Power sector ripe for innovation

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There are huge opportunities for investment and innovation in South Africa's power sector - so says Dr Steve Lennon, power utility Eskom's group executive for sustainability.

When complete, Medupi power station will be the largest dry-cooled coal-fired plant in the world. (Images: Eskom)

Lennon was speaking at the fifth edition of the Innovation Summit in Johannesburg, a two-day annual event that seeks to bring together entrepreneurs and creative thinkers from academia, private companies and the government to network, share ideas, and pitch concepts to potential funders.

"The power sector has been on a roller coaster for many decades," said Lennon, "and there's a big gap in access to advanced forms of energy across the African continent. So - do we accept or address the situation?"

South Africa's power sector presents a number of challenges and opportunities, he said. Since 1994 the economy has grown by 70% while the power supply has not kept pace, growing by just 17% in comparison.

In addition, the world has to adapt to a changing climate, and companies, big and small, are under pressure to reduce their carbon footprint and impact on the environment.

Then there is the challenge of bringing power to every citizen of South Africa. "There are 2.5-million people who have no access at all to any form of electricity - we need to bridge that gap, because poverty holds people back from success."

At the same time, that electricity supply has to be affordable and competitive, and accommodate power production off the grid.

Using resources wisely

This is where the integrated resource plan (IRP) comes in, said Lennon. This is a long-term strategy drawn up by the

Department of Energy to manage South Africa's energy resources in a sustainable way, and covers the period from 2010 to 2030. It may be downloaded from the department's website (PDF, 3.7MB).

"By 2030, we aim to have reduced our dependency on coal to 60%," said Lennon, "while the rest of our power comes from low-emitting sources such as solar, hydro and nuclear."

If successfully implemented, the IRP will see South Africa diversify its mix of power sources away from coal, which is currently where the country gets 90% of its power, and at the same time double its energy output.

Despite the increase in output, the decrease in coal burning will result in a net reduction of carbon dioxide emissions by 2030 to less than 275-million tons a year, and a 60% reduction in water usage.

"Even our coal plants will use less water because of advanced technology such as dry cooling. It's a big challenge, but a huge opportunity which calls for a lot of investment."

Lennon added that the Southern African region's long-distance transmission capacity must also be increased, which is another investment opportunity.

The progress so far

In terms of turning this ambitious plan into action, the country has already come a long way to boost its electricity output and implement new technology, said Lennon.

Two new coal power stations are under construction - the 4 800MW Medupi near Lephalale in Limpopo province, and Kusile in Mpumalanga, which is also expected to have an output of 4 800MW. Medupi is scheduled for full commercial operation by 2015 and Kusile by 2018, although individual units will be brought online earlier as they are completed.

When complete, Medupi will be the world's largest dry-cooled coal-fired plant. It will incorporate super-critical machinery, which can operate at higher temperatures and pressures than older-generation equipment, and is also more efficient, resulting in better use of natural resources and lowered impact on the environment. The super-critical design is Eskom's first.

Kusile, on the other hand, will be the first power plant in South Africa to have cutting-edge flue gas desulphurisation technology installed. This means that its exhaust gases will be processed to remove all traces of sulphur oxides before being released into the atmosphere. Excess sulphur dioxide in the air is one of the causes of acid rain.

Lennon also spoke about the 100MW Sere Wind Farm in the Western Cape, Eskom's flagship renewable project, and the 1 333MW Ingula pumped storage scheme in KwaZulu-Natal. This plant comprises two dams which are connected via an underground powerhouse with four pump turbines. Water will flow from the upper dam to the lower in peak time, generating power as it passes through the turbines, and when the demand is low the turbines will pump the water back to the upper dam.

The Bramhoek and Bedford dams are both complete and according to Eskom, Ingula will be commissioned during 2013/2014. Sere will go into commercial operation towards the end of 2013.

"To date 2 400MW of capacity has been awarded to renewable projects," said Lennon, "with more to come."

He enthusiastically mentioned Eskom's underground coal gasification (UCG) project, which is in the pilot stage with a test plant next to Majuba power station in Mpumalanga. The gas produced is co-fired with coal in Majuba's Unit Four, and contributes 3MW to the station's output.

When the pilot plant delivered its first batch of gas to Majuba in October 2010, Eskom made history because the event

marked the first production of commercial electricity from UCG gas outside the former Soviet Union.

"Eskom is the world leader in this technology," Lennon said, "and we've been working on it for 10 years already."

With the region's substantial coal reserves, there is "enormous potential" in this source of power, said Lennon. It uses coal seams that can't be mined for various reasons - they may be too deep, or fractured, or of poor quality - and turns the coal into clean gas on site.
"This project is going strong, and will play a role in our future plans. It's a great technology."

However, it is one thing to plan for power generation, but another to get it to the customers, so Eskom has developed a 10-year transmission development plan which includes renewable energy integration.

Opportunities in the region

The Southern African region is energy-rich," said Lennon, "but under-exploited."

There are massive coal resources in South Africa, Mozambique, Botswana and Zimbabwe, he said, and natural gas in Mozambique and the Mozambique/Tanzania border region, as well as off the region's west coast, while there are opportunities for wind all along the coastline.
"Central Southern Africa has the best hydro resources in the world," said Lennon, "and this is another great opportunity for investment and innovation."

Finally, the Northern Cape province is one of the best areas on earth in terms of the intensity and consistency of solar radiation.
"If we connect all of these areas with a super grid, we can make maximum use of our wealth of renewables."

The smart grid concept, which is gaining ground around the world, uses ICT to analyse supply and demand of power and adjust its operation accordingly. This will bring about an energy revolution across the entire value chain, said Lennon, from long transmission to end user management.

"The smart grid is wide open for innovation," he said, "but we need to create an enabling environment so that everybody from universities and science councils to small businesses can get involved."