneous renewable penetration
- Higher dependence on dynamic voltage support and plant-level controls
- More hybrid and storage-linked projects with changing operating modes
- Greater scrutiny on model accuracy, control response and disturbance behaviour

For lenders, this translates into a simple question: can the project evacuate power at contracted capacity within the expected schedule and without unplanned capex additions?

That question is no longer answered only by checking whether a project has applied for connectivity, LTA or GNA-related rights. It also depends on whether the connectivity study assumptions match final equipment selection and whether the system operator accepts the modelled behaviour.

Where projects go wrong is predictable:

- Applying with generic inverter or WTG models and later changing OEMs

- Assuming reactive capability that the final plant cannot actually deliver
- Underestimating harmonic filtering or dynamic compensation requirements
- Shifting from plain solar to hybrid or adding BESS after initial studies
- Changing transformer impedance, collector layout or plant controller logic late in execution

Each of these can trigger re-study, comments, fresh data submission or conditional approvals. That can move synchronization by 2 to 6 months, and in some cases longer where the upstream ISTS strengthening plan is also being updated.

What an ISTS connectivity study package typically includes

A serious connectivity package in 2026 is not one report. It is a structured technical submission set. The exact scope varies by voltage level, project size, technology mix and CTU/STU interface, but developers should expect the following components.

- Steady-state load flow study
- Short-circuit study
- Dynamic stability study
- Reactive power and voltage-control assessment
- Harmonic assessment where applicable
- Protection coordination inputs
- Plant controller and inverter/WTG model validation inputs
- Substation single-line and interconnection configuration review
- Telemetry, SCADA and metering data-point architecture inputs

For utility-scale solar and wind projects above 100 MW, and especially for 220 kV, 400 kV and 765 kV interfaces, dynamic behaviour is often the real gating issue. A load flow can look acceptable while the dynamic case reveals voltage recovery problems, poor control interaction or unstable response under fault contingencies.

For hybrids and storage-linked projects, complexity rises because study cases must reflect multiple operating states:

- Full solar, no wind, no BESS
- Full wind, low solar
- Combined peak export
- Charging mode for BESS
- BESS discharge during weak-grid conditions
- Low short-circuit ratio operating conditions

This is why developers increasingly need integrated [Power system studies](/coreservices/transmissionengineering/powersystemstudies) early, not after procurement is mostly frozen.

The data developers must freeze early to avoid rework

The biggest avoidable mistake is starting studies before the design basis is sufficiently mature. Some early assumptions are inevitable, but by 2026 the system can no longer absorb major late-stage changes without schedule impact.

At minimum, developers should freeze or near-freeze the following before advanced connectivity studies begin:

- Point of interconnection voltage level and bay arrangement
- Plant AC export capacity in MW and MVA terms
- Inverter or WTG OEM and model family
- Main transformer ratings, vector group and impedance
- Collector system voltage and broad topology
- Reactive compensation philosophy
- Plant controller architecture
- BESS operating philosophy, if any
- Forecasting, AGC and telemetry approach where required

The practical issue is that OEM finalization and connectivity timelines often move in parallel. If the project starts studies with placeholder OEM models and then swaps to another vendor with different control behaviour, the dynamic study may need substantial revision.

In 2026, this is particularly relevant for projects bidding aggressively where the final supply chain decision is taken after award. The tariff may look viable on paper, but late model changes can add engineering cost, delay and incremental equipment needs.

Illustrative cost impacts from late study-driven redesign can include:

- Additional dynamic reactive support: Rs 8 crore to Rs 35 crore depending on size and technology
- Revised protection and control architecture: Rs 0.5 crore to Rs 3 crore
- Substation layout or bus extension changes: Rs 1 crore to Rs 10 crore
- Plant controller tuning and OEM validation cycles: Rs 20 lakh to Rs 1.5 crore
- Delay-related IDC and liquidated-damages exposure: project-specific, often materially larger than study costs themselves

Compared with this, spending early on robust technical preparation is cheap.

Realistic timelines in India 2026: what sponsors should actually budget

A frequent board-level error is treating connectivity studies as a 3 to 4 week desktop exercise. In simple cases, some preliminary work can move quickly, but full approval-ready packages with utility comments and revisions usually need more time.

Indicative 2026 timelines for a utility-scale RE project are as follows:

- Data consolidation and design basis freeze: 2 to 6 weeks
- Base-case modelling and internal quality checks: 2 to 5 weeks
- Utility-facing study submission pack preparation: 1 to 3 weeks
- First-round technical review and comments: 2 to 8 weeks
- Clarifications, revised models and resubmission: 2 to 6 weeks
- Final acceptance linked to broader interconnection milestones: variable

In practice, a well-prepared project may move through the main study cycle in 8 to 14 weeks. A project with model gaps, late OEM changes or upstream network changes can take 4 to 7 months. If the interconnection node is congested or associated ISTS works are evolving, timelines can stretch further.

This has direct implications for EPC contracting and debt drawdown. If synchronization assumptions are built on optimistic study closure dates, the result is predictable stress on the project schedule.

For lenders, one prudent 2026 approach is to treat study closure as a monitored technical condition precedent or at least as a key milestone linked to disbursement gating for evacuation-related packages.

Key failure modes seen in 2026 projects

Based on current market practice, the most common study-related failure modes are not exotic. They are execution basics.

1. Inconsistent plant ratings across documents

The capacity shown in the application, SLD, inverter schedule, transformer datasheet and controller narrative does not always match. Even small inconsistencies create review cycles and reduce confidence in the submission.

2. Generic OEM models that are not accepted

Utilities and reviewing agencies increasingly expect usable and validated dynamic models. Placeholder models may be tolerated only at an early stage and often trigger conditions or resubmission requirements.

3. Reactive power claims unsupported by design

Projects may claim compliance at the interconnection point without fully accounting for collector losses, transformer drops, auxiliary demand and seasonal voltage conditions. The result is a gap between plant capability and grid expectation.

4. Hybrid and BESS control philosophy not fully defined

When export priority, charging logic, ramp-rate control and plant-level coordination are vague, studies become scenario-heavy and comments multiply.

5. Protection and SCADA left too late

Connectivity is not only about power flow. The interconnection philosophy must also align on breaker failure, synchronization checks, remote tripping logic, disturbance recording, PMU or data integration requirements where applicable, and control-centre interoperability. Early planning for [Protection, control & SCADA](/coreservices/transmissionengineering/protectioncontrolandscada) avoids expensive late-stage retrofits.

6. Upstream network assumptions change midstream

Sometimes the project is not at fault. The evacuation node, planned line loading pattern or nearby generation mix changes. That can alter fault levels, voltage profile and contingency performance, requiring study refresh.

What developers, C&I buyers and lenders should ask before financial close

Different stakeholders should test different technical questions.

For developers:

- Is the design basis frozen enough to support final studies?

- Are OEM dynamic models available in the required format?
- Has reactive support been sized for worst-case voltage conditions, not just nominal operation?
- Are hybrid and BESS operating states clearly defined?
- Has the interconnection package been checked for internal consistency?

For C&I buyers relying on open access supply:

- Is evacuation readiness aligned with contracted delivery timelines?
- Does the project depend on unresolved upstream transmission elements?
- Are there conditions in the connectivity path that could constrain injection in the first operating months?
- Is the seller transparent about study status and substation readiness?

For lenders:

- Has an independent engineer reviewed the study basis and key assumptions?
- Are major electrical packages already aligned with submitted models?
- Is there capex contingency for dynamic compensation or interconnection redesign?
- Are long-stop dates realistic given utility review cycles?
- Do finance documents capture delay risk from study revision or connectivity conditions precedent?

These questions are not over-cautious. In a tight tariff environment, even a modest delay can materially affect project IRR through IDC, lost generation, tax timing and exposure under offtake commitments.

Cost benchmarks and budgeting approach for 2026

Study costs vary widely by project size and complexity. For a rough 2026 budgeting lens in India:

- Basic connectivity-oriented analytical package for a simpler project: around Rs 10 lakh to Rs 25 lakh
- More detailed multi-scenario package for large solar, wind or hybrid projects: around Rs 25 lakh to Rs 60 lakh
- Complex hybrid/BESS-heavy projects with multiple iterations and OEM coordination: often Rs 50 lakh and above

These numbers are indicative and can rise when the scope includes repeated revisions, special studies, extensive utility interface support or integration with detailed interconnection engineering.

However, the larger budget line is usually not the study itself. It is the downstream impact if the study is weak. That is why capable front-end engineering matters. Teams that combine modelling, interface engineering and implementation reality are generally better placed to prevent rework. For example, linking the study package with practical [HV/EHV substation design](/coreservices/transmissionengineering/hvehvsubstationdesign) decisions often resolves issues before they appear in utility comments.

A disciplined budgeting approach should include:

- Study consultant cost
- OEM model validation support cost
- Utility comment response allowance
- Contingency for reactive support optimization
- Interconnection engineering revision allowance

- Schedule contingency tied to approval cycles

A practical playbook to reduce connectivity-study risk

Projects that move smoothly usually follow a simple but rigorous sequence.

- Freeze a design basis memorandum early
- Align application data, SLDs, datasheets and capacity declarations
- Lock OEM model availability before final commercial commitment
- Run internal pre-submission reviews of load flow and dynamic cases
- Stress-test weak-grid and contingency scenarios, not just base case
- Integrate substation, protection, SCADA and telemetry planning from the start
- Track every utility comment in a formal closure matrix
- Avoid late capacity uprates or architecture changes unless clearly justified

For sponsors managing multiple assets, standardization helps. A repeatable study template, model library, document-control protocol and comment-resolution workflow can save significant time across a portfolio.

The broader lesson for 2026 is straightforward: transmission connectivity success is increasingly determined by engineering readiness, not only by application strategy. The projects that achieve timely COD are usually the ones that treat connectivity studies as a core workstream from development stage onward.

For developers, C&I buyers, lenders and public-sector stakeholders, this is now a bankability issue. A project with weak study discipline may still get built, but usually at a higher cost and with more delay than the tariff initially suggests.

If your project is approaching ISTS or high-voltage STU interconnection and you need independent support on study scope, model review, evacuation design or utility-facing technical closure, contact Growthifye’s advisory desk. We support sponsors and financiers across connectivity strategy, Power system studies and implementation-focused transmission engineering.

Explore Growthifye's related capabilities

This analysis connects directly to our advisory practice: [Power system studies](/coreservices/transmissionengineering/powersystemstudies) · [HV/EHV substation design](/coreservices/transmissionengineering/hvehvsubstationdesign) · [Transmission line engineering](/coreservices/transmissionengineering/transmissionlineengineering) · [Protection, control & SCADA](/coreservices/transmissionengineering/protectioncontrolandscada).

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