SPS and Remedial Action Schemes for RE Evacuation in India 2026

By Sudarshan Karweer · 14 September 2026 · growthifye.com

How SPS/RAS improves ISTS evacuation reliability for renewables in India in 2026, with design triggers, costs, approvals and lender focus.

India’s renewable build-out is no longer constrained only by generation economics. In 2026, a growing share of project delay, curtailment risk and lender concern sits at the transmission interface: connectivity, dynamic security, congestion management and credible evacuation under stressed conditions. In that context, Special Protection Schemes, often referred to globally as Remedial Action Schemes or RAS, are becoming an important but still under-discussed tool for RE evacuation planning.

For utility-scale solar, wind, hybrid and storage projects connecting into the ISTS or major state transmission corridors, SPS is not a substitute for sound network planning. It is a targeted operational layer used when conventional planning margins, protection settings and dispatch controls are not enough to maintain security after defined contingencies. For developers and C&I offtakers exposed to open access delivery risk, understanding SPS is now commercially relevant, not just technically interesting.

This article explains where SPS fits in India’s 2026 transmission landscape, when it gets triggered, what it typically costs, how utilities and lenders evaluate it, and how developers should factor it into project timelines and bankability.

What SPS means in the Indian transmission context

An SPS is an automatically initiated control action designed to detect a specific abnormal power system condition and take pre-engineered corrective action fast enough to preserve system security. In practical renewable evacuation terms, that action may include:

- generation runback at one or multiple plants
- tripping of selected feeders, inverters or pooling-station elements
- switching of reactors, capacitors or bus sections
- controlled islanding in rare system designs
- battery response or hybrid-plant active power reduction
- blocking or permissive signals linked to specific line or transformer outages

Unlike ordinary primary protection, SPS does not clear a faulted element in the conventional sense. Its role is to prevent a post-contingency overload, instability, voltage collapse or cascading outage after a known credible event, such as the loss of a heavily loaded 765 kV line, 400/220 kV ICT, HVDC pole or key green-energy-corridor element.

In India, SPS logic has historically been more visible around major inter-regional transfers, import-heavy metros and generation hubs. In 2026, the renewable angle is stronger because high-infeed solar and wind zones can produce steep corridor loading and low-inertia conditions at the same time. That combination increases the value of fast coordinated action.

Why SPS is rising in importance for RE evacuation in 2026

Three structural shifts are driving SPS adoption or at least SPS screening in renewable evacuation studies.

First, generation concentration is increasing. Rajasthan, Gujarat, Khavda-linked developments, southern wind clusters and hybrid parks are producing very large injections into relatively defined corridors. Even with ongoing ISTS augmentation under the Green Energy Corridor and associated interstate schemes, some corridors will operate closer to transfer limits during high-generation windows.

Second, generation profiles are becoming sharper. In solar-heavy pockets, injection can ramp by hundreds of MW within minutes at the pooling-substation and transmission-line level when cloud conditions clear simultaneously across a zone. Wind corridors can show similar aggregate swings during monsoon flow changes. Batteries help, but they do not automatically remove contingency risk unless integrated into the control philosophy.

Third, transmission commissioning and generation commissioning are not always perfectly synchronized. A line bay, ICT, reactor or second circuit delay can temporarily create a system condition where evacuation is feasible but operationally constrained. In such cases, utilities may consider temporary or transitional SPS arrangements until the planned network is fully in place.

For lenders, this matters because a project with approved connectivity can still face practical evacuation restrictions if post-contingency security is weak. A well-designed SPS can reduce that risk. A poorly defined one can increase interface complexity, outage exposure and compliance burden.

Typical use cases: where SPS gets proposed for renewable corridors

SPS is not needed for every substation or every RE plant. It usually appears where one or more of the following conditions exist:

- very high renewable injection behind a limited number of EHV evacuation paths
- heavy loading of one 400 kV or 765 kV corridor under peak export conditions
- post-contingency thermal overloads that arise faster than manual dispatch can respond
- transient or angular stability sensitivity following outage of key network elements
- low short-circuit strength combined with high inverter-based resource penetration
- temporary network incompleteness during phased commissioning
- multi-owner generation complexes where coordinated curtailment logic is required

A practical example is a renewable park evacuating 2 to 5 GW through two or three major EHV paths. Under all-elements-in-service conditions, the network may be acceptable. But loss of one 765 kV line or one 400/765 kV transformer could push surviving elements beyond secure loading. If manual backing down takes 10 to 15 minutes, that is often too slow. SPS can issue automated runback or trip commands in cycles to seconds, keeping the system within stability and thermal margins.

Another example is a hybrid-plus-BESS cluster where SPS logic instructs battery charge increase, inverter active power curtailment and selective feeder runback after a corridor contingency. This can preserve transfer security without a complete block shutdown.

How SPS is studied, approved and implemented in India

No serious SPS should be designed by rule of thumb. It must emerge from detailed simulation and coordination across entities. In India, the workflow usually cuts across CTU, ISTS licensees, STUs, RLDC/SLDC, protection teams and generating entities.

The starting point is rigorous [Power system studies](/coreservices/transmissionengineering/powersystemstudies), including:

- load flow and contingency analysis for seasonal and time-block cases
- transient stability studies for severe disturbances
- voltage stability and reactive performance checks
- sensitivity runs for high RE, low demand, high import/export and outage scenarios
- communication and signal-failure philosophy
- fail-safe and cybersecurity considerations

The key design principle is selectivity. SPS should act only for predefined conditions, with clearly verified measurements and permissives, and should avoid unnecessary operation. Every additional trigger adds complexity and testing burden.

In implementation, the scheme generally uses redundant measurement channels, logic processors, teleprotection or high-speed communication paths, and hardwired or IEC 61850-based interfaces at substations and generating stations. For RE projects, this often means integration across pooling substations, plant controllers, bay control units, relays and SCADA systems. That is why capabilities such as [Protection, control & SCADA](/coreservices/transmissionengineering/protectioncontrolandscada) and [HV/EHV substation design](/coreservices/transmissionengineering/hvehvsubstationdesign) are directly relevant to project execution.

Approval pathways can vary by system importance and ownership, but developers should expect review by utility protection and planning teams, system operators and, where relevant, regional committees. Factory acceptance testing, site acceptance testing, end-to-end signal verification and mock-drill procedures are not optional formalities; they are central to operating acceptance.

What SPS costs in 2026 and how to budget it

SPS cost is highly case-specific, but ignoring it in capex and schedule estimates is a recurring mistake.

At a single substation or generating-complex level, the incremental cost of an SPS package in 2026 can range broadly from about INR 1.5 crore to INR 6 crore for simpler logic, IEDs, redundant communication interfaces, engineering, integration and testing. More complex multi-substation schemes with multiple trip/runback actions, wide-area signals and operator interface enhancements can move to INR 7 crore to INR 20 crore or more, especially where multiple owners are involved.

Cost components typically include:

- engineering studies and logic design
- redundant relays or dedicated SPS controllers
- PLCC/OPGW/telecom interface upgrades
- SCADA and historian integration
- control-panel additions and wiring modifications
- testing, commissioning and periodic validation
- annual maintenance and communication-path health monitoring

For large RE parks, the more material financial impact may not be SPS hardware itself but associated plant-side modifications. Examples include inverter controller changes, plant EMS integration, feeder segmentation, additional metering, breaker automation and battery dispatch interfaces. These can add another INR 0.5 crore to INR 5 crore at project level depending on architecture.

Lenders will also look at indirect cost consequences:

- whether SPS creates a must-run curtailment risk under normal operations
- whether plant generation guarantees account for automated runback events
- whether O&M contracts cover SPS-induced control actions
- whether spare strategy and cybersecurity compliance are funded

From a tariff and delivered-energy perspective, SPS does not usually create a separate recurring charge like transmission service billing. But if the scheme frequently backs down generation under stressed conditions, the commercial effect can be significant. That is why dispatch frequency, trigger thresholds and event-history assumptions should be negotiated and documented as far as possible.

Key commercial and regulatory questions for developers and C&I buyers

For developers seeking ISTS or state-grid connectivity, an SPS-related condition in connectivity approval, evacuation study or bay allocation letter should trigger immediate diligence. Do not leave it for EPC closure.

Questions to ask include:

- Is the SPS permanent, temporary or linked to a future line/reactor/ICT commissioning milestone?
- Who owns the scheme: CTU, STU, transmission licensee, generator or shared parties?
- Who pays for initial capex and future modifications if another project later joins the node?
- What is the required response time, and can the plant controller realistically meet it?
- Is the action full trip, staged runback, feeder-wise shedding or battery-based support?
- What event logging, testing and monthly health checks are mandatory?
- What happens if the communication channel is unavailable?
- Can the generator continue operation under a degraded mode, or is generation restricted until restoration?

For C&I buyers procuring power through open access, especially from remotely located ISTS-connected hybrid assets, SPS dependence should be treated as a deliverability variable. If a seller's evacuation path relies on frequent automated runback during congestion-prone months, the effective plant load factor delivered to the buyer may diverge from P50 assumptions. That should flow into contract design, scheduling expectations and replacement-power planning.

Utilities and policymakers also need to be careful not to overuse SPS as a substitute for transmission augmentation. A good rule is that SPS can buy security and flexibility around specific contingencies, but it should not normalize structurally inadequate evacuation infrastructure over the long term.

Common mistakes seen in SPS-linked RE evacuation projects

In 2026, the most common execution problems are not algorithmic sophistication; they are basic coordination failures.

- SPS is identified too late, after major plant control philosophy is frozen.
- Communications scope is underestimated, especially across multiple owners.

- Battery or hybrid assets are assumed to respond instantly without validating EMS and inverter constraints.
- Trigger logic is overcomplicated, creating nuisance operations and difficult maintenance.
- No clear governance exists for testing after network changes, relay replacement or firmware updates.
- Lender technical advisors receive incomplete documentation on curtailment implications.

Another repeated issue is mismatch between transmission planning assumptions and actual plant commissioning sequence. If 1,000 MW is assumed online in a staged manner but 700 MW arrives quickly before the parallel corridor is ready, the system operator may impose conservative restrictions until all tests are complete. This can affect COD-linked revenue unless the implementation timeline is managed tightly.

This is where integrated advisory across connectivity, studies, substation engineering and commissioning becomes valuable. Teams with capability in Connectivity & open access and Construction & commissioning support can reduce the gap between paper approval and field-ready operation.

What a prudent 2026 action plan looks like

If you are developing, financing, buying from or regulating a renewable project with significant transmission exposure, SPS should be evaluated through a structured checklist.

- Screen the evacuation node for high-infeed and corridor-contingency risk at concept stage.
- Ask for clarity on permanent versus transitional network configuration.
- Run sensitivity studies for seasonal peaks, low demand and high renewable coincidence.
- Confirm plant controller, inverter and BESS response capability against likely SPS actions.
- Budget separately for communication, integration and retesting, not only relay hardware.
- Review curtailment language in PPAs, O&M contracts and lender models.
- Define post-COD governance for maintenance, mock drills and change management.

As India pushes toward higher renewable penetration, system security will increasingly depend on how intelligently generation and transmission controls are integrated. SPS is one of those tools that remains invisible when designed well and painfully visible when ignored. For RE evacuation in 2026, it deserves board-level attention because it affects COD risk, lender comfort, dispatch reliability and delivered energy economics.

If your project is facing connectivity conditions, evacuation bottlenecks or dynamic-security questions, contact Growthifye’s advisory desk for practical support on transmission planning, studies, approvals and implementation.

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).

ABOUT THE AUTHOR

Sudarshan Karweer — Chief Executive Officer, Growthifye

Over 23 years in management consulting — concept to scale — building and scaling new-age digital and energy businesses. An EY alumnus, Sudarshan leads Growthifye's renewable energy & storage advisory, EPC, transmission engineering and green-financing practices for developers, utilities and C&I consumers across India.
Contact: info@growthifye.com · +91 84510 99371 · growthifye.com