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District heating system

Fortum Corporation is a leading energy company in the Nordic countries and the other parts of the Baltic Rim.

meets environmental regulations with Proficy HMI/SCADA iFIX

Fortum Corporation is a leading energy company in the Nordic countries and the other parts of the Baltic Rim. Fortums activities cover the generation, distribution and sale of electricity and heat, the operation and maintenance of power plants as well as energy-related services. The main products are electricity, heat and steam.

AB Fortum Värme runs the District Heating system that supplies hot water to around 100,000 households and commercial and industrial premises in the southern districts of Stockholm, Sweden. Using the energy produced by burning local domestic waste materials, plus additional bio-mass waste from industrial and

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Anders Dahlgren, Automation Engineer, Fortum Högdalen

commercial sources, this represents an equivalent oil saving in the region of 60,000 cubic metres per annum.

NEED FOR UPGRADE
In order to run its Högdalen main plant efficiently, and provide government agencies with regular proof that emissions are within strict guidelines, the automation engineers decided on a major control and monitoring upgrade in 1994. At that time they chose FIX, and then upgraded in 2004 to GE Intelligent Platforms Proficy HMI/SCADA iFIX 3.5. Novotek Sverige A.B., GE

Fanuc Intelligent Platforms partner and distributor in Scandinavia and BeNeLux, provided vital support to Fortum during the decision making process.

Anders Dahlgren, Automation Engineer at the Fortum Högdalen power and heat plant, explained the choice of Proficy iFIX from among the HMI/SCADA software packages offered by a number of vendors. We quickly realised that Proficy iFIX provided very powerful graphics facilities, he said. Only with this system could we produce very detailed graphics just as we wanted them. And, the true openness of iFIX 3.5 allows us to connect very easily to other manufacturers software packages and hardware. We also have the option to select other software from the wide-ranging GE Proficy family should we wish to add other capabilities.

CONVERSION TO DISTRICT HEATING
Originally built in 1969 with 2 waste-fired boilers and one turbine to

produce electricity, the installation was converted in 1979 to provide hot water for district heating and was completed with an oil-fired boiler. In 1985 a fourth boiler was added, and since then 2 more to bring the total to 6. The district heating system in the south of Stockholm has gradually evolved to cover a region from Slussen, just south of the old town centre of Stockholm to Farsta on the southern edge of the suburbs, and from Skarpnäck in the east to the E4 highway in the west.

Independent domestic and apartment heating systems, where oil, for example, was originally burned, have gradually been linked into the hot water distribution grid, as have other, smaller, localised district heating systems.

Fortum supplies hot water to provide space heating via heat exchangers, and also running hot water. Closer to the city centre, customers are mainly domestic and office premises, while further out there are more industrial consumers. Each premise is metered and billed for energy consumption, based on volume of water used and temperature difference between entry and exit. The cooled water is re-circulated to the plant for re-heating.

Högdalen is connected to anoth-er district heating plant to which it can sell surplus energy in the summer, and buy energy if commercially viable in the winter. Fortum also runs a plant nearby at Hammarby, as well as several small plants burning oil. The oil-fired units cope with peak demands, if required, when temperatures plummet in mid-winter. Cleaned water from local sewage treatment works goes to Hammarby, passes through heat exchangers, and is then cleaned and re-cycled. This heat exchange process produces around 250MW. Even the water vapour in the exhaust gases at Högdalen is condensed to extract more energy. Two turbines at Högdalen use the steam to produce up to 70MW of electricity, which is exported to the local grid.

Around 700,000 tonnes of commercial and domestic waste is burned each year, coming directly from commercial and suburban domestic premises in the collection

trucks. Some has to be sorted to remove recyclable materials, such as newspapers, cans and plastics, before being dumped with all the rest in a giant concrete loading pit. From here, a single large, crane is used to scoop material as required to fuel four boilers of a total of 170 MW. The waste is gradually burned as it passes down a steep 40° incline past 6 horizontal burners in each 40m high boiler. The final ash waste is extracted at the bottom. One other 91MW boiler is fuelled by industrial waste (RDF), collected for example, from building refurbishment/de-

molition, timber yards and some forestry clearing. And a sixth boiler is a peak-demand oil fired boiler producing up to 80MW. Around 120 people work at the site.

HMI/SCADA SYSTEM

The total installation covering Högdalen and Hammarby employs around 100 PLCs, which provide around 8000 to 9000 analogue readings per second via Proficy iFIX for storage in the system database. The iFIX Event Scheduler also records in parallel when valves open and close, for example, so that these events can be interrogated in the future if there is a need to investigate the operation of the infrastructure. There are 20 SCADA supervisory control nodes and 15 process visualisation nodes for the operators. Two identical SCADA

networks provide the redundancy that enables automatic switchover to a second system in case of faults occurring, or if the engineers want to carry out maintenance on one of the systems. There is a link between the two sites with operators at either site able to control the complete infrastructure. A firewall exists between the iFIX system and the main office network, allowing management to view similar screens to the operators on a terminal server, but without the functionality to alter any parameters. This Proficy portal also offers a public means of viewing the state of the district heating network in real time.

The main control room at Högdalen, re-designed in 2004, is well appointed and provides 4 main operator positions with 4 displays and keyboards each. The operation runs 24/7 with operators working a 3-shift rota. Three 61" screens on the wall also provide a quick reference to the state of the plant. One screen displays a scrolling series of real-time images from 40 CCTV cameras monitoring key ac-

tivities around the sites, such as the waste storage pit, the rubbish conveyors, the burning waste inside the boilers, and the boilers water levels. Screens 2 and 3 typically show iFIX graphics, one a map of the district heating with key parameters, such as temperatures and flow rates, and the other showing one of the main plant graphics. Two further half-size screens show vital graphics such as the trend of values vital to maintaining operation within strict environmental controls.

There are two further operator positions offering 4 HMI screens and entry keyboards each so that automation engineers can gain access to the system when commissioning new facilities and for system maintenance. In total around 2000 graphics screens have been developed, in general enabling a process of drilling down from a high level screen to investigate specific parameters in specific locations.

MEETING ENVIRONMENTAL EMISSION CONTROLS

The exhaust gas cleaning process includes electrostatic cleaning of particles, scrubbers to remove toxic gases and condensers to extract extra heat from water vapour. Data supplied by iFIX to the historical
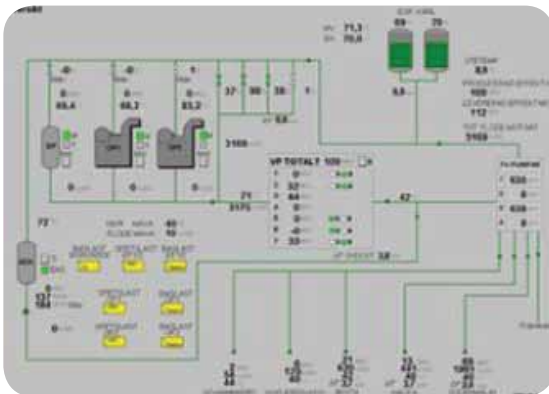
database provides the information required for trending purposes so that Fortum can maintain a careful eye on the efficiency of the plant and plan maintenance. It also ensures capture of data for government agencies. Environmental data of the exhaust gas emissions is particularly important with half an hour, one hour and daily value targets needing to be met, and monthly reports and graphs provided to the authorities.

Dahlgren emphasised the added value of working with the distributor and local system integrator, Novotek Sverige A.B. Novotek has been involved with us since 1994, and provided support in the design of the system initially, he explained. The company was able to help us develop the necessary drivers for the iFIX system to talk to the PLCs. We have developed all the graphics ourselves, and the current team of engineers supports the use and development of the complete HMI/SCADA system and its database and reporting systems. But Novotek is always able to offer a back-up resource if our engineering team is overloaded.

PROJECT HIGHLIGHTS
System benefits
- Environmental data trending in realtime
- Very powerful graphics
- Easy connectivity with 3rd party hardware and software
- Built-in redundancy
- Management access via the local network
- Powerful interrogation capability of historical database

PROFICY HMI/SCADA IFIX TECHNICAL BENEFITS
- Powerful, distributed Client/Server architecture collecting, processing and distributing real-time data using architecture that allows unparalleled scalability.
- Faster system development and deployment in an easy-to-use integrated environment that uses powerful editors and animation experts.
- Powerful application integration with 3rd party applications, MES and ERP systems, and Extensive functionality.

PROFICY HMI/SCADA IFIX BUSINESS BENEFITS
- Rapid ROI
- A safe investment for the future
- Electronic signature and electronic record capability
- Part of an Integrated Enterprise

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