PRESIDENTIAL
CLIMATE COMMISSION
TOWARDS A JUST TRANSITION

PCC recommendations on the IRP2023: March 2024

1. Executive summary

Electricity and electricity planning embodied by the IRP is of critical importance to economic development in South Africa. Electricity is a critical input for most, if not all, formal and informal economic activities, and is strongly linked with economic development. Higher GDP, for example, is correlated with greater electricity use, access, reliability, and affordability. While correlation does not imply causation, access to electricity is critical for addressing the triple challenge. This is true at all scales and across all sectors of the economy, from large industries like mining, and manufacturing through to small, medium, and micro enterprises (SMMEs), and the household economy. Electricity is also essential for delivering basic public services. The direct investment in electricity infrastructure also creates jobs and increases GDP.

The IRP is therefore an essential planning document. The IRP2023 itself states that "the IRP is a living plan that is expected to be regularly reviewed" focused on multiple policy objectives of "security of supply, energy affordability, and carbon emissions reduction" and that ultimately "final policy decisions must be taken on the basis of a long-term decarbonisation trajectory while improving South Africa's competitiveness, growing the economy through industrial renaissance as outlined in the NDP". The IRP is central to energy security as well as other economic development objectives like energy accessibility and affordability. It also provides an important signal to the market to encourage localisation, and local job creation from construction and maintenance of new generation infrastructure. The future of energy generation will also have direct impacts on human health via its impact on air quality and water. Finally, the carbon intensity of the energy mix will determine South Africa's long-term compliance with our climate commitments and will have a direct impact on our trade competitiveness.

The are some positive innovations and results in the IRP2023:

1. The analytical approach of the IRP marks a useful innovation. Splitting the analysis into two horizons allows consideration of both short-term and long-term investment options.
2. The introduction of long term 2050 scenarios allows a far better analysis of climate compatible energy futures. The long-term scenarios demonstrate that extending coal plant and new clean coal are not the least cost options.
3. The least cost mix proposed for horizon one and two is indicated as variable renewable energy, plus mid-merit and baseload CCGT, plus OCGT peaking support, plus storage. While the PCC disagrees with the quantum of each technology deployed and the apparent high capacity factors of expensive thermal plant, the mix of technologies (excluding mid-merit and baseload CCGT) aligns with PCC expectations.

However, we believe there are some significant areas for further exploration:

1. The IRP does not address its primary energy security objective and does not provide any analysis to show how this might be achieved in the short term.
2. The IRP does not acknowledge its developmental context, including socially and community owned renewable energy. It is not a least cost solution and fails to address energy access or energy efficiency. It does not effectively address the issues of climate change and air quality, making it vulnerable to legal challenge. The IRP2023 does not provide sufficient market signals (strength and consistency) to support developmental policies like the South African Renewable Energy Master Plan.
3. The IRP does not fulfil the basic requirements of an IRP. Its analysis is incomplete, and its analysis does not support the conclusions it makes. The calculation of the emissions trajectories and restrictions applied to the model that cap least cost technologies result in a mismatch between the IRP2023 and the benchmark studies reviewed by the PCC.

The PCC make the following recommendations on next steps:

1. Further analysis is required to answer the basic questions that the IRP should address. At the very least a scenario to 2030 that more aggressively addresses load shedding is needed. This needs to be done in the context of different electricity demand forecasts, including demand scenarios aligned with NDP objectives. Without further analysis and scenarios that don't constrain technology deployment the IRP2023 analysis cannot be used to make final decisions about a desired short- or long-term energy mix.
2. The lack of transparency and the limited consultation is problematic and not aligned with the principle of procedural justice. More detail on Table 2 and the proposed energy mix (which is not dealt with in Horizon One scenarios) on cost relative to least cost options needs to be published. The DMRE need to release all the assumptions and results used in the modelling and to widen the breadth and duration of their consultations. Assumptions that should be disclosed include build rate caps on technologies, externality costs, EPRI and Lazard costs used, ramps rates that affect uptake of dispatchable technologies and storage, and technology caps, especially if arising from transmission constraints.
3. A review of the extent of the cost and emissions differences between the IRP2023 and the PCC review of benchmark studies (adding a recently released report by Bloomberg) needs to be undertaken. In particular, the deployment of more expensive CSP technologies over and above an equivalent but cheaper capacity in solar PV and battery storage needs to be explained. The PCC also has concerns about a lack of learning curves in the models, fixing 2021 costs for technologies that are evolving over the period of the study will disadvantage technologies whose prices are rapidly lowering – in particular for storage.
4. A detailed review of air quality and its impacts on technology choices is needed.

The analytical framework is established within the IRP2023 to undertake the additional analysis needed to properly conclude.

2. Introduction and Background

The IRP2023 was released by the DMRE for public comment on the 4th of January 2024. The DMRE hosted online briefing sessions on the 9th, 18th and 31st January. The DMRE has released some supplementary data and supporting reports on their website: https://www.dmr.gov.za/news-room/post/2150 (DMRE, 2024). The DMRE have also announced that they will do further model runs[1], but it is unclear how this will impact the IRP2023 itself. Final comments are due to the DMRE by the 23rd March 2024 (extended from the 23rd February 2024).

Following a consultation with social partners and experts, and based on previous analysis released in April 2023, draft comments on the IRP2023 were presented to Commissioners on the 16th February 2024. Commissioners provided comments which were incorporated within this document. The PCC secretariate has met with the IRP modelling team of the DMRE on two occasions to share perspectives. The secretariate would like to thank the DMRE for their active engagement with us and with our stakeholders.

Procedurally, the IRP is a reflection on various research scenarios and modelling exercises (using Plexos) and considers two timelines; 2024 until 2030[2], and then from 2031 to 2050, referred to as Horizon One and Horizon Two respectively. The DMRE derive five scenarios for each of Horizon One and Two (with Horizon Two scenarios referred to as pathways). The DMRE extract various principles and conclusions from Horizon One scenarios and make some general conclusions. These principles and general conclusions are used to recommend an emerging energy plan described in Table 2 of the IRP2023. There is no explicit modelling of the energy mix offered in Table 2 and the energy mix in Table 2 is not represented in the scenario analysis in Horizon One. As a result, there is a disconnect between the modelled scenarios and the recommendations made in Table 2. However, the pathway determined in Table 2 then forms a consistent input into the Horizon Two pathways.

It should be noted that there is insufficient information provided to fully evaluate the outputs of the IRP2023. The IRP analysis differs with other benchmark studies and there is insufficient detail on the drivers of these differences in the IRP2023 report.

The analytical infrastructure established in the IRP2023 is very useful. The principle of using scenarios and modelling those scenarios as an input into decision making is supported by the PCC. The IRP2023 states that "the IRP is a living plan that is expected to be regularly reviewed" focused on multiple policy objectives of "security of supply, energy affordability, and carbon emissions reduction[3]" and that ultimately "final policy decisions must be taken on the basis of a long-term decarbonisation trajectory while improving South Africa's competitiveness, growing the economy through industrial renaissance as outlined in the NDP". By adding scenarios and adjusting assumptions over time, the established analytical infrastructure enables a national, transparent, regular review of energy planning.

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1 https://www.engineeringnews.co.za/article/dmre-to-remodel-draft-irp-2023-in-light-of-new-information-curtailment-plans-2024-02-01

2 It may be worth considering revising this planning phase to a decade, and not cap it a 2030.

3 The IRP refers to various policy objectives throughout the document, including: secure and sustainable energy for socio-economic development, security of supply, safety, climate change, environment, total cost of supply, emissions reductions, reducing unserved energy, energy affordability, adequate, stable and sustainable power

3. Horizon Two

All major studies of electricity systems in South Africa (CSIR and Meridian (2022), World Bank (2022), UCT (2022) and NBI (2022a, b), IRP2019 (DMRE, 2019); and more recently Bloomberg (2023)) conclude that the least cost, climate compliant future electricity system would be to rapidly build variable renewable energy (VRE), complemented by storage and peaking support (for example OCGT gas peaking plant). This cost-effective energy mix under climate constraints has been echoed by several international reports, including the International Energy Agency, and is reflected in many countries' electricity expansion plans[4].

In the IRP2023 analysis the Horizon Two "least cost reference pathway" builds new renewables, mid-merit and base supply CCGT, plus OCGT peaking support, plus storage. The IRP2023 states that this pathway has an adequate security of supply. While there are differences in respect of mid-merit and base supply CCGT, and the quantities of individual technology new build across these categories when comparing the IRP and PCC recommendations, achieving some alignment is a useful place to start future discussions.

The analysis of Horizon Two pathways echoes the PCC's research that extending the life of coal is not the least cost option and is roughly 10% more expensive than the least cost option (figure 22 in IRP2023). Regarding the extensive reliance on gas to power at high load factors in Horizon 2, it is noted that methane leakage in the gas supply chain has not been accounted for in the emissions from gas to power.

Furthermore, analysis of Horizon Two scenarios echo PCC findings that nuclear and new coal are not least cost options but that future price changes in technologies such as Small Modular Reactors, Hydrogen and Carbon Capture, Utilisation and Storage may disrupt these conclusions in the future. The reliance on technologies not yet commercially proven in certain Horizon 2 pathways is problematic. Some argue that to reach net-zero we need to phase out thermal coal before 2050, with abatement focussing rather on hard to decarbonise sectors.

Another key conclusion, also reflected in the PCC recommendations, is that renewable energy cannot be implemented on its own, and the intermittency and variability of renewable energy requires synergies with other dispatchable forms of power, notably storage and peaking support. Implementing a pathway that constrains storage and peaking support and only allows the build out of renewables is more expensive than least cost, and will threaten system stability. Further investigation is required in respect of the extent of the cost differences between the IRP2023 and the PCC review of benchmark studies. The deployment of very expensive CSP technologies over and above an equivalent but cheaper capacity in solar PV and battery storage requires further analysis and explanation. A lack of learning curves in the models is a material issue, fixing 2021 costs for technologies that are evolving over the period of the study will disadvantage technologies whose prices are rapidly lowering – in particular for solar PV and storage.

[4] 1. IEA, 2021, "Net-Zero by 2050, A Roadmap for the Global Energy Sector", https://www.iea.org/reports/net-zero-by-2050. IEA, 2023, "Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach", https://www.iea.org/reports/net-zero-roadmap-a-global-pathway-to-keep-the-15-0c-goal-in-reach. Australian Energy Market Operation, Integrated System Plan, 2024. https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2023/draft-2024-isp-consultation/draft-2024-isp.pdf?la=en.

The PCC provided a review of benchmark studies in its April 2023 Electricity Recommendations Report. Despite it being included in the reference list attached to the IRP2023 it is not clear how this report has been used. The DMRE should more expressly state how this report has been considered in drafting the IRP.

The PCC Commissioners and DMRE are aligned on what a least cost future generation mix would look like and that this should form the basis for future planning. The recommendations made by commissioners to Government in April 2023 said "South Africa should adopt a least cost electricity pathway and seek opportunities to close coal faster, predicated on achieving energy security". The conclusions of the IRP2023 reinforce the first half of this sentiment but the IRP2023 long term analysis largely ignores or does not explain the DMRE understanding of the long-term climate context.

Given the urgency of resolving the electricity crisis the PCC support the IRP2023's focus on the near term (Horizon One) and that the bulk of the analysis and document discussion is focussed on pre-2030. There is an urgency to resolving the energy crisis in South Africa and of course the further we go out in the timelines of our modelling the greater the uncertainty. However, there are concerns about Horizon One modelling that may materially impact the starting point used for Horizon Two. Furthermore, there are some unusual modelling results in Horizon Two that bear further investigation. Notably the very high renewable costs in comparison to other benchmark studies and the absence of learning curves in the modelling.

4. Horizon One

Table 2 only suggests new gas, new renewables, and new storage as suggested in our electricity recommendations of April 2023. However there is far more gas and far fewer renewables than we would support. Furthermore, the PCC has significant concerns:

- The IRP2023 does not fulfil the basic requirements of an IRP. Its analysis is incomplete, and its analysis does not support the conclusions it makes. The IRP fails to meet the primary energy security objective and fails to provide any analysis to show how this might be achieved in the short term.
- The IRP is not sufficiently developmentally focussed and spends little time on the just transition, as defined in the Just Transition Framework (PCC, 2022). A notable component of this is the issue of air quality and poor market signals for localisation, job creation and skills development.
- The magnitude of technologies deployed do not match benchmark studies. The IRP deploys more gas than a review of a range of models show we would need. The PCC recommend 3-5 GW of peaking support, for example gas, running at low utilisations, by 2030 where the IRP2023 proposes 7 to 8.5 GW) and significantly lower renewables (the PCC recommends 50 to 60 GW variable renewable energy by 2030, at least in the next decade, while the IRP2023 proposes around 20 GW[5]).
- The CO_2 emissions calculations differ significantly from the calculations of the PCC and the DMRE should provide further detail on how GHG emissions are accounted for in the IRP modelling. Methane leakage in the gas supply chain has not accounted for on the emissions from gas to power.

[5] Table 2 of the IRP2023 shows roughly 15 GW, which excludes a private sector behind the meter contribution of roughly 5 GW that was modelled. Confirmed by the DMRE in a public consultation with the PCC.

- The scenario analysis is incomplete and further model runs are required to adequately conclude on a best path forward. Scenarios that fully address load shedding, model the impacts of increasing efforts to rollout more renewable energy, and that explore the consequences of a further decline in EAF are notably missing.
- The scenario results suggest that capacity factors for 'gas' and dispatchable capacity in Table 2 may be very high. If this is the case the cost implications may be severe and should be explored. Former IRPs utilised the Eskom 'MYPD model' to estimate tariff impacts, and this or a similar exercise would add a lot of value.

The IRP analysis does not discuss the broader policy objectives of economic diversification, human health, employment, and skills development. Critically it seems to accept as its starting point that nothing can be done about load shedding in the short term and that government will play no additional role in accelerating the buildout of renewable energy. As a result, the IRP accepts very high, albeit declining, levels of load shedding to 2028 as a fait accompli. Load shedding is the single biggest impact (confirmed in Horizon Two's analysis of costs of each pathway) of failed electricity planning, mismanagement and corruption on the economy. At the very least the IRP2023 should establish a least-cost benchmark scenario and investigate options for meeting that pathway.

It is the experience of the PCC that this pathway would seek to accelerate energy efficiency and renewable energy alongside reasonable, financially viable means of improving EAF. A pragmatic scenario, that builds renewable energy faster (enabled by market mechanisms to limit grid constraints, chiefly curtailment) and that improves the EAF of selected plant to levels closer to 60%, should be explored. The technology deployment constraints exhibited in the reference case of Horizon 2 are unrealistic. Furthermore, the technology constraints or assumptions exhibited in Table 2 of Horizon 1 on behind-the-meter embedded generation seem disconnected with the reality of the pace of rollout. Planning that mirrors historical evidence and market forecasts, for example those by Bloomberg (2023), should be explored.

Modelling a single electricity demand profile that does not allow for much electricity demand growth and further economic growth prior to 2030 does not seem constructive[6]. Economic growth is key for lifting people out of poverty, inequality, and unemployment. Furthermore, it is not clear how the demand for electric vehicles is incorporated. Finally, the assumption that demand for hydrogen will be embedded in the private sector projects needs exploration. To fully understand what is needed of future energy requirements the DMRE need more model runs for different demand scenarios, including for Horizon Two, that reflect the varied possible future options and needs.

It is important that Government does not leave renewable energy generation exclusively to the private sector and to wealthy households. Various forms of social ownership and the role of Eskom in renewable energy generation should be considered. In the absence of a plan that addresses load shedding, private sector and household investment in their own generation will accelerate. Some stakeholders, especially labour, have additional concerns about privatisation of the electricity fleet. They suggest that this will result in an increasing proportion of further disruptions and costs carried by the poor, and that any plan to undersupply electricity will stimulate further investment in private

[6] UCT/SANEDI modelling of demand scenarios disaggregate electricity and economic demand. Due to efficiencies it is possible to increase GDP growth and have flat electricity/energy demand. It is possible that the IRP base case has some economic growth ~2%). The DMRE should clarify which demand curve, whether from the CSIR report cited or from the SANEDI report, was input to the Plexos model and any adjustments made.

sector and household rooftop solar exacerbating inequality and making revenue recovery for Eskom even more challenging.

The IRP fails to give a sufficient market signal to the renewable energy construction and localisation sectors. The job and skills development opportunities in this sector are significant and the South African Renewable Energy Master plans sets the basis for expansion. However, an average of 2 GW of renewables per year sends a weak market signal and undermines SAREM's explicit requirement for "Supporting the local demand for renewable energy and storage by unlocking market demand and system readiness" and "growing the economy by fostering the rollout of renewable and storage projects". Furthermore, the lack of solar build between 2026 and 2028 and the lack of wind build in 2028 would be extremely disruptive to the market. If the IRP provided the necessary support to expanding the renewable energy sector it would unlock significant energy security, jobs, and livelihood opportunities.

The role of air pollution cannot be ignored. A recent report (Centre for Research on Energy and Clean Air, 2023) looking at the health impacts of Eskom's coal plant fleet suggests that air pollution from coal-fired power plants, when considering Eskom's current planned retirement schedule and emission control retrofits, would be responsible for 79 500 air pollution-related deaths from 2025 until their end of life. Other avoided health impacts would include 140 000 asthma emergency room visits, 5 900 new cases of asthma in children, 57 000 preterm births, 35 million days of work absence, and 50 000 years lived with disability. The study estimated that requiring the application of best available control technology at all plants, instead of the current Minimum Emissions Standards, by 2030, would avoid economic costs of R1-trillion (USD68-billion) compared to the Eskom plan. While the IRP2023 acknowledges the role of air pollution on human health it avoids dealing with it. The argument that you need to choose between energy availability and air quality is not valid. A path to continue with coal must take account of legal and constitutional requirements, and factor costs of meeting air quality emissions standards into modelling, otherwise it risks being overturned by the courts.

The modelling of Horizon One scenarios results in an energy mix that significantly deviates from benchmark studies in the amount of each generation technology it builds. The IRP2023 builds significantly more gas and far fewer renewables. This is likely partly due to the construction of the scenarios and partly due to the assumptions used in the modelling. There are two primary challenges in the way the scenarios have been constructed. Firstly, the level of renewable energy has been constrained (both on the public and private side), and secondly, the model does not allow synergies across technologies typical of benchmark studies. In other words, too little renewable energy is built and the advantages of renewable energy working with storage and peaking support to address challenges with intermittency are artificially prohibited. Furthermore, as stated above, the estimates for private sector rollout of electricity are extremely low. By implication the amount of gas built in the IRP2023 far exceeds benchmark studies reviewed by the PCC. This will almost certainly lead to higher cost electricity (recovered either through price recovery or tax bailouts) once again with significant just transition impacts. The issue of tariff impacts is possibly the most serious gap in Horizon 1. In suggesting non-least cost futures, the IRP fails to deal with issues of electricity affordability and access, particularly in a context where millions of people cannot afford electricity right now, even when it is available. While least-cost electricity and the impact of electricity price on affordability and access cannot be the only policy outcome, it is a critical decision variable that should be disclosed. Further reflection by the DMRE on the impact of each scenario and pathway on electricity pricing is necessary.[7]

[7] As suggested previously many of these questions can be addressed with further scenario runs.

An important area of further exploration is the issue of greenhouse gas (GHG) emissions. The DMRE report that Table 2 and all Horizon Two pathways are below the 2030 NDC range. This does not match benchmark studies. There are several points to explore.

1. The starting point at the end of 2023 is 180 MT CO_2e, below the 200 MT reported for the end of 2022 by Eskom in their annual reports. It is possible that this is due to extreme levels of loadshedding in 2023, but the DMRE need to release the GHG emissions reductions calculations.
2. The reduction in GHG emissions is disproportionate to the reduction in energy output. Figure 21 shows a reduction in roughly 23 000 GWH of output reduction but 40 000 MT CO_2e. The grid GHG emissions factor published by DFFE is roughly 1 to 1. It is theoretically possible that a change in energy mix could impact this GHG emissions factor but unlikely over the time up to 2030. The reduction in load shedding should also increase GHG emissions.
3. While there is no formal policy addressing how the NDC reduction targets are to be allocated across sectors, sectoral emissions targets are due to be published under the new Climate Change Act, which is expected to be promulgated shortly. Modelling shows that electricity sector decarbonisation is the cheapest and most effective option to reduce South Africa's GHG emissions, and it is therefore expected that this sector will be required by law to make significant reductions in order for South Africa to meet its NDC range. The NDC range identified by the DMRE as 160 to 180 MT CO_2e by 2030 is different to that calculated by the PCC of 140 MT to 190MT (based on an 80% share of reductions). The contribution of the power sector compared to reductions in the rest of the economy is important to align[8].
4. The NDC range needs to be enhanced overtime. NDC commitments are updated every 5-year period (aligned with net-zero, science and the Paris Agreement and UAE Consensus, UNFCCC, 2023). Therefore, the NDC commitment level for 2035 and outer years will be different to 2030 and this should be considered.

Given limited State and Eskom room for borrowing, it is unclear how each pathway would be funded, this is especially true for pathways that rely on State balance sheets. It would be important to reflect how each scenario would impact the price of electricity (the economic impact of increased electricity prices and its reciprocal impact on demand has not been modelled).

Finally, there is little attention given to model sensitivity and the assessment of risk. It would be important to test both horizon scenarios and pathways against changes in key assumptions. Notably gas prices are historically volatile. How would conclusions change if we change input costs for batteries? How might the skills constraint inhibit the rollout of renewable energy (for example extending lead times)? What would happen if we cannot return the EAF of the coal fleet to 70%, but rather achieved 60% or 55%? A sensitivity analysis of key variables is recommended.

[8] The Presidency (2023) in their Just Energy Transition Plan has done some analysis of this, Figure 15

5. Further action required

The IRP does not fulfil the basic requirements of an IRP. Its analysis is incomplete, and its analysis does not support the conclusions it makes. Further analysis is required to answer the basic questions an IRP should address. The lack of transparency and the limited consultation could be improved. More detail on Table 2 and the proposed energy mix (which is not dealt with in Horizon 1 scenarios) on cost relative to least cost options needs to be published. The DMRE need to release all the assumptions used in the modelling and to widen the breadth and duration of their consultations. This will require an extension on the comment period. Specific additional analysis needed includes:

- A 'system adequacy' scenario to 2030 that more aggressively addresses load shedding is needed. This needs to be done in the context of different electricity demand forecasts, including demand scenarios aligned with NDP objectives. Without further analysis and scenarios that don't constrain technology deployment the IRP2023 analysis cannot be used to make final decisions about a desired short- or long-term energy mix.
- A review of the extent of the cost and GHG emissions differences between the IRP2023 and the PCC review of benchmark studies (including a recently released report by Bloomberg) needs to be undertaken. We also have concerns about a lack of learning curves in the models, fixing 2021 costs for technologies that are evolving over the period of the study will disadvantage technologies whose prices are rapidly lowering – in particular for storage. The calculation of the GHG emissions trajectories and restrictions applied to the model that cap least cost technologies result in a mismatch between the IRP2023 and the benchmark studies reviewed by the PCC.
- Develop a reference case scenario for Horizon 1 that least cost optimises 'new capacity' (green blocks in Table 2) without constraints rather than dispatch simulating a build plan of fixed capacities drawn from manual blending of the pathways results which is what appears to be the basis for Table 2. This will establish the least cost benchmark for eradicating load shedding and guide the best-case developmental outcomes from short-term energy planning. The DMRE has asserted that policy adjustment of least cost optimised modelling results is necessary to account for other imperatives and considerations, yet a least cost reference case, as was performed for Horizon 2, would at a minimum indicate the social cost of those decisions for the Table 2 'emerging plan'.
- Release a full set of assumptions used in the modelling. The assumptions review would especially focus on electricity demand profiles, commodity costs and their volatility, plant construction and upgrade costs, externality costs, life of plant, plant operational costs, plant availability and capacity factor limits, capacity caps especially where transmission system related and GHG emissions factors. We would like to review more detail on the assumptions and methodology used and more detailed outputs for the Horizon 1 modelling that informed Table 2 as well as the dispatch results for Table 2 capacities..
- Provide information on what modelling and assumptions have been made regarding Eskom's ability (or not) to meet its contribution to the NDC target, how would this impact other sectors, and what policy adjustments would be considered in respect of IRP2023.

- Further sensitivity analyses running further scenarios for different demand profiles is required. By varying the assumptions and testing the sensitivity of the model to impactful variables you can assess risk and determine the most likely cost optimal future pathways. In the case of IRP2023 the DMRE appear to have kept many of the exogenous variables constant (for example future demand) and then constrained which technologies the model can deploy together. This would include modelling a worst-case scenario where the capacity factors of coal plants continue to decline.
- Scenarios that account for air quality impacts is essential. This scenario should explore the renewable energy, peaking and storage support needed to close non-compliant plant (delayed slightly) and separately explore the additional cost to electricity to make these plants compliant, offset against the social and human health cost of air pollution.
- The comparison of Horizon 2 scenarios is somewhat sterilised by not addressing the unserved energy in the Renewable Energy scenario. This artificially inflates the costs with the cost of unserved energy and doesn't reflect a practical implementation. The maximum unserved load in the hourly data of the dispatch (ST) simulation should be input as the maximum capacity of a gas peaker in a second run. This will give the best "near complete renewable" solution without unserved energy so that "apples with apples" cost comparisons can be made[9]. Ideally, all the high renewables scenarios should also include the system costs of power quality compensation investments above 30% variable RE penetration. There should be sufficient data emerging to estimate this and, at a minimum, it should be flagged as something to be calculated in future IRPs.
- The cost of fuel in Horizon 1 needs to be explicitly laid out as, given the high capacity factors indicated, as the potential consequences could be extremely grave. The policy adjusted plan (Table 2) should consider the following cases, and the costs compared:
    - Existing OCGTs are not converted and new dispatchable capacity is OCGT except where already decided.
    - All or most 'gas' capacity is CCGT.
    - Gas availability is delayed or does not happen and this capacity operates on diesel at its long-term real escalation of 2% p.a. for both above cases.

[9] Internationally, some 100% RE analyses fuel dispatchable thermal capacity with biofuel or biofuel blends in their high renewables scenarios

6. Conclusion

In a planning exercise it is critical to be cognisant of real-world practical constraints. But equally we should be focussed on maximising new generation to avoid load shedding in the short and long term and to comply with a range of other policy imperatives, including air quality and climate change. As stated in our electricity recommendations report, the PCC recommends a risk-based approach where the strategies of maximising variable renewable energy build and reasonable cost measures to improve EAF (within climate constraints) are pursued in parallel (as well as an important focus on energy efficiency). Understanding the impact of model sensitivities and real-world risk will be a critical enabler of policy formation.

In the PCC electricity recommendations report the PCC reviewed several benchmark studies considering a wide range of demand and supply variables. If we assume we reach the top end of the NDC, implement high levels of energy efficiency, and experience lower levels of economic growth we would need to build around 35 GW of variable renewable energy by 2030. However, this latter pathway would be a high-risk pathway. However, in the interests of development (higher growth and aiming for the lower end of the NDC) the PCC recommendations of 50-60 GW at least over the next decade still hold. This will enable eradication of load shedding, provide a strong market signal in support of SAREM, have the lowest deviation from least cost than many of the other modelled scenarios posited in the IRP2023, be more closely compliant with air quality and meet our climate commitments enhancing trade and financial support for South Africa.

The PCC is concerned that the IRP2023 recommends levels of renewable investment that are too low and levels of investment in gas infrastructure that are unnecessarily high. Furthermore, the analysis presented in the IRP2023 is incomplete. Certainly, many of the conclusions made in the IRP are not consistent with the evidence presented in the IRP or insufficient evidence has been provided.

The PCC appreciate the analytical framework established and believe the DMRE are well placed to conduct the further necessary analysis required to answer the basic questions that the IRP should address. Further scenarios are required to explore different electricity demand forecasts, including demand scenarios aligned with NDP objectives. Without further analysis and scenarios that don't constrain technology deployment and incorporate learning curves the IRP2023 analysis cannot be used to make final decisions about a desired short- or long-term energy mix.

We trust that the next iteration of the IRP 2023 will come with enhanced transparency and will be accompanied by a broader stakeholder engagement programme, including working with the social partners of NEDLAC. A review of the extent of the cost and emissions differences between the IRP2023 and the PCC review of benchmark studies (adding a recently released report by Bloomberg) needs to be undertaken. A detailed review of air quality and carbon emissions and its impacts on technology choices is needed.

The IRP should acknowledge its developmental context, including socially and community owned renewable energy. The IRP analysis should reflect cost impacts on tariffs within its scenarios and therefore the impact on energy access and affordability. The IRP2023 should provide sufficient market signals (strength and consistency) to support developmental policies like the South African Renewable Energy Master Plan.

We would like to thank the DMRE for the opportunity to engage with the IRP and for the opportunity to respond and provide comments. We look forward to feedback from stakeholders and from the DMRE as the process progresses.

7. References

Bloomberg NEF, 2023. South Africa Power Transition Outlook. https://assets.bbhub.io/professional/sites/24/2023-South-Africa-Power-Transition-Outlook_Post-Consultation_Final.pdf

Centre for Research on Energy and Clean Air. 2023. Health impacts of Eskom's non-compliance with minimum emissions standards. https://energyandcleanair.org/publication/health-impacts-of-eskoms-non-compliance-with-minimum-emissions-standards/.

CSIR and Meridian Economics. 2020. Technical Report: Systems analysis to support increasingly ambitious CO2 emissions scenarios in the South African electricity system. https://researchspace.csir.co.za/dspace/bitstream/handle/10204/11483/Wright_2020_edited.pdf?sequence=7&isAllowed=y.

DMRE, 2019. The 2019 Industrial Resource Plan. https://www.energy.gov.za/irp/2019/IRP-2019.pdf.

DMRE, 2024. The 2023 Industrial Resource Plan, issued for conslutation. https://www.dmr.gov.za/news-room/post/2150.

NBI, 2022a. Decarbonising South Africa's Power System. https://www.nbi.org.za/focus-areas/environmental-sustainability/climate-pathways-and-a-just-transition-for-south-africa/.

NBI, 2022b. Climate Pathways for a Just Transition in South Africa. https://www.nbi.org.za/focus-areas/environmental-sustainability/climate-pathways-and-a-just-transition-for-south-africa/

PCC, 2021. South Africa's NDC targets for 2025 and 2030, technical analysis to support consideration of the emissions trajectory in South Africa's NDC. https://pccommissionflo.imgix.net/uploads/images/1eb85a_75d745eb859d43c288f461810b336dd3-compressed.pdf.

PCC, 2022. A framework for a Just transition in South Africa. https://pccommissionflo.imgix.net/uploads/images/A-Just-Transition-Framework-for-South-Africa-2022.pdf.

PCC, 2023. Technical Report Supporting the Recommendations for South Africa's Electricity System. https://pccommissionflo.imgix.net/uploads/images/PCC_Electricity-Planning-Technical-Report_2023-06-01-102932_nihr.pdf.

Presidency, 2023. Just Energy Transition Investment Plan. https://pccommissionflo.imgix.net/uploads/images/South-Africas-Just-Energy-Transition-Investment-Plan-JET-IP-2023-2027-FINAL.pdf.

University of Cape Town (UCT), 2022. ESRG. Exploring Net Zero pathways for South Africa. An initial study. https://zivahub.uct.ac.za/articles/report/Exploring_net_zero_pathways_for_South_Africa_-_An_initial_study/22189150

UNFCCC, 2023. Global Stocktake Decision, CMA2023/L.17. https://unfccc.int/sites/default/files/resource/cma2023_L17_adv.pdf.

World Bank, 2022. South African Country Climate Development Report. https://openknowledge.worldbank.org/server/api/core/bitstreams/52409ffd-96f7-58d4-be7f-c8114abbd4c5/content.

Appendix A – Additional Supplementary Detail

1. About the PCC

The PCC is a multi-stakeholder body established by the President of the Republic of South Africa to advise on the country's climate change response and pathways to a low-carbon climate-resilient economy and society.

In building this society, South Africa needs to ensure decent work for all, social inclusion, and the eradication of poverty. Those most vulnerable to climate change, including women, children, people with disabilities, the poor and the unemployed need to be protected, and workers' jobs and livelihoods also need protection.

The PCC's mandate emanates from the Presidential Jobs Summit held in October 2018, when social partners agreed that a statutory entity should be formed to coordinate and oversee the Just Transition towards a low-carbon, inclusive, climate-resilient economy, and society.

Through a multi-stakeholder process, the PCC successfully delivered the first Just Transition Framework for South Africa, adopted by the Commission in May 2022, and recently approved by Cabinet in July 2022. The PCC also submitted a set of reports to the President and the DMRE detailing recommendations for electricity planning in April 2023.

The commission consists of Government Ministers and 22 Commissioners that represent diverse perspectives of social partners, including: academia, business, civil society, labour and youth. The PCC facilitates dialogue between social partners on these issues and, in particular, defining the type of society we want to achieve and detailed pathways for how to get there.

2. About this submission

This submission reflects the technical analyses, and commissioner and stakeholder inputs that underpin the PCC's critical appraisal of the DMRE's Draft IRP 2023. The IRP is a key document pertaining to South Africa's national long-term electricity planning.

The analyses, comments and subsequent recommendations contained herein, are based on significant research, evidence and engagement with commissioners and social partners, set against the current national policy framework including the Just Transition Framework, Just Energy Transition – Investment Plan (JET-IP) and the PCC's Electricity Planning Recommendations Report.

3. PCC principles in respect of energy, electricity and associated environmental policy, regulation and planning

The work of the PCC involves policy, regulation and planning issues in respect of energy, electricity, the economy, the environment and social equity.

In its work, including in this response to the call for comments on the Draft IRP 2023, the PCC strives to meet and align with the following fundamental principles:

- Objective and fact-based.
- Consultative and inclusive.
- Open and transparent.
- Aligned with established legislation and government approved policies.
- Committed to the principles of restorative, redistributive, and procedural justice.

4. Acknowledgement

The PCC acknowledges and thanks the Director-General, the DMRE team and the Eskom modelers seconded to the DMRE responsible for the significant work and effort that has gone into the preparation of the Draft IRP 2023, and thanks the DMRE Minister for the opportunity to comment and respond to the Draft.

The PCC and its structures have studied the Draft IRP 2023 carefully, and a series of engagements have been conducted with PCC Commissioners, the PCC Net-Zero Working Group, NEDLAC stakeholders, interested stakeholders and the public to develop this response and the comments contained herein. The PCC continues to rely on the extensive stakeholder engagement and research done to prepare the April 2023 Electricity Recommendations reports.

5. General Context

5.1 Short- and medium-term issues in the period to 2030 of concern to the PCC, and of relevance to the planning and proposals embodied within the Draft IRP 2023

The PCC is deeply concerned about the major electricity supply disruptions caused by:

- Regular supply shortfalls by Eskom, resulting from the poor performance of Eskom's coal-fired generation plant, and delays in the procurement and construction of new generation capacity in South Africa, leading to load shedding across the country.
- Regular and growing occurrences of unplanned power outages caused by distribution system infrastructure and equipment failures in Eskom and municipal electricity distribution networks.
- Regular and growing occurrences of power outages caused by "load reduction" imposed by Eskom on certain low-income areas supplied directly by Eskom; on municipal electricity distributors that exceed their notified maximum demand; on areas that are in arrears with Eskom in respect of payments for electricity supply; and/or on low-income areas where overloading of distribution infrastructure is prevalent as a result of electricity theft and nonpayment.

All of this is disruptive to government, public, business, industry, mining and residential sectors in both Eskom and municipal areas of electricity supply, with associated loss of revenue, productivity and jobs, and an inability to grow and adequately serve South Africa's needs for social justice, job creation, economic recovery and inclusive growth.

The PCC has interest and concerns in respect of how these issues are addressed in the Draft IRP 2023.

5.2 Short-term in the period up to 2030 and longer-term issues in the period from 2031 to 2050 of concern to the PCC, and of relevance to the planning and proposals embodied within the Draft IRP 2023

The PCC is also deeply concerned about medium- and longer-term issues, such as:

- The mitigation of the root causes of and adaptation to the impacts of climate change.
- Meeting our Nationally Determined Contribution commitments and the identification and implementation of realistic pathways to net-zero carbon emissions by 2050.
- The implementation of a Just Energy Transition in respect of the decarbonisation of the South African economy in general, and the energy and electricity sectors in particular, as applied to longer-term planning covered in the Draft IRP 2023.
- The health impacts resulting from burning of fossil fuels, including coal, gas, liquid and other fuels, and in particular those associated with power generation as applied to longer-term planning covered in the Draft IRP 2023.
- The associated issues of redistributive justice, restorative justice and procedural justice at local grass-roots level in respect of the above.

The PCC has interests and concerns in respect of how these issues are addressed in the Draft IRP 2023.

5.3 How customers are responding to the short- and medium-term issues

Government, industry, business, agricultural and residential customers are responding to load shedding described above, and the critical need for security of electricity supply, in various ways:

- Installation of petrol and diesel standby generators on a massive scale, with significant up-front capital cost, ongoing fuel and maintenance costs, increased levels of air and noise pollution and CO_2 emissions.
- Installation of uninterruptible power supplies and standby battery energy storage systems at significant capital cost. These systems are net consumers of electricity and add to the burden on electricity supply networks as they recharge after load shedding and other power outages.
- Installation of grid-tied solar PV with battery energy storage for both self-generation and wheeling of electricity. This reduces the burden on Eskom generation, and, as such, serves to reduce the impact of load shedding and improve security of supply for all.

5.4 How an Integrated Resource Plan (IRP) for Electricity is intended to respond to the short-, medium- and long-term issues

An integrated resource plan (IRP) for electricity is ideally an optimisation study and plan:

- over a defined period;
- using defined economic assumptions;
- that takes into account the existing power generation fleet, its performance and decommissioning schedule;
- and takes into account existing transmission grid constraints and planned grid developments and informs new transmission grid developments, iterating planning where significant challenges in timing and cost arise;
- and considers defined generation technology options and associated technology costs;
- under various assumptions, options and generation technology combinations (scenarios);
- to suggest achievable new-generation build mixes and pathways needed for the period under consideration;

- that will use the best available tools to develop and explore the pathways with the least overall discounted system cost (i.e. including capex, opex, fuel and associated infrastructure requirements);
- necessary to meet projected demand and ensure unserved energy is avoided at a defined level of reliability/adequacy;
- while meeting defined boundary conditions / policy imperatives such as pollution limits, carbon emissions, water use, job creation, and socio-economic impacts.

5.5 The broad requirements, expectations and needs for a national IRP for electricity

In conducting and proposing a national IRP for electricity, significant efforts should be taken to meet the requirements, expectations and needs for the IRP to be:

- Rational, realistic and achievable.
- Conducted using a clear and transparent methodology.
- Indicative and non-prescriptive.
- Consultative and inclusive.
- Objective and fact-based.
- Up-to-date and flexible.
- Aligned with the principles of restorative, redistributive, and procedural justice.
- Aligned with approved government principles, policy initiatives and frameworks.
- Aligned with an overall integrated energy plan (IEP) covering the other primary energy sources and energy carriers in a wholistic way.
- Aligned with international commitments and national policy targets for overall and power generation sector carbon emission reduction pathways to net-zero carbon emissions by 2050.
- Aligned with national mandatory legislation, regulations, environmental constraints and mandatory minimum emission standards.
- Able to be tested, replicated and verified independently.

To meet the transparency and other needs of a national IRP as detailed above, the following specific information needs to be included within the Draft IRP 2023 itself, or as appendices:

- Clearly tabulated, economic assumptions and trajectories used over the period of the study.
- Clearly stated, technology costs (i.e. capex, fixed and variable opex, fuel, infrastructure requirements) and cost trajectories used over the period of study, including learning curves.
- Clearly tabulated, technology construction times and roll-out constraints used over the period of study.
- Clearly stated boundary conditions/policy constraints imposed over the period of the study (e.g. limits in respect of pollution, carbon emissions, water use, health impacts, job losses/creation, etc.).

This submission by the PCC analyses and comments on the extent to which the above expectations, requirements and needs for a substantive and meaningful Draft IRP 2023 have been met.

6. Comments on the Draft IRP 2023 published by the DMRE Minister for public consultation

The PCC welcomes and supports the intent of the proposed Draft IRP 2023 published by the DMRE Minister for public consultation, and the following specific comments and suggestions are given below by the PCC in terms of the Draft IRP 2023 consultation process with affected organisations and stakeholders:

6.1 Comments on IRP period under consideration

The PCC generally accepts and supports the approach taken by the DMRE and its modellers to divide the full period under consideration in the Draft IRP 2023 into two horizon periods, namely:

- Horizon 1: Period from 2024 to 2030 – dealing with short- and medium-term issues (the DMRE could consider a planning horizon to 2035).
- Horizon 2: Period from 2031 to 2050 – dealing with longer-term issues.

6.2 Comments on the transparency of assumptions and constraints used in preparing the Draft IRP 2023

While some input data is made available, in many cases the input data, assumptions and hard-wired constraints used in the modelling of the various scenarios is incomplete and ambiguous. This means making meaningful comments on the inputs and results is difficult, and in some cases impossible.

Furthermore, the DMRE has indicted that since gazetting of Draft IRP 2023, there have been a number of changes to the input data used. These include changes in the input data used from external data sources (EPRI, Lazard and the REIPPP programme[10]), and as well as changes to input data indicated in the spreadsheet of assumptions published on the DMRE website on about 10 January 2024. These changes are not reflected or indicated in the published Draft IRP 2023 and its workings, to the extent that the DMRE is said to be embarking on rework and remodelling of the Draft to address these inadequacies and changes.

Some of the limitations of the input data presented/used in the DMRE modelling are listed as follows:

6.2.1 Economic assumptions from 2024 to 2050

The PCC believes the Draft IRP 2023 will be more easily understood with a table (or as an appendix) clearly and unambiguously indicating the specific economic assumptions used in the modelling over the period from 2024 to 2050, such as:

- Rate of exchange US $ / Rand.
- If analysis is in real ZAR, the currency year
- Real GDP growth rate/s informing demand forecasts.
- Energy intensity of the economy
- Weighted average cost of capital (WACC) / discount rate.
- Carbon tax rates.
- Cross border adjustment mechanism (CBAM) rates.

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[10] It appears that the Draft IRP references cites the Centre for Scientific and Industrial Research, "Forecasts for electricity demand in South Africa (2017–2050) using the CSIR sectoral regression model, May 2017. https://www.energy.gov.za/IRP/irp-update-draft-report2018/CSIR-annual-elecdemand-forecasts-IRP-2015.pdf and not the SANEDI demand report posted on the IRP page.

- Cost of unserved energy resulting from loadshedding.

Only limited and incomplete information is presented in respect of the above economic assumptions. In some cases, such as the US $/ZAR exchange rate, only a single constant figure over the whole IRP period from 2024 to 2050 is given, instead of a more realistic view of the trend and trajectory over the study period.

In addition, there is no indication in the Draft IRP 2030 of any sensitivity analysis done on the above economic assumptions.

6.2.2 Socio-economic policy context and constraints

The PCC believes the Draft IRP 2023 will be more easily understood with some analysis and details on the specific socio-economic policy context and constraints used in the modelling for the period from 2024 to 2050, such as:

- Targeted power system reliability/adequacy level and constraints on the level of unserved energy.
- Job creation roll-out requirements and minimisation of job losses.
- Skills development requirements
- Relocation requirements
- Health impact requirements

While there is a DMRE Socio-Economic Impact Assessment System (SEIAS) report in the documents published on the DMRE website accompanying the Draft IRP 2023, the specifics of any socio-economic policy constraints used in the Draft IRP 2023 modelling are unclear.

6.2.3 Emission and water use constraints from 2024 to 2050

The PCC believes the Draft IRP 2023 will be more easily understood with a table (or as an appendix), clearly and unambiguously indicating the specific emission and water use constraints used in the modelling for the period from 2024 to 2050, such as:

- Carbon emission constraints.
- SO2 emission constraints.
- NOx emission constraints.
- PM2 and PM10 particulate emission constraints.
- Water use constraints.

Only limited and incomplete information is presented by the DMRE in respect of the above emission and water use constraints, and in some of the constraints listed above, no information is presented at all.

Later sections in this response deal with carbon emission constraints and air quality constraints in more detail.

6.2.4 Demand growth assumptions from 2024 to 2050

The PCC acknowledge the work done by SANEDI and the University of Cape Town ESRG on the electricity demand growth assumptions and modelling.

However, the PCC believes the Draft IRP 2023 will be more credible with a band of possible electricity demand growth trajectories, including low-, medium- and high-demand growth trajectories, for the modelling of the various scenarios. What is shown is just a single electricity demand growth trajectory used, which does not adequately reflect the inherent uncertainty of this assumption.

In addition, as electricity demand growth is impacted also by the electricity price trajectories associated with the different scenarios modelled in the Draft IRP 2023, one may expect that different electricity demand growth trajectories would be applicable to each of the different scenarios modelled, given that each scenario has its own price trajectory.

6.2.5 Technology rollout constraints (MW per year) from 2024 to 2050

The PCC believes the Draft IRP 2023 will be more understandable with a table (or as an appendix) clearly and unambiguously indicating the assumptions used in the modelling in respect of technology rollout constraints (MW per year) for the major technology options, such as:

- Clean coal-fired power
- Diesel-fired OCGT
- Gas-fired OCGT
- Gas-fired CCGT
- Gas engines
- Nuclear PWR
- Nuclear SMR
- Utility-scale hydro
- Small-scale hydro
- Utility-scale solar PV
- Utility-scale solar CSP
- Utility-scale wind
- Utility-scale pumped-storage
- Utility-scale BES
- Demand management
- Energy efficiency if not included in the demand projection

6.2.6 Small-scale embedded generation (SSEG) rollout constraints (MW per year) in Draft IRP 2023

While a low SSEG uptake rate assumption is conservative with respect to loadshedding mitigation it is not conservative with respect to the demand profile load factor (the ‘duck curve’) and the resulting need for storage or peaking capacity. Understanding market uptake, particularly given the boom caused by loadshedding, is extremely important for power system planning.

Table 2 of the Draft IRP 2023 shows a rollout of SSEG of 900 MW per year in the Horizon 1 study period from 2024 to 2030 i.e. total 6300 MW. This rollout appears to be a hard-wired input in the Draft IRP 2023 modelling process that is mismatched with available data and benchmark studies.

Independent data, including data from Eskom, the South African Photovoltaic Industry Association (SAPVIA) and Trade & Industry Strategies (TIPS), indicate that in 2023 alone, about 2000 MW of rooftop solar PV and BES were installed in South Africa.

With continued load shedding, further incentivisation for rooftop solar PV, and ongoing solar PV, inverter and BES price reductions, this trend may continue or even increase in the years ahead. Further analysis is required in respect of the rollout of SSEG is required.

There are no notable grid access constraints for a major rollout of rooftop solar PV and BES, as these systems are embedded within distribution networks, behind the meter, and on the customer's premises, where an existing network connection already exists. SSEG serves to reduce the burden on the external network, grid and Eskom generators, and therefore serves to reduce loadshedding across the country.

6.2.7 Technology construction time and phasing assumptions

The PCC believes the Draft IRP 2023 will be more understandable with a table (or as an appendix) clearly and unambiguously indicating the assumptions used in the modelling in respect of construction time and phasing for the major technology options, such as:

- Clean coal-fired power
- Diesel-fired OCGT
- Gas-fired OCGT
- Gas-fired CCGT
- Gas engines
- Nuclear PWR
- Nuclear SMR
- Utility-scale hydro
- Utility-scale solar PV
- Utility-scale solar CSP
- Utility-scale wind
- Utility-scale pumped-storage
- Utility-scale BES

These construction time and phasing modelling assumptions are important in determining the total capex (Rands per kW of installed capacity) from the overnight capex costs, particularly for longer lead-time options such as clean coal-fired power and nuclear power.

6.2.8 Capacity factor and energy availability factor assumptions for different technologies over time

The PCC believes the Draft IRP 2023 will be more understandable with a table or trend graphs clearly and unambiguously indicating the assumptions used in the modelling that give rise to capacity factor and energy availability factor outcomes in the model over time for the major technology options, such as:

- Clean coal-fired power
- Diesel-fired OCGT
- Gas-fired OCGT
- Gas-fired CCGT
- Gas engines
- Nuclear PWR
- Nuclear SMR
- Utility-scale hydro
- Utility-scale solar PV
- Utility-scale solar CSP

- Utility-scale wind

6.2.9 Fuel calorific value assumptions

The PCC believes the Draft IRP 2023 will be more understandable with a table (or as an appendix) clearly and unambiguously indicating the assumptions used in the modelling in respect of the calorific value for the major fuel options, such as:

- Coal
- Diesel
- LNG gas
- Natural gas
- Nuclear fuel

6.2.10 Fuel to electricity conversion assumptions

The PCC believes the Draft IRP 2023 will be more understandable with table (or as an appendix) clearly and unambiguously indicating the assumptions used in the modelling in respect of the conversion of fuel to net electricity output (heat rates), for each of the generation technology options that use fuel, such as:

- Coal-fired power plant
- Gas-fired OCGT
- Gas-fired CCGT
- Gas engines
- Nuclear power

6.2.11 Technology cost assumptions from 2024 to 2050

The Draft IRP 2023 indicates that, in general, the technology price assumptions (capex, fixed and variable opex, fuel) for the different generation technology options used in the modelling process were based on an EPRI report prepared for Eskom, dated January 2021.

The DMRE has since acknowledged in a PCC Net-Zero Working Group meeting on 1 February 2024 that the EPRI report data is significantly out-of-date and is largely based on technology costs in the USA.

As a result, the DMRE says it has since updated certain technology cost assumptions based on the latest report by Lazard in 2023, which also covers technology costs in other regions such as Europe and Asia.

Furthermore, the DMRE says that the latest actual bid window prices in the REIPPP programme have been used for utility-scale wind and solar PV, in the Draft IRP 2023 modelling process.

While EPRI and other data sources take into account technology cost reductions arising from learning curves over time, the DMRE has also indicated that it has not taken learning curve price reductions into account in its technology cost assumptions. The PCC considers this to be a major flaw in respect or wind, solar PV and BES capex cost assumptions, where significant further technology capex cost reductions are expected over time in the study period from 2024 to 2050.

As a result of all of the above, there is significant confusion, ambiguity and lack of clarity as to exactly what technology cost assumptions have been used by the DMRE in the modelling process of the Draft IRP 2023.

The PCC would hope that the DMRE will take into account the significant work done by Meridian Economics in respect of a comparative analysis of technology costs from a number of respected data sources (such as EPRI, IEA and several others) in determining and publishing a set of clear, unambiguous and consistent technology cost assumptions, including learning curves over the study period of Draft IRP 2023 from 2024 to 2050, and in particular:

6.2.11.1 Overnight capex cost assumptions from 2024 to 2050

The PCC believes the Draft IRP 2023 will be more understandable with a table (or as an appendix) clearly and unambiguously indicating the overnight capex cost assumptions used in the modelling for the period from 2024 to 2050, incorporating also any learning curve cost reductions in this period, for the various technology options, such as:

- Clean coal-fired power
- Diesel-fired OCGT
- Gas-fired OCGT
- Gas-fired CCGT
- Gas engines
- Nuclear PWR
- Nuclear SMR
- Utility-scale hydro
- Small-scale hydro
- Utility-scale solar PV
- Rooftop-scale solar PV
- Utility-scale solar CSP
- Utility-scale wind (and the turbine size on which the overnight CAPEX assumption was based)
- Utility-scale pumped-storage
- Utility-scale BES
- Residential- and commercial-scale BES
- Demand management
- Energy efficiency

6.2.11.2 Fixed and variable opex cost assumptions from 2024 to 2050

The PCC believes the Draft IRP 2023 will be more understandable with a table (or as an appendix) clearly and unambiguously indicating the fixed and variable opex cost assumptions used in the modelling for the period from 2024 to 2050, such as:

- Clean coal-fired power
- Diesel-fired OCGT
- Gas-fired OCGT
- Gas-fired CCGT
- Gas engines
- Nuclear PWR
- Nuclear SMR
- Utility-scale hydro
- Small-scale hydro

- Utility-scale solar PV
- Rooftop-scale solar PV
- Utility-scale solar CSP
- Utility-scale wind
- Utility-scale pumped-storage
- Utility-scale BES
- Residential- and commercial-scale BES
- Demand management
- Energy efficiency

6.2.11.3 Fuel and water cost assumptions from 2024 to 2050

The PCC believes the Draft IRP 2023 will be more understandable with a table (or as an appendix) clearly and unambiguously indicating the fuel and water cost assumptions, including any stochastic or sensitivity analysis inputs, used in the modelling for the period from 2024 to 2050, such as:

- Coal price
- Diesel price
- Imported LNG price
- Domestic natural gas price
- Nuclear fuel price
- Water price

6.3 Assumptions in respect of the cost of externalities

The PCC believes the Draft IRP 2023 will be more understandable with some analysis and a table clearly and unambiguously indicating the cost of externalities and assumptions used (or not used) in the modelling for the period from 2024 to 2050, such as:

- Climate mitigation and adaptation costs
- Health costs associated with the burning of coal
- CBAM costs
- Road repair costs
- Coal decommissioning costs
- Coal cleanup/reclamation costs
- Nuclear decommissioning costs
- Nuclear cleanup/reclamation costs
- Nuclear low- and medium-level waste storage and disposal costs
- Nuclear high-level waste storage and final disposal costs

6.4 EAF and capacity factor assumptions

For the period from 2024 to 2030, three energy availability factor (EAF) trajectories are considered for the existing Eskom generation fleet in the five scenarios modelled in the Draft IRP 2023, namely:

- The low-EAF trajectory used in Scenarios 1 to 4 of the Draft IRP 2023, where the EAF stabilises at around 50% to 52% in the period from 2024 to 2030.
- The high-EAF trajectory where the EAF shows a step-change from 54% in 2023 to 66% in 2024, and then rises steadily to 69% in the period from 2025 to 2030.

- The modified high-EAF trajectory of the Eskom generation recovery plan used in Scenario 5 of the Draft IRP 2023, where the EAF rises from 54% in 2023 to 60% in 2024, then to 67% in 2025, and then rises steadily to 69% in the period from 2026 to 2030.

In Scenario 5 of the Draft IRP 2023, the modified high-EAF trajectory is used to show that if the EAF were to increase along this trajectory, then even with only the existing firm new generation initiatives of Scenario 1, load shedding could be ended in the period from 2024 to 2030.

However, it should be appreciated that the EAF is not one of the practical options that can simply be increased, or one of the levers that can simply be pulled to end load shedding, and that the low-EAF trajectory, as used in Scenarios 1 to 4 of the Draft IRP 2023, is more likely.

Some analysts consider that the EAF trajectory in the period from 2024 to 2030 may even slowly decline still further as the existing generation fleet continues to age and deteriorate, and the shutdown of poorly performing coal-fired plant is delayed.

It is appreciated that planned maintenance is difficult at present under load shedding conditions, thus potentially further increasing the deterioration of the plant performance in the months and years ahead.

Given that assumptions about EAF are critical, more scenarios testing its sensitivity and exploring options of EAF decline would be prudent.

6.5 Comments on the lack of energy efficiency and demand management initiatives shown in the Draft IRP 2030

Energy efficiency and demand management is seen by the PCC as an important option to reduce demand and load shedding, and optimise existing and future generation, transmission and distribution infrastructure and resources in the Horizon 1 period from 2024 to 2023 of the Draft IRP 2023, as well as the Horizon 2 period from 2031 to 2050, at least cost.

The importance of energy efficiency and demand management is reflected in the President's emergency energy plan to end load shedding, published in July 2022, and in the establishment of a dedicated Workstream 5 of NECOM dealing with energy efficiency and demand management.

However, there is no indication of any analysis of the contribution that could come from energy efficiency and demand management in Horizon 1, Table 2 and/or Horizon 2 of the Draft IRP 2023. While energy efficiency representation is inherent in the methodology of the SANEDI demand report posted by DMRE (industrial energy efficiency aside), this is not cited in the Draft IRP 2023. The PCC sees this as a significant omission that needs to be addressed.

6.6 Comments on the delayed shutdown, delayed decommissioning and life-extension schedule for old Eskom coal-fired power plant in the Draft IRP 2023

The Draft IRP 2023 has suggested delayed shutdown, delayed decommissioning and life-extension of Eskom's old coal-fired power plant, in order to reduce load shedding and unserved energy in the in the years from 2024 to 2035 and beyond.

However, it is not clear whether or not the Draft IRP 2023 has used the suggested delayed shutdown, delayed decommissioning and life extension of Eskom's old coal-fired power plant in the modelling of Scenarios 1 to 5 in the Horizon 1 period from 2024 to 2030 and beyond.

The PCC would have liked to see a table within the Draft IRP 2023 (or as an appendix) clearly and unambiguously indicating the delayed shutdown, delayed decommissioning and life-extension schedule for old Eskom coal-fired power plant used in the Draft IRP 2023 modelling for the period from 2024 to 2035.

Furthermore, if the Draft IRP 2023 has used the suggested delayed shutdown, delayed decommissioning and life-extension of Eskom's old coal-fired power plant in the period from 2024 to 2035, it would be important to know the time, costs and socio-economic impacts associated with this, in terms of:

- The direct increased fixed and variable operating and maintenance costs.
- The direct capital costs and downtime required for any life-extension works, including installation of flue-gas desulphurisation plant and other pollution abatement measures.
- The indirect costs associated with potential loss of international preferential loans and grants linked to an accelerated decommissioning of old coal-fired power plant.
- Impact on GHG emissions trajectories.
- The costs of externalities, including additional health-impact costs, CBAM costs and road-repair costs.
- Other socio-economic impacts.

6.7 Comments on iterations, updates and different versions of Table 2 in the Draft IRP 2023

At a PCC Net-Zero Working Group meeting on 31 January 2024, the DMRE indicated the initial Table 2 published in the Draft IRP 2023 on 4 January 2024 was unclear and ambiguous, and had been misinterpreted by a number of stakeholders.

As a result, the DMRE indicated that there had been a number of subsequent iterations, updates and different versions of Table 2, which have not been published in the Draft IRP 2023.

In the Draft IRP 2023, Table 2 is stated as being "the emerging plan from the Horizon 1 analysis". Table 2 will therefore be considered by stakeholders, the media and the public as the most important and visible outcome from the modelling process of Horizon 1 of the Draft IRP 2023, and will be studied most closely, and referred to most often. It is therefore critical that there should be no ambiguity or misunderstanding of Table 2.

6.8 Comments on the absence of electricity price trajectories in the Draft IRP 2023

An important output of the Draft IRP 2023 modelling process should be a set of electricity price trajectories associated with the various scenarios modelled. This is of particular relevance and importance to stakeholders and the general public.

While it is understood and accepted that the electricity price trajectories associated with the various scenarios modelled may not have a direct correlation with NERSA's electricity price determinations, these price trajectories would indicate the relative implications and pressures on the electricity price paths in the years ahead for the different scenarios modelled.

The PCC would therefore have liked to see a set of trend graphs within the Draft IRP 2023 (or as an appendix) indicating the electricity price trajectories associated with the various scenarios modelled in the Draft IRP 2023 for the period from 2024 to 2050.

6.9 Comments on the impact of green hydrogen on the energy and electricity landscape of South Africa

Within the Draft IRP 2023, there is some uncertainty in respect of the impact of green hydrogen and its derivatives as emerging primary energy sources and/or energy carriers within both the wider energy sector of South Africa, and within the country's electricity sector, particularly in the Horizon 2 period from 2031 to 2050.

It is acknowledged that the IRP assumes solar PV and wind energy generation requirements of green hydrogen production facilities will largely be self-contained generation islands for each green hydrogen production facility, and that these will therefore not draw on Eskom and other external power generation facilities, or on the Eskom transmission grid. We would like to test the validity of this assumption with industry experts.

Green hydrogen production facilities incorporating self-contained power islands with wind, solar PV and BES resources, in addition to producing a green hydrogen stream into a hydrogen transmission pipeline that with serve as a hydrogen gas storage facility, could also produce a steady stream of green electricity for delivery into the national transmission grid.

6.10 Comments on the impact electric vehicles (EVs) on the energy and electricity landscape of South Africa

Within the Draft IRP 2023, it is not clear if the impact of electric vehicles as an emerging transportation technology, and as a distributed battery energy storage resource for demand management, within both the wider energy sector of South Africa and within the country's electricity sector, particularly in the Horizon 2 period from 2031 to 2050, has been considered.

It is expected that a significant number of charging facilities will be at individual residential homes and commercial parking facilities, that would draw on power from Eskom, municipal and other external generation sources, via Eskom and municipal networks.

In addition, EVs can provide an important source of distributed battery energy storage for residential self-generation while the EVs are parked at home, and in particular during morning and evening peak periods in order to reduce the impacts of load shedding, and to save on grid electricity supply costs. Such dual functionality (transport and demand management) makes the business case for EVs ever more compelling.

The impact of EVs on the energy and electricity landscape of South Africa should be taken into account in the modelling in Draft IRP 2023, particularly in the Horizon 2 period from 2031 to 2050. While electric transport is extensively incorporated in the methodology of the SANEDI demand report posted by DMRE, this is not cited in the Draft IRP 2023.

There is a synergy with the Integrated Energy Plan (IEP) covering the other energy sectors, primary energy sources and energy carriers in a holistic way. Future IRP planning cycles should consider IEP interactions.

6.11 Comments on technology combination options modelled in Draft IRP 2023 Horizon 1 and 2

6.11.1 Horizon 1: Period from 2024 to 2030

The scenarios modelled and the technology options included in the Horizon 1 period from 2024 to 2030 are incomplete.

6.11.1.1 Scenario 1: Entitled "Firm initiatives"

From Figure 9 in Draft IRP 2023, Scenario 1 of the Horizon 1 period for 2024 to 2030 includes:

- Business: 2842 MW
- RMIPPP: 150 MW
- REIPPP BW5: Wind: 784 MW

This level of VRE penetration seems infeasibly low and not useful as the major input into scenarios 4 and 5.

6.11.1.2 Scenario 2: Entitled "Reference case"

From Figure 9 in Draft IRP 2023, Scenario 2 of the Horizon 1 period from 2024 to 2030 includes:

- Business: 5304 MW
- RMIPPP: 626 MW
- REIPPP BW5: Solar PV: 975 MW
- REIPPP BW5: Wind: 1608 MW
- REIPPP BW6: Solar PV: 1140 MW
- BES BW1, 2, 3 + Eskom: 2080 MW

This would seem to be the minimum case of potential new generation capacity in the period from 2024 to 2030.

For example, Scenario 2 does not show SSEG of 900 MW per year in the period from 2024 to 2030, which totals 7 x 900 MW = 6300 MW of new generation capacity is not listed for Scenario 2 in Figure 9. Yet Table 2, which is stated as the "Emerging plan from the Horizon 1 analysis", does show the 900 MW per year of SSEG from 2024 to 2030.

A rollout constraint of 900 MW per year for SSEG is low relative to other benchmark studies. The annual rollout of SSEG could be increased significantly, even beyond the 2000 MW of rooftop solar PV that was physically installed in South Africa in 2023.

Furthermore, 3470 MW of additional wind capacity in the Western and Eastern Cape should be added to Scenario 2. This additional capacity results from Eskom's curtailment addendum to its latest Generation Connection Capacity Assessment, GCCA 2025, published on Eskom's website and approved by NERSA. We understand the DMRE is investigating this.

6.11.1.3 Scenario 3: Entitled "Firm initiatives + all initiatives"

From Figure 9 in Draft IRP 2023, Scenario 3 of the Horizon 1 period from 2024 to 2030 includes:

- Business: 10436 MW
- RMIPPP: 626 MW
- REIPPP BW5: Solar PV: 975 MW
- REIPPP BW5: Wind: 1608 MW
- REIPPP BW6: Solar PV: 1140 MW
- REIPPP BW7: Solar PV: 2000 MW
- REIPPP BW7: Wind: 3000 MW

As per Scenario 2, Scenario 3 does not show SSEG of 900 MW per year in the period from 2024 to 2030, which totals 7 x 900 MW = 6300 MW of new generation capacity not listed for Scenario 3 in Figure 9, and the same comments apply as for Scenario 2 in this regard.

Furthermore, Scenario 3 does not show the BES of 2080 MW from BES BW1, 2, 3 + Eskom that was included in Scenario 2.

Furthermore, 3470 MW of additional wind capacity in the Western and Eastern Cape should be added to Scenario 3. This additional capacity results from Eskom's curtailment addendum to its latest Generation Connection Capacity Assessment, GCCA 2025, published on Eskom's website and approved by NERSA.

Scenarios with higher variable renewable energy penetration are therefore both realistic and likely and should be considered in the analysis of horizon 1.

6.11.1.4 Scenario 4: Entitled "Firm initiatives plus gas"

From Figure 9 in Draft IRP 2023, Scenario 4 of the Horizon 1 period from 2024 to 2030 includes the same new capacity as per Scenario 1, plus 6220 MW of new gas capacity, as follows:

- Business: 2842 MW
- RMIPPP: 150 MW
- REIPPP BW5: Wind: 784 MW
- Gas to power: 6220 MW

The DMRE modellers have chosen to use Scenario 1 instead of the Reference Scenario 2, or even Scenario 3. As indicated scenario 1 is improbably low in its estimate of VRE penetration. We are uncertain of the analytical purpose of this approach. It would make sense to use a more likely renewable reference case, or at least test the sensitivity of gas penetration to differing levels of variable renewable energy penetration.

It is also noted that the gas-to-power capacity of 6220 MW listed for Scenario 5 includes DMRE gas, Eskom Richards Bay gas, and RMIPPP dispatchable gas (which includes about 1200 MW from three Karpowership IPP projects). As the Karpowership projects no longer have reserved grid access, a scenario should be tested that does not include Karpowership projects.

It is suggested that for Scenario 4 further analysis should be conducted, considering benchmark forecasts of variable renewable energy, to determine what the minimum gas-to-power capacity and the associated load factor would be necessary in order to eliminate unserved energy and load-shedding.

6.11.1.5 Scenario 5: Entitled "Firm initiatives plus EAF recovery"

From Figure 9 in Draft IRP 2023, Scenario 5 of the Horizon 1 period from 2024 to 2030 includes the same new capacity as per Scenario 1, plus an increasing EAF trajectory corresponding to the Eskom generation recovery plan, as follows:

- Business: 2842 MW
- RMIPPP: 150 MW
- REIPPP BW5: Wind: 784 MW
- EAF: Per Eskom generation recovery plan

As per Scenario 4, using Scenario 1 as the input case for variable renewable energy penetration seems implausibly low.

We suggest further analysis that does not constrain variable renewable energy in this way and also allows the deployment of renewable energy, batteries, gas and EAF improvement simultaneously is needed. The practical constraints of realistic buildout rates and maximum EAFs per plant can then be explored as sensitivities. This will provide useful input into determining optimal, policy adjusted pathways till 2030 or 2035.

6.12 Horizon 2: Period from 2024 to 2030

For the Horizon 2 period from 2031 to 2050, the Draft IRP 2023 models and presents five pathways, each with different combinations of technologies as follows:

Pathway 1: Entitled "Least cost"
Wind + Solar PV + BES + Gas OCGT + Gas CCGT

Pathway 2: Entitled "Renewable energy"
Wind + Solar PV + Solar CSP + BES + Pumped storage + Gas OCGT + Gas CCGT

Pathway 3: Entitled "Renewable energy and nuclear"
Wind + Solar PV + BES + Pumped storage + Nuclear + Gas OCGT + Gas CCGT

Pathway 4: Entitled "Delayed coal shutdown"
Delayed shutdown of existing coal + Wind + Solar PV + BES + Gas OCGT+ Gas CCGT

Pathway 5: Entitled "Renewable energy and clean coal"
Clean coal + Wind + Solar PV + BES + Gas OCGT + Gas CCGT

It is difficult to meaningfully analyse, comment on, or interpret the outcomes of the five pathways modelled in the Draft IRP 2023 Horizon 2 period from 2031 to 2050, because:

- There is inadequate transparency and inadequate information provided, particularly in respect of economic assumptions, socio-economic policy/boundary constraints, technology costs, fuel costs, life-extension costs, technology rollout constraints, and costs of externalities used in the modelling process.

- It is unclear how or why different technologies have been constrained in different scenarios. For example, Solar PV rollout seems to have been constrained to 900 MW per year in all pathways modelled, and wind rollout has been constrained in three of the pathways modelled.
- The costs used for solar PV, wind and BES technology costs appear to be higher than all benchmark studies. With significant local data through REIPPP bid windows in South Africa it is not clear why these costs have been used. Furthermore, it appears that the IRP does not take into account ongoing cost reduction learning curves for solar PV, wind and BES.
- The isolation of certain technologies (such as nuclear, clean coal and life extension of coal-fired plant) is interesting to reflect on but electricity systems in reality would not be implemented in that way. Further analysis where these technologies are deployed simultaneously taking advantage of their interactions (as in the least cost scenario) is required.
- Inadequate attention has been given as to how the pathways of Horizon 2 are to comply with the law in respect of minimum emission standards, and with approved government policies requiring net-zero carbon emissions by 2050.

At a more detailed level the PCC would seek confirmation of:

- Whether an energy production cost model was used for Horizon 2, or whether a capacity expansion model was used, or whether there was any feedback and linkage between the energy and capacity models.
- Understand why and how different technology constraints were applied per scenario. It appears that new-build constraints were applied. For example solar PV does not seem to exceed 9000 MW cumulative per decade (900 MW per annum). Additionally, wind capacity looks to be constrained, at least in the decade from 2031 to 2040, where no more than 17.2 GW cumulative was allowed across four of the scenarios.
- The "Least cost" Reference Pathway 1 builds wind, solar, BES and high load factor gas. It is unclear to what extent the modelling constraints are forcing a high load factor of the gas fleet. High load factor gas is not consistent with the outcomes of the Draft IRP 2019 least-cost plan.
- It is not clear what US$ gas fuel price trajectory is being used/assumed and what US$/ZAR exchange rate trajectory is being used/assumed in all the pathways of Horizon 2 in the years from 2031 to 2050, and this assumption would significantly impact the results of all pathways modelled. The sensitivity to price fluctuations of imported commodities like gas is particularly important.
- The "Renewable energy" Pathway 2 builds large amounts of CSP as opposed to the much cheaper combination of solar PV and BES. This is possibly a result of new build limits applied to solar PV of 900 MW per year, in combination with high cost assumptions for solar PV and BES new build, with no learning curve reductions. These differences could be responding to specific energy security constraints applied to the model. It would be useful to understand these in more detail.
- The Draft IRP 2023 states that "Renewable energy" Pathway 2 and the "Renewable energy and nuclear" Pathway 3 "sought to explore the impact on security of supply". While it is interesting to isolate the technologies in this way this is not how you would implement an electricity system in reality. Some modelling that seeks to ensure that the same level of security of supply is achieved across all pathways, allowing a synergistic mix of technologies. This will also provide a more balanced cost estimate of these scenarios. It is clear from other benchmark studies that a mix of variable renewable energy, storage and peaking support is the least cost new generation mix under climate constraints.
- There is no mention of the actual energy storage value (MWh) for the BES of the various pathways. BES reported in MW can be complimented by the MWh storage capacity of the technology.
- For all pathways, it would be helpful to disclosure tables or graphs showing the energy generated per technology. The energy mix cannot be described based on installed capacity alone. Clarity on cumulative installed capacity (including cumulative decommissioning) over the horizon is also needed.

- In the "Delayed coal shutdown" Pathway 4, it would be instructive to know what cost assumptions were assumed in extending the life of the coal stations, including retrofitting of flue gas desulphurisation and other pollution abatement plant.

6.13 Comments on the carbon emissions post 2030 in Draft IRP 2023

Figure 21 in the Draft IRP 2023 (below) indicates the generation output (GWh) of carbon emitting generators in the Horizon 1 period from 2024 to 2030, and the Horizon 2 period from 2031 to 2050.

Alongside this in Figure 21, the corresponding carbon emissions (MtonneCO_2e) is shown in the Horizon 1 period from 2024 to 2030, and the Horizon 2 period from 2031 to 2050. We note that the domestic generation grid emission factor of 1.013 tonneCO2e/MWh is published by the DFFE.

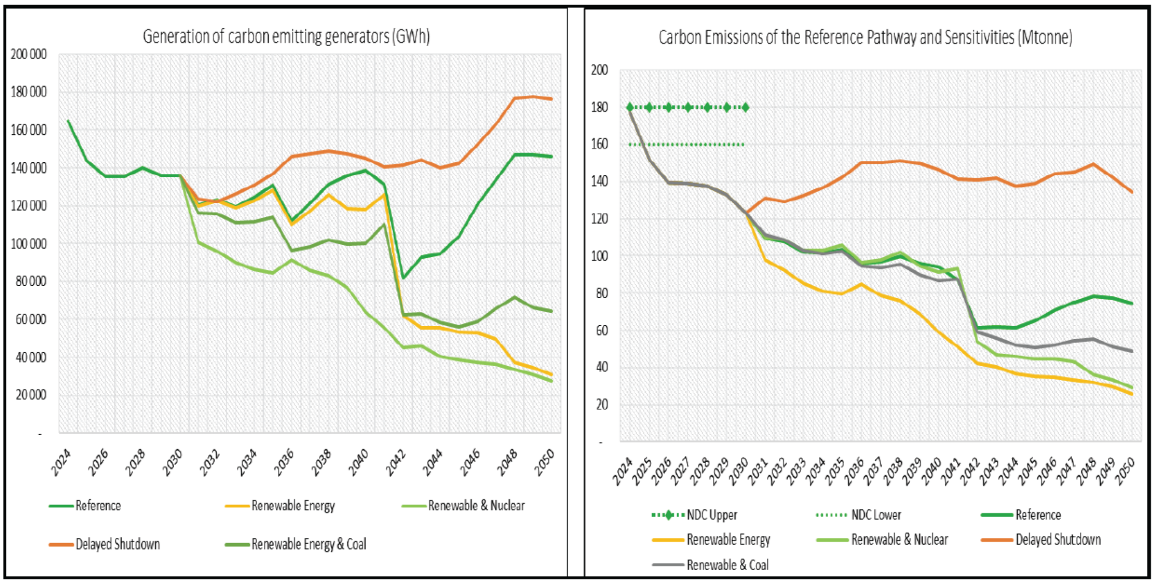

Figure 21: Carbon Emissions Analysis for both Horizons

The PCC has the following queries in this regard:

- The emissions starting point at the end of 2023 is 180 MtonneCO_2e, which is significantly below the emissions of 200 MtonneCO_2e reported for the end of 2022 by Eskom in their annual reports. It is possible that this discrepancy is due to extreme levels of loadshedding in 2023, but the DMRE should provide its emissions reduction calculations in this regard.

- The reduction in CO_2e emissions from 2024 to 2030 is disproportionate to the reduction in energy output. Figure 21 shows a reduction in roughly 23 000 GWh with corresponding reduction of 40 000 MtonneCO_2e. This does not align with emissions factor of 1.013 tonneCO_2e/MWh published by the DFFE, and requires further exploration by the DMRE.

- The range of CO_2e emissions limits for the Horizon 1 period from 2024 to 2030 is indicated in Figure 21 as 160 to 180 MtonneCO2e. This is different to that calculated by the PCC of 140 to 190 MtonneCO_2e (based on an 80% share of reductions). It is important to align on the contribution by the power sector towards meeting the NDC (Nationally Determined Contribution) targets for reduction of CO_2e, and the PCC and the DMRE need to resolve this issue.

- The NDC target range will be extended and reduced over time to include targets beyond 2030 in 5-year periods (in alignment with the Paris Agreement and the COP28 UAE Consensus).

Therefore, prospective NDC commitment levels for 2031 to 2035 should be considered, noting that no official 2035 NDC commitment has been made.

- The PCC notes with that none of the pathways presented by the DMRE for Horizon 2 in the period from 2030 to 2050 in the draft IRP 2023 reach net-zero carbon emissions. Explaining how these emissions will be accounted for and the costs associated is necessary.

6.14 Comments on noncompliance with the minimum emissions standards of South Africa

Air quality regulations under the National Environmental Management Act (NEMA) provide that Eskom's fleet of power stations must meet mandatory minimum emission standards (MES) by a certain date, or they will be considered noncompliant and cannot be legally operated.

Currently, the Eskom coal-fired power station in South Africa does not comply with the minimum emissions standards, despite repeated extensions of the compliance deadlines by the DFFE.

South Africa's minimum emission standards for air quality are in fact amongst the most lenient in the world, far less demanding than those of China, India and virtually every other country. A recent study by the Centre for Research on Energy and Clean Air (CREA) found that SO2 emissions by Eskom's coal-fired power stations in South Africa exceed those of the entire power generation sectors of China and the USA combined.

In considering the health impacts of Eskom's coal-fired generation fleet, another recent report in 2023 by CREA suggests that, based on Eskom's current planned retirement schedule and emission control retrofits, air pollution from the utility's power plants would be responsible for 79 500 air pollution-related deaths from 2025 until their end of life.

The study estimates that requiring the application of the best available pollution abatement technology at all plants, instead of simply meeting the current minimum emissions standards, would avoid economic costs of R1-trillion (US$ 68-billion) by 2030 compared to the Eskom plan.

Other avoided health impacts would include 140 000 asthma emergency room visits, 5 900 new cases of asthma in children, 57 000 preterm births, 35-million days of work absence, and 50 000 years lived with disability.

While the Draft IRP 2023 acknowledges the role of air pollution on human health, it avoids dealing with it, simply stating: "A balance will have to be found between energy security, the adverse health impacts of poor air quality, and the economic cost associated with these plants shutting down."

The PCC is concerned about the impact of MES non-compliance on human health and human rights and the practical threat to electricity planning in that litigation may effect generation. The negative health impacts of air pollution in the power generation sector of South Africa cannot be ignored or deferred indefinitely.

The argument that you need to choose between energy availability and air quality is not valid or appropriate. A pathway that continues with coal must take account of constitutional and legal requirements, and factor in the costs of meeting emissions standards in the modelling of the Draft IRP 2023, otherwise the Final IRP 2023 risks being contested in the courts.

6.15 Comments on alignment of Draft IRP 2023 with other government policy initiatives

Describing the alignment or misalignment of the Draft IRP 2023 with a number of other approved and/or published legislation, regulations, policy positions, initiatives, white papers and reports by Government, the Cabinet and various Government agencies, would provide useful context. This could include:

- The work of the National Planning Commission (NPC)
- South Africa's Just Energy Transition Plan (JETP)
- South Africa's Just Energy Transition Investment Plan (JETIP)
- South Africa's JET IP Implementation Plan
- The National Infrastructure Plan (NIP 2050)
- South African Renewable Energy Masterplan (SAREM)
- The work of the National Energy Crisis Committee (NECOM)
- The 2023 Eskom Medium Term System Adequacy Outlook (MTSAO)
- The Eskom Transmission Development Plan TDP 2023
- The work of the PCC

There is significant misalignment with some of the above that requires careful further analysis, clarification and alignment.

7. Potential IRP requirements

Having concluded the detailed response to the Draft IRP 2023, we reflect on the extent that fundamental requirements, expectations and needs from an IRP for electricity have been met.

These requirements, expectations and needs from an IRP for electricity, that were listed upfront in this report, and are listed again below for ease of reference, to provide an assessment based on the PCC's analysis of the Draft IRP 2023 as follows:

- *Rational, realistic and achievable:* Not adequately met.
- *Conducted using a clear and transparent methodology*: Not met.
- *Indicative and non-prescriptive*. Met.
- *Consultative and inclusive:* Not adequately met.
- *Objective and fact-based:* Not adequately met.
- *Up-to-date and, flexible:* Not met.
- *Aligned with the principles of restorative, redistributive, and procedural justice:* Not adequately met.
- *Aligned with approved government principles, policy initiatives and frameworks:* Not met.
- *Aligned with an overall integrated energy plan (IEP) covering the other primary energy sources and energy carriers in a wholistic way:* Not met.
- *Aligned with international commitments and national policy targets for overall and power generation sector carbon emission reduction pathways to net-zero carbon emissions by 2050:* Not met.
- *Aligned with national mandatory legislation, regulations, environmental constraints and mandatory minimum emission standards:* Not met.
- *Able to be tested, replicated and verified independently:* Not met.