CASE STUDY

Motor Oil Hellas Corinth Refineries S.A. (MOH)—Agii Theodori, Corinth, Greece

Automated Power Management System—An Economical Approach to Greater Operational Dependability

With industrial, commercial, and governmental power users seeking electric power system reliability and energy efficiencies, collocated electric power generation capabilities (e.g., power islands) are becoming increasingly popular. As the number of individual on-site generators increases, so does the need for more powerful means to monitor and optimize power generation and load management throughout facilities. Automated power management systems with inbuilt technology, such as high-speed load shedding and generation control, are now a proven solution to such needs.

Agii Theodori, Corinth, Greece—Motor Oil Hellas Corinth Refineries S.A. (MOH) is the largest privately held industrial complex in Greece. Headquartered in Maroussi, Greece, the company supplies a full range of petroleum products, including fuels and lubricants, to both domestic and international oil companies. MOH is the only lubricant producer and packager in Greece.

MOH constructed its original electric power production unit in 1984. The company installed a gas turbine power generation system to power operations at the refinery in Agii Theodori (province of Corinth) and to supply electricity to the domestic market. By 2005, the plant grew to include four gas turbine generators, each one a different model. Because of a recent major plant expansion, MOH decided to upgrade its on-site power generation and distribution system. The electrical department, directed by section head Vassilis Viziryiannakis, sought out a power management system to increase reliability of the refinery's electrical network and reduce energy costs.

Refineries have elaborate processing systems, many of which are interconnected. Power outages or interruptions can prove catastrophic, potentially creating large, expensive, and toxic messes.

Figure 1—MOH is the largest privately held industrial complex in Greece and is one of the most modern refineries in Southeast Europe. Because of its flexibility, it can process crude oils of various characteristics and produce a full range of petroleum products. MOH complies with the most stringent international specifications and serves major petroleum marketing companies in Greece and abroad.

"With our old system, based on electromechanical relays, we had slow reaction times to events," explains Viziryiannakis. "Sometimes, we were simply unable to identify what occurred first and why something tripped, since there was no sequence-of-events monitoring or advanced diagnostics available. Also, the old protection system was not very selective or reliable."

He adds that the old MOH power protection system had many different relays, products from many vendors, and several generations of relays, most of which were electromechanical. The array of equipment with old technology made training the maintenance staff a huge problem. Plus, they often did not know if the old relays actually worked.

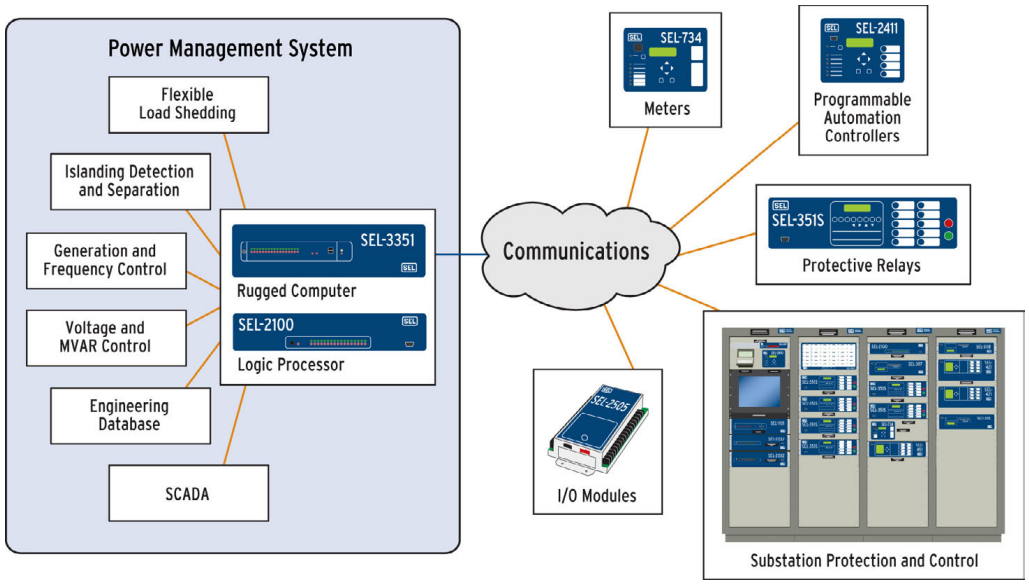

Figure 2—MOH anticipated that upgrading to modern microprocessor-controlled relays would provide the base for a complete power management system. Modern relaying devices offer I/O, programmability, data collection, metering, and power system diagnostics. These capabilities previously required integrating remote terminal units (RTUs), programmable logic controllers (PLCs), digital fault recorders (DFRs), and multiple single-function devices. Reducing device counts and complexities significantly lowers costs and greatly extends power system reliability and automation capabilities.

"One of the primary objectives in upgrading to a complete power management system was to improve our speed and accuracy in finding out exactly what happened to cause a trip or an outage," says Viziryiannakis.

After reviewing the power system requirements, the MOH electrical department selected the SEL POWERMAX™ Power Management and Control System designed and installed by Schweitzer Engineering Laboratories (SEL), based in Pullman, Washington. POWERMAX is the most flexible, robust, cost-effective, and comprehensive system available for power management and control of electrical power systems. The system performs advanced wide-area control using reliable, field-proven SEL hardware devices and universally accepted IEC 61131-3 software programmability.

Figure 3—MOH directed switchgear manufacturers to purchase and install SEL protective relays in new installations.

"Protection systems safeguard expensive power system assets, such as transformers, buses, generators, motors, and switchgear," explains Scott Manson, PE, supervising engineer with SEL.

Comprehensive power management systems include protection and wide-area control systems as well as diagnostic, engineering, visualization, and data archiving tools. "Wide-area control systems used by utilities prevent and mitigate blackouts. Properly tuned wide-area voltage/MVAR control and automatic generation control systems reduce the likelihood of cascading blackouts. When a major disturbance occurs in the power system, a cascading outage is mitigated by load and generation-shedding systems," says Manson. "Diagnostic and engineering tools generally include engineering databases, such as archives for automatically retrieved event reports (oscillography) or detailed Sequential Events Recorder (SER) data. Highly evolved visualization and data archiving tools are integrated into asset management tools to provide sophisticated functions, such as continuous monitoring of breaker wear, motor degradation, or accumulated through-fault current in transformers."

Figure 4—For an economical, high-speed retrofit, MOH abandoned the existing protection and metering, and installed new SEL relays in the switchgear.

Figure 5—SEL relays protect all MOH's major electrical system assets.

Manson adds that MOH's POWERMAX system manages all major power system assets with advanced built-in control and monitoring to increase system uptime.

"For example, SEL provided a suite of advanced algorithms to help the MOH power system survive local utility outages," says Manson. "Those algorithms proactively control generators, transformers, motors, loads, and capacitors. The diagnostic and reporting tools in the POWERMAX system allow the MOH electrical department to be proactive in their maintenance program. They actively monitor the status of all critical equipment, thereby minimizing unscheduled process downtimes."

Manson adds that fault-tolerant design principles in POWERMAX wide-area control systems greatly enhance power system reliability. For example, self-healing data selection enables high-speed load shedding that selects an alternative load to shed if the algorithm cannot verify the status of the first-choice load.

Figure 6—Ultrahigh-speed, remote-mounted I/O modules were installed throughout the plant for the SEL POWERMAX load-shedding system. These control (DIP) switch-configured I/O modules have trip-rated output contacts, devoted communications, on-board power supplies, and full self-monitoring for the utmost reliability.

SEL coordinated the design and installation with PROTASIS, a local representative. PROTASIS provided protective relay settings that worked seamlessly with the POWERMAX system.

Prior to installation, SEL fully simulated the MOH power management system in SEL's model power systems laboratory. The simulation included a full RTDS® (Real Time Digital Simulator). Because of thorough upfront testing, no misoperations occurred during the commissioning of the 70,000-tag system. "Commissioning the load-shedding system was a matter of verifying the customer's wiring and turning the system on," says Manson.

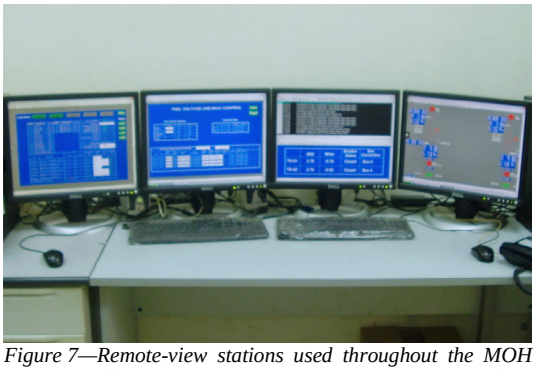

Figure 7—Remote-view stations used throughout the MOH plant allow for continuous visualization and diagnostics of the entire system.

"With the new complete package of integrated protection and monitoring, we have made significant progress toward improving the reliability of our electrical distribution system," says Viziryiannakis. "The system is much better now. We have standardized on a few prod-

ucts from SEL, reducing our training problems. We also now truly know that our protection is always working. We know, for example, that the new POWERMAX system has several times helped us avoid losses of major transformers and motors."

Viziryiannakis is very pleased that the SEL POWERMAX solution is an open system, which has allowed MOH to expand and change the system since installation in 2004.

"We also appreciate that we can make the modifications ourselves," he says. "This was not expected, since none of SEL's competitors could offer such a feature."

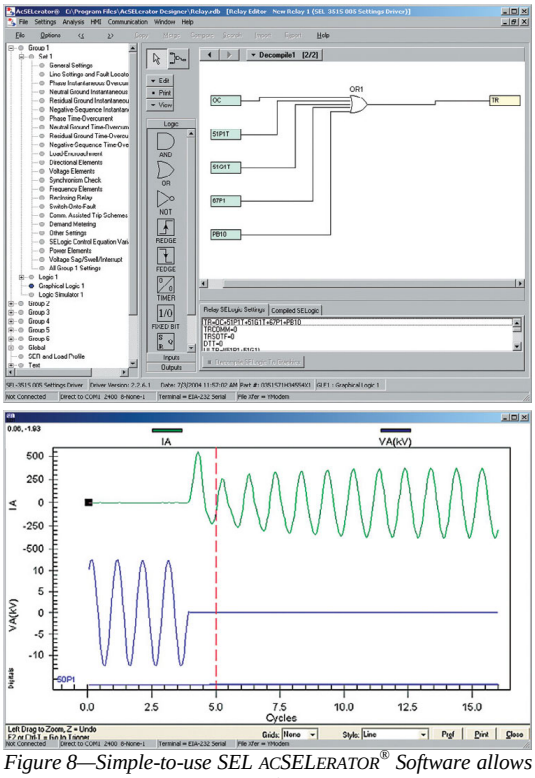

Figure 8—Simple-to-use SEL ACSELERATOR® Software allows engineers to maintain settings for all the protective relays at MOH.

About MOH

Headquartered in Maroussi, Greece, MOH supplies a full range of petroleum products to domestic and international oil companies. The company produces and processes gasoline, light diesel, illuminating kerosene, fuel oil, heating gas oil, basic and final lubricants, mineral oils, and other petroleum products. It also purchases, stores, transports, and distributes crude oil, petroleum products, hydrocarbons, minerals, ores, chemicals, and byproducts. MOH is the only lubricant producer and packager in Greece. For more information, visit the MOH website at www.moh.gr, or contact MOH by phone: +30 (210) 809-4000; fax: +30 (210) 809-4444; email: viziryvz@moh.gr; or mail: 12A Irodou Attikou St., 151 24, Maroussi, Greece.

About SEL

SEL has been making electric power safer, more reliable, and more economical since 1984. This ISO 9001:2000-certified company serves the electric power industry worldwide through the design, manufacture, supply, and support of products and services for power system protection, control, and monitoring. For more information, visit www.selinc.com, or contact SEL by phone: +1 (509) 332-1890; fax: +1 (509) 332-7990; or mail: 2350 NE Hopkins Court, Pullman, WA 99163, USA.

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