INDUSTRIAL SUPERVISION

A truly "wired" hospital center

In order to modernize its facilities and be prepared for possible power shortages, the Bordeaux CHU teaching hospital issued a call for tenders to overhaul all its electrical plant and equipment. The project, carried out by the Ineo-Suez group, resulted in the creation of a secure, redundant power supply system. The fully-automated system is supervised by Panorama. This software from Codra both enables the surveillance of the hospital facilities and improves power consumption management.

The city of Bordeaux has the 4th largest hospital network in France with 13,600 employees at 3 different sites.

With over 1,500 beds and a site sprawling over more than 30 hectares (75 acres), The Pellegrin Hospital Group is the largest of the Centres Hospitaliers Universitaires (CHU, or teaching hospitals) in the city of Bordeaux. It is truly a "city within a city".

This enormous infrastructure could never survive without its technical services. We would not go so far as to say that the technical engineering services are the hospital's pride and joy. Yet they do command a level of respect envied by many of their industrial counterparts who are often under pressure or even threatened with outsourcing. These men in the shadows -- for the patients never see them -- total 119 of the CHU's 6,600 employees.

The diversity of the trades they represent is truly emence. Electricians, carpenters, engineers, masons, foremen, mechanics, medical gas specialists, IT experts, heating engineers, plumbers: the range of job profiles in hospitals is broader than in any other institution or industry. Some of those positions are better represented than others of course. For instance the R&D department includes a staff of 18, while no fewer than 100 people work on facilities maintenance. The buildings -- dating from the 1970s -- are beginning to show their age. That is why a vast project was undertaken in 1992 to bring the hospital up to standard. This is an expensive, long-term operation: renovation projects are scheduled through to 2012. Several projects are underway to improve the management of IT networks, operating rooms, specialized equipment (MRI, scanners, etc.), patient call buttons located next to beds, and access control. All the work regarding the high-voltage power distribution has been completed. This was a top priority: everything runs on electricity, and patients in the intensive care unit would have difficulty with an extended power outage. Although it did not have any dramatic consequences, the 1998 blackout at the Édouard-Herriot Hospital in Lyon caused quite a stir and served as a warning to the public authorities. Today patients are more dependent than ever on a continuous supply of power and it would be unacceptable to have another power failure in a French hospital.

Key points

- The Aquitaine branch office of Ineo-Suez has managed a successful project for renovating and improving the reliability of the power supply circuits at the Pellegrin CHU teaching hospital in Bordeaux.
- The equipment includes two redundant high voltage power supplies, four power plants, and automatic load shedding in case of a serious power outage.
- A supervision system -- based on Panorama from French software developer Codra -- not only controls power distribution but also monitors all the equipment and parameters of the hospital complex.

A “simple” but critical application

The renovation project for the electrical system was awarded to Ineo - Suez, whose local branch office Ineo Aquitaine is an important player in the region -- it was chosen to build the Bordeaux tramway. New high-voltage (HV) lines from EDF, the electrical supplier, were set up quickly.

Views of the SCADA system application illustrating, from left to right and top to bottom: the program's home page, power plant management, a schematic of the hospital's high-voltage power supply, a schematic of the power transformation units, and boiler monitoring.

Ineo technicians installed four powerful diesel generators, uninterruptible power supplies, and medium voltage - low voltage (MVLV) power transformers. The challenge was to install all the connections transparently and continuously without ever interrupting the hospital's power supply. All these new facilities are controlled by PLCs, in turn managed by two Schneider Quantum redundant PLCs. This solution enables excellent responsiveness:
normally only one of the two high-voltage lines are used. But in case the of an outage, the system can switch to the other line in just seven tenths of a second. The power generators supply the hospital in the case of a failure of both input lines -- the generators switch in just 13 seconds -- as well as during "EJP" (peak day clearing) days during the year. *"We have subscribed to this EDF service which consists in paying less for your electricity in exchange for consuming as little as possible a few days a year,"* said Alain Guttmann, Sub-Division Engineer at the Pellegrin CHU. *This represents significant savings for the CHU, particularly considering its overall energy consumption, averaging 30 gigawatt-hours of electricity per year".* The hospital has planned for the possible failure of the diesel generators, of course. If only two of the four generators were producing electricity, then the power supply would be insufficient. Alain Hanen, Department Head and Project Manager at Ineo Aquitaine, explained that "under extreme circumstances, a *"load shedding" process kicks in. Coordinated by the PLCs, it gradually shuts down all the hospital's non-critical equipment."*

Redundancy is everywhere in the hospital's facilities, and the electrical system is a good example. ➔

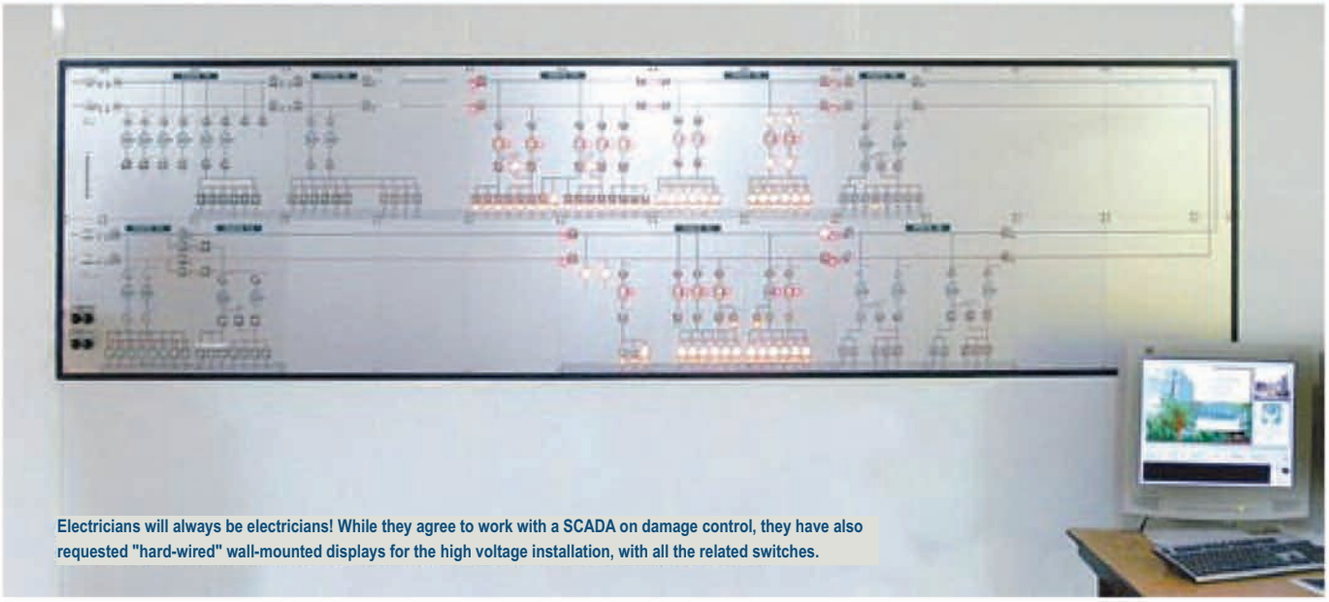
Ineo Aquitaine

The Ineo-Suez Group was created following the May 2001 merger of three firms specializing in electrical work: VDEI, GTMH, and SEEE. In less than a decade Ineo-Suez has become a key player in project management in France, mainly as an integrator of electrical solutions and information and communications systems. Today Ineo-Suez has nearly 300 sites in France, and 13,500 employees. In 2006 the group reported revenue of €1.5 billion.

The Ineo office based in Pessac in the Gironde region of France (33) has a workforce of 120. Very active in the Aquitaine region, the branch office's projects include waste processing facilities, electricity production via wind turbines, universities, urban transportation infrastructures, military buildings, and projects in the chemicals and pharmaceutical industries. For many customers -- as for the Pellegrin CHU -- Ineo Aquitaine offers turnkey solutions, from design and engineering to operations and maintenance, not to mention overseeing building sites.

The history of the Pessac branch office is closely tied to that of the hospital. *"We began working together in the 1970s with the big surge in hospital construction, and have continued ever since,"* said Alain Hanen, Department Head for Ineo Aquitaine. *"Hospital administrators clearly appreciate our reliability and above all the availability provided by a large corporation like Ineo-Suez."*

The Pellegrin CHU renovation project includes a three-year maintenance contract between Ineo and the hospital administrators for the repair and upkeep of equipment, as well as 24/7 availability of on-call personnel. Ineo-Suez has the rare capacity of keeping agents available -- either on- or off-site -- and guaranteeing intervention within 30 minutes of a failure or an incident. The company can also send a team of up to 25 people to the site in case of a serious crisis.



Electricians will always be electricians! While they agree to work with a SCADA on damage control, they have also requested "hard-wired" wall-mounted displays for the high voltage installation, with all the related switches.

➔ The high-voltage power supply is duplicated throughout the system: two lines run through all the power transformation units. While providing additional security, this does not simplify
the installation. Each transformer must be connected to PLCs which switch them to one of the two power supplies. Similarly, all of the main PLCs are duplicated and Ineo - Suez technicians have set up different motor control loops for managing the high voltage lines (switching between lines and the load shedding process) and for the building management system. This system provides both alarm management and reports problems such as failures in the production of medical gases, disconnections, or unauthorized access. Overall, 11 HV PLCs have been installed and a further 10 PLCs for the building management system.

A special network for the SCADA

This project, designed to carefully control power distribution and consumption, required the use of SCADA software. The hospital managers chose Panorama from the French company Codra. For Olivier Guttierez, Manager of Codra's Southwest branch office, this was a natural choice. *"We were competing against other SCADA Products," he said, "but our strong references, along with the ability of Panorama to manage a large number of variables, were both deciding factors."* We should point out that for this power network SCADA application, the software -- developed originally for France's Atomic Energy Authority -- handles over 5,600 variables. It was set up by Ineo Aquitaine technicians. Two redundant servers were installed specifically for the application and located in different buildings in order to secure the SCADA system. Four powerful client workstations -- dedicated exclusively to SCADA and always accessible -- were added to the supervision rooms both in the power plant and in damage control headquarters. A Web server was also set up to enable all of the hospital's IT workstations to become thin clients for the SCADA (Supervisory Control And Data Acquisition) system, if necessary. At the Pellegrin CHU, this represents no fewer than 4,000 workstations. In other words, maintenance technicians can access the SCADA data from almost any room in the hospital.

Finally, this new network dedicated exclusively to centralized PLD management exclusively uses fibre optic cabling. Alain Hanen explains this choice with two reasons. "First of all, network cabling was part of project for renovating the high voltage power supply. This meant we had to run cables alongside the HV lines, which prevented the use of copper twisted pairs. Moreover the network architecture itself, involving over three kilometers (3300 yards) of intermingling loops, favored electromagnetic disturbance which would have made the entire network unstable". Under those conditions, fibre optics were clearly the best solution.

Complete data archiving

The Codra software manages several types of data. First, users can view all the parameters related to the water supply network. Various pages provide animated views of the boilers and their immediate temperatures, as well as temperatures measured in the hot and cold water circuits. Other menus offer network surveillance for all the medical gases required by physicians: oxygen, air, vacuum, etc.
Furthermore, all of the site's alarms are forwarded to the central server.

Key figures for the application

The Pellegrin CHU

- Power consumption: 30 GWh per year
- Gas consumption: 44 GWh per year for hot water
- Visitors: 22,000 vehicles per year on average

Electrical equipment

- 2 high-voltage lines duplicated all the way to the final electrical panels
- 11 PLCs for high voltage distribution
- 10 PLCs for the building management system
- Redundant power transformation units
- 1,500 measurement points forwarded for supervision

The Pellegrin CHU

- 5,600 variables managed
- 2 redundant servers
- 4 client workstations, 1 Web server, and up to 4,000 thin clients
- 3 kilometers (3300 yards) of fibre optic cables

Administrators can disable the display of certain types of alarms according to the user profile so as not to overload the screen or unnecessarily panic certain categories of employees. While a technician can keep a level head when alarms accumulate on the screen, an untrained employee might panic and alert the on-call staff. Finally, a search menu gives access to any type of event through various search criteria: text, time or date, alarm, business data, or electrical station number. *"All the SCADA data is fully archived,"* said FrançoisBournet, who manages maintenance and automation at the CHU, *"so it is possible to access all the temperatures and pressures at any point in time since the SCADA system has been in use".* Alain Guttmann said that "traceability has become vitalfor managing hospital facilities. By archiving all of these parameters we can provide proof were an incident to give rise to litigation."

For now, only the data regarding the electrical circuits can be modified (as they were installed recently).

Four such diesel engines provide power to the CHU during "EJP" (peak day clearing) days; they take over in case of a power outage.

The other parameters are merely monitored and archived. For instance, it is not yet possible to increase the temperature in a boiler, shut down certain access points, or adjust the pres-sure of an oxygen circuit. But projects are being studied, and the long-term goal is to be able to modify all the building management parameters from the SCADA terminals. Regarding the electrical power system which served as the "pilot" module for the SCADA system, results are very satisfactory. The PLCs installed on each high-voltage line and on the low voltage panels are connected to Panorama and can be remotely controlled. This is mainly done for load shedding operations, which are very difficult to perform manually and which, by definition, must be done urgently.

The software is much faster than a human operator in identifying non-critical devices using large amounts of electricity. And as all the data regarding immediate consumption of equipment, services, and buildings is forwarded to the SCADA workstations, the operators can fine-tune the hospital's overall power consumption, thereby saving considerable amounts of electricity.

Frédéric Parisot