Green field water-treatment plant harnesses the power, scalability and flexibility of the PlantPAx distributed control solution

Industry-proven process control solution coupled to off-the-shelf hardware creates model architecture for this and future applications

Challenge
AB Electric was tasked with developing and deploying a state-of-the-art process control solution at a four-site Greenfield water treatment plant in Denmark, with connection to a central control room. Power consumption optimisation was another important part of the brief.

Solutions
A Rockwell Automation PlantPAx solution was installed, which included:
- Process automation controllers
- Distributed I/O
- Variable-frequency drives
- EtherNet/IP, fibre-optic, internet and integration of third party devices/protocols
- Stratix switches and routers
- PlantPAx operator workstations with advanced diagnostics
- 19 inch integrated stainless steel panel computers
- WIN-911 remote-alarming platform

Results
- Robust process control solution exploiting off-the-shelf hardware
- Highly scalable and highly flexible for future expansion
- Strong scalable foundation for other water industry projects
- Performance, cost, reliability and time objective all successfully met

Background
In a recent green field clean water treatment project in Denmark, Danish system integrator AB Electric A/S was tasked with developing and installing a comprehensive control and monitoring solution for a facility spread over several sites and locations that are kilometres apart.

The resulting implementation of a PlantPAx® Distributed Control System from Rockwell Automation – controlling off-the-shelf process automation products – is set to define the footprint for future installations by AB Electric. This is due to its wider in-depth integration, including safety and access control, the flexibility and scalability of PlantPAx and the free availability of the process library

Challenge
Founded in 1980, AB Electric evolved from a traditional electrical installation company to one that now delivers full electrical, automation and process control solutions – with private and business customers in Denmark and abroad.

Its customer’s green field clean water treatment project had no existing application to use as a reference, so the entire control strategy and system had to be developed from scratch. The customer also requested secure...
real-time communication between several sites/locations, full access control, a fully featured monitoring & control centre and applicable alarming on mobile devices. The solution had to interface with multiple third-party devices too, resulting in a mixture of communication protocols that needed to feed data into the control centre.

The total amount of consumers in the catchment area for the plant is 2,400, with a daily water usage of some 700 m$^3$. When in operation, raw water is pumped at the main location from a depth of approximately 7 to 12 m and is passed through a filter system to clean out impurities. This filter system comprises four stainless steel tanks, inside of which is a mixture of stones and a very specific sand material customized in accordance to the desired water quality. Elements removed in the filtration process include nitrites, chlorides, fluoride, iron, manganese and ammonia.

Following filtration, oxygen is added to initiate a chemical reaction before the water is fed to one of two consumer tanks using two feed lines, each equipped with five pumps, which are operated in accordance to the defined pressure settings in the pressure parameters set on the operator workstations (OWS) of the control centre. The installation has three additional locations, two with only consumer pumping systems – including consumer tanks – and one with raw water and an open-filter system.

The four locations are connected, but due to height differences in the terrain, it is a matter of calculating which site is most beneficial to use throughout the day based on the cost and volume of water required. The main site could actually supply all consumers by itself, but this may not work out to be the most efficient method during certain demand periods. The way the system is designed helps assure a very high security of supply and the environment also benefits through the use of sustainable energy production due to the deployment of solar panels.

“The highly effective co-operation between AB Electric and Rockwell Automation resulted in a much smoother development process.”

**Solution**

The primary site is equipped with a PlantPAx distributed control system, which uses the Rockwell Automation Library of Process Objects as well as several distributed I/O modules to provide the overall control of the process. In addition, the solution includes Allen-Bradley® PowerFlex® variable-frequency drives to power the pumps communicating through EtherNet/IP™. The three other locations deploy controllers in combination with
Primary site-to-site and site-to-control room communications are handled by Stratix® Ethernet switches, with a Stratix Service Router remotely connecting two of the other sites via the Internet. The other site is connected via fibre optics.

Remote alarming functionality for safe delivery of key data to smartphones and SMS was provided using the alarm-notification platform supplied by WIN-911, a Rockwell Automation Encompass Partner.

Everything is visualized on an Operator Workstation using a 55 inch monitor in the control room, using a PlantPAx operator interface with advance diagnostics. The three other sites deploy 19 inch stainless steel integrated-display industrial computers. All locations can be operated from the control room.

As well as deploying a PlantPAx DCS as the overall control solution, AB Electric leveraged the PlantPAx system estimator (included with the Rockwell Automation Integrated Architecture Builder) to architect the system. This allowed it to reduce risk in the early stages of the project as it selected the hardware and generated bills of material for the controllers, I/O, networks, drives, cabling & wiring, and other devices. The PlantPAx Alarms Builder tool was used to create alarms and event (AE) database-type alarms in the form of an XML file, which can be visualized from the OWS and the site’s access control is delivered by high frequency RFID EtherNet/IP Interface Blocks, also from Rockwell Automation.

**Results**

According to Frank Jørgensen, Project Manager and co-owner of AB Electric: “The planning and design elements of the project started up very early – almost a year ahead of building up. This is a real dream scenario compared to other project in our world and Rockwell Automation participated in meetings with our end customer almost from the very beginning. Together we were able to demonstrate to the customer the capabilities of a fully integrated Rockwell Automation PlantPAx solution… and our customer didn’t compromise, saying it wanted to go for the ‘Full Package’.

“Following this,” he continues, “the highly effective co-operation between AB Electric and Rockwell Automation resulted in a much smoother development process. Thanks to this support throughout the entire project, including the services of a Rockwell Automation Global Processes Technical Consultant (GPTC), who helped with the PlantPAx integration, we were able to meet all of the end-customer’s requirements in terms of delivery, performance and cost.

“Our customer now has a robust and stable control system that not only offers great reliability,” Jørgensen concludes, “but due to the open and scalable nature of the software,
coupled to the ease of integrating off-the-shelf hardware, the possibilities for future expansion and adaptation are extremely promising. From AB Electric's perspective, we now have a well-designed platform, which we can use for other water treatment plants in the future, as its design means it will be very easy to up/downscale regarding the amount of components and size of the water treatment plant. From my point of view I would rather sell a Rockwell Automation solution to our customers rather than any other solution. Rockwell Automation has proven to us that it can help us on any project and I don't have to be nervous about support if we really need it.”

Additional Information

www.rockwellautomation.com

The results mentioned above are specific to AB Electric’s use of Rockwell Automation products and services in conjunction with other products. Specific results may vary for other customers.