Schneider Electric
digital and electrical
reference architectures

Electrical Distribution Network

Grid efficiency – reduction of technical losses

Solution for medium and large electrical distribution networks

Life Is On | Schneider Electric

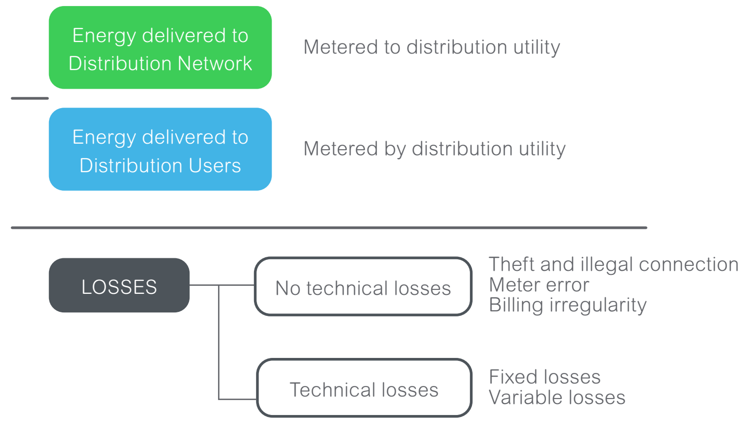
Contents

Context

Grid modernization is a strategic initiative for many electricity companies and one key concern is improvement of grid efficiency.

The key performance indicator for grid efficiency of an electrical distribution network is the amount of losses (expressed in % of the total energy distributed).

There are 2 types of losses: The technical losses and the non-technical losses (also named commercial losses).



Problem to solve

The problem that we want to address in this document is the reduction of technical losses.

What are the technical losses?

The technical losses are due to energy dissipated in the conductors, equipment used for transmission, sub-transmission and distribution lines and magnetic losses in transformers.

Technical losses depend on the network characteristics and the mode of operation. They can commonly be > 20% of the energy transferred to the users.

The electrical distribution systems must be properly designed, operated and maintained to optimize these losses.

There are two types of technical losses:

Permanent / fixed technical losses

- Fixed losses do not vary according to current. They take the form of heat and noise and occur as long as a transformer is energized.
- Between 1/4 and 1/3 of technical losses on distribution networks are fixed losses.
- Fixed losses include: corona losses, leakage current losses, dielectric losses, open-circuit losses, losses caused by continuous load of measuring or controlling elements.

Variable technical losses

- Variable losses depend on the amount of electricity distributed. They are due to the impedance of the system (cables, conductors, and contact resistances) and proportional to the square of the current. Consequently, a 1% increase in current leads to an increase in losses of more than 2%.
- Between 2/3 and 3/4 of technical losses on distribution networks are variable losses.

Main reasons for technical losses are:

- Lengthy distribution lines,
- Inadequate size of conductors of distribution lines,
- Overloading of lines,
- Installation of distribution transformers away from load centers,
- Low power factor in primary and secondary distribution system,
- Unbalanced feeder phase current,
- Inadequate transformer sizing and selection,
- Permanent energization of transformers,
- Abnormal operating conditions of distribution transformers,
- Low voltages at consumer terminals causing higher drawl of currents by inductive loads.
- Poor quality of equipment used, (agricultural pumping in rural areas, cooler air-conditioners and industrial loads in urban areas).

Functional breakdown

Technical losses improvement process includes following functions

Detect losses	Improve components efficiency	Improve operation efficiency	Maintain efficiency
Monitor electrical parameter	Use high efficiency components	Optimize energy flows	Monitor and follow losses trends
Analyse efficiency and trends	Increase cable/busbars cross sections	Optimize transformers load level	Check and maintain transformers
Identify high loss areas		Improve power factor	Check and maintain switchgear
		Reduce harmonics	Check and re-tight connections
		Re-balance loads on phases	
		Optimize operating voltage	

Constructional breakdown

These functions / sub-functions will be covered by products, software, and services as described below

Detect losses	Improve components efficiency	Improve operation efficiency	Maintain efficiency
Power meters (PM & ION)	High efficiency transformers	ADMS (Operational Module: State estimation, Optimal Power Flow, Volt-Var Optimisation, Optimal Branching, LV Analysis, Load Phase Balancing)	ADMS
Connected transformers	Tap changers for transformers		Preventive maintenance services
Smart RMUs	Capacitor banks		APM Software
Connected Switchgear	Harmonic filters	ADMS (Network Planning Module)	
Connected reclosers			

Proven methods for reducing losses can be classified in 3 categories:

Organizational strategy
Implementation of operation strategies related to:

- Feeder and transformer loading,
- Balancing load between phases,
- Fault and maintenance management,
- Demand response management, …

Technical choices
Selection of efficient components or solutions

- Efficient transformers,
- Network automation,
- Harmonic filters,
- Reactive power compensation, …

Data management
Using data for understanding and tracking the energy consumptions and losses

- Monitoring (SCADA),
- Smart metering,
- State estimation, …

Schneider Electric **"Fully integrated solution for losses optimization"** is constructed around ADMS software (Advanced Distribution Management System) and includes:

A) Efficient components:
- Transformers with OLTC (On Load Tap Changers), to rise the supply voltage to an optimized level and consequently reduce the current and decrease the losses in conductors.
- Low losses distribution transformers,
- Capacitor banks (To improve power factor and rise the voltage)
- Active filters to mitigate harmonic currents,

B) Smart and connected equipment:
- Smart RMUs,
- Smart transformers with self-regulated tap changers,
- Connected switchgears, connected transformers, connected reclosers,
- RTUs (including power meters)

C) ADMS software (Advanced Distribution Management System)
- ADMS Operational module, for state estimation, optimal power flow, Volt Var optimization, optimal branching, LV analysis and load phase balancing
- ADMS Network planning module, for network reinforcement, capacitor placement and network automation (RMU) optimization

The following pages are simplified illustrations of the electrical and digital architectures with ADMS and efficient and connected components.

This architecture is based on communicating devices:

- RMU with integrated T-300,
- Secondary switchgear with separate standalone RTU box,
- Smart Minera SGrid transformers with self-controlled tap changers,
- Minera Pole Mounted or Ground Mounted transformers, high efficiency range,
- VarSet Capacitor banks,
- AccuSine PCS+ Active harmonic filters,
- Power Meters

All the data related to these connected devices are gathered by the ADMS system for analysis and control.

The RTUs allow for remote reconfiguration of the distribution network in order to optimize the load flows and reduce losses.

The ADMS will also monitor the voltage in different locations of the system and control the transformers OLTC as well as existing capacitor banks in the distribution network to optimize the voltage operating conditions.

Special case – Management of distributed resources

On top of the “Full integrated solution” with ADMS software described in previous chapter, the understanding and smart management of the DER (*) will bring additional benefits.

(*) DER are the Distributed Energy Resources: PV Plants, Wind farms, Battery for energy storage, Cogeneration, EV stations that are more and more present in all Electrical Distribution networks.

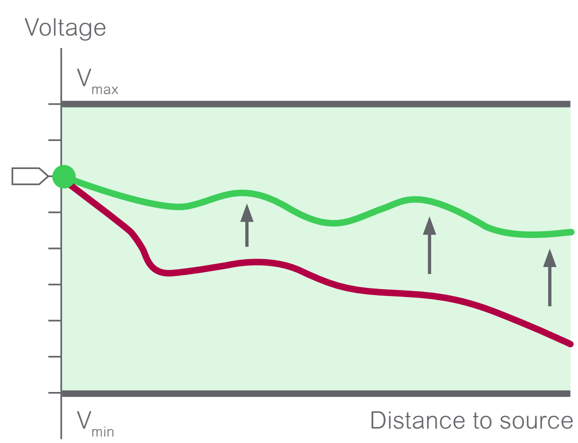
Network operators know that, in electrical networks, the voltage decreases according to the distance to the source.

But what they also know is that every time a DER generation feeds into network it increases the voltage around the connection point.

So, DER management can be used to optimize the Operating voltage conditions of different parts of the network and globally reduce and optimize the technical losses.

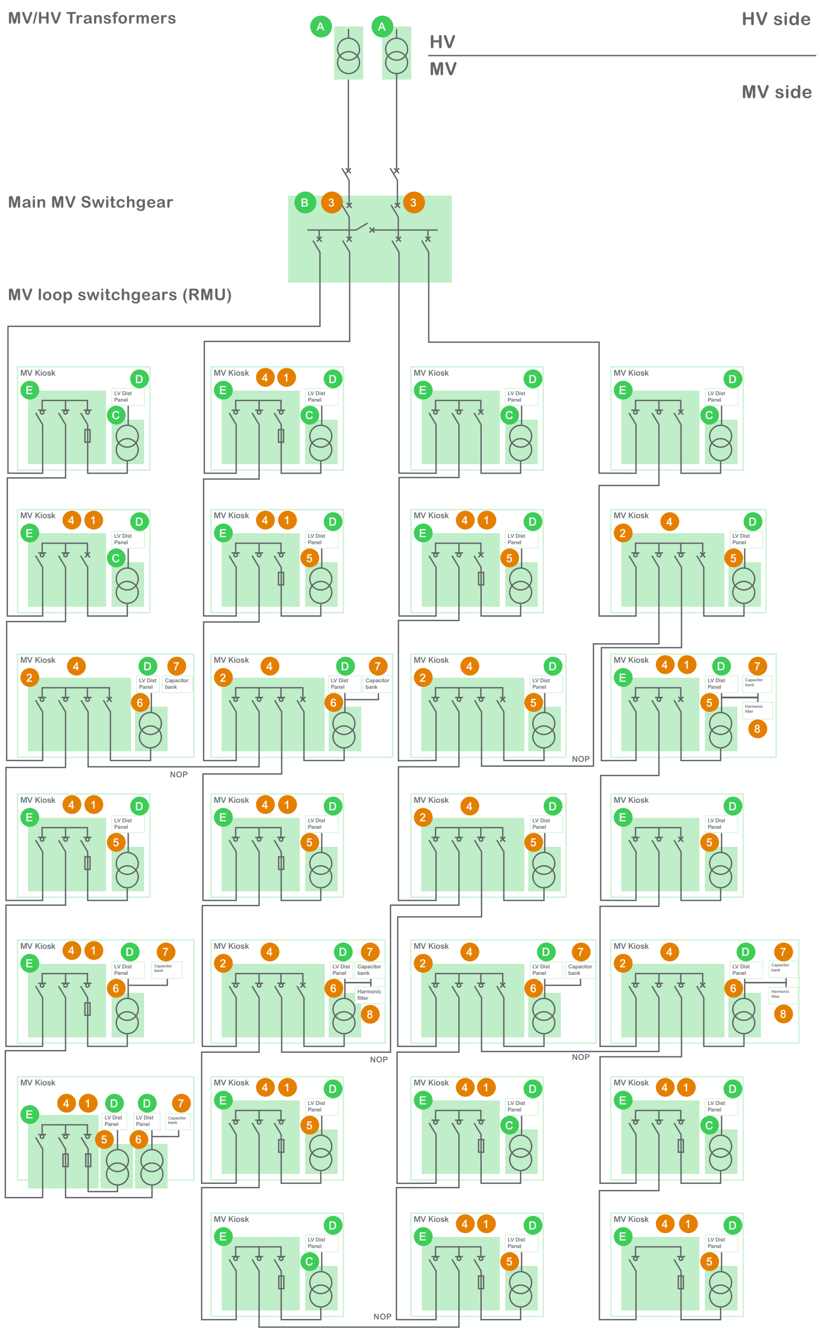
Our DERMS solution enables optimized DER management and network operation.

More specific details with reference architectures are provided in our “Optimization of DER Integration” document.



Electrical architecture – Underground “ring type” distribution network example

Orange =	Schneider Electric components involved in the technical losses improvement process.
Green =	Other Schneider Electric components.



A **MV/HV Power Transformers**
Minera MP

B **MV Switchgear**
Schneider Electric ranges of MV switchgear

Protection Relays
Easergy range

3 **Power Meters**
ION & PM ranges

E **RMU**

1 **RTU cabinet**

RMU — FBX — Ringmaster — T300-IV1

Inside the RTU cabinet

4 **RTU**
Easergy T300

2 **Smart RMU**

Smart RM6 — Smart FBX

Inside the RTU compartment of the Smart RMU

4 **RTU**
Easergy T300

5 **MV/LV Distribution Transformers**

6 **High efficiency MV/ LV transformers**

7 **LV capacitor banks**

Minera S Grid — Minera Ground Mounted (High efficiency design) — Trihal (High efficiency design) — VarSet

8 **Active harmonic filters**

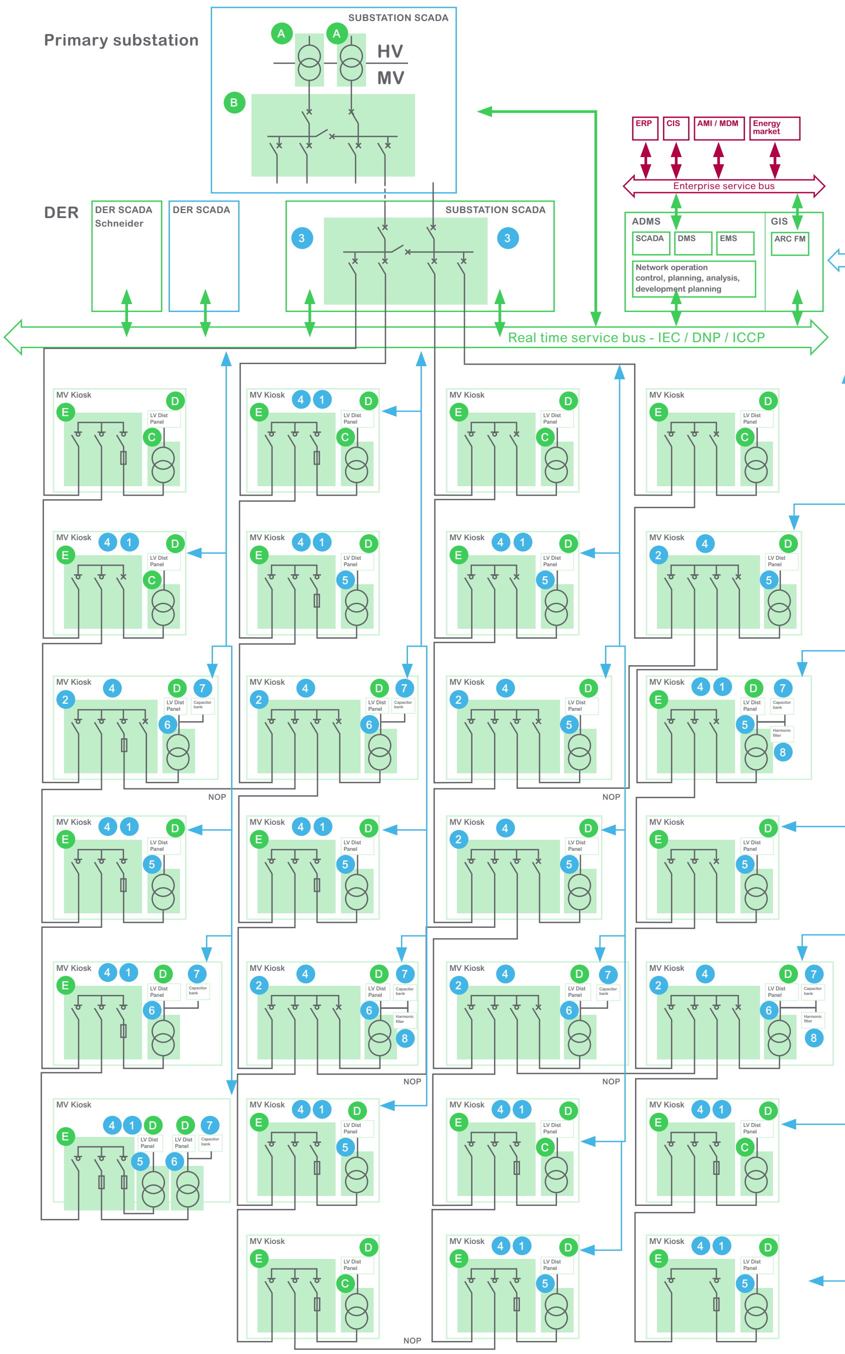
C **MV/LV distribution transformers**

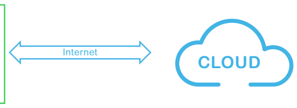
D **LV distribution panel**

AccuSine PCS+ — Minera Ground Mounted (Standard design) — Trihal (Standard design) — LV Prisma Panel

Digital architecture – Underground “ring type” distribution network example

Blue =	Schneider Electric components involved in the communication with ADMS for technical losses improvement process.
Green =	Other Schneider Electric components.





A MV/HV Power Transformers
Minera MP

3 Power Meters
ION & PM ranges

B MV Switchgear
Schneider Electric ranges of MV switchgear

E RMU

1 RTU cabinet

RM6 FBX Ringmaster T300-IV1

Inside the RTU cabinet

4 RTU
Easergy T300

2 Smart RMU

Smart RM6 Smart FBX

Inside the RTU compartment of the Smart RMU

4 RTU
Easergy T300

5 MV/LV Distribution Transformers

6 High efficiency MV/ LV transformers

7 LV capacitor banks

Minera S Grid

Trihal
(High efficiency design)

VarSet

8 Active harmonic filters

C MV/LV distribution transformers

D LV distribution panel

AccuSine PCS+

Minera Ground Mounted
(Standard design)

Trihal
(Standard design)

LV Prisma Panel

Electrical architecture – Overhead “radial type” distribution network example

Orange =	Schneider Electric components involved in the technical losses improvement process.
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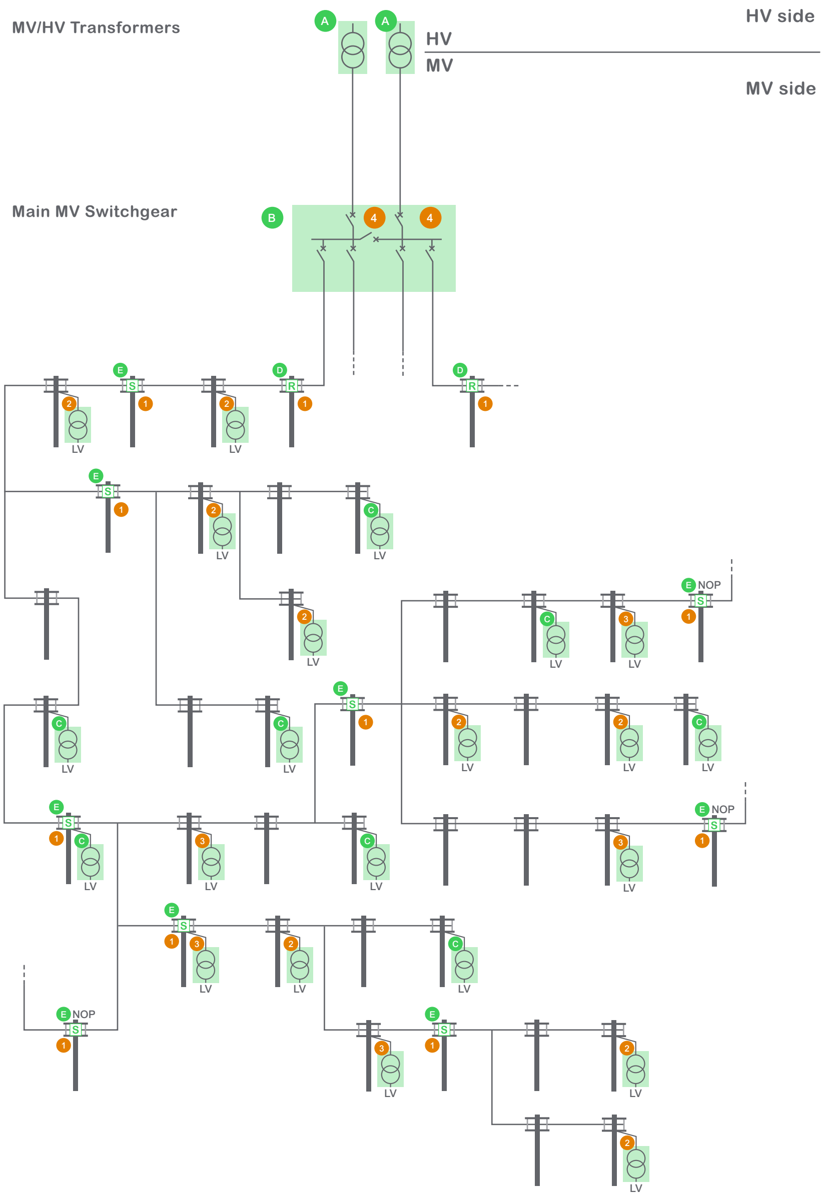


A MV/HV Power Transformers
Minera MP

B MV Primary Switchgear
Schneider Electric ranges of MV switchgear

Protection Relays
Easergy range

4 Power Meters
ION & PM ranges

D Reclosers

E Series U Series W Series

E Sectionalizers

RL Series

1 Control Box

ADVC Ultra

ADVC Compact

2 High efficiency MV/LV transformers

Minera Ground Mounted
(High efficiency design)

Minera Pole Mounted
(High efficiency design)

3 MV/LV transformers
with self-controlled tap changer

Minera
S Grid

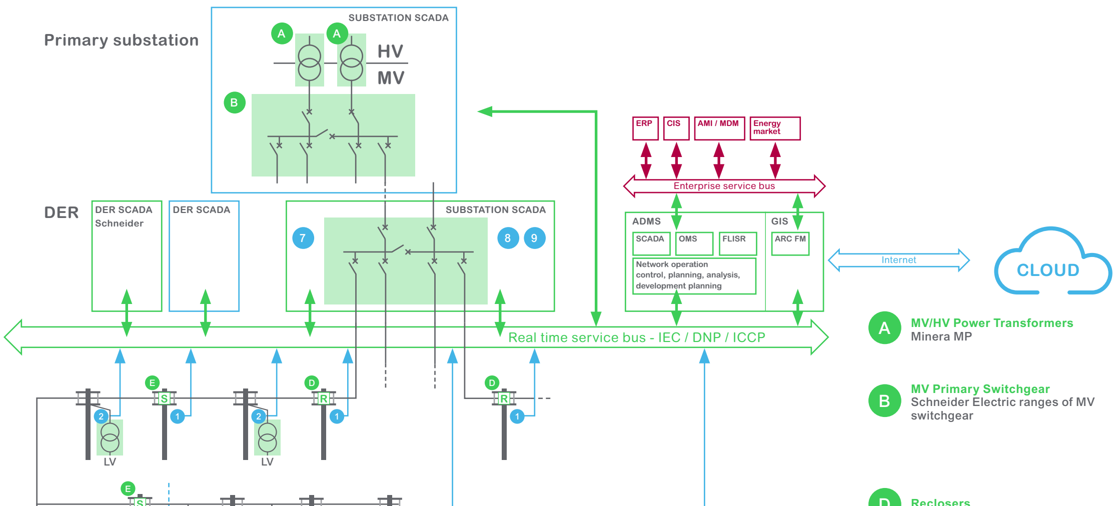
C MV/LV distribution transformers

Minera Ground Mounted
(Standard design)

Minera Pole Mounted
(Standard design)

Digital architecture – Overhead "radial type" distribution network example

Blue =	Schneider Electric components involved in the communication with ADMS for technical losses improvement process.
Green =	Other Schneider Electric components.

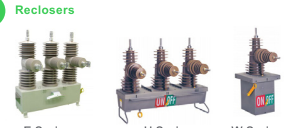


A MV/HV Power Transformers
Minera MP

B MV Primary Switchgear
Schneider Electric ranges of MV switchgear

4 Power Meters
ION & PM ranges

D Reclosers



E Series U Series W Series

E Sectionalizers

RL Series

1 Control Box

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2 High efficiency MV/LV transformers

Minera Ground Mounted (High efficiency design)

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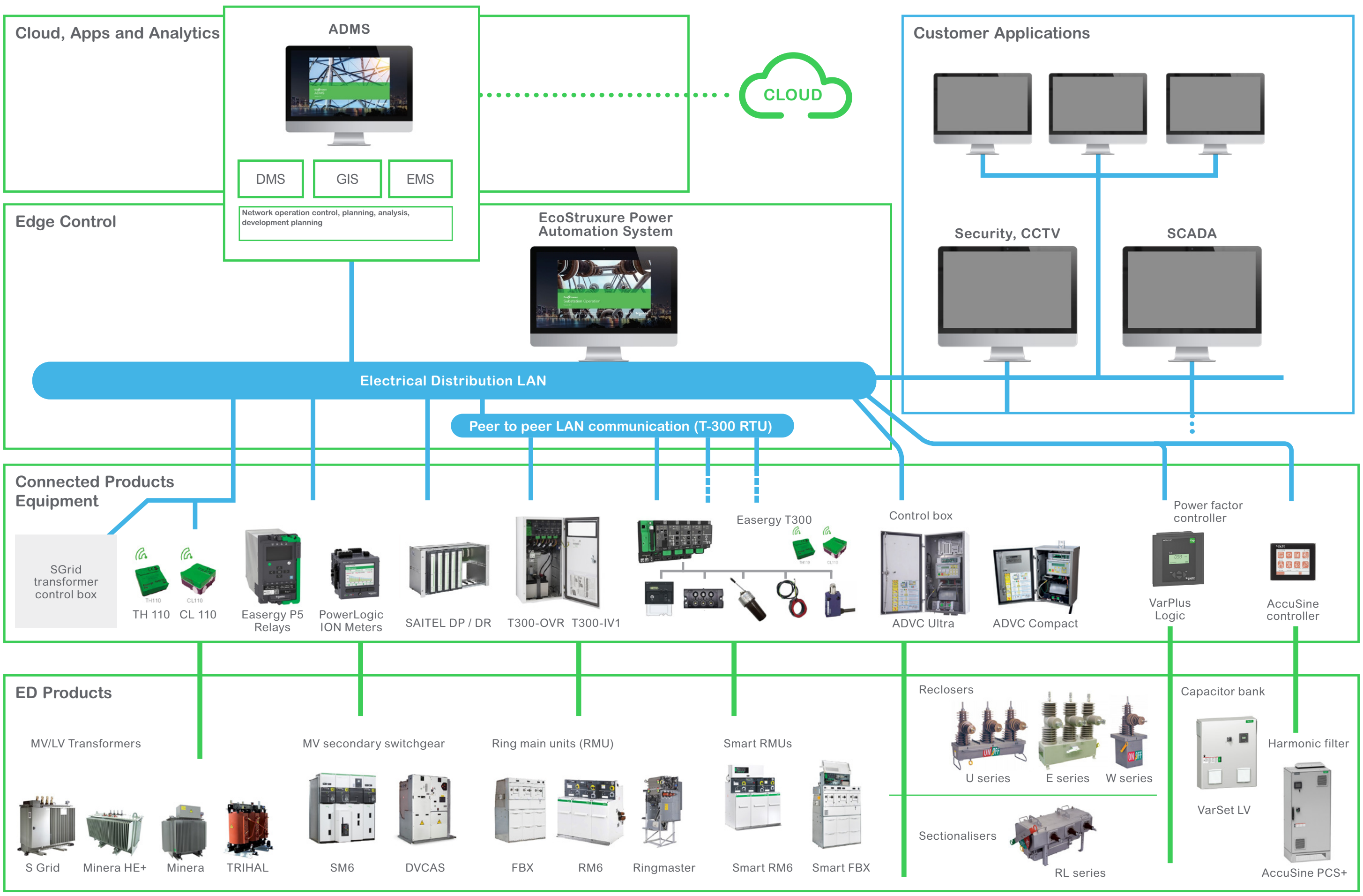
Minera S Grid

C MV/LV distribution transformers

Minera Ground Mounted (Standard design) Minera Pole Mounted (Standard design)

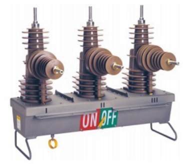
EcoStruxure grid architecture



Schneider Electric products included in the use case

Network function	Product name	Main technical characteristics		Link to offer / spec
ADMS	**EcoStruxure ADMS**	Advanced Distribution Management System (ADMS) with several functionalities from DMS, EMS and SCADA core modules.		learn more
SCADA	**EPAS (EcoStruxure Power Automation System)**	SCADA digital control system for Substation automation based on PACiS technology		learn more
Protection relay	**Easergy P5**	MV protection relay from over-current to differential protection, with arc flash protection, LPCTs, LPVTs, redundant Ethernet communication, and IEC 61850.		learn more
Power meter	**ION range**	PowerLogic ION 9000 advanced power quality metering		learn more
Power meter	**PM range**	PowerLogic PM 8000 / ION7650 / ION7400 compact, high performance power meters.		learn more
RMU	**"Smart" RM6**	Gas insulated switchgear, up to 24kV with T-300 RTU. Short Time current rating up to 21kA, rated for internal arc up to 20kA AFLR with options.		learn more
RMU	**"Smart" FBX**	Gas insulated switchgear, up to 24kV with T-300 RTU. Fully SF6-insulated RMU switchboard, available in compact or extensible installation footprints. Short Time current rating up to 25kA, rated for internal arc up to 25kA AFL with options.		learn more

Network function	Product name	Main technical characteristics		Link to offer / spec
RMU	**RM6**	Gas insulated switchgear, up to 24kV. Short Time current rating up to 21kA, rated for internal arc up to 20kA AFLR with options.		learn more
RMU	**FBX**	Gas insulated switchgear, up to 24kV. Fully SF6-insulated RMU switchboard, available in compact or extensible installation footprints. Short Time current rating up to 25kA, rated for internal arc up to 25kA AFL with options.		learn more
RMU	**Ringmaster**	Hi-reliable Gas Insulated Switchboard for underground secondary distribution. For indoor and outdoor applications, up to 13.8kV.		learn more
RTU	**Easergy T-300**	- Remote Terminal Unit made of: - HU250: head unit communication gateway - SC150: switch controller module - LV150: transformer and low voltage monitoring module - PS25/PS50: power supply module		learn more
RTU box	**Easergy T-300 IV1**	Remote Terminal Unit box for indoor installation, with T-300 RTU.		learn more
RTU box	**Easergy T-300 OVR**	Remote Terminal Unit box for outdoor installation, with T-300 RTU.		learn more
Recloser	**E-Series**	Light-weight reclosers up to 38kV and 170kV BIL.		learn more

Network function	Product name	Main technical characteristics		Link to offer / spec
Recloser	**U-Series**	Light-weight reclosers up to 27kV and 125kV BIL.		learn more
Recloser	**W-Series**	Single-phase reclosers up to 24kV		learn more
Sectionalizer	**RL-Series**	3-Phase load break switch / sectionalizer up to 38kV.		learn more
Auto recloser control box	**ADVC Compact**	304 grade stainless steel cabinet. ADVC monitors the CB and provides protection, measurement, control, and communication functions (connected via a control cable to the recloser).		learn more
Auto recloser control box	**ADVC Ultra**	316 grade stainless steel cabinet. ADVC monitors the CB and provides protection, measurement, control, and communication functions (connected via a control cable to the recloser).		learn more
LV Capacitor bank	**VarSet LV**	Smart LV Capacitor bank with VarPlus Logic controller		learn more
Harmonic filter	**AccuSine PCS+**	Active harmonic filter for harmonic mitigation, power factor correction and load balancing.		learn more

Network function	Product name	Main technical characteristics		Link to offer / spec
Transformer	**SGrid**	Smart Grid MV/LV Transformer Oil immersed transformer with self-controlled tap changer. (Eco-design compliant)		learn more
Transformer	**Minera HE+**	High Efficiency MV/ LV Transformer Mineral oil type, amorphous transformer. Optional Off-Circuit Tap Changer (OCTC) or On-Load Tap Changer (OLTC).		learn more
Transformer	**Trihal**	Efficient and connected “cast resin” type MV/LV Transformer. Optional On-Load Tap Changer (OLTC).		learn more

Zoom on Minera SGrid transformers

An innovative application of proven technology

Minera SGrid helps to solve the modern problem of voltage fluctuation using field-proven components:.

- A serial transformer working together with the conventional active part
- A set of low-current LV contactors
- A PLC to control operations

So how does it work? The serial transformer keeps voltage output within a specified range by using the contactors to manage the step process. Most importantly, the components are arranged in a design that greatly simplifies maintenance and makes it easy to adjust regulation as needed — offering peace of mind to network operators and higher reliability for users.

Minera SGrid is:

Plug-and-play, for optimised investment costs

- Simple installation
- Suitable for existing distribution substations
- Designed for autonomous operation
- Compliant with existing standards and new regulations
- DMS-ready product
- Global support with your local Schneider Electric field services team

Highly customisable

- Voltage range and step number tailorable for more precise regulation
- Special requests: any MV voltage up to 36 kV, oil, low losses
- Remote supervision capability

Minera SGrid brings:

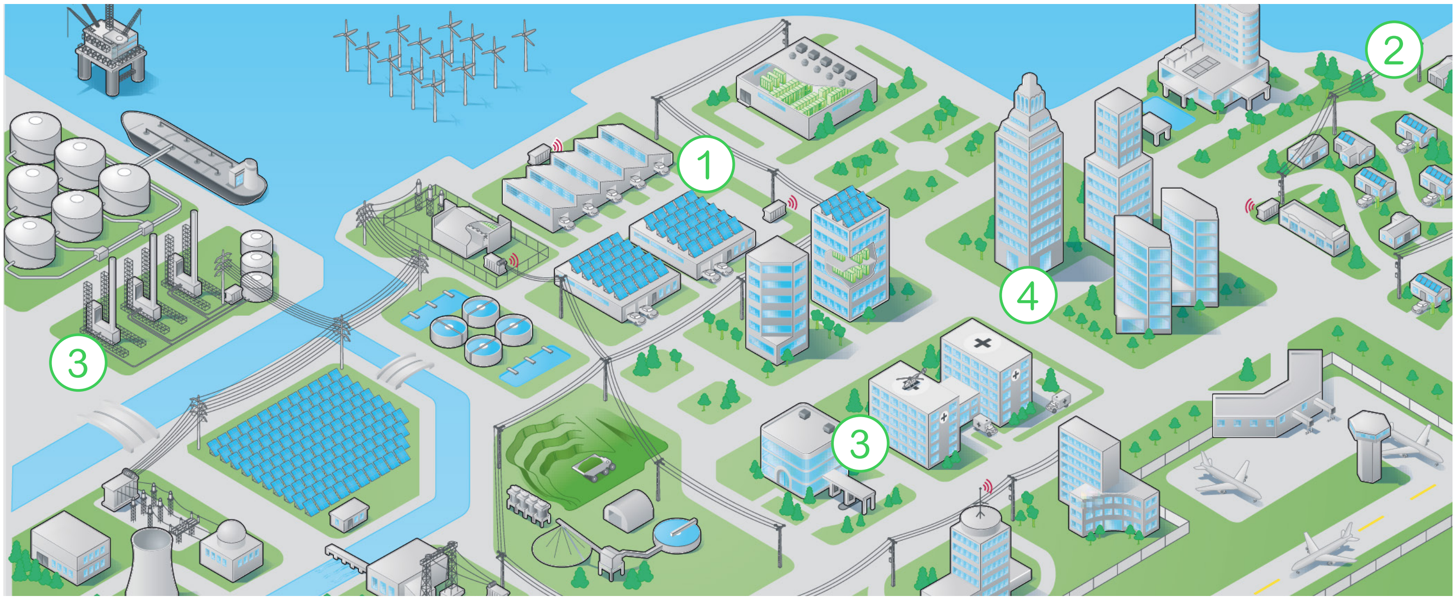
Improved network quality

- Automatically stabilises the output voltage
- Very wide regulation range, thanks to innovative technology
- Increased production of decentralised energy with lower risk of voltage band violations

Enhanced reliability and ultra-low maintenance

- No moving mechanical parts inside transformer tank
- Robust design with proven industrial components
- No power electronics

Minera SGrid automatically regulates voltage throughout your network



Minera SGrid provides stability for both utilities and private networks

Utility networks

1. Decentralised energy generation
   Automatically manage voltage stabilisation

2. Distribution network expansion
   Automatically adjust to line drop

Private networks

3. Poor electrical network quality
   Automatically adjust voltage in accordance with demanding processes

4. Voltage optimisation
   Automatically adjust voltage to provide energy savings

Choose the regulation strategy that best fits your network

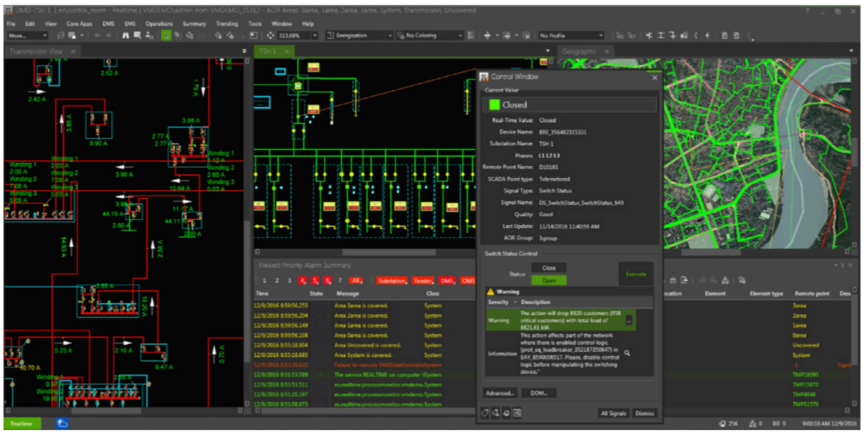
- **Basic regulation**
  You define a set voltage point. Regulation occurs to keep the transformer output value at the set point.

- **Line drop compensation**
  You have two alternatives: regulation based on line characteristics or regulation depending on transformer power output.

- **Remote point regulation**
  You choose to regulate output voltage based on measurements taken at different points of the network to help ensure all points remain within a defined voltage band.

Zoom on ADMS (Advanced Distribution Management System)

EcoStruxure ADMS by Schneider Electric provides the most comprehensive network management solution, including monitoring, analysis, control, optimization, planning, and training tools that all function on a common representation of the entire electrical distribution network.



By merging distribution management (DMS), outage management (OMS), and supervisory control and data acquisition (SCADA) systems into one unified solution **with more than 50 advanced functions**, it can maximize the benefits possible from a growing foundation of intelligent grid devices, distributed renewable energy, advanced metering, and all things smart grid. It delivers better reliability, efficiency, safety and security.

Network operation

- Switching & Validation
- Topology Analysis
- Temporary Elements
- Tracing
- FLISR (Fault Location, Isolation, Service Restoration)
- Large Area Restoration
- Switching Order Management
- Crew Management
- DG Management
- Load Shedding
- Work Order Management
- Under-Load Switching
- Load Transfer/Load Relief
- Dynamic Equipment Rating
- Model Readiness

Operation planning and optimization

- Volt/VAR Control
- Network Reconfiguration
- Near-term Load Forecasting
- Short-term Load Forecast
- Demand Response Management
- Electrical Vehicles Management

HV EMS

- State Estimation, Load Flow
- Contigency
- Optimal Power Flow
- Generators Control
- Breaker Capacity
- Reactive Reserve Monitoring

SCADA

- Remote Control
- Alarming, Trending, Tagging

Core DMS

- Network Model
- Load Flow
- State Estimation
- Performance Indices

Mobility

- Web Access Clients
- Field Crew Support

OMS

- Trouble Call Management
- Incident Management
- Outage Reporting/Statistics

DMS network analysis

- Energy Losses
- Reliability Analysis
- Fault Calculation
- Relay Protection Analysis
- Breakers/Fuses Capacity
- Contingency Analysis
- Low Voltage Analysis
- Harmonic Analysis
- Historian Analysis/Reports
- Phase Balancing

DMS network planning

- Long (Medium) Term Forecasting
- Optimal Capacitor Placement
- Optimal Voltage Reg. Placement
- Network Construction Planning
- Network Automation
- Conductor Reinforcement
- Customer Connection

DMS Analytical Applications System is the "intelligence" of ADMS Software. This system is a fully comprehensive set of sophisticated software and algorithms that enable efficient design, optimal operation and decision making referring to the whole equipment installed in the distribution network.

DMS Analytical Applications System enables performing practically all technical tasks in Distribution Utilities in the following modes of application:

1. Network Operation Control Applications
2. Network Operation Planning and Optimization
3. Network Operation Analysis,
4. Network Development Planning
5. Training

To optimize Technical Losses, ADMS will rely on following bricks and main functionalities:

Network operation control applications

Network Model (NM) is in the background of DMS applications, providing electrical definitions of all network elements, connectivity and models for calculation (balanced or unbalanced networks).

Topology Analyzer (TA) provides an accurate insight into the actual topology of the distribution network (normal or disturbed). Topology Analyzer analytical application (TA) is a general tool for various topology analyses of the distribution network represented in form of graphs. On the basis of network model, connectivity and switchgear statuses, TA provides the network topology that is necessary for running all other analytical applications. Main functionalities are finding a certain element of the network, determining and marking supply paths of network elements, finding neighboring feeders of a selected feeder, searching for the "local network", etc.

Load Flow (LF) application is used for the calculation of steady states of radial and weakly meshed primary MV power grids (networks), as well as state of secondary LV power grids. The network state consists of: complex voltages, currents, flows of real and reactive power, voltage drops, losses, etc. Usually, among all state variables, the state vector is defined as a set of all network nodes' complex voltages. The state vector is sufficient for calculation of any other network state variable.

State Estimation (SE) provides an assessment of loads of all network nodes, and all other state variables (current phasors of all sections and transformers, active and reactive power losses in all sections and transformers, etc.). The load profiles are derived on the basis of historical data, where historical data consist of two groups:

1) Dimensionless daily load profiles for real and reactive power (P-Q) which are weather dependable, and

2) Load weights – peak values (kW, kVAr), supplied energies (kWh, kVArh) or rated powers of the equipment (kVA).

Performance Indices (PI) is used for detection of violations, alarm states, reports of the overall performances of the network state (power injection, losses, consumption, voltage situation and deviations, overloads, etc.). The PI application is used to provide insight into network state and to offer objective assessment whether some changes that improve network operation or not are needed.

Dynamic Equipment Rating (DER) is used for monitoring and prediction of thermal state of network elements. It is applied for calculation of thermal ratings of substation transformers, overhead lines and underground cables, based on actual or forecasted loading and ambient temperature. This application provides simple monitoring of elements in distribution network with the following advantages: having insight into actual thermal state of network elements and providing potential overloading capabilities based on the thermal monitoring.

Network operation planning and optimization

Voltage optimization (VO) application provides control of voltage profile or keeping of voltage on all nodes of the network inside specified (lower and upper) limits, as well as satisfying optimization criteria (minimization of the damage that consumers suffer due to the supply of power with voltages that deviate from nominal values). Resources used for voltage control are "under-load" tap changing transformers and voltage regulators and "off-voltage" tap changing transformers and buck/boost transformers. Voltage regulation (control) provides: calculation of optimal voltages of supply busbars and tap positions of supply transformers in the current states, coordination of the position of transformer tap changer on the different locations, in actual moment and for the desired future time period or minimum voltage deviation that consumers suffer due to the deviations of their voltages from nominal values.

VAR optimization (VARO) reduces losses, reactive power flows and reactive power demands from the transmission network. Capacitor banks and reactors, static and synchronous generators and compensator are considered.

Volt/VAR Optimization (VVO) is one of the basic applications used for control in distribution network operation. As such, it allows management of voltages and reactive power flows in distribution network. VVO, as a part of DMS, operates in centralized way on the whole considered sub-network (HV substation or network supplied from a HV/MV transformer), rather than on the local level as it is possible with local controllers.

Network Reconfiguration (NR) determines the optimal radial distribution network configuration (locations of normally open tie switches) regarding to optimization objective (minimal active power and energy losses; maximal reliability; best load balance or best voltages profiles). Reports about improvement of operation performances and reduction of losses are provided, as well as switching sequence for transfer from existing to optimal state (graphical and listing). Analysis of influence of every switching action on improvement of network performance is possible, enabling selection of only limited number of switching actions that give highest improvement.

Network operation analysis

Energy Losses (EL) provides calculation of energy losses in the distribution network (active and reactive losses in all sections and transformers) up to LV busbars, for specified network configuration in specified time period, for a part or a whole network. Energy Losses includes daily load curves for all types of loads and measurements for each characteristic day in selected period.

Operational Losses (OL) analytical application provides the real operational power/energy losses in the entire distribution radial or weakly meshed, balanced or unbalanced network, or its parts, for real network state and configuration, for the specified time period. OL application provides data about total active/reactive energy injection, active/reactive energy losses, active/reactive energy generation and active/reactive energy consumption in specified period of time. In general, energy losses can be divided into technical (copper and iron) and non-technical (commercial sources). OL calculates technical losses, only.

Harmonic Analysis (HA) application is used for analysis of harmonics influence in MV and LV networks. Power quality of energy in LV networks can be severely affected because presence of electronic devices and various commutations are very intensive sources of harmonics in the LV network, also the intensity of harmonics is not damped by means of transformation or isolated transformer neutrals.

Network development planning

Medium-Term Forecasting (MTF) analytical application is used for assessment of the sequence of annual peak loads of large areas or entire network, for a future period lasting few months or years. The results of this application are used for medium-term planning of the network development and assessment of required investment in the future in order to achieve sufficient energy quality.

Network Development Planning (NDP) analytical application is being used for determining an optimal plan of network development for the coming medium and long-term period on the basis of multiple scenarios and possibility of their comparison. The application provides the building of new distribution networks and planning of development for existing networks, on any saved case from the past on top of real-time data of the network, taking into account the optimal dynamics of installing new elements.

Capacitor Placement (CP) application is used for determination of optimal locations, types, sizes and switching status of capacitor banks, which have to be installed in the distribution system for the purpose of reactive power compensation, real power (energy) losses minimization, reduction of the reactive power supplied from transmission network, power factor correction and voltage profile improvement.

Network Reinforcement (NR) is used for the planning of existing distribution network reinforcement. This application encompasses issues as planning of supply substations, planning of medium voltage network (feeders), planning of the secondary substations and checking of the technical and security criteria.

EcoStruxure grid – services offers

Schneider Electric Consultancy Services can be provided to customers for improving the level of technical losses in their system.

Based on asset information, ADMS data base analysis, sometimes completed with site visits, Schneider Electric Consultancy Services can provide recommendations on technical options allowing significant reduction of technical losses.

It will include:

- Recommendation for the implementation of monitoring devices at strategic locations: Power meters, current and voltage sensors,
- Replacement of the lowest efficiency transformers by high-efficiency units,
- At key points of the network, installation of voltage adjustment systems (Transformers with OLTC), reactive power correction systems (Capacitor banks) or harmonic mitigation systems (Harmonic filters),
- For some weak point of the network: Recommendation for capacity adjustment / conductor's size, type, quantities…

List of acronyms

AC	Alternate Current
ACB	Air Circuit Breaker
ACR	Automatic Circuit Recloser
ADMS	Advanced Distribution Management System
AERC	Automation Equipment with Remote Control
AFE	Active Front End
A-FLR	Authorized Front Lateral Rear
AHF	Active Harmonic Filter
AIS	Air Insulated Switchgear
APR	Automatic Progressive Reconnection
ARMU	Automatized Ring Main Unit
ASAI	Average Service Availability Index
ATS	Automatic Transfer Source
CAPEX	Capital Expenditure
CB	Circuit Breaker
CT	Current transformer
DC	Direct Current
DCC	Distribution Control Centre
DCS	Distributed Control System
DER	Distributed Energy Resources (Wind, Solar, EV, …)
DOL	Direct On-Line
DP	Distribution Points
ENS	Energy Not Supplied
F&S	Fire and Security
FPI	Fault Passage Indicator
FU	Functional Unit
GCU	Generator Control Unit
GIS	Geographical Information System
HMI	Human Machine Interface
HV	High voltage
HVAC	Heating Ventilation and Air Conditioning
IAC	Internal Arc Containment
IEC	International Electrotechnical Commission
IED	Intelligent Electronic Device
IEEE	Institute of Electrical and Electronic Engineers
IGBT	Insulated Gate Bipolar transistor
IMPR	Intelligent Motor Protection Relay
IPMCC	Intelligent Power and Motor Control Center

LCD	Liquid Crystal Display
LV	Low voltage
LSC	Loss of Service Continuity
MAIFI	Momentary Average Interruption Frequency Index
MCC	Motor Control Center
MCCB	Molded Case Circuit Breaker
MV	Medium Voltage
NOP	Normally Open Points
OEM	Original Equipment Manufacturer
OLTC	On Load Tap Changer
ONAN	Oil Natural Air Natural
OPEX	Operating Expenditure
PAC	Programmable Automation Controller
PEI	Peak Efficiency Index
PFC	Power Factor Correction
PLC	Programmable Logic Controller
PCC	Power Control Center
POC	Point Of Connection
PQ	Power Quality
PWM	Pulse Width Modulation
QS	Quick Study
RMU	Ring Main Unit
RTU	Remote terminal Unit
S/S	Substation
SAG	Semi Autogenous
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SS	Soft Starter
SSIS	Screen Solid Insulated Switchgear
TCO	Total Cost of Ownership
THD	Total Harmonic Distortion
TOC	Table of Compliance
UPS	Uninterruptible Power Supply
VCB	Vacuum Circuit Breaker
VSD	Variable Speed Drive
VT	Voltage transformer

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