БО-ЭНЕРГО
СИСТЕМЫ МОНИТОРИНГА

AI-Drone for substations

MULTIPLATFORM SOLUTION:

ARTIFICIAL INTELLIGENCE FOR AUTOMATIC SURVEILLANCE FOR SUBSTATIONS EQUIPMENT FOR DRONE AND STATIONARY SYSTEMS OF VISUAL CONTROL

solution for owners of non-attended substation
and for those who want to use their own substation as it

WHY US?

BO-ENERGO.ASTS is one of the leading enterprises in Russia in the development and implementation of innovative monitoring and diagnostic solutions for assessing the technical condition of substation equipment, turbine generators, electric motors for leading enterprises of the fuel and energy complex of Russia.

AN EXPERIENCE THAT DESERVES TRUST

For more than 19 years the company BO-ENERGO.ASTS has been providing a range of services for the implementation, adjustment and maintenance of diagnostic systems for electrical equipment.
BO-Energo is an active member of the scientific and expert community and participates in CIGRE events in Russia as a co-organizer and technical partner, is involved in the development of industry standards, has implemented and is conducting a number of R&D projects commissioned by the largest Russian fuel and energy companies.

KEY CUSTOMERS

NEW SOLUTION

SPECIALIZED SOFTWARE FOR AUTOMATIC VISUAL CHECKS AND MONITORING BY DRONE

UAVs can provide a safe and effective way for equipment inspections as well as for high-quality data collection for enterprises operating not only in traditional but also in renewable energy sectors.

Automated systems provide utilities with real-time visualization of the substation allowing them to make key decisions designed to prevent outages, save time and reduce costs.

Using UAV with a modern software package **for visual inspections and monitoring of substation equipment** condition in order to prevent events leading to technological disruptions **is more than an industry trend.**

INSPECTIONS AT POWER FACILITIES ARE RISK.
REDUCE THESE RISKS WITH ARTIFICIAL INTELLIGENCE FOR AUTOMATIC SURVEILLANCE FOR SUBSTATIONS EQUIPMENT FOR DRONE AND STATIONARY SYSTEMS OF VISUAL CONTROL

TIME-SAVING

The drone allows to check regularly equipment of the controlled substation at a given speed or in a hovering mode at a waypoint, which provides a significant reduction in inspection time versus traditional ground surveys.

ROUTE AUTOMATION

The flight task, created and saved in the software with reference to photos and thermal images at geographically referenced control points, virtually eliminates the need to use personnel for substation equipment inspections.

QUALITY

High resolution images obtained via the drone while observing equipment indicators can be processed by AI to provide information about technical condition of SS equipment with detailed accuracy.

SAFETY

The use of drone instead of personnel reduces likelihood of incidents and accidents. Trained operators are allowed to operate an industrial UAV and create flight missions in software.

OBJECTIVES

Reduce the role of the human factor. Historically the human factor contributes significantly to amount of incidents and accidents occurring in electric power industry annually and elimination of such factor is a key to improvement

INNOVATIVE SOLUTION

A high-precision UAV operating in automatic mode with an advanced software for analysis and monitoring of substation equipment is the innovation in the world of automated systems

HOW DOES IT WORK?

Proximity technology allows 24/7 remote monitoring of critical assets, providing only alerts to keep the system operating according to a condition-based maintenance program.

- Remote video and audio monitoring of substation equipment;
- Automated inspections to meet site-specific schedules;
- Analysis collected data in order to predict abnormalities leading to utilities failures;
- Notification of any discrepancy in data received from various sources;
- Data collection, processing and storing in automatic mode;
- Control and monitoring of equipment without constant human supervision;
- Reduced time for data processing and subsequent analysis to forecast behavior of the plant;
- Automatically flag/alarm any changes discovered during the inspection.

Flight
Inspection
Data storage
Analysis and display
Recommendations

FLY AND COLLECT

High resolution camera

Infrared camera

NO PERSONNEL REQUIRED FOR AUTOMATIC CHECK

The drone INDEPENDENTLY performs photo, audio and video filming of controlled items of equipment in accordance with the specified flight and transmits data to the server.

The received data is AUTOMATICALLY unloaded from the cloud server to the software package according to the specified algorithm.

The program INDEPENDENTLY analyzes the received data, generates a report on the technical condition and sends notifications when deviations in the indicators are detected.

The program INDEPENDENTLY issues recommendations to personnel for repair or diagnostic work in order to avoid equipment downtime due to a technical problem, thereby providing significant cost savings.

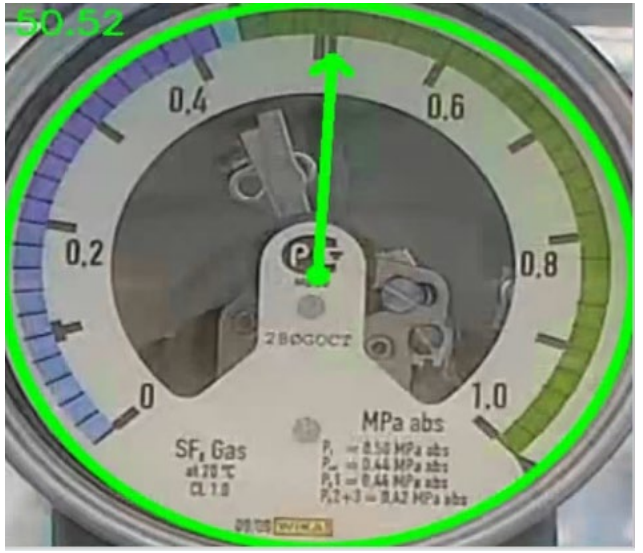
EXCEPTIONAL RECOGNITION METHOD

Computer vision

- Converts into a digital format all data obtained from measuring instruments, color/liquid levels indicators, states of equipment elements etc. based on pictures taken by video cameras;
- photographs of dials and digital instruments are converted into instrument readings in the appropriate units of measurement;
- snapshots of liquid level indicators are converted into a relative value of the liquid level indication so that the range of digital values is between 0 to 1;
- snapshots of position indicators or the actual state of multi-position equipment (for example, switches or disconnectors) are converted into numerical values from 0 to (N-1);
- snapshots of color indicators (for example, the color of silica gel) are converted into percentage values showing the ratio between normal/abnormal so for silica gel indicators - percentage of pink granules in relation to blue.

Infrared vision

- Thermograms are used to determine substation equipment critical hot spots;
- The software analyses the data for each segment and if the values exceed pre-set thresholds generates a corresponding temperature notification;
- AI check the dynamic and will generate the forecast of catch hot spots for the future.



ANALYZE

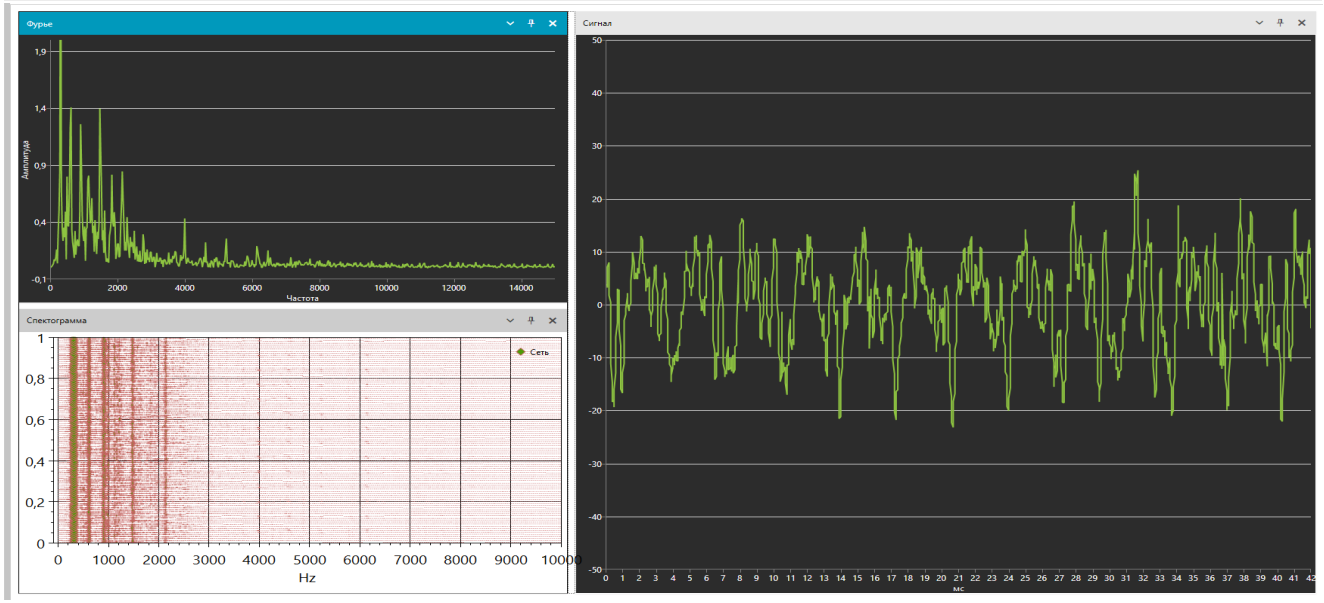
Real-time computer vision including infrared spectrum

- Constant tracking of the measurements within reference values;
- Accurate recognition of the indication including the small-sized instruments. Trend line plotting and prediction. Alarm in case the prediction is out of the reference ranges;
- Online alarm.

Acoustic detection*

- Emerging faults monitoring by means of the acoustic vibration analysis.

  Spectral sound analysis is used to detect abnormal sounds that are characteristic of defects with microphones. For this, the spectrum of the background sound is analyzed, and if the amplitude is exceeded in the frequency ranges typical of the defect, the program issues a corresponding notification.



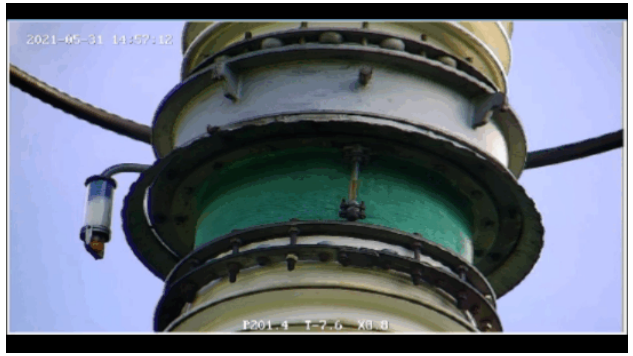
*** option available for stationary visual control and monitoring of substation equipment.**

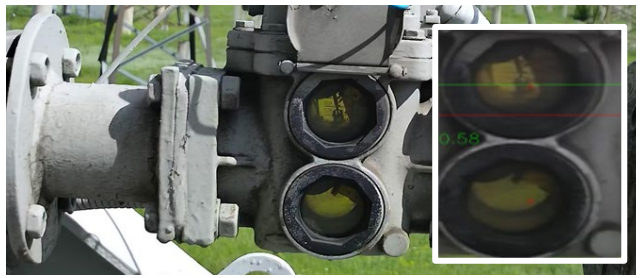
ALTERNATIVE SOLUTION:
STATIONARY SYSTEMS OF VISUAL CONTROL AND MONITORING OF SUBSTATION EQUIPMENT

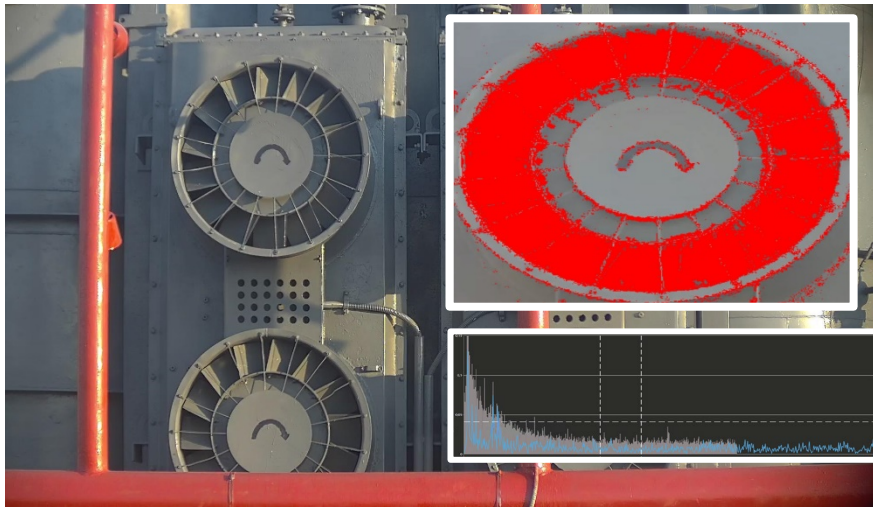
A software and hardware complex for visual control and monitoring of the state of substation equipment in order to prevent the occurrence of technological violations.

Functions:

- Remote video and audio monitoring of Substation equipment;
- Automated inspection of substation equipment according to schedules;
- Automatic data analysis to predict technological disturbances
- Deviations Indicating Violations Notice.
- Storing automatic verification data.







DRONE APPLICATION IN COMPARISON WITH AN ALTERNATIVE SOLUTION FOR VISUAL INSPECTION AND MONITORING OF SUBSTATION EQUIPMENT

Stationary systems for visual inspection and monitoring

Long implementation period:
Research, pre-design and design work is required.

Cost efficiency :
An individual cost varies for each power system object.
The price includes: network device installation costs for the visual control and monitoring software application, the cost of equipment and components, software, personnel training and design work in accordance with company standards and local legal requirements.

Adapted to any weather conditions:
the outdoor design of specialized equipment allows you to minimize the risks arising from adverse meteorological events.

UAV Visual control hardware and software application for monitoring

Ready to use:
does not require any design work and in fact is immediately ready for use on the construction site. Calculation of the electromagnetic environment or equipment using LIDARs is necessary to ensure trouble-free operation.

Cost efficiency :
ROI is faster than that of a full-fledged software and hardware complex of Visual control and monitoring due to the lower cost.

Limited for use in various meteorological conditions:
UAV is applicable only with a limited temperature regime from -20 ... to. + 45 ° and wind no more than 12 m / s. Requires the organization of space for storage and recharging.

Can be used in conjunction with other software and hardware applications for Visual control and monitoring.

THE FIRST IN RUSSIA.

In 2020, in PJSC "Rosseti FGC UES“ developed and introduced into the pilot industrial operation of software and hardware complex of visual inspection and monitoring condition of substation equipment for prevention of technological violations.

In particular, a highly automated monitoring system was installed, which includes thermal, audio and visual control modules, as well as an unmanned aerial vehicle.

PJSC "Rosseti FGC UES“has installed a highly automated monitoring complex at the facility, which includes an unmanned aerial vehicle. It is also equipped with thermal imaging, audio and visual control modules.

The drone camera and thermal imager make it possible to identify defective elements, for example, heating of contact connections, wire damage. All this can be done without lifting the support, which significantly saves time and eliminates the risk of injury to personnel.

The project is aimed at increasing the reliability of the catering center by promptly identifying and eliminating violations.

TECHNICAL REQUIREMENTS

DRONE FEATURES
WHEN USED IN SOFTWARE AND HARDWARE COMPLEX OF VISUAL CONTROL AND MONITORING

- Automatic take-off and landing at a given point and flyby along pre-formed routes with hovering at desired points for photo and video shooting;
- The specialized flight software for assigning photos / videos to a specific piece of equipment;
- In case of error, a flight task is automatically re-generated to re-interrogate the area of concern ;
- Photo and video recording in manual a mode (including in IR spectrum) is available;
- Positioning accuracy (in P mode, with GPS working):
  - Vertical: ± 0.1 m (Downward Vision System On);
  - Horizontal: ± 0.3 m (Downward Vision System on).

MINIMUM REQUIREMENTS
TO THE SERVER FOR INSTALLING THE SOFTWARE

CPU:

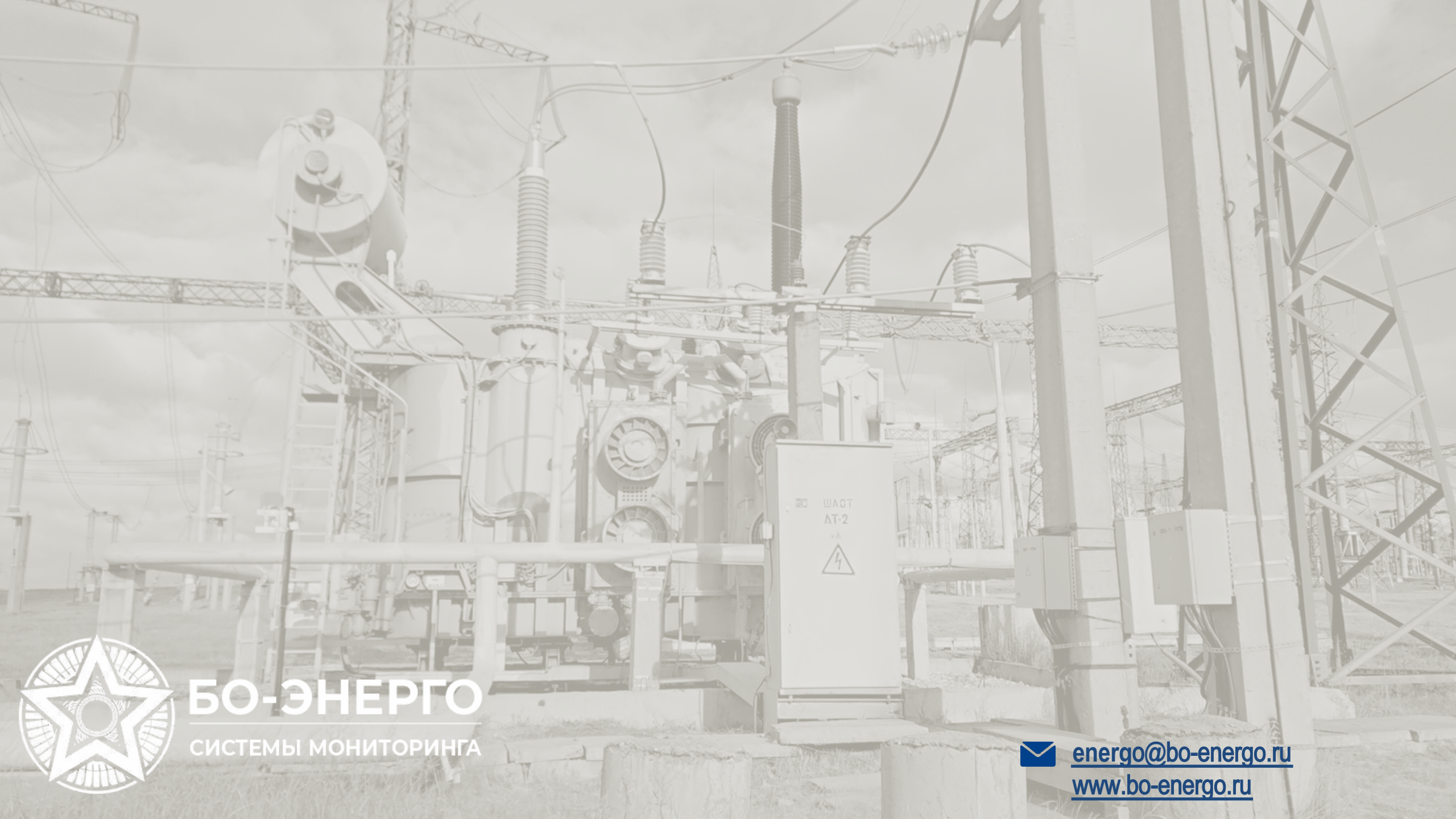
Type	not worse Intel Xeon E-2124 (or analog)
Number of kernel	at least 4
Number of threads	at least 4
CPU Frequency	not less than 3.3 GHz (up to 4.3 GHz with Turbo Boost)
Cash memory	not less than 8 Mb, Intel Smart Cache

RAM:

Type	not worse than DDR4 (or equivalent)
Frequency	not less than 2666 MHz
Bandwidth	not less than 21300 Mb / s
Volume	at least 2x8 GB

Storage:

Type	HDD
Rotating speed	not less than 7200 rpm
Interface	not worse than SATA 6Gbit / s (or equivalent)
Volume	at least 2 TB
Amount	not less than 3



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