

Bloemwater head office is going green

PROPHETIC WORDS

British Prime Minister Winston Churchill stated the following in his speech *The Locust Years* in November 1936 to the House of Commons:

The era of procrastination, of half-measures, of soothing and baffling expedients, of delays, is coming to a close. In its place we are entering a period of consequence ...

Although his words related to the turbulent political situation at that time in the wake of devastating wars and costly errors, these words have relevance to 21st century issues as well, and can be viewed as a stern warning to the decision-makers of today that the days of reckless living, in which decisions are based on immediate harms or gains, are over.

Seventy-odd years after Churchill uttered these prophetic words, and as the consequences of our forefathers' decisions are starting to have an impact, the realisation is dawning that a *period of consequence* means that the preferences which are applied will change the Earth's landscape and that of its inhabitants.




Churchill's statement has become

a mantra for environmental activists because it so eloquently summarises the environmental climate we live in. Since the industrial revolution, civilisation has boomed. Natural resources such as coal, water and wood have been used recklessly at the will of the consumer, often without due recognition of the fact that once a non-renewable resource is exhausted, there is no way of replenishing it. According to some environmentalists, electricity has been produced in the least expensive, but often most harmful ways – particularly in the case of some of the coal-fired power stations.

ENERGY DRIVES DEVELOPMENT

Energy is the lifeblood of worldwide economic and social development. When one considers the current status of global energy shortages, and the emphasis on reducing CO₂ emissions and developing alternative energy generation methods, on the one hand, and the growing energy consumption, on the other hand, it is clear that there is a need to change the way energy is generated and used.

It is a known fact that South Africa

Mokutu Kgwale Executive: Operations and Maintenance Bloemwater mokutuk@bloemwater.co.za	
Marco van Dijk Department of Civil Engineering University of Pretoria marco.vandijk@up.ac.za	
Jay Bhagwan Water Research Commission jayb@wrc.org.za	

is not as well endowed with hydropower conditions as countries elsewhere in Africa and the rest of the world. However, large quantities of raw and potable water are conveyed daily under either pressurised or gravity conditions over large distances and elevations in our country. There are 284 municipalities in South Africa, and several water supply utilities and mines who all own and operate gravity water supply

distribution systems which could be considered for small-, mini-, micro- and pico-scale hydropower installations. Most of these water supply and water distribution systems could be equipped with turbines or pumps as turbines, supplementing and reducing the requirements for pressure control valves. The generated hydroenergy could be used on-site, could be supplied to the

national electricity grid, or could feed an isolated electricity demand cluster.

HYDROPOWER RESEARCH PROJECT

The University of Pretoria (UP), supported by the Water Research Commission (WRC), is engaged in a research project investigating the potential of extracting the excess hydropower energy from water distribution systems. Bloemwater, who is

one of the main organisations participating in this research project, has taken the bold step of converting to a sustainable hydropower energy source as the main supply of energy for operating their head office in Pellisier (Bloemfontein, Free State).

The Caledon–Bloemfontein potable water supply system supplies the bulk of the water needed in Bloemfontein. The water is supplied to the Brandkop Reservoir, which is where Bloemwater's head office is located. Excess energy is dissipated through pressure control valves (Photo 1), before being discharged into the reservoir.

This type of energy generation, referred to as conduit hydropower, is different from the conventional hydropower generation usually associated with large dams. The excess energy available in pressurised conduits (pumping or gravity), normally dissipated through pressure reducing valves (PRVs), is transformed into clean, renewable hydroelectric energy by means of a turbine. In other words it is simply harnessing what is already available in the existing water infrastructure.

For the Bloemwater project a 96 kW crossflow turbine (Photo 2) and synchronous generator from IREM in Italy will be installed. The turbine will be housed in a turbine room currently under construction, located next to the Brandkop Reservoir (Photo 3). The Bloemwater head office will be directly connected to this hydropower plant.

Approximately 30% of the water supplied via the Caledon–Bloemfontein pipeline will be diverted through the turbine. The turbine's runner will be turned due to the water passing through it, which will in turn excite the generator, thereby allowing hydroelectric energy to be generated. After passing through the turbine the water will be discharged through a constructed opening in the roof in the south-west corner of the reservoir. Control equipment will regulate the flow and pressure through the turbine, resulting in the generation of clean, stable electricity at the correct frequency of 50 Hz and voltage. The generated electricity will be connected via the control equipment to the main supply of the head office.

Sufficient renewable energy will be generated to supply the peak demand of Bloemwater's head office, as well as to meet the electricity requirements of the reservoir terrain. Annually approximately 800 MWh could be generated with this micro-hydropower installation.



Photo 1 Pressure reducing valves (PRV) at Brandkop Reservoir



Photo 2 Crossflow turbine and generator

The energy generation potential at this specific site is approximately 3.5 times that of the current planned development, and this could still be exploited in the future. There is also additional generation potential in the rest of Bloemwater's supply infrastructure.

CONCLUSION

Power supply is a necessity for economic growth. The extension of a country's power-generating capacity in an environmentally sensible manner could therefore ensure long-term sustainability.

Hydroelectric energy technology is a proven technology that offers efficient, reliable and flexible operation. Hydropower schemes are known to have very long lifetimes and high efficiency levels, with low operating and maintenance costs.

Conduit hydropower (harnessing what is already available in the existing water infrastructure) requires a small capital investment and has a short return on investment period. So, as long as people use water, renewable electricity can be generated!

REFERENCE

Blersch, C L 2009. Modelling the feasibility of retro-fitting hydropower on

existing dams. Final year project report, Department of Civil Engineering, University of Pretoria. □



Photo 3 Hydropower site location (Photo: Google Earth)