

The benefit of Koeberg's Long-term Operation (LTO) Project



Koeberg Nuclear Power Station, one of Eskom's very reliable baseload stations.

Introduction

Eskom has made an application to the National Nuclear Regulator to extend the life of Koeberg Nuclear Power Station (Koeberg) for another 20 years, this additional period is referred to as long-term operation (LTO). After demonstrating the benefits of extending the operational life of Koeberg, the business case was approved by the Eskom Board in 2010. Extended plant operation has become common nuclear industry practice. By performing comprehensive safety assessments and applying good asset management practices, nuclear power plants can achieve safe plant operation for more than 60 years.

The importance of long-term operation

Koeberg provides a base load supply of energy that is reliable, cost effective and produces low carbon emissions. The contribution of the electricity generated by the two Koeberg units (unit 1 and unit 2) equates to a reduction of loadshedding by approximately two stages. If Koeberg is shut down in 2024 (after 40 years of operation), this would put the electricity system under immense strain given the current shortage of electricity production in South Africa.

A significant amount of ageing coal fired power plants will be taken out of service (decommissioned) before 2030 in accordance with the current electricity Integrated Resource Plan (IRP). This means that the amount of available power to the national grid will be significantly reduced. The IRP 2019 assumes that Koeberg will operate for an additional 20 years. Koeberg LTO will therefore support in reducing the electricity supply challenges caused by decommissioning of the ageing coal power plants.

Plant performance and safety

Koeberg has a proven track record of providing reliable baseload power to the national grid. As an example, Unit 1 shut down for a refuelling outage in December 2022 after 408 days of continuous (uninterrupted) operation. Unit 2 operated for an even longer period of 450 days of continuous operation until January 2022. The Koeberg production record currently stands at 475 days of continuous operation which was set in 2016.

There is general scientific consensus that nuclear plants do not harm human health and the environment more than other low-carbon energy sources.

International experts of the International Atomic Energy Agency (IAEA) conducted a safety review in 2022 using the latest international standards to assess Koeberg's readiness for LTO. Eskom is committed to comply with these standards and implement any learnings to ensure Koeberg continues to operate safely currently and throughout LTO.

Power System stability and security

Koeberg is the only base load power station within the Western Cape along with a few smaller peaking power plants. These power plants are connected to the large power generation pool, situated 1500 km away, in Mpumalanga, via the national grid using 400 kV and 765 kV transmission lines. If Koeberg is not in service, there would be large power losses which occur when transporting power over these long distances.

International experience shows that, despite ageing, nuclear plant reliability tends to remain stable. Koeberg has an important stabilising effect on the national grid. This is particularly important as variable energy sources (e.g., wind and solar power) are added to the national grid. Koeberg is categorised as a baseload power station and its location and size contributes to frequency stabilisation of the national grid.

Cost benefit

The cost of a nuclear plant LTO project is significantly cheaper than adding new onshore wind or solar photovoltaics (PV) according to the International Energy Agency (2020). The primary energy cost of Koeberg is only 9,9 c/kWh and is much lower than the latest new wind or solar projects (the average cost in IRP Window 6 was 49 c/kWh for wind and 43 c/kWh for solar PV).

Should the LTO not continue, Koeberg will have to be decommissioned. A successful LTO would result in the delay of incurring decommissioning costs by an additional 20 years, which is another financial benefit of LTO. In addition, LTO will not result in a significant increase in decommissioning costs.

Environmental impact

Nuclear remains one of the lowest carbon-emission sources of energy for the country and the LTO of Koeberg will make a significant contribution to South Africa's commitment to zero carbon emissions by 2050 in terms of the Paris Agreement. Nuclear plants are among the cleanest sources of energy at 12 gCO₂/kWh since nuclear plants have no direct emissions. This compares favourably with wind power (similar values) and solar PV (about 45 gCO₂/kWh). Replacing nuclear with renewables may result in a net increase in carbon emissions because the back-up power needed may have higher carbon emissions, as experienced in many countries.

The radioactive waste produced during the LTO period will be managed in accordance with an approved waste management strategy. Various projects have been initiated to ensure the safe storage of radioactive waste. This includes an off-site storage facility, to be developed by the National Radioactive Waste Disposal Institute, and an interim on-site dry-cask storage facility for the interim period while the centralised facility is being established. Meanwhile spent fuel continues to be safely stored on-site in spent fuel pools and dry storage casks. This waste management approach is widely utilised and aligned with current international best practices.

Water usage is a critical issue in South Africa, especially considering the relatively low rainfall, climate-change risks, and occurrence of droughts. To ensure low water usage, the steam cycle at Koeberg is cooled by sea water and not freshwater, so the freshwater usage is low. Koeberg now uses about 50% less fresh water than it did more than three decades ago and will continue to focus on the reduction of freshwater usage.



Koeberg Nuclear Power Station is also the home of a number of Zebra's and Eland species who graze the fields within the Koeberg Nature Reserve.

Did you know that Koeberg's current Energy Availability Factor (EAF) is 75%, down from 93% because of extended outages for maintenance and refurbishment.

Did you know that Koeberg is the only nuclear power plant on the African continent. It will soon be joined by El Dabaa Nuclear Power Plant which is under construction in Egypt.

Did you know that Koeberg Nuclear Power Plant is built on bed rock and can withstand severe earthquakes like the Tulbagh earthquake experienced in 1969 that measured 6.3 on the Richter scale.



The Koeberg Nuclear Power Station intake basin and outflow of cooling water from the Atlantic Ocean. This type of cooling saves South Africa more than 2 billion litres of water per year.