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CASE STUDY

Umeå Energi consolidates Siemens PLCs into ABB Ability™ System 800xA
Minimized engineering using ABB OPC Connect

With a long-term vision of a one single operator environment for the whole plant, Umeå Energi has embarked on a digital journey giving a better total process understanding, minimized engineering, less number of process screens and lowering operator risk with one coherent operator interface

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Dirk Mottmann
Automation Engineer
at Umeå Energi
Photo: Umeå Energi AB

Two control systems, no interconnectivity
Umeå Energi, located in the city of Umeå in the northern part of Sweden, has three independent ABB Ability™ System 800xAs as its distributed control system (DCS), managing the district heating network in Umeå. ABB Service, which has an engineering team in Umeå, is available to Umeå Energi when help is required.

”Over the years, our cooperation has grown. ABB Service in Umeå is very committed, always there for us, and over time they have come to know our needs and our plant very well. So it's a very good relationship and cooperation we've got here.”, says Dirk Mottmann, IS and Process at Umeå Energi.

In addition to the three System 800xA systems, Umeå Energi has 21 Siemens S7-300 PLCs at different locations throughout the district heating network in Umeå. They are used for controlling pumps in booster stations and sectioning chambers, guaranteeing the correct pressure in all parts of the network.

In 2015, Umeå Energi decided on the HMI integration project with the local ABB Service team. Before that, the Siemens PLCs were operated with two Siemens Simatic human-machine-interfaces (HMI). The PLCs had basic serial interconnectivity with the main DCS, System 800xA. Besides the central PLC HMI, the PLCs at the sectioning chambers could be manually controlled from local control panels.

"Already in 2005 we had formulated a vision to have all our control systems in the same HMI, so that the operator would have a familiar work environment, and also to minimize risk and in the end to minimize operating and maintenance costs", Dirk Mottmann tells us.

The district heating network had grown and expanded over the years. The additions to the control network had been done mostly one at a time by different departments using subcontractors employing unique automation solutions for the PLC control, not standardizing or using existing solutions.
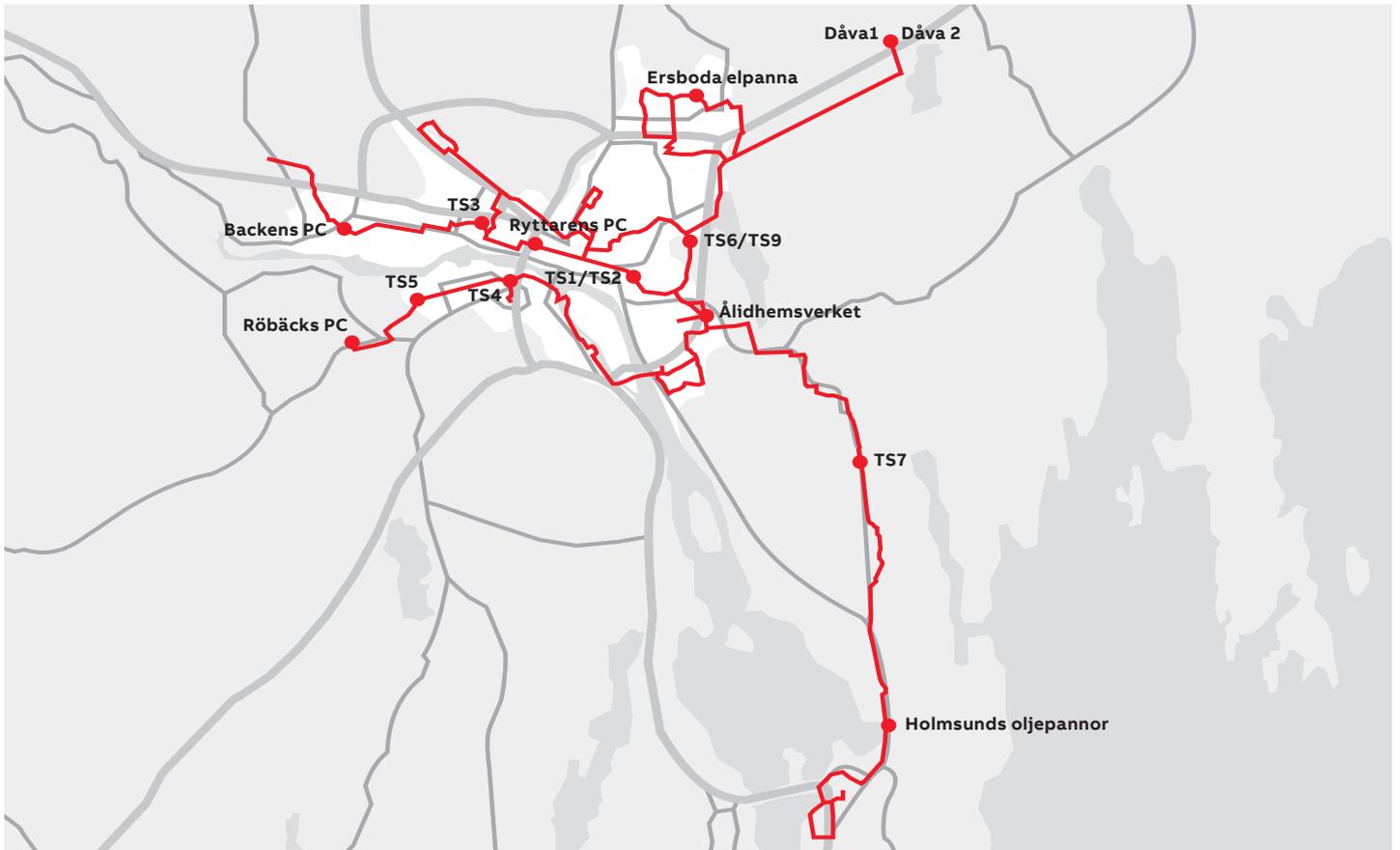
In 2014 the HMI used for operating the PLCs, Siemens Simatic, was outdated and operating the PLCs was proving to be increasingly difficult, resulting in a higher maintenance cost and an increased risk.

Having only basic integration with System 800xA, operators were forced to use different HMIs, each with its own look and feel, to manage different parts of the same plant.

The process team at Umeå Energi realized that while modernizing the Siemens HMI would be the most obvious solution, it would not lead them towards their vision of a coherent operator experience. Therefore, they decided to investigate different solutions to create a complete integration of the 21 Siemens PLCs into their main HMI, System 800xA and to decommission the Siemens WinCC HMI.

ABB OPC Connect reduces engineering time by 50%
In traditional PLC integrations all signals from each asset must be manually connected to System 800xA, which is time-consuming.

Instead, ABB OPC Connect identifies object types based on properties provided by the PLC application. This is used to create and maintain the types and corresponding instances in the control structure connected to the PLC properties.

This new way of connecting PLC objects and its signals saves up to 50% of the engineering time, both in the commissioning and maintenance phases.

HMI Evolution with ABB OPC Connect
When Umeå Energi initially contacted ABB with their challenge, they saw that using the OPC Connect tool from ABB IACT to integrate their Siemens PLCs into System 800xA would result in a much tighter integration than with traditional solutions where only individual signals are integrated.

In addition, they concluded that a standardized and minimized number of function blocks in the Siemens PLC's was needed. Over the years, several different object types had been created for the same asset, such as pumps or valves.

In the beginning of 2014, Umeå Energi began an inventory the different function blocks within the all its PLCs and then started to standardize them. During the summer of 2014, when district heating network load is at its lowest, all changes were implemented, including updated function blocks in the PLCs.

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"We did a thorough work in standardizing our function block library. I think it is absolutely necessary if you are planning to do this kind of integration", says Dirk Mottmann.

The result was a uniformed, standardized function block library for their Siemens PLCS with single common object types for the same type of assets. Simultaneously, the function blocks were optimized to match their application. The result also meant a much more cost-effective HMI integration into System 800xA, as fewer unique object types had to be integrated.

Performing the HMI integration
In the spring of 2015, ABB Service in Umeå joined the project to perform the HMI integration. Having a uniform function block library as a basis to work from, an upload of real time data from the Siemens PLC to System 800xA system using ABB OPC Connect was carried out. This enabled the project team to match the object types in the System 800xA system. With this match, the control structure in System 800xA was created and the object types were instantiated in the control structure.

Less screens, more information
The next task was to recreate the PLC portion of the plant into the process screens of the System 800xA HMI. ABB has efficient tools for automatic conversion of process screens from Siemens WinCC to System 800xA that typically convert up to 80-90% of the objects. However, recreating the old process screens would not fully benefit the operators, even if available in the System 800xA HMI.

Instead the information from the PLCs was directly integrated into the existing process screens of the System 800xA HMI at the Ålidhem district heating plant. With this approach, they could optimize the presentation in the process screens and what originally needed 100 process screens in Siemens WinCC now only needed a total of 20 new process screens in the System 800xA HMI.

One HMI, different controllers
The final result is one common HMI that spans the entire system and its processes, giving the operator a completely integrated plant and district heating network experience.

In the commissioning stage both ABB and Umeå Energi benefitted from being able to use the old WinCC and System 800xA HMI side by side, giving the project team and operators the opportunity to fine tune the integration and complete the engineering for as long as needed to create the best possible result.

Project summary
While being able to retain the plant investment in existing hardware such as cabling and controllers, Umeå Energi now has an improved and simplified single operator interface to their complete plant, resulting in an improved monitoring and process control.

Umeå Energi also concluded that having all information available in one single HMI gives the operators and maintenance staff new possibilities to proactively monitor processes more efficiently and maintain a high system and plant availability at all times.

Using the System 800xA HMI as a single point of integration opens up the possibility to use all functionality in System 800xA across all systems, both over System 800xA controllers and Siemens PLCs.
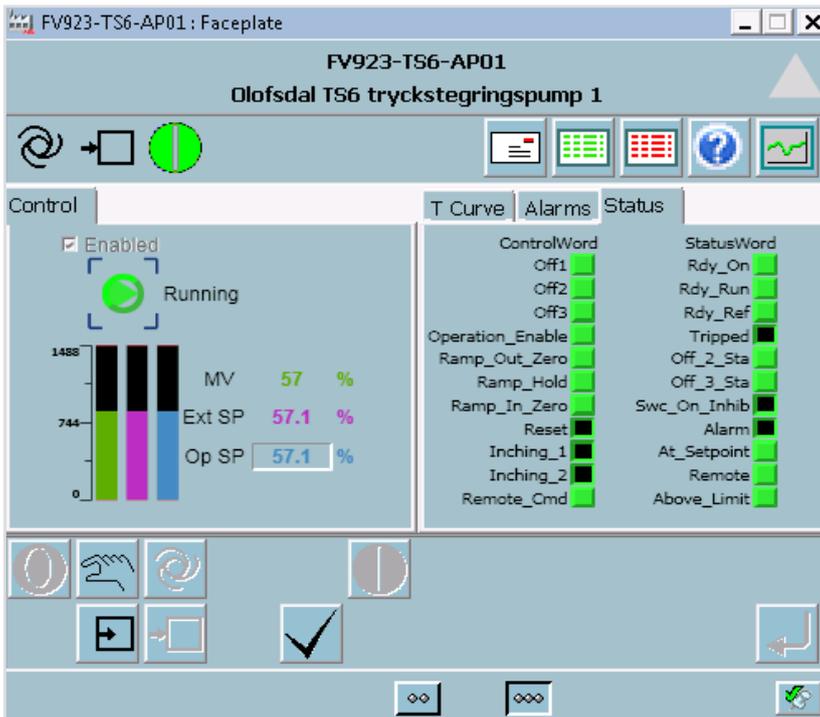
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Benefits of integrating PLCs with System 800xA using OPC Connect
- Same HMI, different controller
- Common HMI gives simplified control and monitoring
- Common source of process information gives high availability through proactive control
- Single point of integrations is a true future proof solution
- Process screen reduction
- Retained hardware investment – controllers, I/O and cabling are kept saving cost

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ABB OPC Connect
- Tool for integrating PLCs to System 800xA
- OPC Server based connectivity
- Simplified engineering compared to current available PLC integration solutions for System 800xA
- Provides real-time PLC to System 800xA connection
- Uses type-object library functionality to build and maintain control structure and populate System 800xA with PLC objects

FV923-TS6-AP01 : Faceplate

FV923-TS6-AP01
Olofsdal TS6 tryckstegringspump 1

Control

☑ Enabled

Running

1488

744

0

MV **57** %
Ext SP **57.1** %
Op SP **57.1** %

T Curve | Alarms | **Status**

ControlWord		StatusWord	
Off1		Rdy_On	
Off2		Rdy_Run	
Off3		Rdy_Ref	
Operation_Enable		Tripped	
Ramp_Out_Zero		Off_2_Sta	
Ramp_Hold		Off_3_Sta	
Ramp_In_Zero		Swc_On_Inhib	
Reset		Alarm	
Inching_1		At_Setpoint	
Inching_2		Remote	
Remote_Cmd		Above_Limit	

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"We have done HMI integrations to System 800xA earlier, for instance on a Siemens turbine, but it has been an integration on signal level, where only values are presented. It has not been this kind of tight integration we've got now", explains Dirk Mottmann.

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Faceplate for a Siemens S7 operated booster pump after consolidation into System 800xA.

Different hardware, same look
This faceplate for a Siemens PLC controlled pump serves as a good example of the final result. Having the same look as any pump faceplate in System 800xA, it shows the same information in the same manner regardless of being controlled by a Siemens PLC or a ABB controller, and that is the point: For the operator, it doesn't matter which controller or PLC is connected to the asset, everything works in the same way and the for the operator the experience is a seamless integrated environment.

All history data in one place
When the integration was complete, all process data was available in one common database, both from the production part of the plant but also from the distribution network. This vast amount of data enabled Umeå Energi to conduct a larger investigation and for the first time they could see how different parts of the distribution network were interacting and how they could be optimized together.

This meant that the PLCs were now optimized to work together, fine tuning the complete process, instead of only completing their individual task (i.e. managing a pump or valve), thus creating a much more coherent process control of the PLCs.

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Umeå Energi
Umeå Energi is an energy and communications company that provides a sustainable grid for electricity and broadband. This includes 100 percent renewable electricity from the sun, wind and watercourses of Norrland, in addition to reliable and convenient district heating and cooling.

Umeå is the largest market however many customers and collaboration partners are found also in the rest of Sweden. Umeå Energi's turnover is approximately SEK 1.4 billion, has some 400 employees and has achieved both environmental and work environment certifications.

Two district heating plants are used in the district heating network serving more than 70 percent of the total area in Umeå. The Dåva plant consists of two combined heat and power plants producing energy effective and environmentally adapted waste/bio-fuelled district heating while the Ålidhem plant is primarily used for peak loads during the coldest months of the year.

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