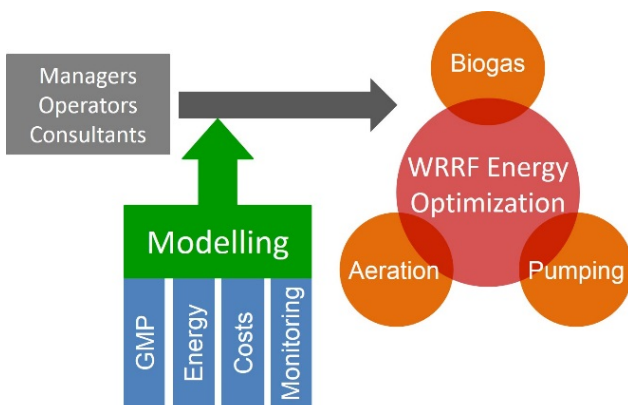


Model-based energy audits in water resource recovery facilities

Catalan Institute for Water Research (ICRA) and Aquafin N.V.

DESCRIPTION One of the largest urban consumers of energy are water resource recovery facilities (WRRFs, formerly wastewater treatment plants). Within a WRRF, electricity consumption accounts for between 25 and 40% of the facility's total operating costs. WRRFs are therefore important targets for reducing energy demand. Energy audits, which identify opportunities to reduce energy use and greenhouse gases in WRRFs, are typically based on the average energy consumption of a facility; they include benchmarking with similar plants or comparison against some standard performance indicators. However, current energy audits could potentially be improved through the use of dynamic models that integrate water and sludge lines. Because this potential had not been explored in the European market, Aquafin and ICRA developed a model-based energy audit tool that will be demonstrated through R3Water.

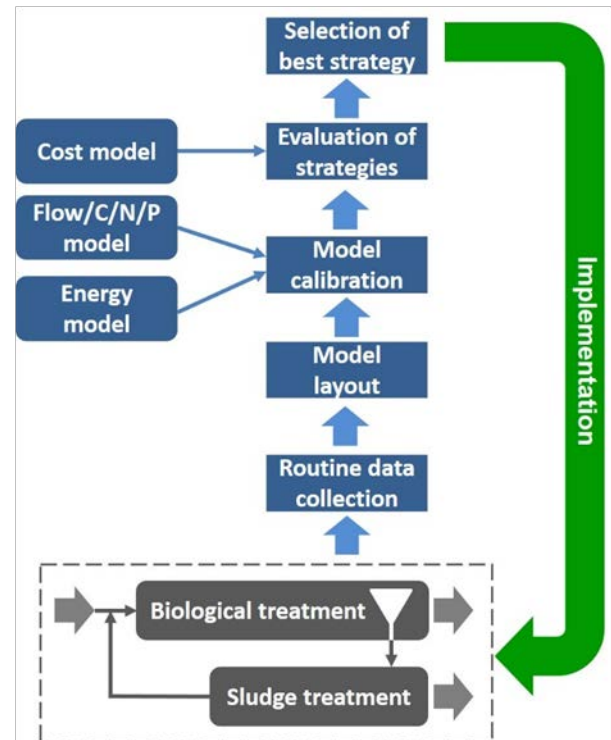
The main goal of the technology is to minimize energy consumption and maximize biogas production in WRRFs.



The key elements of the technology are:

- **Good Modelling Practices (GMP)** – proper use and calibration of existing ASM models.
- **Energy models** – proper description of energy consumption.
- **Cost models** – implementation of real electricity tariff structures.

- **Monitoring of N₂O and CH₄ emissions.**



APPLICABILITY AND PRE-REQUISITES

The model-based energy audit tool can be used to:

Select plant-wide alternatives that reduce energy consumption, costs, and CO₂ emissions.

- Evaluate aeration and pumping strategies.
- Study the interactions between the sludge line (with high nutrient loads in the return stream) and the liquid line.
- Assess the use influent organic content (to maximize either nutrient removal or biogas production).

Complete realistic cost assessments.

- Highlight critical situations where peak demand charges are driving up energy costs.
- Develop strategies to reduce energy consumption and maximize energy production at peak time-of-use periods.

- Find the optimal contracted power for a specific plant.

ADVANTAGES OF THE TECHNOLOGY

The model-based energy audit tool provides the ability to evaluate:

- Multiple strategies without affecting the process.
- Future scenarios (excellent tool for planning).

DISADVANTAGES

The tool requires:

- High quality data from the design and operation of the WRRF.
- Highly-qualified personnel for correct use, which is why ICRA suggests providing the tool as a service with technical support.

OPERATION AND MAINTENANCE The model-based approach has to be updated any time there is a significant change in plant configuration or the environment (e.g. influent wastewater composition, electricity tariff, etc.).

COSTS

This service will cost around 25,000 €. A typical model development study takes 3 months (assuming good quality data is provided by the WRRF). The model layout will be given to clients. If clients purchase specific software and learn how to use it, they can exploit the model. Otherwise, a maintenance contract can be established.

CONTACT

Lluís Corominas: lcorominas@icra.cat
Ignasi Rodríguez-Roda: irodriguezroda@icra.cat
Mehlika Ayla Kiser: akiser@icra.cat



Alessio Fenu: alessio.fenu@aquafin.be
Tom Wambecq: tom.Wambecq@aquafin.be



REFERENCES

The technology will be demonstrated at two full-scale WRRFs:

Girona WRRF (Spain)

- 206,250 population equivalents (PE).
- Plug-flow biological reactor.
- Anaerobic digestion with energy production.



Harelbeke WRRF (Belgium)

- 116,100 PE.
- Conventional activated sludge process.
- Anaerobic digestion with energy production

