

Grid modernization south africa

Thinus receives funding from Eskom for small research projects through the Tertiary Education Support Programme (TESP). He is affiliated with Stellenbosch University and holds shares in two energy-related university spinouts, namely Bridgiot and GreenX Engineering. His research is predominantly sponsored by MTN South Africa through <https://mtn.n.ac/>

Arnold Rix receives funding from Eskom for small research projects through the Tertiary Education Support Programme (TESP). He is affiliated with Stellenbosch University and supported by Scatec as an industry partner.

South Africans are facing another round of power cuts despite promises from South Africa's power utility, Eskom, that it would keep the lights on. Unexpected breakdowns and scheduled maintenance at various generation plants have been blamed for reduced generation capacity. These have compromised the stability of the national power grid. Since this affects everyone in the country, The Conversation Africa invited Thinus Booysen and Arnold Rix to explain what the power grid is and what keeps it stable - or not.

The grid is made up of three building blocks: generation, transmission and distribution.

Generation consists of power stations (or plants) that generate electricity. Examples of these are the newly built Kusile and Medupi power stations. South Africa has a generation capacity of approximately 58 GW - enough to power 26 million kettles concurrently - mostly made up of Eskom's coal-burning power plants. Eskom's share of this is a generation capacity of 44 GW, of which 38 GW is from coal-powered stations.

Transmission comprises the 28,000 km of high voltage lines that transport electricity at high voltage levels (such as 400 kV or 765 kV) to cities and towns.

There, it branches out to 325,000 km of lower-voltage lines that distribute electricity to homes and businesses. In comparison, New Zealand has 150,000 km for a tenth of South Africa's population and the UK has over 800,000 km.

The transmission lines and distribution lines therefore connect the generation plants and users in a network that collectively form the grid, which operates at a synchronised alternating current frequency of 50Hz.

All generating plants, including coal-burning plants, solar farms, wind farms and hydro-electric plants, are synchronised and interconnected in this way. All turbines running in power plants must run in unison, and all renewable sources must fall in line.

The electricity in a house's plugs is also synchronised to the grid. This includes plugs (and light sockets) all



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over the country and beyond South Africa's borders in countries that it sells electricity to.

Like a heartbeat, this 50 Hz oscillation keeps the grid alive. It allows electrical power to flow from the numerous generation plants and spread throughout the country to the places where it is needed.

Unfortunately, due to the backlog of maintenance of older Eskom plants and mismanagement during the development of newer plants, the generation capacity of Eskom often dwindles. With an average plant age of 40 years, breakdowns and maintenance have amounted to as much as a 20 GW loss in generation capacity.

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