

Using water to power agricultural energy efficiency

Entrepreneurs and farmers all over South Africa are beginning to tap the country's water infrastructure for its energy-generating potential – a potential that experts say can deliver hundreds of megawatts of clean, sustainable power.

Unthinkable just a decade ago, the quest for renewable green energy in rural areas is being pursued largely under the radar but the rapid adoption of water-generated power speaks to how the agricultural sector is proactively and creatively embracing new ways of thinking.

Dozens of hydroelectric projects – ranging from less than one kilowatt (1kW) to several dozen megawatts (MW) – are today being actively pursued by individual farmers, hospitality operators and agricultural co-operatives in all nine provinces.

Consultant Ian de Jager of I & F Engineering says the contribution that small- to medium-sized hydroelectric projects can make to national electricity demand is likely to remain relatively small over the medium term. But, he says, small hydroelectric projects tapping into existing Department of Water Affairs and other infrastructure are already having a profound impact on the profitability and sustainability of individual farmers, farming communities and agri-businesses.

I & F Engineering is currently investigating a power-generating scheme on behalf of the Western Cape's Berg River Main Irrigation Board. For decades farmers represented by the board have used water from the Theewaterskloof Dam above Franschhoek for irrigation, and have now engaged De Jager's business to investigate and implement a project that will generate 5MW of electricity while delivering irrigation water to the Berg River.

Enormous hydroelectric potential

"The solution we have engineered has already passed through the environmental-impact and licensing stages and is just waiting for sign-off from the department [of Water Affairs] as it is their infrastructure," De Jager says, adding: "All over the country there is enormous potential to develop hydroelectricity using our existing water infrastructure. It's the cheapest and cleanest kind of electricity you can generate, especially as most of the infrastructure is already in place."

Specifically, South Africa's dams and reservoirs – the most highly developed in sub-Saharan Africa – can be exploited by farmers and groups of farmers to generate clean sustainable energy. So why haven't our dams been used in this way before?

“Essentially, in the past, we built dams without putting in turbines because we simply didn’t need the energy,” explains De Jager. “Today that has all changed. With South Africa currently experiencing energy constraints, we are more aware of the need to install energy-generating capacity that is both clean and renewable.”

As a rule of thumb, says De Jager, the capital expenditure required to generate 1MW of hydroelectricity in South Africa amounts to some R20 million and payback periods average just four and a half years. Also, the Department of Trade and Industry makes available grants of up to 80% of a project’s cost, to a maximum of R50 million per project, subject to certain conditions.

Payback on investment

(A recent hydroelectric installation, by Tulbagh fruit farmer Kobus van der Westhuizen, demonstrates that payback periods can actually be lower than the four and a half year average. Van der Westhuizen’s installation of four turbines is capable of generating 29kWh [kilowatt hours] throughout the year, generating more than enough electricity to power his Murludi Trust operation.)

In addition to the Berg River development, De Jager – a mechanical engineer by training – is implementing a 1.8MW hydroelectric project for a farmer on the Nels River in Mpumalanga. Total cost for the Nels River development will come in at under R35 million, says De Jager, including mechanical, civil and electrical engineering; the turbines; earthworks and all other infrastructure and equipment. “The value of his land and his operation will increase because the project will be generating clean, sustainable power, virtually forever,” says De Jager.

Doing it on the cheap

Farmers don’t have to be able to afford, or find finance for, millions of rands’ worth of expenditure on hydroelectric projects, De Jager says, citing the example of a farmer, also near Tulbagh, who has spent R250 000 to power his farmhouse by generating 7kW of power. “And people are now investing in projects of much less than 7kW, even less than 1kW, because it makes financial sense for them to do so.”

Wherever there is a dam or reservoir of a certain size there is often the potential to generate hydroelectricity. Working with the University of Pretoria, Bloemwater, the water utility supplying Bloemfontein, the Free State capital, is expected to very soon turn the hydroelectric potential of the city’s water infrastructure on to power its office block – for a once-off capital investment of under R700 000.

Wim Jonker Klunne, senior researcher: renewable energy at the Council for Scientific and Industrial Research, is compiling a database of hydroelectric projects not only in South Africa but across Africa. The database he is working on includes installed and operating operations as well as projects under development. These projects under development include “pico” projects (1kW to 10kW); “mini”,

“micro” and “large” undertakings, the latter category comprising developments that will deliver several dozen to hundreds of megawatts each.

In total, Jonker Klunne has identified 22 projects currently under development but he acknowledges that this is “only a fraction of what is actually going on”.

Just on the Orange River in the Northern Cape, says Jonker Klunne, he is anecdotally aware of as many as half a dozen hydropower projects now being actively investigated, each with the realistic potential to have an installed capacity of 4MW to 5MW.

The Ingula pumped-storage scheme, currently being constructed by Eskom and scheduled to become operational in early 2014 with a capacity of 1 330 MW, together with the many smaller hydroelectric projects happening in South Africa, could have a significant impact on ensuring the country remains powered up into the future. “Across South Africa individuals and co-operatives are turning to hydroelectric power to save money, to generate clean renewable power and to reduce their impacts on the environment,” says Jonker Klunne.

He adds that only 5% of sub-Saharan Africa’s sustainable hydropower potential has been developed – in stark contrast to the 80% figure for the economically advanced OECD states. “In South Africa we generate less than 2% of our electricity from hydropower while in Zimbabwe the figure is over 40% - and in Mozambique the number is 99.7% - both obviously largely derived from the big hydroelectric schemes utilising the Zambezi Valley. Coming off a low base, in South Africa we have great scope to increase hydro’s contribution to meeting our energy needs.”

Eskom working with farmers

Andrew Etzinger, Senior General Manager of Eskom’s Integrated Demand Management department, says the company is watching developments in the rural hydroelectric space with great interest. “It’s not just mega projects such as Ingula that Eskom is involved with,” says Etzinger. “On the ground, our Energy Advisors are working with farmers every day on finding ways to optimise their energy efficiency. Where there are real prospects of hydropower being commercially feasible and sustainable, we at Eskom can make a wealth of information and expertise available to farmers and rural communities.”

Eskom’s heritage in identifying and fostering small – even very small – hydroelectric investments has deep roots. In the late 1990s Eskom enabled five deeply rural schools to be electrified by hydropower. And while the lessons learnt in this pilot exercise were not further utilised at the time, or since, the company retains a vast knowledge resource built up from this and many similar undertakings.

“Working in partnership with agriculture we can revolutionise the ways in which we consume electricity, even how we produce it. This kind of out-of-the-box thinking can have far-reaching implications for all

aspects of agricultural operations,” says Etzinger. “For everyone concerned, very exciting, potentially very beneficial opportunities are now within our grasp.”

Eskom Energy Advisors

Eskom Energy Advisors - supported by energy efficient technology suppliers and Energy Services Companies (ESCOs) - excel in:

- Understanding and having access to the latest energy efficient technologies;
- Analysing the energy consumption of farms or specific processes on farms;
- Identifying areas of energy wastage on farms;
- Assessing the current and future energy needs of farms; and
- Identifying the most cost effective and energy efficient technology solutions for farms.

Call 08600 37566 and ask to speak to an Eskom Energy Advisor.

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