

## Water-Energy Nexus

### Energy efficiency in the South African water industry

The WRC has published the first ever compendium of best practices and case studies regarding energy efficiency in the South African water industry.

#### Introduction

Energy will in future remain a high cost item for municipalities and utilities which operate and maintain water and wastewater processes. Energy consumption will continue to increase as more people are provided with water and sanitation and new technologies are implemented to meet stricter effluent and potable water requirements.

#### International trends

To position the water sector globally with regard to energy consumption, the Global Water Research Coalition (GWRC) has embarked on a project 'Energy Efficiency in the Water Industry: A Compendium of Best Practices and Case Studies'. This project looks at these best practices worldwide, and is supported by the GWRC partners as represented by the four continental coordinators in Australasia, Europe, South Africa and North America. Each continental group created a report of best examples submitted by utilities in their region.

The report by the UK Water Industry Research Ltd on energy efficiency in the British water and wastewater sector concluded that overall energy efficiency gains of between 5% and 15% may be achieved, with up to 25% energy improvement in wastewater treatment processes. This report further indicates that renewable energy, mainly in the form of combined heat and power from sludge gas, could contribute significantly to the net energy demand of the water industry.

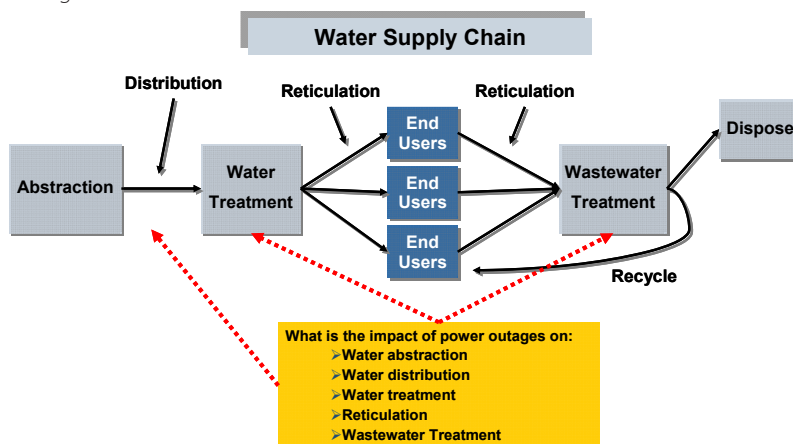
A similar report was compiled by the Water Environment Research Foundation

in the USA, and provides best practices for the energy efficient operation of wastewater industry assets in North America.

#### South African compendium

The WRC, as a member of the GWRC, has funded this project to develop a compendium for the South African water industry. The scope of work covered the principal activities of water and wastewater businesses and focused on the identification of current best practice, tools and technologies.

The study evaluated both incremental improvements in energy efficiency through optimisation of existing assets and operations, and substantial improvements in energy from the adoption of new technologies. It also highlighted new processes, plant types and systems, which realise more substantial energy gains. Water and wastewater treatment plant surveys were conducted to document case studies and examples of best practice.



*Areas of impact of power outages in the South African water-supply chain*

The aims of the project were to:

- Perform a detailed examination of current best practice and technologies, to identify promising developments and future opportunities to help deliver incremental improvements in energy efficiency through optimisation of existing assets and operations.
- Perform a detailed examination of current best practice and technologies, to identify promising developments and future opportunities to help deliver more substantial improvements in energy efficiency from the adoption of novel (but proven at full scale) technologies.
- Conduct water and wastewater treatment plant surveys to document case studies and examples of best practices.
- Develop a compendium of best practice in energy efficiency technologies and approaches in the water and wastewater sector.

## Methodology

A desktop study and literature review was carried out to focus attention on the key areas of the water industry with most potential for energy efficiency improvements. The desktop study and review covered national as well as international literature and case studies.

A matrix was developed showing the areas where potential savings are expected, together with the identification of case studies that were studied (which appear in the matrix), as received from the South African water utilities. By clicking on the subject area in the matrix, a fact sheet on this subject opens in a new window.

A Priority Short List was prepared from the desktop study to highlight the parts of the water cycle matrix which has most potential for making energy savings from incremental to more significant efficiency improvements. A Compendium Framework was then prepared to form the basis of the Compendium document. It was developed to present the case studies against the science and engineering principles of the different subject areas (as are contained in the matrix).

## Case studies

Case study guidelines were prepared to explain the objectives of the case studies and to ensure consistent quality of data from the sources. It presents a table of data required for each study, a set of energy usage matrices and some explanations for the priority areas from which case studies will be expected. Sample Fact Sheets were also drawn up to be used for collection of information from various water service providers.

From the list of case studies that were identified, case study information was obtained for population of the risk matrices. The fact sheets were completed in detail for all of the case study findings, and include information on:

- Incremental improvements (detailed matrices of water, wastewater and sludge areas showing minor changes to existing processes and plant)
- Substantial improvements (detailed matrices of water, wastewater and sludge areas showing new processes realising more substantial gains but requiring significant investment).

The case studies are provided in electronic format on CD as appendices to the Compendium.

## Recommendations

- The guidelines and best practices should be used as a basis for development of energy efficiency and energy conservation targets for the water sector. These targets can then be implemented, encouraged and regulated through the Department of Water Affairs' Blue Drop and Green Drop Programmes.
- Municipalities should already start using the guidelines for energy conservation and energy generation in their strategic planning processes, and include specific targets for energy efficiency in their operations in the Water Service Development Plans. Energy audits should be undertaken on a yearly basis.
- Energy efficiency should form a major criterion when planning new or upgrading existing water supply and sanitation programmes, and funding programmes should use specific targets in the decision-making process.
- Wastewater treatment facilities should be encouraged to implement biogas energy production projects, and incentives should be provided for this purpose.
- Similarly, water supply and distribution projects should investigate the feasibility of mini-hydropower generation in water distribution systems.
- As water demand management programmes also result in energy savings, energy efficiency should be included in water service providers' water demand management and water conservation programmes.
- Loose liaison should be established and maintained with energy suppliers (Eskom), and water services providers and authorities should be aware of and pursue the offerings in the rebate programme.
- The concept of 'Negawatts', i.e. water supply and sanitation processes that use no energy, should be actively encouraged. Examples of these systems are on-site sanitation, slow sand filtration and rainwater harvesting.

- 'Toolboxes' should be developed to provide water and wastewater treatment plant supervisors and process controllers with technical solutions and support for improving energy efficiency in their facilities.
- Investigate the feasibility of using alternative renewable energy technologies with relation to initial capital costs, site conditions, specific climate conditions and return-on-investment. Financial incentives should be provided for such investigations and projects.
- Development of new or alternative wastewater treatment processes and systems (both centralised and

decentralised) should aim towards low-energy processes, especially regarding the high energy requirements for aeration in biological systems.

#### Further reading:

To order the report, *Energy efficiency in the South African water industry: A compendium of best practices and case studies* (Report No. TT 565/13) contact Publications at Tel: (012) 330-0340, Email: [orders@wrc.org.za](mailto:orders@wrc.org.za), or Visit: [www.wrc.org.za](http://www.wrc.org.za) to download a free copy.