

**CONTROL, PROTECTION
& SCADA UPGRADE**

PAGNI HOSPITAL

**EMERGENCY GENERATORS
SYSTEM UPGRADE**

CASE STUDY



**Advanced Power Management
Control, Protection & Monitoring
SOLUTIONS**



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The Problem

PAGNI Hospital relied on its emergency diesel generator system to secure backup power availability for critical hospital operations. However, the existing system presented serious reliability, control and visibility limitations, creating risk for the hospital's emergency power infrastructure.

The generators occasionally started without an actual blackout event, while in more critical cases they failed to start after mains power failure. The system also suffered from poor voltage and frequency control, lack of load sharing between the two generator sets and obsolete analogue control cards, limiting stability, maintainability and response under transient load conditions.

In addition, the system could not support the integration of a new generator capable of operating in parallel and sharing load with the installed units. It also lacked automated sub-load rejection under generator overload, meaning there was no structured way to reduce non-essential hospital loads and protect critical consumers.

Finally, the absence of data recording, adequate monitoring and alarm annunciation limited operator visibility and made incident investigation difficult.





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The Solution

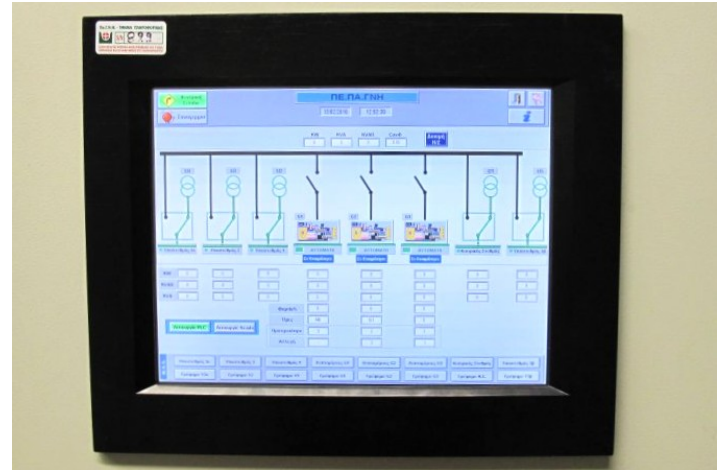
MAS delivered a complete emergency generator control and monitoring upgrade to improve the reliability, stability and operational visibility of the hospital's backup power system.

The solution combined advanced Woodward diesel generator controllers for the existing generators and the additional generator installed in a second phase, enabling parallel generator operation, load sharing, precise voltage and frequency control and future generator expansion.

MAS also replaced the old relay-based automation with a modern PLC system managing transitions between mains power and the emergency bus, with integrated data and alarm logging for improved supervision and incident analysis.

To protect the system under overload conditions, MAS implemented sub-load rejection, automatically disconnecting non-essential consumers to keep demand within generator capacity and safeguard critical hospital loads.

The upgrade also included high-accuracy network analysers at the main hospital substations and a dedicated HMI/SCADA application for remote monitoring, event logging and operator visibility. Communication between the generator controllers, PLC and network analysers was implemented through Modbus protocol, with secure remote access from multiple hospital workstations.



Scope of Works Undertaken

MAS delivered the full engineering and implementation scope, including:

- Assessment of the existing emergency diesel generator control system
- Replacement of obsolete analogue control cards with modern generator control technology
- Installation and configuration of Woodward diesel generator controllers
- Upgrade of the existing relay automation with a modern PLC-based control system
- Development of transition logic between mains power and emergency bus operation
- Implementation of generator load sharing capability
- Integration capability for an additional generator set
- Development of sub-load rejection logic for overload protection
- Installation of high-accuracy network analysers at the hospital's main substations
- HMI/SCADA development for remote monitoring, alarm display and data logging
- Modbus communication between generator controllers, PLC and network analysers
- Remote access configuration with security levels for hospital workstations
- Commissioning, testing and validation of the upgraded emergency power system



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Main System Functionalities

The upgraded emergency generator system included:

- Automatic generators start and stop control during mains failure and restoration
- Reliable transition from mains power to emergency bus and vice versa
- Precise voltage and frequency control of diesel generator sets
- Load sharing between the installed generator units
- Capability to integrate additional diesel generators operating in parallel
- Sub-load rejection to protect the system under overload conditions
- Monitoring of electrical parameters across the emergency electrical system
- Alarm annunciation and event logging through the HMI/SCADA platform
- Remote monitoring from hospital workstations through secure access levels
- Modbus-based communication between field controllers, PLC and monitoring devices
- Historical data recording to support incident investigation and system diagnostics



Testing, Validation & Commissioning

The upgraded system was commissioned to validate correct operation of the emergency power system under the new control and monitoring architecture.

Key validation activities included the verification of generator control behaviour, voltage and frequency regulation, load sharing performance, transition logic between mains and emergency operation, sub-load rejection functionality and communication with network analysers and SCADA workstations.

The HMI/SCADA environment was also validated to ensure that operators could access generator information, alarms, electrical measurements and historical data in a structured and user-friendly way.



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The Result

The upgrade delivered a more reliable, stable and visible emergency generator system for PAGNI Hospital.

The use of modern generator controllers improved the availability of the emergency diesel generator system and supported more precise voltage and frequency control. The improved control architecture also enhanced system behaviour during transient load demand and enabled the addition of one or more diesel generators capable of running in parallel with the existing units.

The introduction of sub-load rejection improved system stability under overload conditions by automatically reducing non-essential demand and protecting the emergency power system.

The installation of network analysers and HMI/SCADA monitoring enabled electrical data recording across the emergency electrical system, providing the hospital with a clearer understanding of system behaviour and the ability to investigate incidents more effectively.



MAS SA is one of the few engineering companies in Europe specializing in the upgrade, design, development and installation of advanced power management control, protection and monitoring systems.

Covering a wide area of expertise for over **50 years**, we **provide solutions for complex problems** both in the Industry of **Marine**, as well as in the Industry on **Land** (Power, Oil & Gas and Heavy industry).

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Remote access to the HMI application from more than six hospital workstations improved operational visibility and enabled authorised users to monitor the emergency power system from different points within the hospital network.

Key results included:

- Higher availability of the emergency diesel generator system
- Improved voltage and frequency control
- Improved response to transient load demand
- Load sharing capability between generator sets
- Load sharing capability between generator sets
- Improved system stability through sub-load rejection under overload conditions
- Electrical data monitoring and recording across the emergency electrical system
- Improved alarm annunciation and incident investigation capability
- User-friendly HMI application with remote access from more than six hospital