Preliminary View of the Draft Integrated Resource Plan (IRP) 2023

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Context

South Africa has experienced severe loadshedding (i.e. controlled/scheduled power cuts), almost daily, since September 2022. This recent spike and high frequency of loadshedding can be largely attributed to a significant drop in Energy Availability Factor of the coal fleet that has not been optimally maintained due to several factors. In addition, shutting down of units at Koeberg for life extension, and the challenges experienced at Kusile when the entire power station had to shut down, contributed significantly to higher levels and frequency of loadshedding. The periods 2022 and 2023 were the worst years in terms of higher stages and frequency of loadshedding in the history of Eskom.

Loadshedding has reportedly cost the South African economy approximately ZAR225 billion from 2020 Q1 to 2023 Q1 (source: *Codera Analytics, 2023, 'Estimates of the cost of load shedding in SA'*, *13 January 2024)*. Arguably, the cost of this loss to the economy will give rise to a positive return for any investment option available (e.g. renewal/upgrade of existing coal power plants, new nuclear build, new cleaner coal technologies, new gas to power, new solar to power, new wind to power, energy storage facilities as well as energy efficiency and demand side management initiatives) to eliminate loadshedding.

Consequently, it is believed that it will take several years, perhaps decades, for South Africa to recover economically from the dire consequences of this excessive loadshedding. Some of the negative impacts of loadshedding include:

- Disruption of essential services
- Disruption of business activities
- Aggravation of socio-economic inequalities
- Shutting down of small businesses due to the high cost of alternative energy sources such as solar energy, diesel and petrol generators
- Disruption of educational institutions
- Stifling economic growth which adds to the high unemployment rate and higher cost of living.

By the same token, South Africa aims to achieve net-zero carbon emissions by 2050. Africa's contribution towards global greenhouse gas emissions continues to be minimal, at 3.9% as of 2021, with approximately 1% contribution coming from South Africa (source: www.statista.com/statistics). Despite this low contribution to greenhouse gas emissions, South Africa is committed to meeting the Nationally Determined Contribution (NDC) targets, which range from 398 to 510 $MtCO_2$ eq for 2025, and 350 to 420 $MtCO_2$ eq for 2030. Already in 2022, South Africa generated below 420 $MtCO_2$ eq of carbon dioxide emissions from fossil fuel combustion and industrial processes. This creates room for a balanced and diversified energy mix going forward. It also allows for the gradual introduction of low carbon initiatives while ensuring that there is security of energy supply.

As South Africa transitions towards a low-carbon economy, it can now carefully balance the energy mix with other pressing matters faced by the country, such as reducing levels of loadshedding, unemployment, poverty, inequality and slow economic growth.

Given this reality, the conclusion of the IRP 2019 revision is extremely urgent to allow for investment decisions to be made and government to facilitate long-term planning. The Department of Minerals Resources and Energy (DMRE) published the much anticipated IRP revision of the IRP 2019, which gave rise to the draft IRP 2023 on 04 January 2024, for public comment.

Positive Observations

Alignment with national priorities and international agreements: The draft IRP 2023 begins by correctly pointing out that its main purpose is to ensure the security of electricity supply while considering the environment and total cost of supply (i.e. system cost of supply).

The security of the electricity supply plays a crucial role in economic growth, job creation, poverty alleviation, and minimising inequality (Gasser, 2020; Usman et al., 2022). In addition, the document reiterates South Africa's long-standing position to pursue a diversified energy mix while ensuring compliance with the country's emissions reduction plan. In this regard the following technology options are part of the draft IRP 2023 horizons one and two scenarios and pathways:

- Coal to electricity (incorporating cleaner coal technologies such as CCUS, Fluidised Bed Combustion, etc.). Life extension of coal power plants is also proposed;

- Nuclear, including supporting the life extension of Koeberg by 20 years and introduction of Small Modular Reactors (SMRs). SMRs are the future;
- Gas to power in the form of a Combined Cycle Gas Turbine (CCGT), Combined Cycle Gas Engine (CCGE) or Internal Combustion Engine (ICE). Conversion of existing Open Cycle Gas Turbine (OCGT) to CCGT and running on gas instead of diesel. Initially, gas will be imported, and later local/regional sources and indigenous sources to be considered;
- Solar PV, Concentrated Solar Power and Wind to power, with storage. There is a great and welcomed emphasis shown in the document on renewable energy with storage. Renewable energy will enable large-scale deployment of small-scale embedded generation (SSEG), Smart Micro/Mini-Grids, New Energy Vehicles and hydrogen use in fuel cells and transport (as outlined in the Hydrogen Society Roadmap);
- Hydropower. This is baseload electricity. Although South Africa has limited resources of hydro, plans to work with SADC/Central African countries (e.g. Mozambique, DRC, Zambia, Zimbabwe, Botswana) in this regard are welcome, but risks must be mitigated.

The "Two Horizons" approach: The "Two Horizons" approach allows a focused view on addressing immediate, medium-term, and long-term energy needs**.**

- **Horizon One:** Horizon One focuses on fixing existing infrastructure, accelerating commitments to new builds and IPP projects (largely renewable energy), and maintaining dispatchable capacity for grid reliability;
- **Horizon Two:** Horizon Two details the focus on adding more dispatchable capacity (i.e. gas and nuclear), continuing with decarbonization initiatives by adding more renewable energy, maintaining grid stability and reliability by introducing cleaner coal technologies and extending the life of the coal power plants

Public Engagements Approach: The DMRE's approach to public engagements, involving senior officials and specialists leading discussions, is commendable. This inclusive consultation strategy enhances the understanding and allows for more informed public engagements. The Draft IRP 2023 was publicly issued on the 4th of January 2024, with the Department of Mineral Resources and Energy (DMRE) inviting written inputs until the 23rd of February 2024. Public engagements, led by senior officials and specialists from the DMRE, are ongoing to clarify aspects of the draft and provide additional insights.

This approach to engaging with the public is commendable and appreciated. At a recent event organized by the South African National Energy Association (SANEA), the Director-General

(DG) of the DMRE, Mr Jacob Mbele, provided valuable context and background regarding the Draft IRP 2023. The DG highlighted the rationale and problem statement behind the draft IRP 2023, emphasizing its primary objective of addressing the country's energy security challenges in the short, medium, and long term. Additionally, the draft IRP 2023 aims to tackle environmental concerns, including the reduction of greenhouse gases, while prioritizing the least cost energy solutions (from a system cost perspective) in the long-term planning part, which is what most countries do.

Involvement of Academic and Research Institutions: Collaboration with renowned academic institutions and research councils demonstrates a commitment to leveraging diverse expertise in shaping the energy future of the country. The DMRE involved renowned academic institutions such as the University of Cape Town (UCT) and research councils like the CSIR in the development of the draft IRP 2023. Expertise was also drawn from Eskom's Planning Department.

Transparency in Data Release: The decision by the DMRE to release all data used for modelling and analysis is a positive step. As part of the public consultation process, the DMRE has made data used for modelling and analysis available. This includes assumptions made for Horizons 1 and 2 scenarios and pathways.

This transparency allows interested parties to perform their verification, promoting a more inclusive and informed decision-making process. The DMRE has also encouraged the public to make additional data available as part of public comments and inputs to the IRP review process by the 23rd of February 2024. This would then allow the DMRE to revisit their modelling and analysis, if necessary.

<u>Gaps Observations</u>

Life Extension of Coal Power Plants: While the draft IRP 2023 outlines objectives well, there is a need for more clarity on the practical implementation strategies. Life extension of coal power plants will be challenged by compliance with Minimum Emission Standards. The plan to address this is not mentioned in this document. If exemptions are not granted or it is uneconomical to extend the life of some of the power stations, then security of supply and grid stability may be a challenge. The draft IRP 2023 document must explicitly state that it is assumed exemptions will be granted by the Department of Forestry, Fisheries and

Environment. The draft IRP must also explicitly indicate which power stations whose life will be extended and at what cost to fixing and running them for the proposed period of life extension. This should then be compared to the cost of unserved energy to the South African economy.

Power lines: The document highlights that more than 14000 km of new transmission lines are required by 2032. Given Eskom's record of only building 4000 km in 9 years, it needs to be explained. That is, how is Eskom going to build 14000 km in 8 years? The Minister of Electricity has indicated in public platforms that he is busy with a model for the involvement of the private sector in the building of the grid. The IRP should include such a plan before the end of the public consultation period so that the public can engage with the plan.

Ancillary Services: There seems to be limited intervention for addressing inertia, frequency instability and system strength through technologies such as synchronous condensers. There is no mention of synchronous condensers in the document. Eskom has conducted a detailed study commissioned through EPRI to look into this aspect, the IRP should rely on the latter study to deal with the aspect of the required ancillary services when there is higher penetration of variable renewable energy.

Energy Efficiency and Demand Side Management (DSM): The electricity demand forecast should consider three scenarios, viz, (1) electricity demand with low uptake of energy efficiency/DSM measures – which is the current scenario; (2) electricity demand with moderate uptake of energy efficiency/DSM measures; and (3) electricity demand with high uptake of energy efficiency/DSM measures.

Eskom Shutdown Plan: Eskom's shutdown plan is left open-ended. There is limited information regarding units or power stations to be considered for running beyond 50 years life. It is left up to Eskom to decide based on economic reasons. Eskom is not a supplier of last resort, but rather the state through the DMRE is the supplier of last resort. Therefore, Eskom must be given direction regarding shutdown dates. Ideally, no coal-fired power plant unit should shut down between 2024 and 2030 to provide baseload electricity and ensure the security of the electricity supply.

Hydrogen Economy: The draft Integrated Resource Plan references the Hydrogen Society Roadmap approved by the Cabinet in 2021. However, it does not detail what the impact would be should the Hydrogen Society Roadmap be implemented in the electricity sector. There are two key high-level outcomes of the Hydrogen Society Roadmap that are related to the electricity sector namely:

- Green and enhanced power sector and building: **Lead department: DMRE**
- Decarbonisation of the energy-intensive industry: iron &steel chemicals, mining, refineries, cement: **Lead department: DTIC supported by DFFE, DMRE and DPE**

There is a need for the IRP to look at the catalytic projects proposed in the Hydrogen Society Roadmap and assess the impact of such projects in the electricity demand and supply patterns going forward. There is also a need for the IRP to make a determination of at least a 100 MW new build capacity for Green Hydrogen production and electricity production using Hydrogen Fuel Cells. This will stimulate the hydrogen sector and the 100 MW system can be used to produce electricity during peak periods, with hydrogen production taking place during low-demand periods using solar and wind energy that would otherwise be curtailed.

Concluding Remarks

In conclusion, the Draft IRP 2023 is a pivotal document that outlines a comprehensive strategy for addressing energy security challenges in the country. The transparency, public engagements, and sharing of information by the DMRE are commendable.

Public engagements via virtual platforms have been very effective. It also allows South African citizens from across the country to participate in the consultation process, without incurring travel costs. One could connect from anywhere in the country using a mobile phone. Face to face for focus groups are also welcomed. In addition, collaboration with academic and research institutions reflects a commitment to decision-making informed by data and science. The Department of Mineral Resources and Energy's commitment to inclusivity and transparency is praiseworthy, and continuous efforts to engage with the public are essential for shaping a sustainable energy future that aligns with the needs and aspirations of the nation.

While the draft IRP 2023 has many strengths, there are also gaps as outlined above that will have to be addressed before finalising the plan. The urgency to conclude the draft Integrated

Resource Plan cannot be overstated, as it holds the potential to unlock various benefits for the country. These include creating investment opportunities, fostering local skills development, generating job opportunities, and establishing valuable partnerships. The plan, once finalized, is not cast in stone. DMRE has indicated that the IRP is a living plan and has committed to reviewing it on a regular basis as necessitated by changing circumstances.