Current Status and Development of Smart Grids in Sri Lanka

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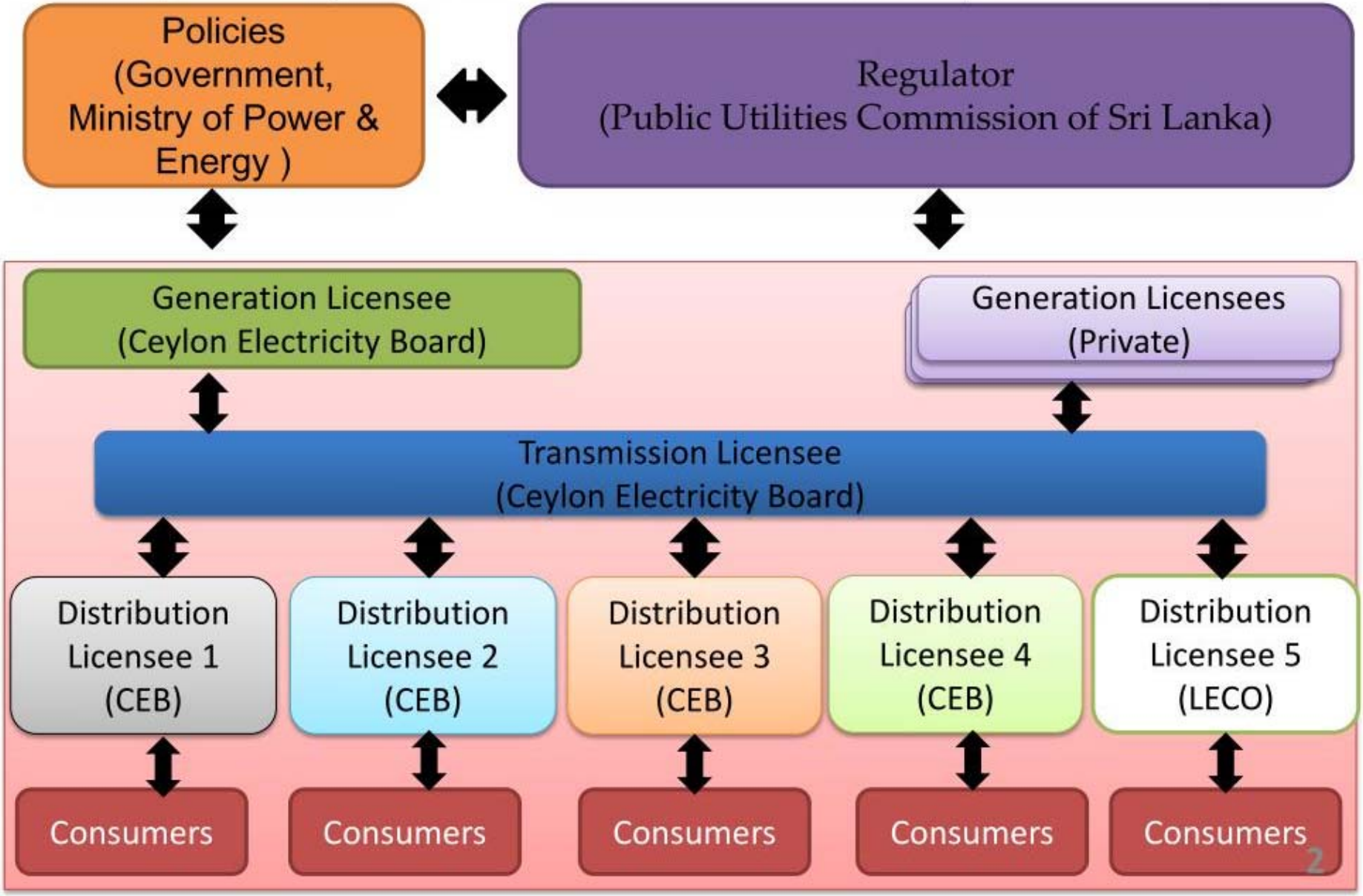
Structure of Electricity Industry
(Subsequent to Sri Lanka Electricity Act 2009)

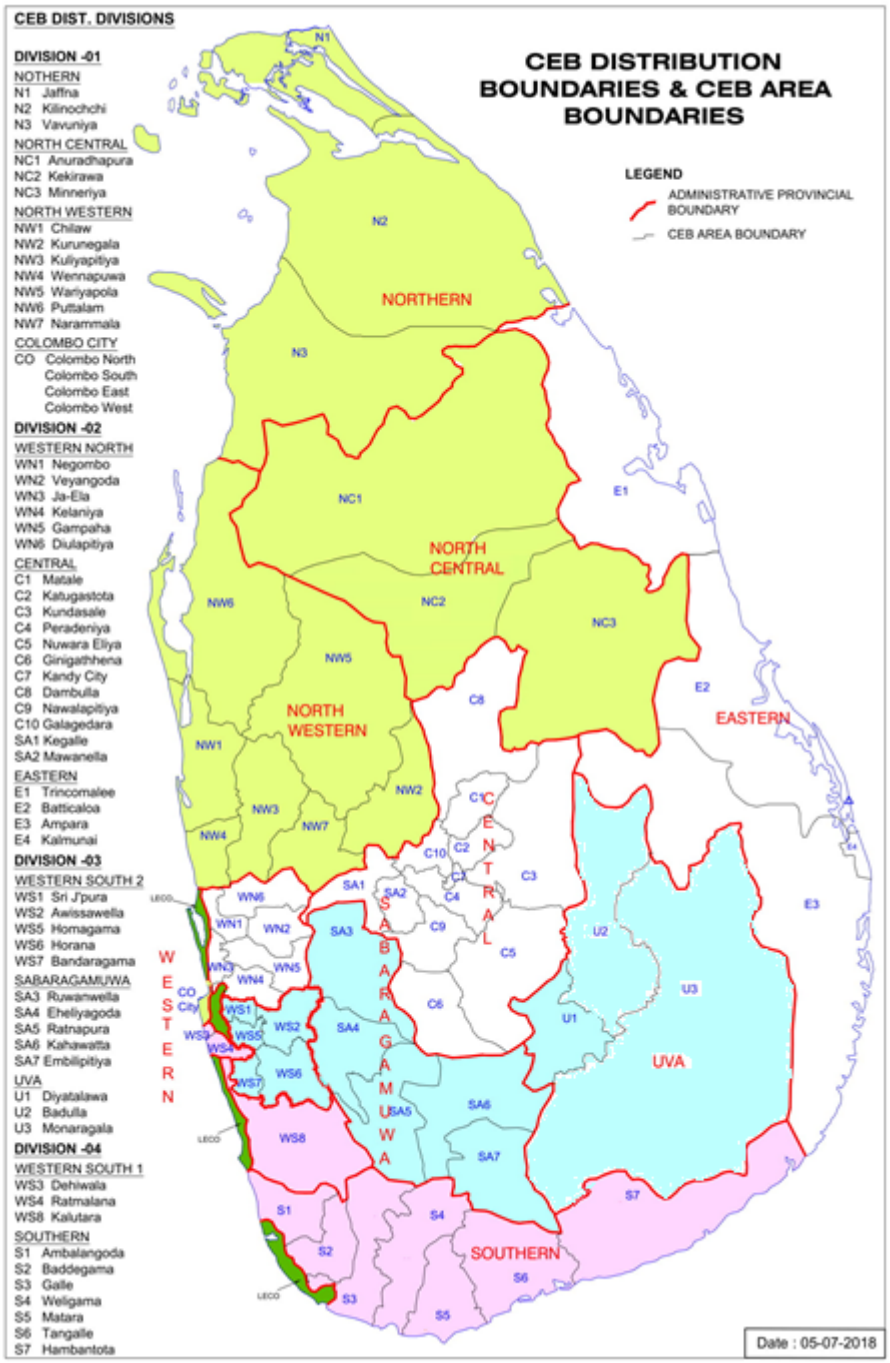


Statistics…

- Installed Capacity : 4,018MW
- Maximum Demand : 2,537MW
- Average cost per unit : LKR 20.32 / USD 0.113
- Average selling price: LKR 16.26 / USD 0.09
- Number of customers : 7Mn

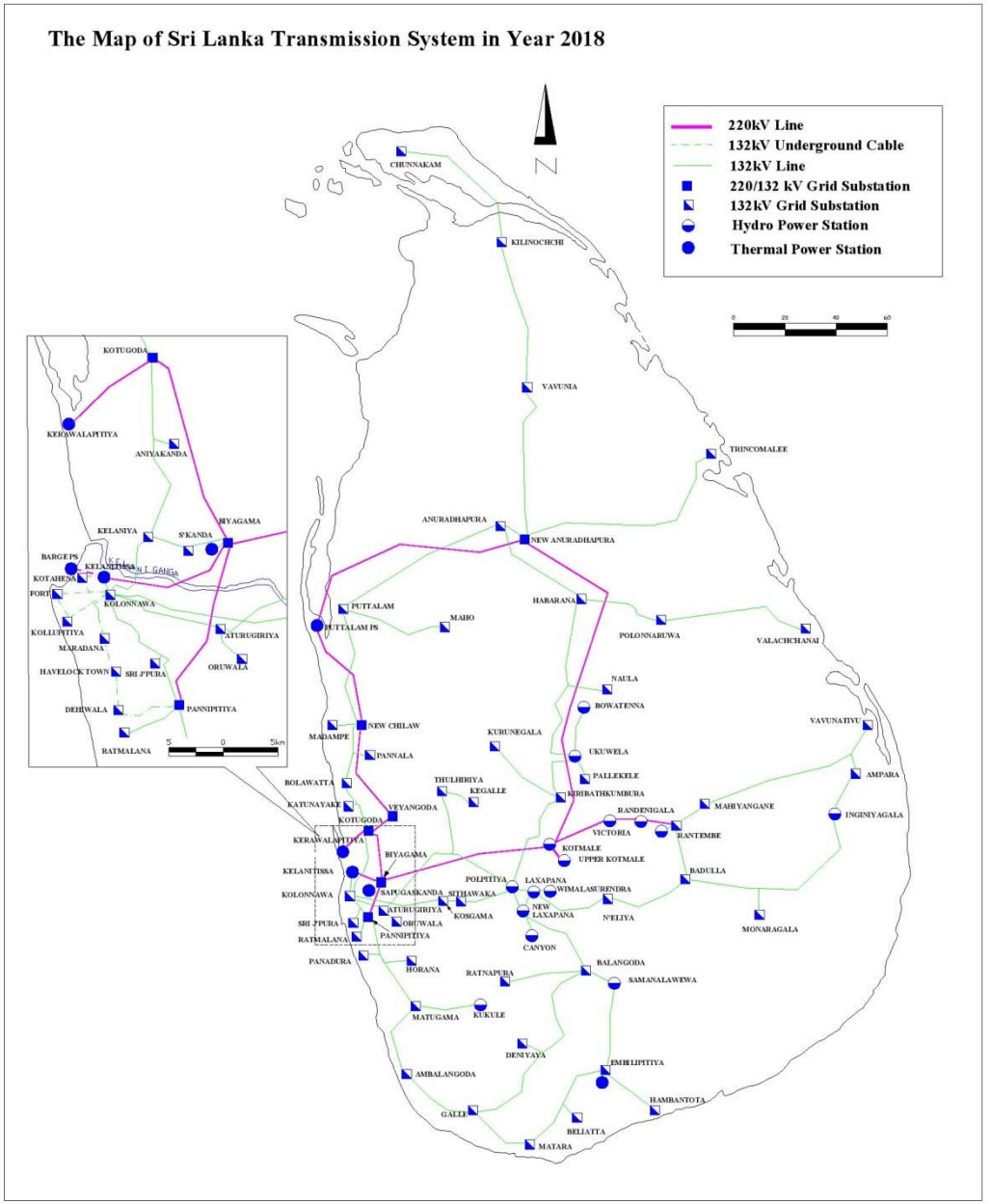
Generation Statistics

Ownership	Type	No. of Power Stations	Installed Capacity (MW)
CEB	Hydro	17	1384
	Thermal (Oil)	7	604
	Thermal (Coal)	1	900
	ORE (Wind)	1	3
PPP	ORE(Mini Hydro)	182	354
	Thermal (Oil)	6	629
	ORE (Wind)	15	128
	ORE (Other)	18	77
Total		24	4018



- Distribution Division 1
- Distribution Division 2
- Distribution Division 3
- Distribution Division 4
- LECO Distribution

The Map of Sri Lanka Transmission System in Year 2018



Significant achievements ….

- 100% electrified
- 8.45% G+T+D Losses
- 24x7 power supply
- Reasonable subsidised tariff for low end customers
- Subsidized tariff for industries – Rs 12 = US Cents 6.50
- Renewable absorption 30% to 50%
- 18,000 Roof Top Net Energy Metering Solar Customers
- 170 MW Roof Solar + 60 MW other solar
- Mini Hydro – 354 MW
- Wind – 128 MW
- SAIDI – Approximately 100 Hrs/Consumer/Annum

Futuristic goals of CEB

- Transition to low carbon technologies for power generation.
- Modernization of Grid to enhance reliability and to integrate large quantities of renewable energy, electric vehicles, distributed generation etc
- Enable seamless digital customer experience
- Business excellence through digital transformation

Drivers of Digital Transformation in Power Utilities

- Higher customer expectations
- Regulatory requirements
- Demand for higher efficiency and effectiveness
- Reduction in technical & commercial losses
- Demand side management (TOU Tariff—Dynamic pricing based for peak Demand)
- 24x7 power for all
- Outage reduction
- Renewable energy integration
- Improved energy efficiency
- Reliable grid stability
- Grid flexibility
- Reduction in peak demand
- Reduction in power purchase cost

Key elements of Digital Transformation of Power Utilities

- Information Technology (IT)
- Enterprise Resource Planning (ERP)
- Smart Grid

Digital Transformation Roadmap for CEB

The key elements of digital transformation roadmap of CEB includes

- **Development and implementation of Information Technology Roadmap of CEB**
- Development and Implementation of Enterprise Resource Planning System for the CEB.
- Upgrading of the existing Grid as a Smart Grid in CEB

IT Roadmap

- IT Roadmap Projects

Digital Transformation Roadmap for CEB

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- Development and implementation of Information Technology Roadmap of CEB
- **Development and Implementation of Enterprise Resource Planning System for the CEB.**
- Upgrading of the existing Grid as a Smart Grid in CEB

Implementation Plan of the ERP Project

No	Sub Project Name	Description	Project Cost Mn. USD	Funding	Duration
1	Preparation of FRS, RFP and Tender Documents of the ERP	M/s KPMH Sri Lanka was appointed as the Consultant	0.6	CEB	2017 June to 2018 October
2	Selection of suitable System Integrator for the ERP Project				2018 November to 2019 March
3	Implementation of the Phase 01 of the ERP Project		7.0	ADB	2019-2021
4	Implementation of the Phase 02 of the ERP Project		1.6	ADB	2021-2022

ERP .....

- **Phase 01**

Financial Management, Treasury & Fund Management, Customer Information System including Billing & Collection, Customer Relationship Management, Energy Management, Meter Data Management, Procurement & Inventory, Project Management, Human Resource Management and Payroll, Business Intelligence & Report Generation, Work Flow and Document Management during the year 2019 and 2020.

- **Phase 02**

Asset Management, Maintenance Management, Fuel Management, Fleet Management during the year 2021

Digital Transformation Roadmap for CEB

The key elements of digital transformation roadmap of CEB includes

- Development and implementation of Information Technology Roadmap of CEB
- Development and Implementation of Enterprise Resource Planning System for the CEB**.**
- **Upgrading of the existing Grid as a Smart Grid in CEB**

Upgrading of the existing Grid as a Smart Grid in CEB

- Upgrading of Distribution Grid as Smart Grid
- Upgrading of Transmission Grid as Smart Grid

Upgrading Distribution Grid as a Smart Grid

- Roadmap for Advanced Metering Infrastructure (Smart Metering)
- Roadmap for Implementation of Advanced Distribution Management System with Outage Management Systems (ADMS - DMS)
- Roadmap for Implementation of Geographical Information System
- Implementation Plan for Home Area Network
- Implementation Plan for V to G and G to V

Roadmap for deployment of Advanced Metering Infrastructure (AMI) for CEB

- AMI Projects for Areas
- AMI Project for Bulk Supplies in the CEB
- AMI Project for Power Quality Management
- AMI for Distribution Transformer Monitoring System

Category 01 Areas

CEB Distribution Divisions	Area Engineers Units which under Category 01	No. of Retail Customers in March 2018
DD-1	Colombo North	51, 293
	Colombo South	48, 960
	Colombo West	31, 732
	Colombo East	44, 217
	Kandy City	43, 205
DD-2	Negombo	106, 922
	Kalmunei	86, 072
	Ja-Ela	94, 181
	Kelaniya	128, 264
DD-3	Sri Jayawardanapura	102, 461
DD-4	Dehiwala	49, 461
Total		786,768

AMI Projects for Areas

- AMI Projects

AMI for Bulk Supplies in the CEB

- There are about 11500 bulk supplies in the CEB and at present remote reading is possible for all the bulk supply energy meters.
- However these installations are not equipped with smart meters and other functionalities of a smart metering system.
- There are many different types of meters installed and different software has to be used to remote read the meters. After reading the meters, meter readings have to be manually entered into the bulk supply billing system for the preparation of bills.
- The present system has facility only to remote read the meter.
- There are many added befits to CEB as well as customers when a fully pledged smart bulk metering system is installed for the CEB including a smart bulk meter, communication network and meter data management system.
- CEB should finance the above program and GPRD/3G/4G/Fiber technology could be used to communicate between the smart meter and the Meter Data Management System.

AMI Project for Bulk Supplies in CEB

Sub Project Name	Description	Project Cost (USD Million)	Funding	Duration
AMI Project for Bulk Supply Customers of the CEB	AMI Project for Bulk Supply Customers of the CEB	2.0	CEB	2019 - 2020

AMI Project for Power Quality Management

- With smart meters in the network, the utility will be capable of measuring specific aspects such as power factors and voltages in near real time. This will enable the utility to take appropriate actions to enhance the power quality and reliability.

- In order to achieve above it is recommended to install a smart meters with AMI infrastructure and functionalities to all LV feeder ends (about 100000 in numbers) of CEB and to use AMI system of the utility to measure power quality parameters in near real time .

- This will enhance power quality, meet regulatory requirements and for operation and planning of the distribution network. This should be done using CEB finances.

AMI for Distribution Transformer Monitoring System

- Remote monitoring and control of distribution transformers will prevent overloading, phase imbalance and burn outs.
- This will transform into huge financial savings taking into account the high technical losses that occur in the system owing to phase imbalance – one phase gets overloaded while other two phases are low on load.
- With monitoring systems in place the loads can be distributed to remove such imbalances on transformers. Also this will facilitate real-time energy auditing of each feeders.
- “Supporting Electricity Supply and Reliability Improvement Project” which is funded by the ADB has called for tenders to procure 25, 000 Nos.

AMI Project for Power Quality Management

Sub Project Name	Description	Project Cost (USD Million)	Funding	Duration
AMI Project for Distribution Transformer Monitoring	A Commercial Project for monitoring of 25000 distribution transformers in the CEB	3.5	ADB for Meter and the Balance from CEB	2019 - 2020
AMI Project for power quality management	A Commercial Project for power quality monitoring and management for 100000 feeder ends of the CEB distribution Transformers	11.0	CEB	2020 to 2022

Advanced Distribution Management System with SCADA and ADMS

- From a SCADA Control Center, operators can control the distribution network efficiently and effectively. Advance Distribution Management System (DMS) is a collection of application design to monitor and control entire distribution network efficiently and reliably.

- ADMS functions are:
  - Network Visualization and Support Tools
  - Applications for Analytical and Remedial Actions
  - Utility Planning Tools
  - System Protection Schemes

ADMS current status

- **DD1**
- Colombo City has commissioned a SCADA operated ADMS in the year 2009
- Another three Control Centers are established and operated at present in North Western Province (at Kuliyapitiya), North Central Province (at Anuradhapura) and Northern Province (at Chunnakam) to monitor and control the overhead distribution network.
- **DD2**
- Western North
- Central / Eastern
- **DD3**
- All 03 Provinces
- **DD4**

Not at present

Roadmap for ADMS

- Roadmap for Advanced Distribution Management System

Geographical Information System

No	Sub Project Name	Description	Project Cost	Funding	Duration
1	GIS for DD1	Establishment of a GIS for all the Provinces of DD1. (MV network of North Western Province is already mapped with GIS)	100 Million	AFD	2021 -2022
2	GIS for DD2	Establishment of a GIS for all the provinces of DD2. (MV network of Western Province North is already mapped with GIS)	100 Million	AFD	2021-2022
3	GIS for DD3	Expansion or review of existing GIS already installed in all three Provinces of DD3.	50 Million	AFD	2021-2022
4	GIS for DD4	Establishment of a GIS for all the Provinces of DD4	150 Million	AFD	2021-2022

Home Area Network / V to G and G to V

- After implementing the Smart Meters in Areas

Smart Grid Functionalities of Transmission Segment

- Supervisory Control and Data Acquisition (SCADA) System
- Energy Management System (EMS) at Transmission Level
- Wide Area Monitoring System (WAMS)
- Substation Automation
- Renewable Integration
- Demand Response
- Energy Storage

Upgrading Transmission Grid as a Smart Grid

- Smart Transmission Grid Implementation Plan

Customer Care Solution

LECO Smart Grid