Courtesy eThekwini Municipality

Pressure reducing valves help Durban central business district curb water loss and save electricity.

OF WATTS AND DROPS – New compendium switches on the lights for SA energy efficiency in water

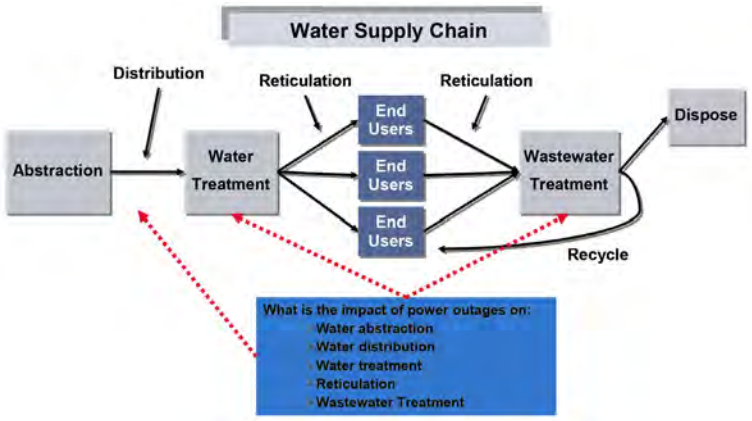
Over the last few winters South Africans have become well acquainted with the flashing messages across their television screens warning of imminent power disruption as a result of a stretched network. And as it has become all of our responsibility to save electricity where we can, the time is now ripe for the South African water sector to implement its own energy efficient methods. Article by Lani van Vuuren.

The energy required for water and wastewater treatment and supply has become a significant cost item for municipalities and water utilities, not only due to the need to expand services to an ever-increasing population, but also as a consequence of the implementation of new technologies to meet stricter potable water and effluent quality standards.

Figures are not available for South Africa, but in countries such as the US, water and wastewater facilities account for up to 4% of the country's annual electricity consumption. The US Department of Energy estimates that their water and wastewater treatment sector is the third-largest energy consuming sector in the country.

While South Africans were for decades accustomed to cheap electricity rates, this is no longer the case. The water sector has not been immune to the power outages and steep tariff increases experienced from 2007. This has gradually prompted an inward reflection at the way energy is consumed by water treatment and supply processes.

Numerous factors influence the amount of energy utilised in the water supply chain, including the stage of the water supply chain, technology utilised, the use of pump versus gravity feeds as well as the quality of the water being treated. It is thus not possible to calculate how much electricity is needed, on average, to treat a megalitre of water or wastewater. It can be said, however that wastewater treatment is by far the largest consumer of energy (between 200 and 1 800 kWh/Mℓ treated). Water treatment, on the



Areas of impact of power outages in the South African water.

other hand, typically reflects lower energy consumption figures at 150 to 650 kWh/Mℓ treated.

GLOBAL FOCUS

The need to improve energy efficiency in the water sector has prompted the Global Water Research Coalition (GWRC), an international alliance of 12 leading research organisations, to include water and energy as a priority area of their joint research agenda. One of the first projects coalition members have embarked on under this research focus is the compilation of an energy efficiency compendium of global best practices and case studies.

Four reports are expected to be received from Australasia, Europe, South Africa and the USA. Once all four continental reports are available they will be compiled into the global compendium.

One of the first energy efficiency reports to be published, that of the UK, concludes that overall energy efficiency gains of between 5% and 15% may be achieved, with up to 25% energy efficiency improvement in wastewater treatment processes (mainly activated sludge processes). The report further indicates that renewable energy, mainly in the form of combined heat and power (CHP) from sludge biogas, could contribute significantly to the net energy demand of the water industry. The US compendium has also been completed.

SOUTH AFRICAN FIRST

Earlier this year, the Water Research Commission (WRC) launched the energy efficiency compendium for the South African water industry at the Fourth Municipal Water Quality Conference, held at Sun City. 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.

"While it is important to learn from international best practice, it is equally important to document South African specific case studies to allow for greater learning across all municipalities (large and small)," notes WRC Research Manager, Dr Jo Burgess. "The compendium provides enormous benefit to the sector through comprehensive guidance on energy efficiency, reduced energy use and cost, as well as a reduction in carbon footprint. There may also be benefits in communication of status and expectations of the industry's contribution to national and global energy and carbon reduction targets."

The WRC compendium provides clearly documented examples which those in the sector can read, digest and tailor to their own situations. Municipalities can 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 their water services development plans.

The study evaluated both incremental improvements in energy efficiency through optimisation of existing assets and operations, as well as substantial improvements in energy efficiency from the adoption of new technologies. The compendium also highlights 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. This is the first time that such a compendium has been made available to the South African water sector.

Courtesy eThekwini Municipality

An outside view of the pressure reducing valve chamber, part of advanced pressure management in Durban's central business district.

LONG ROAD AHEAD

Contrary to countries such as the UK and US, South Africa has not been actively pursuing and implementing energy savings projects on a large scale. This made finding suitable case studies and operational data challenging.

Shaun Deacon

The combined heat and power (CHP) plant, which uses biogas, during construction and upon completion at Johannesburg Water's Northern Wastewater Treatment Works. Through CHP generation, the water and wastewater utility anticipates that it can initially produce about 60% of its wastewater treatment works' electricity requirements.

Energy consumption range for the South African water supply chain

Process	kWh/Mℓ	
	Min.	Max.
Abstraction	0	100
Distribution	0	350
Water treatment	150	650
Reticulation	0	350
Wastewater treatment	200	1 800

Nevertheless, the compendium provides useful and successful case studies from several municipalities around South Africa, including (among others) eThekwini, Tshwane, Johannesburg, Emfuleni, Amatola and Overstrand.

"South African local authorities range from being completely oblivious to extremely sensitive to the need for energy efficiency, including the majority who are aware but not necessarily seeing it as a priority," notes Dr Burgess. "Municipalities who are grappling with services provision have certainly not been able to prioritise energy efficiency."

The compendium guidelines and best practices can and should be used as a basis for development of energy efficiency and energy conservation targets for the South African water sector, maintains Dr Burgess. These targets can then be implemented, encouraged and regulated through the Department of Water Affairs' Blue Drop and Green Drop programmes.

Based on the information that is now available describing to what extent cost and energy savings can be made using different interventions, energy efficiency should form a major criterion when planning new or upgrading existing water supply and sanitation projects, and it is recommended that funding programmes should use specific targets in the decision-making process.

In cases where new systems need to be built, an awareness of the best practices in terms of energy efficiency will enable municipalities to get their systems right the first time, rather than needing to retrofit energy efficiency measures. "In many cases that have been documented in the compendia, we have seen that energy efficiency has formed part of a broader improvement process in which water and wastewater treatment works have been made water efficient, energy efficient and cost efficient all at the same time," says Dr Burgess. "This is because in a majority of cases the driving force behind energy efficiency improvements has actually been a desire to reduce operating costs, and energy consumption reduction has been an indirect benefit."

With the new WRC compendium only a phone call or mouse click away, there is no more excuse for municipalities to remain in the dark regarding energy efficiency.

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; Fax: (012) 331-2565; Email: laniv@wrc.org.za or Visit: www.wrc.org.za to download a free copy. ❑