QCL WATER SCIENCE

Wessex Water
YTL GROUP

WESSEX WATER

Energy Optimisation

Overview

The present driver to “Net Zero Energy” in wastewater treatment is forcing water companies to reconsider their current practices. One of our trials at Wessex Water has a focus on energy optimisation, to do exactly this. SENTRY can be used to turn off certain treatment steps during periods of low microbial flows. Doing this would reduce energy use at this site by 10-20%, resulting in savings of £50,000-£100,000 per annum.

Site Details

The case study Wessex Water wastewater treatment facility receives a combination of municipal and industrial wastewater streams. The treatment process combines an Activated Sludge (AS) treatment system with a Brightwater Biological Activated Flooded Filter (BAFF).

- 55% of the flow is directed to a BAFF system
- 45% of the flow directed to the AS treatment system

With the goal of better managing nutrient requirements, the flow is directed to the second Activated Sludge Process (ASP) and BAFF treat the majority of municipal wastewater.

But they also receive around 15% of the industrial trade flow while a portion of the municipal flow is also directed to the first Vitox AS plant. All flows leaving the site pass through final UV treatment.

The SENTRY monitoring sensor was placed upstream of a Brightwater BAFF unit. The BAFF consists of 5 treatment cells that contain small pea sized plastic beads for biomass growth/retention. These treatment cells take themselves off-line each day to go into a backwash to remove captured solids.

SENTRY Installation

- Installation at the Wessex Water facility consisted of two probes and a control panel
- A SIM card was used to transmit data from the control panel to the SENTRY dashboard, for Innovation and Operations to monitor the output
- Following installation, no calibration or maintenance was required. Reliable and robust data was produced with very limited signal drift

The SENTRY platform was set to record a reading every minute with 1,440 Microbial Electron Transfer (MET) readings in a 24-hour period. The MET readings were displayed on an on-line dashboard with a signal also sent to the on-site SCADA system to integrate with other data being collected at the facility.

Project Objectives

- Monitor incoming wastewater conditions and identify key biological imbalance triggers
- Validate correlations between biological activity and organic loading to the facility
- Develop historical data sets that show the weekly and daily biological activity trends for influent wastewater
- Use the generated microbial activity data sets to predict low organic loading time periods and reduce aeration costs for the BAFF

SENTRY Identifying Periods of Low Microbial Loading

This historical data set was statistically analysed using a signal decomposition with key repeating trends identified. The weekly pattern of MET at this site showed a wider range compared to typical municipal sites, indicating the impact industrial discharge has on the facility. Highest loading to the system occurred late evening between 8-10 pm.

MET showed a decreasing trend from midnight, with the lowest organic loading happening early afternoons 12-3pm. The duration of lowest organic loading was larger on Sunday and Monday (10am-3pm), while on Wednesday and Friday larger organic loads were observed (Figure 1).

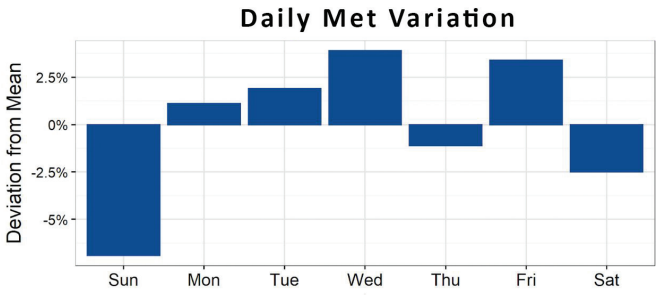

Figure 1 Daily variation of MET

This SENTRY data, combined with flow information, can be used to identify the historical time periods where the lowest periods of organic loading are coming into the system. These periods are the optimum time to decrease the number of functional BAFF units.

SENTRY for Energy Optimisation

The combination and variation of municipal and high strength industrial wastewater flows at this Wessex Water wastewater treatment facility has historically made it difficult to maximise aeration efficiency, with all BAFF cells being operated to meet peak loading events.

Wessex Water were interested in using SENTRY to characterise the incoming wastewater stream and identify periods of time of lower organic loading to the facility. This would enable them to maximise aeration efficiency.

Evidence of over aeration was provided using the SENTRY probes. Figure 2 details SENTRY readings overlaid with on-site dissolved oxygen readings from the AS plant. It shows that high dissolved oxygen readings correlated with low periods of MET activity. These readings indicate periods of the day where the facility was being over aerated.

Based on the SENTRY results, the operators plan to turn off BAFF units when encountering periods of low microbial loads. Like how a motion sensor light is able to save energy when it is not activated then switch itself on as required, SENTRY can be used to turn off certain treatment steps during periods of low microbial flows. Doing this would be an energy saving of 10-20% for this site.

Economic Rationale

Utilising SENTRY, with its zero maintenance technology that provides a reading every minute, water companies can increase their understanding of their wastewater and at their sites.

In this case study of Wessex Water, annual energy use on site is in the region of £500,000. These costs are primarily comprised of aeration energy required for the three treatment streams and UV disinfection. A target of a 10 - 20% energy savings provides a potential for savings in the region of £50,000-£100,000 per annum with improved aeration efficiency.

Based on the MET readings Wessex Water plans to divert more loading during the low organic loading periods from the BAFF reactor to the ASP. This flow re-direction will allow operators to minimise aeration requirements for the BAFF system (turning off blowers during low loading periods) and saving energy. The value of this strategy will result in a saving of £50,000-£100,000 per annum with key savings in energy consumption as well as blower maintenance and cleaning.

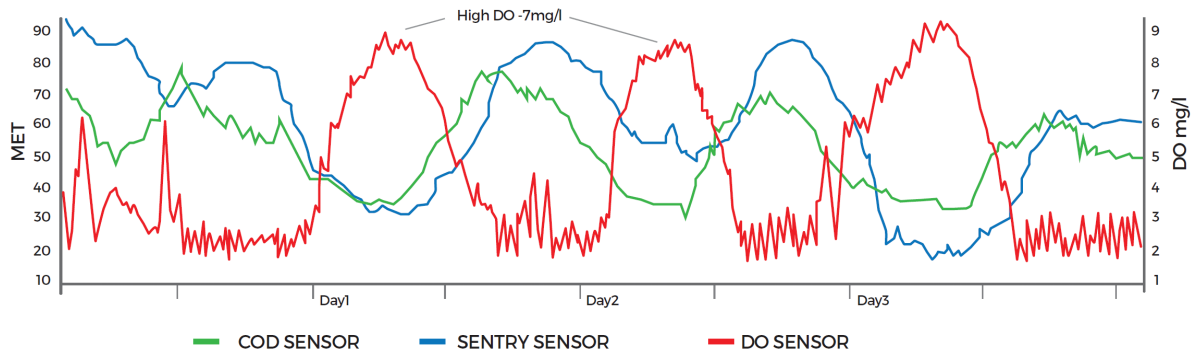

Figure 2. Daily change in organic loading to the facility resulted in clear daily response in MET readings that were inversely correlated to dissolved oxygen concentrations.

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