GREENPEACE AFRICA SUBMISSION ON THE DRAFT INTEGRATED RESOURCE PLAN (IRP) 2018 UPDATE

TECHNICAL COMMENTARY ON THE DRAFT INTEGRATED RESOURCE PLAN, 2018

THIS SUBMISSION HAS BEEN PREPARED WITH THE ASSISTANCE OF CULLINAN & ASSOCIATES INCORPORATED.

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1. Executive summary

The Update to the Integrated Resource Plan (IRP) 2010-3030 is intended to revise the preferred generation types identified in the 2011 to take account of changes since that time. Greenpeace Africa welcomes the steps forward that have been taken since the 2016 draft iteration of the IRP, but we believe that this draft IRP does not adequately take constitutional rights, least-cost electricity, international commitments to act on climate change and the latest climate science into account. In short, this plan does not go far enough fast enough to create the urgent just transition towards renewable energy that is required.

South Africa has committed to keep economy wide emissions within upper bound of 618 MT, and that by 2050 economy wide emissions should be between 212 and 428 MT (South African Government, 2010).

The IRP update as currently presented cannot meet these objectives, and needs to be substantially revised if it is to provide adequate planning for South Africa's future energy system. The revision needs also to take latest scientific evidence by the Intergovernmental Panel on Climate Change (IPCC) into account, which requires even greater ambitions on CO_2 emission reductions, and **would require South Africa's coal use to at least halve by 2030**. At an absolute minimum South Africa should be aiming for a reduction of coal in the electricity plan to 19 500 MW by 2030, instead of the 34 000MW as currently outlined in the preferred scenario.

In summary:

- The electricity sector "lower bound" emissions target (90 MT at 2050) should at least be reset as the upper bound, to enable South Africa to meet its economy wide emission targets. The electricity sector is demonstrably the easiest sector to switch to low and zero emission technologies, with cost-effective renewable energy technologies already having proven themselves as a better alternative to both coal and nuclear.

- The latest Intergovernmental Panel on Climate Change (IPCC) Special Report on **1.5°C** charts pathways to limit global warming to **1.5°C**, and this report makes it clear that all countries, including South Africa, need to significantly increase their CO_2 reduction ambitions to avoid irreversible and catastrophic climate change. At a minimum, South Africa should be aiming to halve our coal capacity already by 2030, and should be aiming for zero emissions as soon as possible. This means there is no space to increase greenhouse gases any further. Currently the World is in a track to global warming of far more than 3°C which would correlate with up to 6°C in South Africa as one of the most impacted countries. The IRP2018 must be aligned with the latest climate science, and it is irrational to lock South Africa into a pathway that will lead to catastrophic and irreversible climate change.

- The IRP aims to identify the lowest cost options for South Africa's electricity supply. Artificial technology constraints – in particular, the upper limit on renewable energy technologies (wind and solar) - must be removed in the preferred scenario. Unless these constraints are removed the IRP cannot present a cost optimised solution, and has significant implications for the rollout of renewable energy.

- Scenarios should be designed to allow easy comparison of lowest cost generation to meet emissions obligations. The scenarios should not restrict technologies, other than to meet technical requirements on emissions and reliability.

- All scenarios should have clear outputs (cumulative technology and fuel costs, carbon emissions, consumer electricity costs, water use, pollutant emissions, job creation, energy intensity of the economy), and should enable SA to meet emissions reduction commitments.

No scenario should result in a blatant disregard of emission mitigation/climate change, to do so is completely reckless.

- Artificial constraints on renewable energy must be removed in all scenarios, since they are applied without adequate explanation.

- The consideration of demand side management (DSM) in the IRP lacks transparency, and appears to fall far short of the potential role for DSM. There is substantial additional cost-effective potential for residential DSM measures such as refrigeration, heating/cooling and appliances, and an even larger DSM potential in the commercial and industrial sectors. The IRP should identify how energy efficiency and other DSM are included within the plan; clearly benchmark energy efficiency and DSM performance against international best practice; and tie energy efficiency and DSM targets to projected peak (MW) and energy (TWh) requirements.

- Input data on costs and cost assumptions and learning rates must be transparent and open to scrutiny.

- The IRP has to incorporate Eskom's inability to meet current Minimum Emission Standards, which means that coal-fired power stations that cannot comply should be decomissioned much earlier than the standard timeline that Eskom currently uses. The IRP must take this into account. A groundbreaking analysis of satellite data reveals that Mpumalanga is the world's largest NO2 pollution hotspot in the world, confirming that South Africa has the most polluting cluster of coal-fired power stations in the world. The satellite data also reveals that the pollution is blown across into Pretoria and Johannesburg from Mpumalanga, impacting on the 8 million people who live in these urban areas.

Finally, we would like to unequivocally make the point that in the interests of policy certainty, and to not make a mockery of yet another public participation process related to an as yet unfinalized IRP (both the draft update in 2013 and 2016 remaining unfinalized, leaving us with a clearly out-of-date IRP2010 as the basis for decision-making), it is imperative that the IRP is finalised in 2018. We call on the Department of Energy to fulfil this obligation without delay.

2. Introduction

Greenpeace Africa is an independent environmental campaigning organisation with a vision of '**an Africa where people live in harmony with nature in a peaceful state of environmental and social justice**'. Our mission is to work with others to foster environmental consciousness where Africa's people can seek social and economic prosperity in ways that protect the environment for the benefit of humans, the planet and the future. In developing our campaign strategies we take great care to reflect our fundamental respect for democratic principles, while seeking out solutions that will promote social and environmental justice.

In South Africa, we campaign for an urgent but just transition away from coal and nuclear power, towards renewable energy and energy efficiency. We do not accept any money from governments or corporations in order to maintain our independence, which means that we work in the public interest; with environmental and social justice at the core of our work.

As a civil society organisation, and citizens, we work towards the achievement of environmental and social rights, combined with environmental and energy justice in our communities across South Africa. We strive for the realisation of the constitutional environmental right to a healthy environment. We believe that climate change is an existential crisis, which acts as a threat multiplier and that urgent action is required to avoid catastrophic climate change.

South Africa is the biggest emitter on the continent and the 14th largest emitter in the world. Nonetheless, we are in a position to lead the way to a clean energy future, but only if the Department of Energy and NERSA acts swiftly to remove the barriers to renewable energy and substantially reduce our reliance on coal. With new leadership in place, South Africa has the opportunity to become a credible climate leader by creating a powerful combination of strong leadership, progressive thinking and forward-looking policies. The IRP2018 is one of the first significant tests of leadership.

We welcome the opportunity to submit written comments on the draft IRP2018. We would however, like to unequivocally make the point that in the interests of policy certainty, and to not make a mockery of yet another public participation process related to an as yet unfinalized IRP (both the draft update in 2013 and 2016 remained unfinalized after cabinet failed to adopt them, leaving us with a clearly out-of-date IRP2010 as the basis for decision-making), it is imperative that the IRP is finalised and adopted by cabinet in 2018. We call on the Department of Energy to fulfil this obligation without delay.

3. Key principles for the IRP

We, along with a multitude of other civil society organisations, submit that the final IRP **must** contain, and be based on, **at least** the following principles in order to be a reasonable and lawful plan that is aligned with the Constitution of the Republic of South Africa:

1. It must be **based on only the latest, accurate and objective data for the modelling assumptions.** Furthermore, it must verify and reference all sources of information, findings and conclusions; including those regarding GDP forecasts; energy-intensity; learning rates; job creation and costs of different technology options.

2. It must **operate within a strict, ambitious carbon budget,** aligning with the latest scientific consensus on climate change, which clearly indicate keeping global temperature rise to below 1.5 degrees Celsius is critical to avoid catastrophic climate change.

3. The Reference Case should be **the least cost combination of technologies** to achieve South Africa's electricity requirements. When other scenarios are run, any deviation from the least cost should be made public and fully explained, so that policy-makers and the public are able to make a value-for- money assessment of the deviation.

4. It must take **full account of the external costs** of the different technologies, ensuring that all external costs to human health, the environment, and the climate are factored into cost calculations in respect of different technology options.

5. Given the uncertainties in energy planning around disruptive technologies, effects of climate change, trajectory of the economic and demand for utility scale electricity; it must be based on **flexible planning and adaptive management**, while meeting long term social, economic and environmental objectives.

6. Given that SA is a semi-arid country and our water resources are already over-subscribed, a situation which will be exacerbated by climate change, any national planning decisions regarding energy need to be **based on the lowest possible impacts on water resources**, both in terms of quantity and quality.

Key components of the IRP:

Based on research and analysis aligning with the principles listed above, while also addressing socio-economic and environmental concerns, we assert that **the IRP must**:

1. Provide an **urgent shift from fossil fuels to renewable energy** by having:
    a. **no new coal capacity;**
    b. **increased rate of decommissioning of coal power stations;**
    c. **no limits on renewable energy expansion;**
    d. **renewable capacity to be added each year to stimulate local sector**

2. Provide for **least cost, flexible generation** options by having:
    a. **no new nuclear capacity**

4. Address the concerns of workers by:
    a. aligning with a **Just Energy Transition plan**; and
    b. factoring in net job creation within the electricity sector.

5. **Align with other policies and legislation** on climate change, electricity, energy and the Constitution.

6. Be **updated every two years** and thoroughly evaluate the role of additional technologies or interventions such as gas, storage, energy efficiency, demand-side management, co- and embedded generation and alternative ownership models in the electricity sector.

4. Climate Change

The scientific consensus is clear that climate change is an existential threat, and the Paris Agreement (to which South Africa is a signatory) makes it clear that urgent and sustained action on a global scale is needed to avoid catastrophic climate change, and to ensure that future generations have a liveable planet. While Greenpeace Africa would like to acknowledge that the IRP 2018 has made significant progress in reducing the level of coal in the IRP up until 2030, we believe that there is absolutely no rational reason to include any new coal in the updated IRP 2018, nor is there any rational reason to consider new coal investments in 2030. Both of these put South Africans at severe risk.

The President himself has gone on record to the media on the fact that we are already living with the reality of climate change in January this year stating that:

"If people around the world ever thought climate change is just a fable, we in SA are now seeing the real effects of climate change. We are facing a real, total disaster in Cape Town, which is going to affect more than 4-million people"[1]

We can no longer afford to delay acting on climate change – we are already living with the impacts of climate change, and these are likely to worsen significantly. As one of the most impacted countries by climate change, South Africans must have a pronounced interest in limiting global temperature rise to 1.5°C. For the country it is a question of survival as **global warming will hit the country double as hard as the average**. A global average temperature increase of 2°C translates to up to 4°C for South Africa by the end of the century (South African Government, 2015[2]).

Along with other developing countries, South Africa is especially vulnerable to the impacts of climate change, particularly in terms of water and food security, as well as impacts on health, human settlements, and infrastructure and ecosystem services. South Africa recently faced one of the most serious droughts and water crises in its history at the beginning of 2018 as the city of Cape Town approached "Day Zero". The government declared the water crisis a national disaster from February to June 2018. Research released this year[3] indicates that **climate change tripled the likelihood of the drought that pushed Cape Town to the brink of Day Zero** earlier this year. Studies cited by the researchers say the Western Cape drought was the worst almost since the beginning of the 20th century.

The IRP2018 *must* be aligned with the latest climate science, and this means aligning it with the Intergovernmental Panel on Climate Change (IPCC) Special Report on 1.5°C[4], which was released on October 8th 2018. The report outlines how – if the world continues to warm at the current rate – there may be catastrophic and irreversible impacts on water scarcity and global food production. It also clearly outlines that the next 12 years are critical to take much more ambitious action in order to meet this goal. This means that in order to be aligned with the latest climate science, the IRP2018 cannot view the next 12 years as Business As Usual, but would have to plan for much more ambitious action on climate change.

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[1] https://www.businesslive.co.za/bd/national/2018-01-26-ramaphosa-speaks-of-the-real-effects-of-climate-change-in-davos/

[2] http://www4.unfccc.int/ndcregistry/PublishedDocuments/South%20Africa%20First/South%20Africa.pdf

[3] https://reliefweb.int/report/south-africa/climate-change-tripled-likelihood-drought-pushed-cape-town-water-crisis-day-zero

[4] http://www.ipcc.ch/news_and_events/pr_181008_P48_spm.shtml

The IPCC assessed 90 different 1.5°C-compatible pathways that were submitted into their database. And based on all of those, the IPCC drew some key summary conclusions. The Low Energy Demand scenario (LED, Grubler et al 2018) is one of four scenarios that are highlighted as pathway archetypes. The scenario shows how to meet the 1.5°C target, without speculative and dangerous negative emission technologies (geoengineering).

Key Results:

- The world needs to **halve global emissions by 2030** and to **reach global net zero CO_2 emissions at the latest by 2050.**
- At the moment with current targets (NDCs) we are globally on a track to **double** emissions by 2030.
- The following reductions in global primary energy use are needed until 2030:
  Oil use: -50%
  Coal use: -67%
  Gas use: -33%

This has now become the *moment of truth* when the question of whether we limit warming to 1.5°C has become a political choice. The road ahead will be challenging, but eventually easier than the one we're currently on. *We can still achieve the Paris goals through transformational change and immediate action,* but it is imperative that we do not delay acting on climate change, and instead increase our ambition.

Climate change has very real implications for South Africa in both the short and long-term, including the following:

Increased droughts

The Department of Environmental Affairs has said the following about the likelihood of increased droughts*:* "Direct impacts such as reduced income and labour productivity (due to heat) in rural communities as a result of negative climate change impacts on agricultural output can be expected. Without adaptation, increased heat is expected to decrease plant yields in addition to negatively affecting livestock. For example, with a 2°C increase in temperature and a 10% reduction in rainfall, the maize yield for South Africa is expected to reduce by 0.5 t/h (DEA, 2013). The knock-on effects will put an additional strain to provide services and promote social and economic development for local government."[5]

"In Ethiopia, rainfall was reduced 16% in the 2015-2016 period and in the same period rainfalls reduced 24% in South Africa, according to a 2016 study by the American Meteorological Society."

Increase in diseases

"Along with threats to food and water resources, climate change also provides a suitable environment for the spread of malaria. In South Africa, the number of malaria cases has risen by nearly 3,000 from 2016, with 9,478 reported cases in 2017, according to a report from the National Centre for Communicable Diseases."

[5] https://www.environment.gov.za/sites/default/files/docs/ltasphase2report1_adaptation_sadc.pdf

Economic Damage

"The World Bank also estimated that the impacts of climate change could further cripple Africa's economy. If temperatures rise even 2°C, the continent's per capita consumption would decrease by 4-5%."[6]

The effect of warming waters on fisheries

"The fisheries sector in South Africa is worth around six to seven billion rands per annum and directly employs, in the commercial sector, some 27 000 people. Many thousands more people depend on fisheries resources for food and as a source of income to meet basic needs" (Department of Agriculture, Forestry, and Fisheries). Warming waters are expected to harm highly temperature sensitive fish populations and their coral reef habitats.[7]

Implications for the IRP2018

Limiting warming to 1.5°C would require much higher ambition to reduce greenhouse gases (GHG) by South Africa and other countries.[8] Globally we need to meet net zero CO_2 emissions at the latest by 2050 and have to - at an absolute minimum - halve coal use by 2030 (LED scenario). The existing National Determined Contributions (NDC) by South Africa clearly overshoots here (along with most other countries). Current global targets (NDCs) lead to double the current level of emissions by 2030. This also means that the latest draft of the IRP2018 needs to be revised and must aim for significantly higher CO_2 emissions reductions and a faster coal phase-out in a just transition. In fact, it is likely that South Africa will be pushed to the bottom of the PPD (a median PPD is no longer reasonable), and there is a need for faster decarbonisation of the grid than is envisaged in the policy adjusted scenario. We believe this to be a significant flaw in the IRP2018.

In reality, this means that we need to be aiming for zero emissions as soon as possible (and absolutely no later than 2050) and that instead of a reduction to 34 000 MW of coal by 2030 (as currently proposed by the IRP2018 draft), at an absolute minimum South Africa should be aiming for a reduction of coal in the electricity plan to 19 500 MW by 2030. This is a significant shift and will not come without removing new coal from the IRP2018 entirely (including units 5 and 6 of Kusile), and speeding up the decommissioning of Eskom's ancient and highly polluting coal-fleet.

It is not too late to act decisively to avoid the worst impacts of climate change, but that will require that the silos between government departments must be removed (acting on climate change is as much the Department of Energy's responsibility as it is the Departments of Environmental Affairs'), and the interlinkages between the country's electricity plan and our ability to live on an inhabitable planet in the future are inextricably linked.

South Africa needs to increase its ambition to reduce CO_2 emissions significantly and to radically shift away from fossil fuels like coal. By 2050 the whole electricity supply has to be decarbonized/based on renewable energy. The earlier we start, the easier it will become in the future, and instead of being punitive, action on climate change can be a real opportunity to transform our economy.

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[6] https://www.diplomaticourier.com/8348/

[7] http://www.nda.agric.za/doaDev/sideMenu/fisheries/03_areasofwork/Resources%20Research/STATUS%20OF%20THE%20SOUTH%20AFRICAN%20MARINE%20FISHERY%20RESOURCES%202014%20WEB.pdf

[8] South Africa has committed to keep economy wide emissions within the upper bound of 618 MT, and that by 2050 economy wide emissions should be between 212 and 428 MT (South African Government, 2010 reference to actual commitment), with the aim is to get to the lower bound of 212 MT. This still means that the country's emissions increase until 2025, remain on that level until 2030 and start to decrease afterwards. Corresponding targets for the electricity sector are set at the upper bound of 260 MT, with the 2050 limits at 90-180 MT (Department of Energy, 2016).

The 2011 Climate Change Response White Paper aims to 'effectively manage inevitable climate change impacts' and confirms that the majority of South Africa's energy emissions come from electricity generation[9]. According to the White Paper:

"***The main opportunities for mitigation consist of energy efficiency, demand management and moving to a less emissions-intensive energy mix…Policy decisions on new infrastructure investments must consider climate change impacts to avoid the lock-in of emissions-intensive technologies into the future***". (emphasis added)

Greenpeace Africa does not believe that the draft IRP2018 adequately considers climate change impacts, and the draft does not consider the IPCC Special Report on 1.5°C, which is a fatal flaw, since it will therefore not manage to avoid the lock-in of emissions-intensive technologies into the future. A key example here are the final two units of Kusile (which should not be completed), and the 1000MW of new coal in the draft IRP2018, which will end up being stranded assets and should be removed from the final IRP. As it is, both Medupi and Kusile will become mega stranded assets in the future, due to the need to move to a completely decarbonised economy by 2050.

5. Greenhouse gas emissions limits

South Africa has committed to keep economy wide emissions within the upper bound of 618 MT, and that by 2050 economy wide emissions should be between 212 and 428 MT (South African Government, 2010). The aim being to get to the lower bound of 212 MT. This still means that the country's emissions increase until 2025, remain on that level until 2030 and start to decrease afterwards. Corresponding targets for the electricity sector are set at the upper bound of 260 MT, with the 2050 limits at 90-180 MT (Department of Energy, 2016). When compared with the latest IPCC report, it is clear that these commitments are completely inadequate. While it may not be the remit of the IRP2018 to set new emission reduction commitments, it is imperative that the IRP2018 takes the latest climate science into account, and recognises where investments in the electricity sector will clearly cause us to overshoot our current commitments, and also not act adequately to avoid more than 1.5°C warming.

Greenpeace believes that the minimum requirement would be that the upper bound for the electricity sector needs to be set at 90 MT for 2050 so as to be compliant with South Africa's current economy wide obligations. In essence however, South Africa must reach zero emissions by 2050. There are straightforward, cost-effective options to reduce electricity sector emissions to near zero, and without a greater contribution from this sector it is unlikely South Africa will be able to meet its economy wide obligations.

The IRP cannot be based on any scenario that will not reduce South Africa's greenhouse gas (GHG) emissions sufficiently and progressively to the extent that it can ratchet up its ambition in terms of climate change commitments. One of the consequences of the failure to take account of the best available information is that the IRP fails to favour supply sources and scenarios which promote sustainable development, and which will most optimally achieve security of supply, affordability, job creation, localisation, mitigation of environmental impacts, diversification, improved access, improved efficiency, and the protection of human health and safety.

A recent study by the Energy Research Centre[10] clearly indicates that Thabametsi and Khanyisa - which Greenpeace assumes to be the 1000MW of new coal included in the draft IRP2018 – are **no longer needed, and would cost South Africa nearly R20 billion more than is necessary, while**

[9] Produced by the Department of Environmental Affairs and available at https://www.environment.gov.za/sites/default/files/legislations/national_climatechange_response_whitepaper.pdf.
[10] http://www.ee.co.za/wp-content/uploads/2018/05/ERC-Coal-IPP-Study-Report-Finalv2-290518.pdf

pushing out renewable energy, and making electricity more expensive. According to the study, the reason that the two projects are no longer needed is due to declining electricity demand and surplus supply.

A key finding of this study is that neither new coal nor new nuclear is required to meet demand at lowest cost. Therefore, a least-cost electricity build plan for South Africa does not include new coal plants. Greenpeace Africa therefore believes that this new coal has been irrationally 'forced' into the IRP preferred scenario. In essence, the Energy Research Centre found that:

"the inclusion of the coal IPPs in South Africa's electricity build plan raises the total system costs compared to a scenario without the coal IPPs"[11]

The coal plants are neither cheap nor clean compared to other options like wind and solar. The argument given for including this new coal in the draft IRP2018 is that these projects are 'already procured', but Greenpeace Africa would like to point out that construction of the two power stations has not yet begun, and both coal-fired power stations still have to attain various licences to operate, and face numerous challenges in court. It is therefore irrational for the draft IRP2018 to include these coal-fired power stations, just like it is irrational for the draft IRP2018 to include units 5 and 6 of Kusile, which although classified as 'committed' in the draft IRP2018, are not classified as 'commissioned'[12], and for which it is clear that Eskom does not have the money to complete[13].

If the Department of Energy were to publish the rational least-cost plan that civil society organisations have been demanding, it would not include new coal. It is important here to point out that Medupi and Kusile alone mean that there is already 6.4 GW of new coal in the pipeline.

Allowing the new coal plants to go ahead and continuing with the construction of units 5 and 6 of Kusile would be disastrous for water resources, air quality, health, land and the climate. Including new coal in the IRP is irresponsible, and puts future generations at risk. Indeed, not only should the IRP remove the 1000MW of new coal, but it should also remove Kusile units 5 and 6, which will become stranded assets that the South African public must pay for in a carbon constrained world. Kusile alone increases South Africa's contribution to climate change by nearly 10%[14].

As pointed out by Meridian Economics:

"Our results show that decommissioning the older coal plant or abandoning the construction of Kusile units 5 and 6 are likely to be the most economic way forward for Eskom[15]*…decommissioning (of three power stations) in the GrHeKo scenario and avoiding the completion of Kusile units 5 and 6 could give rise to a financial saving in the region of R15 – 17bn without affecting security of supply."*

A recent projection by the International Energy Agency (IEA) and International Renewable Energy Agency (IRENA) of a global trajectory to meet the 2^0C target showed the electricity sector making the greatest contribution to reducing reference case emissions both in absolute terms (22 GT globally compared to total reduction of 38 GT), and the greatest sectoral contribution, of an 85% reduction compared to the reference case, despite that fact that electricity generation nearly doubles (IEA and

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[11] Page 8
[12] http://www.energy.gov.za/IRP/irp-update-draft-report2018/IRP-Update-2018-Draft-for-Comments.pdf page 26
[13] https://www.fin24.com/Economy/Eskom/no-silver-bullet-for-eskom-but-radical-pursuit-of-renewables-is-a-no-brainer-20180920
[14] https://www.banktrack.org/download/kusile_power_project_factsheet/kusile_power_project_factsheet.pdf
[15] http://meridianeconomics.co.za/wp-content/uploads/2017/11/CoalGen-Report_FinalDoc_ForUpload-1.pdf

IRENA, 2017). This demonstrates the capacity to make deep emission cuts in electricity generation compared to other sectors.

In terms of the IRP2018 Greenpeace strongly believes there should be a model that looks at the advanced decline input and not just the moderate decline, and that if the serious aim is to decarbonise the electricity sector we should be declining to almost zero emissions for electricity by 2050. None of the current scenarios fulfil the IRP objective of total decarbonisation, and leave very little room for decarbonisation in other sectors.

6. Air pollution

Mpumalanga is the world's largest NO2 pollution hotspot

Air pollution is a global health crisis, with up to 95% of the world's population breathing unsafe air[16]. A ground-breaking analysis of satellite data from 1 June to 31 August this year [to be formally released on the 29th of October 2018][17] reveals the world's largest NO2 air pollution hotspots across six continents in the most detail to date. Greenpeace analysis of the data points to coal and transport as the two principle sources of air pollution, **with Mpumalanga in South Africa topping the chart as the world's largest NO2 hotspot across six continents. This confirms that South Africa has the most polluting cluster of coal-fired power stations in the world.** Mpumalanga is home to a cluster of twelve coal fired power plants with a total capacity of over 32 gigawatts owned and operated by Eskom. South Africa is a significant global hotspot with its high concentration of coal-fired power stations and its weak air pollution standards. Nitrogen Dioxide (NO2) is a dangerous pollutant in and of itself and also contributes to the formation of PM2.5 and ozone, two of the most dangerous forms of air pollution.

Globally, the main sources of NO2 pollution are coal-fired power plants, followed by manufacturing/construction and transportation. NO2 is a severe respiratory irritant that inflames the lining of the lungs, which reduces the body's immunity to lung infections. Immediate effects can include coughing, wheezing, flu, and bronchitis. Longer-term effects can include the exacerbation of conditions like asthma and increasing rates of heart disease and lung cancer [18][19][20].

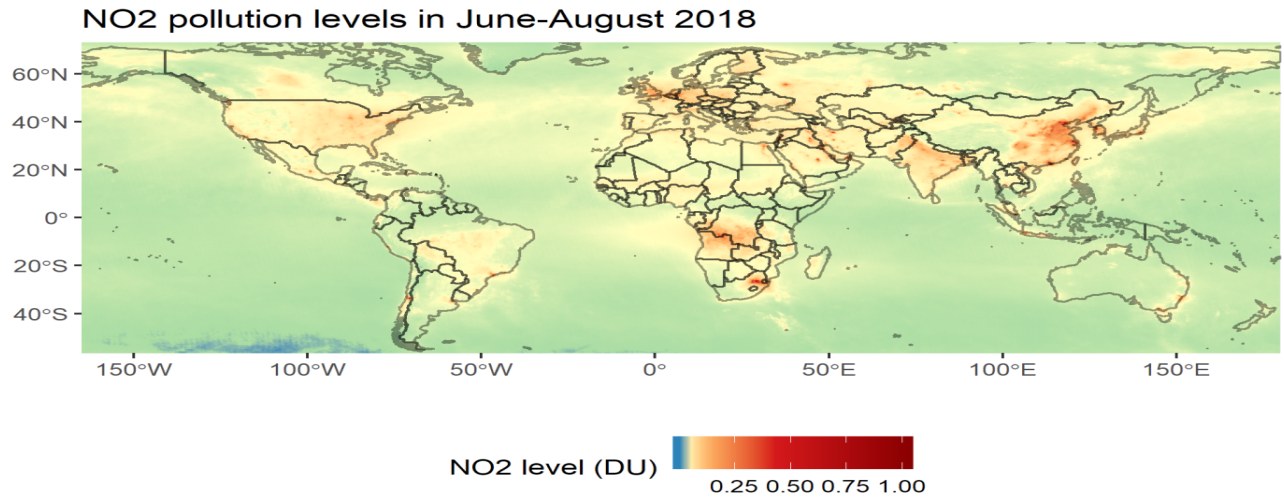
[16] https://www.stateofglobalair.org

[17] The analysis is based on new, publicly available data produced by the European Space Agency's Sentinel 5P satellite between 1 June and 31 August 2018. The TROPOMI instrument onboard the European Space Agency Sentinel 5P satellite has been providing data on NO2 levels in the atmosphere with unprecedented detail and accuracy since June 1, 2018. Greenpeace has analysed the data and has released a global map of the worst NO2 emissions sources around the world. Greenpeace is the first organisation to process the data into averaged NO2 levels on a gridded map. The EDGAR global emissions inventory was overlaid with the satellite data to indicate the probable major sources of NO2 emissions in each hotspot.

[18] http://apps.who.int/iris/bitstream/handle/10665/69477/WHO_SDE_PHE_OEH_06.02_eng.pdf;jsessionid=86895294AB11CA84FD49D037F66025DC?sequence=1

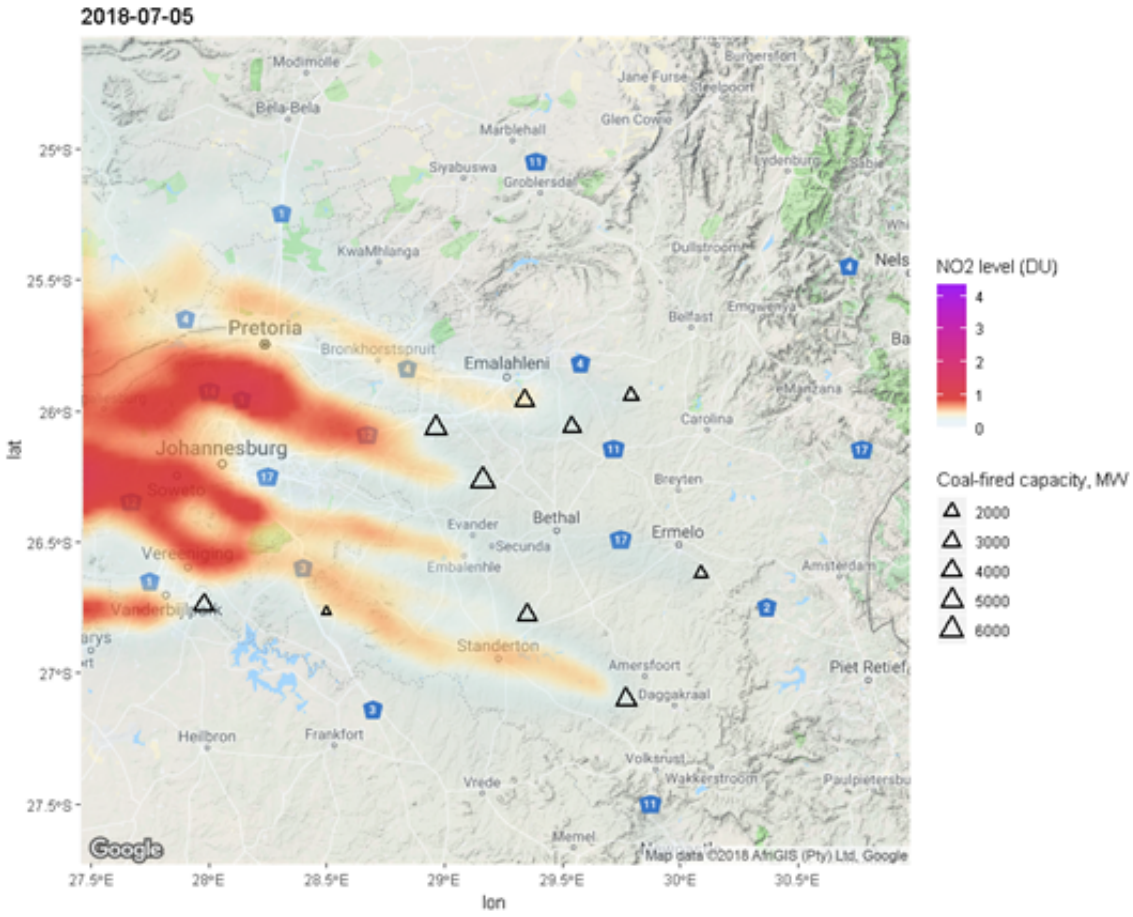
[19] https://www.umweltbundesamt.de/en/press/pressinformation/nitrogen-dioxide-has-serious-impact-on-health

[20] https://cer.org.za/wp-content/uploads/2017/04/Annexure-Health-impacts-of-coal-fired-generation-in-South-Africa-310317.pdf



The satellite data further reveals that the cities of Johannesburg and Pretoria are also highly affected by extreme NO2 pollution levels which blow across from Mpumalanga and into both cities due to close proximity and regular eastwinds. The average wind directions over Johannesburg and Pretoria in the last 30 years on Meteoblue show that for about 28% of the year, the wind is blowing over Johannesburg from either ENE, E, ESE, SE, SSE, and S which are all directions where the winds would be blowing pollution from coal-fired power plants into the cities[21]. This means that plumes of dangerous NO2 pollution regularly cover these cities and their 8 million people.

[21] https://www.meteoblue.com/en/weather/forecast/modelclimate/johannesburg_south-africa_993800



Power plant pollution plumes detected by Sentinel 5P on Jul 5, 2018, transported by winds from Eskom's coal-fired power plants in South Africa to Johannesburg and Pretoria.

A 2016 report by the World Bank estimates that roughly 20,000 South Africans die from air pollution related causes every year. A different study by the International Growth Center at the University of Cape Town estimated an even higher cost of 27,000 deaths and over 300 billion rand (6% of the country's GDP), using the United States Environmental Protection Agency's Environmental Benefits Mapping and Analysis Program (BenMAP)[22]. The Johannesburg-Pretoria metro area suffers the highest losses of life, followed by other densely populated areas such as Cape Town and Durban.

A 2016 report by British-based air quality and health expert Dr Mike Holland found that air pollution from Eskom coal-fired power stations kills more than 2 200 South Africans every year, and causes serious illnesses including bronchitis and asthma. This costs the country more than R33-billion annually in hospital admissions and lost working days. Using the data from Lauri Myllyvirta's health study, Dr Holland assessed the health impacts and associated economic costs of current emissions of just one type of pollutant from Eskom's coal-fired power stations (PM2.5) in 2016. In his report, entitled "Health impacts of coal fired power plants in South Africa"[23], he estimates that the following impacts are attributable to these emissions:

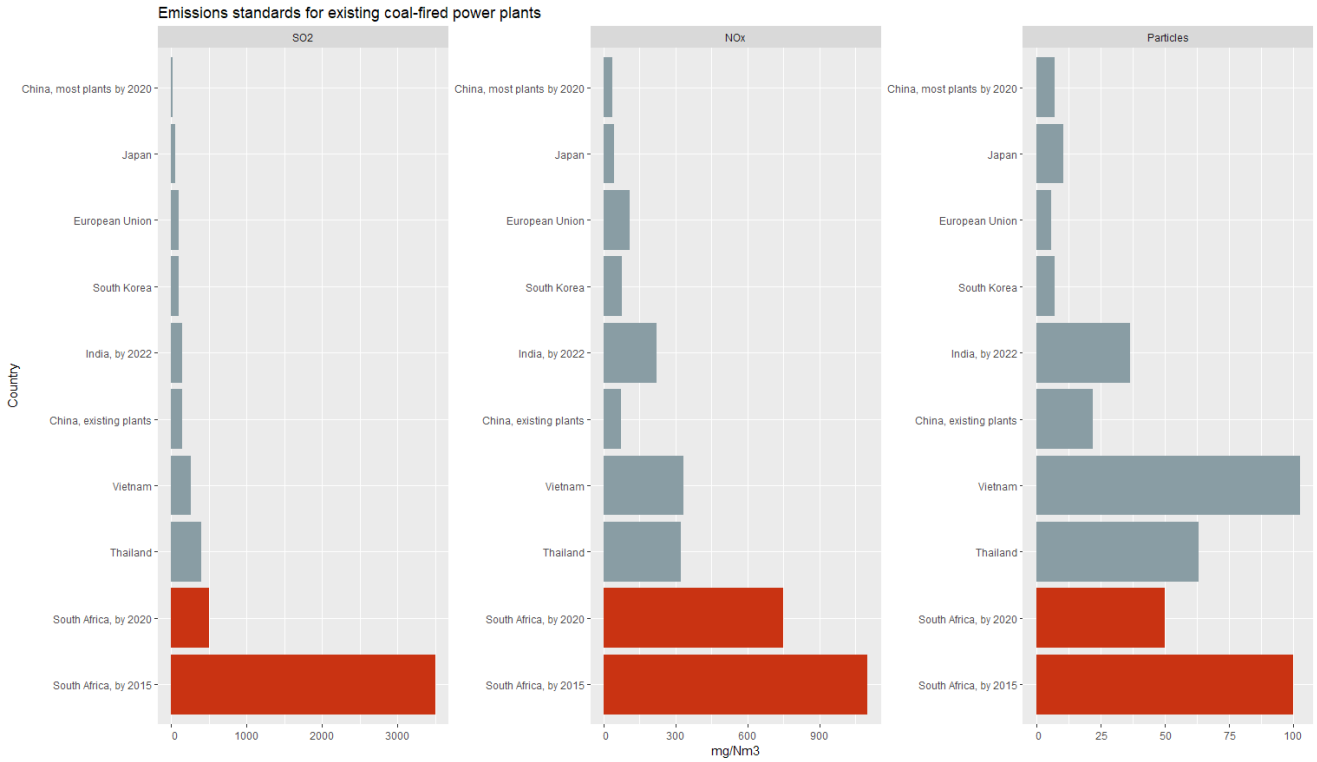
[22] https://www.theigc.org/blog/the-cost-of-air-pollution-in-south-africa/

[23] https://cer.org.za/wp-content/uploads/2017/04/Annexure-Health-impacts-of-coal-fired-generation-in-South-Africa-310317.pdf

- 2 239 deaths per year: 157 from lung cancer; 1 110 from ischaemic heart disease; 73 from chronic obstructive pulmonary disease; 719 from strokes; and 180 from lower respiratory infection;
- 2 781 cases of chronic bronchitis per year in adults;
- 9 533 cases of bronchitis per year in children aged 6 to 12; and
- 2 379 hospital admissions per year.

The majority of Eskom coal-fired power stations do not comply with weak air pollution legislation

Compared with many other countries South Africa has relatively weak Minimum Emission Standards (MES), that allow coal-fired power stations to emit up to 10 times more NO2 than allowed in China or Japan. Nonetheless, the majority of Eskom's ancient and highly polluting coal-fired power stations do not comply with these MES. In 2015 Eskom was granted a five year postponement from complying with MES. This decision was taken although postponements can only be made if "ambient air quality standards in the area are in compliance, and will remain in compliance even if the postponement is granted". But the Highveld region (covering Mpumalanga) has been declared a High Priority Area by the Department of Environmental Affairs, because it is not in compliance with the National Ambient Air Quality Standards (NAAQS).



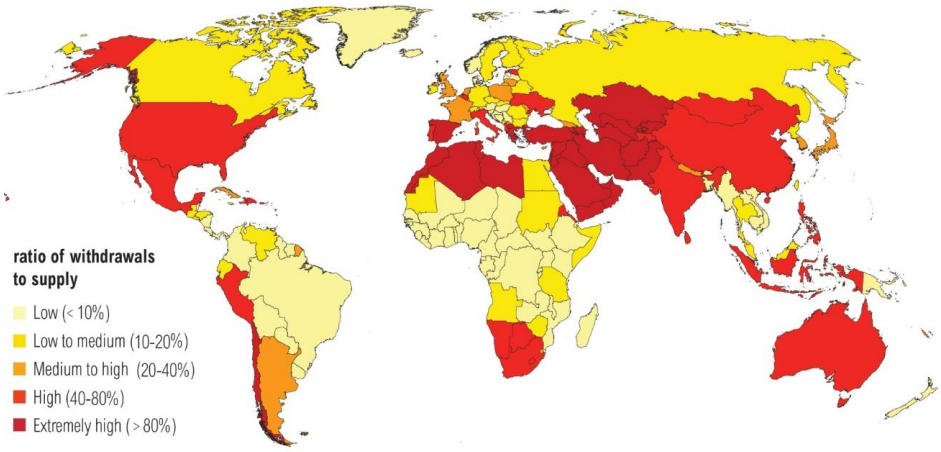
In 2018 Eskom is again applying for postponements from complying with the MES for nitrogen oxides (NO_x - which includes NO2) for 16 of its 19 power plants (including 14 coal-fired power plants and 2 liquid fuel power plants) for the MES. Greenpeace believes that this postponement application indicates that Eskom does not intend to comply with the MES for almost its entire coal fleet, and if this is the case, then the existing coal-fired power stations must be decommissioned on an accelerated schedule.

Greenpeace believes that the draft IRP2018's modelling approach that includes standard (50-year lifespan) decommissioning rates and an assumption that Eskom will comply with the MES is inaccurate, and instead Eskom's current levels of pollution should be modelled, with the assumption that 16 of its power plants will not comply with the MES, and will need to be decommissioned earlier than anticipated in Eskom's current decommissioning schedule. Indeed, the IRP2018 should model a decrease of at least 50% in South Africa's coal fleet by 2030, in line with the latest IPCC Special Report on 1.5°C.

Greenpeace is strongly opposed to Eskom's postponement application, and believes that this satellite data provides even more evidence that air pollution is a crisis in South Africa, and Eskom's coal-fired power stations must either comply with air quality legislation or be decommissioned faster than anticipated. This map clearly indicates that the air pollution levels in Mpumalanga and the Highveld coal cluster are the highest in the world and require urgent attention, and that the pollution also affects those living in both Pretoria and Johannesburg. It is critical that the South African government take urgent steps to avoid the substantial health impacts of coal, and the IRP2018 cannot allow the status quo to continue. The health toll from these emissions clearly indicates the need for an urgent just transition that eliminates our reliance on fossil fuels and instead focuses on renewable power generation combined with energy efficiency and demand side management.

7. Water

South Africa is a dangerously water-scarce country, and in 2018 we faced a mega water crisis over three provinces that was declared a national disaster. South Africa's mean annual precipitation is 50% lower than the global average, and water scarcity is an ongoing significant challenge that climate change is likely to worsen. The map below indicates the levels of projected water stress in the world by 2040. The high 'water stress' areas of the SADC countries Lesotho, South Africa, Namibia and Zimbabwe are clearly evident in this map, which means that there is an issue of both national and regional water stress for South Africa. Water scarcity is not a problem that is going away and decisions taken on electricity supply are fundamentally important for water security in the long term.



Projected global water stress by 2040 (World Resources Institute, 2015)[24]

[24] http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/KV%20365-18.pdf

In fact, the water-energy-food nexus requires an intersectoral approach to resource management, and viewing these sectors in isolation when they have major implications for each other is short-sighted. Water is life, and we must make sure that people's right to sufficient, clean and safe water is protected. According to the Water Research Commission, it is imperative that the water-energy-food nexus approach be closely aligned with the Sustainable Development Goals (SDG) for South Africa *"particularly to SDGs 2 (zero hunger), 6 (clean water and sanitation) and 7 (affordable and clean energy)"*[25] and an integrated approach is required in order to attain these goals. The IRP2018 must much more clearly acknowledge the adjacent sectors of water and food, and the implications that electricity planning has on both of these sectors.

The 17 Sustainable Development Goals agreed upon by 193 countries in 2015 (UNDP, 2015)[26]

The Water Research Commission has made it clear that *"Water and energy resources in South Africa are closely linked, and ultimately determine the availability and abundance of the other…Generally, coal mining activities in the Mpumalanga Province occur within areas where high potential arable land is also located…The process of energy generation by means of coal requires substantial amounts of water, while also impacting on water quality. Both agricultural and mining activities therefore have significant impacts on the local water quality and quantity in Mpumalanga, while competing for land."*[27]

Climate change is a threat multiplier because it takes existing vulnerabilities (such as water scarcity, poverty, inequality, unemployment) and makes them worse. Scientists have predicted that Africa is likely to experience significantly higher temperatures, rising sea levels, changing rainfall patterns and extreme weather (like droughts and floods), which is likely to impact on food security and drive diseases, while displacing millions of people. Water scarcity is an ongoing, significant problem that isn't going away, and climate change is likely to make it worse. Greenpeace Africa believes that water is a fundamental human right. We cannot live without it, and we must make sure that people's right to water is put first and protected. We believe that government departments, agencies and entities must place water at the centre of all decision-making. The battle for access to clean water must end.

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[25] http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/KV%20365-18.pdf
[26] http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/KV%20365-18.pdf
[27] http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/KV%20365-18.pdf

Social justice means putting people's right to water first

The water crisis has exposed a layer of stark inequality in South Africa: the unequal access to water of mega water users in comparison to people. While South Africans struggle with complex water access issues, mega water guzzlers have undisputed access to high-quality water. An estimated two-thirds of South Africa's water goes towards irrigation for agriculture. Single water users, like Eskom, can use mind-boggling amounts of water and pay less for this water on average than South African consumers do. South Africa's coal-based energy sector consumes more water per second than the global average.

Greenpeace believes that the 2002 UNESCO General Comment that "*the human right to water is ... a prerequisite for the realisation of other rights*" goes to the heart of the matter. As the Water Research Commission has clearly stated, water is a human rights issue and "*the Constitution of South Africa has placed a legal obligation on the government to realise people's right to sufficient water*"[28]. If we agree that water is fundamental to human life, then the injustice in terms of how water is distributed in the country, along with the quality of water supply becomes clear.

South Africa's mean annual precipitation is 50% lower than the global average. The fact remains that government needs to place water at the heart of all of its operations and decisions. This means that government departments and agencies must take administrative and policy steps to protect this invaluable resource, and the draft IRP2018 must put water at the centre of decision-making.

We are asking that no government department takes decisions that put our human right to water at risk. For the Department of Energy, this means ensuring that water-hungry energy projects do not go ahead. We believe that we are all in this together, and ask that your department begins to see water as a fundamental development constraint. Calculations based on water-use figures released in Eskom annual reports, indicate that the utility currently uses a staggering 10 000 litres of water per second to keep the country's coal-fired power stations running, which is clearly an unsustainable situation. We call on you to act in the best interest of all South Africans by protecting water.

The truth is that although we have recognised water as a human right, 14% of South Africans do not have access to water at all. Millions of South Africans live with Day Zero every day. And while there has been an almost unending list of government plans and strategies around water, there has been a complete failure to put water at the centre of decision-making.

To avoid Day Zero becoming the new normal in South Africa, every decision to spend money or invest in infrastructure by every government department needs to account for water and to prioritise the realisation of water as a fundamental human right. Government departments must take decisions that actively fulfil and enhance basic human rights, particularly access to water by ordinary South Africans. The Water Research Commission clearly articulates the challenges being faced in terms of resource planning in South Africa:

"Currently, the various governmental departments – DAFF, DWS, DoE, DEA, etc. – generally approach resource management in isolation, without considering the usage of water, energy and land by other sectors. This is a major challenge in South African policymaking, especially when referring to the country's limited water availability, the scarcity of high potential arable land, and its reliance on fossil-fuel based energy generation. Furthermore, it is predicted that climate change will have a negative impact on the availability of resources in South Africa, where ecosystem services, rainfall frequency and distribution, and natural disasters will impact the reliability of the ecosystem."[29]

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[28] http://www.wrc.org.za/News/Pages/Waterasahumanright,whatdoesitmeantoSouthAfricans.aspx
[29] http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/KV%20365-18.pdf

The reality is that South Africa is currently almost entirely dependent on coal for its electricity needs. These coal-fired power plants require large amounts of water for cooling, drive climate change and threaten to further harm the country's ecosystems. According to the Water Research Commission:

"Increasing the amount of energy generated from renewable sources will reduce industrial water demand, lower carbon emissions and minimize water contamination from industrial activity related to coal production"[30]

The bottom line is that water is life. We cannot live without it and we must make sure that people's right to water is put first and protected. This means putting water at the centre of decision-making, and ensuring that water-intensive projects like coal-fired power stations are de-prioritised in favour of essentially water-free technologies like wind and solar PV.

8. Artificial constraints on technology types must be removed in all scenarios

The IRP aims to identify the lowest cost options for South Africa's electricity supply. In the first instance it is a modelling exercise to produce a cost optimised generation mix to meet a particular level of demand. Artificial constraints have no place in such an optimisation; technical constraints (for example, to provide security of supply and to meet emission limits) of course need to be included. Thus the IRP2018 as a starting point must remove the constraint on renewable energy build in all the scenarios, including the scenario that is ultimately selected.

There is inadequate justification for constraining renewable energy technologies in the IRP2018, particularly given their steeply falling costs.

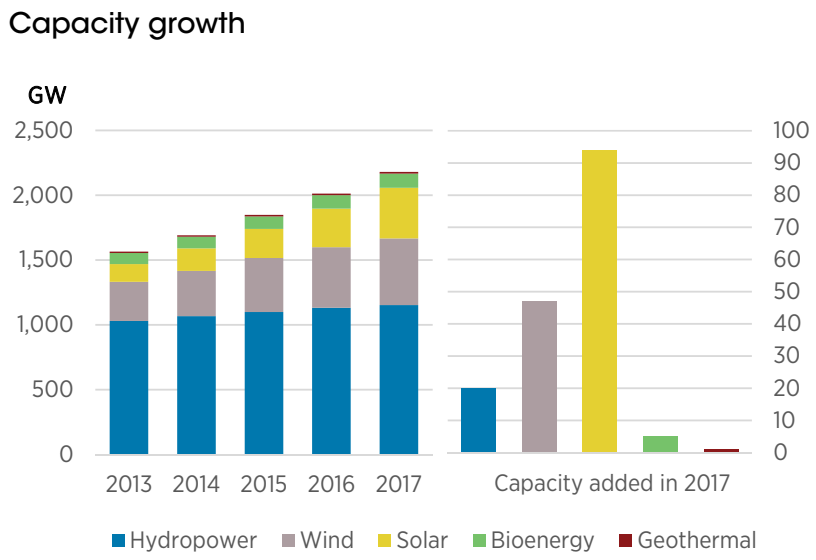
The actual limits imposed on renewable energy build are still 1.6 GW per year for wind, and a cap of 1 GW per year for solar[31], mirroring the limits that were in place for the 2016 draft update of the IRP. There is no technical reason for these limits. Germany has maintained annual solar installations of between 2 GW and 9.3 GW since 2009, and Italy maintained installations of 1.7 - 2.3 GW for four years in a row. Japan has maintained annual installations between 1.3 and 12 GW for over 5 years. Germany has installed between 1.2 and 5.9 GW of wind per year since 2009, with India installing between 1-3 GW each year. Brazil has installed between 0.5 and 2.7 GW. These build rates are summarised in Table 1.

[30] http://www.wrc.org.za/Knowledge%20Hub%20Documents/Research%20Reports/TT%20741-17.pdf
[31] http://www.energy.gov.za/IRP/irp-update-draft-report2018/IRP-Update-2018-Draft-for-Comments.pdf

Table 1 Annual solar PV and wind installations 2009-2015, selected countries

	2009	2010	2011	2012	2013	2014	2015
ANNUAL SOLAR INSTALLATIONS, MW							
Italy	723	2,321	9,301	3,648	1,747	424	300
Germany	2,321	9,301	7,485	7,604	3,304	2,006	1,355
Japan	483	991	1,296	1,787	6,968	9,740	12,000
ANNUAL WIND INSTALLATIONS, MW							
India	1,338	2,139	3,020	2,337	1,729	2,315	982
Germany	2,938	1,171	1,809	2,267	3,043	4,535	5,913
Brazil			504	1,077	958	2,496	2,753

The global trends are clear: renewable energy capacity increased by 167 GW (8.3%) in 2017, which is a continuation of the trend of 8-9% annual capacity growth in recent years. Renewable energy capacity expansion continues to be driven primarily by new installations of wind and solar energy, which when combined accounts for 85% of all new capacity installed in 2017.



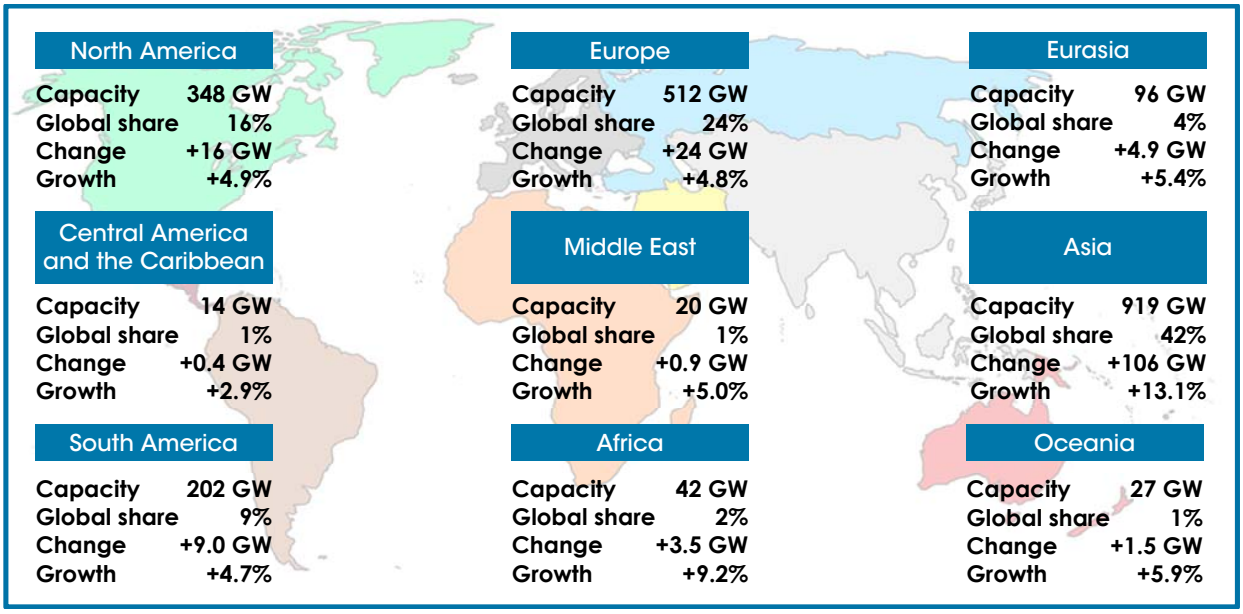
Global renewable energy capacity growth in 2017[32]

However, Africa is at risk of being left behind unless the barriers to renewable energy are removed, with the continent accounting for only 2% of the global share of renewable energy. In South Africa, this means decommissioning existing coal at an accelerated pace, combined with removing the

[32] http://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Mar/RE_capacity_highlights_2018.pdf?la=en&hash=21795787DA9BB41A32D2FF3A9C0702C43857B39C

pauses in renewable energy procurement and increasing renewable energy targets. This also includes transforming Eskom's business model to generate electricity from renewable energy instead of coal.

Renewable generation capacity at the regional level



For the complete dataset see: IRENA (2018), Renewable capacity statistics 2018, available at: www.irena.org/publications.

[33]

While Greenpeace Africa is pleased to see an allocation for embedded generation included in the draft IRP2018, we believe that it has been included rather arbitrarily, without evidence or transparency. The potential for embedded generation goes well beyond the 200MW allocated per year in the draft IRP2018, and we believe that arbitrarily including a figure on embedded generation may actually limit the uptake of embedded generation. We would therefore urge the Department of Energy to carefully and transparently assess the potential for embedded generation, and use the IRP2018 as a tool to increase the uptake of embedded generation, rather than arbitrarily limiting it.

Cost optimisation is the selection from alternative options to achieve the best value solution to meet a desired outcome. In the case of the IRP modelling, the cost optimisation aims to provide the lowest cost energy solution to meet future electricity demand while also maintaining (or providing) sufficient reliability and meeting emissions targets. Capping renewable penetration undermines the goals of the modelling, as it prevents cost optimisation.

Particular parameters may be imposed on the model, either to provide reliability or in order to ensure the electricity solution will enable South Africa to meet its carbon commitments. These parameters should be entirely transparent.

Once a technology neutral cost optimisation has been undertaken, additional scenarios should be run in order to inform policy direction. For example, considerations of energy justice may lead to a greater provision of highly distributed energy sources, even if there is a small cost penalty. Imposing a highly distributed generation mix as a test scenario can inform such a policy decision.

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[33] http://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Mar/RE_capacity_highlights_2018.pdf?la=en&hash=21795787DA9BB4

As pointed out in the study completed by Meridian Economics:

"South Africa is endowed with among the best renewable energy resources in the world. Renewable energy resources now provide the cheapest source of energy on a new build basis, and will soon be cheaper than running many existing coal stations[34]*"*

We are now at a tipping point when renewable energy is clearly the cheapest and cleanest electricity option, and more coal in our electricity mix does not make economic sense. Coal is an outdated and dirty technology, and the environmental and health costs of coal have not been adequately factored into electricity planning.

Greenpeace Africa is of view that the draft 2018 IRP in its present form does not represent a "reasonable measure" as required by section 24(b) of the Constitution for the protection the environment because it does not secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development. Renewable energy is by far the most ecologically sustainable option for future electricity generation. However, the draft IRP2018 still retains artificial constraints on renewable energy penetration through the yearly limit on both wind and solar. There is no technical reason for this limit and inadequate justifications are given in the draft IRP2018. The IRP aims to identify the lowest cost options for South Africa's electricity supply, but in order to do this artificial technology constraints on renewable energy must be removed. Unless these constraints are removed the IRP cannot present a cost optimised solution.

The 'no build limit for renewable energy' scenario was only run for the median demand forecast model, and it is unclear why. Surely this scenario should be run for all demand forecast models, especially because it is the least cost scenario. In fact, Greenpeace Africa believes that given the current economic situation in South Africa, a lower demand forecast is more aligned with current information, and over-estimating future demand can seriously skew investment pathways.

Greenpeace Africa acknowledges the increased emphasis on renewable energy in the draft IRP 2018, and the potential opportunities that this opens up, but unless the energy minister substantially amends the draft IRP to ensure that the constitutional right to a healthy environment is preserved and protected — and specifically excludes any new coal — the department runs the risk of the IRP being challenged in court. It is crucial that South Africa's future electricity plan is least-cost and in the public interest.

While Greenpeace welcomes the direction of the draft IRP2018, it is important to remember that the IRP2010 (a plan developed 8 years ago, when there was practically no renewable energy on the grid) included plans for 17.8GW (excluding hydro) of new renewable energy by 2030. This consisted of 8.4GW each of solar PV and wind plus 1.2 GW of concentrated solar power (CSP). While the draft IRP2018 has postponed the nuclear threat until 2030, and reduced new coal investments until 2030, it still only adjusts the plans for new renewable energy to 20GW of renewable energy by 2030 (excluding hydro): consisting of 8GW of solar PV, 11.4 GW of wind and 0.6 GW of CSP. While the argument that renewable energy was un-tested in 2010 may have been defensible, renewable energy has already more than proven itself in South Africa, and retaining artificial yearly limits on renewable energy is now irrational.

As far as Greenpeace is concerned, the draft IRP2018 does not fully utilise the opportunities offered by renewable energy, and does not constitute a significant increase in ambition. In reality, retaining yearly limits for renewable energy will not provide for a 'smooth roll out of renewable energy' as argued in the draft IRP2018, and will in fact impact on the scale of the renewable energy sector well

[34] http://meridianeconomics.co.za/wp-content/uploads/2017/11/CoalGen-Report_FinalDoc_ForUpload-1.pdf

beyond 2030. The draft IRP2018 indicates that after 2030 "*imposing annual build limits on renewable energy will restrict the cumulative renewable installed capacity and the energy mix for this period".* It is irrational to take decisions now that will constrain renewable energy in the future, particularly when the latest climate science clearly indicates how urgent action on climate change (and reductions in coal, oil and gas) is.

The smooth roll out of renewable energy will not be facilitated by artificial limits on the least-cost electricity type, it will instead be facilitated by ambitious targets set by the government, no delays in the commissioning of renewable energy, an allocation of renewable energy for Eskom, the removal of barriers to small scale embedded generation, and the removal of new coal in the plan, together with decommissioning of older coal-fired power stations at a faster rate than anticipated.

9. Removal of multi-year pauses in the procurement of renewable energy

There is no doubt that South Africa has some of the best renewable resources in the world, which provides the country with a competitive advantage in a carbon constrained, climate change affected world. However, after rapid investments in renewable energy as a result of the bid windows led by the Department of Energy, there has been a significant slow-down in finalising procurement of renewable energy. This has meant that the viability of renewable energy has come under threat in South Africa due to a severe lack of policy certainty. Steps were taken at the beginning of this year to finalise the outstanding 27 renewable energy projects, which had needed outstanding power purchase agreements for the past two years, but this is still inadequate to undo the damage that has been done. What is required now is for the artificial constraints on renewable energy to be removed, and for steady investments in renewable energy to begin.

Multi-year pauses in the procurement of renewable energy prevent the sector from capitalising on our competitive advantage, and more than that, prevent South Africa from incentivising and investing in a renewable energy manufacturing sector. Greenpeace Africa calls on the Department of Energy to ensure that multi-year pauses in the procurement of renewable energy are removed from the final IRP2018.

10. Emissions Externality costs

There is a lack of transparency around the assumptions and inputs that were used to calculate the emissions externality costs on page 25 of the draft IRP2018. We believe using the CO_2 emissions constraint imposed during the technical modelling does not adequately impose the costs of CO_2 from electricity generation, and that the costs of climate change (which are both direct and indirect) must be included in the analysis.

At the same time the draft IRP2018 seems to imply that the externalities of air pollution calculated into the models are based on Eskom's compliance with the Minimum Emissions Standards. This is fatally flawed and unrealistic given Eskom's many applications for postponing compliance with applicable Minimum Emission Standards. Instead, Eskom's current rates of pollution should be transparently used (this is dealt with separately in the air pollution section).

11. New coal

Greenpeace Africa has made it clear in this submission that we believe that units 5 and 6 of Kusile should be cancelled, Eskom's coal-fired power stations should comply with air quality legislation or be decomissioned, and that the 1000MW of new coal included in the draft IRP2018 is irrational in the face of the latest climate science, and evidence about the competitive costs of renewable energy. In addition, we would like to comment on articles in the press that indicate that the President has signed

an agreement that would commit South Africa to building a 4 600MW coal-fired power station in Limpopo, in order to power a special economic zone.[35] Very little is known about this agreement, or what the implications are, but this proposed coal-fired power station has certainly not been included in the draft IRP2018, and we believe that no electricity investments can proceed outside of the IRP process. Therefore, we request that the Department of Energy clarify the situation regarding this proposed coal-fired power station, and how it fits into the IRP planning process. Given the comments on climate change, water, constitutional rights, air pollution and emissions above, Greenpeace Africa would like to clearly state that we are opposed to the irrational consideration of this coal-fired power station, and we believe that if it were to proceed in any way, it would be subject to legal challenge on a number of grounds.

12. Hydro Power

The draft IRP2018's inclusion of 2.5GW of hydropower by 2030 should be removed, and replaced with renewable energy instead. According to a study completed by International Rivers in 2017, the project will not be profitable for the DRC or for South Africa, because the project's economic justifications are based on flawed and dangerously optimistic assumptions[36]. An additional 2017 study by researchers from the University of California-Berkely Energy and Resources Group indicates that once one factors in the costs of transmittting the power from Inga to South Africa (should it ever be completed) it simply cannot compete with South Africa's domestic energy options, particularly solar PV and wind[37].

The likelihood of the Grand Inga project being able to deliver electricity as promised is exceptionally low, given the proposed scale of the project, combined with the ongoing political challenges in Central Africa. Moreover, the social and environmental impacts of a mega dam like Inga are potentially enormous and must be avoided, particularly when significantly better options like renewable energy exist. In addition, there is growing opposition from potentially affected communities, especially among the thousands of people who were displaced without compensation for the Inga 1 and 2 dams, and who would be displaced again for Inga 3. There are significant risks of delays and cost overruns, which means that this is not a stable investment, nor will it drive job creation in South Africa. In order to ensure that the 2.5 GW of electricity are delivered timeously the allocation should be transformed into local renewable energy.

13. Gas

Gas is a fossil fuel and contributes to climate change. The IPCC Special Report on 1.5°C makes it clear that gas use must reduce globally by 2030 by -33% in order to avoid catastrophic climate change. This is completely mis-aligned with the draft IRP2018, which includes an **increasing** share of gas power generation. Greenpeace Africa strongly believes that the levels of gas use need to be reduced in South Africa.

In addition, the draft IRP2018 is non-specific about the type of gas that would be produced, and Greenpeace Africa would like to point out that all types of gas are not the same, nor do they cost the same. This blanket approach to gas does not work, and should be revised in the final IRP to provide clarity. In particular, we are strongly opposed to any moves to implement shale gas fracking in South

[35] https://city-press.news24.com/News/ramaphosas-china-visit-culminates-in-investment-coal-deals-worth-billions-20180903
[36] https://www.internationalrivers.org/resources/in-debt-and-in-the-dark-unpacking-the-economics-of-drc%E2%80%99s-proposed-inga-3-dam-16497
[37] https://www.internationalrivers.org/resources/renewable-riches-how-wind-and-solar-can-power-drc-and-south-africa-16532

Africa, and believe this would be an irrational approach when clean, safe, cheap renewable energy has clearly already proven itself in South Africa. We would also like to point out that it remains unclear whether any shale gas resource would be either technically or economically viable, and applying the precautionary principle would mean investing in well-known renewable energy resources instead.

14. The Integrated Energy Plan (IEP) is missing

The IEP gives a holistic view of the entire energy sector, and has not been released for public comments along with the draft IRP2018 as was the case in 2016. The draft IRP2018, in addressing public comments in relation to the link between the IRP and IEP and which one comes first, states that "*the IEP does not necessarily come first and that the two plans feed into each other*."[38]

Greenpeace Africa is deeply concerned that a further draft IEP has not been published for consideration and comment alongside the IRP – as both clearly have significant implications for South Africa. The IEP is a key planning instrument to which the IRP must be aligned, and an IEP needs to be finalised as urgently as the draft IRP2018 does.

15. Scenarios should be designed to enable comparison, and test risks and opportunities

The final preferred policy adjusted scenario should be designed to allow easy comparison of lowest cost generation to meet emissions reduction obligations and universal access to electricity. All scenarios should have clear outputs (cumulative technology and fuel costs, carbon emissions, average annual consumer electricity costs, water use, pollutant emissions, job creation, energy intensity of the economy), and should enable South Africa to meet even deeper emissions reduction commitments in line with the latest climate science.

It is appropriate to include a "Low emission" scenario (equivalent to the current IEP "Environmental Awareness" scenario), that would aim well below the 90 MT bound for the electricity sector, to enable economy wide emissions to in turn approach the lower bound of 218 MT by 2050, in order to get to as close to zero emissions by 2050, which is in line with the latest climate science.

As discussed above, there is no justification to restrict technologies in the core scenarios other than for technical reasons, in particular to maintain a reasonable percentage of flexible generation capacity. It is appropriate, however, for strategic constraints to be considered in additional scenarios, and any specific technology restrictions which might meet other policy objectives. These scenarios can be used to inform policy makers.

For example, the SA government may wish to consider a policy to ensure that South Africa has a fleet of CSP plants, because of the additional job creation potential. This would be appropriate to test in a scenario with a minimum requirement for CSP, so that the costs of the policy can be understood.

A highly distributed scenario, including mini-grid development for non-electrified areas, with the ultimate aim of achieving universal energy access, should be tested in an additional scenario. This type of distributed energy has the potential for local employment creation and enhanced energy justice, and identification of the cost benefit will inform policy considerations. Note that this will not be able to assist decision making unless grid augmentation costs are included in all scenarios. A study by the Global Sustainable Energy Partnership identifies the provinces where mini-grids could provide an alternative to grid based electrification (Global Sustainable Energy Partnership, 2004).

[38] http://www.energy.gov.za/IRP/irp-update-draft-report2018/IRP-Update-2018-Draft-for-Comments.pdf

Greenpeace would like to reaffirm that the preferred policy-adjusted scenario must include universal access to electricity targets.

16. Constitutional rights

Section 24 of the Constitution of South Africa, 1996 ("the Constitution") creates a justiciable environmental right, and ancillary obligation on the state to realise this right. Section 24 provides:

"Everyone has the right –
(a) to an environment that is not harmful to their health or well-being; and
(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
(i) prevent pollution, and ecological degradation;
(ii) promote conservation; and
(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

The "other measures" in section 24(b) include executive and administrative action; and section 24 obligates the state:

to protect the environment for future generations; and
to ensure that development is ecologically sustainable.

Given the undisputed link between the electricity sector and its impacts on the environment new generation capacity and electricity planning must be in compliance with section 24 of the Constitution. Further, the IRP as policy instrument qualifies as an "other measure" for purposes of section 24 of the Constitution. Therefore, the Department of Energy is obligated to ensure that the IRP is reasonably able to prevent pollution and ecological degradation, and to secure ecological sustainable development and use of natural resources and that economic and social development is justifiable with regard to ecological sustainability.

In order to ensure that future generations also have the ability to enforce the right to have the environment protected, development must be ecologically sustainable, and the precautionary principle must be applied to avoid unjustifiable harm to the environment. The precautionary principle is expressly recognised as a factor of sustainable development in the principles set out in section 2 of the National Environmental Management Act 107 of 1998 ("NEMA") which provide "that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions". The draft IRP currently does not reasonably protect the environment as required in terms of section 24 of the Constitution and further does not support ecological sustainable development.

17. Technical restrictions for reliability

As the penetration of variable renewables increases, driven by both cost and emission reduction objectives, maintaining system reliability will require increasing proportions of flexible generation that can follow load. Generators that have been traditionally used to supply baseload are not well suited to load following. The result of this switch to variable renewable resources is likely to mean that:

"…demand for the uninterrupted operation of fossil-fired plants in base load that is the rule today will virtually disappear from the market." (Pickard and Meinecke, 2011)

Technical restrictions to ensure reliability, including both adequacy and security, must be explicit in the IRP modelling as the optimal means to meet these requirements are changing. Instead of making any technical restrictions explicit, the IRP refers to "baseload" generation. While it is not clear whether the core scenarios have imposed any particular proportion of baseload generation, this may be the case as such a requirement would favour the continuation of current coal generation and would over-ride their cost penalties. This is no longer appropriate as South Africa and the world moves towards low emission electricity systems, and in fact a requirement for flexible generation would be more beneficial.

"Baseload" refers to the minimum level of demand on the electricity grid in question. Traditionally, this was provided by continuous generators, which operate best at a constant output. Coal is designed for continuous generation, hence its description as a "baseload generator". However, as far as Greenpeace Africa is concerned, coal should be described as 'inflexible load', since it does not have the flexibility to follow the load, or adjust to changes in electricity demand.

The optimum mix of electricity generators changes as the penetration of variable renewable resources increases, and arguably represents a conceptual paradigm shift. A low or zero emission electricity system is likely to have high levels of variable renewable generation, particularly wind and solar, as these sources now have the lowest LCOE of both renewable and non-renewable sources (LAZARD, 2015). In order to achieve system reliability, flexible generation to provide load following is required, rather than constant generation to meet a particular threshold (Pickard and Meinecke, 2011; Pape *et al.*, 2014; Riesz *et al.*, 2016), with the provision of baseload generation becoming increasingly counter-productive.

Generators that have been traditionally used to supply baseload are not well suited to load following. An analysis of projected renewable penetration of 40% renewable energy in Germany's electricity system by Siemens concluded that:

*"... conventional power generation will hardly deliver any continuous and uninterrupted base load supply any more. On-line times of more than 600 hours are required only for about 5 GW[39]. By contrast, on-line periods of 4 to 12 hours will be more and more common…. **The forecast indicates that demand for the uninterrupted operation of fossil-fired plants in base load that is the rule today will virtually disappear from the market**." (Pickard and Meinecke, 2011)*

Generation requirements in the order of 4-12 hour periods are eminently unsuitable for either coal or nuclear generation. An examination 9500 coal fired power stations starts showed typical times of 6 hours to first generation, with 40% of normal starts taking more than 10 hours (Kokopeli, Schreifels and Forte, 2013)[40]. The cost of increased cycling of the plant is high, and is likely to lead to increased failure rates and unplanned outages, as well as significantly increased operations and maintenance costs (Kumar *et al.*, 2012). Overall, the change of operation to increased load following was found to do significant damage to plant designed for baseload operation.

18. Demand side management

The consideration of demand side management (DSM) in the IRP lacks transparency, and appears to fall far short of the potential role for DSM. In fact, there is no explicit analysis of DSM in the draft IRP2018, which means that a key component of electricity planning has simply not been considered in this iteration of the IRP. This fails to recognise the substantial additional cost-effective potential of

[39] 5 GW is equal to 2.5% of total installed capacity in Germany today.

[40] 23% of start attempts actually failed, with the mean duration of the attempt four hours.

residential and commercial DSM measures such as refrigeration, heating/cooling and appliances, or the even larger DSM potential in the commercial and industrial sectors.

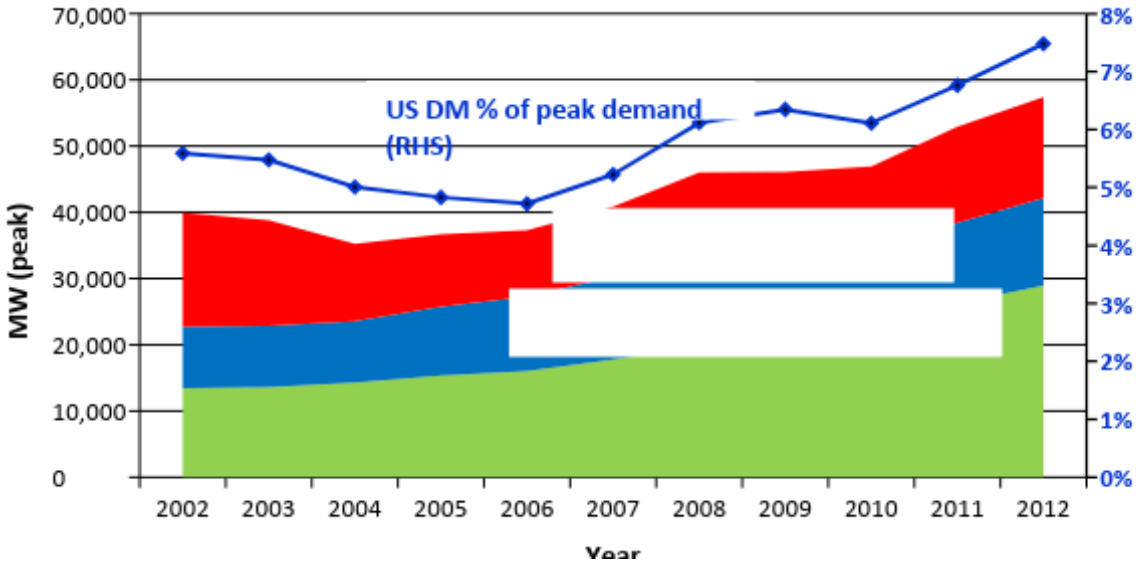
Observations of South Africa's efficiency indicate substantially below average performance (European Union, 2011), and huge potential for cost-effective improvements (International Energy Agency, 2015).

More mature DSM markets such as the United States suggest that international best practice should be targeting upwards of 7% of total system peak demand as shown in Figure 1.

DSM is likely to represent the most cost effective investment in ensuring future network and generation supply capacity, with average delivered demand response costs (utility driven peak-focussed reductions) in the US experience in the order of only $USD 50-60/kW/yr.[41] Any effective IRP must adequately and transparently consider demand side opportunities to enable the delivery of the optimal mix of cost effective demand and supply opportunities to meet South Africa's energy system requirements. More specifically, the IRP must:

- Clearly identify how energy efficiency and other DSM are included within the plan;
- Benchmark energy efficiency and DSM performance against international best practice; and
- Tie any energy efficiency and other DSM targets to projected peak (MW) and energy (TWh) requirements, and should thereby not proportionally decline over time.

Figure 1: DSM delivery in the United States, 2002-2012



The priority in terms of planning is to first focus the low hanging fruits. With regards to integrated planning, energy efficiency should be prioritised before undertaking any new build programme. As such South Africa's energy efficiency potential and other DSM measures should be much more ambitious.

[41] U.S. Energy Information Administration, Form EIA-861, "Annual Electric Power Industry Report.", Tables 10.8, 10.9.

19. The role of Eskom

According to the draft IRP2018, "*The decommissioning schedule is linked to Eskom complying with the minimum emission standards in the Air Quality Act No. 39 of 2004 in line with the postponements granted to them by the Department of Environmental Affairs…Failure to comply is likely to result in these plants becoming unavailable for production, which could lead to the early retirement of some of the units at these plants*"[42]

Eskom has recently initiated a process to postpone compliance with South Africa's Minimum Emission Standards for a second time since 2014 [43](the draft IRP2018 refers to the first round of postponements, but not the second). As far as Greenpeace Africa is concerned, the current application indicates that Eskom has no intention of complying with air quality legislation for the majority of their coal-fired power stations. This has massive implications for people's health in South Africa, and will result in thousands of premature deaths. Thus, the IRP2018 cannot make the assumption that Eskom will comply with Minimum Emission Standards, when their latest application makes it clear that they do not intend to do so, for at least another five years.

We are of the opinion that Eskom's non-compliance cannot simply be tolerated: either the current (old) coal fleet must comply with our relatively weak Minimum Emission Standards, or the decommissioning of these coal-fired power stations must be accelerated. Greenpeace Africa believes that the IRP2018 cannot simply take the current draft decommissioning schedule as a given, and the final selected scenario should include the accelerated decommissioning of coal-fired power stations in line with Eskom's failure to comply with the Minimum Emission Standards. Otherwise, we will not be able to avoid the massively negative impacts on people's health, water and air quality due to ongoing and persistent non-compliance.

The draft IRP2018 assumes that Eskom's plant performance is going to rise from around 70-77% to 80-84% under different scenarios, even though Eskom's plant performance (and the money available to ensure maintenance is completed) has decreased in the past five years. This assumption is irrational based on the evidence, and should be revised to an assumption that Eskom's plant performance is in fact going to worsen. All scenarios model a moderate Energy Availability Factor (EAF) for Eskom plant performance, along with a 50-year decommissioning schedule. Greenpeace believes that a low EAF is much more appropriate to model for each scenario, including the policy-adjusted/recommended scenario. If the Department of Energy underestimates this key issue, it skews the plan, and means investments needed to replace decommissioned coal will not be planned for in time.

At the same time, the role of Eskom in relation to renewable energy has never been clarified by any iteration of the IRP, which means that our national utility is almost 100% invested in the dying coal industry, with ancient polluting coal-fired power stations that cannot comply with air quality standards. Given that Eskom's core business currently revolves around coal which is completely unsustainable in a carbon constrained world, we believe that the IRP2018 should make it clear that Eskom will be given an allocation of renewable energy in order to allow it to transition away from coal and towards supplying electricity from renewable energy.

20. Nuclear

Greenpeace Africa welcomes the move by the Department of Energy to delay any decisions on further nuclear investments until 2030. We believe this is in line with the evidence, which indicates

[42] http://www.energy.gov.za/IRP/irp-update-draft-report2018/IRP-Update-2018-Draft-for-Comments.pdf
[43] https://cer.org.za/wp-content/uploads/2018/08/English-Background-Information-Document-August-2018.pdf

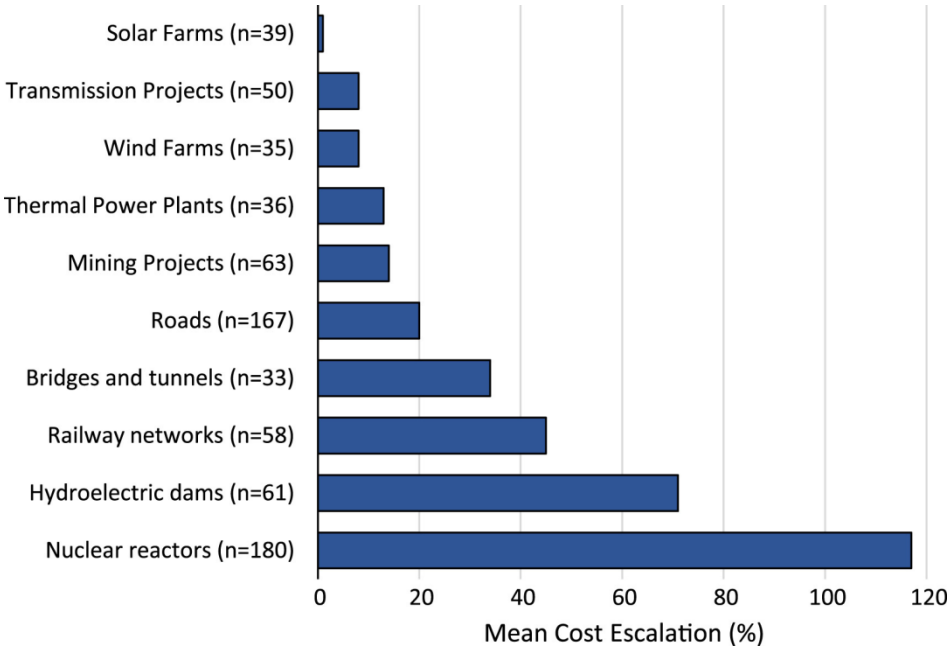
that new nuclear is the most expensive source of electricity. However, we call on the Department of Energy to close the back door that has been left open for nuclear, and remove it as an option entirely - even after 2030. At the moment the risk of nuclear investments in the future has not been removed, it has only been delayed.

While the pro-nuclear lobby seeks to irrationally re-include nuclear in the final IRP, it is critical to remember that nuclear investments are simply unaffordable. A study by the ERC is highly critical of effects of developing nuclear power on consumer prices, and states ".. there is a 94% chance that electricity prices will be higher in 2030 as a result of the commitment to nuclear power" (Energy Research Centre, 2015). This reaffirms the approach taken by the Department of Energy to exclude nuclear from the IRP2018, and we call on the department to increase this commitment to beyond 2030 as well.

Underestimating costs is particularly imprudent in the case of nuclear owing to its propensity for cost overruns. Ramana (Ramana and Security, 2017) notes "175 out of 180 nuclear construction experiences had resulted in increases" whilst Sovacool et al (Sovacool, Gilbert and Nugent, 2014) note "nuclear reactors are the riskiest technology in terms of mean cost escalation as a percentage of budget and frequency".

Indeed, nuclear power stations are inflexible, and are designed to remain on all the time, other than during closure for maintenance, and very few nuclear power stations operate in load following mode. Even nuclear power plant classified as load following are restricted in how much they can vary output, and how quickly. In order to qualify as load following under the European Utility Requirements, a nuclear plant must be able to vary output from 50-100%, at a rate of 3-5% per minute (Lokhov, 2011). Compare this with pumped hydro or gas turbines, which can go from zero to full power in a matter of minutes. There is also a cost penalty, both because the fixed costs of the plant are spread over a smaller output, and because the variable operation increases the wear and tear on the equipment significantly (Alexeeva, 2014).

The graph below highlights the difference between the mean cost overrun for nuclear and for other technologies.



Mean cost over-runs for different types of projects

from (Gilbert *et al.*, 2016)

21. Input data and transparency

Cost assumptions and learning rates must be transparent, up to date, and open to revision at future updates. There is a clear need to have comprehensive and consistent transparency in all input assumptions, models and outcomes related to the IRP.

Provided the arbitrary restrictions on the scenarios are removed[44], the scenarios should provide least cost generation mix under various assumptions for economic growth, demand and external influences. However, this will only occur if the input assumptions on costs are reasonable. Of course, these are predictions, and cannot be truly accurate, which makes it all the more important that all of these assumptions are transparent and open to scrutiny.

Greenpeace would like to reiterate that for the updated IRP to have any relevance it is essential that it uses the most up to date technology costs. It is crucial for transparency that we know what figures being used are in relation to updated costs.

22. Conclusion

Greenpeace Africa believes that the IRP2018 is an important opportunity for South Africa to show true leadership and we urge the Department of Energy to build a just energy future that contributes to safe, clean, affordable electricity for all, and safeguards the planet for future generations. The latest

[44] As discussed above, there are currently arbitrary restrictions in almost all of the core scenarios, in that wind and solar PV are restricted to a maximum increase of 1.6 and 1 GW respectively.

climate science makes it clear that climate change is an imminent existential threat, but it is also an important opportunity for transformation, hope and renewal. With the next 12 years being critical for climate action, we clearly do not have any time to lose and the IRP2018 cannot delay action that is urgently needed now. It is imperative that the IRP is finalised, and that in its finalisation it sets South Africa on a rational, cost effective pathway to a better future, in which our consitutional rights are protected and fulfilled.

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