RP2017

ENERGY BENCHMARKING FOR EFFICIENT, LOW-CARBON WATER RECYCLING OPERATIONS

Research Question

Wastewater treatment processes are important in safeguarding public and environmental health, but are energy intensive. Their high energy demand makes current wastewater management practices unsustainable and the optimisation of wastewater treatment plants (WWTP) represents a challenge for water utilities when considering energy costs, and associated greenhouse gas (GHG) carbon emissions.

To reduce energy costs for WWTPs and also minimise environmental impact from energy-related GHG emissions, the Australian water industry is applying an energy benchmarking method. This approach, however, involves the direct application of European (German) benchmarking methodology to Australian WWTPs, which in many cases may not be directly relevant to the Australian context.

This research is addressing this disparity by developing a new adaptation of the European **energy benchmarking approach** which is suitable for local industry to use in the optimisation of wastewater treatment/water recycling processes in Australia.

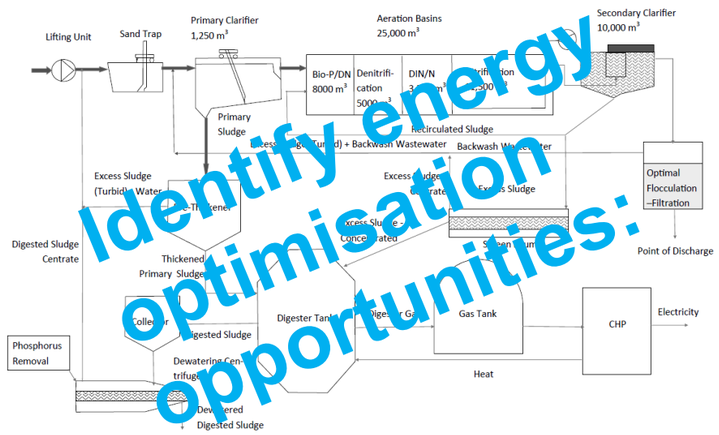

Figure 1: Model-plant (100,000 PE) schematic flow diagram (adapted from Müller et al. (1999)).

Methodology

The Australian energy benchmarking model is currently based on a direct application of German methodology. While this approach provides immediate results when directly applied—fast-tracking the process and allowing the water sector to quickly recognize the economic gains associated with energy benchmarking investments—the application of existing European benchmarking approaches should ideally be done with some adaptation in the way that reflects local contexts. In order to develop a new adaptation of the German method for optimising WWTP processes in Australia, a critical review of the European benchmarking model and associated methodology has been undertaken. Next, the German methodology is being adapted using an Australian national WWTPs dataset, and a comparative analysis being undertaken to identify the need for and nature of, adaptations to procedures and processes when applying energy benchmarking models to Australian scenarios.

Based on a series of full-scale Australian wastewater treatment operations case studies, the project is also currently assessing process-level energy consumption and optimisation potential at WWTPs:

- Treatment level required vs. energy consumption
- Calibration of energy benchmarks according to Australia's WWTPs performance (average *Guide* and best performance *Target* values)

Initial Results

Initial investigation of the German model has identified that the energy benchmarks currently used by the Australian water sector require further adaptation to reflect the energy performance of Australian wastewater treatment processes. A comprehensive dataset comprising energy performance data for 244 Australian and New Zealand WWTPs is being interrogated to determine the overall energy performance of WWTPs nationally, and established common energy performance benchmark values to guide future energy optimisation efforts.

When compared to German WWTPs, preliminary results show that the specific energy efficiency (kWh/person equivalent/year) is lower in Australian WWTPs; however, Australians WWTPs receive a higher organic (COD) load and higher nitrogen loads (C/N ratio) which significantly impacts wastewater treatment performance and overall energy efficiency. Wastewater treatment process configuration and climate also impacts relative energy use performance.

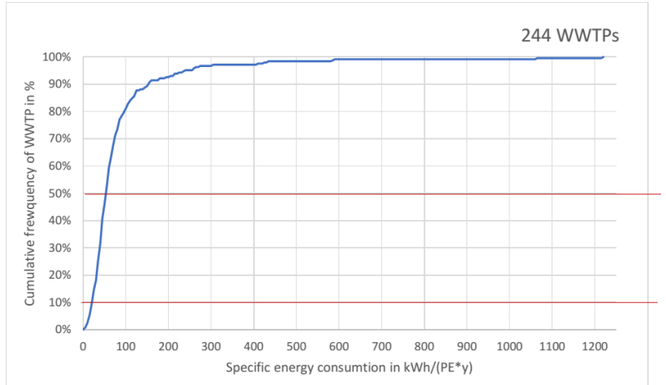

Figure 2: Australian benchmarking values applying a statistical approach as per German methodology (LFU BW 1998).

Anticipated impacts

Our research will deliver to the Australian water industry the first ever critique and adaptation of international energy benchmarking methods, currently applied by the sector without fully understanding the applicability of such methods to Australian conditions. Outputs will benefit water sector personnel seeking to minimise energy use and associated GHG emissions.

Key statement

Improving the energy efficiency of urban wastewater treatment for low carbon precincts.

Further information

Project leader: Dr Michael Short (UniSA)
E: michael.short@unisa.edu.au
Partners: UniSA; SA Water; Sydney Water; UNSW

Contact

Name: Ilda Clos
Organisation: UniSA
E: ilda.clos@mymail.unisa.edu.au