

# India - The **fastest growing** Renewable Energy Sector in the world

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## **Expansion or Transformation** What is the real solution?

RelayCSP tackles the 7 most pressing Renewable energy revenue challenges of today



## Executive Summary

India's renewable energy market is entering a new phase. With the Government targeting 450 GW of renewable capacity by 2030, developers must move beyond capacity growth to manage merchant markets, hybrid portfolios, storage, and tighter compliance.

- While these opportunities expand revenue potential, they also introduce significant risks:
- Forecasting errors and DSM penalties erode margins.
- Fragmented manual processes slow down billing and reconciliation.
- Complex multi-market participation (IDAM, RTM, bilateral) increases operational strain.
- Settlement disputes and delayed payments threaten cash flow predictability.
- Evolving regulatory frameworks amplify compliance pressure.

Without digital processes, developers risk revenue leakage, compliance lapses, and scaling bottlenecks.

Relay CSP directly addresses these challenges. Designed for renewable portfolios, it transforms accounting and settlement into a strategic lever for revenue resilience by:

- Reducing DSM penalties through real-time forecasting and scheduling integration.
- Maximizing revenues with automated bidding and RTM resubmission.
- Ensuring settlement accuracy via consolidated, validated meter and market data.
- Accelerating cash flows with automated invoicing and reconciliation.
- Enhancing compliance and transparency with structured reports and audit trails.

For renewable developers, the impact is clear:

- Secure revenues by minimizing penalties, disputes, and delays.
- Enable scalable growth without proportional overhead.
- Strengthen competitiveness in merchant markets through advanced analytics.

## Industry Landscape & Strategic Context

India's renewable energy sector is undergoing one of the fastest transformations in the world. With the Government of India targeting 450 GW of renewable capacity by 2030, the market is shifting from capacity addition alone to more complex forms of participation. Developers must not only add solar and wind capacity but also integrate hybrid and storage for firm, flexible power. Alongside this growth, the market structures are evolving rapidly:

- GNA / T-GNA (General Network Access & Transmission – GNA) frameworks are redefining how renewable developers contract and allocate transmission corridors.
- IDAM (Integrated Day Ahead Market) and RTM (Real-Time Market) are expanding opportunities for merchant trade, but also require agile forecasting, bidding, and settlement processes.
- Participation in multiple markets simultaneously means developers must manage a far greater number of transactions, schedules, and reconciliations.



This expansion of opportunity is accompanied by rising complexity and compliance pressure. The Deviation Settlement Mechanism (DSM) imposes penalties on forecasting inaccuracies and scheduling mismatches, while market settlement rules from regulators such as CERC and SLDCs continue to evolve. For developers with multi-asset portfolios, this introduces significant risk of revenue leakage if operations remain dependent on fragmented tools and manual processes.

India's renewable market has shifted from capacity-driven to efficiency-driven. The companies that will lead in this landscape are not those with the largest pipelines alone, but those who can protect and optimize their revenues through robust forecasting, automated settlement, and compliance-ready operations.

### **Revenue Sources for Renewable Energy Companies:**

For renewable energy developers, revenues are derived from multiple streams that balance stability with opportunity. Each source plays a distinct role in ensuring portfolio resilience:

#### **1. Contracted Revenue (Long-term PPAs)**

- The cornerstone of revenue assurance, long-term Power Purchase Agreements (PPAs) provide predictable cash flows by locking tariffs with DISCOMs or corporates. These contracts ensure stability despite market volatility, supported by GNA/T-GNA frameworks that guarantee transmission corridor access.

#### **2. Market Revenue (Merchant Trades: IDAM, RTM, Bilateral)**

- The emergence of IEX's Integrated Day Ahead Market (IDAM), the Green Day Ahead Market (GDAM), and the Real-Time Market (RTM) allows developers to sell surplus renewable power, access green-only trading opportunities, or optimize portfolio allocations. While merchant revenues offer higher potential returns, they also expose developers to greater volatility and require robust forecasting, bidding, and settlement capabilities.
- Bilateral contracts add flexibility but demand efficient reconciliation with grid and market operations.

#### **3. Green Attributes (RECs and Carbon Credits)**

- Developers can monetize Renewable Energy Certificates (RECs) and carbon offsets in compliance or voluntary markets.

- These attributes are becoming increasingly valuable as corporate buyers and international investors demand stronger ESG performance.
- For companies, with a large renewable portfolio, these can represent a growing secondary revenue stream.

#### **4. Future Value Streams (Storage Arbitrage and Ancillary Services)**

- As storage and hybrid plants scale, developers can generate revenues by time-shifting energy (charging during low demand and discharging during peak pricing windows).
- Participation in ancillary services markets (such as frequency regulation and grid balancing) will open additional revenue avenues.
- These streams place renewable at the forefront of India's transition to a flexible, resilient grid.



# Challenges in Renewable Energy Revenue Management

## 1. Forecasting Inaccuracy & DSM Penalties

- Wind/solar generation is variable forecasts often diverge from actuals.
- Even small errors lead to Deviation Settlement Mechanism (DSM) penalties.

## 2. Manual & Fragmented Processes

- Forecasting, scheduling, and reconciliation often run on disconnected tools.
- High risk of human error, duplication, and delays.

## 3. Complex Market Participation

- With IDAM, RTM, and bilateral trades, developers must manage multiple bids and resubmissions daily.
- Missing narrow trading windows means lost revenue.

## 4. Settlement Disputes & Data Gaps

- Mismatches between SCADA/MDA/WBES data and meter readings often cause disputes with SLDCs, DISCOMs, and buyers.
- Missing or delayed data leads to cash flow uncertainty.

## 5. Slow Invoicing & Payment Delays

- Manual preparation of provisional/final invoices slows down billing cycles.
- Receivables get delayed, straining working capital.

## 6. Compliance & Regulatory Pressure

- New frameworks (GNA, T-GNA, CERC rules) demand timely, transparent reporting.
- Failure risks penalties, audits, and reputation damage.

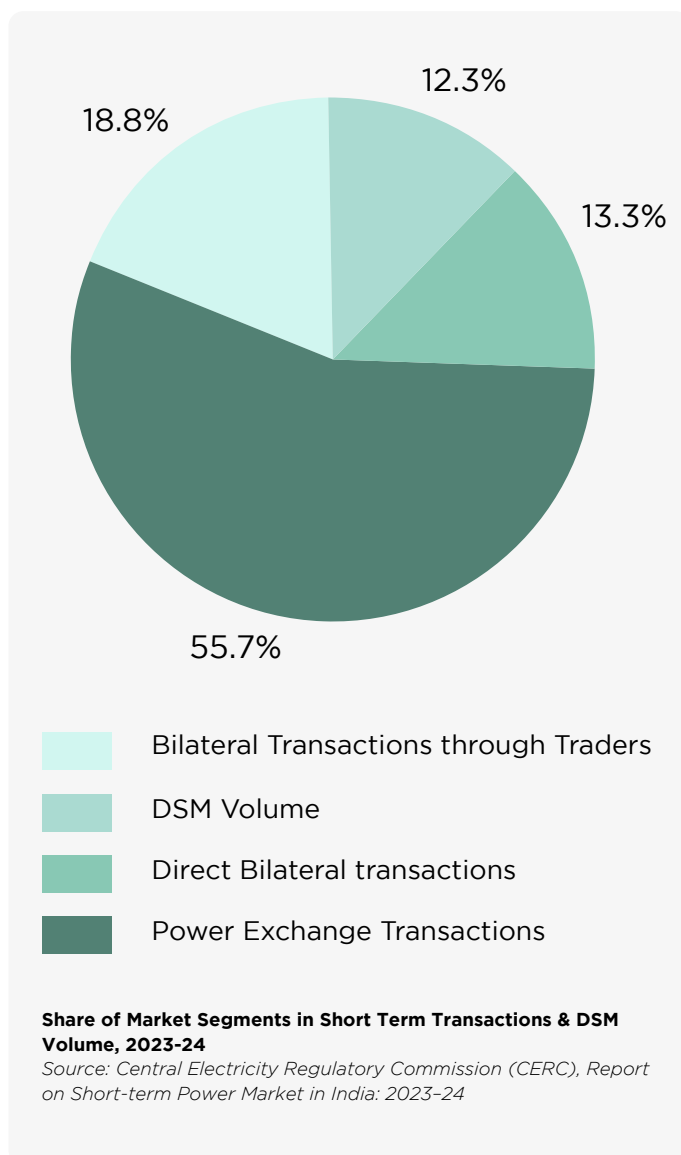
## 7. Portfolio Complexity & Scale

- Multi-asset portfolios (solar, wind, hybrid, storage) across states mean more schedules, bids, and settlements.
- Without automation, scaling operations proportionally increases manpower and cost.

# Revenue Risks & Market Shifts in India's Power Sector:

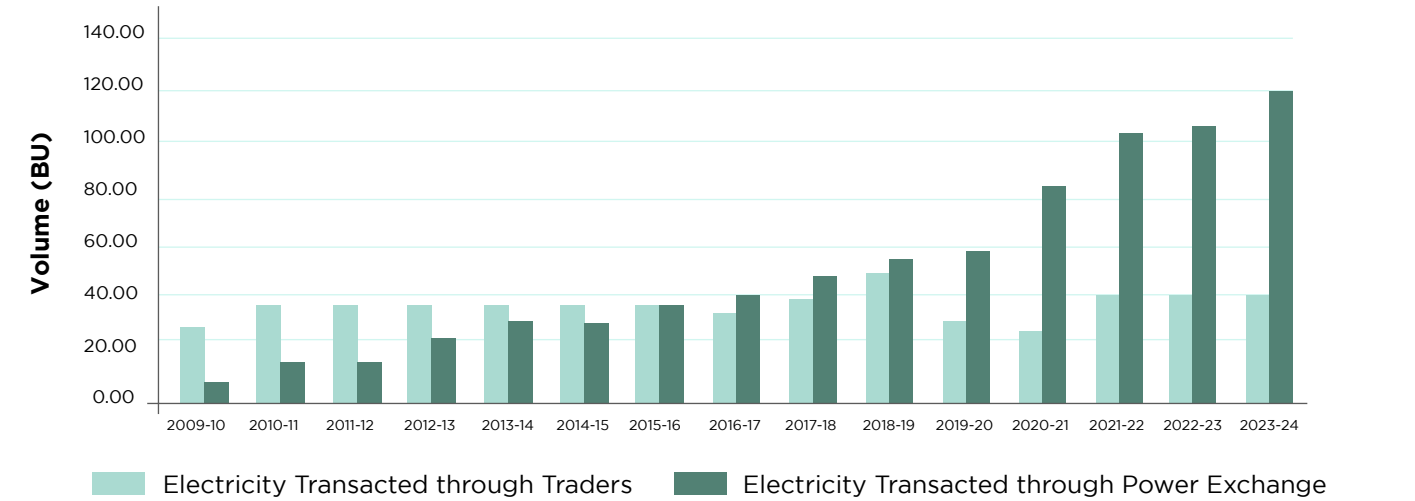
## DSM Penalties are Material

- In Uttar Pradesh alone, DSM penalties reached ₹374 crore in just the first half of FY 2023. Over-drawals (₹459 crore) were nearly four times under-drawals. This illustrates how deviation costs can quickly accumulate without proactive management.
- Regulatory analysis shows that under the new DSM regime, the annual penalty burden for a 250 MW solar project could rise from 0.15% to 1.65% of annual revenues—a direct hit to margins if forecasting and scheduling remain inaccurate.



Real-Time Market is Expanding Rapidly

- RTM volumes surged 41% YoY to 39.01 BUs in FY 2024-25 (from 27.64 BUs in FY 2023-24), with the Indian Energy Exchange (IEX) capturing 97.4% of this volume.
- In Q1 FY 2025-26, RTM traded 12,975 MU, up 41% YoY, while the Green Market segment grew 51% YoY to 2,660 MU.



Volume of Electricity Transacted through Traders and Power Exchanges, 2009-10 to 2023-24.  
Source: Central Electricity Regulatory Commission (CERC), Report on Short-term Power Market in India: 2023-24

Payment Delays Persist

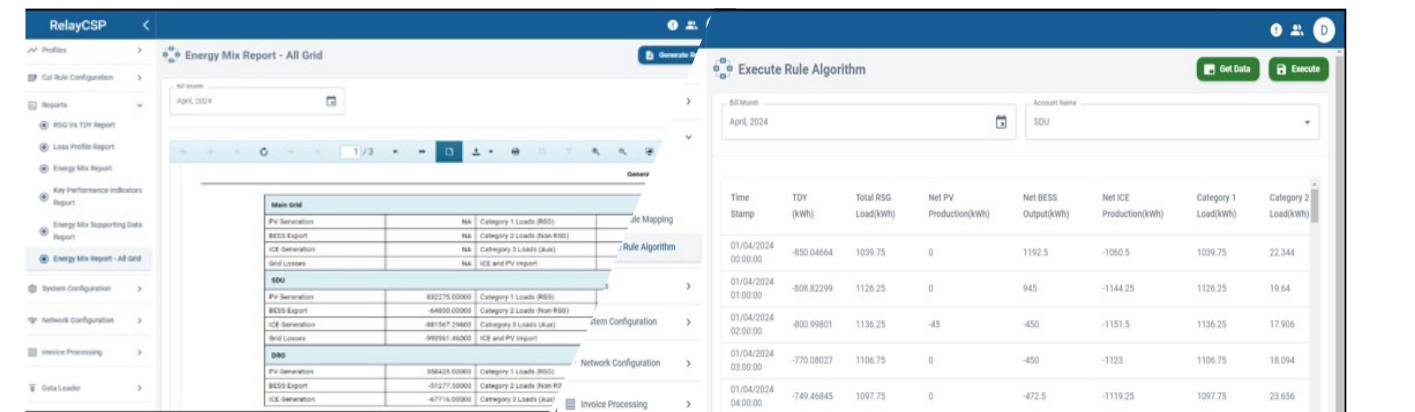
- According to Ministry of Power data, DISCOMs owed generators ₹80,000+ crore in overdue payments as of mid-2024, with average payment delays ranging from 6 to 9 months in several states. This strains developer cash flows and underscores the need for faster, automated invoicing and reconciliation.

Globacom’s Solution (Relay CSP): Addressing Revenue Risks

Relay CSP is designed to directly plug the gaps where renewable developers face revenue leakage. By digitizing critical processes, the platform transforms operational risks into opportunities for efficiency, accuracy, and resilience.

1. Forecasting & Scheduling Integration Reduces DSM Penalties

- Relay CSP integrates forecasts and schedules from WBES, validating them against SCADA/MDA data in near real time.
- Automated deviation alerts allow operators to act before DSM thresholds are breached, reducing costly penalties.
- Over time, this strengthens forecasting discipline and ensures greater compliance with regulatory norms.



## 2. Automated Bidding & RTM Resubmission: Captures Lost Revenue

- The system prepares and tracks bid submissions for IDAM automatically.
- If bids remain unawarded, Relay CSP triggers resubmission into the RTM, ensuring no capacity goes underutilized.
- This maximizes revenue opportunities while reducing manual dependency during tight market windows.

## 3. Meter Data Management & Validation: Ensures Settlement Accuracy

- All generation and dispatch data are consolidated, validated, and estimated where readings are missing.
- By creating a single source of truth, Relay CSP minimizes disputes during settlement with SLDCs, Discoms, or buyers.
- Clean data feeds directly into invoicing and reconciliation modules, protecting revenue integrity.

| Time Stamp          | TDY (kWh)  | Total RSG Load(kWh) | Net PV Production(kWh) | Net BESS Output(kWh) | Net ICE Production(kWh) | Category 1 Load(kWh) | Category 2 Load(kWh) |
|---------------------|------------|---------------------|------------------------|----------------------|-------------------------|----------------------|----------------------|
| 01/04/2024 00:00:00 | -850.04664 | 1039.75             | 0                      | 1192.5               | -1060.5                 | 1039.75              | 22.344               |
| 01/04/2024 01:00:00 | -808.82299 | 1126.25             | 0                      | 945                  | -1144.25                | 1126.25              | 19.64                |
| 01/04/2024 02:00:00 | -800.99801 | 1136.25             | -45                    | -450                 | -1151.5                 | 1136.25              | 17.906               |
| 01/04/2024 03:00:00 | -770.08027 | 1106.75             | 0                      | -450                 | -1123                   | 1106.75              | 18.094               |
| 01/04/2024 04:00:00 | -749.46845 | 1097.75             | 0                      | -472.5               | -1119.25                | 1097.75              | 23.656               |
| 01/04/2024 05:00:00 | -800.99801 | 1122.75             | -45                    | -450                 | -1138.5                 | 1122.75              | 20.297               |

## 4. Invoicing & Reconciliation Automation Protects Cash Flow

- Provisional and final invoices are generated automatically using REA data and contractual rules.
- This accelerates the billing cycle, reduces delays in receivables, and improves cash flow predictability.
- Automated reconciliation ensures discrepancies are identified and resolved before they escalate.

## 5. Alerts & Dashboards Proactive Revenue Management

- Relay CSP provides role-based dashboards for operators, finance teams, and auditors.
- Alerts notify stakeholders of DSM deviations, invoice deadlines, bid cut-offs, or settlement discrepancies.
- This shifts revenue assurance from a reactive to a proactive process, enabling faster corrective actions.

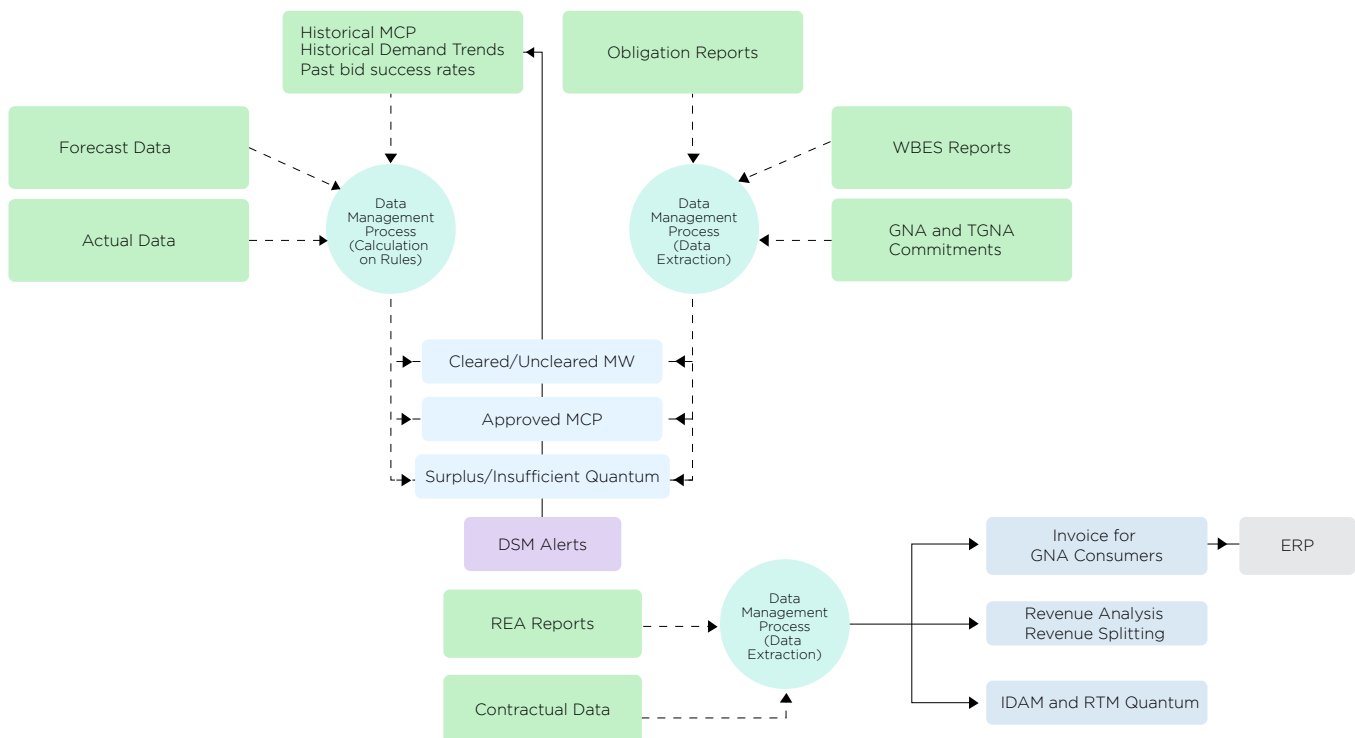


The key revenue risks renewable faces — and how Relay CSP addresses them — are mapped below. This one-to-one linkage makes clear how operational challenges translate into direct solutions.

| Challenge                                                                                                                                              | Relay CSP Solution                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Forecasting inaccuracy &amp; DSM penalties</b><br>Variable wind/solar output leads to frequent deviations and costly fines.                         | <b>Forecasting &amp; scheduling integration:</b> Validates forecasts against SCADA/MDA in real time, with automated deviation alerts > reduces DSM penalties and improves compliance. |
| <b>Manual &amp; fragmented processes</b> Forecasting, scheduling, invoicing, and reconciliation run on disconnected tools, creating errors and delays. | <b>End-to-end automation:</b> Consolidates forecasting, bidding, invoicing, and reconciliation in one platform > cuts errors and saves effort.                                        |
| <b>Complex multi-market</b> participation Multiple bids/resubmissions daily for IDAM, RTM, and bilateral trades.                                       | <b>Automated bidding &amp; RTM resubmission:</b> Submits IDAM bids automatically; unawarded bids are resubmitted into RTM > captures lost revenue.                                    |
| <b>Settlement disputes &amp; data gaps</b> Mismatches between SCADA/MDA/WBES and meter data trigger disputes with SLDCs/DISCOMs.                       | <b>Meter data management &amp; validation:</b> Consolidates and validates all generation/dispatch data > creates a single source of truth and minimizes disputes.                     |
| <b>Slow invoicing &amp; payment delays</b> Manual invoice preparation slows billing cycles and strains cash flow.                                      | <b>Automated invoicing &amp; reconciliation:</b> Generates invoices automatically, accelerates billing cycles, and flags mismatches early > improves cash flow predictability.        |
| <b>Compliance &amp; regulatory pressure</b> New frameworks (GNA, T-GNA, CERC, SLDC) demand transparent, timely reporting.                              | <b>Compliance &amp; audit readiness:</b> Generates structured reports, maintains audit trails, and enables regulator-ready transparency > reduces risk of penalties.                  |
| <b>Portfolio complexity &amp; scale</b> Multi-asset, multi-state portfolios require high manpower if processes stay manual.                            | <b>Scalable modular design:</b> Onboards new plants, contracts, and corridors > supports lean, scalable growth.                                                                       |

# Amplifying Strengths: How Relay CSP Scales To Renewable Companies Advantage

Relay CSP not only plugs revenue leaks — it strengthens foundations, enabling scale, compliance, and smarter trading.



## 1. Scalability - Managing Growth Without Overhead

- As renewable developers expand their portfolio across multiple states, plants, and technologies (solar, wind, hybrid, storage), operational complexity grows exponentially.
- Relay CSP's modular design allows new plants, contracts, and corridors to be onboarded without adding proportional manual effort or staffing.
- This ensures renewable developers can grow their portfolio while keeping operational costs lean.

RelayCSP

Dashboard

Account Dashboard

Plant Dashboard

Meter Data Management

Profiles

Cal Rule Configuration

Reports

System Configuration

Network Configuration

Invoice Processing

Data Loader

Plant Dashboard

Search

PLANT LIST

SHE.RO.STP.Plant  
SHEROSTPPlant  
SHE  
Plant Capacity: 400...  
Plant Location: She...  
ACTIVE  
01/10/2021 - 31/01/2030  
SHE.RO.STP.Plant

DRO.STP.Plant  
DROSTPPlant  
DRO  
Plant Capacity: 150...  
Plant Location: Sau...  
ACTIVE  
01/10/2021 - 31/01/2030  
DRO.STP.Plant

SDU.STP.Plant  
SDUSTP  
SDU  
Plant Capacity: 120...  
Plant Location: Sau...  
ACTIVE  
01/10/2021 - 31/01/2030  
SDU.STP.Plant

SF1.STP.Plant  
SF1STP  
Main Grid  
Plant Capacity: 1500  
Plant Location: Sau...  
ACTIVE  
01/01/2021 - 31/01/2030  
SF1.STP.Plant

SF1.RO.Plant  
SF1RO  
Main Grid  
Plant Capacity: 320...  
Plant Location: Sau...  
ACTIVE  
01/01/2021 - 31/01/2030  
SF1.RO.Plant

SHE.Generating...  
SHEGeneratingStat...  
SHE  
Plant Capacity: 2000  
Plant Location: She...  
ACTIVE  
01/10/2021 - 31/01/2030  
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DRO.Generating...  
DROGeneratingStat...  
DRO  
Plant Capacity: 1300  
Plant Location: Sau...  
ACTIVE

SDU.Generating...  
SDUGS  
SDU  
Plant Capacity: 2300  
Plant Location: Sau...  
ACTIVE

SF2.Generating...  
SF2GS  
Main Grid  
Plant Capacity: 1300  
Plant Location: Sau...  
ACTIVE

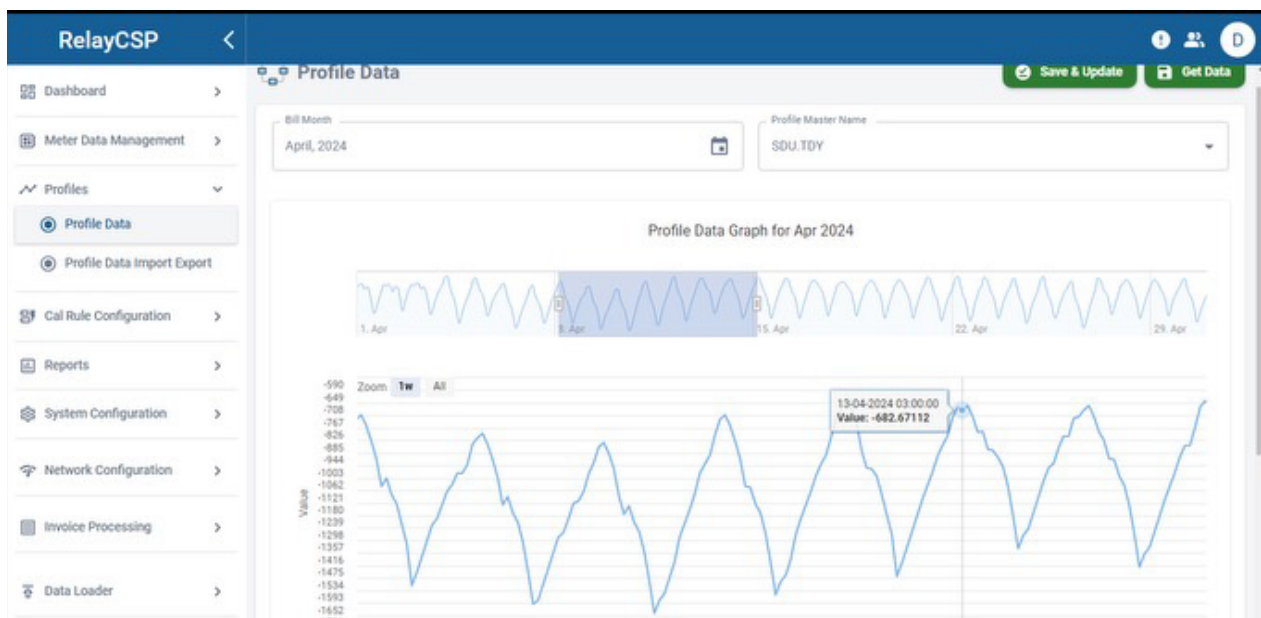
SF1.Generating...  
SF1GS  
Main Grid  
Plant Capacity: 2200  
Plant Location: Sau...  
ACTIVE

## 2. Compliance - Transparent Audit Trails for Regulators

- The Indian power sector is increasingly regulated, with stringent reporting requirements from SLDCs, RLDCs, and CERC.
- Relay CSP generates structured compliance reports, maintains end-to-end audit trails, and enables role-based access for auditors.
- This reduces regulatory risks and enhances a developer's reputation as a transparent, compliant market participant.

## 3. Advanced Analytics - Optimizing Bidding and Portfolio Mix

- Beyond basic reporting, Relay CSP provides advanced dashboards that analyze MCP trends, bid success rates, DSM risks, and revenue vs. obligations.
- These insights help portfolio managers optimize bidding strategies, identify underperforming assets, and adjust the portfolio mix for higher returns.
- Over time, this analytical edge positions renewable developers as a more competitive traders in India's energy markets.



## Conclusion

As India's renewable energy market matures, the challenge for developers is shifting from building capacity to protecting and optimizing revenues. In an environment of complex contracts, volatile merchant markets, and evolving regulatory frameworks, revenue assurance is no longer optional — it is the foundation for sustainable growth. For leading renewable developers, this means every unit of energy generated must be matched with accurate forecasting, efficient scheduling, timely settlement, and transparent reporting. Without this discipline, penalties, disputes, and delays can erode margins and weaken competitiveness.

Relay CSP provides the digital backbone to secure this future. By automating settlement workflows, reducing DSM penalties, accelerating invoicing, and delivering real-time insights, it transforms accounting and settlement from a back-office necessity into a strategic lever for revenue resilience. In doing so, Relay CSP enables renewable developers to achieve sustainable, predictable growth — not just by minimizing risks, but by building the scalability, compliance readiness, and analytical edge required to lead in India's evolving power markets.

The next step is clear: embed revenue assurance at the core of renewable developers' operations through a tailored digital roadmap.

We propose to:

- 1. Pilot Relay CSP on a representative asset to demonstrate DSM savings, faster invoicing, and compliance readiness.**
- 2. Scale across the portfolio by phasing in automation for forecasting, bidding, and settlement.**
- 3. Build advanced analytics capability to optimize trading strategies and portfolio performance.**

With this roadmap, Globacom positions itself not just as a technology provider but as renewable developers' strategic partner in securing revenues, scaling efficiently, and

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