

# South Africa's power generation plans are out of date

*Hartmut Winkler says an urgent rethink is needed*

South Africa's economy has taken a number of very heavy body blows recently. These include a slowdown due to measures taken to control the spread of COVID-19, on top of increased state dysfunctionality due to corruption. In July, the country experienced the worst riots since it became a democracy in 1994. All have left it struggling financially, while investor confidence has been shaken.

The country's president, Cyril Ramaphosa, and then finance minister, Tito Mboweni, put measures in place to try to soften some of the hardships caused by the pandemic, as well as the arson and violence. But a host of additional adjustments need to be made – to economic plans as well as budgets. One of these is the country's power generation and electricity supply programmes.

Electricity demand projections are interlinked with economic progress. Changes in the economy therefore have a direct impact on the energy sector. In addition, energy generation technologies are evolving rapidly, affecting available technological choices and associated costs. A reappraisal of the country's long-term electricity requirements – and a review of technologies best suited under the circumstances – has therefore become a priority.

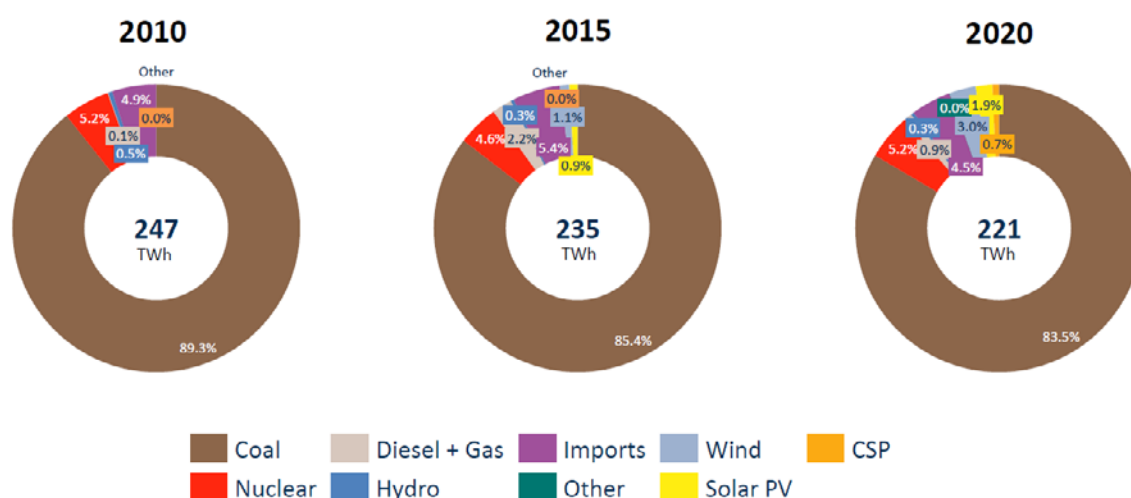
## Energy planning

South Africa's energy policy is managed through the Integrated Resource Plan. The document is prepared by a panel of experts and sets out the preferred evolution of the power generation landscape (additions, closures, technologies to be used) based on scenario planning. These plans are supposed to be reformulated every two years. The most recent one was gazetted in 2019.

Since then there have been a number of significant developments in the sector. The first revolves around technology, in particular electricity storage, a major enabler of wind and solar as sources of electricity generation. Renewables currently make up only 10.5% of electricity generation in South Africa. But there's widespread recognition that this needs to be increased. The push factor is that the country needs to reduce its dependency on coal. The pull factor is that it has ample supplies of both wind and sun.

The cost of storage is a massive obstacle. Wind and solar can only function at specific times. The way round this is to store some of the electricity in batteries, to be released at times when the sun or wind aren't available. At the moment

## Generation share from primary supply sources in 2010, 2015 and 2020 in South Africa – marginal shifts in energy mix over past 10 years



Wind includes Sere wind farm (100 MW); Imports dominated by hydro from Cahora-Bassa (Mozambique)  
Sources: Eskom



Coal still dominates the South African energy mix, but the contribution from renewable energy sources now totals almost 11%.



Eskom

**Koeberg is South Africa's only existing nuclear power plant, but Eskom has applied for a nuclear installation site licence for Thyspunt, between Oyster Bay and St Francis Bay on the south coast.**

building batteries large enough to see the grid through dozens of hours without wind or sun is both impractical and too expensive.

But batteries with more capacity are being developed with the use of hydrogen. Better and cheaper storage will make the intermittent renewable electricity generating technologies more viable and increasingly attractive.

The other reason the plan needs to be revised is that it would allow South Africa to settle the lingering confusion about possible future nuclear builds. The 2019 plan did not envisage any new nuclear developments until at least 2030. Despite this, and in the face of opposition from various quarters, the government has been encouraging the nuclear sector to engage in preparatory work leading to a new build.

In my view this option should be left out of any revised plan. The main reasons are South Africa's national fiscal shortages – nuclear is very expensive – as well as the ongoing global decline in nuclear technology. The other reason that the plan needs to be revised urgently is the changing patterns of demand.

### **Electricity demand will grow less than projected**

A number of assumptions that were used to develop the integrated resource plan two years ago are no longer accurate. One has been a drop in electricity demand from the power utility Eskom. This has been driven by slower economic activity as was evident during the COVID-19 lockdowns. In addition, demand has been dampened by steep rises in electricity rates. Power cuts have also been a contributor to the drop in demand.

This trend is likely to continue as the move to solar generation accelerates. Mines have been keen to set up their own on-site solar plants and there has been significant growth in solar installations on domestic rooftops and in shopping malls and factories. This will be given further wings by the fact that the government is changing the regulatory environment to make it easier for independent developers to set up power plants up to 100 megawatts (MW).

While a quicker than imagined economic recovery is always possible, this would be accommodated in future electricity plan revisions. But even here caution is required. Economic growth only leads to slightly higher electricity demand – an increase that's always been overestimated in the past.

### **Plugging the gaps in the interim**

The national power utility, Eskom, has been unable to provide a steady power supply due to ageing infrastructure and an abnormally high number of breakdowns. This has led to periodic electricity blackouts at times when demand has exceeded supply.

To alleviate power shortages in the interim, the Ministry of Mining and Energy launched an initiative to solicit 2 000 MW of emergency power from private developers. But the plans aren't panning out very well. Most of the capacity awarded under the programme was to a Turkish company that operates a fleet of ships with gas power stations on board. Three ships were to be moored off South Africa's coast, but the floating power stations ran into major difficulties related to environmental authorisation requirements, and there were also court challenges. However, the successful

bidders were all then granted an extension until the end of January to reach financial closure – when all the project and financing agreements have been signed.

The remainder of the interim plan was to be taken up by renewable energy-based projects. But a new requirement in the plan for emergency power was that wind and solar plants must be able to deliver power continually from 5 am until after 9 pm. This means that renewable projects require supplementation when there is no sun or wind, making them expensive.

The most problematic aspect of the emergency power programme is that it will award 20-year contracts to successful bidders. So a short- to medium-term power shortfall is to be settled by long-term contracts that will supply electricity at considerably higher cost than alternative sources. The emergency power programmes were supposed to be operational by 2022. This deadline is clearly not going to be met.


### What next

South Africa needs a detailed and thoroughly researched set of scenarios mapped out to inform a new electricity plan. These would weigh up the various options – from renewables through to nuclear, coal or gas plants. They would also factor in the eventual completion of the three remaining, much-delayed units at the Kusile coal plant. These will add 2 400 MW when they come on line in the next few years, corresponding to about 5% of the country's electricity generating capacity.

### • UPDATE

On 28 October 2021, government announced 25 new renewable energy projects that are envisaged to produce 1 600 MW of wind power and 1 000 MW of solar power. Most of these are to be located close to the main powerlines crossing the Karoo and Free State. They are expected to be up and running in 2024, but will not be able to cover the present electricity shortfall. Many more such developments will be needed in future, and the current national electricity plan envisages similar annual additions up to 2030.

An interesting development is that the electricity produced by these projects will be sold to Eskom at significantly cheaper prices than existing solar and wind farms. This price drop is due to the steady worldwide decline in the cost of building renewable power plants. It implies that there are now strong economic incentives for the long-term replacement of polluting, global climate change-inducing coal-fired power stations with clean energy.

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*<https://theconversation.com/south-africas-power-generation-plans-are-out-of-date-an-urgent-rethink-is-needed-162771>*

*Images sourced and captioned by the editor with Prof. Winkler's approval. The CSIR graphic was extracted from Calitz, J & Wright, JG, 2021. Statistics of utility-scale power generation in South Africa in 2020. Available online at <http://hdl.handle.net/10204/11865>*

## Karpowership SA

In March 2021, Karpowership SA was announced as a preferred bidder to provide power to South Africa's national electricity grid under the Risk Mitigation Independent Power Producer Procurement Programme. Karpowership SA is a 49% South African-owned BBBEE company, with the remaining 51% owned by Karadeniz Holding, based in Istanbul, Turkey.

Karadeniz already has 25 powerships in 15 locations in Africa and Asia. A powership is a fully self-contained floating power station, which relies on liquid natural gas (LNG) to generate electricity using gas reciprocating engines and steam turbines. LNG is a natural gas that is cooled to  $-162^{\circ}\text{C}$  to convert it to the liquid state, which can then be easily stored

and transported because its volume is 600 times smaller than the gaseous state.

Karpowership SA's bid was to berth five powerships in three harbours around the South African coast – two in Richard's Bay, two in Port of Ngqura in Algoa Bay and one in Saldanha Bay. Each of the harbours will also have one floating storage regasification unit (FSRU) moored nearby. The FSRU is where the LNG is warmed in heat exchangers to convert it back into the gaseous state before it is piped to the powership. The FSRUs would be resupplied with imported LNG by tankers, known as LNG carriers, every 20–30 days. Together, the three powerships would be capable of producing 1 220 MW, which would be enough to reduce load-shedding by one level.



**The five powerships planned for South Africa will be accompanied by three floating storage regasification units, where liquid natural gas (LNG) is stored before being converted back to the gaseous state and piped to the powership for electricity generation.**