

# Schneider Electric™ Application Note

## Unleashing Artificial Intelligence on the Industrial Edge to Revolutionize SCADA Systems—Use Cases in the Water & Wastewater Industry

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# 1. Introduction

In today's industrial landscape, the only constant is the rapid evolution that is fueled by digital transformation and artificial intelligence (AI), with over 90% of businesses engaging in some form of digital activity.<sup>1</sup> Innovation and businesses' adaptability are key to staying ahead. However, the digital transformation journey for industrial organizations is not an easy one, and the Water & Wastewater industry is no exception.

The need for real-time data analysis and increased automation via AI-driven decision-making creates numerous challenges. Traditional supervisory control and data acquisition (SCADA) systems enable condition monitoring, fault diagnostics, and predictive maintenance through the centralized monitoring, control, and deployment of basic analytics. However, they still need to evolve in this area in order to catch up with and avoid replacement by cloud/edge computing and advanced AI model systems.

This application note will explain the importance of integrating legacy SCADA systems with AI, how to achieve this at the industrial edge, and provide examples from the Water & Wastewater industry.

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<sup>1</sup> Digital Transformation: How to Scope and Execute Strategy, Gartner.

## 2. What is a SCADA system?

SCADA systems form the backbone of modern industrial automation, facilitating seamless communication between various hardware and software components within a networked infrastructure. At its core, a SCADA system comprises several key elements, including remote terminal units (RTUs), programmable logic controllers (PLCs), human-machine interfaces (HMIs), communication networks, and data servers. RTUs and PLCs serve as data acquisition units and control devices, respectively, interfacing with sensors, actuators, and other field devices. The HMIs provide operators with intuitive graphical interfaces for monitoring processes, analyzing data, and executing control commands. Communication networks enable data transmission between field devices and central control centers.

### 2.1 SCADA systems within the Water & Wastewater industry

SCADA systems facilitate many critical functions aimed at optimizing operational efficiency and helping ensure regulatory compliance. Within Water & Wastewater, these functions encompass real-time monitoring of water levels, flow rates, pressure levels, pump statuses, and other relevant parameters.

By continuously collecting and analyzing data from various sensors and instruments installed throughout the pump station, SCADA systems enable operators to gain insights into system performance, identify potential issues, and proactively initiate corrective actions. Moreover, they facilitate remote control capabilities, allowing operators to adjust pump settings, alter flow rates, and implement emergency shutdown procedures from centralized control centers or mobile devices from anywhere at any time. This helps minimize downtime, reduce energy consumption, and mitigate risks associated with equipment failures or process disruptions.

## 3. What is edge computing?

Edge computing is a distributed computing model where data processing, analysis, and storage happen closer to the data source instead of a centralized data center on-premises or in the cloud to help:

- Reduce latency
- Optimize performance
- Enable real-time data analysis
- Quicken decision-making
- Enhance privacy and security by processing sensitive data locally

This approach, using edge devices like smart sensors, cameras, gateways, and other connected devices, is particularly beneficial in scenarios that require immediate action or response, such as industrial automation, autonomous vehicles, smart cities, and remote monitoring applications.

## 4. How to maximize customer value by integrating SCADA systems with edge AI

Traditional SCADA systems enable the deployment of basic analytics for tasks like condition monitoring, fault diagnostics, and predictive maintenance strategies. For instance, flagging anomalies in pipeline flow rates that fall outside the expected norms.

Currently, these systems rely heavily on simplistic, rule-based models, failing to tap into the potential of advanced AI models such as neural networks. As a result, the data-rich insights generated in industrial settings remain underutilized, depriving end users of the benefits of powerful AI-driven decision-making.

### 4.1 Underutilization of data

Data is underutilized for two main reasons:

1. Traditional RTUs and PLCs do not have the required memory and power to run advanced AI applications. Many AI models require intense computational power, often requiring substantial resources to train and execute tasks effectively.
2. Data granularity. AI models demand large volumes of data to ensure accuracy and high performance in their predictions and analyses. For tasks such as abnormal event detection and pattern recognition, data granularity and frequency play pivotal roles. Without sufficiently detailed data, these models may overlook critical anomalies, compromising their effectiveness in real-world applications. SCADA systems alone cannot provide the necessary field-level data granularity due to high costs and potential bottlenecks.

### 4.2 A hybrid approach

Integrating traditional SCADA systems with AI on the edge presents a powerful solution for industrial automation challenges. Organizations can leverage SCADA systems' robust control capabilities while harnessing edge computing's agility and intelligence by adopting a hybrid approach to:

- Ensure a higher level of reliability by keeping critical control of the SCADA system
- Strategically deploy edge devices in the field, capturing high-frequency data crucial for real-time decision-making. They also host advanced AI models capable of processing and analyzing data immediately without the need for constant connectivity to centralized servers.
- Provide AI-generated insights that can then be seamlessly integrated back into the SCADA system or accessed through separate built-for-purpose applications, either on-premises or hosted on the cloud. In either scenario, transferring high-volume data within the SCADA system is unnecessary, avoiding increased costs and bottlenecks.

This integration enriches data available to operators, empowering them to make informed, accurate, and timely decisions. By bridging the gap between traditional SCADA systems and cutting-edge AI technology, organizations can unlock new levels of efficiency and reliability, optimizing their return on investment (ROI) and time to value.

## 5. Real-world examples from the Water & Wastewater industry

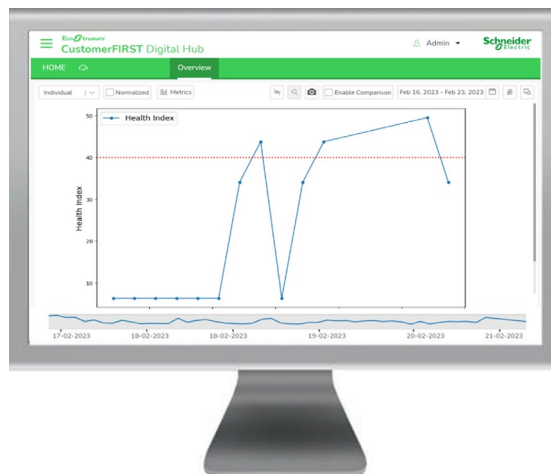
Schneider Electric's Industrial Automation Services team provided the aforementioned hybrid solution to Water & Wastewater customers, enabling them to enrich their existing legacy control systems with powerful AI models running on the edge.

### 5.1 Use Case 1: Pump station health assessment

Schneider Electric delivered a hybrid, cloud-to-edge health monitoring solution for pump stations connected to the existing SCADA system. This required no new sensors, as we connected to the same registers.

Data collected on the edge has a much higher granularity than the adjacent SCADA system, enabling the detection of even subtle and acute patterns. The data was assessed at the edge for anomalies using time series anomaly detection algorithms. Schneider Electric then synthesized the prediction into a health index (see **Figure 1**) that quantified the recency and frequency of the detected anomalies for the asset. From there, the health index was transmitted to a web-based application where the user can configure thresholds for generating alerts based on the asset's criticality.

The “Wastewater Station Analytics” application was deployed using Schneider Electric's Customer FIRST Digital Hub to monitor sewage pump stations for blockages and other subtle deviations in operating patterns.



**Figure 1**

*A health index that quantifies the recency and frequency of anomalies in the pump station can be used to optimize maintenance.*

## 5.2 Use Case 2: Pipeline analytics for abnormal event detection

Schneider Electric delivered a hybrid, cloud-to-edge solution to detect leaks in pipeline networks. Utilizing AI models trained on the cloud but deployed on the edge, high-granularity, edge-collected data was assessed for anomalies to infer if there was a pipeline leak. Again, no new sensors were needed, as the connection was into the same registers used by existing controls (e.g., PLCs).

The end user received access to valuable insights and alarms to help prevent or minimize costly remediations. In addition, the provided web-based user interface (UI) lets the user provide feedback about the model's accuracy. This allowed for retraining—continuous improvement of the AI models on the cloud—followed by automatic deployment on the edge. Through co-innovation with the customer, valuable experience and feedback from subject matter experts (SMEs) were embedded in the models, ensuring high accuracy and performance.

The “Water Pipeline Analytics” application was deployed using Schneider Electric’s Customer FIRST Digital Hub (see **Figure 2**) to monitor long, difficult-to-access water pipelines in remote locations and detect leakage events.



**Figure 2**

*Remotely monitor the selected metrics of interest (e.g., downstream pressure, upstream pressure, flow rate) and receive notifications if the edge AI models detect any leakage event.*

## 6. Maximizing value with products tailored to specific customer needs

Integrating AI into SCADA systems brings a new era of efficiency, reliability, and sustainability to industrial operations. Almost any industrial application can benefit substantially, and the Water & Wastewater industry is a prime example.

Leveraging the power of AI at the industrial edge gives operators the ability to:

- Gain real-time insights
- Optimize processes
- Prevent potential failures
- Help ensure the smooth operation of systems
- Enhance productivity
- Minimize downtime
- Reduce maintenance and repair-related costs

Embracing AI-driven solutions empowers industries to meet the evolving demands of water management while tackling challenges such as aging infrastructure and fluctuating environmental conditions.

As Schneider Electric continues to innovate and harness AI's potential, the future of SCADA systems promises to be even more transformative, paving the way for smarter, more resilient, and environmentally conscious industrial practices.

## 7. Ready to unleash AI and disrupt the industry?

Schneider Electric's expertise in digitalization, AI, cloud, and edge computing, along with a co-innovation process, provides new perspectives to our customers. Don't compromise with one-size-fits-all solutions. Embark on a digitalization journey with our Industrial Automation Services and maximize your ROI with a solution tailored to your unique needs.

Get started by exploring how [Industrial Automation Services](#) can help you not only meet but exceed your business goals.