

A monthly review of energy-related news

# South Africa Energy Roundup

**DECEMBER 2017**

## Energy planning

### Academy of engineers calls for nuclear procurement halt

The South African Academy of Engineering has called for a moratorium on the procurement of new electricity generation capacity, including nuclear power, until consensus has been reached on a new Integrated Resource Plan (IRP), which should be the outcome of "proper consultation in an open and transparent process". The academy, which is a voluntary organisation comprising 197 eminent engineers across all disciplines, also called for the "hastily planned and convened Energy Indaba", scheduled for December 7 and 8, to be postponed to January. This will allow for "proper planning, including the release of a draft IRP by the Department of Energy to allow meaningful participation by all relevant stakeholders". Similar calls have been made by several nongovernmental organisations, which believe the indaba may be an attempt by Energy Minister David Mahlobo to "rush" through an updated IRP, which includes a new nuclear build component. Mahlobo has denied that the nuclear energy deal was being in any way rushed or expedited.

### CSIR signals renewables-led electricity mix by 2050

The Council for Scientific and Industrial Research (CSIR) Energy Centre has published updated research outcomes indicating that South Africa's least-cost electricity mix, by 2050, includes predominantly solar photovoltaic (PV) and onshore wind contributing nearly 80% of the country's electrical energy. The research outcomes are a follow-on from the techno-economic analysis produced by the science council in response to the Department of Energy's (DoE's) call for public comment on the draft Integrated Resource Plan (IRP2016) Base Case, published in late 2016. In its formal submission to the DoE, the CSIR showed how renewables should comprise around 70% of the least-cost mix by 2050, instead of the less than 25% outlined in the draft IRP2016 Base Case, which also showed that nuclear would contribute around 28%. The science council has since stress tested the model using additional assumptions not included in either the draft IRP2016, or in the CSIR's formal response to the DoE. For instance, the new research outcomes include: more aggressive learning rates for solar PV, onshore wind and stationary storage (in the form of lithium-ion batteries) based on forecasts supplied by the Bloomberg New Energy Finance New Energy Outlook; learning rates for concentrated solar power; and demand side flexibility in the form of electric vehicles and domestic electric water heaters. These assumptions have been applied to high- and low-demand scenarios. The outcome for the high-demand scenario is a least-cost mix in which solar PV and wind

supply 79% of the energy at a system cost of \$33-billion a year, which translates to an average tariff slightly above \$0.06/kWh. In the low-demand scenario, solar PV and wind supply 75% of the energy at a system cost of \$24-billion a year and at a tariff slightly above \$0.06/kWh.

### Second study states renewables is South Africa's cheapest option

A new, independently produced techno-economic model of South Africa's cost-optimal power generation mix in 2040 outlines a system where 69% of the electrical energy is produced from onshore wind and solar photovoltaic (PV) generators, supported by batteries and gas-fired generators. Conducted by the Frankfurt Institute for Advanced Studies (FIAS), the study concludes that there will be no need to add new coal or nuclear power stations beyond what is already installed. Constructed using open-source energy modelling software, known as Python for Power System Analysis (PyPSA), the study has drawn the bulk of its assumptions from the draft Integrated Resource Plan (IRP2016) base case. Some of the information was also sourced from the Council for Scientific and Industrial Research. The study's parameters deviate from the draft IRP by aligning wind and solar PV costs with the R0.62/kWh achieved during the most recent bid window of the Renewable Energy Independent Power Producer Procurement Programme. 'Moderate' learning rates have also been applied, which halve overnight costs for solar PV and wind by 2040. The battery energy storage costs used in the analysis are also more conservative than forecasts provided by Bloomberg New Energy Finance forecasts. Another deviation is that the assumptions have been modelled using the PyPSA software tool, rather than the sophisticated Plexos system used by State-owned power utility Eskom and the Department of Energy to produce South Africa's IRP2016.

The outcome is a least-cost configuration in 2040 comprising 53% wind, 16% solar PV and 25% coal, with the balance of the energy derived from nuclear, gas, hydro and batteries. The system will still comprise 19 GW of residual coal-fired generation and 1.8 GW of nuclear in the mix, despite the closure of several coal plants between 2020 and 2040. There will also be 2.9 GW of pumped storage, while Cahora Bassa is expected to contribute 1.5 GW of capacity. Increasingly, though, the variable wind and solar generators will need to be backed up by 11 GW battery units and 12 GW closed cycle gas turbines. The least-cost mix has an average system cost of R510/MWh in 2040; a "base case" that is nearly 20% cheaper than a scenario where at least 10 GW apiece of new coal and new nuclear is incorporated into the mix.

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## Coal

### Eskom links Medupi unit to the grid

Power utility Eskom has linked Unit 4 of its Medupi coal-fired power station, which has been marred by delays, to the grid. The coal-fired unit in Limpopo is a rare example of a Medupi project that has been completed ahead of time. It was scheduled for completion in July of 2018. Medupi will contribute 794 MW to the national grid and join the already linked units five and six.

### Hendrina power station may not have adequate coal

Power group Eskom has admitted that coal stock at its Hendrina power station may be lower than the 20-day supply requirement, but said on November 30 that load-shedding was unlikely as its other 12 power stations had sufficient supply. Investigative news website Amabhungane has reported that Gupta-linked mining company Tegeta Exploration and Resources have threatened to shut down coal supply to the Hendrina power station. The miner wants to increase the amount that Eskom pays for coal. The power station has also reportedly been starved of coal that it is entitled to, while the mining company exports coal.

### Study urges Eskom to accelerate station decommissioning, curtail Kusile

A new study argues that Eskom should accelerate the decommissioning of three of its older coal-fired power stations and that it should halt construction of units 5 and 6 at the Kusile project, in Mpumalanga, to make an immediate cost saving of up to R17-billion. However, should Eskom's financial crisis worsen to the point where it threatened the country's fiscal and economic sustainability, the study suggests that it could become necessary to abandon more of Kusile, as well as parts of the Medupi project, in Limpopo. Compiled by economics consultancy Meridian, the study draws on the Council for Scientific and Industrial Research's Energy Centre's modelling of the least-cost electricity system, which concludes that new coal and nuclear plants are no longer competitive in light of the falling costs of renewables, and that, for the foreseeable future, no gas-fired power stations are required. It also includes a Meridian analysis of the incremental cost associated with running particular stations for their remaining life, which in the case of Kusile units 5 and 6, includes the avoidable capital cost of completing the units. It concludes that an early decommissioning of Grootvlei, Hendrina and Komati, while avoiding the completion of Kusile units 5 and 6, could yield net financial savings of between R15-billion and R17-billion, without affecting security of supply.

## Nuclear

### Activists to appeal enviro authorisation for proposed new nuclear power station

Earthlife Africa Johannesburg, Greenpeace Africa and the Southern African Faith Communities' Environment Institute have officially filed a notice informing the Department of Environmental Affairs that they intend to jointly appeal the environmental authorisation for the construction and operation of a new nuclear power station in Duvynfontein, in the Western Cape. Greenpeace Africa argues that the environmental-impact assessment (EIA) fails to properly assess the impacts of the proposed nuclear power station and that, should the project go ahead, it will infringe the environmental rights of present and future generations.

The EIA process has been under way for nearly a decade, and has been contested by affected communities and broader South African society because of the potentially far-reaching implications of the construction of a new nuclear power station.

### Mahlobo's call for 'modular' electricity roll-out at odds with nuclear ambition

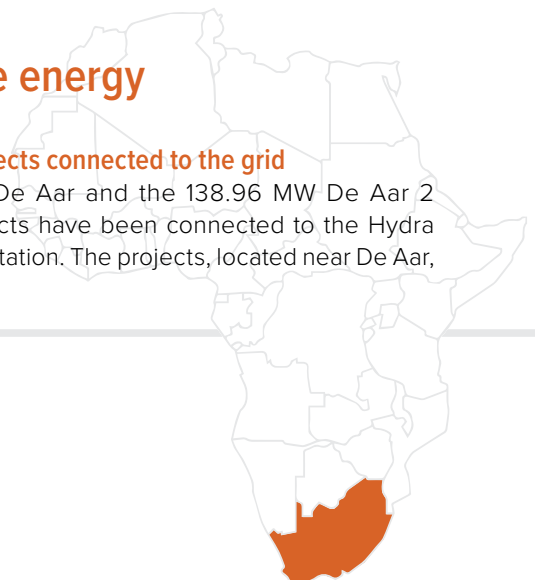
A November Parliamentary reply of Energy Minister David Mahlobo, in which he argues that there is no longer a need to build large generation units owing to the availability of low-cost smaller generation options, is at odds with his support for a large-scale nuclear build programme. In response to a question by Economic Freedom Fighters MP Mzingisi Dlamini, the Minister has acknowledged the risk of building "stranded assets". He went on to say: "The low cost of smaller generation units makes it easy, as we now do not have to build large units i.e. infrastructure build programmes must be implemented in a modular manner so that it can respond to changes in the market." The reply flies in the face of the Minister's open support for large-scale nuclear. All the pressurised water reactor designs that may be considered should South Africa restart the process to procure nuclear would have capacities of greater than 1 000 MW a unit.

## Renewable energy

### De Aar wind projects connected to the grid

The 96.48 MW De Aar and the 138.96 MW De Aar 2 North wind projects have been connected to the Hydra transmission substation. The projects, located near De Aar,

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in the Northern Cape, were selected as preferred bidders under Round 3 of the Renewable Energy Independent Power Producer Procurement Programme. About R5-billion in capital was spent on the projects, with the senior debt provided by Nedbank Capital and the Industrial Development Corporation. The wind energy facilities are owned by a consortium comprising Longyuan Power Group, Mulilo Renewable Energy, DLO Energy Resources, Sula Energy and a local community trust.

### Globeleq increases stake in South African renewables projects

Electricity generation project developer, owner and operator Globeleq has increased its shareholding in the Jeffreys Bay Wind Farm, as well as in the De Aar Solar and Droogfontein solar projects by acquiring Mainstream Renewable Power's minority shareholdings in the three projects. Globeleq will fund the acquisition through a mix of internal funds and available credit facilities.

### Solar switch flipped at WesBank and FNB's Fairland campus

WesBank and First National Bank's (FNB's) 150 000 m<sup>2</sup> campus, in Fairland, Johannesburg, has officially switched on 7 647 reflective photovoltaic cells across 1 010 parking bays, helping reduce the campus's carbon footprint by 2 700 t/y. At peak efficiency, this system can generate 1.99 MW. The companies initiated the project in 2015, after commissioning a feasibility study to establish the possibility of replacing ageing carports with solar panels. Power from the solar panels is routed through 83 km of dc cabling, where power is stored across 83 dc-to-ac inverters.

### Wind energy industry optimistic despite frustrations

The South African Wind Energy Association (SAWEA) is confident that the tide will turn and that Eskom will soon sign the outstanding power purchase agreements (PPAs) that have delayed the procurement of new renewable energy for the past two years.

SAWEA chairperson Mark Pickering outlined the frustrations experienced by the industry at the seventh yearly International Wind Industry conference, Windaba 2017, held in Cape Town in November. PPAs for projects procured in bid window four of the Department of Energy's Renewable Energy Independent Power Producer Procurement Programme were meant to have been signed in July 2016 and since then several dates have been missed, including the most recent set by the previous Energy Minister for the end of October 2017. SAWEA CEO Brenda Martin said manufacturing companies were feeling the brunt of the delays.

## Storage

### Eskom to test vanadium redox flow battery

Aim-listed Bushveld Minerals' 84%-owned energy subsidiary Bushveld Energy has deployed its first utility-scale vanadium redox flow battery (VRFB) to Eskom for testing. The power utility will test the VRFB and its performance and applications under numerous simulations to validate the operational performance of energy storage systems in local conditions and to demonstrate the abilities and maturity of the VRFB for broad commercial use in South Africa and across the African continent. The testing outcomes will include minimum load shifting, wind generation smoothing, solar generation smoothing, power quality improvement and self-black-start capability. This follows the completion of market studies commissioned by Bushveld Energy, and the Industrial Development Corporation, in the second half of 2016, to assess African VRFB demand and opportunities, and global vanadium electrolyte demand and requirements.

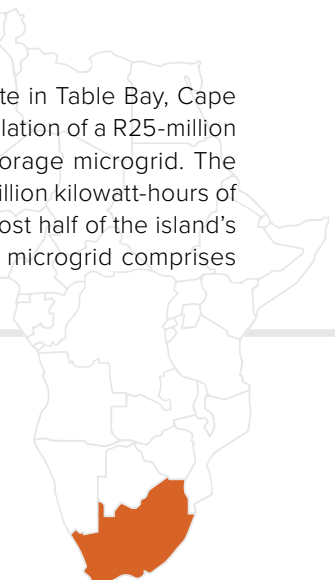
### Grid operators turning to batteries as costs fall and need for flexibility rises

The standalone cost of battery energy storage remains above South Africa's prevailing, albeit rising, electricity tariffs, but could already be commercially viable in some instances when the "stacked benefits" of the technology are taken into account. A levelised cost of electricity (LCOE) study undertaken by Mott MacDonald Africa, based on a vanadium redox flow solution ranging in size from 1 MW (6 MWh) to 20 MW (120 MWh), calculated the LCOE of battery storage to be between \$0.23/kWh and \$0.45/kWh. The battery LCOE was already below, in some instances, the \$0.40/kWh calculated for generation using diesel and only marginally above Eskom's winter peak tariff of \$0.20/kWh. However, it remained well above the \$0.10/kWh LCOE associated with coal and nuclear, as well as Eskom's summer tariff. Nevertheless, Mott MacDonald Africa's Paul Tuson argues that the viability of battery storage will continue to improve as battery costs decline and that, in some cases, such systems could already be commercially justified when the associated, or stacked, benefits are also considered.

### Robben Island installs microgrid

Robben Island, a World Heritage Site in Table Bay, Cape Town has gone green with the installation of a R25-million solar energy, lithium-ion battery storage microgrid. The microgrid will produce about one-million kilowatt-hours of electricity a year. This supply is almost half of the island's yearly electricity requirement. The microgrid comprises

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three power production elements: a solar photovoltaic (PV) farm, the battery bank and the diesel generators. The solar PV farm has 1 960 monocrystalline modules that total 666.4 kW power supply. The battery bank comprises 2 420 lithium-ion battery cells. The bank is able to store 837 kWh and output a maximum of 500 kVA. The diesel generators are used when no solar or battery storage is available. Technology group ABB supplied the solar inverters that convert the variable direct current output from the solar panels into the alternating current required for electric utilities.

## Eskom funding and tariffs

### Eskom's 'business-as-usual' tariff application comes under fire

The 'business as usual' stance adopted by State-owned utility Eskom in its application for a 19.9% increase in tariffs for 2018/19 came under sustained attack during the Gauteng leg of the National Energy Regulator of South Africa's (Nersa's) public hearings, which started on November 16. Eskom interim CEO Sean Maritz started off the hearings with an appeal for the utility's application for allowable revenue of R219.5-billion to be reviewed on its merits, rather than the "negative information that currently drives public opinion" about the utility.

The group has rejected calls for its 2018/19 tariff to be capped at the level of inflation, arguing that such a move will be financially unsustainable as it will result in a revenue reduction, which will further squeeze its liquidity and could place the country's credit rating at further risk. Several business organisations, individual companies and civil society groups called on Nersa to restrict the hike to consumer price inflation, or lower, arguing that Eskom should improve its sustainability by embarking on aggressive cost cutting and by addressing serious allegations of corruption and wasteful expenditure. Several presenters also called for the utility to save costs by accelerating the decommissioning of expensive coal-fired generation and possibly even by curtailing its build programme in light of indications that Eskom will be running a sizeable electricity surplus for the foreseeable future.

However, Eskom showed little sign that it had been moved by appeals – made through 23 000 submissions to Nersa and oral presentations at hearings held in just about all of the nine provinces – for it to depart from its 'business-as-usual' tariff application. The utility did, however, make some slight adjustments to its application in relation to expected

sales volumes and costs associated with independent power producers. Eskom is now forecasting 'standard tariff' sales of only 188 TWh and 'total sales' of 211 TWh, as opposed to 216 TWh in its original application. It has also removed 6 305 GWh of independent power producer purchases, worth R7.1-billion in its revenue application, owing to delays in the introduction of renewables projects procured in 2015, but where contracts remained unsigned. As a result, the tariff application has been moderated by R6.6-billion, lowering Eskom's calculation of allowable revenue to R212.8-billion, from R219.5-billion in the original application. However, the lower standard tariff sales will still mean an average hike of 18.9% from April 1 and municipal increases of 26.9% from July 1.

Nersa will announce its decision on December 7.

## Transmission and distribution

### Johannesburg faces R17bn electricity infrastructure challenge

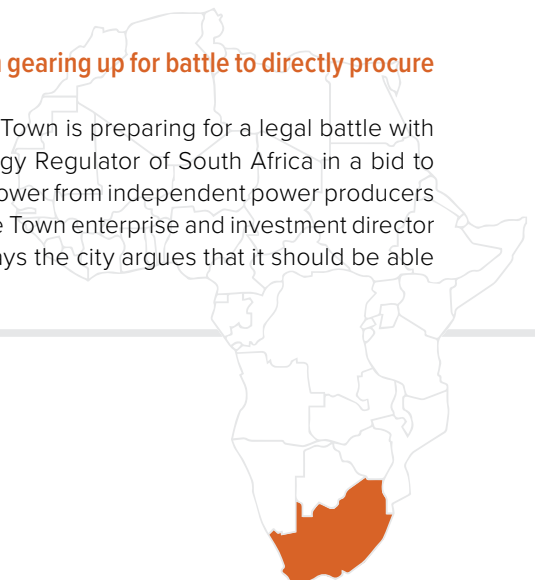
The previous administration's laxity has resulted in the City of Johannesburg requiring an investment of about R17-billion over the next ten years to upgrade its ageing electricity infrastructure. City of Johannesburg Mayor Herman Mashaba says his administration is facing serious infrastructure backlog challenges, compounded by an ageing network infrastructure, theft and vandalism, a backlog in asset renewal and bulk tariff trajectory. He points out that the inner city of Johannesburg is serviced by a 75-year old substation, Cleveland, which is undergoing a R180-million refurbishment. The city's Van Beek substation is also using old switchgear that is difficult to operate and unsafe to use. It is also difficult to source spares for the substation. He further highlights that theft and corruption remain significantly challenging and are costing the city millions each year. About R76-million was spent on security measures in an attempt to curb cable theft and vandalism in the 2016/17 financial year.

## Other

### City of Cape Town gearing up for battle to directly procure power from IPPs

The City of Cape Town is preparing for a legal battle with the National Energy Regulator of South Africa in a bid to directly procure power from independent power producers (IPPs). City of Cape Town enterprise and investment director Lance Greyling says the city argues that it should be able

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to procure power from an IPP without necessarily getting the Minister's determination. Cape Town will go to court to get a declaratory order to be able to do so.

### Investment in solar has overtaken coal globally, says IEA

Breaking all-time records, renewables currently account for two-thirds of global net capacity additions, according to one of several reports about how renewable energy is powering ahead. The trend is set to continue. International Energy Agency (IEA) renewable-energy division head Paolo Frankl said at the yearly Windaba, in Cape Town, in November that renewables would grow at double the pace of fossil fuels in the next five years. Solar photovoltaic has shot ahead of

coal to become the global leader in net capacity growth and wind power additions are "very close" to coal. Frankl added that the growth was partly attributable to the incredible success in cutting the cost of renewables.

The cost of solar had halved from 2014 to 2017, with another halving of the price expected over the next three years, he said. China has been leading the push on renewable energy and has banned new coal power plants, with a sharp focus on the environment now embedded in China's Constitution. It also has a new focus that it has dubbed 'Beautiful China'. The IEA says China will generate 30% of the world's electricity from wind by 2022.

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