



ESMAP Knowledge Exchange & Study Tour on Grid Digitalization and Cybersecurity in Italy

May 20 - 27

📍 Italy

COUNTRY SPOTLIGHT



Kabir Malik
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Global Energy Department
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Network Management,
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Company (KPLC)

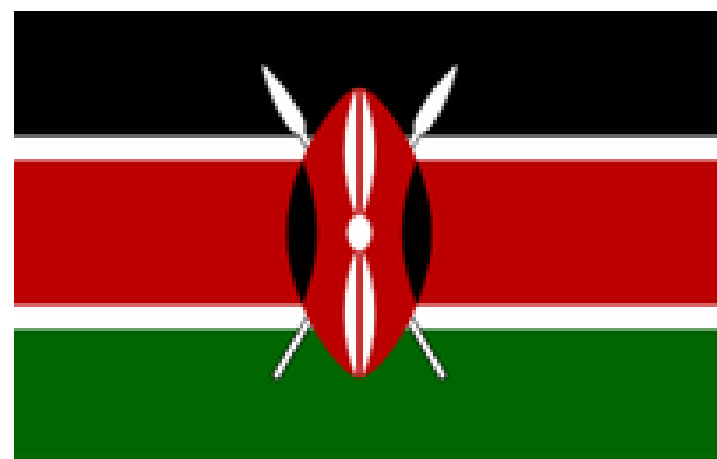


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Strategy and Management
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Country Spotlight Kenya



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KENYA'S ELECTRICITY SECTOR

Towards a Smart Kenyan Grid



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02 ELECTRICITY SECTOR MANDATE

03 DIGITILIZING KENYA'S POWER GRID

KPLC

SECTOR AGENCIES

Policy

REPUBLIC OF KENYA



Ministry of Energy

Regulation



Power System
Operator

Generation Licensees

Hydro
Geothermal
Thermal
Wind
Solar

Transmission Licensees

Distribution Licensees

Retail Licensees

Control
Sub-station(s)

- KenGen
- REREC
- IPPs
- Off Grid Stations

- Kenya Power
- KETRACO
- IPTs

- Kenya Power
- Various licensed by EPRA

- Kenya Power

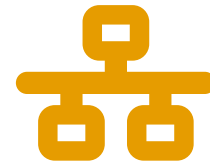
KENYA ELECTRICITY SECTOR MANDATE

Five core functions of Kenya's Energy Sector Entities



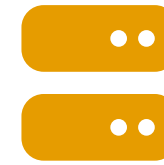
Purchasing Bulk Electricity

Acting as the Single Buyer, procuring electricity from generators for national distribution. **(KPLC – KenGen and IPPs)**



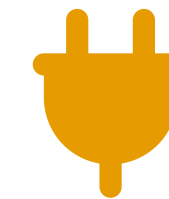
Network Development & Maintenance

Building and maintaining a robust, reliable power transmission and distribution network. **KETRACO / KPLC / IPTs / REREC (Distribution Grid & Minigrids)**



System Operator & Dispatch

Real-time monitoring, dispatch of generators, maintaining system balance and stability. **KPLC (Current) in transition to KETRACO**



Retail of Electricity

Distributing and selling electricity to residential, commercial, and industrial consumers. – **KPLC / New Retailers to be licensed**



Customer Service

Delivering excellent customer experience through responsive service and support. – **KPLC**

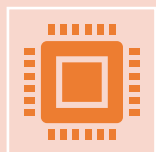
DIGITILIZING KENYA’S GRID & BUSINESS OPERATIONS

Towards a SMART Kenyan Power Grid

Transmission SCADA	Distribution Automation	Advanced Metering Infrastructure	ICT REJUVENATION PROJECT
<ul style="list-style-type: none">• 500/ 400/ 220/ 132 / 66 / 33kV substations• Transmission SCADA – 78% Implementation – Target 100% by June 2028• EC 61850/10/103 Protocols – need to upgrade to high-capacity protocols• No AGC yet• Cybersecurity risks – mitigated with independent network / Airgap	<ul style="list-style-type: none">• 33 / 11kV Distribution network• DMS (2010) – Remotely operated LBS / Part of Nairobi and Mombasa• ADMS (2020/21) – WB KEMP 6 Counties• Stand alone auto recloser units, minigrids systems• Transformer metering – 30,000 of 87,000 DTs• No DERMS yet	<p>Scope: 900,000 Smart Meters out of 10.3M Customers</p> <p>Phased approach- 300 -400K installed annually - (new and replacement)</p> <p>Outcomes:</p> <ul style="list-style-type: none">• Reduction of losses• Improved billing efficiency• Not integrated to ADMS / CMS for wholesome Customer Experience	<p>Modern IT / OT Systems to support the Digitalization efforts</p> <p>Business Process Re-engineering – At RFP stage</p> <p>Outcomes: Improved operational efficiency, Faster, interlinked processes; enhanced customer satisfaction; Advanced data analytics for business decisions.</p>

TRANSMISSION SCADA DEVELOPMENT

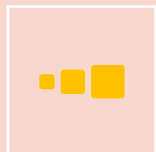
Historical Context



2008: Upgrade from vendor-specific to quasi-open SCADA system. 78 stations onboarded / All stations to be SCADA ready (ESRP)



2019: Major SCADA upgrade of Hardware, OS & SCADA software from Vs 3.2 to Vs 9.2



2024: Front-End upgrade to increase capacity of the system to take-up to 512 stations from 256.

Evolution & Current State of SCADA / EMS

Substations with SCADA has grown to over 270 substations currently, from a total of 78 at the initial rejuvenation of the SCADA system in 2008.

2023: 52 Legacy substations were integrated

2025-2027 : 54 substations in progress

2028: Projected Completion of integration of remaining legacy substations (approx. 30)

The Future of SCADA

Improve SCADA data quality to Enhance use of SCADA applications for system planning and design, protection systems diagnostics etc.



Integration with Energy Management Systems (EMS), Automatic Generation Control (AGC), and Inter-control Communication Protocol (ICCP) is crucial for further automation and regional grid collaboration.

NEW NATIONAL SYSTEM CONTROL CENTER - KETRACO

New NSCC

KETRACO is currently implementing the National System Control Center (NSCC) Project which centralizes real-time grid monitoring control



WAMS / Data Analytics

Enhanced data analytics capabilities through advanced SCADA/EMS and WAMS platforms



Cybersecurity Scope

The project incorporates a defense-in-depth cybersecurity architecture aligned with IEC 62443 and NERC-CIP principles, including network segmentation, secure remote access controls and continuous security monitoring.



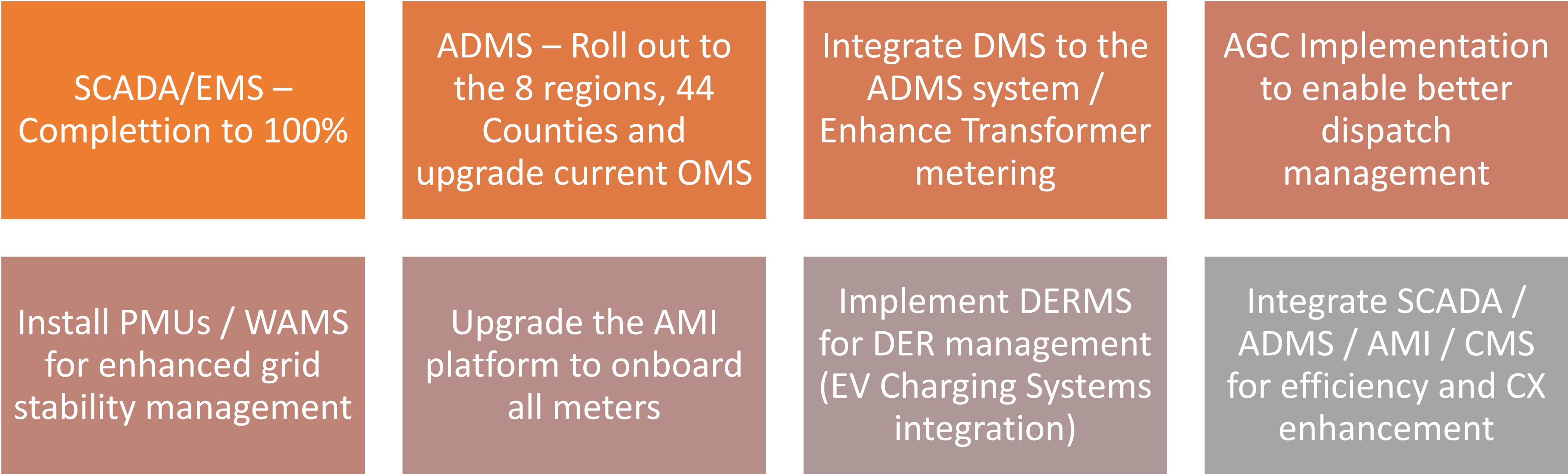
OT Specific Focus

Enhanced OT-specific protections are being integrated to safeguard critical SCADA communications and telecom infrastructure against evolving cyber threats.



KENYA’S DIGITALIZED FUTURE GRID – FROM FRAGMENTED TO COORDINATED ACTIONS

- Prepare a **harmonized country Smart Grid Strategy** for all Electricity sector entities for common approach – Assessment of current situation and **develop a roadmap to the digitalized future**
- Implement a **common cybersecurity approach for all entities** / installations to allow seamless **inter utility integration**



POWERING KENYA'S FUTURE

"Pamoja Twang'aa" — Together We Shine

Committed to delivering reliable, affordable and sustainable electricity while creating enduring value for customers, shareholders, employees, and the nation.

Country Spotlight Colombia



Juan David Molina

Strategy and Management
Leader
Colombia Inteligente

Challenges of digitalization, smart grids, and cybersecurity

Colombia Case

ESMAP Knowledge Exchange & Study Tour on Grid Digitalization and Cybersecurity



Italy
May 20-27, 2026

Colombia

Key Data (2025)

Public Policy



Ministry of Mines
and Energy

Energy Planning



Mining and Energy Planning
Unit



Institute for Planning and Promotion
of Energy Solutions for Non-
Interconnected Areas

Regulation



Energy and Gas Regulatory
Commission

Oversight and Control



Superintendence of Public Services
(energy, gas, water, sewerage, solid
waste)



Fund
Renewable Energy
Promotion



Mining
Promotion



Hydrocarbon
Promotion
(energy*)

≈ 12 GW Peak Demand

≈ 84 TWh Energy Consumption

≈ 21 GW Installed Capacity

≈ 78% Renewable Energy

≈ 3% VRE

17 Million energy users

154 Generators

15 Transmission Operators STN (≥ 220 kV)

29⁽³⁸⁾ Distribution Companies

STR (≥ 57,5 kV & < 220 kV) / SDL (< 57,5 kV)

159 Energy Retailers

Power System Operation and Market Administration



- National Dispatch Center
- Administrator of the Commercial Exchange System
- Liquidator and Account Manager

Advisory Bodies

Operation



National Operation
Council

Energy Retail



Marketing Advisory
Committee

Grid Planning



Transmission
Planning Advisory
Committee

Risk
Management



Advisory Commission for
the Coordination and
Monitoring of the Energy
Situation

Technology Foresight and Integration of New Technologies



Actions to support the transformation of the Colombian power sector



Different experiences have been developed in topics such as renewables, market mechanisms and digitalization, especially, the following can be mentioned in capacity building....

Flexibility of the power system (2024)

Enhance Power System Flexibility in Colombia - Workshop on International Insights and Best Practices

- **Experience** of flexibility services and the use of technology to provide flexibility
- **Tools** and **Platforms** for the Provision of Flexibility Services
- **Regulatory Mechanisms** and Incentives for the Development and Deployment of Flexibility Services
- Tailored **recommendations** for Colombia

Energy Data Exchange (2025)

Identify, analyze, and propose criteria and requirements necessary to ensure data exchange in order to enable **technical operation** and **transactional functions** for the following use cases:

1. The operation of the **Energy Community's Microgrid**
2. The use of **Demand Response** programs for the management of energy consumption
3. The use and **aggregation** of different Distributed Energy Resources - **DER**
4. The use of **Electric Vehicle** infrastructure

Cyber security and data model strategies (2025)

Cyber Security Strategies

- *Cyber Security in utility OT Environment*
- *Analysis Centers (ISACs)*
- *Tabletop Exercises*
- *Initial response, Escalation and Coordination, Recovery and Lessons Learned*

Data Management Strategies

- *Data Management for electric utilities (OT)*
- *Data Management Maturity Model (Case studies)*
- *Role of the CIM in Data Management and Architecture*
- *Digitalization Trends for Utilities (ICCS)*

2016 roadmap ...

Smart Grids
Colombia
VISIÓN 2030



Fuente imagen: UPME (2016)
Fuente datos hoy: XM (2925) & Colombia Inteligente (2025)

- Smart grid implementation roadmap
- Policy and regulatory analysis (power and ICT sectors)
- Technical and analytical supporting framework

Goals 2030

Advanced distribution
automation

Electric
vehicles

Distributed energy resources

Smart meter (AMI)

ADA
(No. Interruptores
telecontrolados por
circuito)

VE
(% respecto al No.
total de vehículos)

DER
(Generación distribuida)
(% del total de
potencia instalada) (MW Instalados)

DER
(Almacenamiento)
(% del total de potencia
instalada)

AMI
(% respecto a la energía
total consumida)

#

%

%

MW

%

%

FASE I
2016 - 2020

2,7 – 3,3

1,0 – 1,2

0,1 – 0,2

20 – 60

0

58,0 – 70,9

FASE II
2020 - 2025

4,2 – 5,7

2,9 – 3,9

0,4 – 0,5

90 – 120

0

65,2 – 88,3

FASE III
2025 - 2030

Self-Healing

9,3 – 14,0

1,0 – 2,5

240 – 600

0,1 – 0,3

73,0 – 100,0

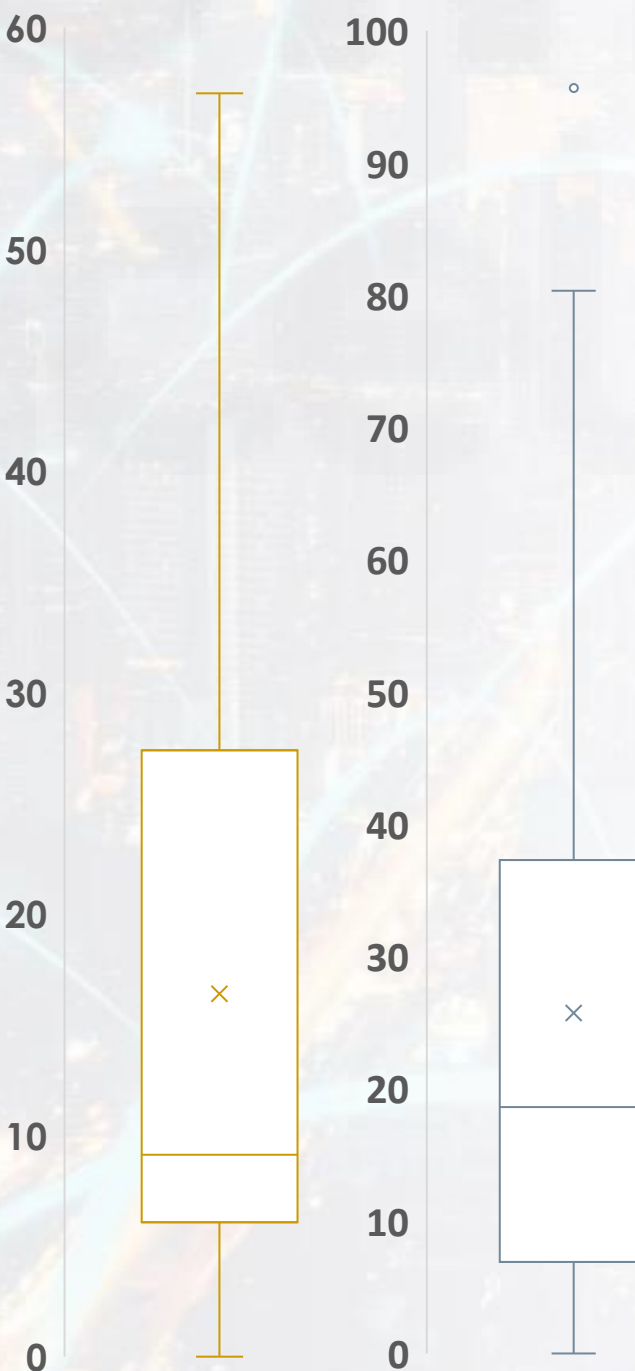
Actually... ≈ 3 DNO [0,11% - +20k] [2,1% - +435MW] [0,06% - +12MW] [3% - +13MW]

Advances towards a digitalized power system ...

29 Regional utilities (distribution)



SAIFI SAIDI
2025 (#) 2025 (Hours)



15%
Energy losses

Digital users

Millions
17,2
Energy users

0,584
Smart meter
74,6%
Basic functions

0,006
Non-regulated users

Tariff
ToU (No)
EV (No)
Net-Metering (DG)

Digital and flexibility asset

DNO (in progress) / Total DNO (29)

Advanced Distribution Management System – ADMS
Fault Location, Isolation, and Service Restoration

3/29
3(1)/29

Distributed Energy Resource Management System - DERMS
Meter Data Management System - MDM

1(2)/29
1(4)/29

Batteries for grid management
EV charging infrastructure

0(2)/29
+15/29

Digital Substations
Station Bus/Process Bus
16/807

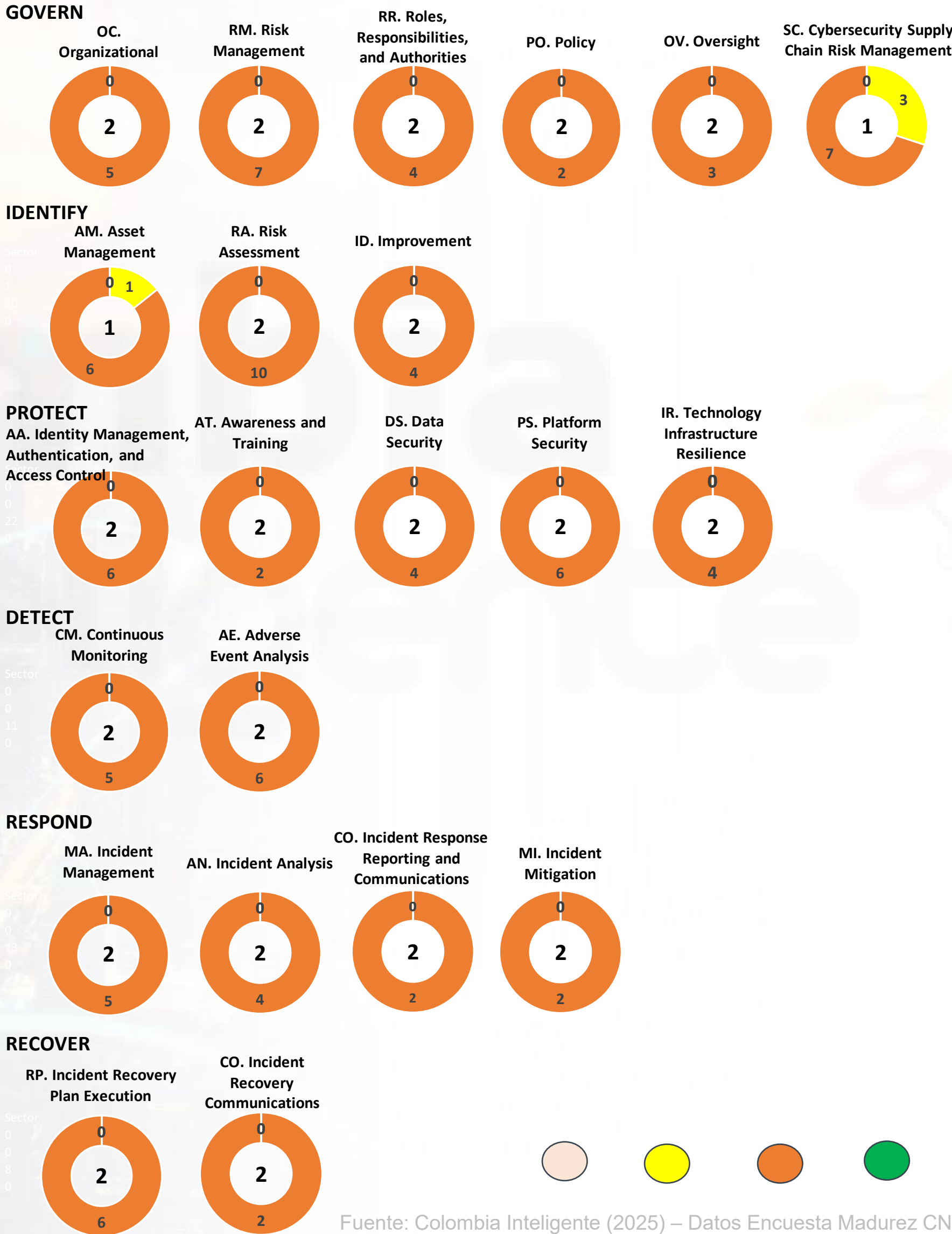
Advances towards a cyber-secure power system ...

Mechanisms ...

- Legal framework (Laws)
Crime and privacy
- National strategy (digital & AI)
- Energy-specific regulation
IT policy, 57 practices (NERC-CIP based) and incidents report rule, but without regulatory investment rules
- Capacity building
But, non-continuous activities
- Evaluation and continuous improvement
But, non-continuous activities and non-mandatory



Implementation level cyber security practices (NIST-CSF v2)



Challenges to achieving an smart power system ...

Smart Resource

I Active Consumer AMI

- Pilot Plans Program
- Criteria for the delivery of information
- Assign roles and responsible for investment (all agents in the system)
- Promote use of mobile apps

II Distributed Services DER/VE

- Interoperability requirements and facilitating appropriation of standards
- Intersectoral Public Policy (RI & Territories)
- Training in technological appropriation
- Flexible rates (signals, efficiency and operation)

Smart Grid

III Quality and Resilient ADA

- Implement Common Information Model(all agents)
- Update remuneration methodology (modernize)
- Strengthen CNO (accelerate automation) functions
- Develop telecommunications infrastructure

IV Interoperable and Cybersecure TIC/CIBER.

- Comprehensive ICT-cybersecurity training with allies
- Regulatory Incentives for modernization (Scalability and standardization)
- Standards, technology architecture, and data governance
- Expand telecommunications infrastructure coverage

i Thanks a lot !

i We will continue to work for the transformation of the sector !

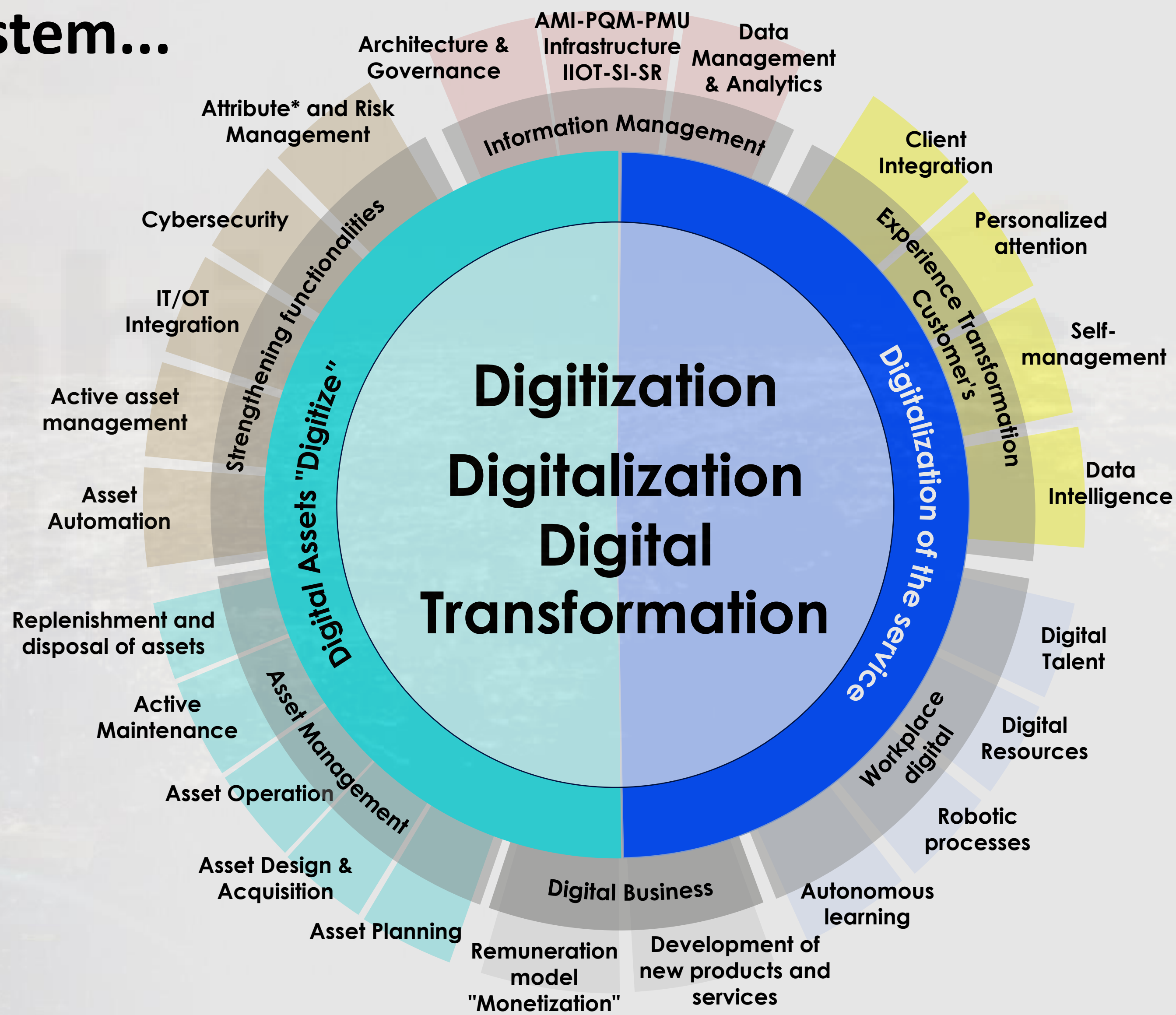
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Towards a smart power system...

Components of the digitalization strategy for the electricity service

- Attributes***
- 1. Reliability, security and quality of service
 - 2. Robustness
 - 3. Resilience
 - 4. Flexibility
 - 5. Sustainability



Country Spotlight India



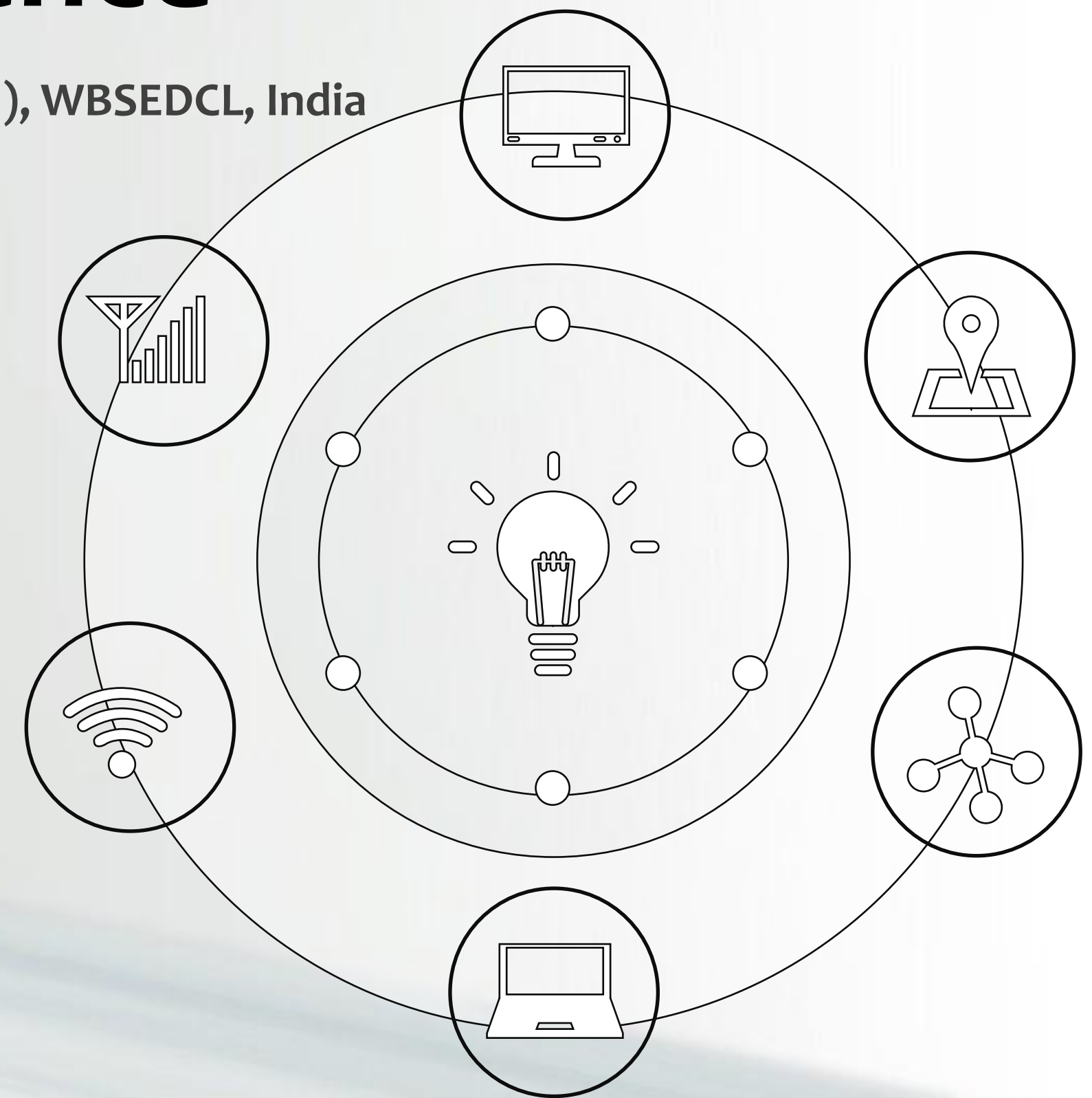
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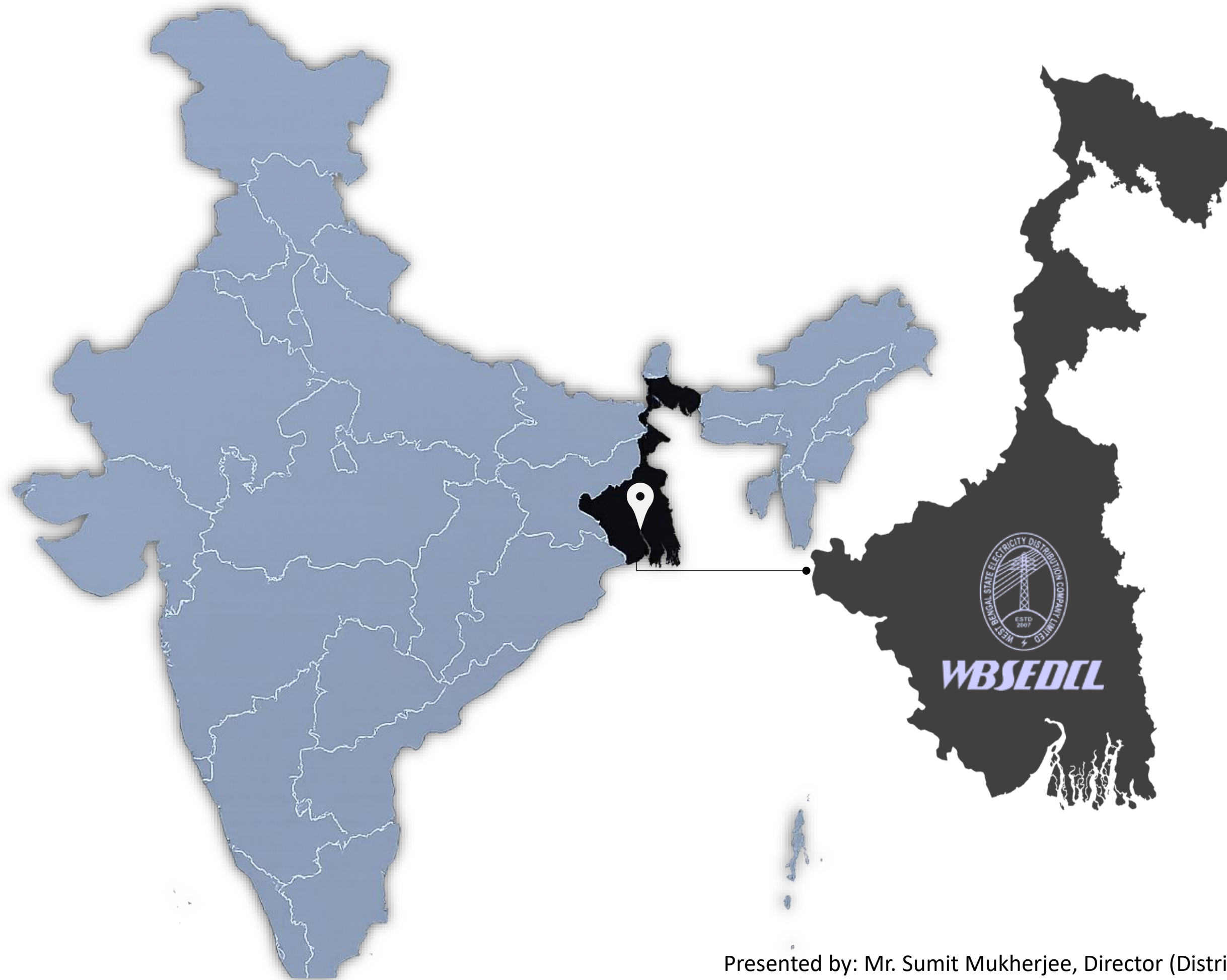
WBSEDCL

Digitization and Grid Modernization -- WBSEDCL Experience

Presented by: Mr. Sumit Mukherjee, Director (Distribution), WBSEDCL, India



WBSEDCL: Company Dashboard

**WBSEDCL**

Second Largest Power Utility in India

One of India's largest power distribution utilities Serving more than **25 Million** of consumers across West Bengal, India. Handling **60000 MU per annum** with **peak demand 11 GW**



Operational Footprint

WBSEDCL covers nearly **96%** of West Bengal's **88,752 Sq. Km.** geographical area with widespread electricity distribution infrastructure making profit for last 20 years.



Sustainable Loss Reduction

Sustained operational improvements have enabled WBSEDCL to reduce AT&C loss by around 18% during the last 15 years, currently operating at **12.5%**.



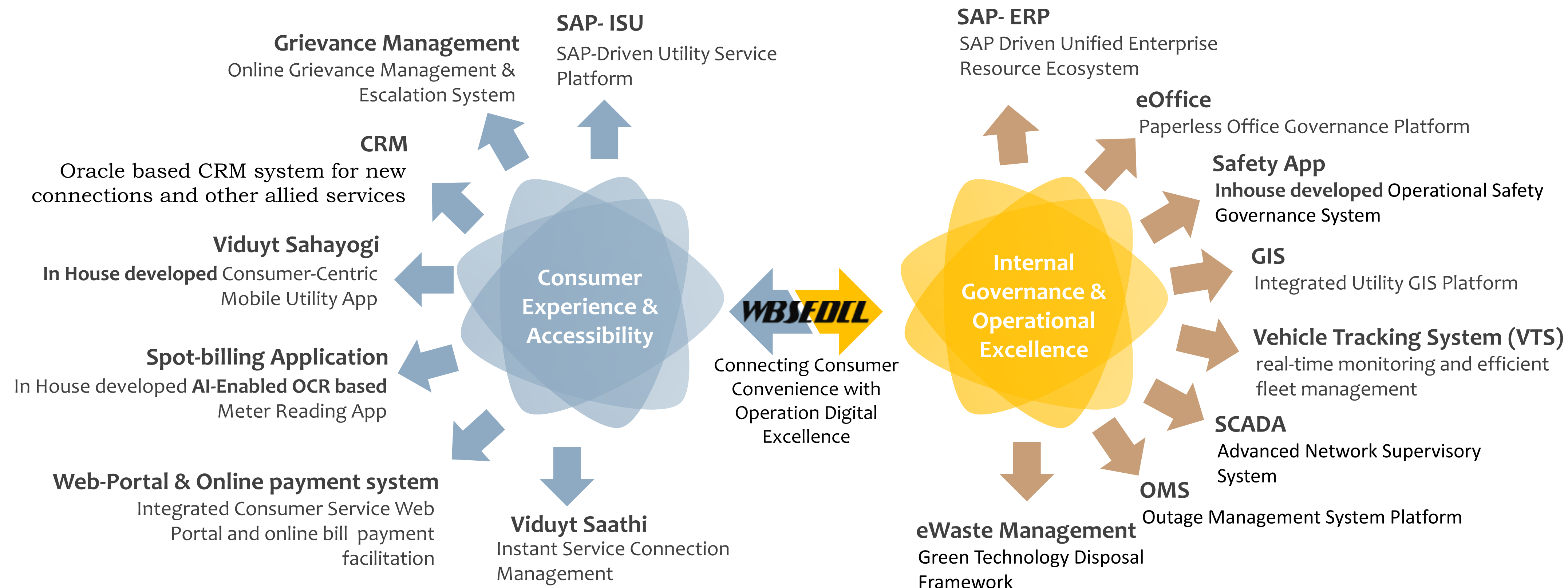
Leading Digital Utility Transformation

WBSEDCL remains a frontrunner in advancing innovative digital utility services and governance frameworks.


WBSEDCL

Unifying Consumer Convenience and Operational Digital Excellence

Applications Running in WBSEDCL




WBSEDCL

Integrated Digital Ecosystem of WBSEDCL

Financial & Payment Integrations

Payment Gateway Integration

Seamless digital transaction enablement



RTGS / NEFT Integration

Secure banking fund transfer framework



BBPS Integration

PAN-India unified bill payment ecosystem



BSK Integration

Statewide citizen service facilitation network



Integration with IFMS portal [e-Pradhan]

State Government-enabled digital payment platform



Integration for Ease of Doing Business



EODB Integration

Ease of Doing Business facilitation through single window portal of GoWB



Integration Various GoWB Departments

Festival/Puja temporary connections, Passport address verification, Election Police Camp electrification, and Rice Mill consumption assessment support etc.



DigiLocker Integration

Electricity bill presentment to the consumers through the PAN-India Digital document framework



IGR Integration

Verification/ updation of owner name during mutation by Directorate of Registration and Stamp Revenue Department.



PM Surya Ghar Integration

Integration with National portal for rooftop Solar PV connections



Urjamitra Integration

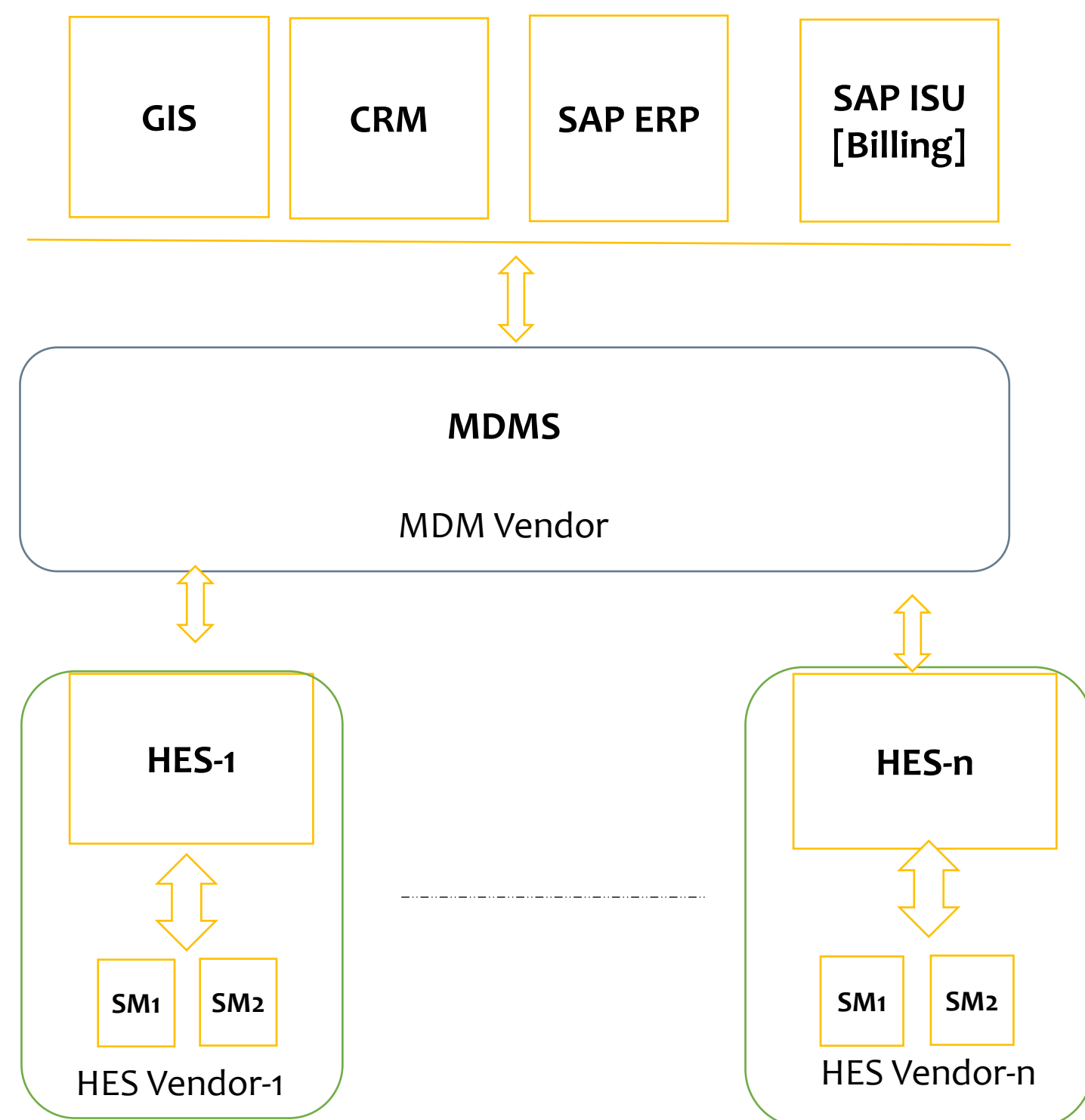
Integration Power outage information platform of GoWB

Smart metering [AMI] Ecosystem of WBSEDCL



WBSEDCL

Model 1



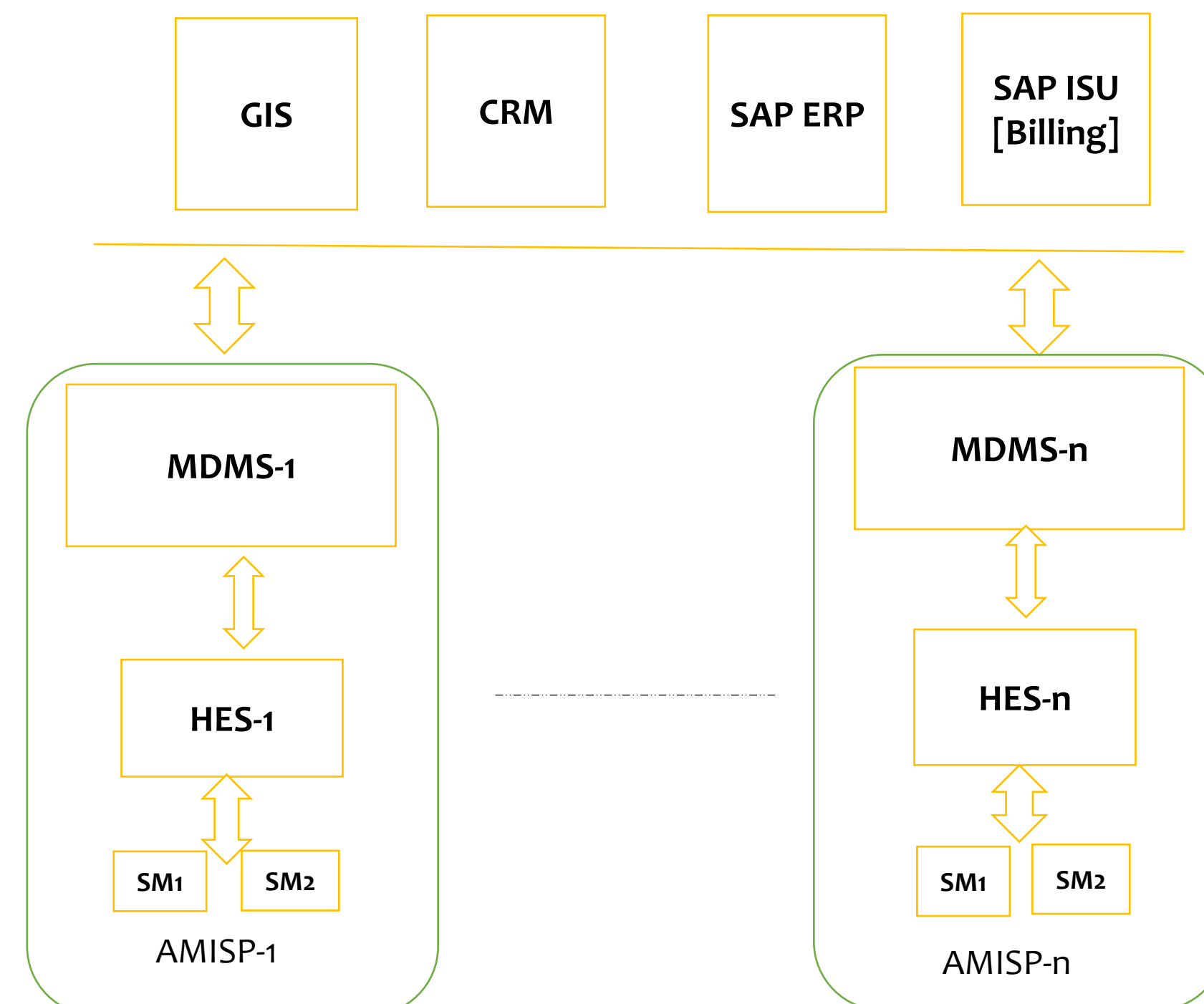
Target

- LOA Issued
- for 3.7 Million consumer meters.
 - 100% Feeder Meter
 - 100 DT Meters

Achievement

- Consumer meters installed 0.7 Million
- Feeder Meter installed 100%
- DT Meters installed 20%

Model 2



PROS : Unified business logic due to Centralized data storage in single MDMS

CONS : Assigning responsibility to a specific service provider is challenging

PROS : Responsibility can be clearly assigned to the service provider

CONS : Distributed data storage in multiple MDMS


WBSEDCL

IT Security Governance & On-premise own DCDR Ecosystem of WBSEDCL

ISO 27001 Certification

- Adopted stringent IT Policy with ISMS 93 Controls
- Established IT Security Governance with Certified Framework
- ISO 27001 aligned Information Security Management System (ISMS) implemented

Strengthening Data Protection & Compliance Readiness

- Preparations underway for compliance with upcoming DPDP Act requirements
- Focus on data privacy, data protection, consent management, and regulatory alignment with comprehensive security solution having endpoint detection enabling DLP and NGAV and response management

Risk & Control Management

- Enterprise-wide risk assessment and mitigation strategy
- Continuous monitoring of IT assets and vulnerabilities
- Security controls embedded across systems and processes

Advancing Cybersecurity Operations Capability

- Security Operations Center (SOC) implementation under planning stage
- Real-time threat detection, monitoring, and incident response capability
- Periodic cyber security audit for achieving cyber resilience with VAPT, DC-DR Drill



Infrastructure Excellence

- Established in **2010 having** HADR provisioned Dedicated Disaster Recovery Centre at Berhampore, West Bengal, India
- **Tier-III Data Centre with ISO/IEC 27001:2022 Certification**
- Supports mission-critical applications for **25 million consumers**
- BMS-integrated heat, fire, moisture & leakage sensors

Physical Security Framework

- 24×7 security surveillance with trained guards in shifts
- 30 Night-Vision CCTV Cameras with 90-day backup retention
- Biometric & Access Card Authentication for critical areas
- Metal detectors, visitor pass systems & material movement tracking

Power & System Reliability

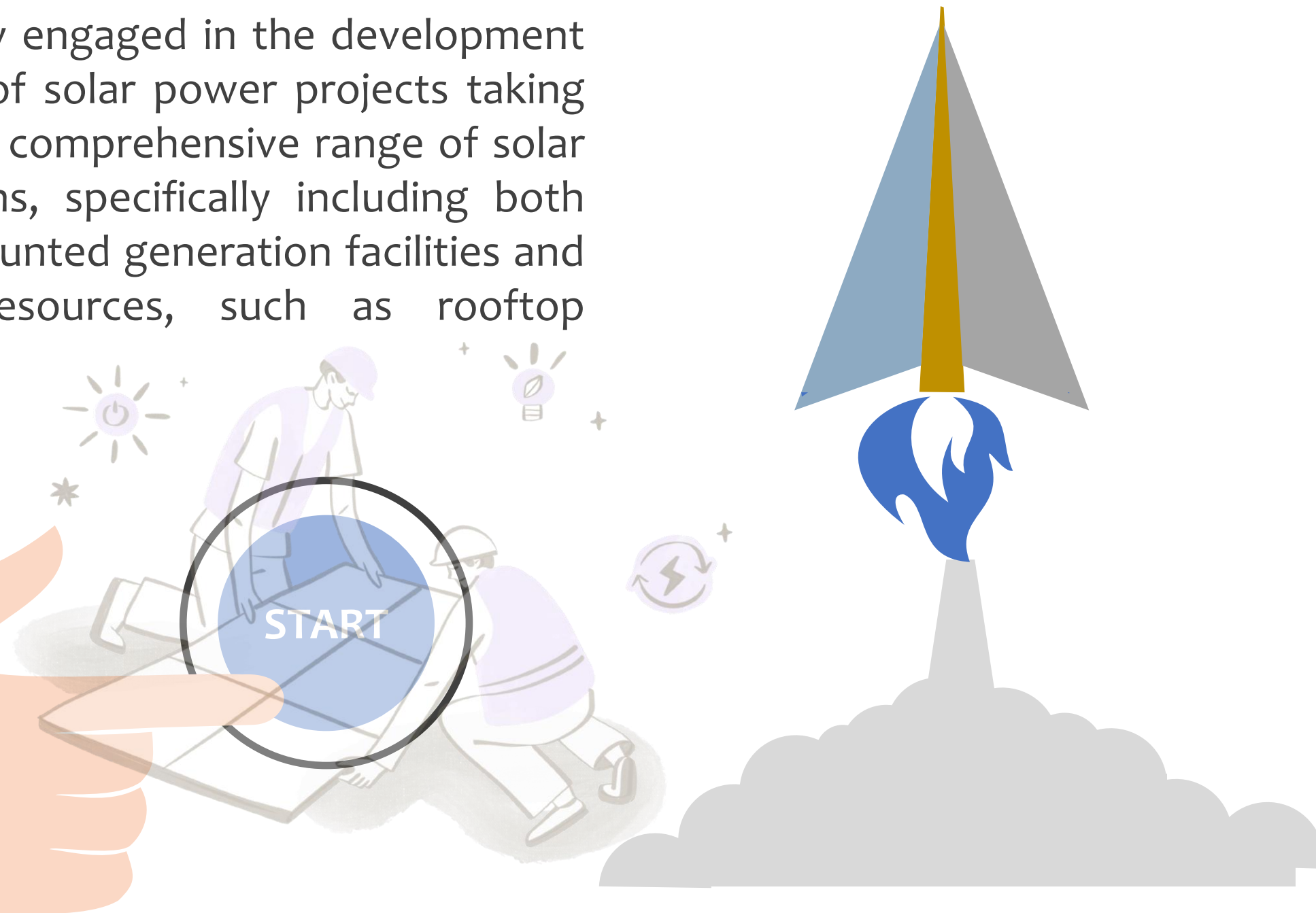
- Redundant DTR, DG, UPS & PPC infrastructure
- SDN-enabled 10G digital backbone with device-level redundancy
- POWER10 high-end servers for Billing & SAP-ERP operations
- 1500+ TB NVMe Flash Storage across DC & DRC.

Transition towards Renewable Energy



WBSEDCL

WBSEDCL is proactively engaged in the development of a diverse portfolio of solar power projects taking initiatives encompass a comprehensive range of solar energy implementations, specifically including both utility-scale, ground-mounted generation facilities and distributed energy resources, such as rooftop installations.



Solar Power Plants [Ground Mounted Floating, Solar Power Project, Rooftop Mounted]

- ✓ Diversified solar power development of approximately 750 MW through ground, rooftop, and floating installations.

Run-of-River Hydro Power Portfolio

- ✓ Diversified hydro generation portfolio of 1071.1 MW through run-of-river river flow based systems across state.

Pump-storage Power project

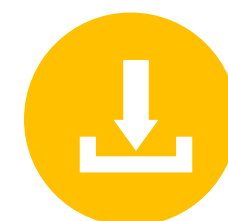
- ✓ The Purulia Pumped Storage Project (PPSP) is a 900 MW (4×225 MW) operational closed-loop hydropower facility located in the Ajodhya Hills of West Bengal's Purulia district, developed by WBSEDCL. Commissioned in 2007 **maintaining grid stability and meeting peak electricity demand**

Way Forward : WBSEDCL Digital Transformation Roadmap



Expansion of Smart Metering Infrastructure

Accelerating statewide intelligent energy monitoring and analytics.



BESS Integration Initiatives

Enhancing grid stability through Battery Energy Storage System



AI & Data-Driven Utility Operations

Leveraging AI, automation, and predictive analytics for smarter decision-making



Migration to S4/HANA Platform

Migration to next generation cloud based SAP solution S/4 HANA from the existing on-prem SAP system for both ISU- and ERP leveraging between Private & Public cloud



SCADA & Smart Grid Modernization

SCADA implementation in progress at 122 Sub-stations



SD-WAN Enabled Network Transformation

WBSEDCL is adopting SD-WAN architecture for secure, scalable, and high-performance enterprise connectivity.





WBSEDCL



THANK YOU