



SA's reliance on coal remains major hurdle to 'just transition'

By Martin Nicol

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South Africa will go to COP26 in November with new targets for reducing its emissions of carbon dioxide and other greenhouse gases. But it is going to be very difficult to achieve these goals – even as they are criticised by environmental groups for being inadequate. A 'just transition' to a zero-carbon world is the broadly accepted aim: but as MARTIN NICOL makes clear, its elusiveness is right up there with unemployment, poverty, corruption, inequality and gender-based violence.

South Africa is one of the world's biggest per capita greenhouse gas emitters.¹ Greenhouse gases are released by all sorts of human activity, but particularly when beneficiating coal – turning it into liquid fuel or gas (as at Sasol) or converting it into electrical energy (as at Eskom).

Increased greenhouse gas concentrations in the atmosphere accelerate climate change – the process in which world temperatures rise and lead a domino effect as glaciers and icecaps melt faster, and climate disasters such as droughts, heat waves, floods, cyclones, hurricanes, typhoons and tornadoes become more frequent and more intense.²

In 2015, South Africa joined many other nations in signing 'the Paris Agreement', which was premised on the notion that if all countries work together to cut greenhouse gas emissions, they can reduce the risks and impacts of climate change. The air and the oceans are shared by everyone, so all countries need to be involved. The Paris Agreement required all countries to make commitments on how they would monitor and manage their greenhouse gas emissions. The long-term temperature goal is to keep the increase in global average temperature to below 2°C above pre-industrial levels and to pursue efforts to limit the increase to 1.5°C.

However, these commitments made in Paris, according to climate scientists, were not large or swift enough to reach either of these targets. In 2021, the signatories are meeting in Glasgow,

Scotland in November to make new emission commitments – delayed a year because of the Covid-19 pandemic. The hope is that these new measures will be better tailored to make the Paris temperature goals viable.

Countries are taking a range of steps to reduce greenhouse gas emissions. Some countries (including South Africa) favour a 'carbon tax' to increase the cost of emitting greenhouse gases and to encourage businesses to emit less by increasing efficiency or shifting to new technologies – like solar or wind power. South Africa has also taken direct action to regulate emissions from electricity generation and from Sasol – although the government has been notably lax in enforcing legislated emission standards. Consumers are encouraged to reduce our 'carbon footprint' by reducing unnecessary air and car journeys and recycling.

South Africa has been fully involved in world research and discussions on the climate for many years. The country 'punches above its weight' in contributing to scientific investigations on climate change. In 2021, Parliament is scheduled to pass a 'climate change act' to bring all South Africa's climate interventions under one umbrella. ►►

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[While] a sharp reduction in coal-fired electricity generation would be the most efficient way for the world to cut carbon emissions ... South Africa ... relies on coal overwhelmingly for its electrical power.

Unfortunately, South Africa also punches far above its weight as one of the world’s biggest per capita greenhouse gas emitters. The main reason for this is our heavy reliance on coal and oil for our energy needs, and on industries that are particularly energy intensive, such as mining, smelting, cement and petro-chemicals. The entire modern economic history of South Africa has been built on energy from fossil fuels.

WE DESIGNED OUR ECONOMY AROUND COAL BECAUSE WE HAVE LOTS OF IT

South Africa has huge reserves of coal – enough for over 100 years – and its energy decisions in the past have been based on using this resource. It is cheap (for the user) and easily available.³ Coal underpins thousands of jobs. Mines support communities all over the country – particularly in Mpumalanga.

South Africa has some of the biggest coal-fired power stations in the world. Eskom became a world leader in inventing ways to burn low-grade coal



in power stations. Eskom even financed the coal mines – which are privately owned. The low-grade coal went to Eskom – and the mines exported better quality coal, earning huge profits for their owners.

It is only in the last decade that renewable energy technologies – using solar and wind power – have become cheaper than coal (Roser, 2020). But coal-fired power stations last for 40 years or more, and it takes that long to recover their capital costs. Switching takes time and costs money.

It is not surprising that unions whose members are employed in the fossil fuel sector have been quiet or expressed scepticism about the urgency of action to reduce greenhouse gas emissions. Government’s commitment to a ‘just transition’ and to support for ‘green jobs’ is hard to see. After 1994, when the gold industry declined, shedding more than half its workers and 200,000 jobs by 2004, government did not lift a finger to assist the stricken workers and abandoned communities.

The 90,000 miners and 60,000 or so other workers directly employed in the

coal value chain today (Montmasson-Clair & Hermanus, 2021) can be excused for opposing the carbon tax and trying to hold on to fossil fuel industries for as long as they can. But the writing is on the wall. The major mining companies are aggressively divesting from coal mining. Eskom is planning to decommission coal-fired power stations at a new, faster rate. The Integrated Resource Plan (Department of Energy, 2019) sees electrical energy from coal falling by over two-thirds between 2030 and 2050.⁴

Unions would be better advised to insist on training for their members in new jobs in the sustainable energy sector – and to assist government to define the parameters of a just transition.

We now face a situation where experts agree that ‘The major driver of global warming is the emissions of CO₂ from the burning of fossil fuels’ (Nordhaus 2013). A total of 96% of South Africa’s primary energy needs are met by burning fossil fuels, compared with 85% for the world as a whole:



Primary energy: Consumption by fuel*

	South Africa 2019			Total World 2019		
	Exajoules	% shares		Exajoules	% shares	
Oil	1.18	22%		193.03	33%	
Natural gas	0.15	3%		141.45	24%	
Coal	3.81	71%		157.86	27%	
Nuclear	0.13	2%		24.92	4%	
Hydroelectricity	0.01	0.2%		37.66	6%	
Renewables	0.12	2%		28.98	5%	
Total	5.40	100%	SA % of energy consumption 0.92%	583.90	100%	

* Primary energy comprises commercially traded fuels, including modern renewables used to generate electricity (BP, 2020).

Electricity generation by fuel 2019

Terawatt-hours	South-Africa	% shares		Total World	% shares	
Oil	1.2	0.5%		825.3	3.1%	
Natural gas	1.9	1%		6,297.9	23%	
Coal	217.3	86%		9,824.1	36%	
Nuclear energy	14.2	6%		2,796.0	10%	
Hydroelectricity	0.8	0.3%		4,222.2	16%	
Renewables	12.6	5%		2,805.5	10%	
Other	4.6	2%		233.6	1%	
Total	252.6	100%		27,004.7	100%	

Studies suggest that a sharp reduction in coal-fired electricity generation would be the most efficient way for the world to cut carbon emissions (Krugman, 2013). This is bad news for South Africa which relies on coal overwhelmingly for its electrical power.

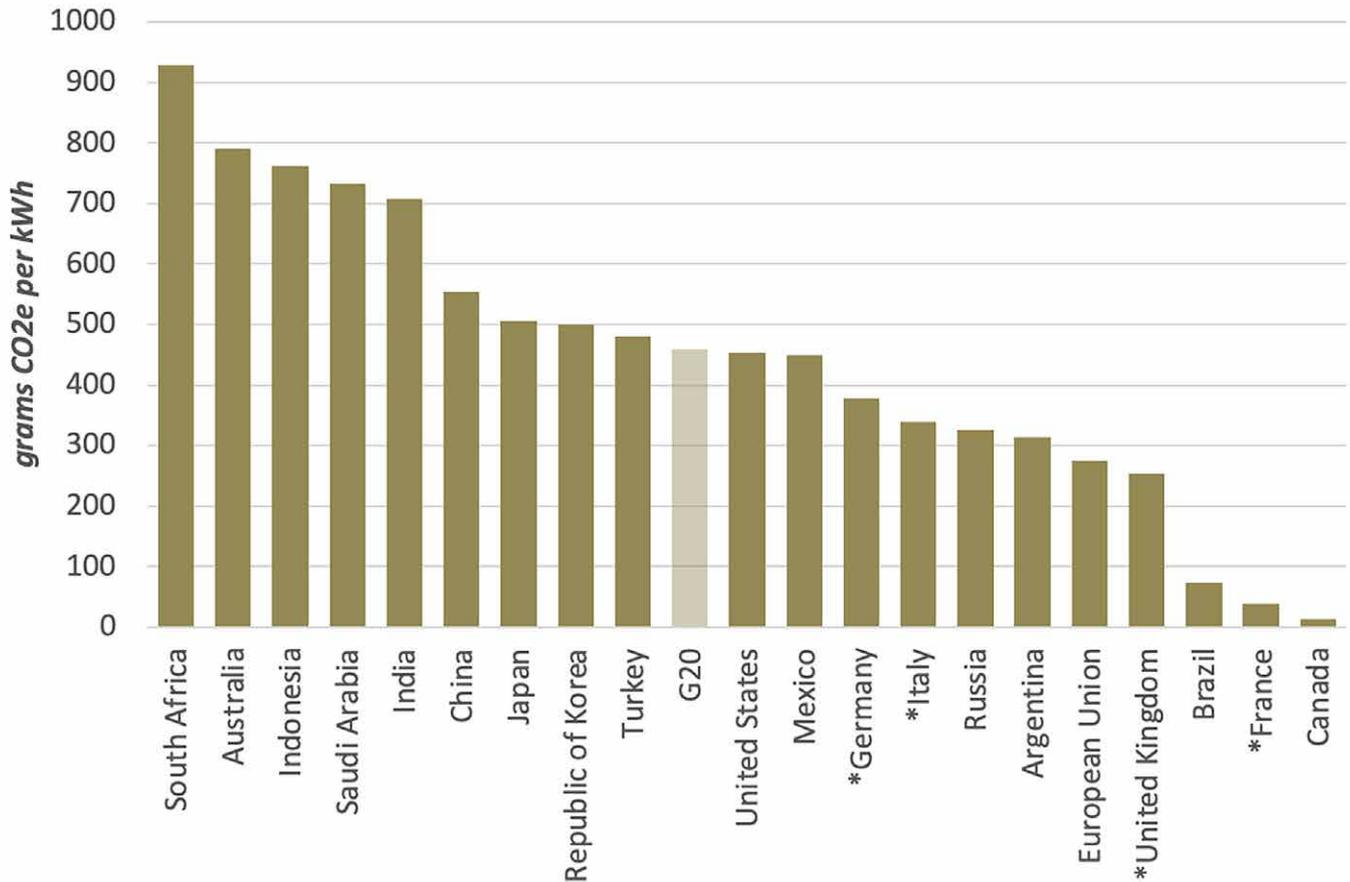
‘Other’ includes sources not specified elsewhere eg pumped hydro, non-renewable waste and statistical discrepancies (which can be positive or negative) (BP, 2020).

UNDERSTANDING HOW MUCH GREENHOUSE GAS WE EMIT

South Africa is not the biggest emitter of greenhouse gases – by a very long way. That privilege rests with the USA and China. But South Africa is an outlier when it comes to the amount of greenhouse gases emitted per unit of electricity produced. This is measured in kilowatt hours (kWh) and Eskom’s

power stations in 2018 emitted 923 grams of CO₂ for every kWh generated. This is down from over a kilogram in 2009 (Carbon Footprint, 2020: 3; SACRM, 2011). Comparable figures were half a kilogram in the USA and China – both of which use a mix of primary energy – and much less than 100g per kWh in Brazil and France, which rely mainly on hydro and nuclear power respectively. ➤

EMISSION INTENSITY GRAMS OF CARBON DIOXIDE EQUIVALENT PER KILOWATT HOUR



* Data is for 2019, not 2018.

Source: Climate Transparency (2019:29); Carbon Footprint (2020)

If you top up your City of Cape Town electricity meter with R600, that buys you 250 kWh. Eskom generates this power by emitting 232kg of CO₂. That is the weight of 12 twenty-litre water containers! And you probably need to buy this amount of electricity many times each year.

South Africa emits 10 to 11 tons of carbon dioxide equivalent per person per year. This compares with a global average of about 6.5 tons per person per year – although the range is wide, from over 20 tons in the US, Russia and Australia to one or two in India and China.⁵

One of the most efficient ways for the world to reduce greenhouse gas emissions is to stop using coal

to generate electricity. But this is one thing South Africa has got used to doing. Heading towards Glasgow, South Africa will re-set its commitments for reducing carbon emissions. It has to do this, and to set tougher goals, in terms of the Paris Agreement, but this is like an alcoholic signing another pledge to drink less.

In 2016, South Africa said by 2025 and 2030 its emissions would be in the range of 398-614 megatons of carbon dioxide equivalent (MtCO₂e) per year (Climate Action Tracker, 2021). It is hard to visualize this. A megaton is 1,000,000 tons, the weight of more than 750 Toyota Corollas.

In 2015, South Africa's CO₂ emissions were 550 MtCO₂e for the whole year – in

2020 it was probably a little less, because of Covid.

Carbon dioxide is a gas. It is transparent and odourless. How on earth do you weigh it? When CO₂ is cooled below minus 78.5°C, it freezes solid. Solid CO₂ – called 'dry ice' – is used in the catering industry to chill food. You can see it in the tubs on ice cream sellers' bicycles. It is also used in entertainment, to create a swirling spooky fog. If you throw dry ice in a river, it 'explodes' darting around, releasing CO₂ until it dissolves. According to Wikipedia, a cubic meter of dry ice weighs 1,562kg.

So, if you could freeze South Africa's greenhouse gas emissions in 2015 into solid dry ice, it would take up a volume



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The entire modern economic history of South Africa has been built on energy from fossil fuels.



of 352 million cubic meters. If you divided this into one cubic metre blocks and laid these next to one another in a row, they would stretch over the horizon and around the world almost nine times although the dry ice would certainly have disappeared into thin air each time you came to the original starting point!

Alternatively, you could pile the cubic blocks of dry ice into four-sided pyramids the size of the Great Pyramid of Cheops in Egypt, 138m in height, built on a base 230m by 230m. South Africa's CO₂ emissions for 2015, properly frozen, would yield 144 of these pyramids. Quite a wonder of the world! These illustrations show that South Africa produces a lot of greenhouse gases. But the amounts and their impacts are hard to comprehend.

Another thought experiment beckons: What if each South African took charge of the 10 tons or so CO₂ e emitted 'on their behalf' during a year (by all households and all industry)? This is 27kg per day, which would be

a block of dry ice the dimensions of a CD case (14 by 12.5cm), but in a short tower 1m high. You could probably fit this, super cold and foggy, under your kitchen sink. Imagine this multiplied by 365 for each day of the year and the population of some 59 million.

Now consider that in addition to electricity, transport releases CO₂. If you drive a car that uses seven litres of petrol per 100km – perhaps a Toyota Corolla – and you drive, say, 100km, the CO₂ emissions will weigh about 16.8kg.

BURNING FOSSIL FUELS EMITS MORE THAN THEIR OWN WEIGHT OF CO₂

The arresting fact here is that seven litres of petrol weigh about 5kg. Yet the CO₂ e emitted weighs over three times more – 16.8kg in this example. This is because petrol is made up of hydrogen (the lightest element) bonded with carbon (atomic weight 12). When the fuel is burned in the engine, the result is (mainly) water (H₂O) and carbon dioxide (CO₂). The oxygen (atomic weight 16), from the atmosphere, is many times heavier than hydrogen. Wikipedia summarises: '1kg of fuel reacts with 3.51kg of oxygen to produce 3.09kg of carbon dioxide and 1.42kg of water.'⁶

The same principle applies with coal: The carbon content of coal varies, but in 2009, Eskom consumed 122.7 Mt of coal and emitted 225.5 Mt CO₂ e.⁷ Other fossil fuels – like natural gas and even oil and jet fuel – emit less CO₂ e than coal when consumed, because of their particular chemical composition (U.S. Energy Information Administration, 2016).

DECIDING HOW MUCH TO CUT OUR GREENHOUSE GAS EMISSIONS

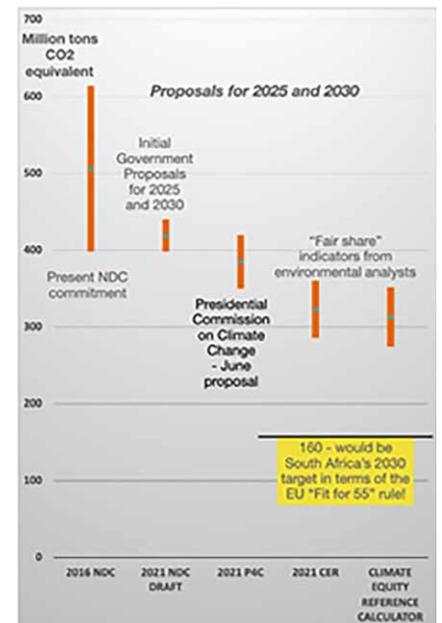
In April 2021, the Department of Forestry, Fisheries & Environment (DEFF) issued its draft of South Africa's Nationally Determined Contribution (NDC) for COP26 for comment. The NDC is a self-imposed emissions reduction target set by countries under

the Paris Agreement on climate change. DEFF proposed a target range of 398-440 MtCO₂ e by 2030 (DEFF, 2021b). Countries must revise their previous targets in the lead-up to COP26, due to be held in the UK in November 2021 (see *The Economist*, 2021a).

Following the June 2021 report of the Presidential Climate Change Coordinating Commission (P4C) government has committed to slightly lower NDC bounds, between 350-420 megatons (Loser, 2021; Paton 2021b).

Environmental groups have said this is still too high. The Centre for Environmental Rights (CER) stated that South Africa's fair share of emissions reduction (to meet the global objective of limiting global warming to 1.5°C) was in the range of 286-360 MtCO₂ e by 2030 (*Business Day*, 2021; Paton, 2021a and b). The climate equity reference calculator suggested a still lower range of 274-352 MtCO₂ e (Loser, 2021).

SOUTH AFRICA'S NATIONALLY DETERMINED CONTRIBUTION (NDC) TARGET RANGES FOR GREENHOUSE GAS EMISSIONS PER YEAR





South Africa's main excuse for staying with coal – its 'cheapness' – has been overtaken by more affordable technology that converts solar power and wind energy into electricity.

President Cyril Ramaphosa says

As a developing economy, we have taken some ambitious and progressive national actions to contribute our best effort to the global cause of addressing climate change under the auspices of the UN Framework Convention on Climate Change (UNFCCC). African countries are among the leaders in ambition, despite their development challenges and carrying the least responsibility for causing climate change ... It is important that the right of developing economies to policy space and sufficient time to achieve a just transition be respected. We should be careful not to advocate one-size-fits-all approaches to disinvestment from fossil fuels or impose non-tariff barriers or discriminatory taxes that would unfairly harm developing economies (Ramaphosa, 2021).

CARBON TARIFF PRESSURE FROM THE EUROPEAN UNION (EU)

The EU, a region which has been able to reduce its reliance on coal quite substantially, is now discussing the imposition of tariffs on goods such as steel and aluminium that are exported by countries where firms may face no carbon price, or one that is lower than Europe's (*The Economist*, 2021b).

The future threat – widely spoken of – is for rich countries to impose 'climate duties' on a much wider range of items to protect their producers – and disadvantage those in developing economies. South Africa, with its world-beating reliance on coal for electrical energy is particularly vulnerable to being hit by such tariffs. They will increase the prices of South African goods in foreign markets and reduce demand for them.

The EU's proposed 'Fit for 55' climate target is for carbon emissions in 2030 to be 55% below their 1990 level. For South Africa, this would mean total emissions of below 160 Mt CO₂e per year.⁸

SOLAR AND WIND ARE CHEAPER – SO WHY NOT MOVE FROM TROUBLESOME COAL?

South Africa's initial, slow responses to threats related to climate change were to try and improve the efficiency of coal-fired power stations, peddling the myth of 'clean coal' and promoting research on 'carbon sequestration' (where carbon dioxide is buried in deep mines). Environmental laws introduced stiff penalties and regulations on the principle 'the polluter must pay'. But the major polluters, Eskom, Sasol and metal producers, either got exemptions or failed to obey the new rules.

In the 1990s and 2000s, coal was still cheaper than the new renewable technologies for solar and wind generation – so long as externalities were not factored in. Other governments chose to subsidise

renewables to encourage companies, farms and households to move off the carbon energy treadmill. South Africa eventually decided to introduce a carbon tax – a good start – but with wide exemptions and reviewable lead times, so tax will not be paid on carbon emissions until after 2022.

But the technologies have changed and costs of solar and wind generation plants have plummeted. In 2020, Max Roser of the scientific online journal, *Our World in Data*, summarised the remarkable declines in the prices of renewable technologies over the last decade. (Single figures are just indicative. Many variables are used to calculate the present cost of a power station over its working life.)

'Electricity from utility-scale solar photovoltaics cost \$359 per MWh in 2009' (Roser, 2020). Within a single decade the price declined by 89% to \$40 per MWh in 2019. The price of onshore wind electricity cost \$135 per MWh in 2009. The price declined by 60% to \$41 per MWh in 2019. Meanwhile, 'the global price of electricity from new coal (levelized costs of energy LCOE) declined from \$111 to \$109. While solar got 89% cheaper and wind 70%, the price of electricity from coal declined by merely 2%' (Roser, 2020).

South Africa's main excuse for staying with coal – its 'cheapness' – has been overtaken by more affordable technology that converts solar power and wind energy into electricity. A hot, sunny country with many windy areas, South Africa has access to an abundance of non-coal options for generating electricity. The way is now open to reduce reliance on fossil fuels for electricity.

Electricity supply from solar and wind will always be intermittent, so there will continue to be a role for coal power generation in the future – and (even more costly) nuclear power. Imperatives here will lessen as batteries and other power storage technologies improve.



SOUTH AFRICA'S SLOW STEPS ON CLIMATE CHANGE

1997: South Africa joined the **United Nations Framework Convention on Climate Change** (UNFCCC) or the Kyoto Protocol and established a National Climate Change Committee (DEFF, 2021a).

2005: The Kyoto Protocol, the UNFCCC's first accord, came into force. South Africa participated, but was not bound to any targets by the Kyoto Protocol. Nor was China. USA and Canada soon withdrew, citing unfairness.

2010: South Africa pledged to reduce its greenhouse gas emissions by 34% by 2020 and 42% below the business as usual (BAU) emission trajectory by 2025 (DEFF, 2021a).

2011: The National Climate Change Response Policy (NCCRP) was approved by the Cabinet, and the national greenhouse gas emissions trajectory range Peak, Plateau and Decline (PPD) was defined.

2013: The concept of '**Nationally Determined Contributions**' (NDCs) was first introduced at COP19 in Warsaw. In 2014 it was agreed all countries, except the poorest, were obliged to make plans to reduce their emissions, though the mechanisms (such as increased use of renewable energy or carbon sequestration) and the speed with which they did so could vary (*The Economist*, 2021).

2015: South Africa submitted its Intended Nationally Determined Contribution (INDC) for COP21, making clear that it was 'currently heavily dependent on coal ... as well as being reliant on a significant proportion of its liquid fuels being generated from coal' (UNFCCC, 2015).

2015: The Paris Agreement, negotiated at COP21, committed the world to a common goal: keeping the world's average temperature to 'well below' 2°C above pre-industrial levels and 'pursuing efforts to limit it to 1.5°C' (*The Economist*, 2021).

2016: The Paris Agreement was ratified by South Africa, the National Framework for Climate Services (NFCS) was finalised, while the Climate Change Bill was drafted (DEFF, 2021a). South Africa said by 2025 and 2030 its emissions would be in the range 398-614 MtCO₂e (Climate Action Tracker, 2021).

2017: *President Trump removes USA from the Paris Agreement.*

Oct 2018: The Presidential Jobs Summit agreed that a statutory body be formed to coordinate the just transition towards a low-carbon, inclusive, climate change resilient economy and society in South Africa (Presidency, 2020). This body will exist in terms of the Climate Change Bill, which is to be tabled in Parliament in 2021. A draft bill was published for comment in 2018 (PMG, 2021; DEFF, 2021a).

Sept 2019: President Ramaphosa promised South

Africa's participation in ensuring a just transition at the United Nations Secretary-General's Climate Summit. He stated that 'Meeting these commitments will be very challenging for South Africa'.

Oct 2019: The 'development of a just transition plan' was a key decision reflected in the new Integrated Resource Plan, 2019 (Department of Energy, 2019).

2020: The National Climate Change Adaptation Strategy (NCCAS) was approved by Cabinet (DEFF, 2021b).

9 Sep 2020: The **Presidential Commission was established** to co-ordinate the country's transition to a low-carbon economy and build consensus among social partners for a 'just transition'. It is chaired by President Ramaphosa with former cabinet minister Valli Moosa as deputy (Paton, 2021a). Instruments of the commission for informing policy and directing action include: the National Employment Vulnerability Assessment (NEVA) and Sector Job Resilience Plans (SJRP), both of which involve key stakeholders.

Dec 2020: President Ramaphosa appointed the initial 22 members of the inaugural Presidential Climate Change Coordinating Commission (P4C), which is chaired by the President. The terms of reference specifies its tasks, including advising on South Africa's climate change response (Presidency, 2020). Its first meeting was in February 2021 (DEFF, 2021a).

2021: *President Biden returns USA to the Paris Agreement.*

30 Apr 2021: A draft of South Africa's NDC for COP26 was issued for comment by DEFF. This proposed a target range of 398-440 megatons of carbon dioxide equivalent by 2030 (DEFF, 2021b).

May 2021: The International Energy Agency, an intergovernmental forecaster, called for an immediate halt to all new oil and gas exploration projects and an unprecedented switch to renewable energy. This was part of a new 'roadmap' detailing the policies and innovations that countries would have to pursue for the world to reach 'net zero' carbon dioxide emissions by 2050. This is a stark challenge to South Africa, which is rolling out a range of oil and gas exploration projects at present (*The Economist Espresso*, 19 May 2021).

Sep 2021: South Africa submitted an updated NDC which reduced the 2030 target range to between 350 and 420 megatons. This followed the recommendations of the majority of the P4C. The Executive Director of the Commission is Dr Crispian Olver (RSA 2021; Paton, 2021a and b).

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ENDNOTES

1. This is 'due to its energy-intensive industries and the high share of coal use.' See Climate Action Tracker (2019), citing DEA (2017). South Africa's 2nd Biennial Update Report. Retrieved from http://unfccc.int/files/national_reports/nonannex_i_parties/biennial_update_reports/application/pdf/south_africa_2nd_bur.pdf.
2. See the Summary for Policymakers in The Fifth Assessment Report (AR5) of the United Nations Intergovernmental Panel on Climate Change (IPCC), 2014. AR6 will be issued in 2022.
3. https://www.eskom.co.za/AboutElectricity/ElectricityTechnologies/Pages/Coal_Power.aspx. Eskom's website explains here that solar and wind energy are expensive and unreliable.
4. See the summary at <https://www.cliffedekkerhofmeyr.com/en/news/publications/2019/Corporate/energy-alert-22-october-The-Integrated-Resource-Plan-2019-A-promising-future-roadmap-for-generation-capacity-in-South-Africa.html>
5. / CAT-Decarbonisation-Indicators.AllData.190421.xlsx|DataSelector - Pivot
6. <https://en.wikipedia.org/wiki/Gasoline>
7. SACRM, 2011, Overview of the South African Coal Value Chain. Prepared as a basis for the development of the South African Coal Roadmap (SACRM), October 2011. Available at <http://www.fossilfuel.co.za/initiatives/2013/SACRM-Value-Chain-Overview.pdf>. Sasol mining (also in 2009) produced 39Mt of coal for the Sasol chemical processes, yielding 60Mt CO₂e.
8. The Economist, (2021b); Climate Action Tracker (2020) Country Assessments September 2020. Available at: <http://climateactiontracker.org/> Country: South Africa. Emissions in 1990 were 354.7 Mt CO₂e. **NA**