Reliable Monitoring for Water Quality in a Smart Water Distribution Network with a Low Energy Analyzer

Introduction

Smart Water Networks: The New Route to Water Quality

Water distribution networks are steadily entering the age of smart technology and communication. As this movement develops, more governments, municipalities and urban planners are embracing the Internet of Things (IoT) for intelligent water distribution systems. This includes the various aspects of maintaining a water network; so it is expected that water quality monitoring and control will be included in the evolving systems.

SWAN – The Smart Water Networks Forum has defined a smart water network as *"the collection of data-driven components helping to operate the data-less physical layer of pipes, pumps, reservoirs and valves."* When redesigning or upgrading an existing water network and its monitoring methods to meet the standards and benefits of a smart system, the ultimate goal must remain as it always has been: to bring safe and clean water to all consumers' homes, offices and public areas.

Embracing 'smart' technological developments, facilities are also challenged by market demand to reduce power usage and increase energy efficiency and are therefore seeking low-energy and off-grid water quality monitoring solutions.

Background

The Steady Foundations of Water Quality Management

A water distribution network is and is likely to always be an elaborate conveyance system that pumps water through miles of piping from the source to the tap. Throughout the network, various forms of treatment must be applied to ensure the quality and safety of the water for drinking and hygiene uses. Different countries and regions have their own specifications for standards that must be met, and regardless of how "intelligent" the system is, treatment will invariably depend on the quality of the water at the source and at various points along the route thereafter.

While water treatment methods are constantly developing and improving, the actual process of removing contaminants from the water also remains constant. This might include filtration, flocculation and sedimentation, followed by chlorine dosing for disinfection, or other methods of purification.

The Location and Power Challenge

Monitoring for Water Quality & Efficiency

Any water network is ultimately examined through the eyes of the end consumer. Does the city's population put its full trust in its drinking water providers? Are bottled water sales rising or falling? Are consumers boiling their water or relying on the safety of the drinking water from the tap? Are water system maintenance costs so high that the population is required to subsidize it heavily?

A smart water network must aim to respond to these issues and to provide transparency for the consumer.
It must aim to:

- consistently provide safe water
- operate efficiently
- and cut costs.

Meticulous water quality monitoring and data-transmission at many strategic locations along the distribution network is key to the best results for both management and consumer.

Installing water quality monitoring systems at what would be ideal points in the network can be challenging, for two reasons:

- Water networks do not necessarily follow the same route as a power supply network and therefore do not have full access to power supply at any given point;
- Underground or remote locations around neighborhoods and industrial areas are more demanding for on-site visits.

Expanding the electricity grid to follow the complex route of a water distribution network to enable water quality data collection and transmission is in most cases too costly to even consider. Moreover, such an undertaking would require ongoing maintenance and would create a severe environmental imprint. Consequently, water management might favor water quality monitoring sites that are simply more convenient, possibly compromising the competence of an entire network.

Sustainable Solution

Low Energy Analyzer to Monitor All Locations in the Smart Water Network

High-precision water quality sensors and analysis devices that can perform online data collection and streaming are integral components for the 'intelligent' operations of a distribution system. They make it possible sustain an environmentally sound, reliable, efficient and safe distribution process, all along the route from source to tap.

Independent Power Supply

The *Smart LEA™* system has been developed by Blue I Water Technologies to provide such a practical, efficient and viable solution for gathering and communicating water quality data

without relying on a city's power supply to gather and transmit data in a smart water network.

Self-powered by a long-life battery, the device's innovative measurement sequence and operation algorithms reduce power consumption and significantly prolong battery life. This means that site visits for maintenance can be significantly reduced and that measurement can therefore be performed where it is needed and not where it is simply convenient.

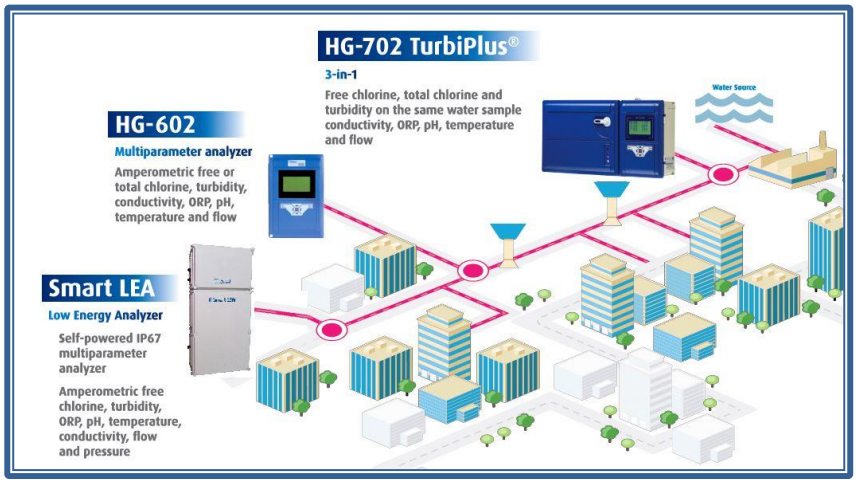

Figure 1: An off-grid smart water quality analyzer complements a smart water monitoring network.
*Blue I Water Technologies' **Smart LEA™** gathers and communicates water quality data without relying on a city's power supply.*

Multi-Parameter Measurement and Fast Response

The device performs periodical and on-demand measurements in areas with restricted accessibility in the water distribution network. The measurement data and alarms are logged locally and also transmitted through GSM/GPRS data communication systems.
The analyzer features fast response time to level changes in the parameters being monitored. This will enable real-time reporting and alerts to secure prompt corrective action. A decline in adequate active chlorine or exposure to contaminating elements near the consumer are possible scenarios that the Smart LEA™ can indicate to elicit immediate response for continuous water safety.

The system's default setting is to measure once every two hours, which can be increased to once an hour. When a deviation is detected, the system can switch to a turbo mode to measure continuously for a time.

Automated and Robust

The Smart LEA's automated system saves costs and time by eliminating the manual labor involved in collecting water samples and analyzing them in the lab. Indeed, site visits for manual measurement – at best once or twice a week - result in severe incident response delays and water quality fluctuations that can be avoided with Blue I Water Technologies' system.

The device's communication and control board is separate from the sensors panel, and both parts are assembled in waterproof enclosures (IP67) for reliable operation in isolated, wet or damp environments.

Synchronized Water & Energy Regime

Smart LEA™ combines ICT (information and communication technology) with accurate water analysis.

Amperometric. The water chemistry is measured using high-precision amperometric technology. With a specially designed sampling cell, the multiple measurements are performed simultaneously at regular intervals for reliable analysis. Integrated pH and temperature compensation enables accurate measurements at low levels of chlorine, providing stable and reliable measurements.

Turbidity is measured with Blue I's closed cell turbidity sensor, in which air bubbles are automatically removed from the water sample before being measured. Measurement is performed using multi-angle nephelometry white light (90° and 180°) and the cell is automatically cleaned between measurements.

Conductivity and **flow** sensors are designed to consume minimal power between measurements and to operate with a low electricity current.

Calibration can be performed remotely from the control center while USB ports on the device enable on-site calibration as well.

Energy-Saving Standby. Every feature of the Smart LEA™ has been designed to be energy-efficient, from the electronics panel to valve operation and the choice of hardware.

The system's electrodes are placed on standby when no there is no flow and no chlorine entering the measurement cell. Whether measurement is being performed at regular pre-programmed intervals or on demand, power consumption is reduced to an absolute minimum in the interim to save energy while ensuring that the electrodes are preserved and resume operation without delay.

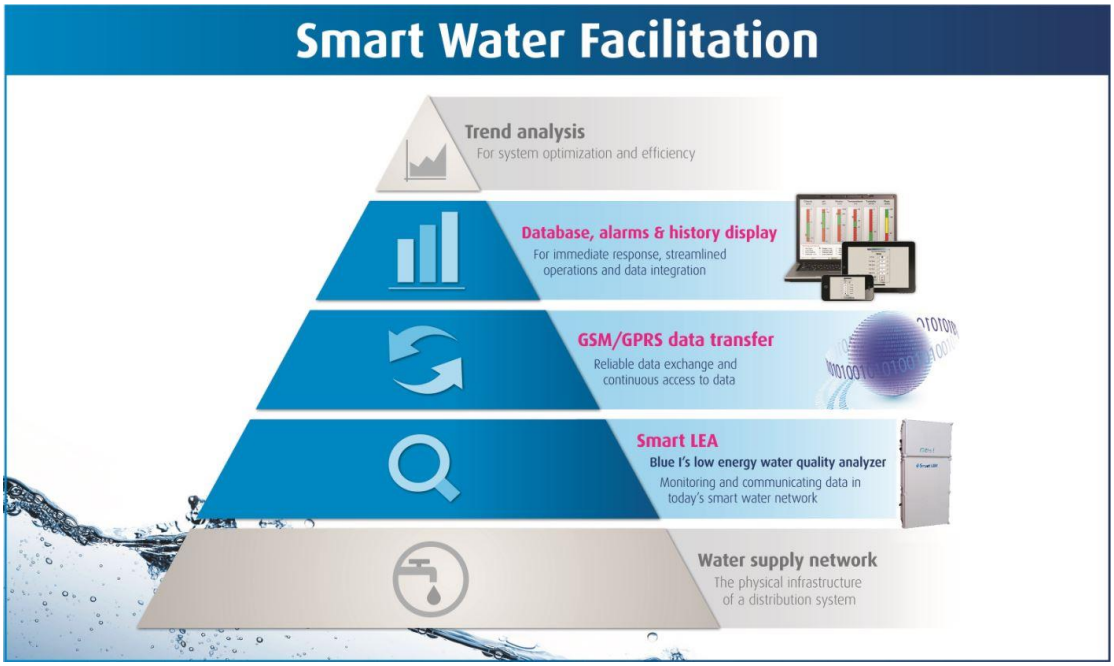

Figure 2: Smart data collection for water quality. The Smart LEA solution provides water quality testing and analysis, data collection, GSM/GPRS data transfer and display

*Solution Advantages**

- Designed for smart water networks
- Efficient installation for widely branched networks

- IP67 Water proof and UV resistant enclosures
- Water proof cable connections

- Ultra low power consumption
- Configurable measurement interval or on-demand measurement
- Electrode standby mode

- Minimum calibration
- Automatic pH and temperature compensation
- Real-time fault/leakage detection
- Input for flow logging
- Built-in pressure transducer

- Multiple parameter measurements
  - Free chlorine
  - pH
  - Temperature
  - ORP
  - Conductivity
  - Flow
  - Pressure
  - Turbidity

- Database, alarms and history display and management
- GSM/GPRS communication
- Data and alarms transmission also via SMS/e-mail
- Open data protocol for integration in any SCADA system
- Local serial port for onsite configuration and calibration

**Request a data sheet for more technical specifications.*

Summary

Smart, Safe & Cost Effective Monitoring

Water distribution networks are entering an age of smart data analysis and require technologies and devices that can gather and transmit data in a way that also supports efficient, conservational, cost-effective and safe water supply systems. A smart city should include multi-parameter water quality systems at critical points along the network - even where power supply is not available. By doing so, operations are improved so as to secure safe and healthy water for all consumers.

The Smart LEA™ solution provides timed or on-demand chlorine, turbidity, ORP, pH, temperature, conductivity, flow and pressure measurements in areas with low accessibility in the water distribution network. The self-powered analyzer operates on standby to save energy; yet it is designed to provide a fast response to deviations in the levels of monitored parameters. It reports all data in real time to the network's online management system and enables continuous access to data, alerts and history. It is easily integrated in a water distribution network.

Introduce Smart LEA™ to Your Water Network

Blue I Water Technologies has launched the beta version of Smart LEA™.
Experienced distributors in the water treatment sector and water supply bureaus seeking solutions for water treatment systems can contact the company directly for more information.

About Blue I Water Technologies

Blue I Water Technologies provides innovative water quality control systems for municipal and industrial applications. Blue I's products enable water treatment facilities of all sizes to benefit from the accuracy of advanced online colorimetric and/or amperometric measurements and reduce maintenance overhead.

Our mission is to provide accurate systems that offer unprecedented reliability, maintainability, and ease of use.

Among the company's global customers are GE Europe, Nestle South Africa, Euro Disney, Coca-Cola and Yoplait.

For more information about Blue I Water Technologies, please visit **www.blueitechnologies.com** or email us at *info@blueitechnologies.com*