Using zenon to ensure water supply in an arid environment

SEOMD: Maintaining the source of all life

With a growing population and very limited natural sources of fresh water, a reliable water supply based on non-conventional resources is vitally important for Bahrain. To ensure this, the kingdom's Ministry of Works, Municipalities Affairs and Urban Planning runs several wastewater processing plants and a pipeline grid spanning the country. COPA-DATA Partner Zayika Technical Services WLL (Z-Tech) used the zenon software platform to implement a control and monitoring system for the grid's pumping stations in less than three months. The resulting solution greatly improved the supply system's performance and reliability

The Kingdom of Bahrain comprises a small archipelago of 33 islands in a bay on the Persian Gulf between Qatar and Saudi Arabia. The location gives the country its name: Bahrain means "the two seas". While there is an abundance of sea water surrounding the country, fresh water is scarce. The country's extremely arid environment averages rainfall of only approx. 80 mm per year, with limited natural groundwater resources and annual evapotranspiration rates as high as 1,850 mm because of the high temperatures.

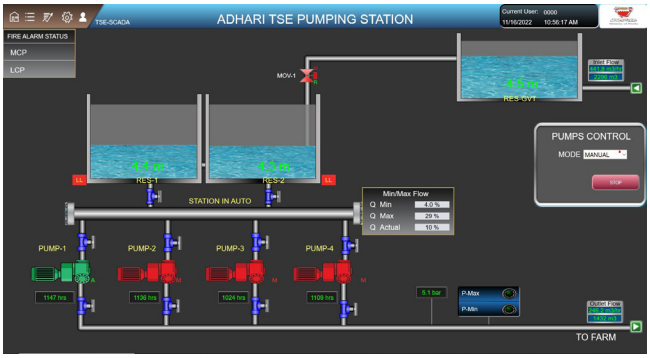
PROVIDING WATER IN AN ARID ENVIRONMENT

Bahrain is one of the countries with the lowest per capita freshwater availability in the world, a situation that is exacerbated by population growth. Despite this water scarcity, Bahrain's water supply services reach almost 100 percent of its residents, meeting municipal water requirements with non-conventional water resources.

In addition to several large desalination plants which fulfil most of the municipal water requirements, Bahrain has 12 wastewater treatment plants with a total capacity of approx. 750,000 cubic meters per day.

CHALLENGES IN MAINTAINING A WIDE-AREA WATER GRID

The plants are designed, owned and operated by the Sanitary Engineering Operation and Maintenance Directorate (SEOMD) of the Ministry of Works, Municipalities Affairs and Urban



The HTML5-based zenon visualization provides operators with a fast and easy way to switch between different screens displaying information about the state of the pumping stations, ranging from situation overviews to historical and trend reports.

SEOMD staff can monitor the stations remotely via zenon and optimize station performance using information provided by zenon's Extended Trend. This also helps to flag sudden changes, enabling operators to swiftly pinpoint leakages in the pipeline grid.

Planning. As well as sewage treatment plants, SEOMD operates systems for the transportation of treated water and the rainwater system.

The distribution of the reprocessed water relies on more than 50 pumping stations that are spread out across a wide area. All of these are equipped with programmable logic controllers (PLC) to ensure fully automatic operation. The entire network of pumping stations is supervised and monitored from a central control and monitoring station using a supervisory control and data acquisition (SCADA) system.

REACHING THE LIMITS OF A LEGACY SYSTEM

For monitoring and supervisory control, SEOMD had used a solution which relied on a proprietary visual programming language. Primarily designed for data acquisition and instrument control in industrial automation applications, it was suitable for creating small applications. Creating and maintaining large, distributed applications such as the one at SEOMD, however, required in-depth programming skills. Consequently, its performance was considered less than optimal.

The operators working in the control room and at various client stations were regularly confronted with communication issues and report generation was cumbersome. "The system's graphics were very limited, providing a meagre choice of objects and elements," explains Mohammed Ismail Kamil, Project Engineer at SEOMD.

"As there had been no web server, the system needed to concurrently perform calculations for multiple graphics, often overexploiting the system's resources." Although some of the functionalities had been limited to minimize the likelihood of the display stalling, there were, nevertheless, frequent performance issues.

A WATER SUPPLY FIT FOR FUTURE GROWTH

As the water distribution system has been built and continuously extended over several decades, many of the PLCs in the pumping stations had reached end of life and needed to be replaced. SEOMD decided to replace all the PLCs, opting for a different brand to that previously used so that the hardware aligned with existing generation systems. At the same time, SEOMD also decided to replace the SCADA system so the process could be improved and downtime reduced.

The contract was awarded to Z-Tech. Based in Tubli, Bahrain, Z-Tech provides customized and robust industrial automation solutions and other technical solutions for a wide range of industries, using the most advanced systems available on the market for seamless integration. For this comprehensive and critical infrastructure project, Z-Tech decided to use the versatile zenon software platform from Austrian manufacturer COPA-DATA, which recognizes Z-Tech as a bronze partner.

RAPID SYSTEM IMPLEMENTATION

"Providing a very large number of native drivers to all kinds of external components and systems, zenon makes it easy to build wide area applications integrating PLCs and communication hardware," says Khalid Quarooni, Technical Sales and Business Development Manager at COPA-DATA Saudi Arabia. "Its low-code configuration using various specialized modules and its object-oriented engineering helps to accelerate the design

> *The zenon-based control and monitoring system provides richer reports and a graphical user interface, enabling quicker and more sure-footed operator responses to issues.*

MOHAMMED ISMAIL KAMIL, PROJECT ENGINEER, SEOMD

of complex system architectures with rich graphical user interfaces."

COPA-DATA bronze partner Z-Tech essentially built a new application from scratch. It migrated the existing data from various separate data silos within the proprietary database of the legacy system to a new implementation of an SQL Server database. "Using the zenon Data Historian module and with some assistance from COPA-DATA, we were able to complete this data preparation within only a month," notes Sandeep PT, the Z-Tech project manager in charge of the water supply system upgrade. "The entire implementation took no more than three months."

Z-Tech took the opportunity to go beyond the previous system's file-based reports. The team used the zenon Report Viewer, reaction matrix, and element groups to create an entirely new set of reports. "Without the constraints of the legacy system, reporting is a lot richer, enabling quicker and more sure-footed operator responses to issues," states SEOMD project engineer Mohammed Ismail Kamil. "Operators can use the system's graphical user interface to directly invoke corrective actions."

IMPROVED PERFORMANCE AND RELIABILITY

Using zenon, Z-Tech upgraded the graphics in both the control room and the client stations with organized navigation. They used zenon's linked objects function to provide operators with a fast and easy way to switch between different screens, which had been difficult and time-consuming in the previous system.

SEOMD staff can now monitor the stations remotely via zenon and use information provided by the extended trends monitor to optimize station performance. zenon's Extended Trend module helps to identify sudden pressure drops and elevated flow values, enabling operators to swiftly pinpoint leakages in the pipeline grid.

The SCADA system based on zenon provides operators with a greater wealth of information. This is made available via a more comprehensive graphical user interface. At the same time, the solution requires far less computing power. "Although it is running on existing hardware, the system's performance has improved considerably and so has its reliability. Downtime has become a thing of the past," Mohammed Ismail Kamil says. "The time required to run typical reports was reduced by about 40 percent."

HIGHLIGHTS:

zenon as a high-level water supply automation system for the Bahrain Ministry of Works:

- More than 50 pumping stations in a pipeline grid spanning large parts of the country
- Project completed in less than three months
- Rapid engineering process, eliminating the need for programming skills
- Improved user interface, supporting better operator responses
- Faster reporting with less computing power required
- Minimized downtime
- Improved water supply reliability