(Draft) WESSA Energy Policy

WESSA's MISSION is to Educate, Advocate and Act for environmental and social justice to drive climate action, protect and restore biodiversity and reduce pollution through citizen action, sustainability education, conservation programmes, legislative and media engagement, compliance monitoring, and strategic partnerships.

This policy is grounded in the Precautionary and Polluter Pays Principles. This policy recognises that the socio-economic and environmental landscapes are complex and so must make space for continuous change and emergence. The views expressed by WESSA in this policy were developed in the context of the information, data and projections available at this time, and may change in response to new information and insights.

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INTRODUCTION

The science, and now increasingly the daily experience of many across our planet, is clear: **climatic conditions best suited to human wellbeing are rapidly changing**. These changes include CO_2 concentrations in the atmosphere higher than any previous time in at least 2 million years; global warming of 1.1°C above pre-industrial 1750 levels; and biodiversity (habitats and species) loss at an extinction-event level scale, amongst other.

The recent changes to the climate are our own doing, namely **they're caused by human activity**, principally through the unabated emission of greenhouse gases (GHGs). GHG emissions, like a run-away train that isn't showing signs of slowing, are in turn due to "*unequal historical and ongoing contributions arising from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production across regions, between and within countries, and among individuals*" (IPCC AR6 Synthesis Report, March 2023, p.4).

As the IPCC's Sixth Assessment Synthesis Report also makes clear, **we are on course to exceed 1.5°C global warming** during the 21st century and will find it very hard to limit warming below 2°C based on what countries have voluntarily committed to through their nationally determined contributions (NDCs).

In short, climate change is here, and we're not doing enough to prevent cumulative and exponential change to the planetary conditions we need for our own ongoing wellbeing.

What is to be done? The IPCC is clear, "*limiting human-caused global warming requires net zero CO_2 emissions*" (IPCC AR6 SYR 2023, p. 20) And in turn, **getting to the net zero CO_2** emissions target by 2050 (as is required to keep us below 1.5°C warming) will "*involve rapid and deep and, in most cases, immediate greenhouse gas emissions reductions in all sectors this decade*".

In 2020, it was estimated that 91% of global CO_2 emissions came from fossil fuels and related industry, whereby fossil fuels were being used mainly for the generation of electricity, followed by their use for transport and then heating. Specifically, oil (33%), coal (27%), and gas (24%) collectively comprise 84% of our total energy use. **Consequently, rapid, deep, and sustained change is specifically required in our energy (production and use) systems.**

In South Africa we produce and use energy in four main ways:

1. Electricity primarily generated by Eskom; of which 80-85% is generated from burning coal
2. Wood/coal-fired cooking and heating fires
3. Fossil-fuel propelled vehicles (internal combustion engines using either heavy oils, diesel, or petrol)
4. Organic – animal, human, plant internal energy systems and decomposition

Three important points need to be made upfront. The continued high use of wood/coal-fires to cook and heat homes in South Africa marks a complex development challenge rooted in rural-urban divides; persistent inequalities founded in colonial and apartheid systems; and unemployment and poverty cycles driven by an extraction-based economy that exports its mineral wealth. However, to change that requires moving current heating and cooking by means of wood and coal fires, to electrical sources. Which informs our second point, namely that humans in the 21st century cannot live without electricity; it is integrated and embedded into our lifestyles and critical to our livelihoods, mechanised structures, and industrial networks. The third point is the general recognition that while fossil-fuelled energy has driven our industrial progress globally, it is what has brought about an existential crisis for humanity and life on the planet. Simply swopping out one form of energy for another doesn't address the infinite-growth assumption of current economic models. That growth assumption needs addressing and will be covered in a separate policy statement.

To the second point, that we cannot live without electrical energy, we also now know that the way we generate electricity is heating the planet we depend on, polluting the air we (and other life forms) breathe, and using vast amounts of water in the process. As Max Roser of The World in Data explains, "*the world faces two energy problems: most of our energy production still produces greenhouse gas emissions, and hundreds of millions lack access to energy entirely*" (https://ourworldindata.org/energy). Thereby the horns of the dilemma, we cannot live without (electrical) energy and need to expand its use to make life better for all. But how we generate the energy we use is steadily changing climatic conditions on the planet that will detrimentally effect all of humanity. **In short, electricity is both the problem and the solution**.

In South Africa, much of our debate and focus on energy is taken up with the question of "load-shedding" or more accurately, rolling blackouts. In essence when the demand for electricity outweighs the supply, Eskom forces a restriction of supply of 1GW per load-shedding stage. The reasons for -, and solutions to load-shedding are complex, and will be covered in a separate policy position, but it is important for us in South Africa to separate out symptom from cause, and not to rush to an energy solution simply because it will supposedly solve the crisis in the short-term - energy choices have long-term and embedded consequences. We must choose wisely.

POLICY STATEMENT

WESSA unequivocally supports the goal of getting to net zero CO_2 emissions by 2050 and the urgent need to adapt our energy systems (and lifestyles) to achieve this.

We recognise that this will require some major “transitions”, particularly in how we think about energy, and how we produce and use it. In South Africa this will require in our view three key energy transitions: firstly, in how we generate (and distribute) electricity, shifting from mainly (centralised) coal power generation to mainly (decentralised) renewables; secondly, how we transport ourselves and our goods, requiring a transition from internal combustion engine powered vehicles (ICE) to alternative-powered transport systems (EV’s, green hydrogen, and other); and thirdly, in how we cook our food and heat our homes, transitioning from coal and wood home fires to electrical sources of heating and cooking.

It is also important to note that there is no form of electricity generation that does not impact the climate negatively or damage ecosystems/reduce biodiversity. But energy production/power generation systems are not all equal. The relative and holistic impact of different systems varies greatly, with fossil fuel sources being exponentially of greater harm to people and the planet than renewable sources. In understanding impact, it’s important to compare power production systems across the lifespan of the technology – that is from cradle to grave (e.g., from what is mined to what rehabilitation is required post closure of operations); to include “externalities” in the evaluation of options (e.g., waste disposal costs, illness from air or radiation pollution, road decay from trucks shipping the fuel, etc.); and to understand the relative value of the measure being applied to assess impact (e.g., the bird mortality from turbine blades as compared to bird mortality from buildings, roads, electrical lines, and coal pollution).

We will expand on specific technologies in supplementary position papers, but as a general point we support the transition away from fossil fuels to using renewable sources of energy production. And while nuclear (Generation 3 models) and gas can serve as a bridging source in countries with existing infrastructure, these are not options for South Africa given our lack of infrastructure and the likelihood of any future investment becoming “stranded” by the rapid advances in renewable and supporting technology. Bio-gas power generation from “natural” resources typically leads to biodiversity loss and competition with food production, and in our view does not mitigate but rather amplifies the high carbon-use challenge. Green hydrogen and green ammonia, wave, and current power, and small modular (nuclear) reactors (SMRs) are in the early stages of their technology development and will need closer consideration if and when they reach commercial viability. In our view, roof-top solar, mini-turbines, and (floating) off-shore wind resources have the potential for greater use and representation in the energy mix in South Africa.

In the discussion about energy use, an oft overlooked strategy in reducing the impact of power generation are the opportunities for improving the utilisation of energy, in short, energy efficiency - using less electricity and using it more effectively. In response, we call for energy to be treated as a scarce resource in the design and utilisation of electrical devices and machinery, and in the public communication about energy usage. Regulations and product designs should require the highest possible efficiency outputs of electrical components, and incentives must be employed to balance and shift demand to non-peak times.

In part, the energy crisis in South Africa is rooted in a global shift from centralised power generation and large-scale state-owned utilities, to decentralised localised and often privatised power provision. Driven by the shift to renewables, a decentralised system has the potential for greater citizen and community participation (also referred to as “socially-owned” systems) in power generation – part of which is shifting citizens from being “consumers” to “prosumers”. We hold that national and local government policies (e.g., feed-in tariff rates and systems) and services (e.g., local grids) should be opened for and geared to promoting a mix of (renewable) local generation and micro-grid options, including the possibility of community cooperatives and home generation alongside privatised options.

Important too is to recognise that there are large and vested interests, corporate, political, and geo-political, in what technology is chosen to produce energy. The public relations campaigns employed by the different industries that aim to influence decision-makers, media, and citizens in support of their technology, often use information selectively, seek to redirect attention away from their flaws, sometimes misrepresent key facts, employ influencers or NPOs/think-tanks to proactively drive key industry-friendly talking points, hire “fixers” to shepherd projects through political and administrative corridors, or “greenwash” their value chains with glossy adverts and seemingly good intentioned projects. It is important therefore for government, media and the public to be aware of the public relation campaigns and to critically interrogate the detail of industry claims about the technology being promoted. This includes examining a technology’s (global) history of operations. The caution holds for both renewable and fossil fuel industries, and applies equally to environmentalist claims and campaigns, WESSA included. In short, each technology, and arguments for/against should be weighed on their merits and suitability for South African conditions, its people, and its eco-systems.

In general, WESSA supports energy generation solutions that:

1. Are assessed to be a combination of “**best fit**” and “**minimal harm**” to the specific country and local ecosystem conditions.
2. Adhere to the principle of **sustainable development** (in which social, economic, and environmental considerations are evaluated and addressed).
3. Employ the practice of **collective stewardship** in which all of society carries responsibility for addressing the challenge. But that such doesn’t absolve the polluter from paying, and importantly **environmental justice** principles must guide energy decisions, which includes enabling marginalised and disadvantaged communities to participate in the decision-making and beneficiation process.

Specifically, in deciding on what power generation systems to use, we hold that several factors need to be holistically and carefully considered before energy decisions are made. We suggest amongst other, the following (not in order of priority):

1. How efficiently does the technology work? For instance, start-up time, shut-down time, how frequently does it need to be maintained, what capacity does it deliver on average, what’s its lifespan - how long will it last?
2. Life-cycle cost and sustainability (environmental, social, economic) aspects
3. What exists currently, and where is the technology and the industry supporting it going – will it be a “stranded” asset by the time it comes on stream?
4. Cumulative and legacy impacts – who evaluates and polices long-term impacts, who will clean up the mess, and is the cost and responsibility of doing so provided for today?
5. What other natural resources are required to operate the technology, specifically water, soil, and air?
6. What supply and distribution networks are in place or still need to be built (e.g., grids, gas pipelines, charging stations)?
7. Affordability – both for the national fiscus and the individual citizen, small business, or company?
8. How will the energy production system be financed and on what terms? For instance, will it be based on a build, own, operate (BOO) financing systems, and if so, how will they operate? Specifically, are input-variables index-related, what security is used - will it allow seizure of state assets like ports on default, etc.?
9. Ownership/accessibility to the technology – are there components (e.g., enriched uranium) that need to be exclusively sourced and on what basis?
10. Availability of -, and the extraction/mining requirements of the fuel/natural resource the technology relies on (oil, gas, sun, wind, water, underground thermal, uranium, hydrogen, waves, currents)?

11. What minerals are used to manufacture component parts and their recycling ability, including the total of earth/soil needing to be mined and conditions (especially labour practices) where such are mined?
12. Does it include public participation processes that seek input especially from under-resourced and marginalised communities?
13. Political and geopolitical interests – what will the piper charge?
14. What are the waste/pollution outputs and disposal requirements of the entire value chain?
15. Employment in energy solutions vs. employment in industries that require electricity – jobs are primarily created by industries and businesses reliant on reliable electricity supply, is that where the focus is?
16. Decommissioning of production facilities and restoring mined land – who will monitor and evaluate, and will the entity be around to pay for future liabilities?
17. Who generates what revenue (private, municipal, national) along the entire value chain, and how does that impact their decisions about energy choices?
18. Industry lobbying and public relations (and disinformation) campaigns – do they listen, is their focus on the integrity of their processes or influencing decision-makers?

CONTEXTUAL INFORMATION

Some key energy concepts:

- **Demand profiles:** typically, a 24-hour demand profile (when people use electricity) shows peaks in the morning and early evening (when geysers and stoves are mostly used), a trough during the day when people are at work, and a significant drop-off in use from late night to early morning when most people are asleep. However, in South Africa's case (due to the high use by industry and commerce) we have a "tabletop" profile, which display slight peaks in the morning and evening, but a relative shallow trough during the day when factory machines are running.
- **Thermal**: many power generation systems essentially work like a large kettle that uses steam from heated water to drive the turbines that generate electrical power.
- **Baseload:** the minimum amount of power available to the grid that is required at all times of the demand cycle. Essential to keep fridges, medical equipment, industrial furnaces, computer servers and other equipment operating 24/7.
- **Peaking and mid-merit power:** peaking power is a power source that comes on-line when the demand is at a daily high and at short notice. Mid-merit power typically bridges the gap between baseload and peaking power. A key aspect of power technology is whether it can "follow", as in whether its output can be ramped up or reduced to match demand – often referred as "dispatchable" power. Gas power, either via open-cycle gas-turbine (OCGT) which are less efficient, or via closed-cycle gas-turbine (CCGT) that are more efficient, are typically the preferred means of peaking and mid-merit power. Nuclear and coal plants have limited capability to follow. In renewable systems, battery and other storage options will increasingly fulfil this role.
- **Variable vs. intermittent supply:** you may have heard the term "the wind doesn't always blow, or the sun doesn't always shine" as a critique of the variable-supply nature of renewable energy; or in support for baseload (continual-supply) power generation (gas, coal, and nuclear) systems; or as an argument that RE cannot supply 100% of energy to a grid. At issue is the predictability of supply more than the assurance of continual supply. To deal with variability in supply, renewable power has brought with it live-trading of energy and shorter prediction cycles (e.g., 1-hour projections) to address predictability. In South Africa, it is somewhat less of an issue as the combination of wind and solar generally matches our demand profile, and given the geography and size/width of the country, the wind is always blowing somewhere, and we have high irradiation levels across a large part of the country.

- **Renewable energy:** energy produced from nature-based sources such as wind, sun (irradiation), hydro, geo-thermal, sea currents, bio-gas, and wave action, that in theory are unlimited and are not depleted by their use in the generation of the power, that in effect “renew” themselves.
- **Low-carbon:** energy sources that have a low level of CO_2 emissions, typically benchmarked against coal-plant emissions, and ranking/rating may also depend on whether the focus is just on production emissions or emissions along the entire value chain. Whilst nuclear and (green) hydrogen/ammonia are low carbon sources of power, their sources are finite and don’t qualify as renewable in that they deplete their power source.
- **Green:** a broad category description that varies from country to country as to what power sources are considered environmentally friendly or of low environmental impact.
- **Cumulative impact**: power generation technologies are complex systems that have impacts across many areas and across decades. Understanding the holistic impact of a power generation technology is important in understanding its full benefit or negative effects.
- **Capacity factor (CF)**: Capacity factor is a measure of power plant efficacy; the ratio of the actual average electrical power a plant delivers over time to the nominal (nameplate) power it can deliver at peak conditions. If a coal plant is rated at 1000 MW, that’s its maximum (nameplate) capacity, but what it actually delivers to the grid will be less, due to maintenance, breakdowns, stoppages, wet coal, etc. This will also vary between different models and makes of the same technology, and country/utilities managing the power plants. By example the 2021 CF in the USA for nuclear was 92.7%, coal is 49.3%, wind 34.6%, and solar PV 24.6%. In South Africa for 2022, the CF of nuclear was 61.8% (vs. 74.6% in 2021), coal was 50.1% (54.2%), wind stood at 33.6% (35.8%), and solar PV at 24.8% (26.4%). And taken monthly, by example for SA in 2022 solar PV peaked at a CF of 29.3% in January and was lowest in June at 18.4% (the month of the winter solstice thus less sun).
- **Energy availability factor (EAF):** is the amount of energy available compared to installed capacity, and when used for a specific technology is effectively the same measure as CF. However, in SA the measure is used to understand the availability of all power plants as a whole.

Some key facts relevant to South Africa’s energy challenge:

- 1 gigawatt (GW) = 1 000 megawatts (MW) = 1 million watts.
- In 1965 coal generated power delivered some 16,140 TWh globally, in 2021 that figure stood at 44,473 TWh.
- In 2010 the IEA predicted that solar would generate some 630 TWh globally, that figure was reached in 2019, 16 years ahead of world expert’s predictions. By 2022 solar was generating double the 2019 amount.
- Most recently USA’s grid-scale battery capacity grew by 900% in 3 years.
- SA is the 15th highest carbon emitting country globally - largely because it is one of the world’s top 5 coal users. China, USA, India, Japan and SA account for 82% of the world’s consumption of coal.
- Eskom is responsible for 43% of SA’s carbon greenhouse gas emissions and 25% of Sub-Sahara emissions. Eskom’s emissions per year equal: 71 tons (ash) particulates, 804 000 tons Nitrogen Oxide, and 206.8 million tons CO_2.
- Eskom, the #1 user of coal-to-steam generation systems in the world, and 5-6th biggest power utility globally, currently supplies 90% of SA’s electricity, 80% of which is from its 15 coal-steam power plants that have an installed generation capacity of 39.8 GW in total.
- Consequently, Eskom is considered the world’s worst polluting power company and Mpumalanga (encompassing the Highveld crescent layout of coal generation plants) is the world’s largest air pollution hotspot.
- Other sources of Eskom electricity generation include (installed capacity): nuclear (Koeberg): 1.9 GW; diesel (OCGT’s): 3.4 GW; pumped (storage): 2.7 GW; and hydro: 600 MW. Independent power producers generate via wind 3.4 GW and solar PV of 2.3 GW.

- In 2022, while Eskom's installed capacity stood at 52.4 GW, the country's peak demand was only 34.6 GW (vs. 36.7 GW in 2010), but Eskom's energy availability factor (EAF) stood at 58.1% (vs. 61.7% for 2021) meaning that only just over half of Eskom's nominal capacity was available to the grid.
- "Loadshedding" (1 000 MW per stage of load reduction) began in 2007 with 176 GWh shed, became constant in 2018, and in 2022 equalled 11 529 GWh (or 3 773 hours in duration). By May 2023 it had already surpassed all of that load shed in 2022.
- Eskom electricity customers went from 1,7 million (1996) to 6,7 million customers (2022)
- 94% of Eskom customers are residential but only account for 17,9% of electricity sold, and 35% of peak demand.
- Residential growth accounts for only 12% of increase in electricity supply since 1994, the majority comes from the mechanisation of industry production facilities.
- Biggest users by sector are *redistributors* (municipalities) at 89,591 GWh, *industrial* at 50,150 GWh, and *mining* at 30,629 GWh.
- The *Energy Intensive User Group* (EIUG) consists of 27 industrial concerns (which includes Anglo American, Mondi, Glencore, Sasol, Implats, Afrox, ArcelorMittal, Harmony, Rand Water, amongst others) and accounts for 40% of SA's electricity consumption. The EIUG employs some 600,000 people, and generates more than 20% of SA's GDP.
- Eskom's biggest single customer is the *South32 (previously BHP Billiton) aluminium smelters* in Richards Bay (the Hillside smelter draws 1 205 MW) and Mozal (47% of its power comes from Eskom) in Mozambique. In total the smelters account for 5% of Eskom's capacity and operate at a significant tariff discount.
- Municipalities (restricted by legislation as to revenue sources) generate on average 30% of their annual revenue from the on-sale of Eskom generated electricity – meaning new technologies such as rooftop solar generated locally for on-site use threaten that revenue stream.
- The Eskom grid has 399 546 km of power lines across SA.
- Eskom's electrical grid was originally designed to supply mines and railway lines and then to get coal-fired power from highveld across the country using an East Rand to Cape Town main power line. Consequently, connecting renewable resources, based in different locations to coal plants and coal reserves, is constrained by grid capacity (the wires aren't large enough in the areas they produce).
- The Renewable Energy Power Producer Procurement Programme (REIPPPP) administered by the DMRE, Treasury and Development Bank of SA had procured by June 2017 some 6,422 MW of RE power supply via 4 bid windows and 112 projects. Total investment = R194 Bn, of which foreign sourced = R53,4 Bn (FDI in 2015 = R22,6 Bn). Bid windows 5 (confirmed in 2021) and 6 (2022) will add another 31 projects and a total of 3 583 MW to the SA grid.
- Operational REIPPPP completed projects to date number 88 projects.

REFERENCES & RESOURCES

Links to previous and other WESSA policies and position statements:

- Renewable Solutions & Reduced Demand - ENERGY Policy; 2012
- Wind Energy Position Statement; 2013
- Nuclear Power & the Proposed Pebble Bed Modular Reactor Position Statement; 2000
- Nuclear Energy Position Statement; 2012
- Fracking Position Statement; 2012

Legislation and Policy that have bearing (some examples):

- ???
- ???

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Other key sources of information:

- IPCC 6th Assessment Report (AR6): https://www.ipcc.ch/assessment-report/ar6/
- CSIR power generation data: https://www.csir.co.za/csir-releases-statistics-on-power-generation-south-africa-2022#:~:text=Coal%20still%20dominates%20the%20South,of%20the%20total%20energy%20mix.
- Eskom data:
    - https://www.eskom.co.za/dataportal/
    - https://www.eskom.co.za/investors/integrated-results/
- Energy data: https://ourworldindata.org/energy
- International Energy Agency's (IEA) reports and data: https://www.iea.org/reports/world-energy-outlook-2022
- Presidential Climate Commission's recommendations on electricity planning: https://cisp.cachefly.net/assets/articles/attachments/90770_may_2023_-_pcc_-_electricity_planning_recommendations_report.pdf
- REIPPP's: https://www.ipp-renewables.co.za
- Energy Intensive Users Group (EIUG): https://eiug.org.za
- South32 Hillside: https://www.tips.org.za/policy-briefs/item/4534-hillside-aluminium-low-carbon-energy-options-and-the-implications
- Capacity factor: https://www.pnas.org/doi/10.1073/pnas.2205429119
- International Atomic Energy Agency: data on Koeberg Nuclear Power Station: https://pris.iaea.org/PRIS/CountryStatistics/ReactorDetails.aspx?current=836
- CSIR on renewables supplying 100% of grid: https://www.csir.co.za/energy-renewable-sources-sceptics
- What is Green Hydrogen and will it Power the Future? CNBC: https://www.youtube.com/watch?v=aYBGSfzaa4c
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Some observations that you may regard as relevant.

The latest Rockström (Stockholm Resilience centre) publication (Johan Rockström et al 'Safe and just Earth system boundaries' (July 2023) 619 *Nature* 102 (https://doi.org/10.1038/s41586-023-06083-8) has the following to say:

Assessment of significant harm from climate change suggests the need for a stricter just (NSH) boundary [stricter than 1.5°C]. At 1.0 °C global warming, tens of millions of people were exposed to wet bulb temperature extremes (Fig. 2), raising concerns of inter- and intragenerational justice. At 1.5 °C warming, more than 200 million people, disproportionately those already vulnerable, poor and marginalized (intragenerational injustice), could be exposed to unprecedented mean annual temperatures[41], and more than 500 million could be exposed to long-term sea-level rise (Fig. 2 and Methods). These numbers of people harmed vastly exceed the widely accepted 'leave no one behind' principle[29] and undermine most of the Sustainable Development Goals. Moreover, past emissions have already led to significant harm, including extreme weather events, loss of habitat by Indigenous communities in the Arctic, loss of land area by low-lying states and sea-level rise or reduced groundwater recharge from changing glacial melt systems[3]. Irreversible impacts from cryosphere and biosphere tipping elements that are committed by anthropogenic greenhouse gas emissions in the coming decades but which unfold over centuries or millennia also threaten intergenerational justice (Supplementary Methods). We conclude that if exposure of tens of millions of people to significant harm is to be avoided, the just (NSH) boundary should be set at or below 1.0 °C. Since returning within this boundary may not be achievable in the foreseeable future, adaptations and compensations to reduce sensitivity to harm and vulnerability will be necessary. During the 2022 United Nations Climate Change Conference (COP-27), developing countries indeed focused actively on issues of adaptation, loss and damage.