

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

May 20 - 27

 Italy

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Alessandro Guerri

Director General

Directorate – General for European,
International Affairs and Sustainable Finance
Ministry of the Environment and Energy
Security

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Stefania Lenoci

Resident Representative in Italy and Special Representative for Southern Europe, the Holy See and the United Nations Agencies in Rome
World Bank Group

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



Fanny Missfeldt-Ringius

Manager

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Ministry of Environment and Energy Security

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Carlo Bardini

Head of International and European Affairs
of the Energy Department
Ministry of Environment and Energy Security

Italian Private Sector Panel



Giorgio Boneschi
General Manager
Elettricità Futura



Simonetta Sabatino
Head of Cyberdefens
A2A

The Path of Rome, from Grid Automation to Demand Response (ACEA)



Mario Bruni
Head of International
Development
ACEA



Ercole De Luca
Head of Regulatory &
European Affairs
ACEA

COUNTRY SPOTLIGHT



Fanny Missfeldt-Ringius
Manager Energy Access
ESMAP
World Bank Group



Michael Debela Gossa
Chief IT Officer
Ethiopian Electric Utility
(EEU)



Griselda Merkaj
Head of Market
Department, Operatori i
Sistemit të Transmetimit
(OST)



Darwin Castillo
Manager for IT
Consejo Unificado de las
Empresas Distribuidoras



Đình Chiến Nguyễn
Deputy Head, General Division -
Chairman's Assistant
National Power System and
Market Operator Company
(NSMO).



Country Spotlight Dominican Republic

Mr. Darwin Rafael Castillo

Manager for IT

Consejo Unificado de las Empresas Distribuidoras

DR SPOTLIGHT

THE COST OF OBSOLESCENCE

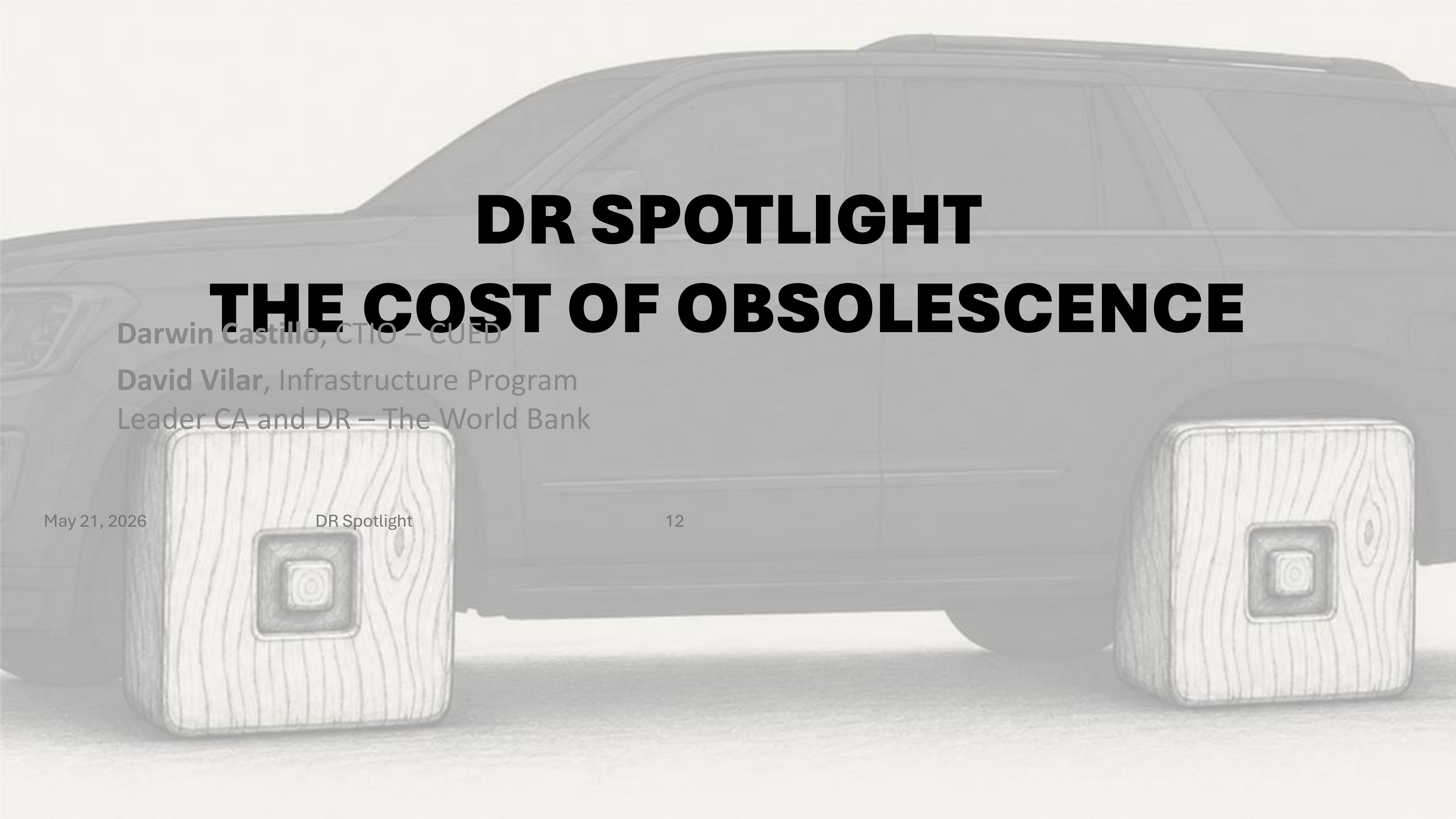
Darwin Castillo, CTIO – CUED

David Vilar, Infrastructure Program
Leader CA and DR – The World Bank

May 21, 2026

DR Spotlight

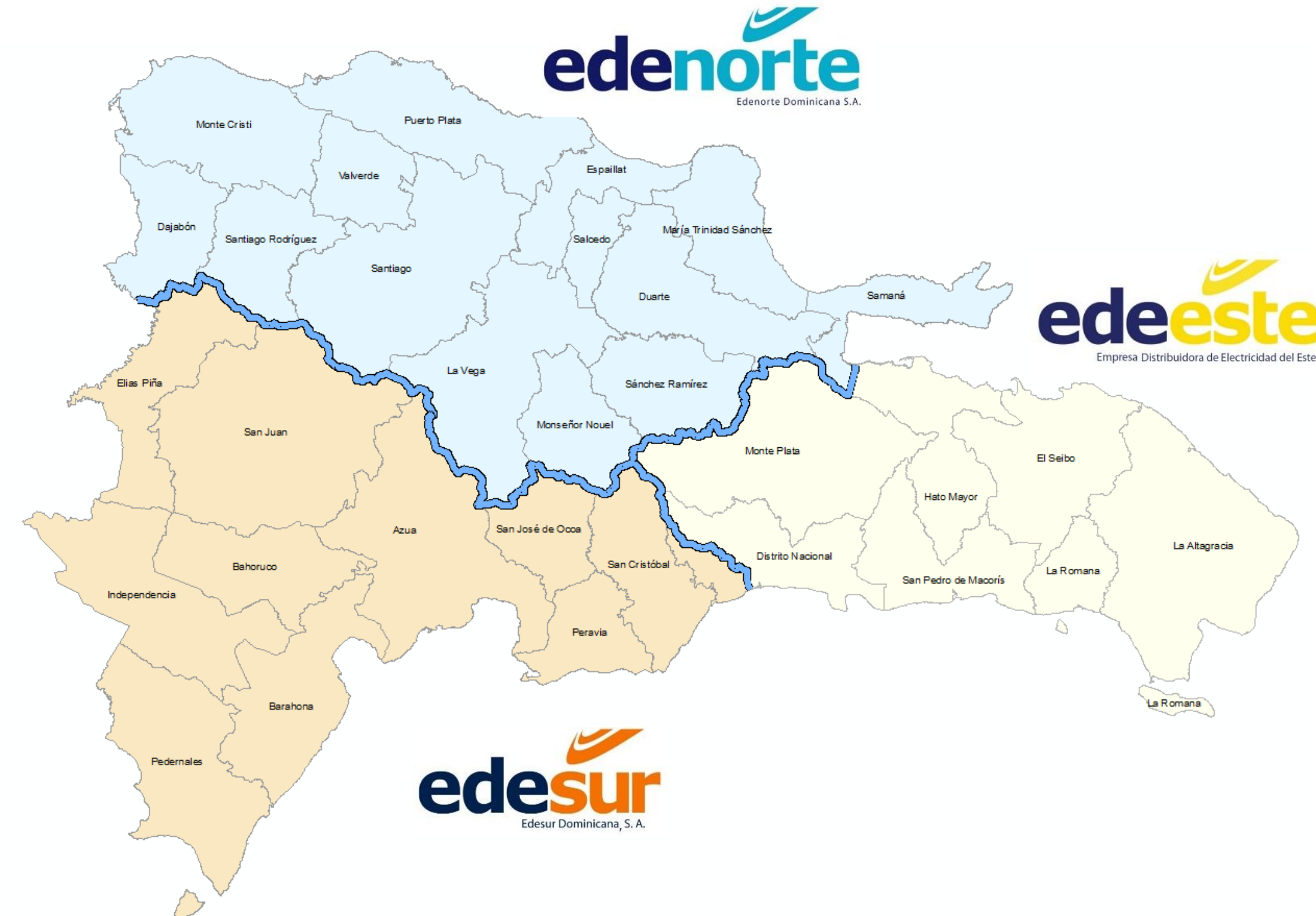
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About Dominican Republic

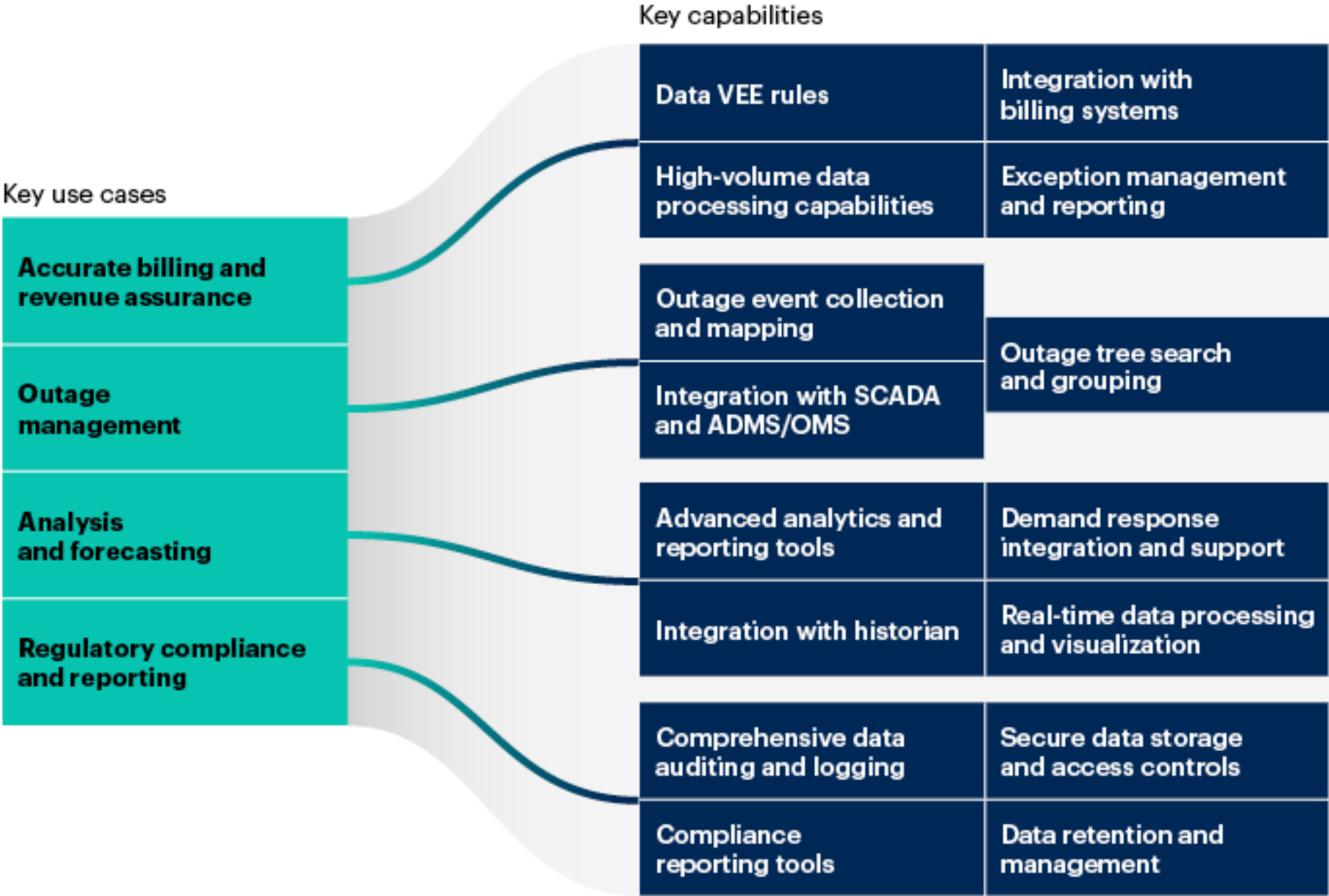
EDESUR, EDEESTE, and EDENORTE are the DR three state-owned distribution companies.

Together, they serve approximately **3 million customers**, have recorded a peak demand of around **4 GW**, operate with high energy losses (*about 38%*), and face challenges across both commercial and distribution operations.



Meter Data Management (MDM) – Scope

MDMS Use Case and Capability Alignment



Revenue protection
Metering’s source of truth

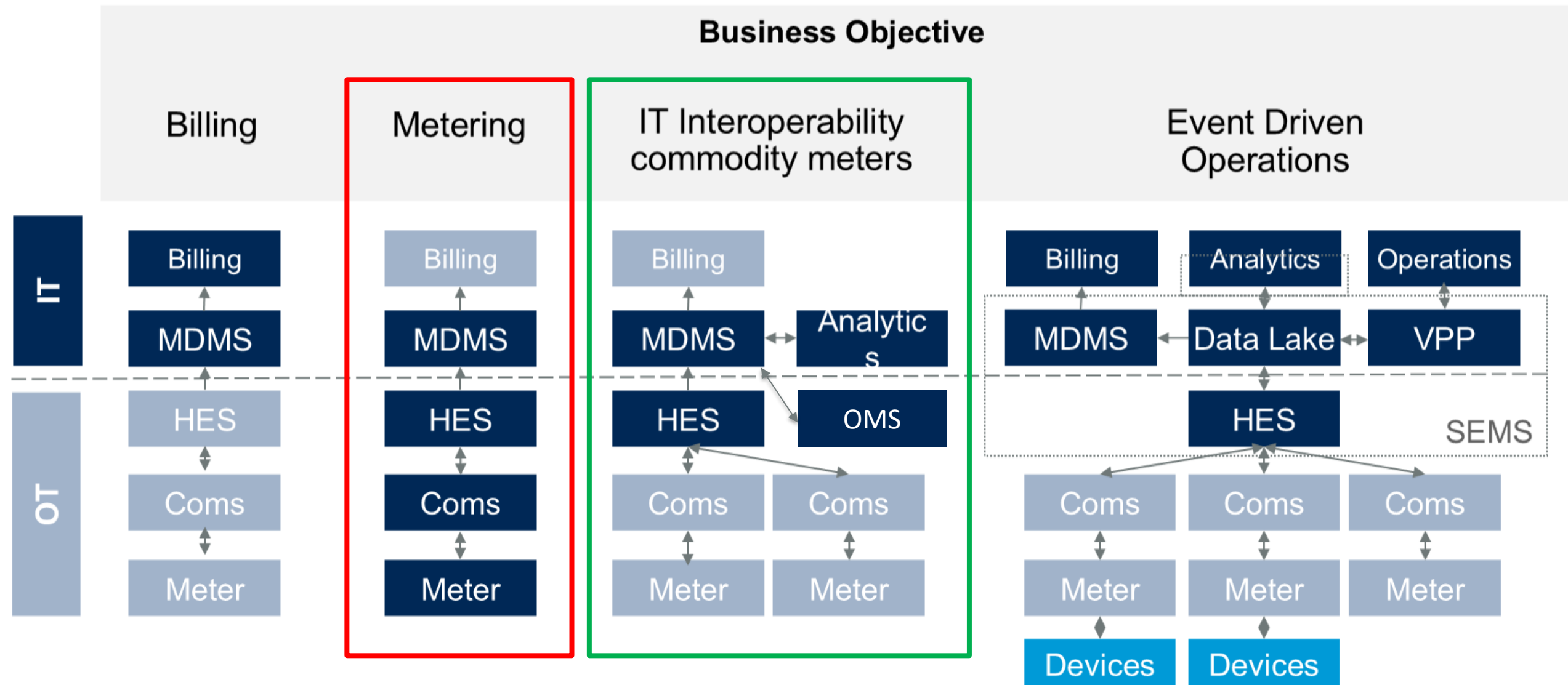
Operational excellence
Outage management and observability

Source: Gartner
VEE = validation, editing and estimation; SCADA = supervisory control and data acquisition; ADMS = advanced distribution management systems; OMS = outage management systems
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MDM – Implementation patterns

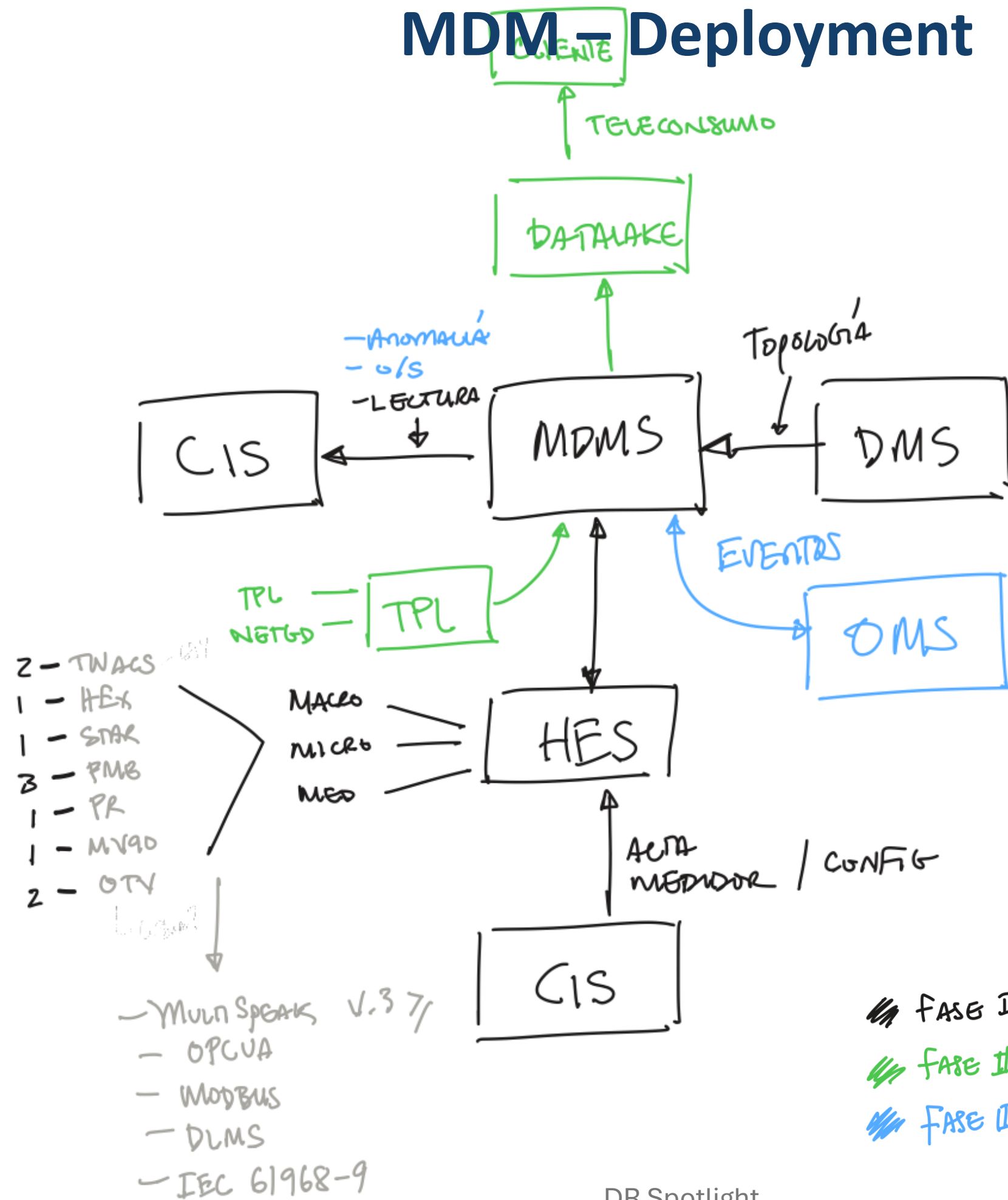
Observed MDMS patterns



Source: Gartner
826640

Gartner®

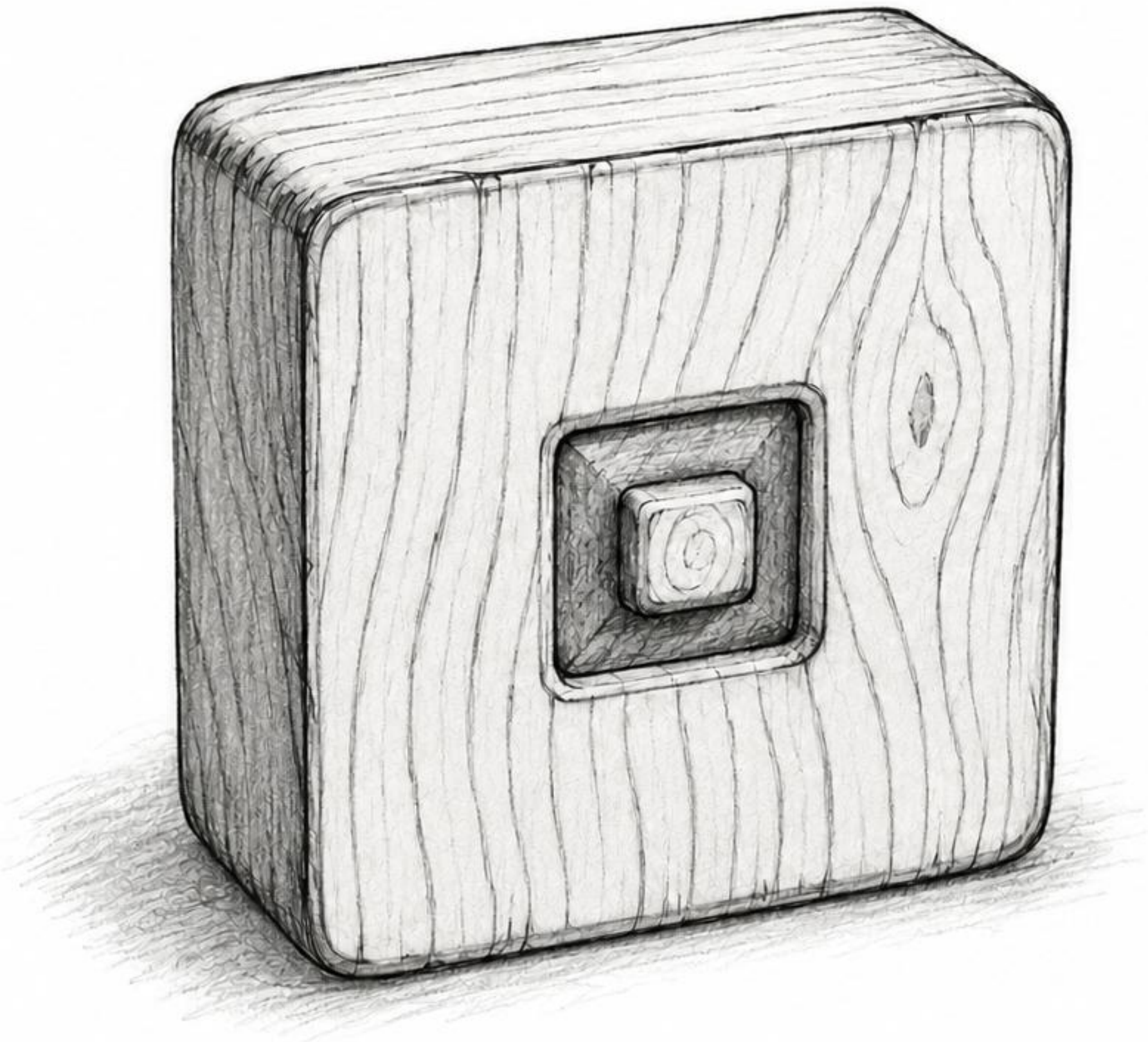
MDM – Deployment



1. Grandes Consumidores R.M.
2. TWACS RF
3. Compra energía Puertos frontera

- /// FASE I - Construcción y aporte fact AMI
- /// FASE II - Analisis medidor + Tpl (medida convencional)
- /// FASE III - eventos e incidencias operativas

Challenges



- High **dependency** on third-party vendors.
- **Interoperability** between systems (legacy, custom-developed and incomings).
- HES's **obsolescence**.
- Not enough **infrastructure** for what's coming.
- **AMI** telecommunication requirements.

Distribution Efficiency Improvement and Utility Strengthening Project (P180512)

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BASIC INFORMATION

Amount	USD 120,000,000
Country:	Dominican Republic
Approval:	December 2023
Effectiveness:	August 2025
Disbursement:	< 1%
Closing:	November 2028
Implementing agency:	3 distribution companies EDESUR, EDEESTE and EDENORTE

Project Development Objective

To improve the governance and financial and environmental sustainability of the electricity distribution companies in the Dominican Republic

KEY COMPONENTS

C1

Improving governance of the distribution companies

USD 36.5M

- (a) Commercial Management System (CMS). Upgrade of current System for the three EDEs, including prepayment module [To be procured]
- (b) Metering Data Management System (MDMSs). New Development. Procurement launched and finalizing bidding documents

C2

Supporting the implementation of the Integrated Loss Reduction Plan

USD 183.5M

- (a) Rehabilitation of networks and client normalization
MV km: 1,342 [under procurement]
Normalized clients: 225k [7.5% of total clients]
- (a) Procurement and installation of smart meters and totalizers AMI
Totalizers (micro-meters): 10,800 [under procurement]

C3

Capacity building, administration, monitoring, and evaluation

USD 5M



Supporting the Energy Transition and Decarbonization of the Electricity Matrix (TF0C3497) USD 445K

Design and implementation support for commercial and information systems
Support the integration of BESS in the power market
Project implementation support

Country Spotlight Ethiopia



Mr. Michael Debela Gossa
Chief IT Officer
Ethiopian Electric Utility (EEU).



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Ethiopian Electric Utility

Corporate overview

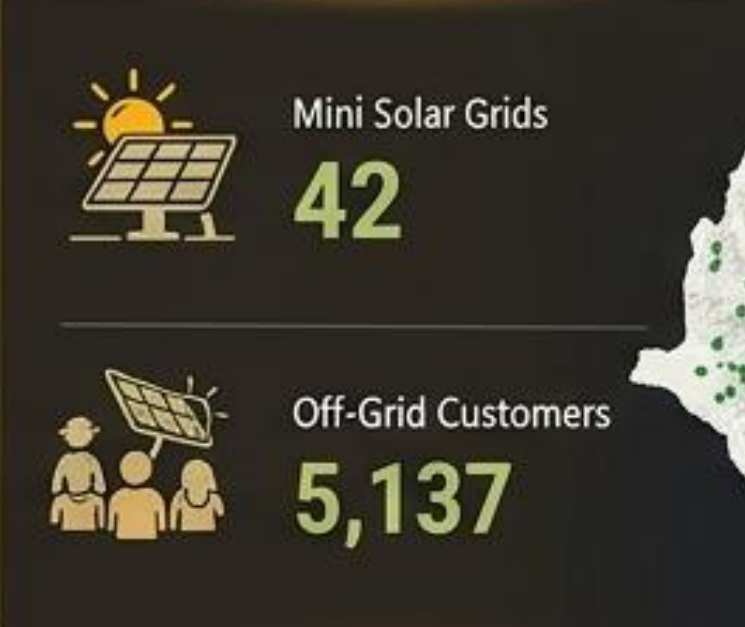
1 NETWORK INFRASTRUCTURE



2 CUSTOMER BASE & ACCESS



3 OFF-GRID & RENEWABLE ENERGY



4 OPERATIONAL STRUCTURE



5 WORKFORCE



6 SELF CONTAINED SYSTEM (SCS)



Powering Ethiopia Today
Building a Brighter Tomorrow

Ongoing Digitalization Projects

As part of IT/OT roadmap



SCADA/ADMS Implementation

Addis Ababa and Surrounding



Esri GIS Implementation

Advanced geospatial asset mapping and analysis



Metering Control Center (MCC)

Centralized smart meter control infrastructure



Planning & Engineering Software

Procurement of planning & power engineering design toolkits



Modern Cloud Native Tier-1 ERP

Comprehensive business solution with built-in AI capabilities



AICC Contract Center

Modernized AI driven customer interaction software



Operations Digitization

Field crew, outage and customer service management



Customer Indexing

Substation to end user for energy auditing



NationalID (Fayda) Integration

Credit rating system based on power consumption



Cyber Security Strengthening

NAC, Zero Trust architecture, WAF, etc.

FUTURE DIGITALIZATION PLANS



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Ethiopian Electric Utility

 **SCADA/ADMS**
Nationwide Rollout (8 cities)

 **AMI Rollout**
+4 million units planned

 **Grid Automation**
Fault localization & smart reclosure

 **IoT Transformer Monitoring**
Sensor-based DT visibility

 **Grid Edge Devices**
Remote sensing via edge computing

 **Enterprise OMS**
SCADA, AMI, Contact Center, Mobile App, etc.

 **EV Infrastructure**
500+ charging stations expansion

 **BESS Integration**
Enhanced power system reliability

 **AMI 2.0 with DER Support**
Next-generation infrastructure for Distributed Energy Resources



Edge Intelligence & Automation

Grid Automation

-  Core smart grid distribution components
-  Self-healing networks (FDIR)
-  Intelligent switching & protection
-  Improved reliability & outage reduction

RMUs • Reclosers • Sectionalizers • FPIs • Fault Localizers

Grid Edge Devices

-  Extend intelligence to distribution edge
-  Real-time sensing (V, I, f, PQ)
-  Edge analytics & automation
-  Demand response & peak shaving
-  VPP & DER integration

Secondary Substation Automation • Local Edge Processing

AMI 2.0

-  Beyond billing & meter reading
-  Two-way real-time communication
-  Edge analytics & intelligence
-  Demand response & peak shaving
-  DER & VPP readiness

Next-Gen Telemetry Mesh • Smart Endpoints

Together, these operational layers enable a self-healing, DER-ready and intelligent distribution grid

KEY CHALLENGES



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Ethiopian Electric Utility



Funding and Investment Constraints



Legacy (Aged) Network Infrastructure



Interoperability & Integration of Multiple Systems



Ensuring Vendor-Agnostic Technology Architecture



Smart Grid & Digital Skills Gap



Evolving Cybersecurity Threats





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Ethiopian Electric Utility



THANK YOU

Country Spotlight Albania



Ms. Griselda Merkaj
Head of Market Department
Operatori i Sistemit të Transmetimit
(OST)

Digital Enablers for Energy Market Development and Regional Integration

Secure, reliable and interoperable digital infrastructure as a key driver for the future energy system



Enabling Regional Cooperation

Digital infrastructure enables real-time operational coordination, data exchange and secure communication between TSOs and regional partners.



Supporting Energy Markets

Reliable digital solutions support market processes, data transparency, settlement activities and cross-border information exchange.



Secure and Interoperable Communications

Interoperability, confidentiality and operational continuity are essential for secure communications across systems and borders.



Beyond Infrastructure – Towards Resilience

OST is focusing on secure, resilient and future-ready communication platforms such as Private Communication Networks (PCN).



Enabling the Energy Transition

Digital infrastructure supports renewable integration, system flexibility and the development of a sustainable and interconnected energy future.



Stronger Together

Through continuous investment and regional cooperation, OST strengthens secure communications and contributes to a more integrated and resilient energy region.

Digital infrastructure connects systems, markets and partners to build a more integrated, secure and efficient energy future.



Security by design
Built-in security for critical systems



Operational continuity
High availability and business continuity



Regional partnership
Stronger cooperation for a stronger region



Future-ready
Investing today for tomorrow's grid



Cyber resilience
Protecting the energy system of the future

Regional market integration requires not only electrical interconnections, but also secure, reliable and interoperable digital ecosystems.

OST and the Digital Transformation Journey

Digitalization as a Key Enabler for Secure Market Integration



OST – Albanian TSO

We operate and develop the national transmission system, ensuring security of supply and system stability.



Nationwide Telecom Network (OPGW)

OPGW network and DWDM technology provide high-capacity, secure and redundant communication across the entire grid.



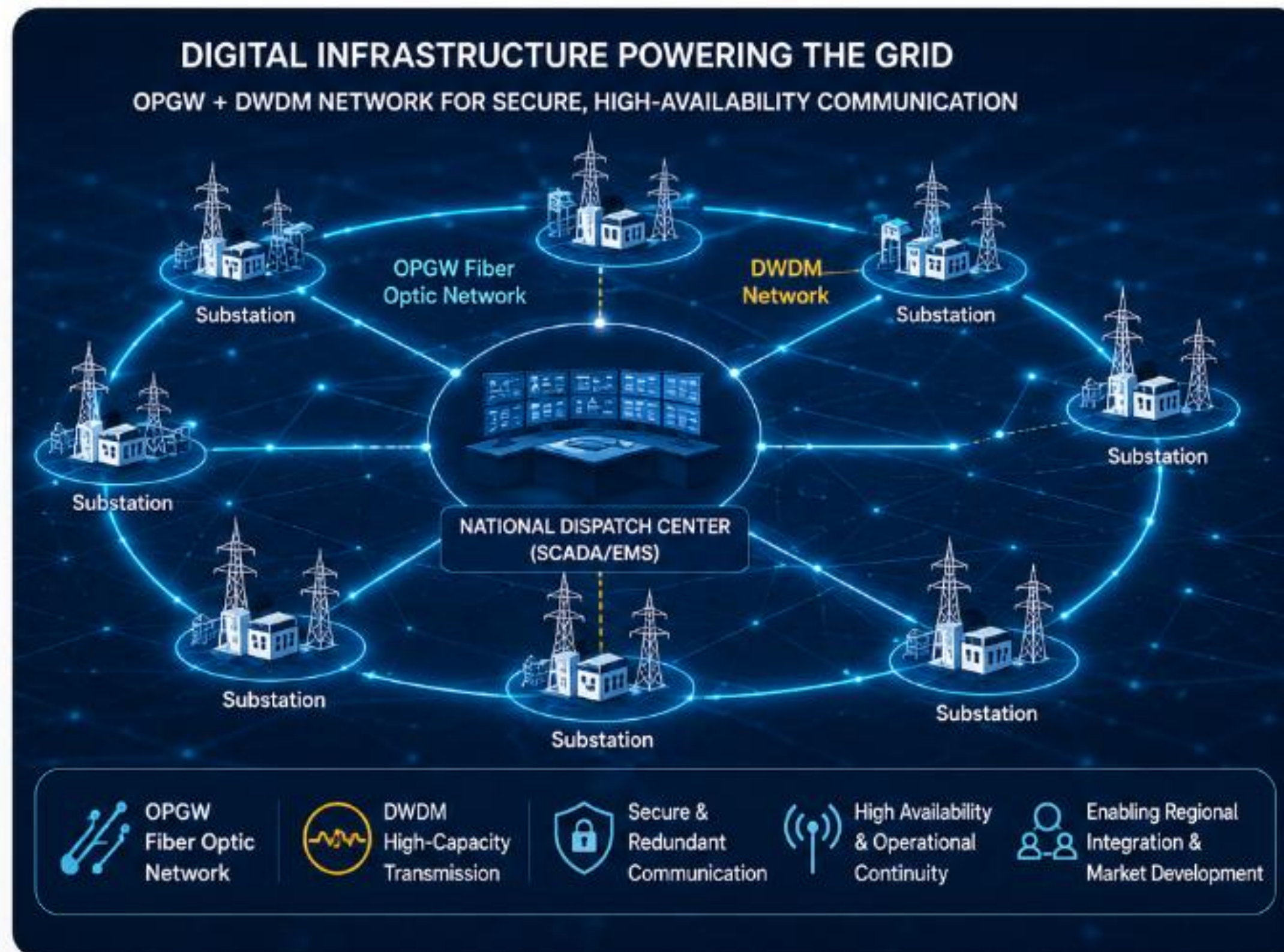
SCADA/EMS Modernization

Advanced SCADA/EMS systems enable real-time monitoring, automation and remote operation of the transmission network.



Digitalization as a Key Enabler

Digital infrastructure, data exchange and cybersecurity are now as critical as electrical infrastructure for a modern energy market.



Reliable digital infrastructure is now as important as electrical infrastructure.

Digital Infrastructure Supporting Energy Markets

Secure, Integrated and Interoperable Communication for Regional Markets



Regional Integration & ENTSO-E Alignment

Active participation in ENTSO-E initiatives and implementation of European standards for market and system operations.



Cross-Border Data Exchange

Secure and reliable exchange of real-time operational data, market data and grid information with regional partners.



Private & Secure Communication (PCN)

Migration towards Private Communication Networks to ensure confidentiality, integrity and high cybersecurity for market platforms and operational communication.



High Availability & Operational Continuity

Redundant digital infrastructure and high availability solutions ensuring continuous support for market operations 24/7.



Enabling a Competitive & Integrated Market

Digital communication is the backbone for market coupling, transparency, liquidity and efficient integration of renewable energy.

CROSS-BORDER INTERCONNECTIONS & DIGITAL CONNECTIVITY

Reliable digital infrastructure enabling secure data exchange and market integration

NETWORK LEGEND

- 400 kV Transmission Line
- 220 kV Transmission Line
- 400/220 kV Substation
- 150/110 kV Substation
- OPGW Fiber Optic Network
- Cross-Border Digital Links



OST CONTROL CENTER

National Dispatch Center (SCADA/EMS)



High-Capacity OPGW Network

Nationwide fiber optic backbone on 400 kV transmission lines



Secure Cross-Border Connectivity

Dedicated and encrypted digital links with neighboring TSOs



Real-Time Data Exchange

Operational, market and grid data exchange in line with ENTSO-E standards



Market & System Integration

Supporting day-ahead, intraday and balancing market processes

Regional market integration requires secure, reliable and interoperable digital ecosystems.

Cybersecurity & Operational Resilience

Protecting Critical Infrastructure, Ensuring Secure Operations



Security by Design

Cybersecurity is embedded in all digital systems and processes to protect critical infrastructure and operational technology.



SOC & SIEM Monitoring

24/7 monitoring of IT and OT environments using advanced SOC capabilities and SIEM platforms for real-time threat detection, analysis and response.



Network Segmentation (IT/OT)

Strict segregation between IT and OT networks to minimize risks and prevent unauthorized access to critical systems.



SCADA/EMS Protection

Robust protection of SCADA/EMS systems and critical data through access control, patch management and vulnerability management.



Operational Resilience

Ensuring business continuity and rapid recovery through redundancy, backups, incident response and disaster recovery procedures.



A secure and resilient digital ecosystem is the foundation of safe, reliable and sustainable operations.

Digital Innovation Enabling the Future

Intelligent technologies for a smarter,
more efficient and sustainable grid



AI & Advanced Analytics

Leveraging AI and machine learning for smarter decision-making, automated analysis and operational optimization.



Power BI & Data-Driven Insights

Centralized dashboards and analytics for better visibility, performance tracking and data-driven decision making.



Predictive Maintenance

Using data and AI models to predict asset health, reduce failures and optimize maintenance activities.



Smart Monitoring & Automation

Real-time monitoring, intelligent alarms and automation to improve reliability, efficiency and situational awareness.



Digital Substations & Smart Grid

Digital substations, IEC 61850, and integrated systems enabling a more flexible, secure and future-ready grid.

BUILDING AN INTELLIGENT, DATA-DRIVEN AND SUSTAINABLE ENERGY FUTURE

AI, data and digital technologies at the core of OST's transformation journey



AI-Powered Operations

AI-based alarm analysis, anomaly detection and intelligent decision support for daily operations.



Data & Analytics

Advanced analytics and Power BI dashboards transforming data into actionable insights.



Operational Efficiency

Process optimization, automation and intelligent tools improving efficiency and reducing risk.



Sustainability

Enabling renewable integration and supporting a sustainable and clean energy transition.



Future-Ready Workforce

Building digital skills and a data-driven culture ready for the future energy landscape.



DATA FOUNDATION

Strong, secure and integrated data across systems and infrastructure.



INTELLIGENT APPLICATIONS

AI, analytics and digital solutions enabling smarter operations and decisions.



SMART GRID OPERATIONS

Real-time visibility, automation and advanced control for a resilient and flexible grid.



SUSTAINABLE ENERGY FUTURE

A secure, reliable and sustainable energy system supporting people, economy and future generations.



OUR DIGITAL VISION

To build a secure, intelligent and innovative digital ecosystem that empowers our people, strengthens operational excellence and enables the future of energy.



Secure



Interoperable



Intelligent



Sustainable

Digital innovation is not just about technology – it is the foundation of a resilient, sustainable and connected energy future.

Country Spotlight Vietnam



Mr. Đình Chiến Nguyễn

Deputy Head, General Division - Chairman's Assistant,
National Power System and Market Operator
Company (NSMO).

NSMO's solutions in RE Operation:
Forecasting combination, and AGC



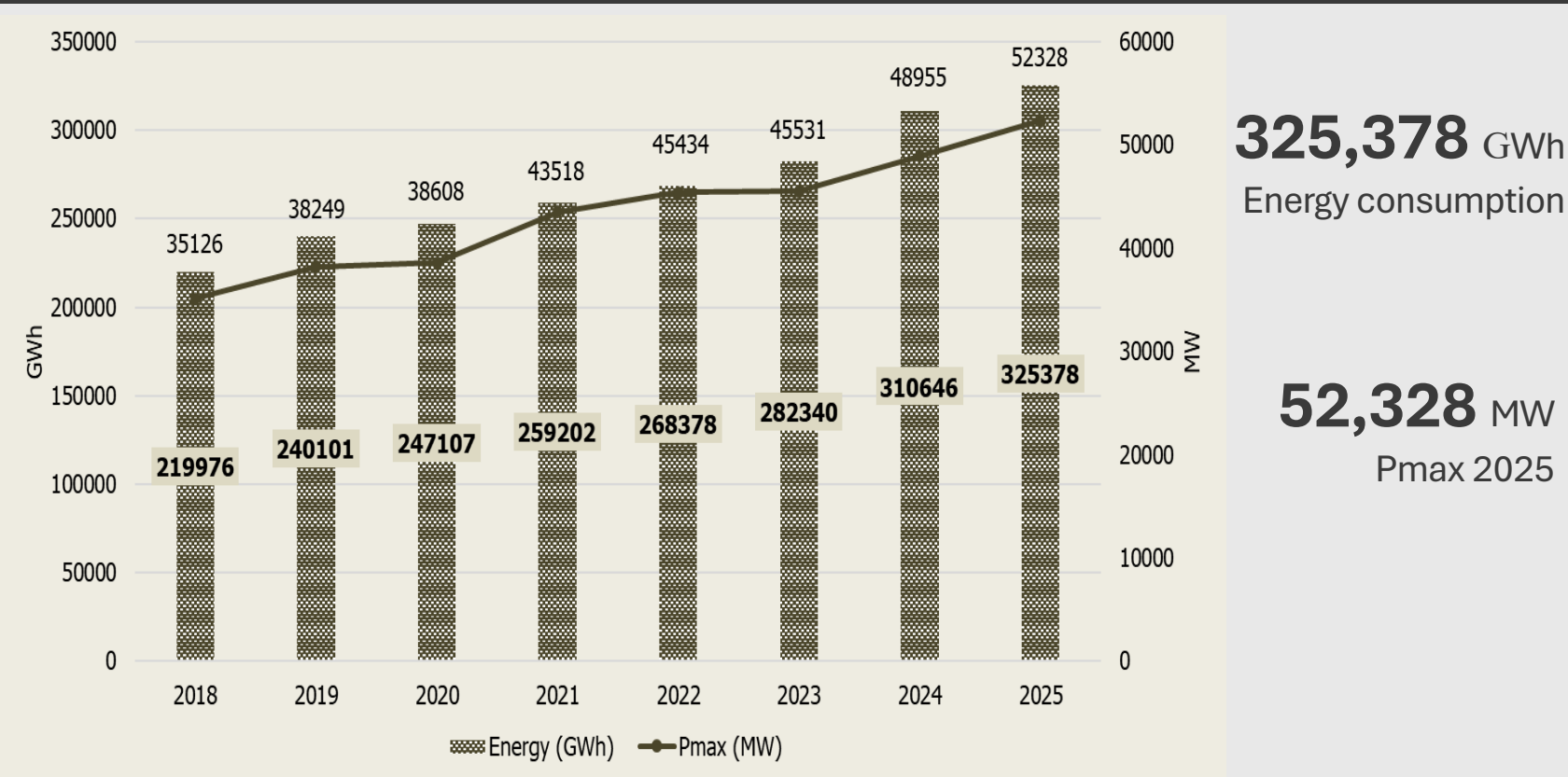
CÔNG TY TNHH MTV VẬN HÀNH HỆ THỐNG ĐIỆN
VÀ THỊ TRƯỜNG ĐIỆN QUỐC GIA

1

Overview of Vietnamese Power System and Renewable Energy Development

Overview of Vietnam Power System

ELECTRICITY DEMAND



AVERAGE GROWTH 2018-2025



INSTALLED CAPACITY 2025

92.383 MW



Coal		28.926 MW (31%)
Hydro		25.039 MW (27%)
Gas + Oil		10.264 MW (11%)
Wind		6.345 MW (7%)
Solar		17.488 (19%)
Other		4.323 MW (5%)

Rapid capacity growth in a **short time (03 years: 2019-2021)**, **concentrated** in **specific regions**

RE (not included
Small Hydro)

Installed Cap. : ~31 GW (~33%)
Production : ~43 TWh (~13%)



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VÀ THỊ TRƯỜNG ĐIỆN QUỐC GIA

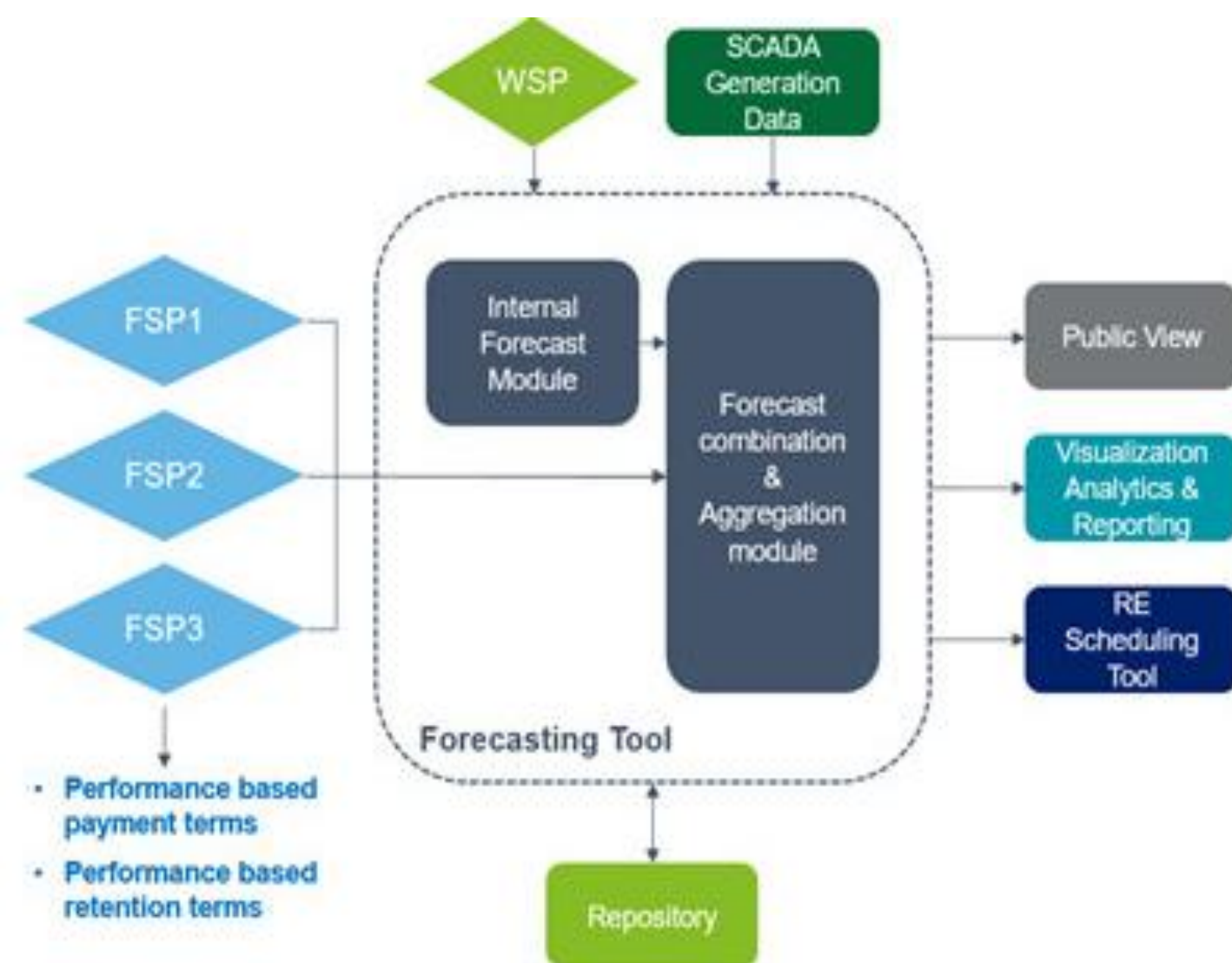
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NSMO's solutions in Renewables Operation

- Forecasting Combination
- AGC

Forecasting Combination for Utility-scale RE Power Plants

Vietnam Forecasting Model



Forecasting Sources

Third party supplier 1

Third party supplier 2

Power plants forecast

In-house forecasting



Forecast resolution: **30** min → **15** min

Forecasting Combination for Utility-scale RE Power Plants

Forecasting combination algorithm



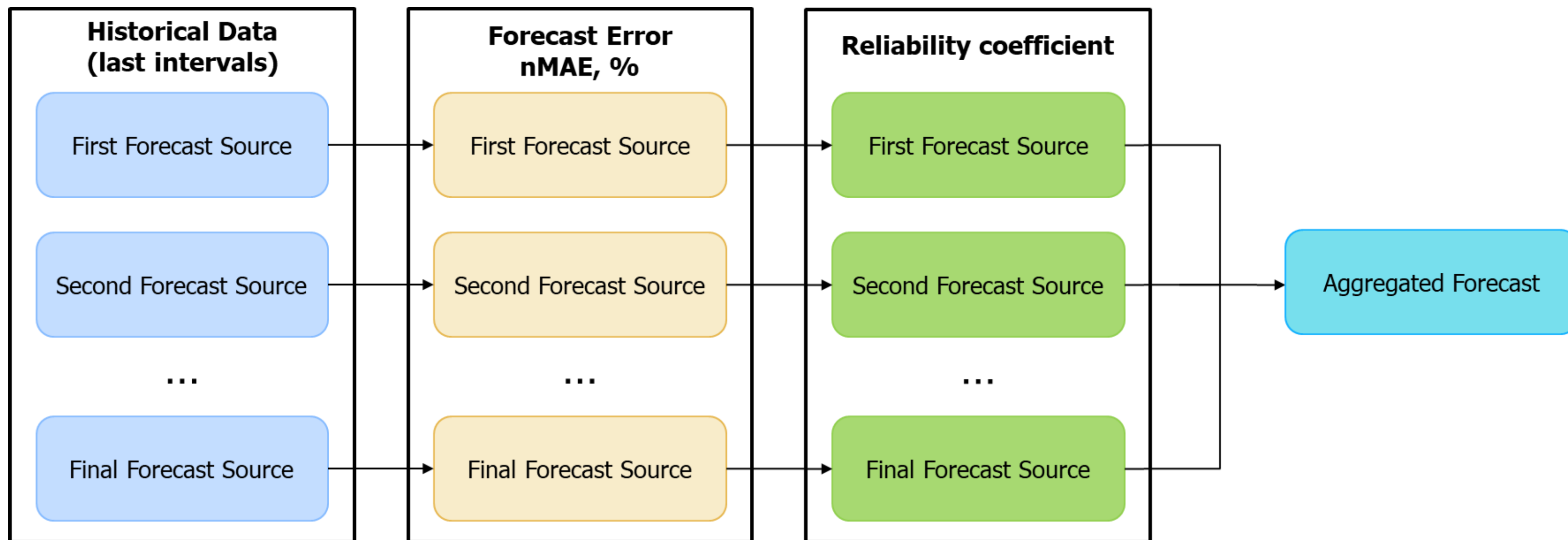
Real-time running



Tool for RE Operator



Accuracy Improvement

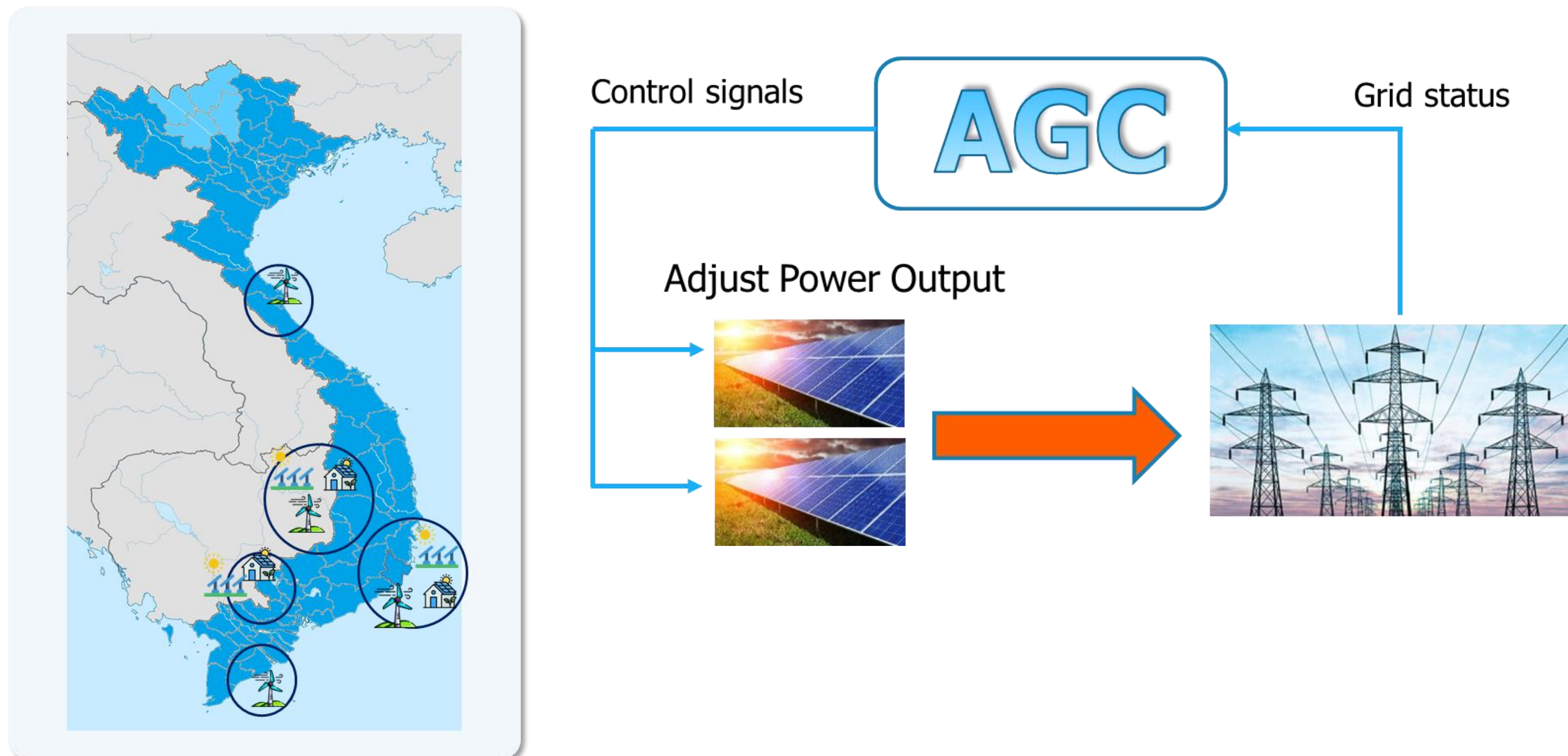


$$nMAE = \sum_{i=1}^n \frac{|F_i - A_i|}{P_{installed_capacity}}$$

F_i : Forecast values
 A_i : Actual values

Grid Overload – Automatic Generation Control

Online control RE plant



Grid Overload – Automatic Generation Control

Online control RE plant

L10	276NP2-276TNam	To Bus	232.2	59.9	19.2	163.3	153.1	944.1	ON
			230.6	-59.4	-22.2	153.1			
L11	172PNinh-178HSA	From...	114.7	3.9	4.9	33.0	33.0	666.3	ON
			114.3	-3.6	-4.4	26.0			
L12	172CLam-172BDC	To Bus	113.1	-1.5	1.8	0.0	15.2	494.7	ON
			112.7	1.3	-2.8	16.6			
L13	272DTrong-276DL	From...	231.5	127.4	-11.8	314.6	314.6	489.9	OFF
			0.0	0.0	0.0	0.0			
L14	172DNai-175TC2	From...	114.7	-32.8	-3.6	168.2	168.2	445.0	OFF
			116.1	33.1	0.4	168.0			
L15	171TC1-174TC220	From...	116.7	-23.1	5.0	114.3	114.3	536.4	ON
			115.3	22.9	-4.3	119.0			
L16	171HBRE-171DHon	From...	117.8	12.3	0.0	60.0	60.0	494.7	ON
			117.2	-12.3	-0.9	66.4			
L17	172TNguy-175Krb	From...	116.2	15.6	-3.4	80.8	80.8	460.4	ON
			116.0	-15.6	2.3	80.9			

Unit	No.	Alarm	TYPE	Area	Name	Group	CE
	75		TD_0_xa	NamMT	CH1-SONGHINH_H2	0	
	29		DMTroi	NamMT	CP1-AMIKHANHH...	L06	
	82		DMTroi	NamMT	CP1-BINHNGUYEN	L07	
	116		DMTroi	NamMT	CP1-BMT (A3)	L08	
	31		DMTroi	NamMT	CP1-CAMLAMVN	L09	
	83		DMTroi	NamMT	CP1-CATHIEP	L10	
	84		DMTroi	NamMT	CP1-CUJUT	L11	
	160		DMTroi	NamMT	CP1-DAMTRAO	L12	
	6		DMTroi	NamMT	CP1-DLMIENTRUNG	L13	
	148		DMTroi	BacMT	CP1-DOHWALETH...	L21	
	57		DMTroi	NamMT	CP1-EUROPLAST...	L19	
	85		DMTroi	NamMT	CP1-FUJIWARA	L03	



High-frequency Control

Calculate every 4s, send control signal every 8s



Zonal Area Definition

Covers 220/110kV network & inter-area 500kV AC lines



NSMO Innovation

NSMO fully owns the power ceiling and sequential line control algorithms



CÔNG TY TNHH MTV VẬN HÀNH HỆ THỐNG ĐIỆN
VÀ THỊ TRƯỜNG ĐIỆN QUỐC GIA

3

Challenges in Rooftop Solar

- Load Forecasting
- Regulation & Compliance

Challenges in Rooftop Solar

~8,400 MW

Total installed capacity
of rooftop solar PV
by end of 2025

9.1%

Share of national
installed power
system capacity

Key Threshold: 100 kWp

≥ 100 kWp: Connected to Power
Company 's Control Centers

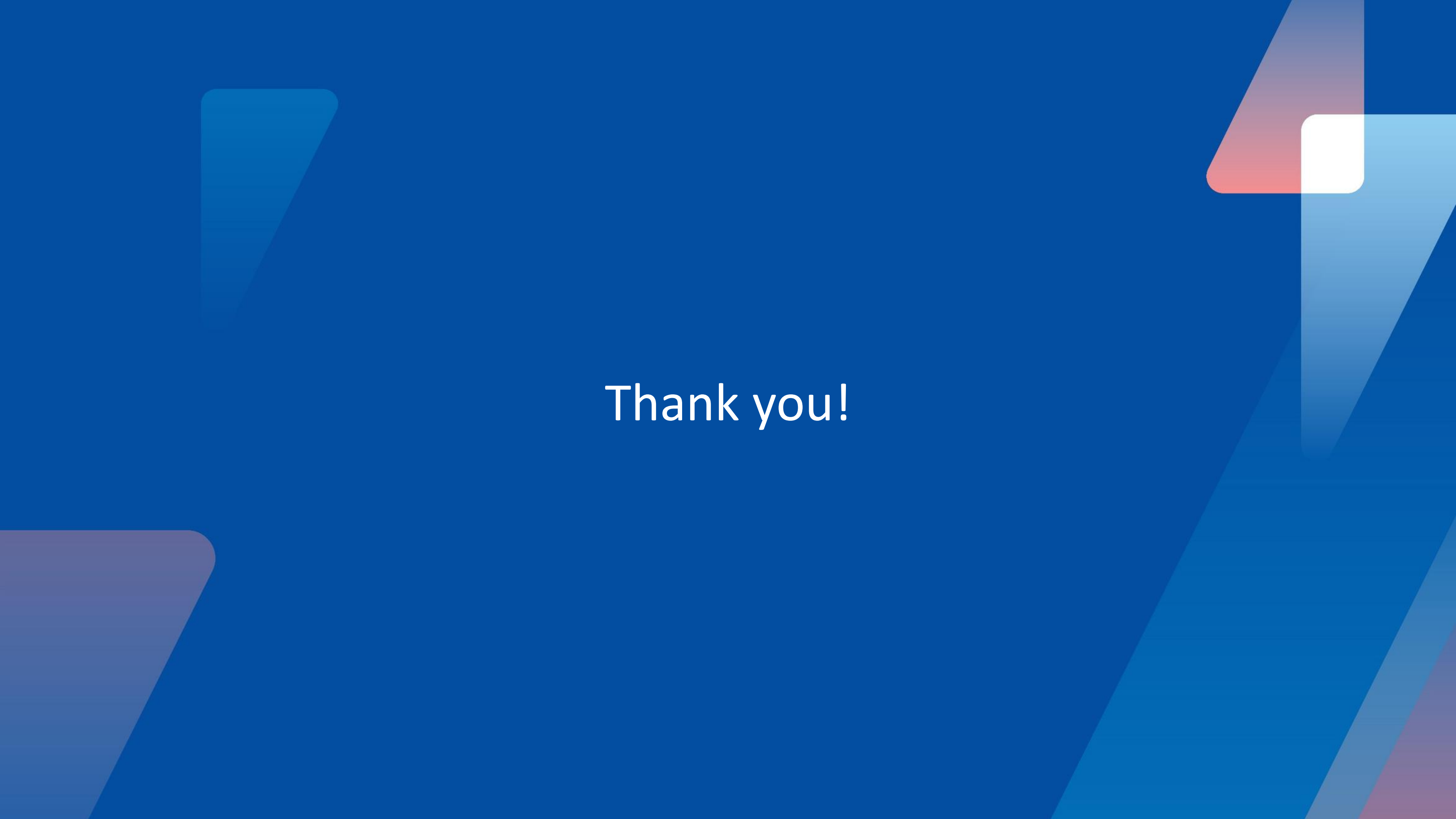
< 100 kWp:
Dispersed & insufficiently monitored

Operational Challenges

- Significant impact on system load profiles
- Difficulties in accurate load forecasting
- Incomplete operational management framework
- Requires government-level regulation and public compliance

NSMO's Way Forward

- NSMO collaborating on data-driven management solutions
- Expanding monitoring coverage for systems < 100 kWp
- Seeking international knowledge exchange on best practices



Thank you!