

Questions for SDG Discussion on SA Energy Crisis
15 February 2023

1. What are the causes of our loadshedding crisis?
2. What are the key interventions of government's Energy Action Plan to overcome loadshedding?
3. Why has South Africa declared a State of Disaster and will appoint an Electricity Minister to deal with the electricity crisis?
4. What is meant by the energy transition?
5. What is meant by the just energy transition?
6. How will we be sure to have enough electricity if wind and solar are variable source of power?
7. Why is Eskom R400bn in debt?
8. Why does Eskom need to be restructured?

What are the causes of our loadshedding crisis?

The major sources of the current electricity shortage is due to a series of policy failures over the past two decades including:

1. failure to implement the power sector unbundling and market reforms announced in the early 2000s (while the necessary reforms were not implemented to enable the announced private sector investment policy, Eskom was also not allowed to build new capacity in the early 2000's – effectively leaving the country with no strategy to meet a looming short-fall in supply);
1. after the Eskom go-ahead was given in 2004 for the building of new power plants, rather than adopting an approach of smaller turn-key projects, government agreed to the risky choice of Eskom building extra-large mega-projects (Medupi and Kusile). The Medupi and Kusile projects were severely delayed, suffered from enormous cost overruns and corruption and continue to perform poorly;
1. serious delays from 2010 to 2019 in finalising the terms of government's chief instrument for the expansion of new electricity generation capacity, the Integrated Resources Plan (IRP);
1. a period from 2015 to 2018 during which the previous Eskom leadership refused to procure available renewable energy, although this refusal was in breach of government policy and derailed the Independent Power Producer Procurement Programme (IPPPP); and
1. from 2019 to 2022 the pace of implementation of the IRP has not been sufficient to close the electricity supply gap and restore energy security, neither has the IRP been updated to take into account changing circumstances including Eskom's lower than assumed Energy Availability Factor; and
1. in the meantime, urgently needed transmission grid expansions have been delayed as Eskom financial resources were redirected to pay for the cost overruns and corruption at Medupi and Kusile. The backlog in grid expansion is significantly slowing the pace, and increasing the cost, at which new electricity generation capacity can be brought onto the national grid.

What is NOT causing loadshedding is:

- a. the fact that we are exporting coal is not causing loadshedding – in reality Eskom has more than enough coal to burn (it is the machinery

that is breaking down), and South African coal mining companies are making good money exporting coal, as the price of coal has risen due the Russia-Ukraine war, also South Africa has begun exporting more to Europe as Russian coal is subject to sanctions. A major constraint for coal exporters has been the declining efficiency and security of the RBCT rail line.

- b. the fact that we have invested in renewable energy sources is not what is causing loadshedding – detailed modelling shows that if we had not stopped the independent power producers programme a few years back and if that electricity had been brought into the systems we would have had virtually no loadshedding in recent years.

What are the key interventions of government's Energy Action Plan to overcome loadshedding?

Government's National Energy Crisis Committee, Eskom and many other South Africans, are taking a number of concrete steps to reduce loadshedding. There are many things being done.

- a. We are mobilising funds to buy more diesel so that our diesel peaking plants can continue to run and reduce the degree of loadshedding.
- b. Red tape on private investment in electricity generation has been removed and this has caused a spike in investments in new generation capacity.
- c. Red tape is being cut and skills and finance are being mobilised to assist Eskom to improve the maintenance and performance of its existing power stations.
- d. Through incentives it will be made easier for households and firms to invest in their own invertors and solar and gas systems to alleviate the impact of loadshedding
- e. There are plans to get the massive Kusile power station up and running again by the end of the year after it suffered damage in its chimney system.
- f. We must reduce Eskom's debt (and mobilise international finance) so that we can accelerate Eskom's restructuring, strengthen Eskom's finances and operations, and allow its Transmission Entity to expand the grid to allow more electricity to be brought in the system.
- g. In the medium and long run we must accelerate implementation of the Integrated Resources Plan (IRP 2019) so that we can take forward the

just energy transition and restore the country's electricity supply and demand balance. (See IRP table)

South Africa's Integrated Resource Plan 2019

	Coal	Coal (decommissioning)	Nuclear	Hydro	Storage	PV	Wind	CSP	Diesel & Gas	Other (Distributed Energy, Cogen, Biomass, Landfill)
Current Base	37149		1860	2100	2912	1474	1980	300	3830	499
2019	2155	-2373					244	300		2019 to 2002 allocation to extend needed by shortage of capacity and energy gap
2020	1433	-557				114	300			
2021	1433	-1403				300	818			
2022	7111	-844			513	1400	1600			
2023	750	-555				1000	1600			500
2024			Extension of life of Koeberg				1600		1000	500
2025						1000	1600			500
2026		-1219					1600			500
2027	750	-847					1600		2000	500
2028		-475				1000	1600			500
2029		-1694			1575	1000	1600			500
2030		-1050		2500		1000	1600			500
Total Installed Capacity by 2030 (MW)	33364		1860	4600	5000	8288	17742	600	6380	
% Total installed capacity	43		2,36	5,84	6,35	10,52	22,53	0,76	8,1	
% Annual Energy Contribution	58,8		4,5	8,4	1,2	6,3	17,8	0,6	1,3	

Source: IRP 2019; 42

- h. Government has allowed Eskom exemptions - and has asked for Nersa's concurrence – so that Eskom can procure more electricity over and above what is provided for in the IRP 2019, as follows:
- Up to 1 000 MW of cross-border capacity from a range of energy producers, including utilities or independent power producers in the Southern African region;
 - Up to 2 000 MW of new generation capacity under the loadshedding reduction programme from a range of energy technologies in accordance with the short-term risk mitigation capacity allocated for the years 2025 to 2028 in the IRP 2019 (this is where the power ships could come in – but not on a twenty year contract as it should be for 5 or 10 years only);
 - Up to 800 MW of new generation capacity from a range of energy technologies in accordance with the 'Emergency Generation Procurement Programme' for the years 2029 to 2030 outlined in the IRP 2019.

- Enabling Eskom to procure 344.5 MW of new generation and storage capacity, comprising:
 1. 75 MW of solar photovoltaic (PV), to be located at the Lethabo power station in the Free State;
 2. 19.5 MW of solar PV, to be located in Sere in the Western Cape;
 3. 100 MW of solar PV, to be located at the Komati power station, in Mpumalanga; and
 4. 150 MW of battery energy storage at the Komati power station.

Why has South Africa declared a State of Disaster and will appoint an Electricity Minister to deal with the electricity crisis?

- a. The declaration of a state of disaster and imminent appointment of an Electricity Minister could have some value if it will enable us to move rapidly to implement the detailed interventions being worked on by NECOM, Eskom and others.
- b. For example, if, in law, a state of disaster will help us to accelerate the authorisations needed to fix the Kusile power station, or to improve the security for critical infrastructure, or to buy diesel more cost effectively, then the declaration of a state of disaster will help us to overcome load shedding more rapidly
- c. But, it is important that there must be *a clear legal basis* and *a clear purpose* behind a declaration of a state of disaster.
- d. A state of disaster and new Minister will be helpful if it accelerates processes and improves the co-ordination of an *all of society approach* to solving the loadshedding problem.
- e. A state of disaster will not be helpful if removes transparency from procurement processes, or if it opens the door to corruption.
- f. It would not be useful if it would have the effect of disorganizing or delaying actions to reduce loadshedding that are already underway.

What is meant by the energy transition?

Previously the natural monopoly economics of electricity systems was such that large vertically integrated systems were cost effective in lowering the cost of producing electricity.

Now globally the technology has changed and it is cheaper to produce electricity through distributed systems with a mix of technologies – solar, wind, gas, coal, nuclear and hydro. Solar and Wind plants are also quicker to build which is key in South Africa’s current loadshedding context. The table below from Eskom shows that relative costs and speeds of deployment of new technologies although it does not show the cost of grid extension to areas optimal for wind and solar power production.

Technology	Levelized Cost of Energy	Capital Cost	Build Time	Eskom Position
PV	4,1 US\$/kWh	825 US\$/kW	18 to 24 months	Identified potential sites to retrofit PV to capitalise on existing infrastructure and available resources
Wind	5,4 US\$/kWh	1 450 US\$/kW	24 to 36 months	Leverage sites for wind, with environmental authorisations to capitalise on existing infrastructure and available resources
Gas	7,3 US\$/kWh	1 250 US\$/kW	24 to 60 months	Intend to use gas as means to enable renewables, thereby supporting the transition
Nuclear	19,8 US\$/kWh	12 500 US\$/kW	12 to 15 years	Supports governments plans to roll out nuclear, will be unable to build due to inadequate balance sheet
New Coal	15,9 US\$/kWh	62 250 US\$/kW	10 to 12 years	Will own and operate current coal fleet till end of life, will focus on repurposing sites to be decommissioned with renewables. No new coal projects by Eskom

Source: Eskom, 2021b; 5

Also, there is a global policy imperative due to global warming is to move towards low carbon sources of electricity solar, wind, nuclear and hydro. This has meant that raising finance for building new coal plants is now just about impossible. Also talk of clean coal technologies is not really viable as the costs likely to be associated with such technologies will push up the cost of electricity and damage international competitiveness. There are also moves to put tariffs on goods produced off a carbon intensive base, known as carbon border adjustment mechanisms, which will pose a risk to South African exports and jobs if we do not decarbonize our electricity production.

The economic and the policy imperatives are aligned (we don't have to pay more to go for lower carbon) so throughout the world a massive energy transition underway.

The US, Europe and China are contesting who will have the greatest economic and industrial benefit from this, and there is scope for other countries like South Africa to also position themselves to benefit from upstream and downstream industrial activity linked to the energy transition.

What is meant by the just energy transition?

Protection must be put in place for workers, industries and communities negatively affected by the energy transition. Areas like Mpumalanga will see coal power stations being repurposed and closed over time (mainly as they come to the end of their economic lives). Komati power station is over 60 years old – creating industrial activity on site to build containerized solar systems to electrify off-grid rural villages.

Also, Mpumalanga is well-endowed with grid so Eskom land is being made available for new wind and solar investment. Seriti coal has set up Seriti Green in that area to build facilities to produce renewable power. Sasol also planning to build renewable energy components and green hydrogen,

How will we be sure to have enough electricity if wind and solar are variable source of power?

The system must be able to supply enough electricity to meet demand. If not then there is loadshedding. Wind and solar power are variable, but are generally predictable (especially if built in many different parts of the country), when wind and solar power is predicted to fall due to lack of wind or sun then peaking plants especially gas and even diesel can be turned on to meet electricity demand. Battery systems are also key to delivering electricity to the system.

South Africa will also for many years have coal, nuclear and hydro plants contributing to electricity supply. South Africa's plan for our energy mix is outlined in the country's IRP 2019. The IRP 2019 will need to be updated, and already exemptions from the plan are being applied for, as it is based on an overly optimistic assumption regarding Eskom's plant performance, so more power than planned needs to be brought on stream.

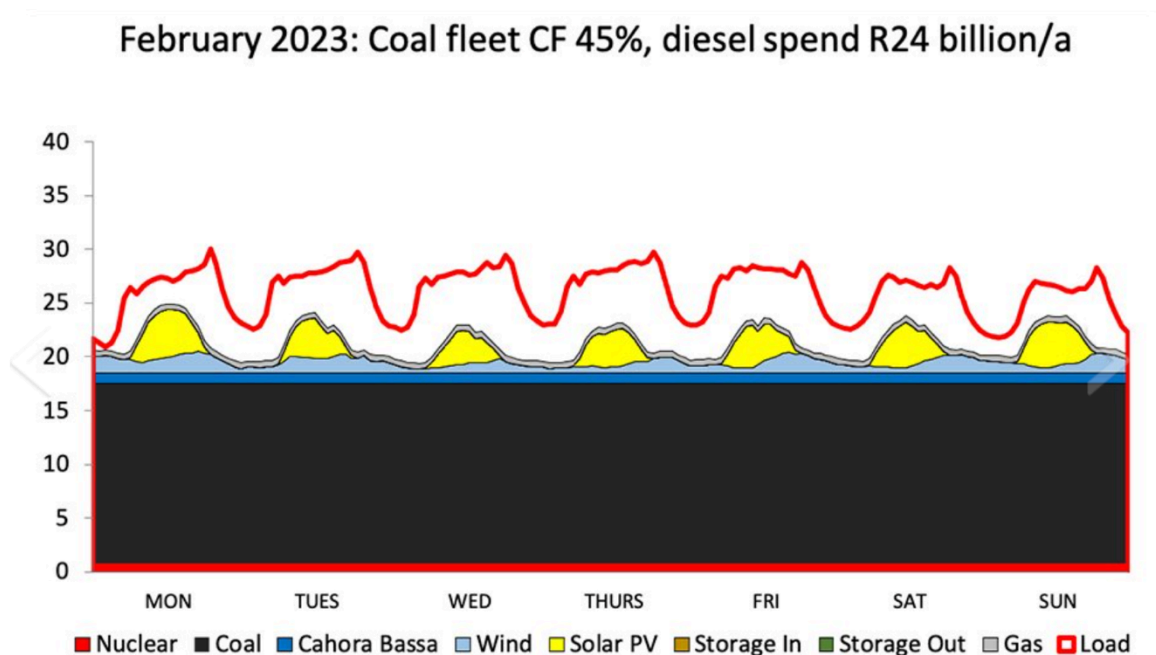
A constraint for the implementation of the IRP is that planned grid investment has not taken place so it is difficult to bring new electricity generation capacity onto the grid. As result of grid constraints, in December 2022, Bid Window 6

for new wind and solar capacity, was only able to announce 850MW to 100Mw of new projects rather than the planned for 4200MW. Investment in new grid capacity is urgently required (and it on of the key investment objectives of the concessional finance of the Just Energy Transition Partnership), but such investment will take some time to realise.

Given this constraint it is vital that we also encourage and incentivise firms and households to invest in generation capacity, such as, rooftop solar and battery systems, which use local distribution networks rather than wider transmission networks. This can be done via tax incentives as well as via feed in tariffs (which enabled Vietnam to mobilise 9000MW of distributed investment in just a couple of years).

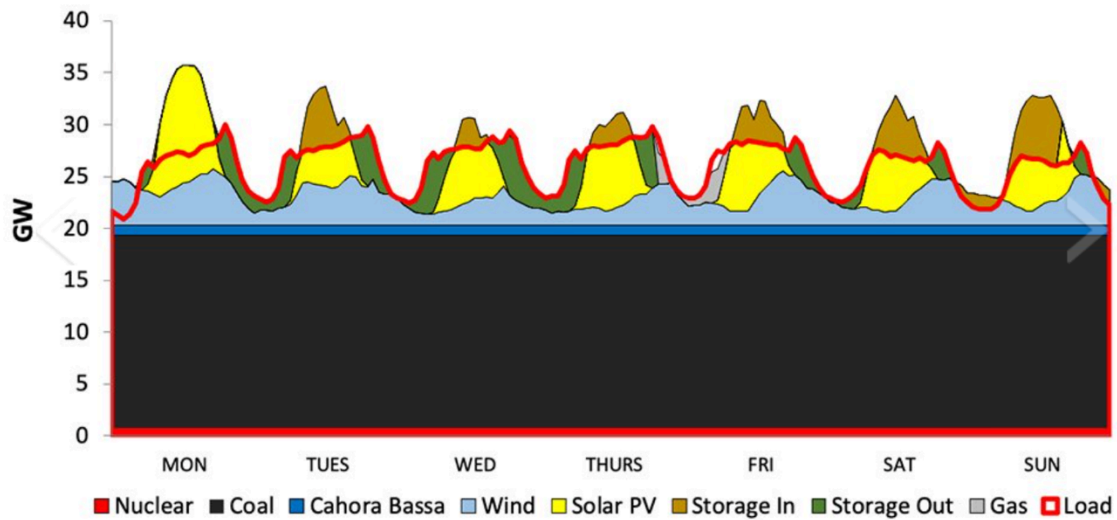
Modelling has shown the following:

Scenario 1: The current electricity situation in February 2023 with loadshedding indicated by the area between the red line (load or demand) and supply.



Scenario 2: The current electricity situation in February but if 8 GW of solar, 5 GW of wind and 3 GW of storage added had been added, then South Africa would no longer experience loadshedding, the prices of electricity will stabilise, there would be more space to maintain Eskom's coal fleet and we would not need to burn nearly as much diesel.

February 2023: Coal fleet CF 50%, 8GW extra PV, 5GW extra wind, 3GW extra storage. Diesel spend R2 billion/a



Why is Eskom R400bn in debt?

Eskom is in debt to the bond markets to the value of around R400bn. More than half of Eskom's debt is regarded as unsustainable – meaning that even if it is profitable for a number of years it will not be able to pay that portion of the debt. Tax payers through the fiscus are having to transfer billions of Rand each year to keep Eskom as a going concern.

To reset Eskom's financial position and enable it to normalise its relationships (and the relationship of its unbundled entities) with capital markets so that it can borrow money to invest in plant maintenance and grid extension, etc. government has said that it will take around R200bn of Eskom's debt on the books of the national government.

This will increase South Africa's national debt which is around R4tn (or around 80% of GDP), but it may reduce debt repayments as South Africa may be able to pay at a lower interest rate than Eskom. It is imperative that the bond holders agree to replace their Eskom bonds with government bonds as it would severely disrupts South Africa's finances if bond holders regarded the process as a debt default.

Eskom debt has ballooned due to a combination of factors. Firstly, Nersa has on a number of occasions not granted Eskom the tariff increases that it has required to cover its costs. Eskom has successfully taken Nersa to court where

it has been found that Nersa has not been correctly following the legislated pricing methodology. Clearly Nersa has felt that Eskom has not been run efficiently and has also responded to business and societal pressure to keep electricity prices from rising too sharply.

Secondly, there were tremendous cost overruns and delays in the management of the Kusile and Medupi power station projects which have pushed up Eskom's debt. And, thirdly, large-scale corruption and fraud has led to Eskom overpaying of many goods and services (some of these monies have subsequently been repaid to Eskom).

Why does Eskom need to be restructured?

As part of the country's transition to a system characterised by less centralised, and more distributed, electricity generation, to be fit for purpose Eskom, in turn, will need to be restructured into three entities, namely a Generation entity, a Transmission entity and a Distribution entity.

The Eskom Generation entity will need to downsize back towards profitability, but it is likely that for some time it will continue to be the largest supplier of electricity in South Africa, though it will be joined by a growing number of privately-owned electricity generation entities.

Electricity from various sources will be supplied into a single national grid run by the Eskom Transmission entity. China has followed the same model and now its grid company is one of the biggest and most strategic entities in that country. Eskom's Transmission entity will manage the grid and will serve as a neutral intermediary contracting with public and private entities generating electricity, as well as those running consumer-facing distribution systems, a large part of which is likely to be Eskom's Distribution entity.

Eskom (Transmission) will be required to invest in the maintenance and extension of the national grid network. To connect the best acreage for wind and solar generation to the grid, some R188 billion will need to be invested over the next 10 – 15 years to build some 8 000 km of new transmission line by 2030.

The reason that IRP's Bid Window 6 has in large part failed is due to a lack of grid capacity. This is a symptom of our failure to follow many other countries in

setting up an independent Grid Company which will focus on grid extension, investment and maintenance. We need a state-owned Grid Company that builds our grid and operates independently to the generation companies - so that its work is not neglected (as is currently the case) and so that it is not conflicted in how it serves its various customers.

Eskom (Distribution) will be required to invest in distribution networks, as well as battery and other storage facilities to better manage fluctuations in supply caused by the increasing proportion of variable generation capacity.