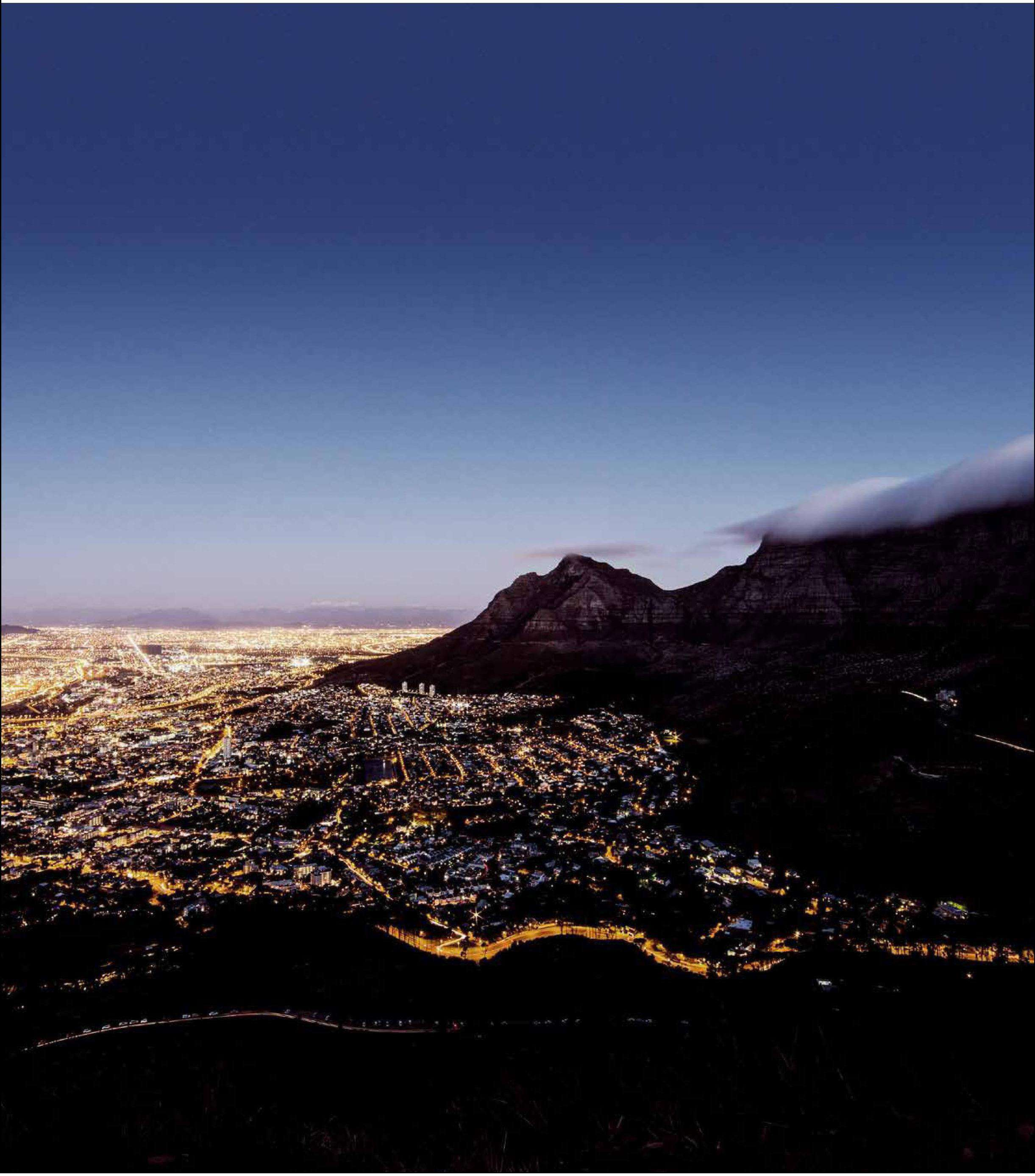
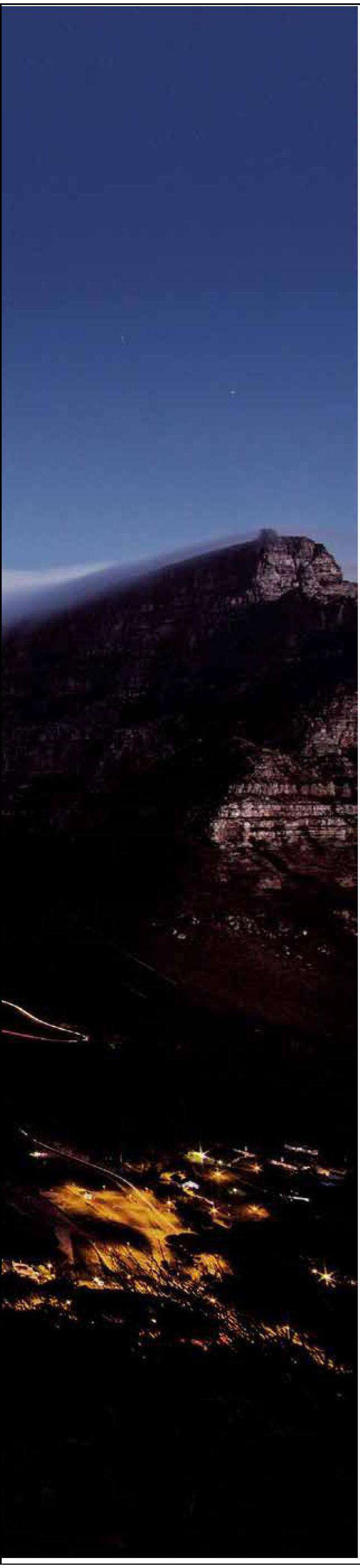
Publication: African Decisions

Date: Monday, June 01, 2026

Page: 60





HOLDING THE LINE

Renewable energy projects are boosting Africa's electricity supply, but national grids must be able to support it

The first switch tripped in Spain at 12:32:57 on Monday, 28 April 2025. The minutes and seconds are important because things happened quickly after that. First, a substation in Granada failed, followed by substations in Badajoz and Seville. Then, more generators tripped in Portugal and France, and by 12:33:20, the entire Iberian Peninsula had disconnected from the grid. Load shedding was activated, but that didn't help. Within seconds, the entire grid collapsed, 31 GW of load was lost, and most of Spain and Portugal were plunged into a 10-hour total blackout. Some regions had no power for 19 hours.

José Guillermo Sánchez León, an associate professor with the Department of Economy and Economic History at the University of Salamanca, later described the experience in an article for the Conversation. 'For the first few minutes, confusion reigned, aggravated by the disruption of landline and mobile phone networks. Rumours circulated that other European countries were affected (I myself heard this on the battery-powered radio that I had rushed out to buy), and fingers were quickly pointed at a possible cyberattack. I doubted this hypothesis, as the computer networks that control electrical systems are usually disconnected from the internet, and a Europe-wide grid outage would lead to something closely resembling an episode of Black Mirror.'

Publication: African Decisions

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Page: 62

There was plenty of time later to pick apart what had actually gone wrong. The immediate trigger of the 2025 Iberian blackout (which turned out to be mostly limited to Spain and Portugal) was a sharp voltage spike, but further investigation and analysis would conclude that the real problem was an outdated, inflexible power grid.

In the seconds before the grid collapse, renewables were providing 78% of Iberian electricity, with solar alone providing nearly 60%. Grids that use so much renewable energy require fast-responding storage, advanced voltage control, digitalised grid management and strong interconnections. The Iberian grid didn't have enough of these. It simply hadn't been modernised for high levels of renewable energy. Spain was running on 21st-century power, using 20th-century infrastructure.

It was a warning to the rest of the world, says Sabine Dall'Omo, chief executive of Siemens Sub-Saharan Africa. 'Today's electricity grids are not equipped to handle the major increase in renewable energy that the world needs,' she says. 'By 2030, to facilitate this integration, the global length of transmission lines will need to increase by almost 2.5 million kilometres and distribution networks by over 16 million kilometres. This means the world will have to spend up to US$630 billion a year by 2030 to upgrade its ailing grids.'

This will require a comprehensive overhaul of the electrical grid to make it more resilient, flexible and capable of integrating renewable energy sources and advanced technologies. 'It involves upgrading infrastructure, implementing smart grid technologies and enhancing grid management systems to handle the complexities of modern energy demands,' says Dall'Omo. 'The reality is that we simply cannot meet the African continent's unique energy problems and opportunities without accelerating grid transformation.'

That's the side of the renewable energy story that's not often told – or wasn't, until the Iberian blackout gave the global industry a nasty midday wake-up call.

Recently, a similar warning was issued by the South African Photovoltaic Industry Association (Sapvia). By the end of 2025, the country's cumulative installed solar PV capacity had surpassed 10.2 GW (placing South Africa first in Africa for installed capacity per capita). Now that the pipeline of renewable energy projects has reached 220 GW, the energy sector faces a critical bottleneck. The focus has shifted from investor interest to the urgent need to modernise the national grid to handle the surge of renewable energy.

'We have the current; we just lack the conduit,' says Sim Khuluse, technical and policy manager at Sapvia. 'The priority has shifted from incentivising investment to actively unblocking the grid. By expanding and modernising our national grid infrastructure and refining wheeling frameworks, we can finally move the 220 GW renewable pipeline into active production. In 2026, grid connectivity, not capital, is the final arbiter of South Africa's energy success.'

All the solar power in the world won't help us if we don't have a grid that's built to handle it. 'In South Africa and the rest of Africa, the grid was never designed to accommodate large-scale rooftop solar adoption, widespread distributed generation or the rapid growth of electric vehicles and charging infrastructure,' says Taru Madangombe, VP for power and grid segment, MEA at Schneider Electric.

He says that while South Africa has historically relied on coal-fired baseload power stations, those conventional plants delivered stable, predictable output, which made system planning and balancing far simpler.

NETWORK SUPPORT

South Africa's planned overhead lines, 2025–2034

LOCATION	VOLTAGE	LENGTH
FREE STATE	275, 400 and 765 kV	832 KM
GAUTENG	275 and 400 kV	197 KM
LIMPOPO	400 kV	824 KM
MPUMALANGA	400 kV	824 KM
NORTHERN CAPE AND HYDRA CENTRAL	400 and 765 kV	5 124 KM
NORTH WEST	400 kV	688 KM
WESTERN CAPE	400 and 765 kV	1 553 KM
KWAZULU-NATAL	400 and 765 kV	1 054 KM
EASTERN CAPE	400 and 765 kV	3 102 KM
TOTAL		14 198 KM

Source: Eskom

'From a grid-management perspective, variability was limited and interruptions were easier to control,' he says. 'However, the introduction of renewable energy sources has fundamentally changed this certainty if you will. Renewable sources like wind and solar are, by their very nature, variable and intermittent, fluctuating with weather conditions and the time of day. Yes, the transition to a grid that comprises renewables is a positive and necessary move; however, it does expose the grid to far greater variability than it was originally designed to handle.'

Eskom's unbundling represents an opportunity. The proposed Eskom 2.0 strategy would see the utility being split into three subsidiaries: Generation (GxCo), which will eventually compete with private producers; the National Transmission Company South Africa (NTCSA), which will act as an independent 'traffic controller' for the grid; and the National Electricity Distribution Company of South Africa (NEDCSA). A fourth subsidiary, Eskom Green, has also been established to accelerate the utility's investment in renewable energy projects.

'The priority has shifted from incentivising investment to actively unblocking the grid'

[redacted]

Eskom's unbundling could enable the roll-out of smart grid technologies in South Africa. Systems such as virtual wheeling and advanced metering would allow businesses to buy green energy from distant independent power producers and have it delivered via the national grid. The unbundling will also force a shift towards a decentralised system, where the national grid is no longer just a one-way pipe from coal mines to cities, but an intelligent, multi-directional network capable of balancing variable wind and solar inputs in real-time.

This restructuring could be the primary engine driving grid modernisation in South Africa, as it decouples the wires from the power plants – in effect, enabling non-discriminatory access to the national network. By establishing the NTCSA as an independent entity, the South African government aims to attract the vast private investment required to build more than 14 000 km of new transmission lines to link high-resource renewable areas (such as Northern Cape and Eastern Cape) to the rest of the country. Under the

THE SWITCH TO 21ST-CENTURY, RENEWABLE ENERGY SOURCES SUCH AS WIND AND SOLAR POWER, WHICH ARE VARIABLE AND INTERMITTENT, REQUIRES A CONCOMITANT TRANSITION TO A MODERNISED POWER GRID

Publication: African Decisions

Date: Monday, June 01, 2026

Page: 64

THE GOAL IN SOUTH AFRICA IS AN INTELLIGENT, MULTI-DIRECTIONAL POWER GRID THAT CAN BALANCE VARIABLE INPUTS FROM WIND AND SOLAR POWER PLANTS IN REAL TIME

NTCSA's 2025–2034 Transmission Development Plan, 5 044 km of power lines and 87 transformers are expected to come online between 2025 and 2029 alone.

Private players will have to be involved. Expanding the grid by 14 000 km by 2033 would require building about 2 500 km of new lines every year. In the 2024/25 financial year, Eskom installed just 293 km of new transmission lines. That's not nearly enough – but it's on par with Kenya's plan.

Kenya already generates more than 80% of its electricity from renewable sources, but bottlenecks in transmission limit how much new wind, solar and geothermal can actually be used. Under national utility Ketraco's 2030 Grid Master Plan (established in 2023), Kenya requires 3 000 km of new transmission lines over 10 years, or 300 km per year. Kenya's plan is supported by the World Bank and the AfDB, as part of Mission 300: a co-ordinated, donor-backed, US$90 billion programme launched in 2024 to connect 300 million Africans to electricity by 2030. Under Mission 300, half of the new connections are expected to come from expanding existing national grids, while the other half will come from renewable solutions such as wind and solar minigrids. Future-proofing the grid is a big part of those plans.

'The transition to a grid that comprises renewables is a positive and necessary move; however, it does expose the grid to far greater variability'

[redacted]

In February 2025, South African energy analyst Chris Yelland posted on X: 'In my view, 3 major power sector risks facing SA and its economy are: 1. Overdependence (about 90%) on Eskom as the primary power generation company in SA. 2. Overdependence (about 80%) on coal-fired power as the primary power generation technology in SA. 3. The dysfunctional electricity distribution industry in SA.'

As if to underline his third point, an outdated, dysfunctional grid collapsed just eight weeks later, plunging Spain and Portugal into hours of darkness. AD

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