

Power Plant Automation Retrofit



Darkhan Thermal Power Plant is a state owned 48MW coal power plant in Mongolia. It provides electricity to the 100,000 residence of Darkhan city and Selenge province. The plant was built in 1963 and consists of four 12MW turbines. Due to its aging, a step by step modernization process is ongoing since 2012. The objective of the renovation is improving its control, as well as increase the total power capacity to 83 MW.

THE PROBLEM

The existing fault recording and automation system is based on Russian equipment that was commissioned in 2002. Additional equipment was required to support the increased capacity, and it was not possible to add it to the existing system due to its age.

The user specified new needs including:

1. Distributed fault registration system (separated IED's)
2. Monitoring and dispatch system with 1-second data update time
3. High accuracy Energy Metering System based on same platform
4. Possibility for analyze fault events waveforms from separate devices on one screen
5. SNTP time synchronization between different IED's
6. Flexible hardware and software solution, with different modules, screens and languages





THE SOLUTION

MSEL (<http://www.msel.mn/>), SATEC's partner in Mongolia and one of the well known company in the Mongolian energy market, who is providing engineering services for 0.4-110kV substations and distribution facilities as well as supplying relay protection, metering, testing equipment and HMI, SCADA system to ensure the reliable operation of energy system under high quality work standards, and focusing on substation and power plant automation. Based on the extensive experience of the well qualified team, MSEL designed and built a first modern system in Mongolia for fault registration, monitoring, control and high accuracy energy metering focusing on the quality and reliability to meet the customer needs. The system incorporates 39 SATEC PM180 devices, 3 Ethernet switches, a DELL server, 5 electrical cabinets, SEL-2488 satellite-synchronized network clock and SEDMAX software.

SEDMAX (sedmax.ru) is an industrial informational and analytical system which can be widely used for local and complex automation purposes in the energy industry, industrial enterprises, manufacturing, etc.

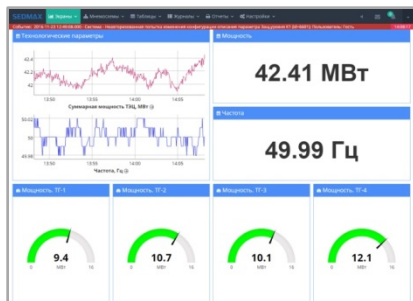
MSEL has built complete five new cabinets with all the equipment. The PM180 included various I/O, as well as DFR (Digital Fault Recorder) module. The DFR module allows simultaneous connection to one device of the measurement CTs and the protection CTs, to provide both revenue grade accurate measurement and $40 \times I_{nom}$ fault recording.

Upon completion of the project, the power station receives in real time all information. This includes measurements through 380 analogue signals, 624 status signals, normal mode currents and fault currents. Also there are 88 additional calculated parameters and 420 various warning events which was set up for immediate user notification about changes in technological process.

MSEL designed the system to operate in both normal and fault situations. In normal operation, it provides high accuracy measurements. This allows calculation of energy consumption of various parts in the station with Class 0.2S accuracy. During fault situations the system performs fault registration for currents up to $40 \times I_{nom}$ and to save long-term waveforms up to 3.5 minutes long each. With zero gap between consecutive logs, there is no practical limit for continuous logging.

On top of the highest energy accuracy standard Class 0.2S, the PM180 provides the highest accuracy standard for measurement and power quality - IEC61000-4-30 Class A. The complete power quality monitoring, based on EN 50160 standard, allows detection of power quality issues and correcting them before they affect the system reliability.

SEDMAX collect the entire real-time measurements, I/O states, waveforms and logs from PM180 via Modbus as well as diagnostic data from server, Ethernet switches and SEL-2488 via SNMP and ICMP. It store data and provide flexible tools for data management and processing. SEDMAX use versatile web-based interface for configuration and data visualization. SEDMAX provide informative system, waveform and event logs which gives full historical overview of the system operation. Furthermore, tens of mimic diagrams were developed for full detailed control of the processes at Darkhan Thermal Power Plant.



Advantages of SATEC PM180

- Multi-purpose device
- Class A accuracy
- $40 \times I_{nom}$ Digital Fault Recording
- Zero gap continuous waveform logging
- EN5016 Power Quality Analysis
- Hot swap digital and analog I/O

The design of the new system is very flexible, allowing the operator to make changes at any time. Changes can be made such as additional monitoring devices (SATEC PM180), more I/O in exiting devices or retrieving additional information from the thousands of different parameter available from each PM180. The PM180 I/O modules can be connected or disconnected while the system is up and running ("hot-swap"), which allows changes to be done without any interruption.

CONCLUSION

SATEC PM180 is multi-purpose device that can replaces several devices. In this case study it was used for revenue metering, power quality analysis, automation controller and digital fault recording. The usage of one device saves space and cost without compromising and quality and performance.

