

# For the sake of the environment and the economy

A new SCADA system based on System 800xA



TVIS (Trekantområdets Varmetransmissions-selskab I/S) is a heat transmission company for the municipalities of Fredericia, Kolding, Middelfart, Børkop and Vejle. These municipalities forms the Trekantområdet geographical area of Denmark and has 55.000 households. TVIS is taking care of excess heat from the industries and power plants in the area. The heat is then distributed in pipelines to house-holds, public institutions, offices, shops etc. in the municipalities. ABB in Denmark has supplied a SCADA solution based on System 800xA for controlling this district heating network.

## Five control rooms have received new operator systems based on System 800xA



ABB has supplied the new SCADA system based on System 800xA to the TVIS district heating utility in Denmark. The dispatch centre of TVIS is in Fredricia. The main supplier of heat is the Skærbæk combined cycle power plant.

*The Danish tax policy helps to make district heating good value for money, but even if this were not the case, district heating is a benefit for the environment under all circumstances. Trekantsområdet's Varmetransmissionselskab I/S (the 'Triangle Area' Heat Transmission company, TVIS), receives industrial excess heat equivalent to the burning of 130,000,000 litres of diesel oil every year or a decrease in emissions equal to 225,000 tons of CO<sub>2</sub>*

Imagine the scenario: a fire crackles pleasantly in the small oil burner in each individual home. An oil burner that is often old and poorly maintained, and which therefore burns very inefficiently. The nearby power plant sends its cooling water for cooling into the surrounding sea, resulting in a change to the fauna and poor efficiency, while a refinery pumps thousands of cubic metres of warm air and water out into the great outdoors. The answer to these scenarios, which are, sadly, reality across most of the world, is district

heating. Collecting, combining and exploiting the excess heating from processes and using it for public heating purposes must, therefore, be in everyone's interest.

The Danish tax policy, makes district heating a sensible investment and is also the background to the start-up and continued profitable operation of TVIS, which was formed in 1983.

### **Industrial excess heat**

Previously, the municipalities in the Trekantsområdet geographical area of Denmark was supplied with heat from several sources that were not linked to one another. The municipality of Fredericia received excess heat from what was then Superfos, a fertilizer industry, and it was also possible to use the excess heat from Shell's refinery and power plant heat from the Skærbæk plant. So Vejle, Børkop, Fredericia, Middelfart and Kolding invested a total of DKK 1.8 billion in setting up TVIS, and thus linking these municipalities for heating

purposes. They also included the heat from waste incineration in Kolding and Middelfart. These heat sources are supplemented with local peak and reserve production

### Purchase and sale

In 1987, the district heating pipe was fully expanded, and since then TVIS has fulfilled its role by purchasing the excess heat and selling it on at cost price to local district heating companies. In 2006, TVIS paid off the last of its debts and is now ready for new challenges.

The heating supply comes, as mentioned, from refuse burning in Kolding and Middelfart, as well as from Shell's refinery – sources that are always fully exploited. Heat is also supplied from the Skærbæk combined cycle power plant, which is slightly more expensive. During peak loads, extra boilers are connected up, which, however, are even more expensive to run. It is therefore important to con-

stantly monitor and control the supply from the various suppliers so that heat can always be supplied at the most advantageous price.

The heat is transferred via heat exchangers to TVIS' 75-kilometre main network of double pipes, which supply it on at a temperature of up to 120 degrees Celsius and a pressure of up to 25 bar. The pressure is reduced to 6 bar and temperatures to 99 degrees or lower for use in individual areas of the network.

### Low heat loss

The diameter of the pipes starts at 650 millimetres and falls, at the furthest end, to 150 millimetres. Due to the excellent insulation and the effective control of pumps, temperatures and flow, the heat loss is only three per cent. 5 booster stations, 28 exchange stations and 19 valve and boiler stations – a total of 52 substations are linked together in a main

SCADA system at TVIS' head office in Fredericia, where the 14 employees deal with everything to do with documentation, operation and maintenance. The SRO system is based on a System 800xA solution delivered by ABB Denmark. In addition, each individual pumping station is equipped with a PLC controller from ABB, which in turn is linked to the main SCADA system in Fredericia. Each station can also operate independently in the event of a fault elsewhere in the system. The SCADA system logs all data and guarantees overall automatic control and supervision of the entire system, as well as allowing the operator to intervene manually and control the entire system, or parts of it. The SCADA system and control principles are being constantly developed and refined so that TVIS' system is now run optimally with regard to reliability and energy efficiency.



22 stations are ready to deal with heat production during peak loads. Each station is equipped and monitored by a PLC controller from ABB, which is linked in turn to the huge System 800xA based SCADA system in Fredericia.



Shell's refinery in Fredericia (above) supplies a reasonably constant quantity of excess heat, as do the waste burning plants in Kolding and Middelfart. Fluctuations in the load are dealt with by supplementing the heat from the Skærbæk plant with local peak and reserve production.

## 75 kilometres of pipes

TVIS purchases and resells heat from Shell's refinery and the Skærbæk power plant. Heat from waste burning is also included in the area's supply. The five municipalities supplied are themselves responsible for distribution to individual households. 75 kilometres of double pipes transport the 30,000 cubic metres of water in the system. The system runs at a pressure of up to 25 bar and a supply of up to 120 degrees Celsius, which changes to 6 bar and a supply of up to 99 degrees in the municipalities' own networks. There are five booster pumping stations with a total of 20 pumps in the system, and the total system delivers 350-400 MW of district heating from the 28 heat exchanger stations.

## Delivery reliability

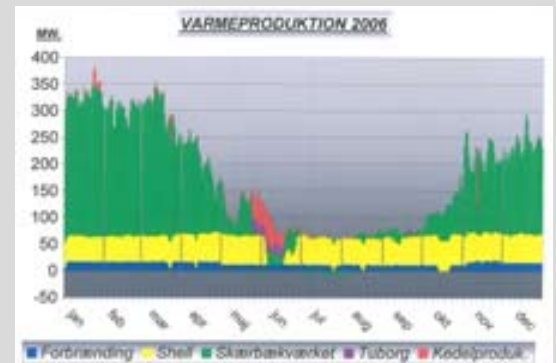
TVIS supplies heat to 50,000 households. Over more than 20 years, they have pumped hot water to citizens in Kolding, Fredericia, Børkop, Middelfart and Vejle. During the same period, ABB has serviced the controls for the numerous pumps, and together with TVIS' operations department replaced and modernised the automatic system at a sensible pace. Recently, an ultra-modern control room with a curved giant screen has been established, providing operations engineers with a perfect overview.

District heating for the sake of the environment. The excess heat used by TVIS for district heating reduces the annual environmental impact by 225,000 tons of CO<sub>2</sub>, corresponding to chimney smoke from the burning of 130,000,000 litres of diesel oil.

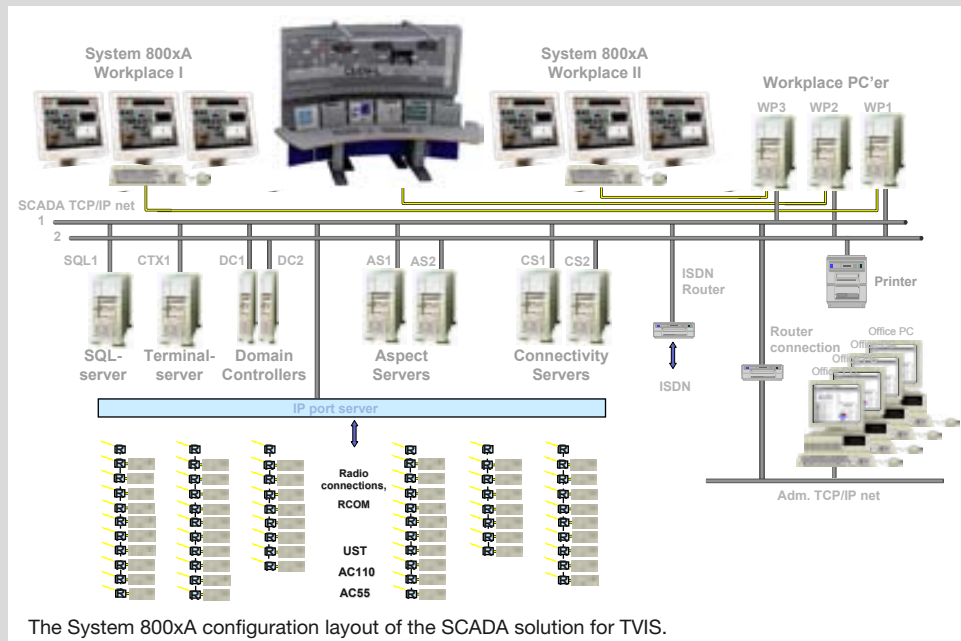
The TVIS project has focused attention on the development of Danish district heating systems in a socio-economic and environmentally-correct direction. And it has provided ideas for solutions to global environmental problems.

TVIS have always placed a high priority on having overview and the working conditions for its operators, so when they decided to upgrade the existing SCADA system to System 800xA, they also decided to modernise the control

room itself, and thus gain the option of a new and improved overview of the remote heating network. By guaranteeing operators access to the right information and also improving the physical working conditions with new, ergonomic control room furniture, TVIS could optimise operations and also make it more attractive to be on operations duty.



A schematic display of TVIS' heat production in 2006 where blue is from waste-to-energy plant, yellow from Shell, green from Skærbæk, purple from Carlsberg Tuborg and red from peak load stations. Heat from Carlsberg Tuborg brewery can only be used in a few periods. For example in June when Shell's refinery (yellow) was closed for maintenance it was also necessary to use the more expensive in-house production (red).



The System 800xA configuration layout of the SCADA solution for TVIS.

## New control room

Via the SCADA system, the seven operators and their managers control the operations based on information from thousands of measurement points out in the network. At the same time, they deal with maintenance and replace parts as they become worn or old. However, always so that all the stations function the same. The old control room was in need of replacement, and ABB, which had previously supplied most of the control solutions, was selected as the supplier. The recently equipped control room is in a class of its own. Initially, it was designed by the company CGM, Sweden as a 3D file with giant screen and control room

furniture as it was to look once it was finished. The control system contains something very special, namely a curved, height-adjustable desk with a total of seven LCD screens placed in front of a curved giant screen close to the operators and operated by three projectors. This new operator console or Extended Operator Workplace (EOW) provides perfect overview images of the entire process with excellent graphics. This solution gives hence a first class working environment for the operators meeting highest ergonomical standards. On the LCD screens, the operators can obtain the 200 or so process displays specifying flow, pressure, temperatures and other important parameters for

operation, and show them on the giant screen. Here they can also change all the specified parameters for operation, so supply reliability and economics go hand in hand, ensuring consumers receive the best possible delivery. The solution to the control room is based on System 800xA with three operator workplaces of which one is for the large curved screen. PLC Connect are utilized to communicate with all ABB PLC controllers in the pump stations (AC 110 and AC 55).



The improved modern control technology thanks to the System 800xA solution plus furnishings, including a giant screen, where the images of the different sites can be viewed and serviced, meets the approval of the operations engineers. Morten Thomsen (right) and Johnny Borgen enjoy the advantages of the new operator environment.

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