

Grid digitalization R&D, Engineering & System Solutions, Production & Services



**Our Team
Introduction**

- International team
- 30+ years experience (predominantly ABB)
- following old ABB localization strategy - BRICs + countries (India, Vietnam, Nigeria, Egypt, Morocco, Central Asia and in near future Brazil and China)

**Our international
technology partners**



Mihailo Pupin
NIKOLA TESLA



SRIWIN ELECTRIC-
GP



ASTOR



HYUNDAI ELECTRIC
Hyosung



Alageum Electric



TBEA TGOOD
CHINT Sieyuan
XD TAIKAI



CHEAZ
MIRTEC
HD Service



Sieyuan



TAIKAI



Growing local market demand - retrofitting of mid aged installed base (“brownfield sites”) required

- Modernization, retrofitting, digitalization of mid aged substations, upgrading to modern standards required (redaction of CAPEX by extension of life cycle of existing equipment versus premature replacement)

Internal Market of Potential Local Partner

- Electrical Balance of Plant (EBOP)

Our proposal

- Foundation of JV with Local Partner
- Development (R&D, within JV) of own grid digitalization products in order to maximize local added value and improve profitability (Local R&D Center)
- Development (within JV) of Local engineering center (LEC) capability in order to be able to supply system solutions based on own and third party products
- Development (within JV) of Own Local Production, assembling and testing – of own and licensed products
- Development (within JV) of Local Service and Training Center

Grid digitalization R&D

6-500 kV Products and System Solutions

Integrated Unified Platform

6-10 kV Relay Protection

- Outgoing feeder protection;
- Incoming feeder protection;
- Bus coupler protection and automation;
- Voltage transformer bay control.

6-35 kV Relay Protection

- Outgoing feeder protection;
- Bay control and protection unit;
- Incoming feeder protection;
- Bus coupler protection and automation;
- Voltage transformer bay control;
- Tap changer control with voltage regulator;
- Load-shedding protection.

6-500 kV Multifunctional Controller

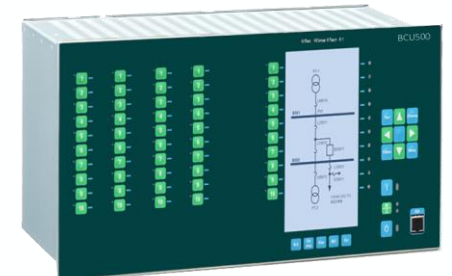
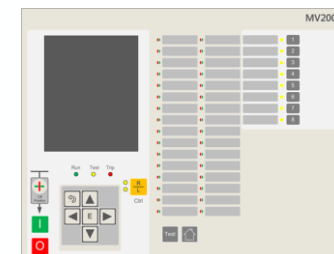
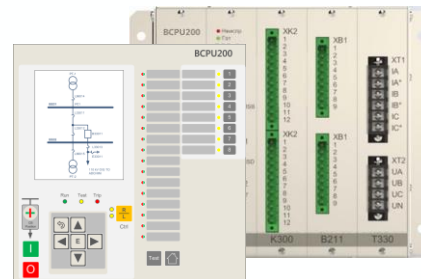
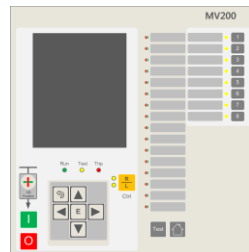
- Data acquisition and transmission device – for 6-20 kV substations;
- Advanced Metering Infrastructure (AMI);
- Bay controller unit 6-35 kV;
- Bay controller unit 35-500 kV with detached display module (BCU: Bay Control and Protection Unit up to 500 kV);
- Controller for the telecommunication systems of power facilities.

110-220 kV Relay Protection

- Main and backup high voltage lines protection;
- Main and backup protection of transformers, autotransformers and reactors;
- Bay and circuit breaker control;
- Bus bar differential protection;
- Generator protection;
- Emergency control automation;
- Digital Substations solutions.

330-500 kV Relay Protection

- HV and EHV Line protection;
- Main and backup protection of two-/three-winding power transformers, autotransformer and reactors;
- HV CB and Bay control and protection relays;
- HV Bus Coupler control and protection relays;
- HV Busbar differential protection relays;
- Generator protection relays;
- Emergency Control;
- Digital Substations solutions.



Grid digitalization R&D

Phases of Products Development (6-500 kV Products)

Phase 1 - Products and System Solutions 6-220 kV – 85% of Market

Our offer

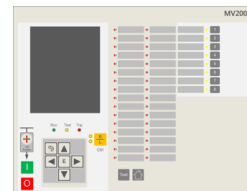
6-10 kV Relay Protection (**MV100**)



6-35 kV Relay Protection (**MV150, MV200**)



110-220 kV Relay Protection (**HV200**)



6-500 kV Multifunctional Controller (**FTU100, RTU200, RTU300**)



Analogue example



Schneider Electric:
Easergy P1



ABB: REF615



Hitachi Energy: REx650



ABB: RTU560

Grid digitalization R&D

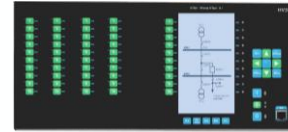
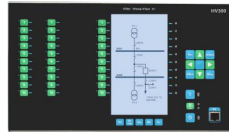
Phases of Products Development (6-500 kV Products)

Phase 2 - Products and System Solutions 330-500 kV -10% of Market

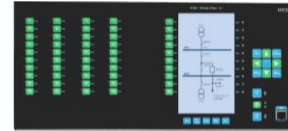
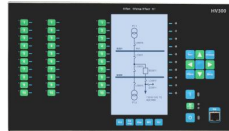
Phase 2

Our offer

330-500 kV Relay Protection
(HV300)



Bay Control Unit **(BCU300)**



Solutions for Digital Substation
(SMU)



Analog



Hitachi Energy: REx670



Hitachi Energy: REx670



ABB: SMU

The remaining 5% of the relay protection market are specific devices

Grid digitalization R&D

Phases of Products Development

Phase 3 – Grid Automation Products

Our offer

SCADA for electrical substations



ABB Microscada
GE iPower
SE EcoStruxure

Network Analysis Package
(EMS/DMS)



ABB Network
Manager
GE Digital Energy
SE EcoStruxure

Outage Management (OMS)

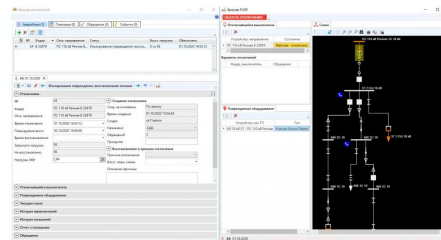
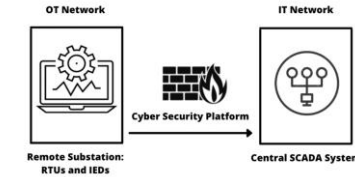


ABB Ability
GE OMS
SE EcoStruxure

Phase 4 – Cyber Security Products & Solutions

Phase 4

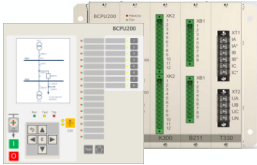
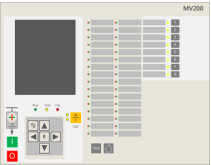
Technology sovereignty, information & cyber security



In Russia: Prosoft,
Kaspersky, Positive
Technology

Grid digitalization R&D

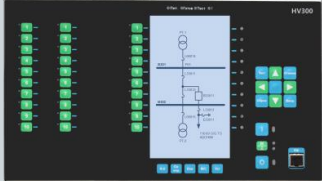
Phase 1 – Total: 37 Products to be Developed (6-220 kV Products)

	Integrated Unified Platform				
	6-10 kV Relay Protection	6-35 kV Relay Protection	6-500 kV Controller	110-220 kV Relay Protection	
					
Market volume	35 % (Relay Market)	25 % (Relay Market)	95 % (RTU Market)	25 % (Relay Market)	Total: 85% Relay & 95 RTU Market
Market prize	1 000 USD	2 000 USD	5 000 USD (for 5 boards)	4 000 USD	
Lead time to complete	1Q24	3Q24	2Q24	2Q2025	

Additional task - development CPU Board on the RU/Chinese processor

Grid digitalization R&D

Phase 2 – Total: 16 Products to be Developed (220-500 kV Products)

	330-500 kV Relay Protection	AMU	DMU	
				
Market volume	10 % (Relay Market)	Using for Digital Substation		Total: 10% Relay & Solution for Digital SS
Market price	from 6000 USD	3 000 USD	3 000 USD	
Lead time to complete	1Q26 (First Product)	2Q24	2Q24	

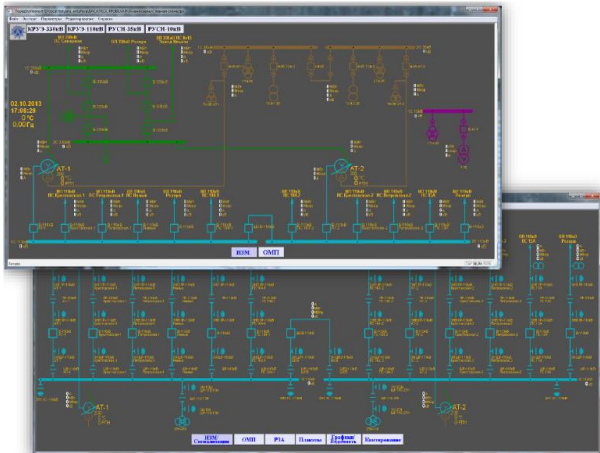
Additional task - development CPU Board on the RU/Chinese processor

Grid digitalization R&D

Phase 3 – Grid Automation Software Products

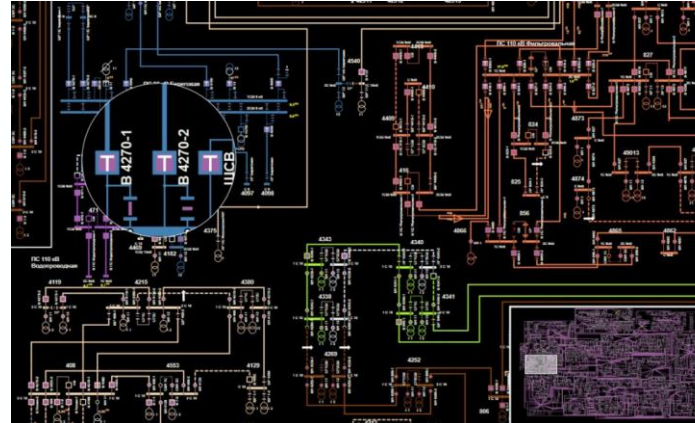
Phase 3.1 - SCADA for electrical substations

- Data collection from microprocessor devices
- Logical data processing
- Data display
- Archiving data
- Registration of users in the system
- Flexible support for creating and displaying mnemonic diagrams
- Collection and unloading of emergency waveforms
- Creating templates for generating reports
- Flexible alarm settings



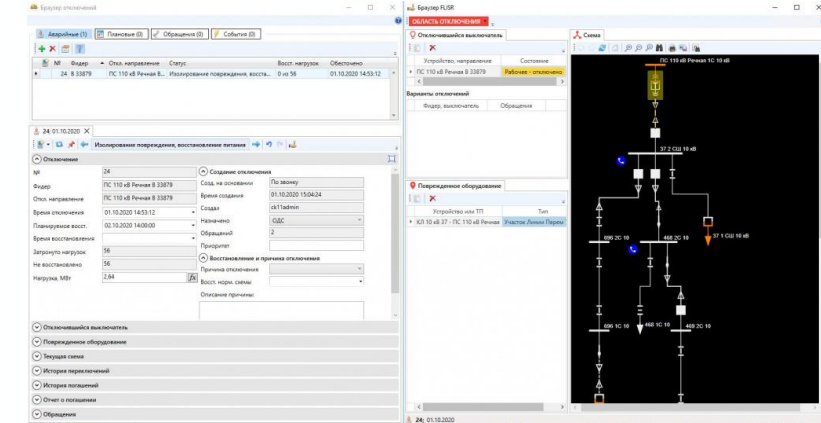
Phase 3.2 - Network Analysis Package (EMS/DMS)

- State estimation
- Consumption Forecast
- Steady-state analyses
- Regime Optimization
- Technological constraints control service
- Regime reliability analysis
- Unbalanced modes analysis
- Monitoring of process parameters
- Network development planning
- Calculation and analysis of electricity losses.



Phase 3.3 - Outage Management (OMS)

- Restoration of the normal circuit
- Automatic calculation of power supply reliability indicators (SAIDI, SAIFI, CAIDI, CAIFI)
- Fixing consumer outages based on analyses of field device signals and information received from consumer calls;
- Maintaining information on outages
- Management of mobile teams
- Automatic and Automated Fault Location, Isolation and Service Restoration (FLISR)



Implement real baseline security measures



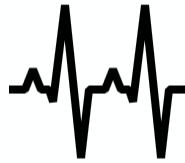
Identify

A cyber security risk assessment, threat intelligence & modelling can prioritise risk areas.



Protect

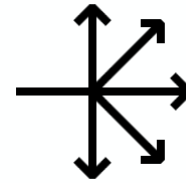
Implement security solutions and services ensuring the right security controls are in place.



Detect

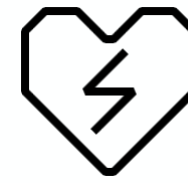
Monitor and notify when breaches and vulnerabilities are detected.

Specialists can improve detection and reaction time.



Respond

Ensure you can respond 24hr x 7d/365d and have mitigation responses in place to reduce further damage.



Recover

Have proper backup and recovery systems in place and ready to be used.

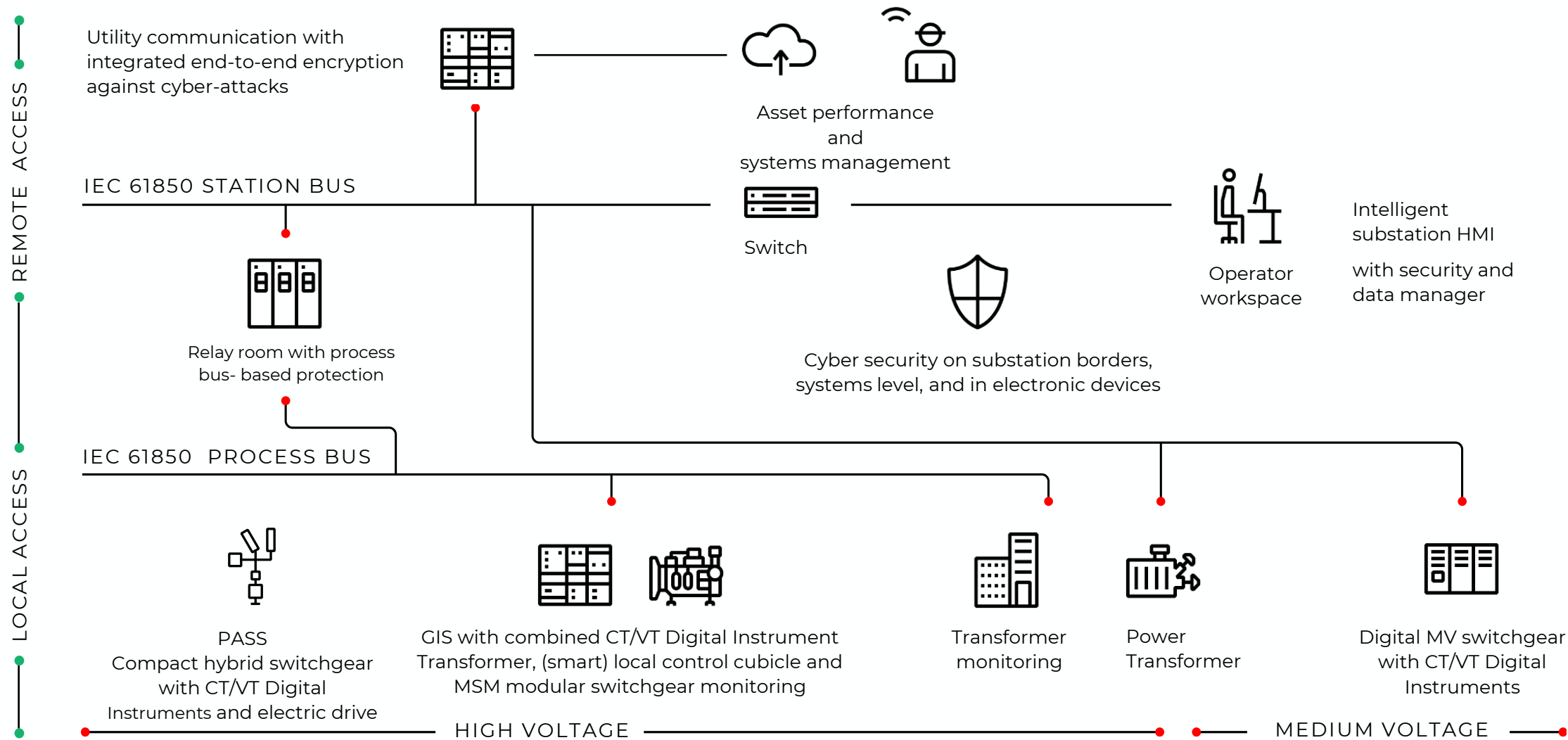


Comply

Standards and policies protect against fines & allow companies to benchmark to ensure a minimum standard.

Grid digitalization R&D

Phase 4 – Cyber Security Solutions

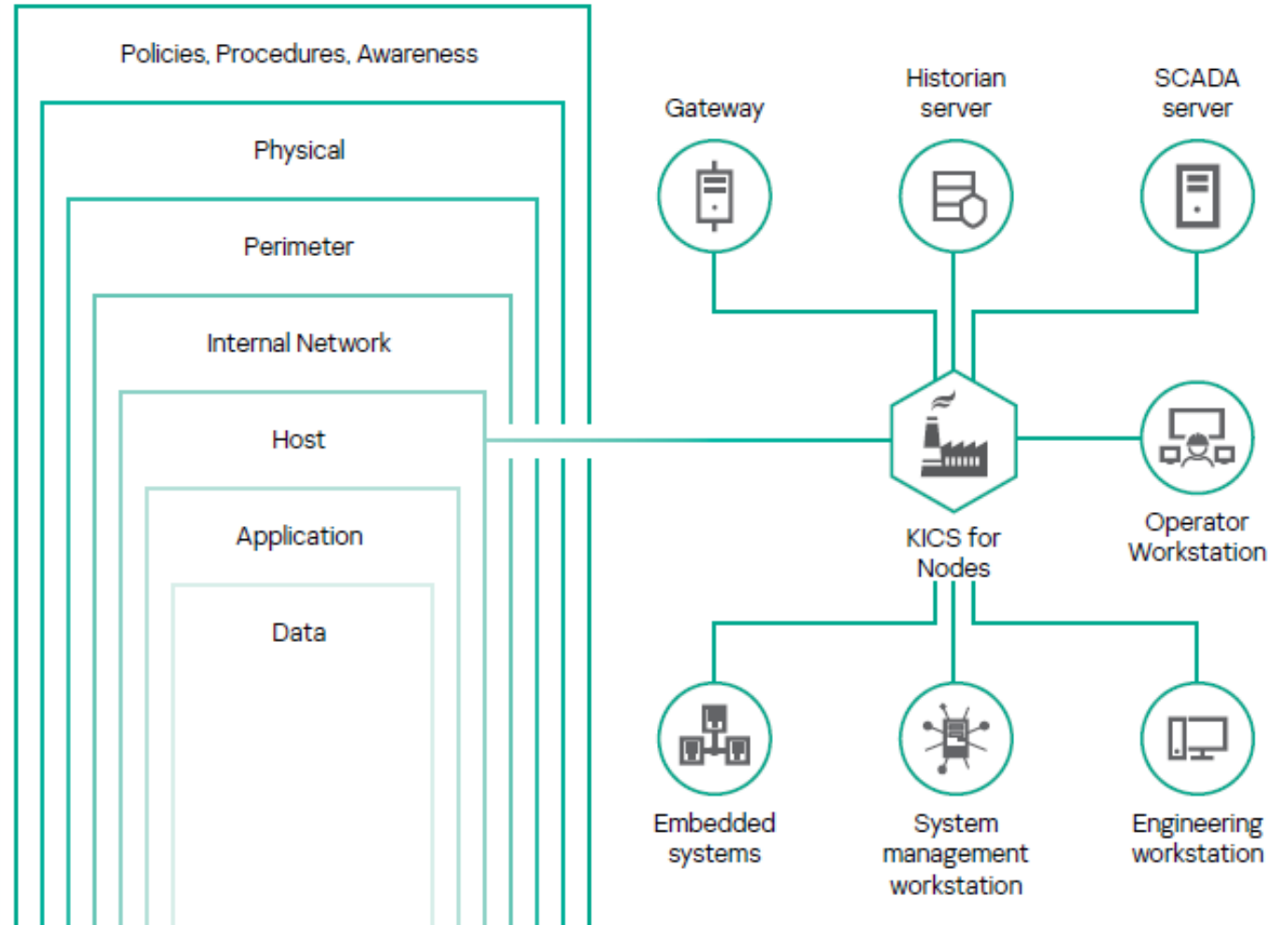


Grid digitalization R&D

Phase 4 – Cyber Security Solutions

Malicious cyberattacks on industrial systems – including industrial control and automation systems (IACS) and supervisory control and data acquisition systems (SCADA) – have significantly increased in recent years. The critical infrastructure operators become victims.

Industrial CyberSecurity (ICS) is a platform of natively integrated products and comprehensive set services. It is designed to protect the operational technology (OT) layers of industrial enterprises without affecting system availability or technological process consistency. The product protected layers and elements include: DCS, SCADA, HMIs, controllers like PLCs, IEDs, Robotic Automation, OT Networking equipment, Gateways, Operator and Engineering workstations.

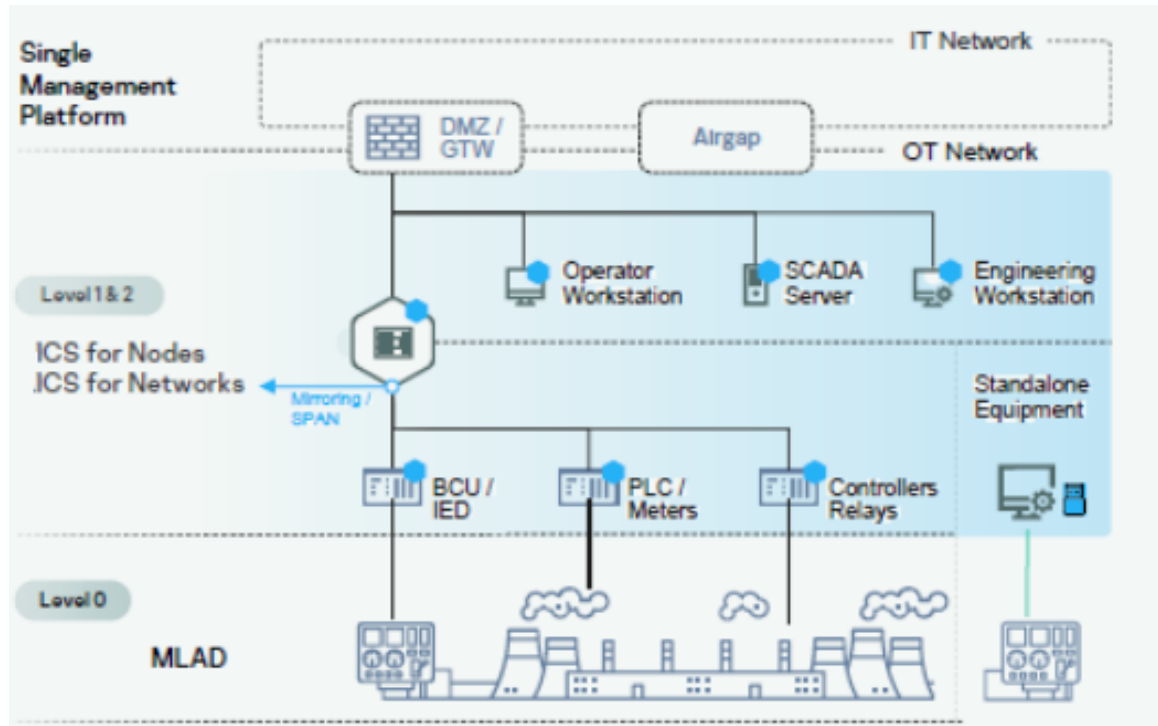


Grid digitalization R&D

Phase 4 – Cyber Security Solutions

ICS Platform

Designed to comprehensively secure the industrial elements of your organization: ICS for Nodes is aimed at industrial endpoints, while ICS for Networks monitors industrial solutions that are agile and future-proofed, delivering flexibility and additional value.



ICS for Networks

Detects early-stage anomalies and intrusions inside ICS networks and ensures that the necessary actions are taken to prevent any negative impact on industrial processes. Appliance-agnostic solution that allows the customer to choose the industrial computing appliance vendor they trust the most. The ICS for Networks interface displays a live dashboard and a network map, for working with assets and security events.

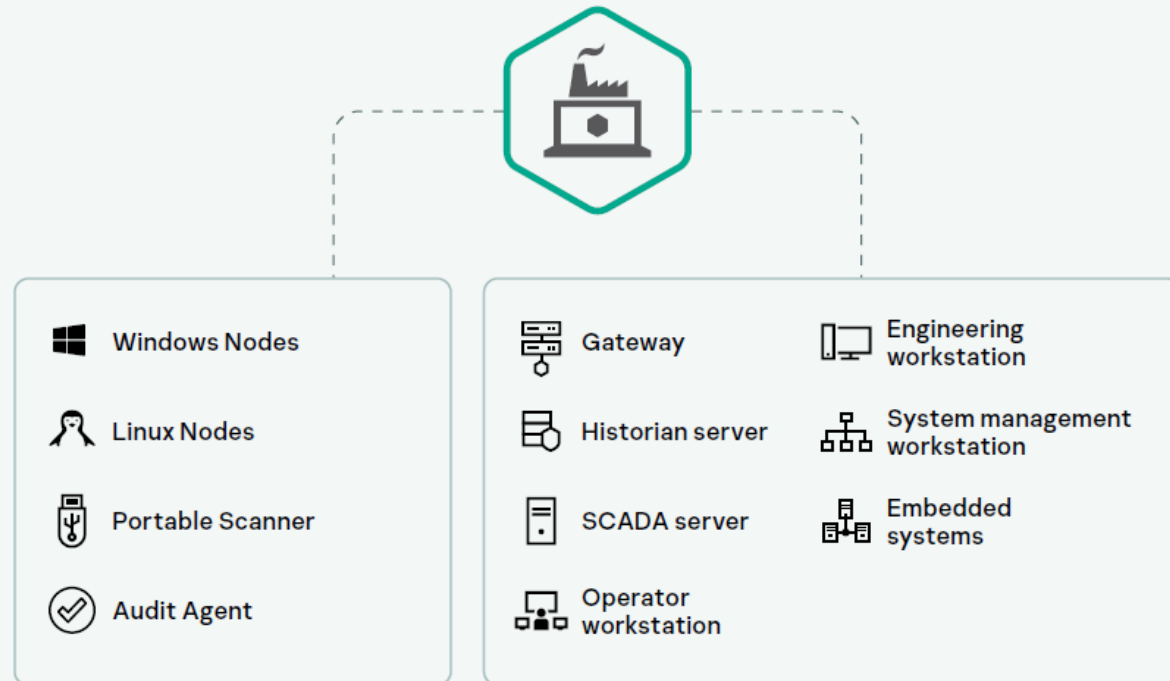
ICS for Nodes

Specially designed to consume minimal resources. Its modular architecture means you only have to install the protective components you need. You can configure these components to threat prevention mode or detection-only mode. This approach is ideal for legacy, low-performance machines that require the maximum available computing power.

Grid digitalization R&D

Phase 4 – Cyber Security Solutions

ICS for Nodes was specifically designed for the harsh requirements of distributed automation systems: mixed and complicated environments, extended time in operation, standalone and connected use cases, attended and maintenance-free instances and priority of control availability at all costs.



Benefits

✓ **Low impact**

on protected device for the best system performance

✓ **Compatible**

with low-performance computers from previous generations, and systems from Windows XP SP2 and Windows Server 2003 SP1 and above

✓ **Extended lifecycle**

up to 5 years licensing and extended support

✓ **Full functionality**

for all MS Desktop, Server and Embedded Windows OS

✓ **Modular deployment**

Flexible options and safe non-intrusive settings

✓ **Covers mixed infrastructures**

Windows, Linux and Portable variants

Industrial Endpoint Protection, Detection and Response

Protects every endpoint of a modern, digital, managed and distributed automation system. It reveals new levels of incident visibility in the root cause analysis process. The agent collects the endpoint telemetry to create a clear and detailed visual representation of an incident's progress on workstations, servers, gateways and other endpoints, reassuring automation system administrators that an incident has been fully dealt with and won't happen again.

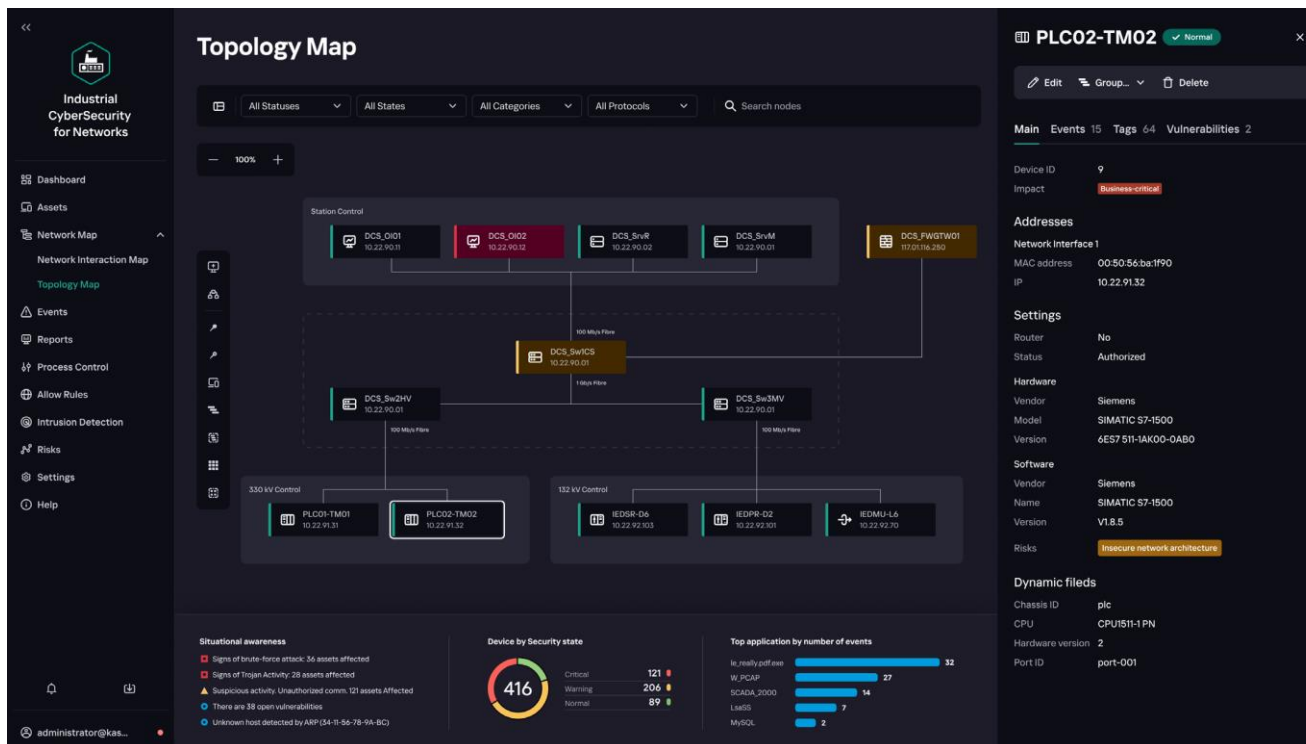
Grid digitalization R&D

Phase 4 – Cyber Security Solutions

ICS for Networks

OT Network Traffic Analysis, Detection and Response. Clear risk visibility with passive traffic monitoring, active polling and endpoint sensors.

Detects anomalies and intrusions inside ICS networks at their early stages and ensures the necessary actions are taken to prevent any negative impact on industrial processes.



Features

Asset discovery

Passive OT asset identification and inventory

Deep packet inspection

Near real-time analysis of technical process telemetry

Network integrity control

Detects unauthorized network hosts and flows

Intrusion detection system

Sends alerts about malicious network activities

Command control

Inspects commands over industrial protocols

External integration

Flexible API integration adds detection and prevention capabilities

Machine learning for anomaly detection (MLAD)

Finds cyber or physical anomalies through real-time telemetry and historical data mining (recurrent neural network)

Grid digitalization R&D

Phase 4 – Cyber Security Solutions



Tesla BOX® is VPN incepted device designed for industry grid and power generation , military, police and the government institutions secure data transmission through public infrastructure

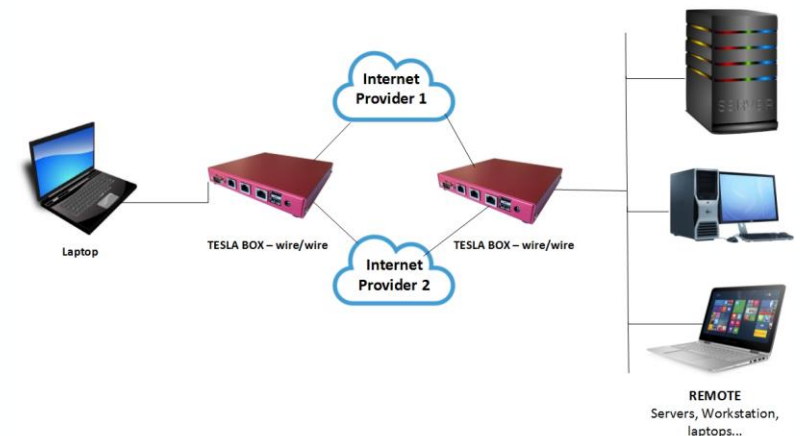
- 512-8192 bits – asymmetric key („OpenVPN encrypted“)
- 256 bits – symmetric keys for packets protection by algorithms (AES-CEMELLIA...).



Possibility of „backdoor“ closing, „source code“ insight on demand (unique on the market)!

- Automatic switching from one to another transmission route!
- Failover automatic switching between main and backup VPN tunnels through the entire transmission path (unique on the market)!
- Number of tunnels depends only on the RAM size

Possibility of using Multifunction Controller with system SW of TESLA BOX for reduction and cheapening of instruments at substations



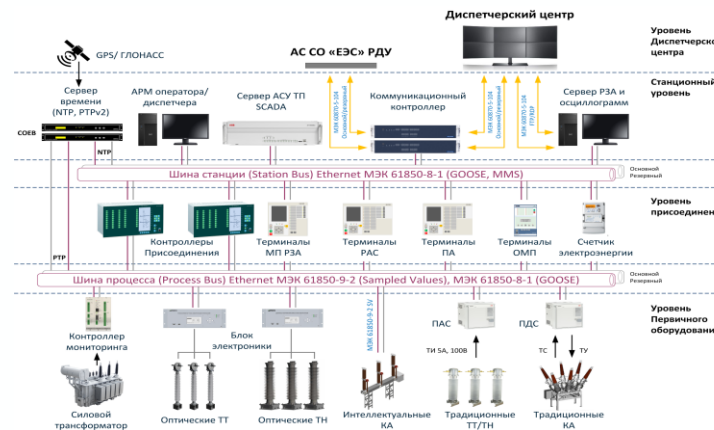
Engineering & System Solutions

Installed base 6-500 kV substation

- Modernization and digitalization of installed base 110-550 kV substations
- Modernization and digitalization of 35 kV substations
- Modernization and digitalization of 0,4/6/10 kV grid
- Real-Time Grid-Wide Relay and Substation Monitoring & Service System
- Primary & secondary equipment monitoring system

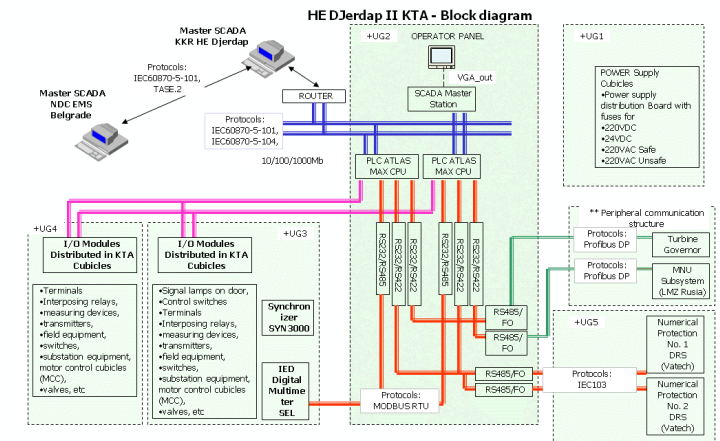
New substation 6-500 kV

- Substation automation systems (IEC 61850 standard, PRP, HSR, digital substation)



Generation & Industrial projects

- Electrical automation
- Process automation
- Excitation systems (generators & motors)



Engineering & System Solutions

Modernization and digitalization of installed base of HV substations

Modernization and digitalization of installed base of 110-500 kV substations

Problems:

- Different vendors, different models – interconnectivity, communication problems
- Old communication protocols
- Service issues (lack of service personnel)
- Half life cycle of equipment – large suppliers offer full replacement which is expensive

Our offers:

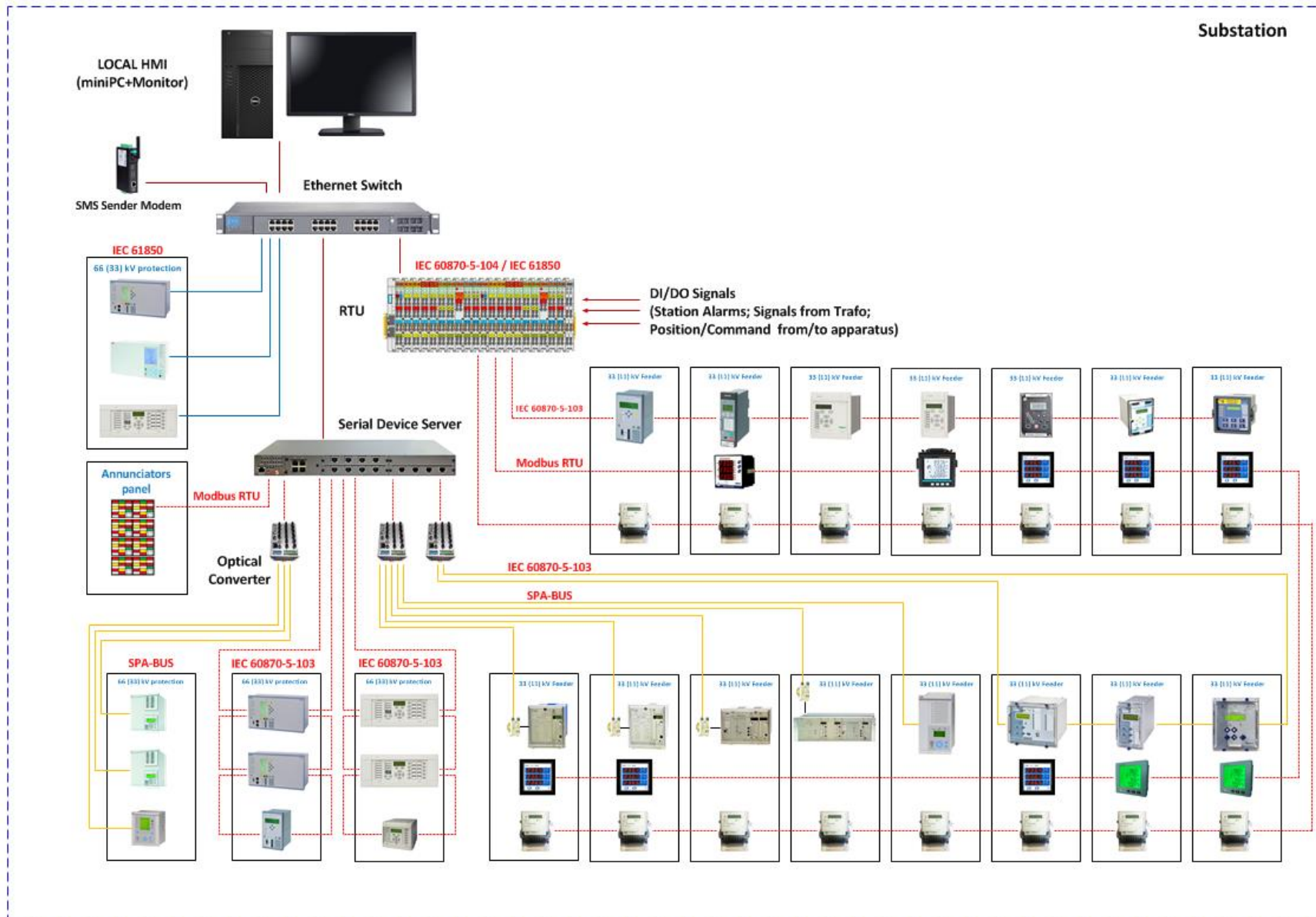
1. Upgrade of existing system with modern solution allows all existing equipment to:
 - 1.1. integrate into SINGLE SYSTEM for partial gradual upgrade to 61850 communication protocol
 - 1.2. No man - using VPN router with encryption for distant real time monitoring / control / service.

- **Easy integration of old installed base of products as well as new products allowing modernization of older legacy substations to most advanced standards and reducing investment cost by keeping old equipment rather than buying and installing new one**
- **Distant substation service** including:
 - Distant health check control of relays
 - Local and distant HW “health check” for all the automation system components and relays (where applicable)
 - Connectivity check
 - Distant SW “health check”
 - Distant SW configuration/programming/troubleshooting
 - In case of event – HW or SW failure – alarm list generated on all system levels
 - SMS's automatically sent to chosen users in case of tripping – with tripping relay info
 - E-mail's automatically sent with last 5 min. measurements + disturbance reports



Engineering & System Solutions

Modernization and digitalization of installed base of HV substations



Unique SCADA Automation system for substations of ALL voltage levels – for retrofitting substations TO INTEGRATE LEGACY PRODUCTS WITHOUT REPLACING THEM

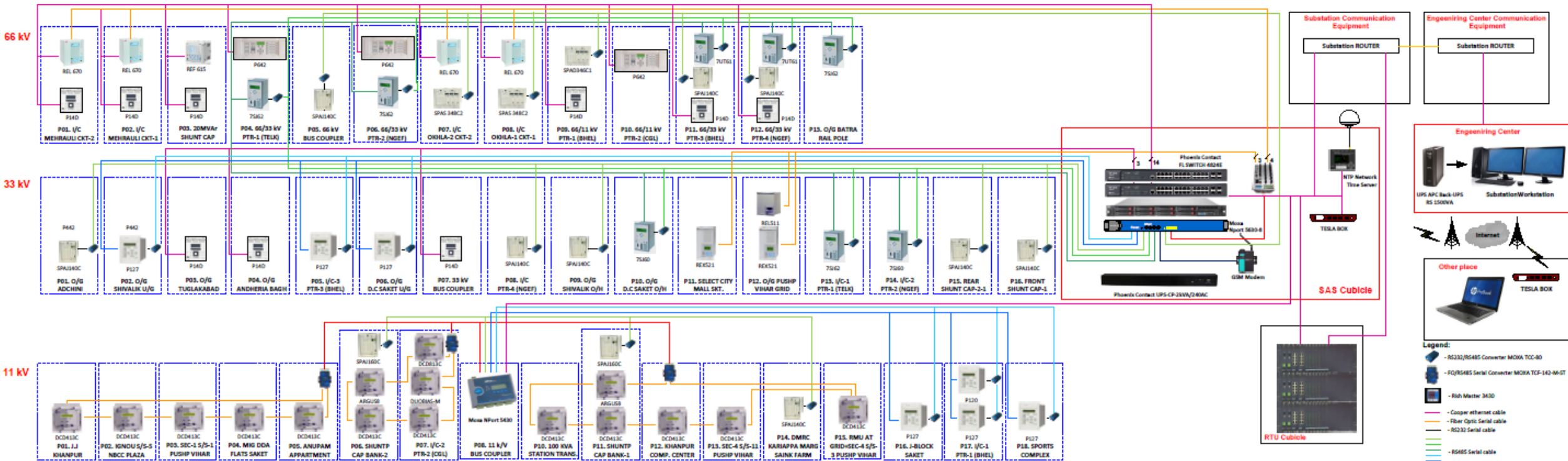
All devices can be combined into one system:

- Different types of Devices (Relays, Metering, RTU, Controllers etc.)
- Different Producer of devices (ABB, Siemens, GE Alstom, Schneider Electric, China Relays? Indian producer etc.)
- Different communication protocol (IEC61850, IEC 60870-5-103, Modbus, SPA bus etc.)
- Different interfaces (Ethernet, FO, RS485 etc.)

Engineering & System Solutions

Modernization and digitalization of installed base of HV substations

**Unique SCADA Automation system for substations of ALL voltage levels –
for retrofitting substations TO INTEGRATE LEGACY PRODUCTS WITHOUT REPLACING THEM**

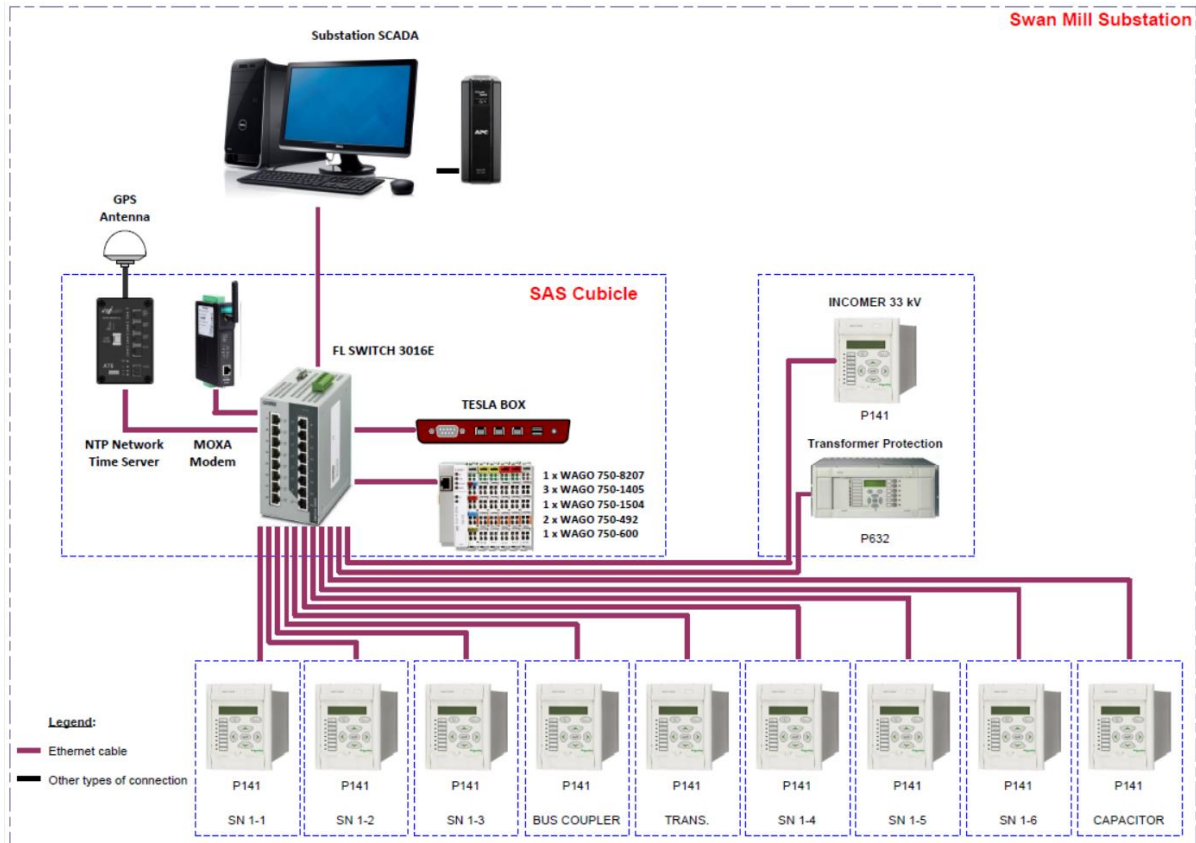


66/33/11 kV Malviya Nagar substation

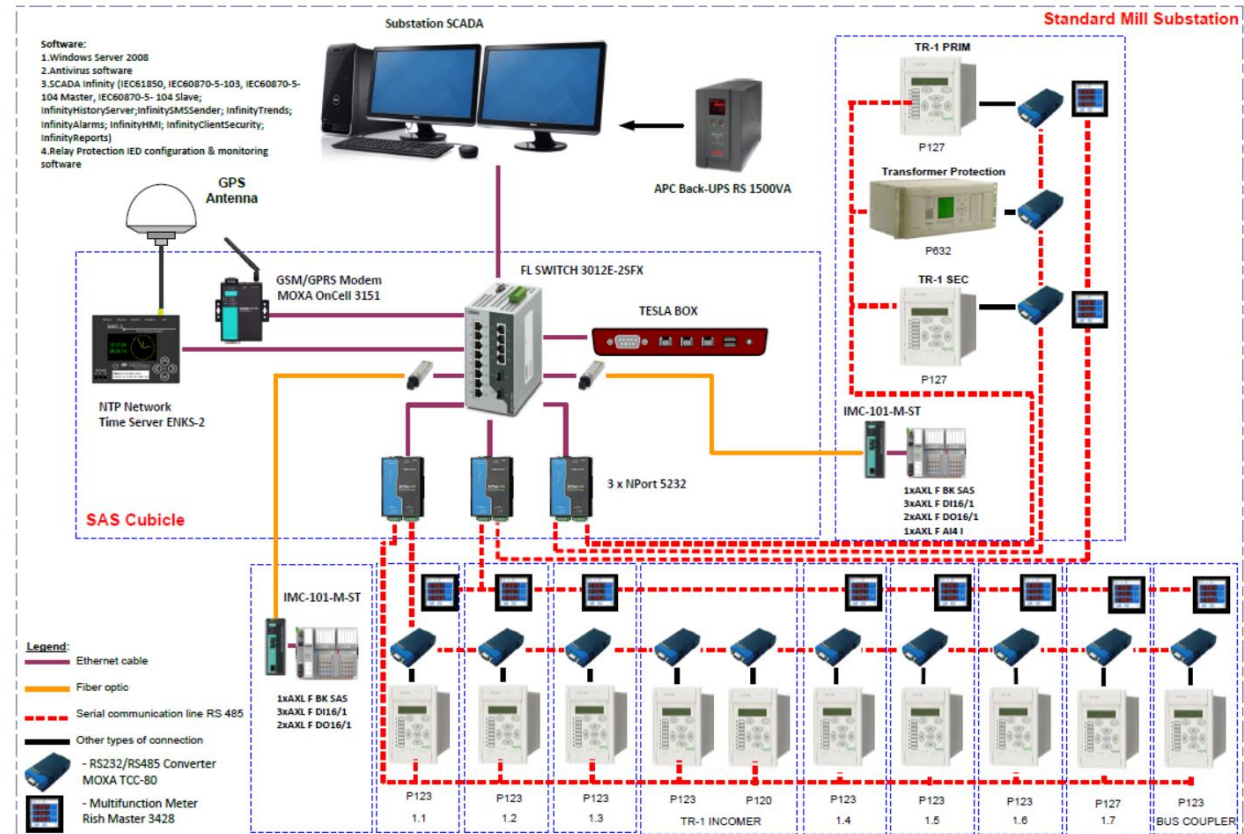
Engineering & System Solutions

Modernization and digitalization of installed base of MV substations

IEC61850 Solutions



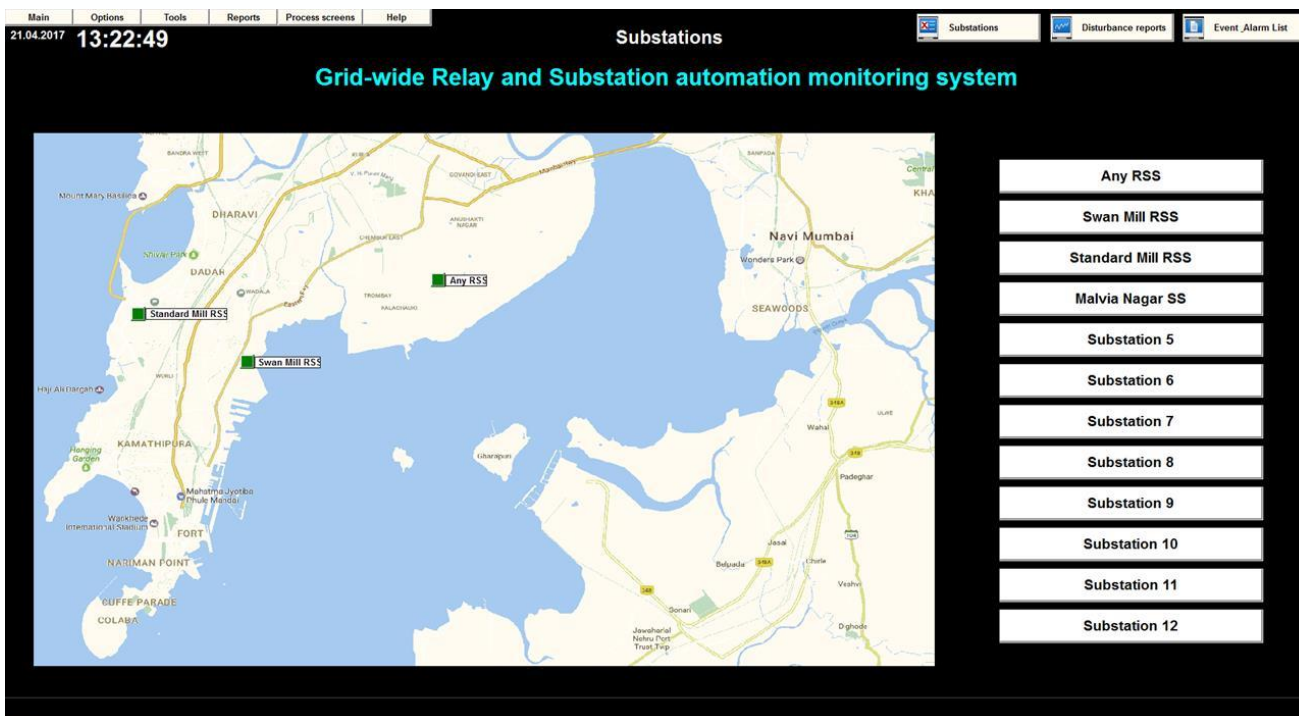
IEC 60870-5-103 Solutions



33/11 kV Swan Mill & Standard Mill substations, BEST UNDERTAKING, INDIA

Engineering & System Solutions

Grid-Wide Relay Protection and Substation Monitoring Systems



Advantages of our solution:

1. Modern IT type Distant service of substations:

- Diagnostics of HW & SW;
- Corrective service & maintenance of HW & SW with the most modern IT type solutions (distant SMS's, mails etc), applicable both to new and old substations

2. Significant investment reduction in relay & automation upgrade of existing retrofit substations

3. Reduction in operational & service cost & reduction in downtime, giving clear return on investment strategy (minimize travelling time, human error)

4. Openness

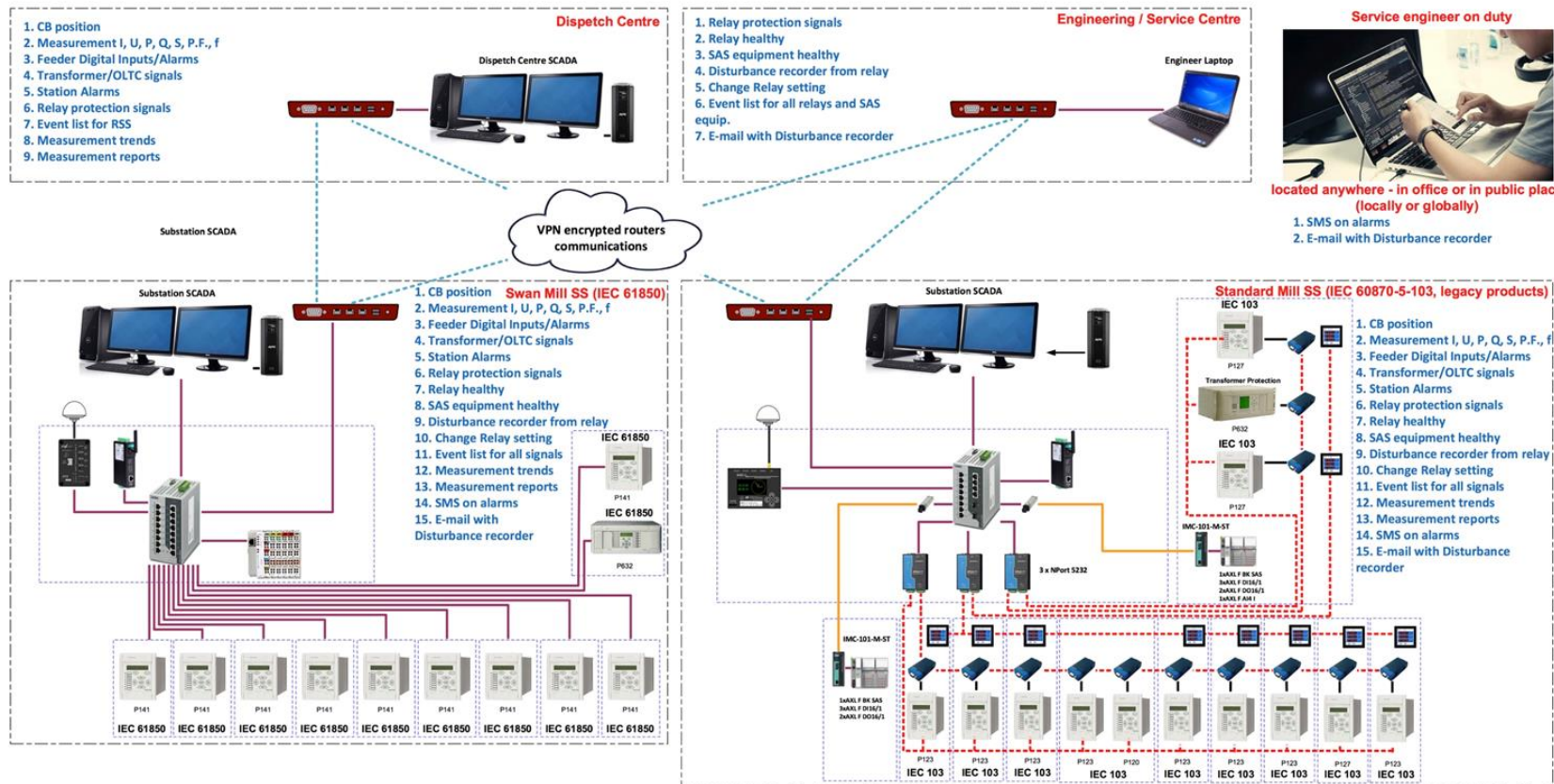
- customer's reduced supplier dependability (often close to "hostage" situation) – by switching from specialized, "black-box" suppliers solutions to widely available IT suppliers solution with IEC61850 communication protocol;

5. Standardization

- one solution (hardware and software unification)

Engineering & System Solutions

Grid-Wide Relay Protection and Substation Monitoring Systems



Engineering & System Solutions

Modernization and digitalization of 0,4/6/10 kV substations

On the one hand:

Transformers represent one of the largest portions of capital investment & in addition transformer outage has a considerable economic impact on the operation of the electrical network. Therefore, transformer's condition is essential to meet the goals of maximizing return on investment and lowering the total cost associated with transformer operation...

Objective 1 – to maximize efficiency of transformers in operation, maximize return on investment by reducing the downtime, reducing loss of service and reducing Operation & Maintenance cost.

On the other hand:

Extending the useful life of transformers is the single most important strategy for increasing life of power grid infrastructure. (EPRI report number 1001938).

Objective 2 – extend life-cycle of equipment, in case of a transformer it could be up to 15 to 20 years more than manufacturer's input.

Finally:

Current situation is that:

- Most of installed fleet of transformers is over aged or get close to the end of their life-cycle;
- Capital expenditure is reduced, while in the same time there is an increase in demand pushing for higher utilization of equipment;
- Operations & Maintenance budget is shrinking, while in the same time there is lack of sufficient service & maintenance force.

CONCLUSION: Objectives above can be met by implementation of Distant, Real-time Centralized Transformer

Monitoring & Asset Management System (that includes some distant (SMART) service functions)

Engineering & System Solutions

Modernization and digitalization of 0,4/6/10 kV substations

Transformer Monitoring & Asset Management system comprises of:

1. Centralized online/real-time monitoring of crucial measurements for chosen transformers and optionally apparatuses involved in its operations (re-closers, fuses, surge arresters, LV CB's, etc) – allowing distant centralized monitoring (and optionally distant emergency/service related control);
2. Centralized population databank with:
 - transformer operating history from the day of installation till present time (temperature, overload history, etc), service and maintenance reports (including failure history and causes of failure, anomalies determined by physical inspection, oil leakage history, oil inspection and replacement history);
 - Transformer manufacturer's product specification as well as recommendations (including overcurrent, overload & temperature recommendations);

... Both designed to support Operation & Maintenance activities reducing the response time, reducing outage duration as well as to help mitigate potential risks of unexpected outages by acting in preventive maintenance mode rather than acting upon accidents (optionally electricity, oil and asset theft indication and protection);

Information available, helps avoid dangerous and costly failures, optimizing maintenance schedules and extending the life of your transformers benefits:

- **Timely action on critical fault;**
- **Before-hand knowledge for critical parameters like overloading, loading balance, poor transformer health;**
- **Easy complete and fast report generation;**

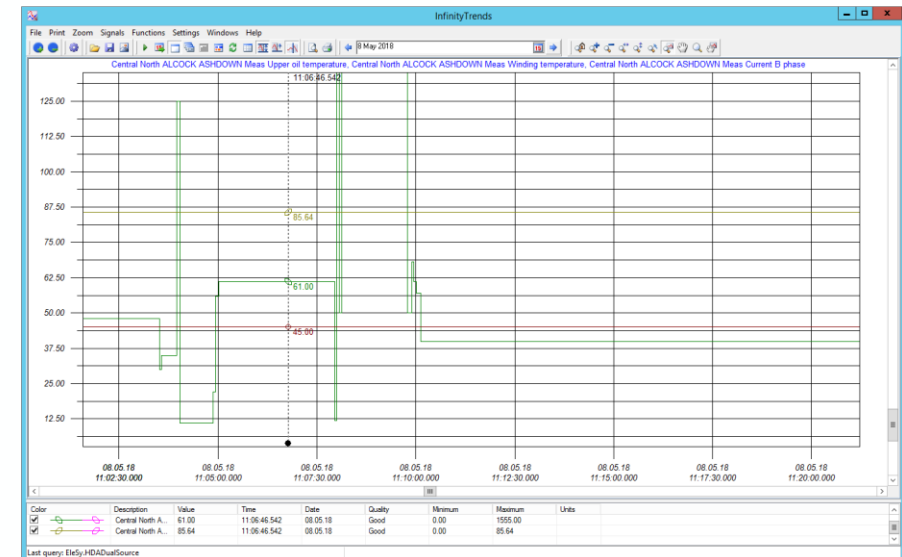
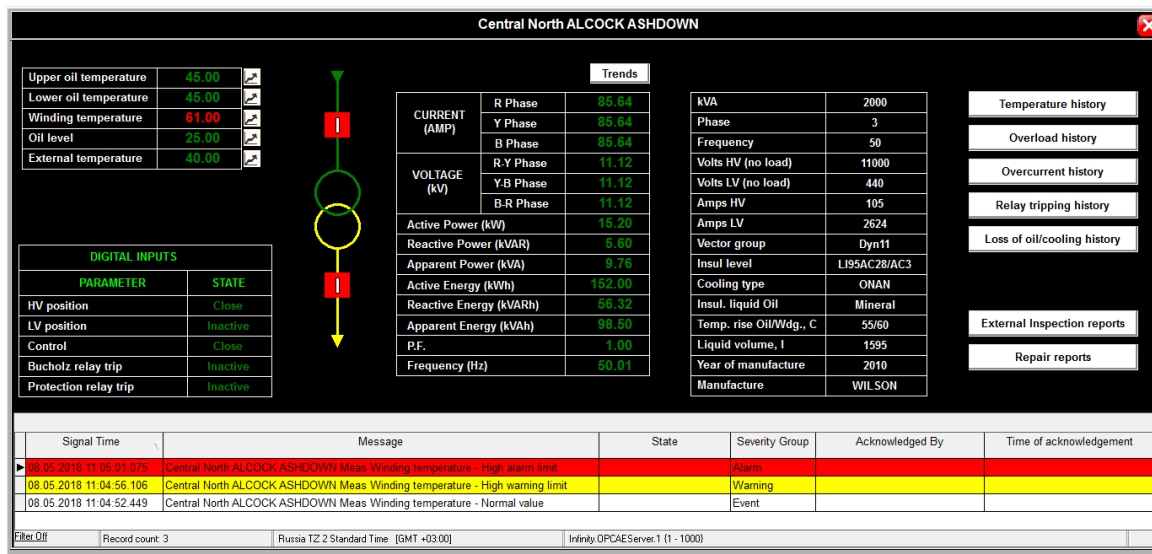
Engineering & System Solutions

Modernization and digitalization of 0,4/6/10 kV substations

3. Asset management transformer information

Designed to support MORE INFORMED asset management and investment decisions based on equipment and life-time information as well as consumption history and circumstances, allowing utilities to get most of their existing assets.

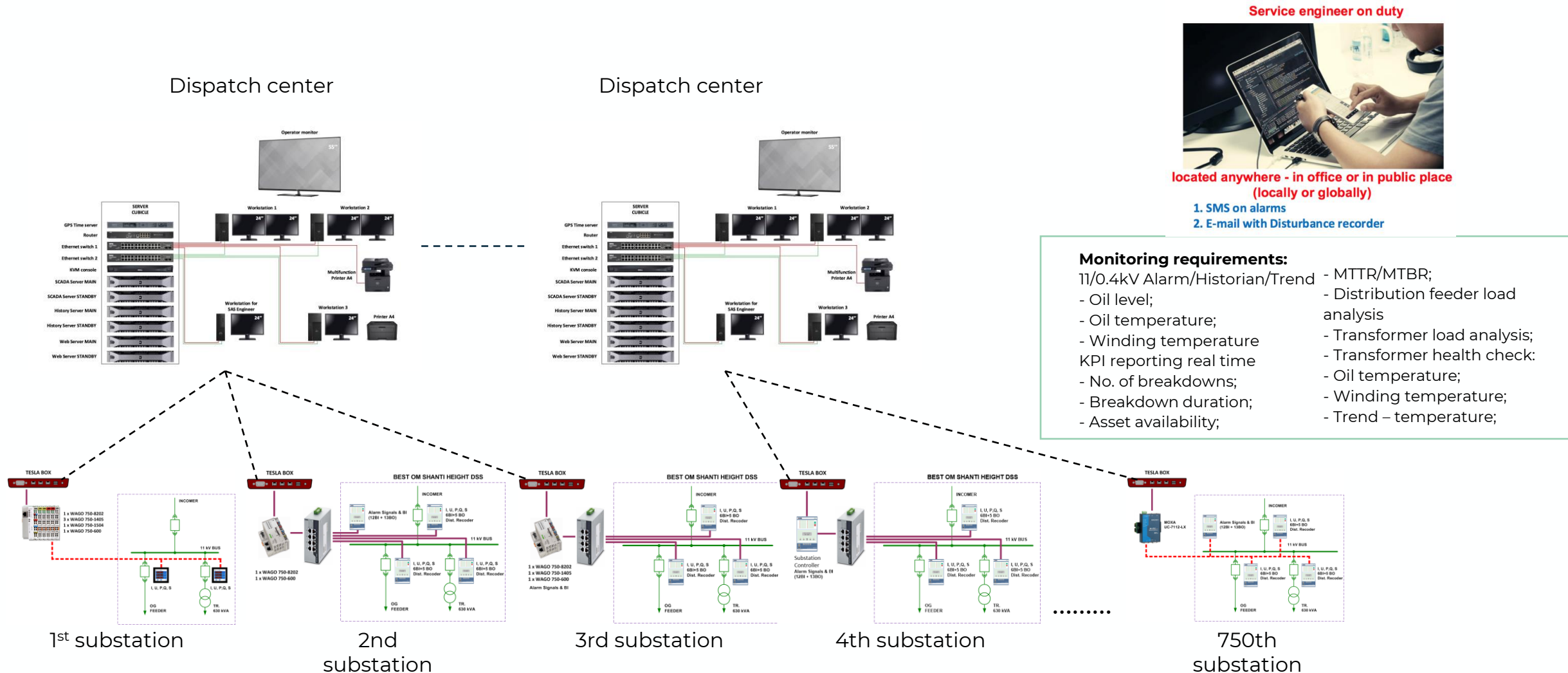
- Previous failures on this equipment, failures and problems on equipment of similar design, construction or age that operate in a similar environment, condition indicator for age);
- Fast and reliable suggestion regarding infrastructure extension;
- Power load monitoring and historization as well as electricity supply quality control (for example: under/over voltage control or fuse failure monitoring – rapport/ alarm/historian) ;
- Life-cycle expectations calculation and analysis of failure rate of installed base with emphasis on equipment performance per brand and model;



Engineering & System Solutions

Modernization and digitalization of 0,4/6/10 kV substations

**Example of solution for BEST Undertaking 750 substation automation & dispatching 11/0.4kV grid
(solution applicable for rural grids too)**



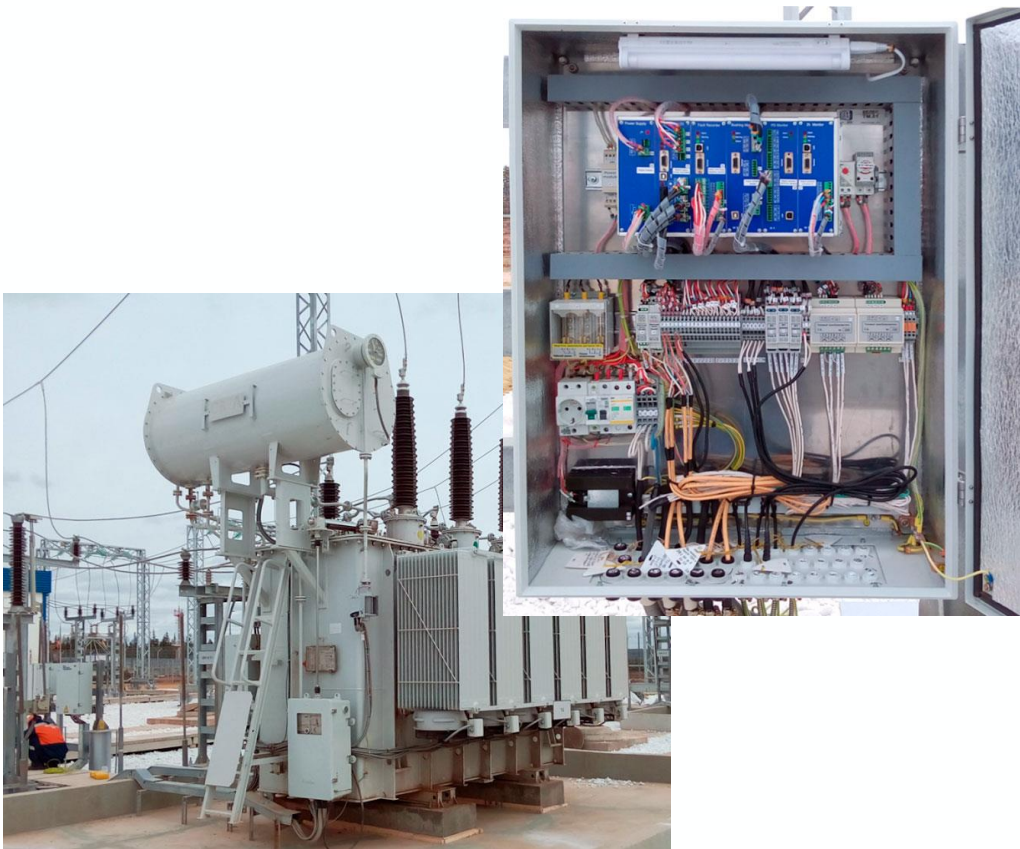
Engineering & System Solutions

Primary & Secondary Equipment Monitoring System

Power Transformers Condition Monitoring and Diagnostics System

The problem of power supply reliability raising is very serious nowadays. It could be partly solved by improving the reliability of power transmission infrastructure, including the high voltage power transformers. This could be achieved by introducing the systems of on-line monitoring and diagnostics both for new transformers and the transformers in use.

The complex monitoring «TDM» (Transformer Diagnostics Monitor) system is for efficient power transformer condition monitoring. It includes the number of hardware and software for power transformer condition diagnostics and assessment.



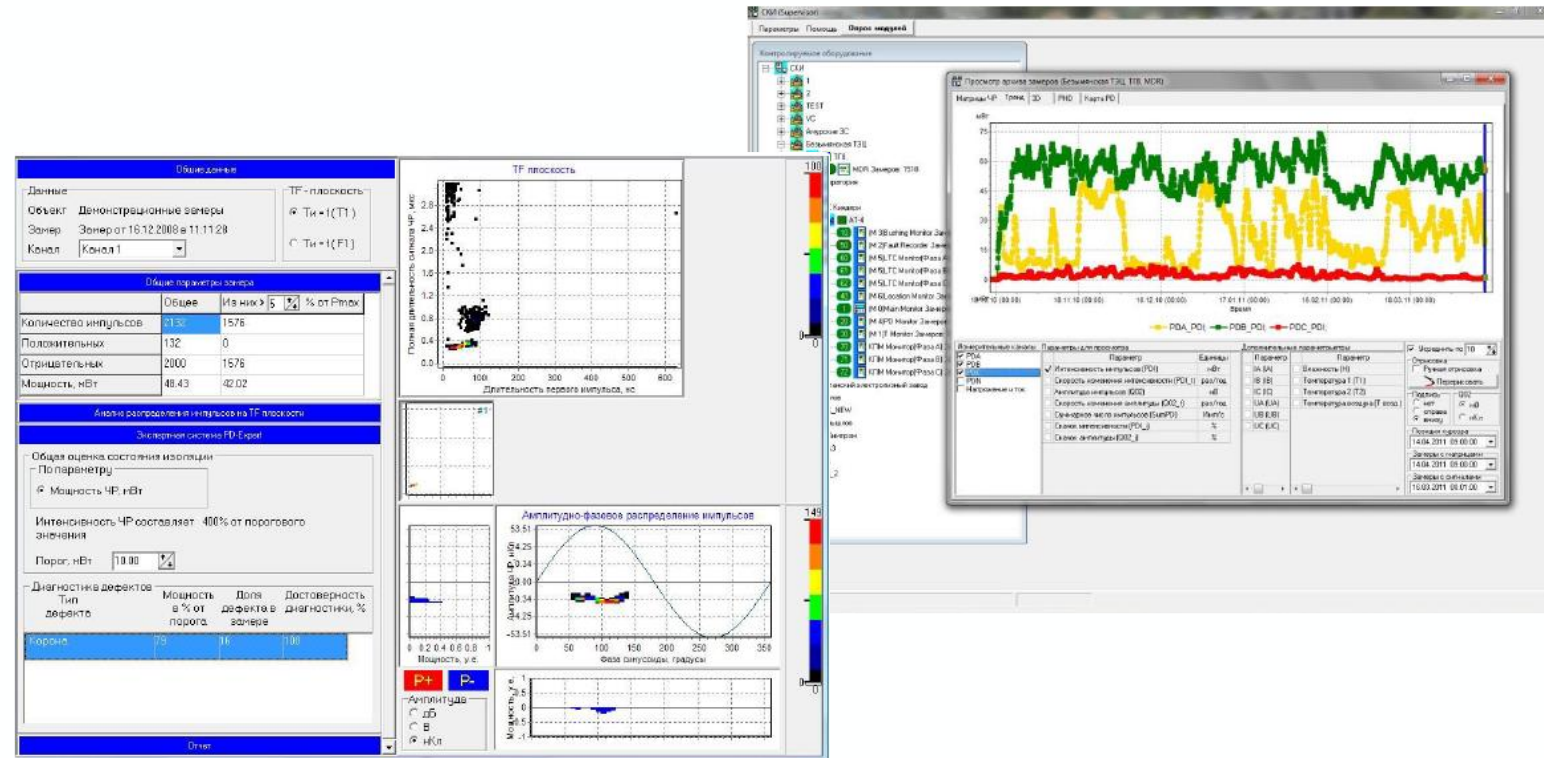
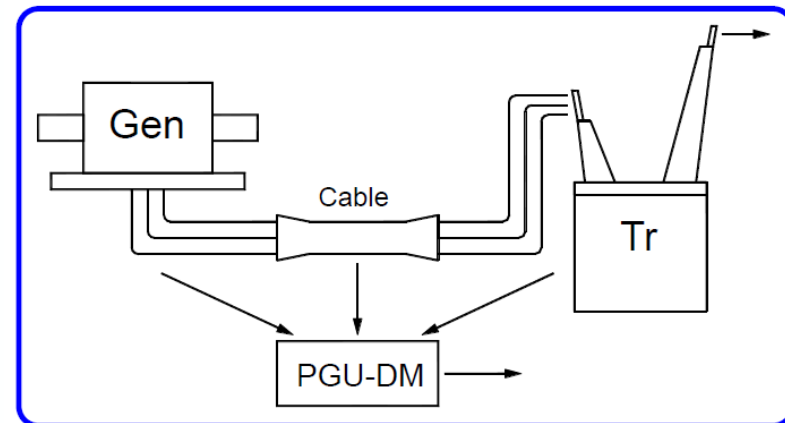
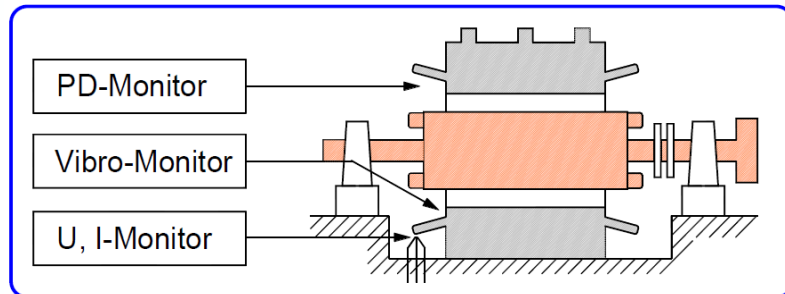
Engineering & System Solutions

Primary & Secondary Equipment Monitoring System

Generators and Electric Motor Monitoring and Diagnostics System

The «MDR» system is for the insulation condition monitoring of the large electric machines – generators and electric motors. In the «MDR» monitoring system 3 different methods of diagnostics of the large electric machines are realized. They are:

- The measuring, analysis and distribution of the PDs in the winding insulation of the electric machine stator.
- The measurement and analysis of the stator core vibration.
- The measurement and analysis of the phase currents and voltages for the phase parameter imbalance monitoring



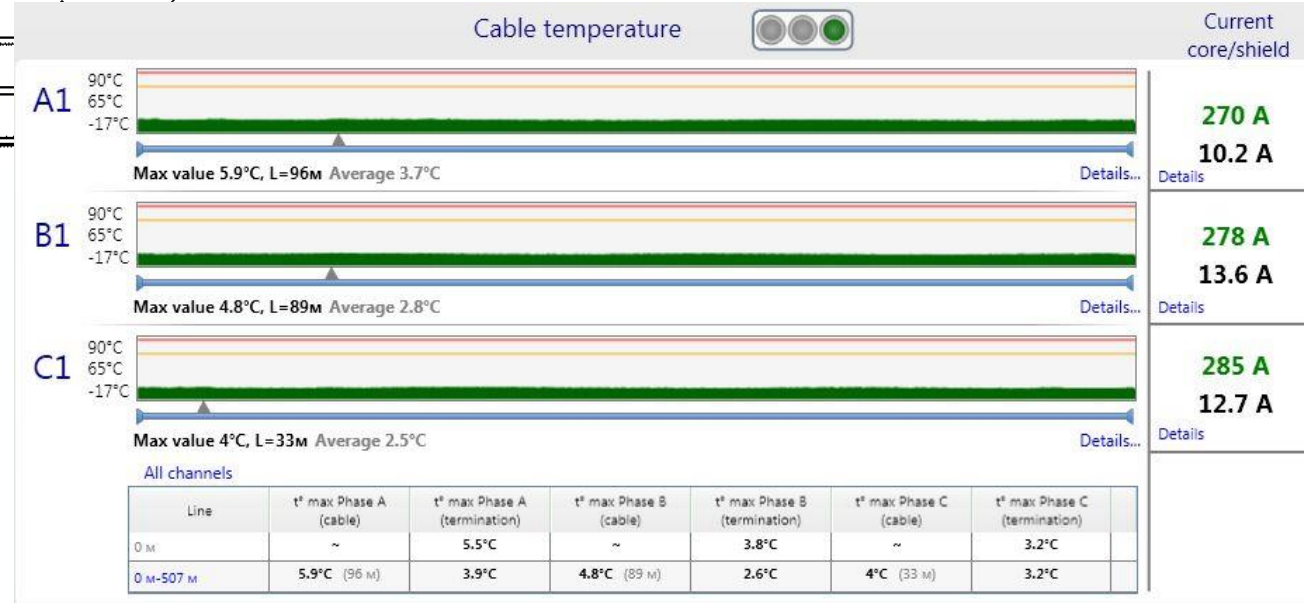
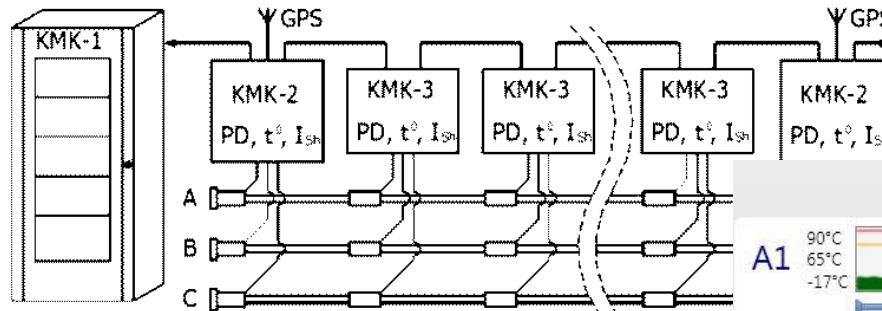
Engineering & System Solutions

Primary & Secondary Equipment Monitoring System

Integrated System for 110÷500 kV High-Voltage Cable Monitoring

Integrated System for 110÷500 kV High-Voltage Cable Monitoring system is for integrated on-line monitoring of cable condition, including:

- Monitoring of cable operating modes by distributed temperature sensing.
- Monitoring of cable insulation condition by partial discharge measurement, using high-frequency sensors.
- Monitoring of terminations and joints condition by partial discharge measurement, using acoustic sensors.
- Measurement and analysis of the capacitance leakage currents in cable shields.



Engineering & System Solutions

Primary & Secondary Equipment Monitoring System

Diagnostics of a MV circuit breaker resource

As a part of the circuit breaker diagnostics, the following is calculated:

- residual switching resource and
- residual mechanical resource of switches

for various types (low-oil, vacuum, SF6) according to known factory characteristics.

In modern vacuum circuit-breakers, the functions of switching on and off are carried out by the same contact system, the wear of the vacuum circuit breaker arc interruption chamber is significantly lower when the load is on than when the load is off, so the current residual resource of the vacuum circuit breaker is the remainder of the vacuum circuit breaker resource in % that is calculated in real time after each operation of switching off the load currents, short-circuit currents and without current loads.

The residual resource that determines the breaker's outage for repair, means a level of technical condition of the circuit breaker, in which, if the breaker cuts off rated breaking current, its available resource constitutes at least 5% (i.e., the capacity of the circuit breaker to perform another load breaking operation with a rated breaking current)

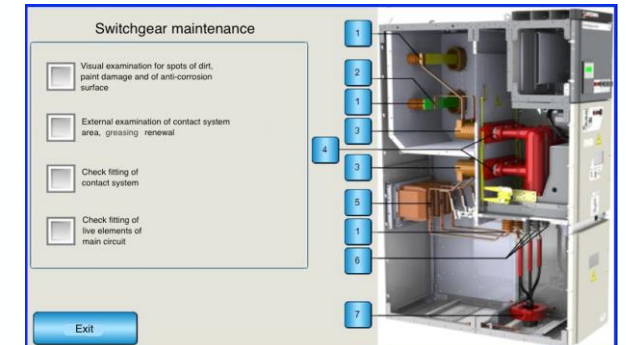
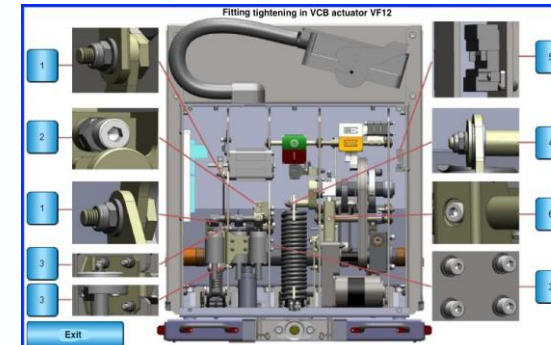
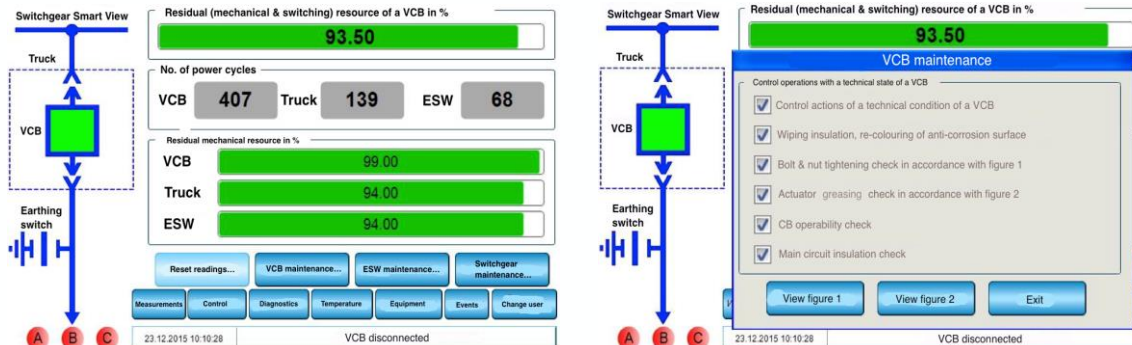
The initial parameters for calculating the mechanical resource is the data on the permissible number of power cycles.

Switching wear of the circuit-breaker is determined for each phase separately by the registered values of the emergency currents. The initial data is taken to be the following:

- number of trips at the rated current of the circuit breaker,
- the number of trips at the rated breaking current of the circuit breaker (20kA, 31.5kA, 40kA, etc.).

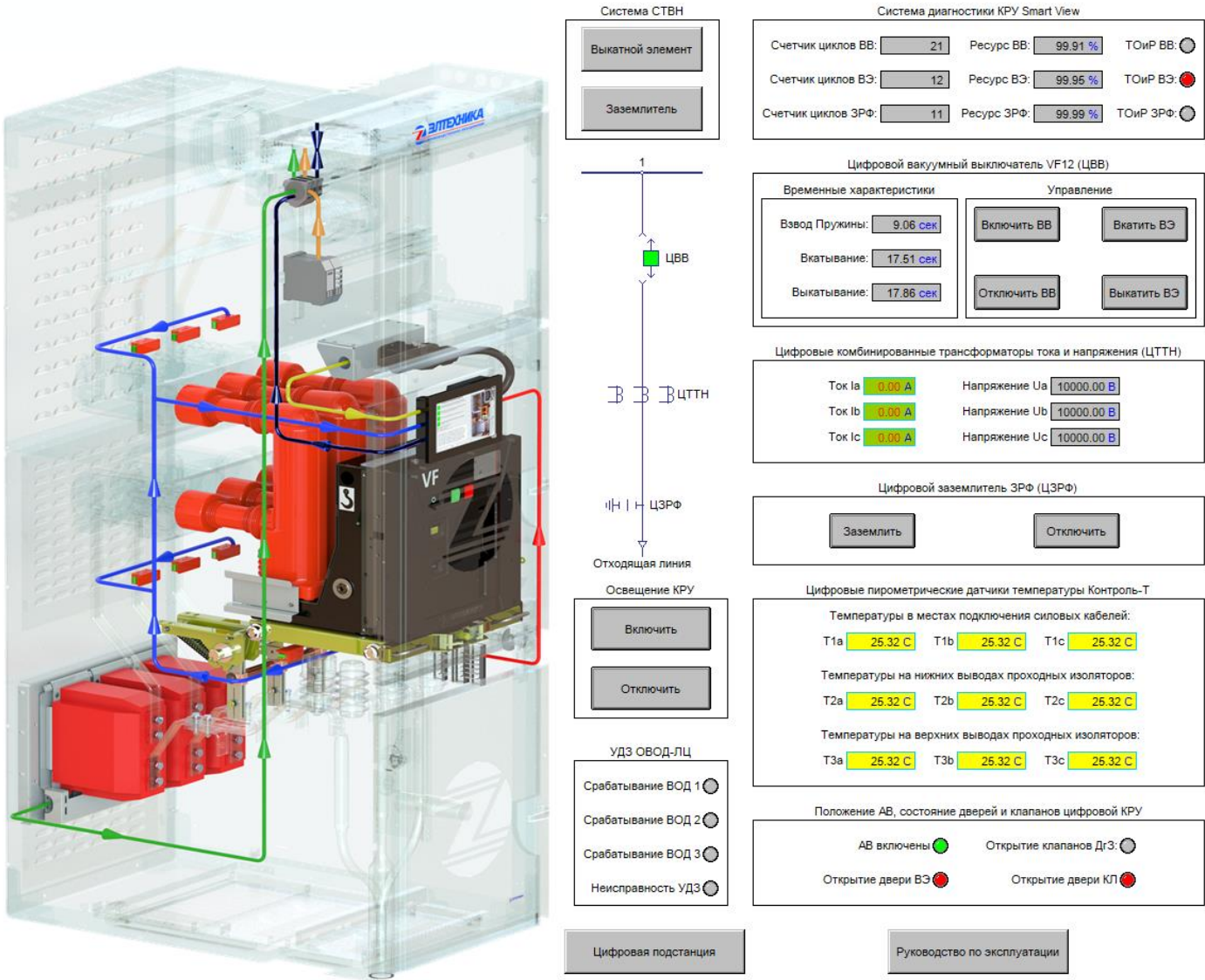
In the future, the calculation of the circuit breaker wear is made in accordance with GOST for high-voltage switches.

In the presence of more detailed data on the number of trips in the whole range of currents, it is possible to divide into 10 sub-ranges the entire operating range of the Circuit-breaker currents at the site (from I_n to I_{sc}). Each sub-range corresponds to a very definite number of trips, which must be set when working with the menu. This makes possible to determine more accurately the wear of the circuit breaker when tripping upon short circuit with different fault currents.



Engineering & System Solutions

Primary & Secondary Equipment Monitoring System



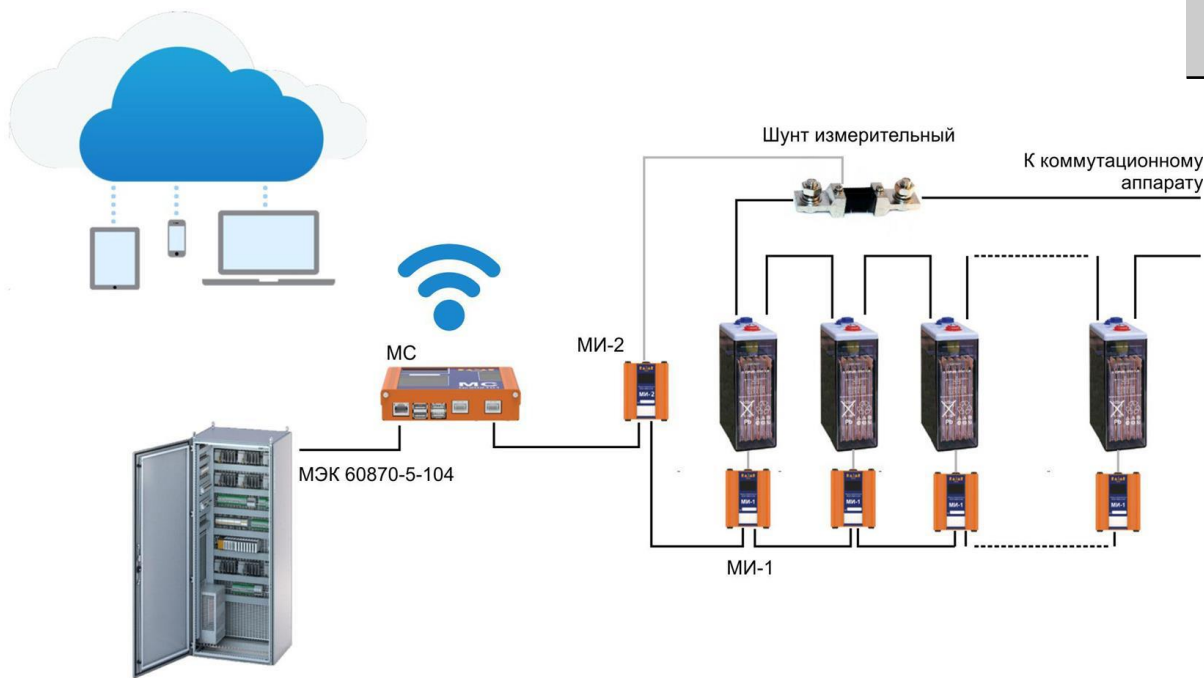
digital switchgear	Description	Main switchgear value
Level 1	Simply replace CTs & PTs with Current & Voltage Sensors	1. Reduced weight 2. Space saving (primarily due to elimination of PT compartment) 3. Eliminates problems of saturation & ferroresonance 4. Safety – no possibility of open CT circuits
Level 2	Above + IEC 61850-9-1 & GOOSE messaging - Ethernet cabling between IEDs.	Above + 5. Significant reduction in wiring between frames 6. Late customization
Level 3	Above + Process bus (61850-9-2LE). - Requires use of Merging Units (MUs), time synchronization devices & Ethernet switches. - Fiber optic connection from bay (switchgear) to substation.	Above + 7. Improved flexibility – changes in protection only require IED level changes.

Engineering & System Solutions

Primary & Secondary Equipment Monitoring System

Element-by-element battery monitoring system

The system is designed for element-by-element control of battery parameters in DC operating current systems of stations, substations, communication systems, backup power supplies for computer centers and data processing centers, as well as any industrial systems that include batteries.



Supply voltage, VDC	24
Rated voltages of the measured cells of the batteries, VDC	2; 4; 6; 12; 24
Number of batteries in the system, pcs.	255
Communication Protocols	IEC 60870-5-104, Wi-fi, Bluetooth
Communication interface between system sensors	RS-485, wired

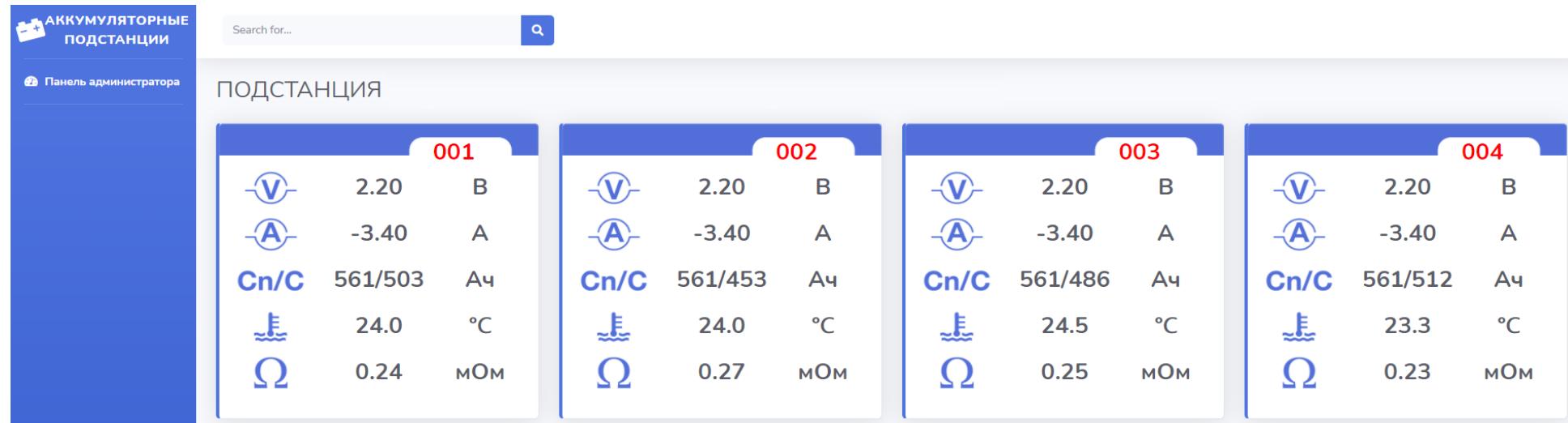


Engineering & System Solutions

Primary & Secondary Equipment Monitoring System

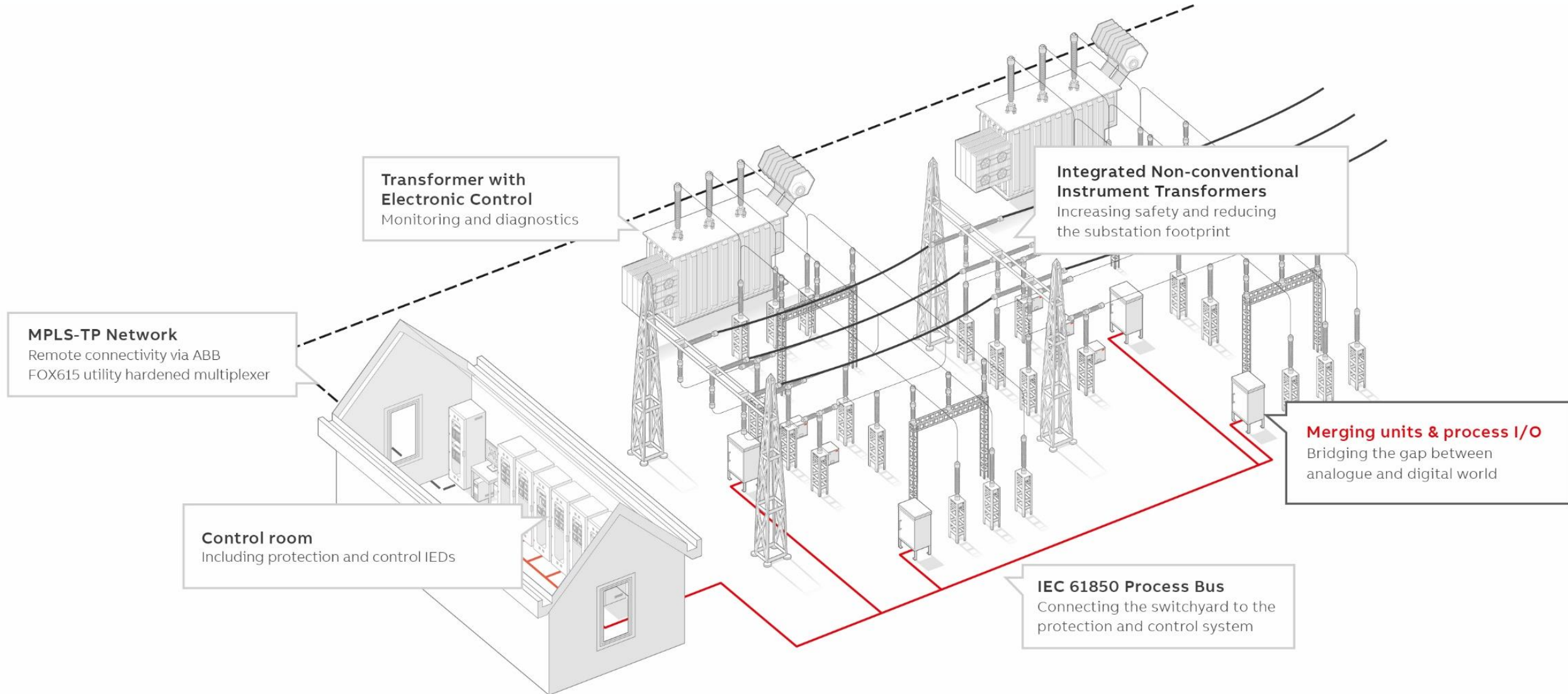
Advantages

- The system monitors the state of the battery constantly, in all operating modes.
- Universal installation method. Possibility to install the system on any batteries, regardless of their type and size.
- Modular layout of the system (the ability to assemble a system for a different number of elements in the battery).
- Possibility of dismantling the system and installation on another object with additional equipment with the necessary number of measuring sensors.
- Reducing the time spent by service personnel on battery operation.
- Reducing operating costs for the maintenance of the operating current system. Savings in terms of one battery is from 250 man-hours per year.
- The original algorithms on which the operation of the system is based have no analogues.
- Ability to analyze the performance of batteries in real time and build graphs of cell degradation over the entire life of the battery.
- Data analysis allows you to evaluate the actual service life of batteries and make a comparison with the nameplate data of the manufacturer.
- Detection of defective elements in the battery assembly.



Engineering & System Solutions

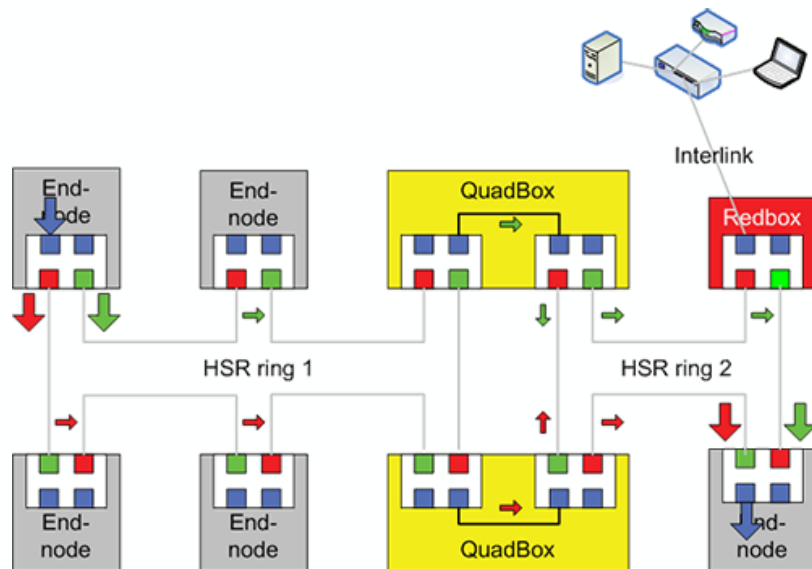
Digital Substation Automation



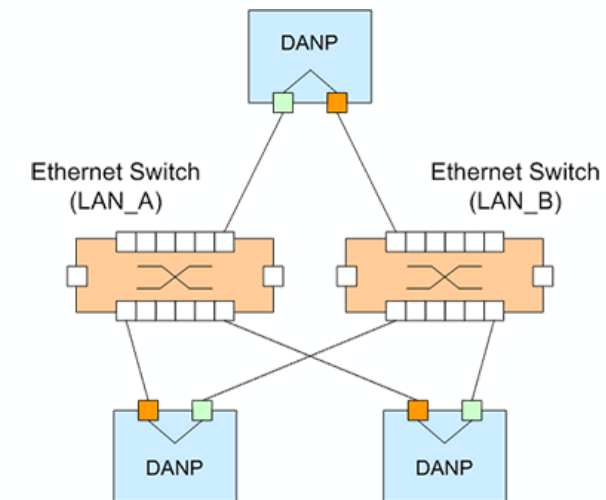
Engineering & System Solutions

Digital Substation Automation

- **High-availability Seamless Redundancy (HSR)** is a standard (IEC 62439-3 Clause 5) answering to the need for reliable Ethernet. It is suitable for applications that require short reaction times and high availability. With HSR, a network can be made very robust with zero reaction time in case of a single failure, with predictable latency and with less cost than with other Ethernet redundancy solutions.
- The typical HSR topology is a ring. The source node duplicates all the frames it has to send, and sends them using two different paths to their destination. If either one of the paths is broken, due to link or node failure, the frames are still able to reach their destination.

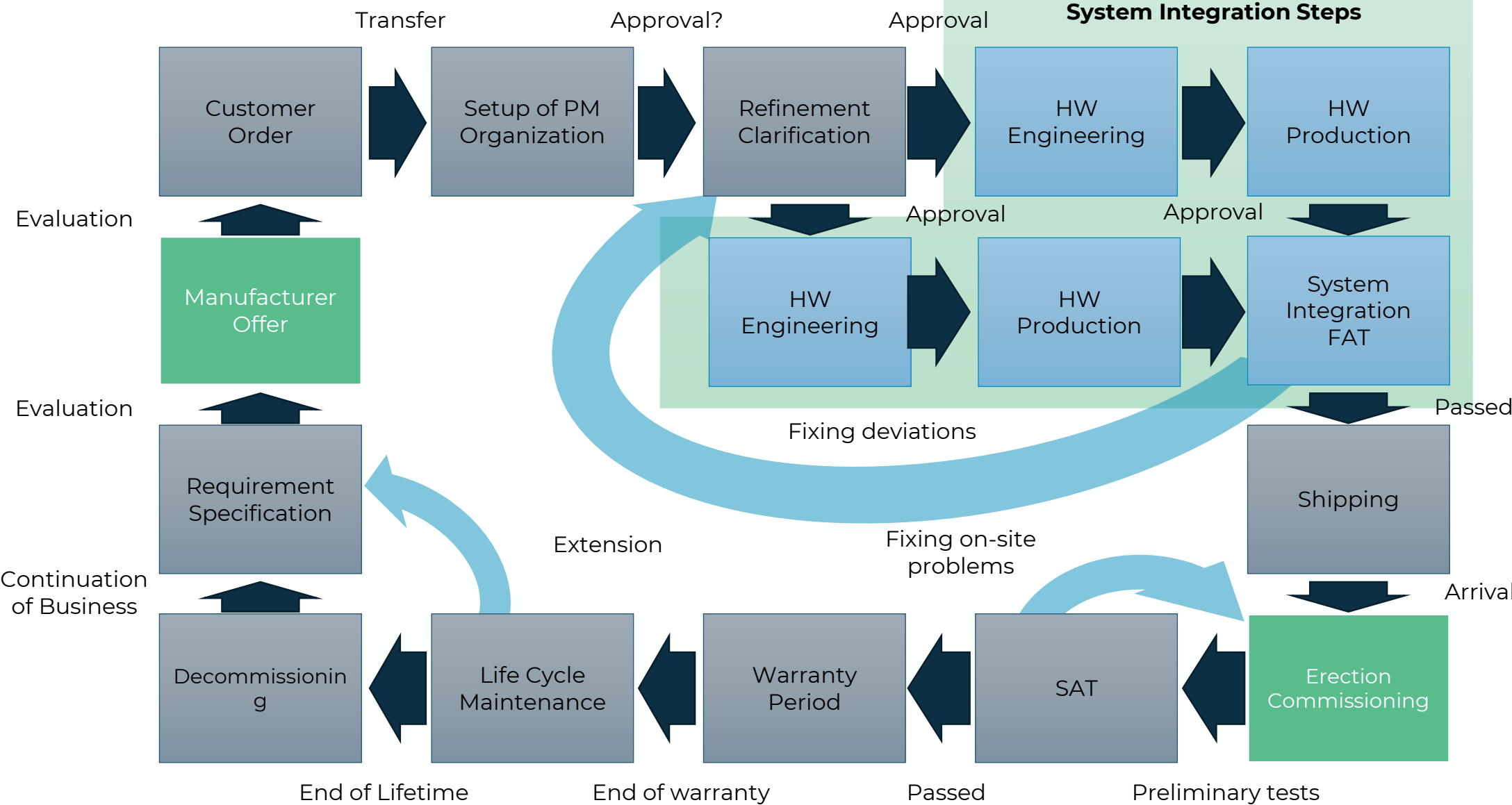


- The **Parallel Redundancy Protocol** is an IEC standard (IEC 62439-3 Clause 4) providing redundant Ethernet. Under PRP, each node is connected to two separated, parallel Local Area Networks (LANs). Source nodes send two copies of each packet, one over each network. When a destination node receives a packet, it accepts the first copy and discards the second copy, in other words, eliminating the duplicate.
- The two networks are assumed to be fail-independent. The destination node will always receive at least one packet as long as either one of the two networks is operational. This provides zero-time recovery in case of a single failure, so no frames are lost.



Engineering & System Solutions

Project phases: Project Life Cycle





THERMAL POWER PLANTS

The main characteristics of the View T-Power solution:

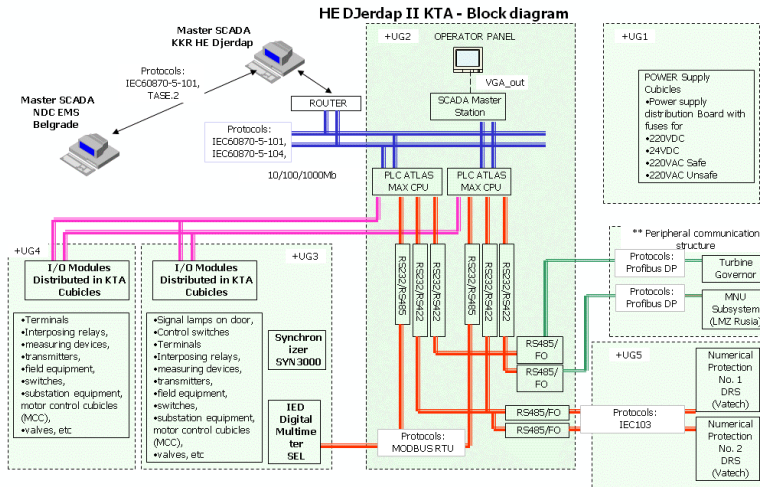
- Integration with turbine control systems of other manufacturers- **ALSTOM TGC** (TPP Morava, TENT-A4, TENT-A6).
- Integration of SIL3 subsystem – overspeed protection.
- Turbine control systems of own production and integration in DCS (TENT-A2 & A1, TPP Kostolac-B1 & B2, TPP Kolubara-TA3, TPP- HP Novi Sad –TA2)
- Communication between the generator electrical protection system and the 6kV plant (TENT A, TE Kostolac, TETO Novi Sad).



THERMAL POWER PLANTS

The main characteristics of the View T-Power solution:

- Integration of new electro filtering systems (TENT-A4, A2, A1, TE Kostolac B1 (**made by CMEC**)).
- Integration of new oil burner systems (TENT-A4, TPP Kolubara K4 & K4, TPP Kostolac B1 & B2).
- Integration of other manufacturers' DCS as subsystems
- **SIEMENS TSP3000** – subsystem of auxiliary turbine systems (TPP Kostolac-B1 & B2)
- Integration of all thermal power plant systems into National Dispatching Center in Serbia
- Open for integration of future systems
- All international standards supported (IEC, HART, PROFIBUS, MODBUS, DNP.3...)



HYDRO POWER PLANTS

The main characteristics:

- KTA – Generator and block transformer control and protection systems
- Integration with the new turbine regulation systems LMZ Russia (HPP Djerdap 2).
- Integration of old turbine control systems (HPP Vrla 1).
- Integration of new turbine thermal protection systems (HPP Djerdap 2).
- Compliance with the PLC standards: IEC 61131
- Redundant control and protection systems
- Integration into the central hydroelectric power plant control system.
- Integration with AKI703 ACP (SAT Automation – VAtech) systems.

Engineering & System Solutions

Photovoltaic power plants & cogeneration power plants process automation

Institute Mihajlo Pupin IMP-Automation & Control Systems



PHOTOVOLTAIC POWER PLANTS & COGENERATION POWER PLANTS

- Between 2012-2016 IMP- Automation & Control Systems delivered: project and technical documentation, installed and commissioned Supervisory Control System for 6 photovoltaic power plants, 8 cogeneration power plants and 4 wind power plants in Serbia.



Engineering & System Solutions

Water utilities supply process automation

Institute Mihajlo Pupin IMP-Automation & Control Systems

SCADA systems for the water supply and management:

- Design
- Development
- Manufacturing
- Testing
- Installation
- Putting into operation



Engineering & System Solutions

Process automation referent

Institute Mihajlo Pupin IMP-Automation & Control Systems



VIEW T-POWER DCS Systems

- TPP Morava, 125MW, 2004
- TENT-A2, 210MW, 2005
- TENT-A1, 210MW, 2006
- TENT-A4, 307MW, 2007
- TPP KOSTOLAC-B1, 350MW, 2008
- TENT-A6, 320MW, 2008
- TPP-HP Novi Sad – K3, 2008
- TPP-HP Novi Sad– K1, T2, 120MW, 2009
- TPP KOSTOLAC-B2, 350MW, 2010
- TPP-HP Novi Sad Novi Sad – K1, T1, 120MW, 2010
- TPP Kolubara A3, 68MW, 2011
- TENT A – Toplifikacija, 2011
- TPP Kolubara K4, 2012
- TPP Kolubara K5, 2013
- TENT A3 – Generator systems, 2014
- TENT A – Cooling pumps, 2015



Generator control boards

- HPP Đerdap 2, 2005-2010
- HPP Vrla 1, HPP Vrla 2, HPP Vrla 4, PSP Lisina 2008 - 2015
- HPP Ovčar Banja, 2008
- HPP Bajina Bašta, 2008-2010
- HPP Medjuvršje, 2009
- HPP Djerdap 1, 2010-2015
- HPP Trebinje 2, 2011-2015

Total power of **thermal power plants** in Serbia - 5.171 MW

Mihajlo Pupin Institute's DCS systems - 2.344 MW

Total power of **hydro power plants** in Serbia - 2.853 MW

Mihajlo Pupin Institute's DCS systems – 2.150 MW

Total power in Serbia- 8.024 MW

Mihajlo Pupin Institute's DCS systems- 4.494 MW

Engineering & System Solutions

Power generation & industrial project - electrical automation



Integrity SCADA is a high-tech cross-platform software and tool complex for implementation of automated process control systems.

Integrity SCADA is not tied to a specific type of production, and can be applied at enterprises of various industries. Integrity SCADA has a modular structure, which allows to implement projects of any scale, only from the necessary functional components depending on the goals of the automation project.

Integrity SCADA - full functionality for automation

- ✓ visualisation of technological processes in a visual form: mnemonic diagrams with control functions, graphs, tables, event logs;
- ✓ analyses and control of technological processes, informing about occurring events and accidents;
- ✓ dispatch and automatic control;
- ✓ reliable real-time data acquisition and logical-mathematical data processing;
- ✓ storage and provision of a complete history of production operation;
- ✓ integration with third-party systems via secure industrial protocols.

Engineering & System Solutions

Power generation & industrial project - electrical automation

Integrity SCADA components

The component-based approach of **Integrity SCADA** allows to build automation systems for specific tasks, buying only the necessary components and communication protocols, up to the integration of individual Integrity SCADA components with third-party systems, due to strict compliance with industry standards and specifications.



IntegrityServer - operational data input/output server

Collection of data on technological protocols, mathematical data preprocessing, generation of event and accident messages, provision of data to third-party systems and client applications.



IntegrityHistoryServer - History Server

Collects and stores process data and provides historical data to third-party systems and client applications.



IntegrityHistoryServer - History Server

Collects and stores process data and provides historical data to third-party systems and client applications.



IntegrityDataTransport - data transport server

Data transport, both between local PC components and within geographically distributed data sources and client components, organises a single address space.



IntegrityClientSecurity - client security server

Management of user access rights to functions of SCADA-system client applications.



IntegrityHMI - visualisation application

Process visualisation through graphical primitives, dynamics and other ways of displaying process data.



IntegrityTrends - graph display application

Display of changes in operational and historical process parameters in the form of graphs.



IntegrityAlarms - event display application

Displays operational and historical events and alarms in a tabular view with colour and sound coding. It implements a message acknowledgement mechanism.

Engineering & System Solutions

Excitation systems (generators & motors)

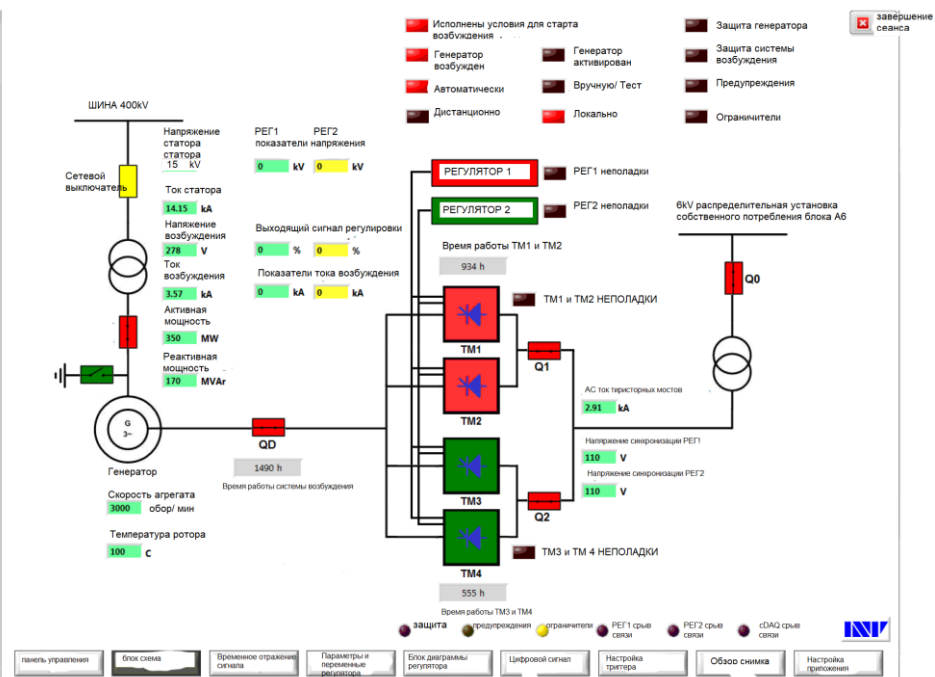
Institute Nicola Tesla



Excitation System is intended for turbo, hydro and diesel – generators and synchronous motors for generating machines control operation

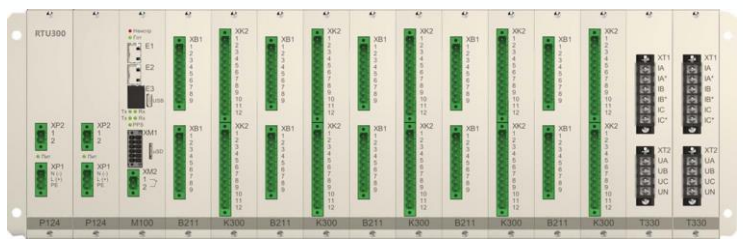
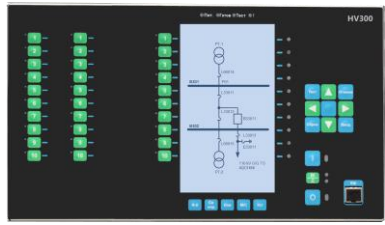
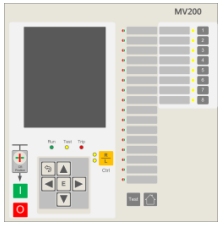


Synchronous machine power	from 300 kW to 650 MW
Regulator configuration	1 + 1
Thyristor converter configuration	1 + 1
Thyristor converter type	B6C
Cooling type	Natural air or forced air cooled type
Rated excitation current	from 7A to 6000 A



Production localization

Relay Protection IEDs, Multifunction Controllers & Meters



Our offering

- Relay Protection
 - own development
- Multifunction Controllers
 - own development
- Smart Meters
 - on license

Production localization

Relay Protection, Automation & Communication Panels

Our offering

Relay Protection Panels

Automation Panels

Communication Panels

Power Distribution Panels

Enclosures

with own products
with 3rd party products

with own products
with 3rd party products

with own products
with 3rd party products

with own products
with 3rd party products

own product



Production localization

MV Switchgear & Circuit Breakers



Our offering

MV Gas Insulated Switchgear (GIS)

based on license
agreement

MV Air Insulated Switchgear

based on license
agreement
own product

Recloser & circuit breakers

based on license
agreement

Generator breakers

based on license
agreement

Production localization

MV & HV prefabricated containerized and mobile substations



Our offering

MV Containerized transformer substations

own product

HV Containerized transformer substations

own product

MV Mobile substations

own product

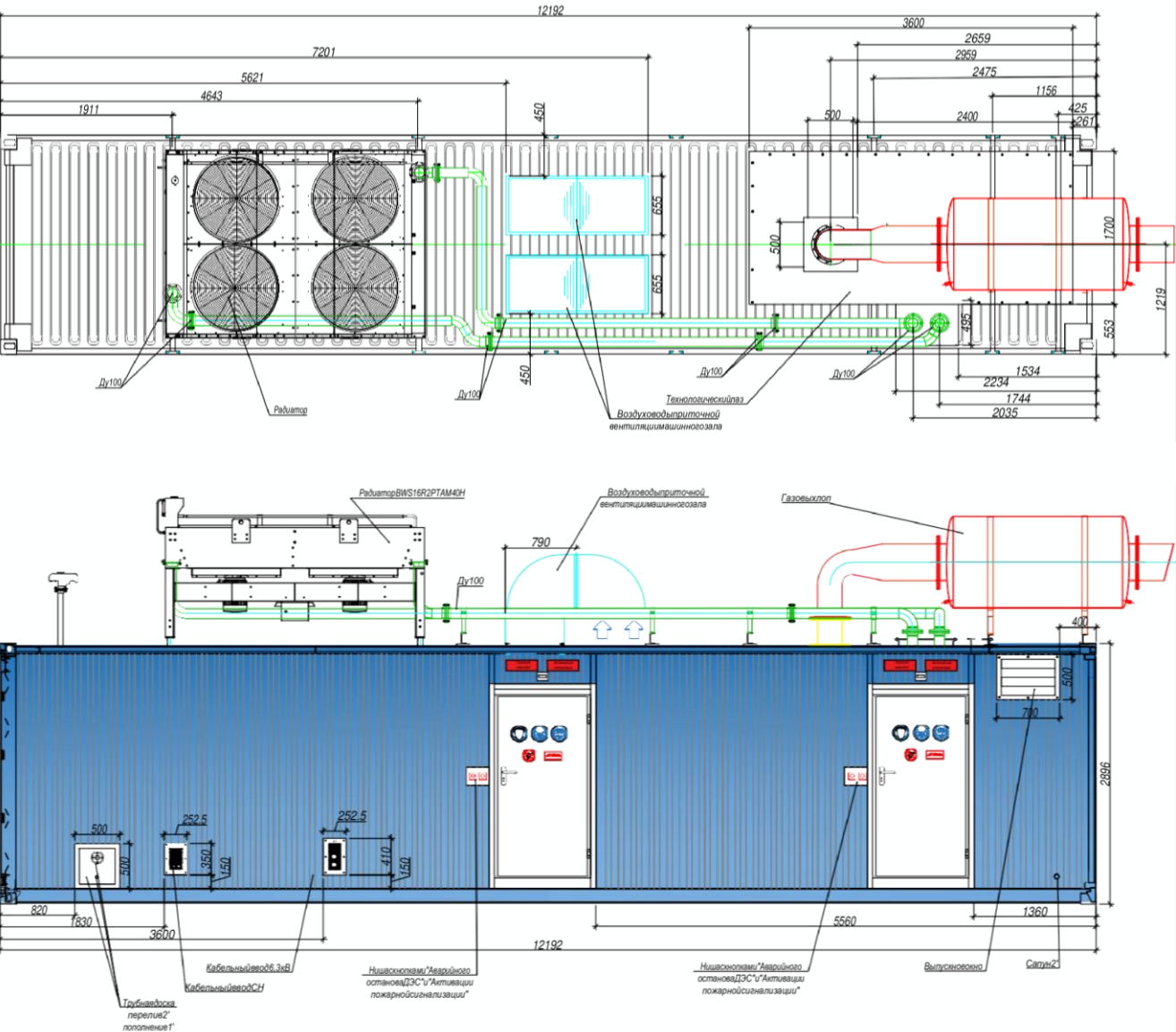
HV Mobile substations

own product



Production localization

Diesel power plant



Our offering

Diesel power plant

own product



Production localization

LV Products



Our offering

LV Molded Case Circuit Breakers - MCCB

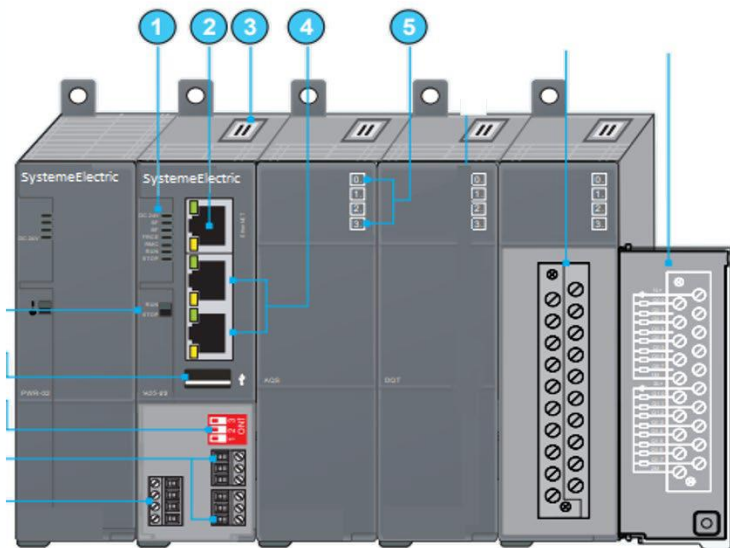
based on license agreement

LV Air Circuit Breakers – ACBs

based on license agreement

PLC Controllers

based on license agreement



Services & Training

Services

TESLA INNOVATIONS provides warranty service of supplied products & systems

Scope of warranty service:

- Repair and/or replacement of failed equipment
- Troubleshooting, Preventive Maintenance

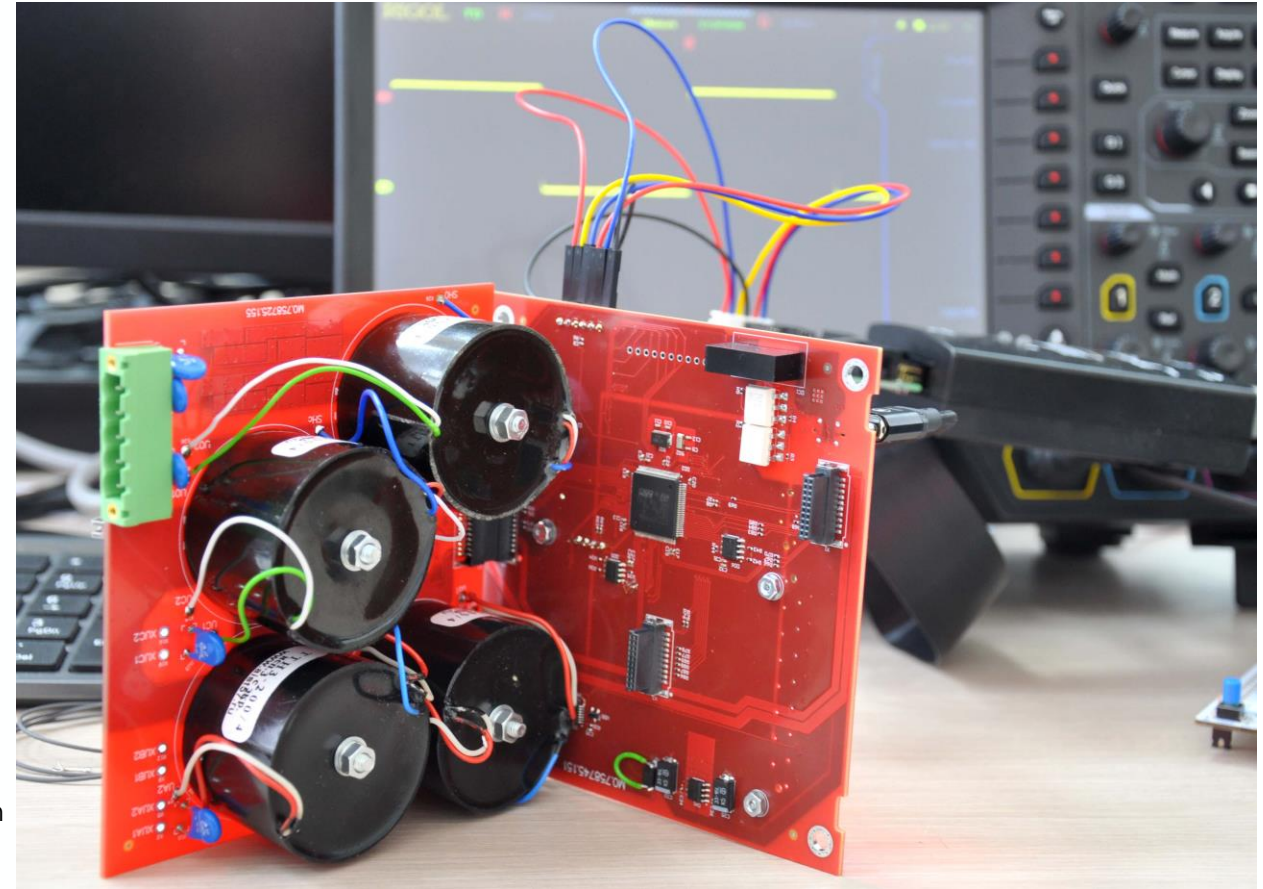
Annual service contracts are custom-tailored to exact customer needs and can include any combination of below proposed services.

Preventive Maintenance Service

It is recommended to schedule preventive maintenance services twice a year – amount of days to be calculated based on installed base of equipment. On average, one service engineer and one technician – 10 days visit twice a year.

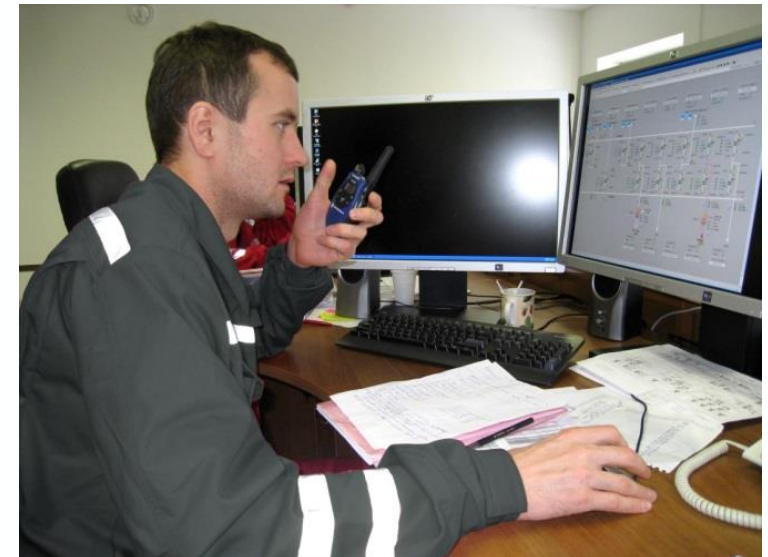
Preventive maintenance service is systematic and structured service concept:

- cost efficient -minimizing maintenance and operational cost (system maintenance rather than component by component repair in a case of component failure);
- consequently minimizing downtime (by reducing risk of system malfunction);
- ensuring full life-cycle and operational capability
- maintenance information could be used as a base of future investment plans;
- performed according to well-ahead schedule maintenance plan rather than responding to sudden emergencies when equipment malfunctions.



Preventive maintenance has the following steps:

- Site Audit/on Site survey (Diagnostics & health check)
 - System component survey
 - Cable survey
 - Insulation survey
 - Communication survey
 - SW survey (Debugging)
 - System's Reports survey
- Maintenance work & repair
- Testing
- Replacing Malfunctioning Equipment (equipment to be provided by customer)
- Upgrading SW License (when available)
- Small Hardware & Software upgrades
- Software releases health check and saving
- Help analyze fault events & support
- Help & Support International Call Center 24/7 during preventive maintenance activity
- Customer training



Emergency Service

It includes visit of one service engineer and one technician for a period of five days each visit.

Spare Parts Support 24/7 (spare parts – short delivery time for Large Customers)

Remote support 24/7 (with on-call duty time engineer)

24/7 Hot line

This service provides 24/7 hotline support by engineer-on duty which will support local customer engineer in trouble-shooting of ongoing problem. This service also has escalation built-in, which means that engineer on duty after unsuccessful troubleshooting attempt escalates problem to expert level and then to R&D level. This service is subject to separate agreement.

Interactive web access and support (working hours)

With the internet availability at substation level or dispatch center level temporary access to the system can be granted to our specialists, who can remotely assist local operation engineers in trouble-shooting & repair.

TESLA INNOVATIONS is ready to arrange an SPTA warehouse for its customers:

- The recommended warehouse contents will be determined individually basing on the failure statistics of the installed equipment
- The entire contents of the warehouse will be the property of the customer

GRID – WIDE AUTOMATION & RELAY PROTECTION monitoring system



Services & Training

Customer Training

TESLA INNOVATIONS runs customer training for full product line:

- Substation Automation
- Medium Voltage Relay Protection
- High Voltage Relay Protection
- Communication Networks
- High Voltage Products

Training is provided by high-profile specialists with vast production experience in micro-processing relay protection and automation equipment, as well as SAS and SMS;

Training program can be changed on customer's request;

Training is usually run with the use of program and technical complex and on the site of the training center of TESLA INNOVATIONS;

If necessary, technical consultation can be provided on the customer's site.

