

Draft Project Title

Innovative Actuators for empowering pipe-bound supply networks towards smart infrastructures for substantial resource efficiency increases

Short Description of the project idea and expected outcomes

Prosperity of modern societies heavily depends on the quality and reliability of public supply infrastructures for water and energy, making sustainable resource management necessary. We aim to demonstrate a novel smart actuator for cost-effective remote valve automation in supply infrastructures and its corresponding improvement potential regarding operational, energy and water resource efficiency and quality control.

The actuator addresses public piping systems, which currently are merely mechanical, manually controlled, and vulnerable to undetected leakages, ruptures, contamination or sabotage. Operating fully wireless, the actuator combines remote control with sensor technology. Water grid operators cannot just only monitor their system, like it is possible with current smart water management solutions, but actually affect flows. This will drastically improve managing capabilities of grid infrastructures, leverages the potential of monitoring technologies and adds an important stepping stone to the ecosystem of smart water management solutions.

By demonstrating high added value and high reliability of its solution with pilot partners, we aim to get a partner in relevant projects and to integrate our solution with other smart water technologies.

Main Objectives

Today, automation of valves with current technology causes immense installation costs as a lot of civil engineering and cabling infrastructure is needed. With the wireless-operated valve actuators of 3S at least 60% of automation costs can be saved on civil engineering and peripheral components for the retrofit of existing buried valves. Furthermore, the remotely controlled actuators can be combined with sensor technology to collect information from the supply network.

Furthermore we want to demonstrate the actuators' potential to allow enhanced smart water management applications and increase the operational efficiency of water suppliers. We aim to prove that a network of automated valves with smart actuators will allow enhanced monitoring AND control of network water flows, contributing to develop the water services of the future.

Finally we want to explore the technical improvement potential of the actuators as well as the integration potential with other smart water management solutions to leverage their mutual improvement potential and synergies.

Specific Objectives

The main objectives to prove the innovation potential of our actuators are:

1. Large-scale demonstration of comprehensive and cost-effective retrofit automation of buried valves in the fresh water, sewage water and other supply networks of European municipalities, achieving 30% of water loss reductions and operational cost savings.
2. Prove that the smart actuators will allow enhanced monitoring AND control of network water flows, contributing to upgrade to smart infrastructures and water services of the future.
3. Large-scale demonstration of enhanced smart water management applications, such as active leakage control, pressure management and network flow control and resulting operational and resource efficiency increases for supply infrastructure operators.
4. Development of integrated use cases of smart actuators with sensing technologies and other smart water management solutions, such as SCADA management solutions, data analysis, control algorithms and simulation of network flows.

List of potential activities

3S will proceed with the improvement of the actuators' marketability and demonstrate their technological potential. Potential activities include

- the development of hardware and software components to provide all product features that are demanded by the market will be completed. In particular, further sensor and DNP3 interfaces could be integrated in the actuators controller PCB and its Energy Save technology, to ensure wireless and energy self-sufficient operation.
- Sensor data processing capabilities, including control algorithms could be developed and integrated. The integration of wireless actuator and sensor technology builds synergies with regard to monitoring and control of water networks.
- The integration of innovative energy harvesting technologies such as hydro turbines or PV-installations is also possible
- The product design can be optimised and adapted to new application areas or use cases (for instance waste water with very aggressive substances), including value engineering to keep high functionality and robustness while reducing material costs straight forward e.g. substitute expensive stainless steel with coated PVC or higher degree of standardized hardware with reduced components diversity.
- Further activities are dedicated to the preparation, execution and evaluation of the pilot large-scale demonstration at pilot customers' premises, including requirements specification and operational planning, hardware installation and training.

Smart actuators ensure a secure, reliable, and affordable public supply of water in terms of:

1. Network monitoring and remote control: 3S allow for cost-effective while comprehensive real-time data collection about conditions in the network and the current network flow situation, available at a central control room as well as on mobile devices for onsite personnel. Central information and remote control considerably supports decision making and lowers the effort for daily operation and maintenance measures. It also helps to enhance installations maintenance life time and to prioritize replacement investments. Finally it helps to improve customer services.
2. Active leakage control: grid operators are able to exercise progressive detection measures such as stepwise testing and continuous control of minimum night flows to reduce the timespan between occurrence and detection of leaks where a lot of water is gone lost and may cause damage in the surroundings.
3. Pressure management: varying pressure over time or between pressure zones allows providing the lowest possible pressure at each point of use what saves energy for pumping. It furthermore relieves pressure from the pipes and helps to avoid pressure shocks, reducing water losses and enhancing pipes service lifetime.
4. Demand side management: It can be further used for electricity demand side management by operating pumps when power is the cheapest or by providing large customers with varying abstraction data on the current network conditions to engage them in active abstraction management.
5. Network flow optimization: real-time monitoring and control of the network flow situation in complex urban networks helps to avoid that different pressure sources (pumps) work against each other resulting in energy waste or for instance water stagnation zones that in turn deteriorate water quality and accelerate material fatigue of the infrastructure through incrustations.
6. Realtime management of water conditions: In particular the flow situation in sewage water infrastructures can actively be managed. Water with high concentrations of pollutants can be blended or separated from fractions with lower concentrations in real time
7. Increasing network reliability and resilience: Through the independence of 3S smart actuators from mains-supply and data cables, the system makes network monitoring not vulnerable to cable damages during underground construction or power outages

Expected impact on European level

Being mainly software-based, current Smart Infrastructures and Water Management Solutions lack the capability to actually influence conditions in the supply network correspondingly. Their full potential will only be exploited in combination with automated remote valve operation. Unfortunately, valve automation with state of the art technology is far too expensive to allow a widespread coverage.

The most important immediate impact will result from the economic benefit of 3S actuators to considerably lower overall cost of valve automation and enable extensive network automation. 3S actuators can be installed at existing buried valves without manhole, cabling and switching cabinet including PLC. This saves a significant part of the automation costs.

A further important key market application is that SWM technology providers can use 3S smart actuators for cost-effective implementation of their SWM solutions into water grids. Providers can focus on their core competencies of developing software-based technologies such as network flow simulations, data intelligence, and monitoring and control algorithms and the smart actuator capacities for data collection, processing and transfer. The improvement potential of smart actuator product features relates to its computing power for data processing capacities and the development of powerful control algorithms that will allow communication between several actuators and their aggregation to an autonomous self-regulating entity for a whole section of the water network.

By combining sensor technology with a wireless actuator 3S provides a smart technological approach that is not “only” limited to smart monitoring of water pipelines, but can also influence water flows according to the intelligence of sensors and management systems. This smart technology approach has also been identified as promising cross-cutting solution from the European Innovation Partnership on Water (EIP Water) to help other smart technologies to unfold their full potential and lever to problem solving capability of smart water solutions. Our solution directly addresses three of eight EIP Water topics, namely i) water treatment and distribution, ii) water-energy nexus and iii) decision support and monitoring, significantly contributing to tackle European water challenges.

Through the direct and remote control of physical water flows and the monitoring of critical parameters, the actuators can mitigate consequences of adverse events which are a main concern of the European Innovation Partnership on Smart Cities and Communities. By contributing to a modernisation of Europe’s water networks the project is exemplary for preserving and strengthening European high-quality infrastructure, which is the base for its global competitiveness and quality of life of its inhabitants. With its focus on water and energy savings as well as operational efficiency, the project also addresses environmental and economic aspects and contributes to Europe’s strategy for sustainable and environmentally sound development . This does not only help to preserve the resource base in the long run but also help to maintain Europe’s high level of welfare at economically justifiable cost.

By the time innovative operating concepts will be developed and will encourage further investments towards smart water grids. In smart water grids of the future, water could be supplied on demand with different water prices in different times of the day. Thus operators can reduce peak-demand and can thus optimize pipe dimensioning. Furthermore, operators could offer (negative) balancing energy services at the power exchange to gain additional revenues. For example they could take excess energy in times of high production and store them in their network in form of high-pressure zones. In addition, the 3S technology can easily be transferred to also manage supply of gas and heat/cold pipelines, because the operation of valves is nearly identical all over the world.

Call identifier

CIRC-02-2016-2017: Water in the context of the circular economy; SCC-1-2016-2017: Smart Cities and Communities lighthouse projects

Type of action (RIA, CSA, etc.)

IA

I am looking for a project leader/coordinator

Which kind of partner are you searching for?	Research Institute/University SME Industry Public institution water utilities
Expertise or specific role of partners sought	sensing technologies; water and sewage water management solutions; simulation and control of network water flows; operation of supply networks
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Organisation	3S Antriebe GmbH
Description of the organisation	<p>In 2007 the “3S” brothers Axel (MBA), Fabian (Lawyer and M.Sc. in Physics) and Steffen Sacharowitz (Engineer) founded the 3S Antriebe GmbH, enclosing all key qualifications to put their prize-winning business plan into reality.</p> <p>3S develops, manufactures and sells innovative electrical actuator systems that allow the automation of buried valves in water, sewage, gas and district heating supply networks without any cabling. 3S provides a track-record of several publicly funded development projects.</p> <p>The vision of 3S is to provide operators economically feasible tools to facilitate a fully automated, sophisticated and efficient operation of buried supply networks worldwide.</p>