ENLIT ASIA 2026 - AIDA STUDY TOUR - EXECUTIVE DEBRIEF

ASEAN & PT PLN Grid Learnings for Indian DISCOM Modernisation

Comparative Analysis, Early Indian Adoption Milestones, and Segmented Strategies under RDSS

LOCATION & EVENT

Jakarta, Indonesia | Enlit Asia 2026
Sep 21st - 24th, 2026

ORGANISER

AIDA Delegation (All India DISCOM Association)

CORE IMPERATIVE

Tailored Adoption — No "One-Size-Fits-All"

Delegation Overview

Confirmed roster supplied for the AIDA International Study Tour

14 Delegates

01 Shared agenda

ASEAN Regional exchange

S. No.	Name	Designation	DISCOM
1	Rahul Kumar	Managing Director	NBPDCL
2	Neha Jain	Managing Director	KESCO
3	Rattandeep Singh	Deputy Chief Engineer	PSPCL
4	Ankit Srivastava	Superintending Engineer	UPPCL
5	Anupam Kumar	Assistant Vice President	BRPL
6	Partha Pratim Dutta	Executive Director	WBSEDCL
7	Rajeshkumar Govindbhai Nagariya	Chief Engineer (Project)	MGVCL
8	Nand kishor Mishra	Director Technical	PVVNL
9	Siddharth Ranjan	Superintending Engineer	UPPCL
10	Anshuman Yadav	Superintending Engineer	DVVNL
11	Manoj Gupta	Superintending Engineer	MVVNL
12	Madhusudhan Thalakokkula	Director Operation	TGNPDCL
13	Vanaja T Sunduru	Director Projects	APEPDCL
14	Sudhir Kumar	Research Officer	AIDA

Visit Context & Programme

Study tour organized through AIDA; technical exposure aligned with distribution modernization and smart-grid themes

20–25 Sep
Overall travel / study-tour window

22–24 Sep
ENLIT ASIA 2026 event dates

14
Members in AIDA delegation

Jakarta
Indonesia – host location

Key programme components

- **PLN technical exposure** — Indonesia Distribution Grid Modernization presentation by PT PLN (Persero), 21 Sep 2026.
- **ENLIT ASIA 2026** — Regional platform covering grid modernization, digitalisation & AI, generation, decarbonisation and energy resilience.
- **Knowledge exchange** — Interaction with utilities, technology providers, policy / regulatory stakeholders and industry participants.
- **Executive focus** — Identify distribution technologies, operating models and implementation approaches relevant for Indian DISCOMs.

ENLIT ASIA 2026 – Executive Theme

Powering Regional Sovereignty, Securing Energy System Resilience

The programme was structured around the transition from conventional, one-way electricity delivery toward resilient, flexible and digital energy systems.

1 GRID MODERNISATION

Network automation, reliability, system visibility

2 DIGITALISATION & AI

Digital operating infrastructure, data and AI

3 CLEAN & THERMAL GENERATION

Generation mix, flexibility and system needs

4 INDUSTRY & DECARBONISATION

Industrial demand and clean-energy integration

Distribution-system relevance

- Visibility of feeders, assets and consumers
- Automation, outage management and faster restoration
- Integration of DER, rooftop PV, storage and EVs

PT PLN (Persero) – Distribution Scale & Modernization Context

PLN presentation dated 21 September 2026

95+ Mn	1.1+ Mn km	~16 Mn	317+ TWh	~85 GW
Customers	Distribution line	Electricity poles	Electric energy sales	Generation capacity

What the PLN case demonstrates

Scale

A very large, geographically distributed network requires standardised architecture, asset data and operating processes.

95+ million customers

Digital foundation

GIS, EAM, SCADA/ADMS, AMI and integrated data are treated as building blocks of the modern distribution platform.

Integrated digital asset view

System transition

The distribution role is evolving toward active orchestration as DERs, EVs and two-way power flows increase.

DNO → DSO operating model

PLN Smart Grid Framework – Technology Stack

PLN's roadmap spans foundational capabilities, distribution automation, DER integration and microgrids

FOUNDATION	Governance • competency • architecture • GIS • cyber security • asset/ERP integration
DISTRIBUTION	DERMS / VPP • ADMS / D-SCADA / DMS / OMS • DRMS / TOU • synchronized measurement • AMI
MICROGRID / DER	Microgrid controller / EMS • smart inverters • PV + storage • EV / V2G
DATA & DECISION	Sensors • communications • integrated asset data • analytics • AI/ML • visual management

Key point for a DISCOM

Digitalisation is not a standalone IT project; it is an operating model linking field assets, network control, customer data and decision support.

Smart Distribution Architecture – Scaled by Network Complexity

PLN defines Small, Medium and Large distribution-cluster architectures

1 SMALL / DISPERSED

<20 kV / isolated

Microgrid EMS
Local DER + BESS
Autonomous operation
Critical-load priority

Local resilience

2 MEDIUM

20 kV / modular

SCADA priority feeders
Limited FLISR
OMS–AMI integration
DER controller / MG-EMS

Selective automation

3 LARGE

20 kV / interconnected

ADMS + DERMS + OMS + SCADA
Automatic FLISR
VVO / real-time control
AMI–MDMS + customer platform

Integrated smart-grid control

Design principle Adopt capabilities according to network complexity, DER penetration, reliability needs and digital maturity—not a single uniform architecture.

From DNO to DSO – The Operating Model Shift

PLN frames the transition from network delivery to active orchestration of distributed resources

DNO

Distribution Network Operator

- Network delivery
- SCADA / DMS / OMS
- GIS + Asset Management
- AMI + Meter Data

→

VISIBILITY TO ORCHESTRATION

DSO

Distribution System Operator

- ADMS + DERMS
- Microgrid EMS / VPP
- DERs + demand response
- Real-time coordination for reliability, flexibility & quality

Executive message As two-way flows increase, the distribution function moves from monitoring assets to coordinating assets, customers and distributed resources.

What every session kept coming back to

Six Key Learnings

1
Visibility first
Utilities are blind below the DTR: see, then predict, then control

2
Smart meters beyond billing
Use AMI data for DTR loading, forecasting and planning

3
Flexibility before reinforcement
Test storage and demand response before building new network

4
Storage at the distribution edge
BESS at DTRs and substations, with grid-forming inverters

5
New loads: data centres and EVs
Large blocks arrive suddenly; plan contingency from day one

6
AI adoption is about people and data
AI recommends, operators decide; clean data comes first

Visibility First: You Cannot Manage What You Cannot See

Panellists: most utilities still have little visibility beyond the distribution transformer

See
DT meters, AMI, SCADA

→

Predict
Load and solar forecasts

→

Control
ADMS, fault isolation and restoration

→

Orchestrate
Storage, demand response, rooftop solar

What utilities said

- SP PowerGrid: redundancy and full system visibility are what make a grid intelligent
- AMI, outage management and SCADA data sit in separate silos: integrate them first
- Give control-room operators only the data they need during a fault; the rest goes to analysts
- Use local automation where communication is unreliable; central systems for optimisation

Measure outcomes, not meters

- Technical loss
- Peak reduction
- Restoration time
- Solar hosting capacity

The number of smart meters installed is not the KPI: loss, peak and restoration time are

Smart Meter Data Beyond Billing

Utilities have invested heavily in smart meters; the value comes from using the data for operations

DTR overload detection

- Find DTRs overloaded by evening EV charging and new loads

Behind-the-meter insight

- Identify rooftop solar, EVs and usage times at each service

Bottom-up forecasting

- Build DTR and feeder forecasts from meter data, not samples

Planning without new capex

- Decide augmentation from data already being collected

What panellists reported

- AMI is moving from a billing platform to an operational platform (Trilliant, PEA Thailand)
- Behind-the-meter analytics on AMI data already in use by utilities (Bidgely)
- Smart-meter coverage is high in Singapore and Malaysia and rising in Thailand

Meter data already in hand can show which DTRs and feeders really need augmentation

Flexibility Before Network Reinforcement

Network constraints often last only a few hours a year: check flexibility before building

The shift in planning

- Check storage, demand response, EV charging and rooftop solar before new feeders or substations
- UK regulator requires distribution utilities to consider flexibility first
- PEA Thailand: plan the network for flexibility, not only for peak
- BSES Rajdhani, Delhi: assess flexibility and reinforcement together over 15 years; take the cheaper option

Before relying on flexibility

1. Visibility of the resource
2. Reliable communication
3. Ability to dispatch it
4. Verification that it responded

Start with small pilots, prove the response repeatedly, then defer capex

Battery Storage at the Distribution Edge

Peer utilities are placing storage close to the load

BSES Rajdhani, Delhi

- BESS co-located with 1–1.5 MVA DTRs
- About 15 MW grid BESS in service, similar quantum planned
- Moving from 2-hour to 4-hour storage

PLN Batam, Indonesia

- 3 × 5 MWh BESS at three substations
- Acts as a grid-scale UPS for data centres
- Plan: about 800 MWh in five years

Elopura Power, Sabah

- Brownfield BESS commissioned in nine months
- BESS handles frequency response
- Gas turbines freed to run as base load

Technology direction in India

- Smart inverters (IEEE 1547-2018 / IS 18968) for DERs: CEA rollout plan under the 2026 connectivity rules
- Grid-forming inverters for new large BESS; safety built into every installation

Storage at DTRs and substations gives the most network value per MWh

New Loads: Data Centres and EVs

New loads arrive in large blocks and change the network faster than plans

Data centres: West Bengal SEDCL

- 250–300 MW of data-centre demand came up within a short period
- N-1 / N-2 contingency for transformers and substations
- Short-circuit and reactive-power studies for the large load
- GIS network model and AMI-based load profiling

Electric vehicles

- Battery sizes grew from 30–40 kWh to about 70 kWh
- Evening charging creates new DTR peaks

A caution from the panel

- If technology shifts, data-centre network capex could become stranded
- Panellists compared it to the 2000s dark-fibre glut

Plan large new loads with contingency studies and data-driven load profiles from day one

AI in Utilities: People and Data First

Grid control stays deterministic: AI recommends, operators decide

Start with the problem

- Business problem first; AI is one of many tools
- Thermal plant: about 10,000 t of coal a year saved through AI-assisted heat-rate analysis

Data comes first

- "How many customers do you have?" often gets 4–5 answers
- Aim for a single view of truth across systems

People make it work

- Remove the hype and the fear of job loss
- Teach three modes: autopilot, co-pilot, pilot

Where AI fits in operations

- Automate low-risk, high-frequency decisions; keep a person on safety-critical ones
- AI on SCADA explains plant behaviour and flags anomalies 1–7 days ahead (Yokogawa)

Adoption is a people and data challenge more than a technology challenge

Signals from the Region

Context shared by the moderator and regional utilities

India

- 562 GW on one synchronous grid, 165 GW of it solar
- REMCs: two-day-ahead forecast, fine-tuned day-ahead
- Spinning reserve: India 5%, Europe 10%, US 15%

Indonesia (PLN)

- About 42 GW of renewables in the 10-year plan
- Sumatra–Java HVDC link planned
- 100 GW solar programme announced

ASEAN

- ASEAN Power Grid seen as route to energy security
- Singapore imports power from neighbours
- Nuclear and SMRs back on the agenda

Australia

- Rooftop solar meets entire demand on some days
- Export limits on rooftop solar to keep the grid secure
- Distribution utilities taking on system-operator roles

Rooftop solar and storage growth will reach distribution networks first

What This Means for Indian DISCOMs

Possible next steps, building on work already under way

1. Use hourly substation load data and incoming smart-meter data for DTR- and feeder-level forecasting and planning
2. Track outcome KPIs: technical loss, peak, restoration time and solar hosting capacity
3. Run a flexibility check (storage, demand response) before sanctioning network augmentation
4. Explore BESS at high-loading substations and large DTRs, building on the substation solar + BESS study
5. Bring SCADA, AMR/AMI, outage and GIS data into one operational view for the control room
6. Take up AI through problem-first pilots with operator training

Where peers have proven a solution, adopt it with fewer repeated pilots

Specific Input from Member DISCOMs

- SCADA and ADMS
- PLN Mobile
- Focus on Renewables
- Shift in System Output Metrics
- Field Devices - DTR and Poles

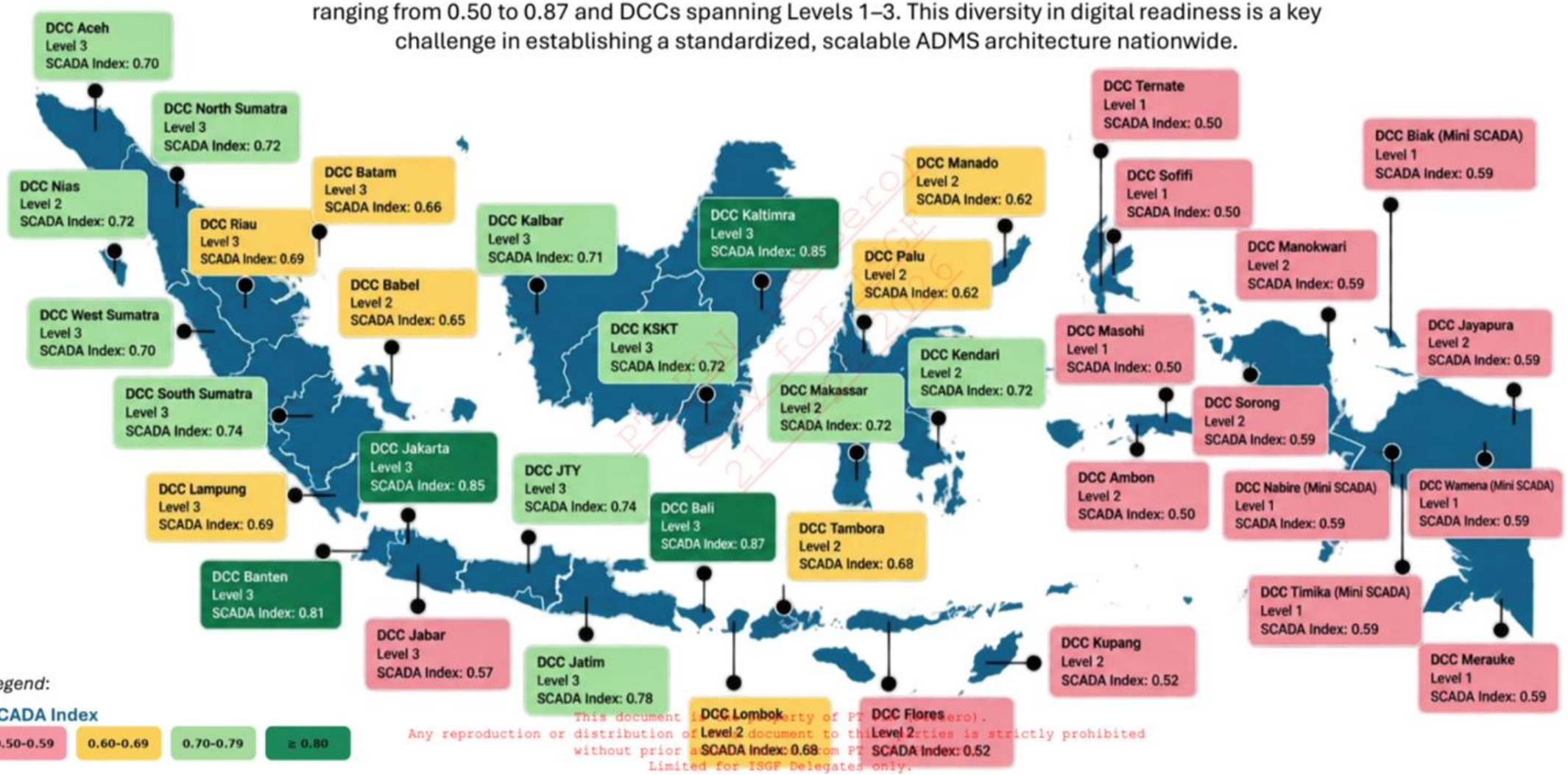
Danantara Indonesia

ADMS Implementation Challenges:

Distribution Control Center (DCC) of Indonesia

PLN

The 38 DCCs across Indonesia show significant variation in SCADA maturity, with SCADA Index ranging from 0.50 to 0.87 and DCCs spanning Levels 1–3. This diversity in digital readiness is a key challenge in establishing a standardized, scalable ADMS architecture nationwide.



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SCADA & Unmanned Substations: APEPDCL's Foundation for Distribution Automation

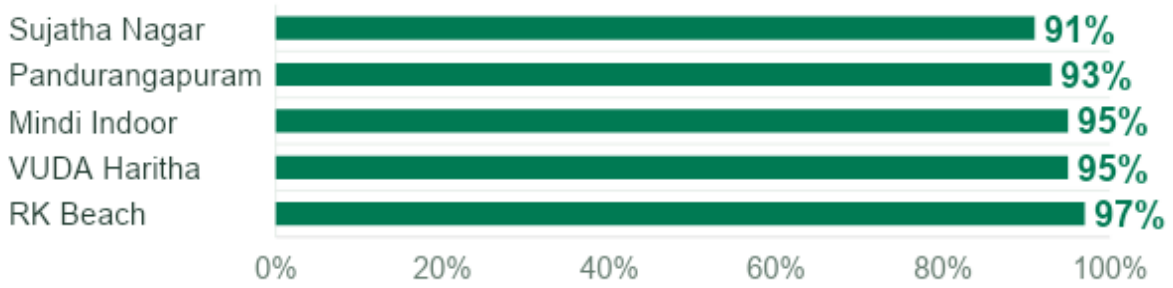
- PT PLN demonstrated integrated operation through SCADA, GIS and central command centres.
- Utilities are increasingly adopting automated switching and FLISR to improve restoration performance.
- Automation is being used to improve reliability, operational efficiency and asset utilization

66
SCADA-integrated 33/11 kV substations

52
Unmanned substations

4
Additional substations under unmanning

Operational Benefits Achieved by APEPDCL



80%
weighted-average SAIDI improvement

2-4 Min
incoming supply changeover time

₹13.6 lakh
annual OPEX saving per unmanned substation

Conference practices and APEPDCL opportunities

Integrated control and field operations

PT PLN combines SCADA, GIS and field operations. It reported 35% lower downtime with unified command centres.

Automated fault handling

FLISR locates faults, isolates affected sections and restores healthy sections. Switches and reclosers reduce manual switching

Examples

Jawa-Bali: isolation <60 sec. EVNHCMC: 100% automated MV operation. BSES Rajdhani / CESC: self-healing 11 kV networks.

Conference learnings validated APEPDCL's existing SCADA and unmanned substation initiatives. The demonstrated improvement in reliability and operational efficiency provides a strong foundation for future distribution automation and advanced grid management

Consumer Digitalization: Lessons from PLN Mobile

- PT PLN has integrated multiple consumer services through a single digital platform (PLN Mobile).
- Consumer digitalization is being used to improve service quality, communication, collection efficiency and customer engagement.
- Utilities increasingly view digital consumer platforms as a strategic component of utility modernization

>70 million
consumers served, as described in the source

Seven services in PLN Mobile

- Billing and payments
- Complaint registration / tracking
- Rooftop solar services
- Customer communication
- New service connections
- Outage information
- Consumption monitoring

Potential Areas for APEPDCL

Consumer self-service capabilities

Complaint registration and tracking

Outage communication

Digital billing and payments

Rooftop solar and net-metering services

Consumer energy usage visibility

Benefits Observed

- Improved customer engagement
- Faster complaint resolution
- Improved payment convenience
- Better communication during outages
- Increased transparency
- Enhanced consumer experience

The Renewable Focus

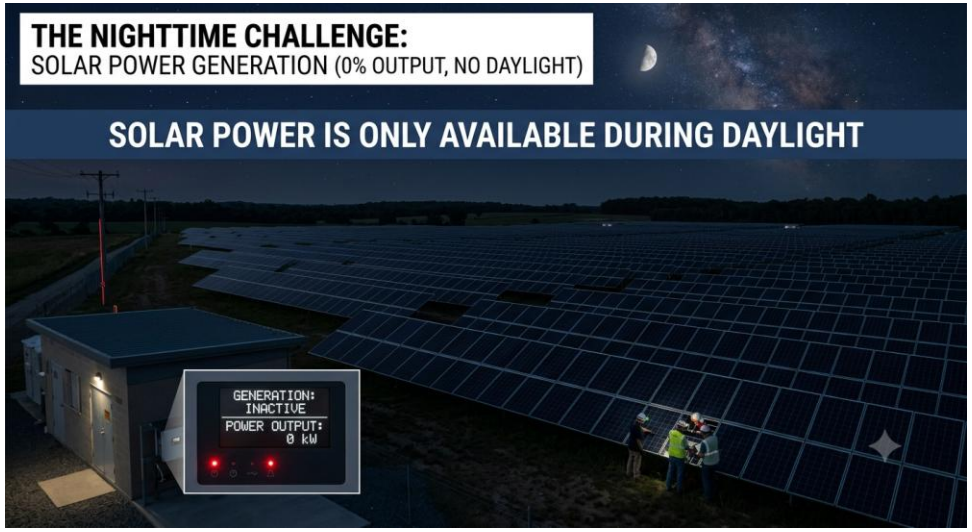
Indonesia

- **Strategic Vision & Expansion Goals:** PT PLN's 10-year plan targets a 69.5 GW capacity expansion by 2034, with **42.6 GW from renewables** (17.1 GW solar, 7.2 GW wind, 11.7 hydropower and 6.1 from geothermal and bioenergy)

India

- India’s installed non-fossil capacity (~302 GW) is roughly 20 times larger than Indonesia’s (~15.4 GW). India has set ambitious targets for expanding its renewable energy capacity, aiming to achieve **500** GW of non-fossil fuel power capacity by 2030**.** Of this, **280 GW** to be met by **solar**.

Challenge- Solar Power is only available during daylight



The Renewable Focus: Grid Infrastructure Solutions

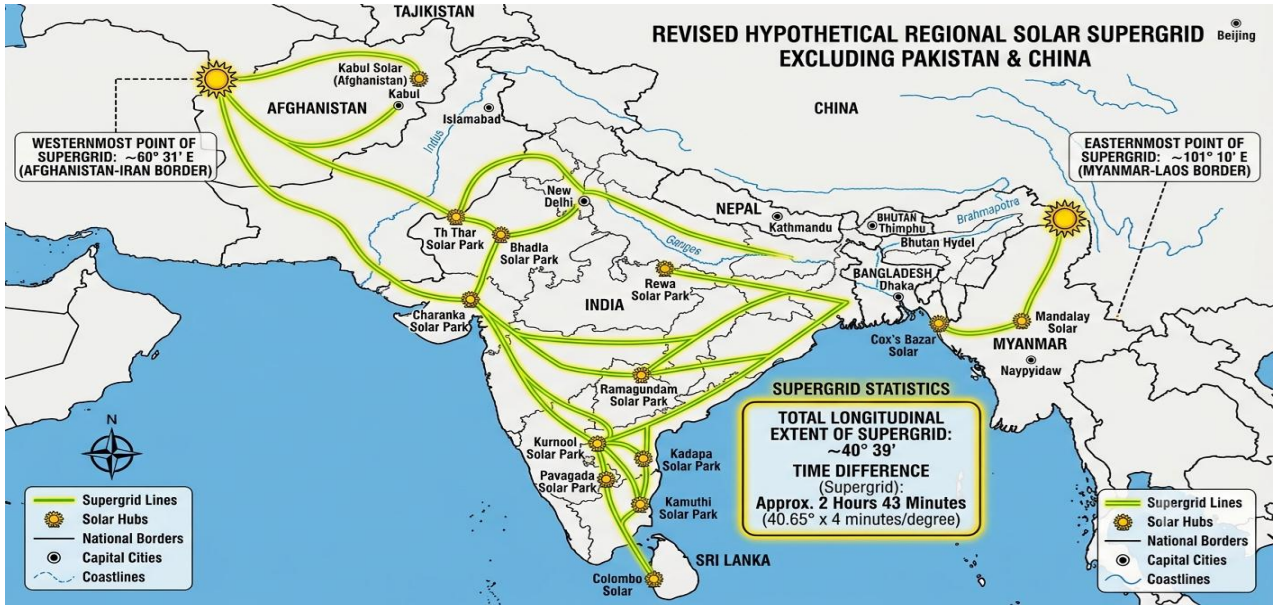
Indonesia

- To bridge demand centres with renewable-rich, isolated islands, PT PLN is deploying a green enabling super grid.

India

- The Solar Super grid-
  - Solar generation is typically available for 8-9 hours.
  - As Indonesia, **India can look into creation of multinational solar super grid.**
  - Every degree of longitudinal increment adds about 4 minutes of solar availability via interconnected grid.
  - A longitudinal span of 40◦ will add **2H 40 Min of solar power availability.**





Use of Renewables

- Indonesia unleashing the potential of Renewables; Target : 23 GW by 2030 with more ambitious Solar deployment program.

  India Picture : Possess a target of 500 GW by 2030 with present installation capacity touching 300 GW

- Indonesia - Establishing Microgrid in 17000+ archipelago presence through Solar Plant couple with Battery Storage & connect them to act as one Grid.

  India - May adopt the model for the area having space constraints. Floating Solar may be another option to adopt.

  Example : in WB, WBSEDCL adopted 10 MW Solar Plant in upper Dam of 900 MW Purulia Pump Storage Project (Pics in separate slide) and PDCL adopted 12 MW in Sagardighi TPP expandable upto 38 MW

- Has huge untapped Geothermal potential as compared to India

Floating Solar Plant (PPSP & Sagardighiin WB)

- Placed at Upper DAm of PPSP,
- Capacity - 10 MW Provides green power
- Beneficiary remote villagers of Hills
- Handy DER,operational from Feb’25
- Reduction Carbon Footprint : 383898 Ton
- Expandable to 15 MW by July’26



Grid reliability: Shift in System-Outcome Metrics

- Reliability as an overall system outcome measured in real-time—utilizing dynamic indicators like **system flexibility** and **Energy Not Served (ENS)** alongside traditional metrics (SAIDI/SAIFI) to handle high penetration of inverter-based renewables, distributed energy resources (DERs), and storage.

SAIDI & SAIFI

Legacy Customer-Centric Outage Indices

PRIMARY FOCUS

Interruption duration (SAIDI) and frequency (SAIFI) per customer.

UNIT OF MEASUREMENT

Minutes per customer & outage events per customer.

GRID ARCHITECTURE SUITABILITY

Traditional grids with dispatchable thermal/hydro generation.

KEY LIMITATION IN VRE GRIDS

Treats all unserved energy equally; misses real-time MW balancing deficits.

VS

Energy Not Served (ENS / EENS)

Modern System-Outcome Metric

PRIMARY FOCUS

Exact volume of unsupplied energy due to capacity or grid bottlenecks.

UNIT OF MEASUREMENT

Megawatt-hours (MWh) unsupplied over a period.

GRID ARCHITECTURE SUITABILITY

High renewable penetration with inverter-based DERs and BESS.

KEY ADVANTAGE IN VRE GRIDS

Quantifies exact economic/power deficit and enables probabilistic forecasts (EENS).

System Flexibility Indicators

- System flexibility is the grid's ability to respond quickly and adequately to rapid, unpredictable fluctuations in both electricity supply and consumer demand. Dynamic tracking tools evaluate this using specific technical metrics:
- **Operational Scheduling Flexibility:** Measures whether controllable resources (like quick-start thermal plants, hydro, or battery storage) can scale up or down fast enough to meet changes in the "net load" (total demand minus non-controllable renewable generation).
- **Ramping Capabilities:** Evaluates the rapid MW-per-minute adjustment speeds of power assets to capture sudden generation drops (e.g., when the wind stops blowing or clouds cover a solar farm).
- **Demand-Side Flexibility (DSF):** Tracks how effectively industrial or residential loads can temporarily scale back or shift their usage (load curtailment) via smart pricing and automated response.

Energy Not Served (ENS)

- ENS is an energy-centric adequacy and reliability metric.
- It quantifies the exact magnitude of electrical energy (measured in Megawatt-hours, MWh) that a power system **fails to supply** to consumers over a given period due to a deficit in capacity or transmission bottlenecks.
- In long-term planning, it is often modelled as **Expected Energy Not Served (EENS)**. EENS uses probabilistic calculations to forecast potential annual shortages, helping grid operators design appropriate capacity reserves.

TRANSPARENT TRANSFORMER: TRAINING VALUE

Enlit Asia 2026 • Jakarta, Indonesia | Proposed use in UPPCL / MVVNL training institutes



USE IN UPPCL / MVVNL TRAINING INSTITUTES

- Use the transparent transformer as a visual demonstration model to explain the core, windings, bushings and cooling arrangement to trainees.

ROUND DOUBLE PCC POLE: LESSON FROM INDONESIA

Potential alternative to assess for MVVNL / UPPCL after storm-related pole failures



POTENTIAL BENEFIT FOR MVVNL

- Assess Indonesia-style round double-pole PCC structures as a pilot for storm-prone feeders, including vulnerable locations in Gonda Zone, against the existing flat-pole design.



AIDA STUDY TOUR | DELEGATION & TECHNOLOGY EXPOSURE

Jakarta • ENLIT ASIA 2026

Backup Slides

Day 1: Visit to PT PLN & Key Learnings

- PT PLN is the single body governing all Energy needs in Indonesia (17000+ islands, Generation, Transmission, Distribution)
- Indonesia PT PLN - Transition from Electricity service provider to establish potential Energy Digital Platform. India thought : Indian Energy Stack
- Reliability Index Measure - beyond traditional reliability index from SAIDI, SAIFI to ENS (Energy not served)
- Robust Infrastructure development in Establishing Distribution Network (UG Cabling, LT AB, Covered Conductor, DTR placement)

Key Learnings from ASEAN Countries

- ASEAN GRID - Indonesia is not a signatory
- They have Integrated Energy Department - (Electricity, Gas, Renewables, Hydrogen, Nuclear) but we need not go back from where we evolved.
- Grid Flexibility – Microgrid
- DISCOM as an orchestrator
- Use of AI Governance
- No DTs, No distribution network visible on roads in Jakarta. DTs covered with porcelain material. Covered conductors, LAs on lines.

Tailored Technology Matrix across Indian DISCOM Types

STRATEGIC ALIGNMENT

Focus Domain	Metro / Low Loss (e.g. TPDDL)	Agrarian (e.g. MSEDCL, GUVNL)	High Loss (e.g. UPPCL, Bihar)
Smart Metering	Postpaid TOU + Real-time App analytics	DT & Feeder metering for energy audit	Prepaid smart meters with auto-disconnect
Loss Reduction	Predictive DT overloaded prevention	Agricultural feeder separation & solar	AI theft detection & ABC cabling
Grid Automation	Full SCADA-ADMS & FLISR self-healing	Substation automation & solar controls	Feeder-level remote monitoring units
Energy Storage	Substation BESS for DT upgrade deferral	Solar feeder BESS for evening agricultural power	Pilot Micro-BESS at weak remote nodes