Company	Perceptive Engineering Limited
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Introduction	SME formed in 2003, management buy-out 2012. Headquarters in Cheshire, office in Singapore, 25 staff serving global client base. Proprietary software combined with in-depth process engineering knowledge. Award-winning, Advanced Process Monitoring, Diagnostics, Control and Optimisation.
Summary	Advanced Automation has been used in the petrochemical industry for decades. Perceptive Engineering has adapted the technology for use in water and wastewater treatment, overcoming numerous obstacles and constraints, with the twin aims of reducing treatment costs while improving environmental performance.

Background

UK Water accounts for 3% of UK electricity use, mostly for pumping, producing drinking water, or treating wastewater so it can be safely returned to the environment. The industry is committed to reducing its greenhouse gas emissions by 20% by 2020.

The industry is highly regulated and monitored, with heavy penalties for failures in either the security of supply or the quality of treatment. Wastewater processes can be very large scale operations, handling millions of litres per day. Process design involves multiple treatment stages, with many complex interactions. Because of the harsh operating environment, process instrumentation is not always reliable.

Some of the savings will be achieved through on-site electricity generation, via solar, wind or anaerobic digestion systems. However, to achieve the goals being set, the industry recognises that it must also improve efficiency and, thereby, reduce electricity consumption.

Environment

The water sector is expected to comply with goals set by the UK environment agency and the European Urban Waste Treatment Directive. Treated water must be returned to the environment within rigid quality limits, so as not to cause damage to the receiving waters (rivers, estuaries, seas).

The vast majority of wastewater is treated using biological processes. The biomass must be constantly aerated to ensure sufficient activity to remove contaminants and meet the required quality targets.

In almost all cases, quality takes priority over efficiency; high energy consumption is tolerated (and even encouraged) to ensure quality is maintained.

Advanced Process Control

Perceptive Engineering has perfected a data-driven, robust control system for complex processes. This technology was originally developed for the petrochemical industry, but has now been adapted to bring numerous benefits to other sectors, such as pharmaceutical and nutritionals manufacturing, steel and paper making, fine chemical production.

For the water sector, specific issues needed to be addressed:

- online instrumentation is prone to failure, so the available data is not always reliable
- the treatment processes have many complex interactions and long time delays
- key quality parameters may not always be measured online but are available via daily lab analysis
- site operators have multiple tasks and roles to perform

WaterMV

Process and quality data is used to construct a digital model of how the process behaves and performs under dynamically varying conditions. Once the model is built, it can identify opportunities for improving the process:

- how does a change manifest itself through the process
- what control parameters are available to correct for that change and how quickly do they respond to adjustment
- which parameters have the biggest impact on quality and efficiency
- what are the limits of control (the minimum and maximum range within which control can be exercised)

The model enables **predictive** control – the process can be automatically and constantly adjusted, based on an accurate prediction of how it will respond and the impact of each adjustment. As a result, energy use is closely matched to environmental goals, all the time.

Innovation

Perceptive's system is able to identify when process data becomes untrustworthy. Without reliable measurement, any process is difficult, if not impossible, to properly control.

All critical information is passed through a series of real-time statistical checks. If a fault is detected, the system highlights the error to site operators. At the same time, a virtual value is being calculated in real-time, from all correlated data associated with that signal. This 'soft' sensor provides an instantaneous – and robust – replacement as soon as process hardware fails. By doing this, efficiency can be maintained at a very high level, even when important data is no longer available.

The controller will always ensure quality remains the top priority, but is able to reduce energy at every safe opportunity, automatically.

Benefits

Energy consumption, in the most energy-intensive part of the process. is reduced by 25-35%.
Operating the process more efficiently opens up additional treatment capacity, which extends the usable life of the plant and helps defer capital upgrade costs.
The process is more resilient to sudden changes, such as storm events, and control is more robust under all conditions.
Predictive, dynamic automation reduces the risk of environmental failure.
With Advanced Automation, there is far less need for intervention by site personnel, freeing them up for other tasks.

Lower operating costs can be passed back to the consumer as lower bills or re-invested. Lower risk of pollution benefits the wider environment. Lower energy use equates to a reduced carbon footprint; a single asset might save 1000 tonnes per year of CO_2e.