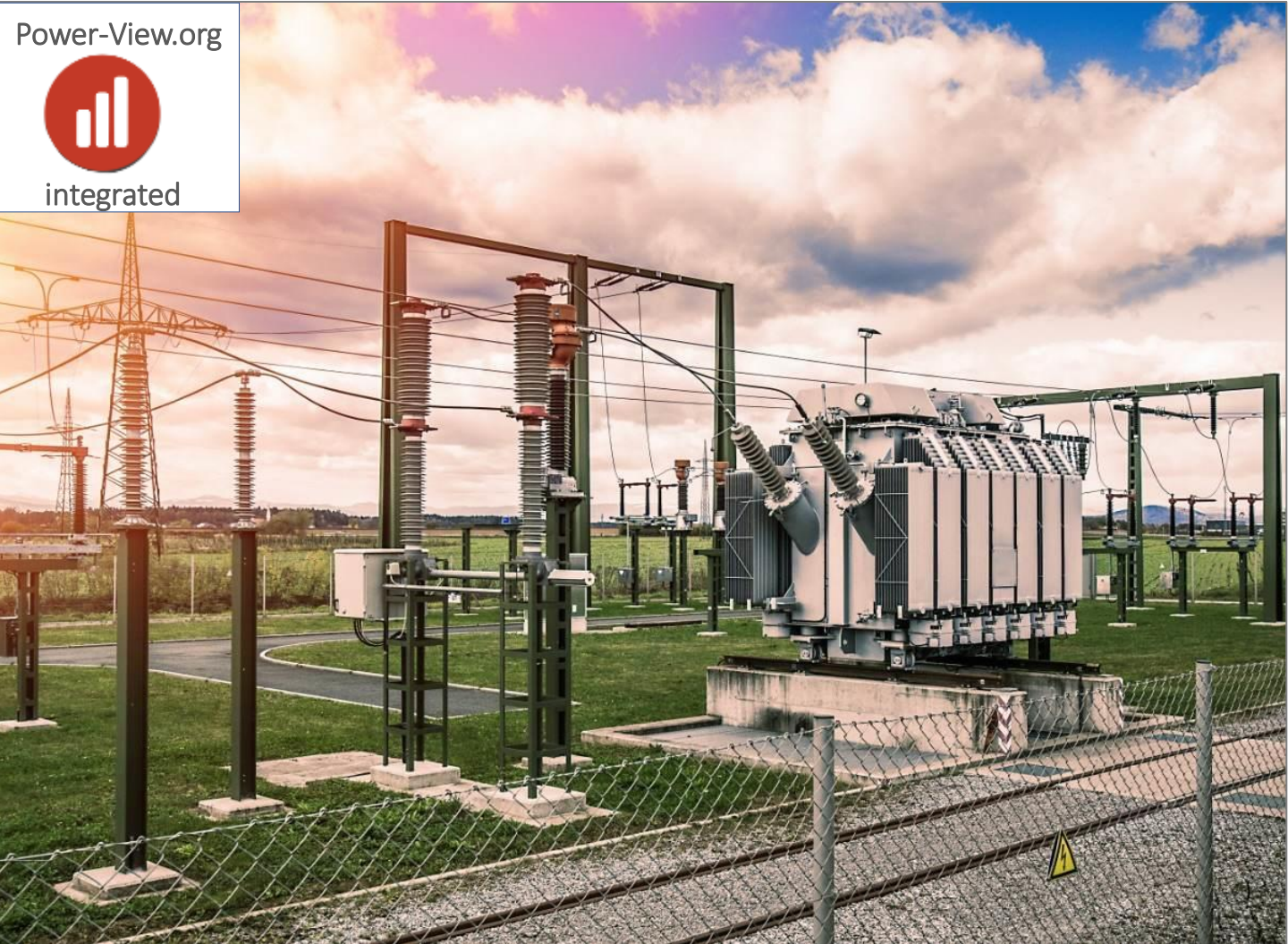


Complex Transformer Monitoring

Immersed tank sensor



www.powerview-energy.com



Pioneering the future of power testing and monitoring

Immersed Tank Hydrogen DGA Sensor

World's fastest response time to fault

Immersed Tank DGA Sensor gives world's fastest fault reaction on key fault gas H₂

Proven Hydrogen monitoring sensor and technology

ABB, SIEMENS, use the identical sensors and measurement technology.

Description

The Immersed Tank Sensor is a DGA monitoring unit. It is capable of monitoring hydrogen, temperature, moisture and oil degradation directly from the transformer tank by permanently mounting on a flange. It has no moving parts (like pumps membranes gears etc. and uses solid state nickel palladium sensor for H₂ measurement. No spare parts maintenance or recalibration are required in the min 15-year lifetime.

Different sensors and technologies

Various types of sensors have been used for Hydrogen monitoring. Some had very limited lifetime (about 5 years due to gel saturation, some had very large cross sensitivity to other gases and drifting results.

Our solid-state Nickel palladium sensor is most widely used today for hydrogen monitoring as it has no requirements for recalibration, no maintenance and spare parts and minimum lifetime of 15 years

The importance of probe type and installation

There are absolutely no limitations and no moving parts (such as membranes and pumps) needed for Immersed Tank Sensor installation. It can be installed on a flange on any transformer valve, and it measures the dissolved hydrogen directly in the transformer tank.

This is the key advantage as the sensor technology requires moderate oil movement for better measurement and fast response. That is why the Power View ITS Monitor has the fastest response to fault development.

No spare parts consumables or recalibration

Absolutely no consumables or spare parts are needed for Immersed tank sensor and diagnostic (all fault gas) DGA.



Fully configurable and field upgradable

This online monitoring system is fully configurable onsite upgradable. Users can start as hydrogen + temperature monitoring as a fault indication unit only

Not all transformers fail. No need for expensive all fault gas DGA on all transformers. Start with key parameters and upgrade only if necessary.

This onsite upgrade is extremely valuable and money saver as Customers can start from fault indication unit and if fault is detected upgrade just the faulty transformer monitoring with fully fault diagnostic (according CIGRE TB783 recommendation).

This monitoring system has no consumable, moving parts, spare parts, parts with a limited-service life (less than 15 years), no need for recalibration.

Why transformers fail

Transformers, like any other equipment, are susceptible to faults caused by the factor of imperfection and premature aging of materials, imperfection in making human errors in maintenance and manipulation. Depending on the value of the transformer, these faults, if not detected on time, develop into more expensive faults (more expensive repair and lost production if the fault is not repaired in early stage).

Yearly maintenance lab DGA addresses only slowly developing faults . Hydrogen is gas which is generated at all transformer faults . Water content also damages the transformer as it reduces the transformer oil breakdown voltage and paper insulation characteristics. Monitoring transformer temperature is also important as 3 deg C increase in temperature above designed temperature reduces the lifetime in half .

DGA background

Dissolved gas analysis for transformer has been used for decades as a reliable tool for indication and prevention serious damage caused by transformer faults. According to international standards for maintenance of transformers- this analysis is mandatory. Dissolved gas analysis (DGA) monitoring is the most powerful tool for transformer early phase fault detection and trending. Proven diagnostic tools (such as Duval triangle and Roger's ration) help determine nature of the fault by analyzing different gas presence.

Gasses formation

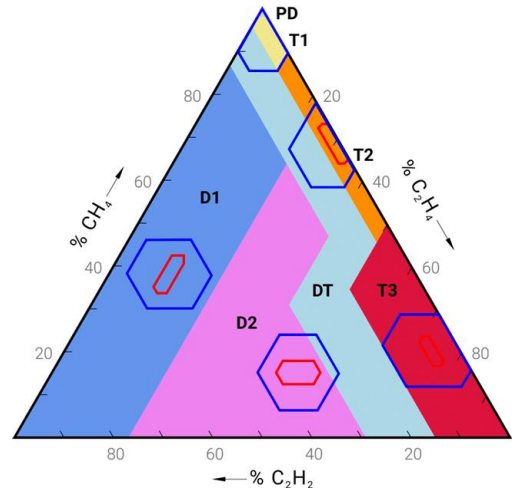
Gases in oil are created by breaking the molecular bonds of oil molecules caused by electrical stress, partial discharges, hot spots, oxidation, decomposition of insulation, etc.). Molecules of insulating oil in high voltage equipment break down under the influence of the thermal and electrical stresses to produce hydro-carbon gases, hydrogen and carbon oxides. According all diagnostic tools and standards there are 7 known fault gasses Hydrogen, Carbon monoxide, Carbon dioxide, Methane, Acetylene ,Ethane Ethylene + nitrogen and oxygen (which are formed due to pour sealing)

Water formation and importance

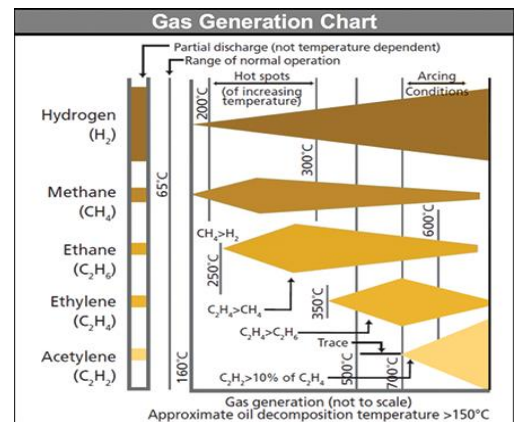
Water can be present in transformers due to pour dehydration in production, inappropriate handling, poor sealing (water ingress), chemical water (which comes as a by product from various chemical reactions of materials).

Oil degradation

Transformer Oils are prone to degradation from electrical stress and various chemical reactions between copper , oxygen , water and particles released from insulation decomposition and different molecular re-bonding . Transformer oil quality is generally assessed by oil laboratory testing .Breakdown voltage which is critically connected to water content tan delta, particles and acidity gives most valuable information in this regard to oil contamination and degradation . Oil degradation is a catalytic process which speeds up snowball effect which leads to sludge formation



Duval triangle



Gases formation at different temperature



Immersed Tank DGA Sensor



Worlds first Field upgradable from single gas to full DGA

Not all transformers fail. No need for expensive all fault gas DGA on all transformers. Start with key parameters and upgrade only if necessary.



Advanced reporting and communication

Most advanced reporting and communication Protocols.

Technical specification

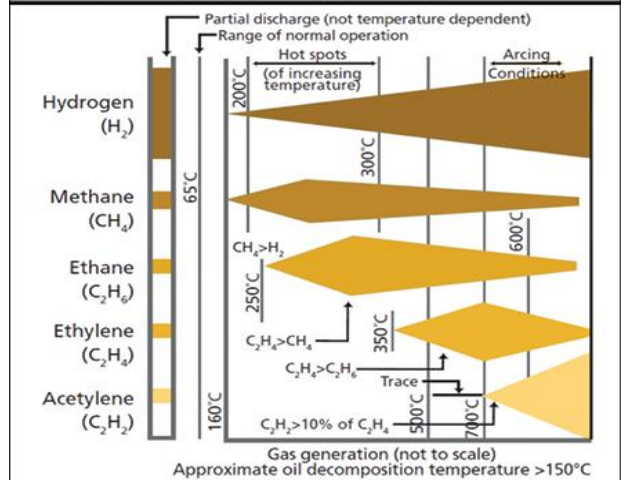
Measurement range (in oil)	0 ... 5000 ppm _v
Accuracy (in oil temperature range)	±10 % of reading or ±25 ppm _v (whichever is greater)
-20 ... +60 °C (-4 ... +140 °F)	
Repeatability	±10 % of reading or ±15 ppm _v (whichever is greater)
Minimum detection limit	25 ppm _v
Typical long-term stability	3 % of reading / year
Cross sensitivity to other gases	< 2 % (CO ₂ , C ₂ H ₂ , C ₂ H ₄ , CO)
Response time	63 % of full response: 2.5 h (when sensor is not in reference cycle) 90 % of full response: 17 h
Warm-up time	2 h, 12 h for full specification
Sensor	Catalytic palladium-nickel alloy film solid-state sensor
Oil type	Mineral oil / Natural ester oil / Synthetic, ester oil
Operating temperature (electronics)	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-40 ... +60 °C (-40 ... +140 °F)
Operating humidity	0 ... 100 %RH, condensing
Pressure tolerance (probe, short-term)	Max. 10 bara
Pressure tolerance (probe, continuous)	Max. 4 bara
Temperature tolerance, sensor head	-40 ... +120 °C (-40 ... +248 °F)
Integrated protection for short power outages	> 3 s
EMC standard EN61326-1, Industrial environment;	Fulfills the requirements of IEC
CISPR22 class B emission limits when DC powered	61000-6-5 in the following tests: IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11, IEC 61000-4-12, IEC 61000-4-16, IEC 61000-4-17.
Communication	Modbus IEC 61850 4 Analog outputs 6 Relays

Oil Humidity Sensor

- Continual condition monitoring of transformer oils
- Relative moisture and temperature
- High pressure rating
- Quick installation via process connection

Application:	mineral oils; synthetic esters; biodegradable oils
Measuring range relative saturation	0-100% RS
Accuracy [%] :	± 3 %
Tank pressure [bar]	50 bar
Oil Medium temperature [°C]	-40...105
Operating voltage [V]	9...33 DC
Current consumption [mA]	< 25 mA

Gas Generation Chart




Comprehensive Risk assessment and diagnostic software

Complete substation maintenance application software with all electrical tests with diagnosis, all inspections and wireless monitoring cloud SCADA with diagnosis for complete reliable HV asset risk assessment

 User editable alarms with log history

 6 individual preset monitoring alarms according international standards

 Automatic diagnostics and test reports

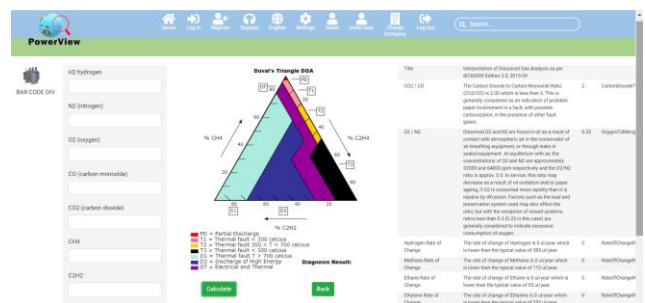


Risk assessment and automated asset Diagnostics

Risk assessment and digitalization of all data includes analysis and manages all substation data such as electrical tests, monitoring, visual and thermal inspections for the most comprehensive asset assessment. It includes trending each individual parameter of the Electrical tests and analyzing the results of electrical tests performed on each element (comparing them with preset editable limits) depending on the element characteristics (like voltage level, type of insulation media etc.). It also includes managing of all other types of inspections and analyzes all the possible monitoring values (and compares to preset editable limits).

Predictive maintenance stands for knowing your high voltage assets condition while it is still in service. Smart substation maintenance is based on smart decisions. Smart decisions are based on individual elements condition holistic evaluation (monitoring electrical tests and other inspections such as thermal and corona). This kind of evaluation of your substation results in asset performance at its optimal maximum with minimum downtime. Comprehensive risk assessment means analyzing all important parameters in advance so actions can be taken at the optimal timing with minimal. repair and downtime costs .

The test reports and inspections data are processing and automatic results analysis is performed with recommendations using artificial intelligence for further tests (if needed) or course actions



Limits

Preset limits are assigned in the software for each element type according International standards (having in mind elements nominal characteristics such as operating voltage, type of insulation, connection type etc.) These limits are automatically assigned to each new element. Users with adequate permissions can edit these limits. There are several million different models (with different limits which can be assigned to an element.





Build your digital substation



QR codes containing all the relevant data for all electrical elements



True Digital Electrical Substation with all existing substation element real electrical test, visual inspection, thermal and corona inspection and monitoring.



Substation Digital is integrated smart substation maintenance web application for digital HV asset management , risk assessment, inspections management , electrical tests management, processing and automated analysis according international standards and records keeping. A wireless maintenance Scada is also integrated in the app capable of connecting more than 1000 existing monitoring devices with alarms distribution . The app also features notification and access management for all elements. Everything can be arranged digitally as existing originally in HV substations. The features are also available as IOS and Android mobile app . The application functionalities are being divided as electrical tests, monitoring , visual, thermal and corona inspection on a cloud platform or on premises installation . This application allows power and big industrial companies to set up a virtual substation, assign authorizations within the company (staff can have different authorizations similar to the ones they have in maintenance such as: upload electrical tests, analyze tests, change limits, connect monitoring devices, analyze monitoring data, upload visual , thermal or corona status, comments and pictures, arrange meetings, edit inspection lists,

SMART decision making

Access for all the relevant information to the relevant people anytime anywhere. This app makes all information related to substation maintenance, inspections and monitoring available on web and mobile app from server access. This helps decision making , records keeping , information availability and ease of access .

Costs reduction

Cost reduction in monitoring installations, and HV assets life extension.

Down time reduction

The system evaluates all the data in a matter of seconds and does the most advanced artificial intelligence analysis and limits comparison to international standards.

The Smart affordable wireless monitoring enables commercially viable monitoring on all relevant parameters on one platform irrelevant of the equipment manufacturer with integrated alarms and notifications with single click and virtual intelligence data evaluation



Cloud digital substation



True Digital Electrical Substation with all existing substation element real electrical test, visual inspection, thermal and corona inspection and monitoring and asset monitoring



Issues history

The first system offering one click specific element data upload, the first system which integrates different parameters (electrical, monitoring, visual ,thermal and corona inspections).

Electrical tests

This software can directly import test reports from existing manufacturers, process the test reports and analyze test results and compare to preset limits against international standards. For each element there is a complete list for all possible electrical tests created according nameplate information (example voltage category , vector group and connections type etc) . All tests are divided depending on importance and the system only trends ones that user actually tests.

Special algorithms do most accurate temperature correction of the results and on import results from test reports. The software automatically compares all test results against international standards recommendations , rate of change limits , testing intervals performs risk assessment and automatically suggests further tests (if necessary)

Results upload permissions are arranged in the most natural way and are editable by account administrator.



Integrated diagnostic tools



Integrated automatic element analysis
And data evaluation



Preset editable lists for visual, thermal and corona and electrical tests



Integrated 3rd party limited or unlimited substation data analysis

TEST REPORTS INTEGRATED Test Instruments whose Test Reports can be imported on the platform

Megger.

TRAX

CPC 100

CHAUVIN ARNOUX

doble

OMICRON

The screenshot displays the PowerView software interface. At the top, there is a navigation bar with icons for Home, Log In, Register, Support, English, Settings, Guest, Invite User, Change Company, and Log Out. A search bar is also present. Below the navigation bar, the main content area is titled "Electrical Tests - Blok 1". It features several panels: "Issues" (List of Past Alarm Trigger Issues, Each Status Change Activates, Event and Gets, Stored as Issue), "Street View" (3D model of a substation), "Bay View" (table of test results), "Summary View" (3D model of a substation), "QR code" (QR code for location tracking), and "Current Position" (3D model of a substation). Below these panels, there is a table of test parameters:

PowerPlan electric tests	Temp	Test Results	Test Field 2	Test Conditions	Value with Temp correction	Trend	Test Files	Alarm Status	Percent in Relation to ROC Alarm	Percent in Relation to Limit Alarm	Test Field 2 Alarm Status	Percent in Relation to ROC Alarm Test Field 2	Percent in Relation to Limit Alarm Test Field 2
	C												

Below the table, there is a "Basic" section with tabs for "Insulation resistance test" and "Polarization index test PI". It includes a "Temp correction" toggle and a "Temp Value" input field. The "HV to LV" section shows a range from 5000 to 5000V. There are also buttons for "Edit Limits", "Apply Test", and "Save Test".



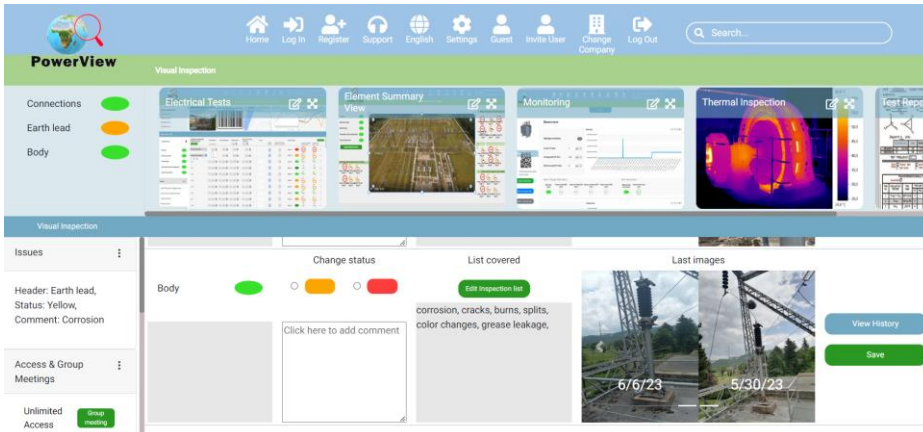
Thermal and corona inspection
 With history, comparison, meeting options, comments, predefined inspection lists and recommendations due, alarming and meeting options .



Mobile application for IOS and Android



Direct thermal pictures upload from existing thermal and corona cameras .



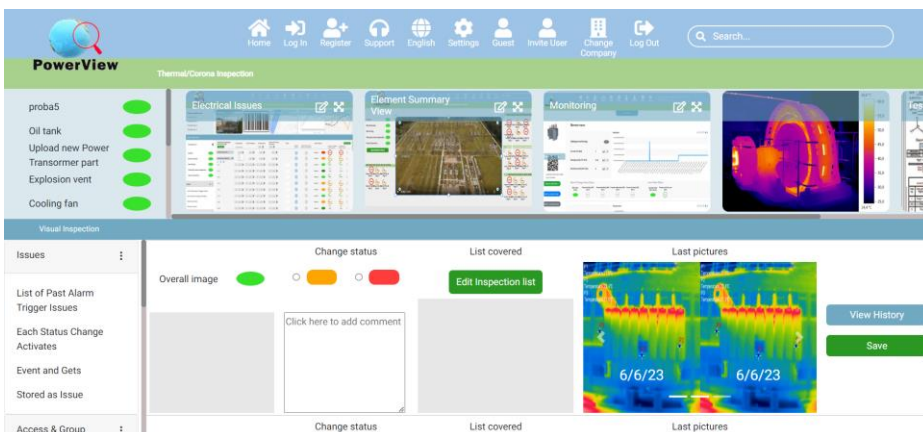
Visual inspection

A smart visual inspection app (integrated into the web app and mobile app) offers users the ability to keep track of visual inspection , and integrate the data into the asset records. With simple QR code scan user can directly upload a picture , change status and report an issue for visual inspection directly from the field . This application has dynamic preset editable list of visual inspections for each particular HV element in relation to it's nameplate (such as voltage level insulation type etc) . There is also help for each inspection which guides operators with suggestions and recommendations.


Thermal and corona inspection


A smart thermal and corona inspection app (integrated into the web and mobile app) offers users the ability to keep track of thermal and corona inspection and integrate the data into the asset records. With simple QR code scan user can directly upload a picture, change status and report an issue for thermal and corona inspection directly from the field.


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 Combined monitoring view on all existing elements

 Simple 3 step monitoring connection in less than 10 minutes

 Monitoring integration of more than 1000 existing monitoring devices from various manufacturers such as ABB, Siemens, Iris POWER, Doble, POWER VIEW with alarms integrated

 Simple notification divided by elements Types , type of inspection , monitoring

 Editable access list and online meeting platform

 Most advanced integrated power grids evaluation monitoring reporting, management and remote support solution

Monitoring

Centralized wireless monitoring, data management alarms and notifications. This feature currently integrates over 1000 different commercially available monitoring units from different manufacturers into the software. The wireless electronic devices communication includes one router which covers the entire substation and reads data from up to 1000 devices installed in the substation (area of several square kilometers).

This dramatically reduces expensive installations from several thousand EUR per unit to several hundred of thousand EUR per unit in terms of shielded cabling, expensive SCADA RTU's, and installation costs and reduces waist.



This software can also integrate and communicate with big number of existing monitoring devices. This was particularly important for users that already have monitoring equipment from different manufacturers. The software was developed in a way which made it possible for them to continue using the equipment that they already use .



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