# Creating employment and reducing emissions: Options for South Africa

**Harald Winkler and Anthony Black**

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DSI/NRF SOUTH AFRICAN RESEARCH CHAIR IN INDUSTRIAL DEVELOPMENT

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## Abstract

Apart from having amongst the highest rates of unemployment and inequality in the world, South Africa is also a highly emissions-intensive economy. This paper examines the key drivers of the historical growth path that led to an economy based heavily on mining, mineral processing and heavy industry, subsidised by cheap electricity. It then considers how South Africa could shift to a more employment-intensive and low-emissions development path. An integrated employment and mitigation strategy is required. This means aligning the two objectives, seeking synergies across industrial, energy and climate policy, while at the same time managing trade-offs.

Keywords: Employment intensity; carbon intensity; climate change mitigation; unemployment; South Africa; poverty; capital intensity; industrial policy; energy policy; climate policy

JEL codes: E24, Q54, I3, L52, J18

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## 1. Introduction

In South Africa (SA), very serious development problems co-exist with high emissions intensity. The triple challenge of unemployment, poverty and inequality is depressingly persistent. At the same time, the climate emergency means that deep decarbonisation is required in all countries, starting immediately.

South Africa has the dubious distinction of having amongst the highest rates of unemployment and inequality in the world. It is also one of the most emissions-intensive economies, measured in greenhouse gas (GHG) emissions per unit of economic output. The official unemployment rate was 29% pre-COVID, but if discouraged workers are included and with the impact of the pandemic, it increased to 44.4% by the second quarter of 2021 (StatsSA 2021). This is a social, economic and political disaster of immediate concern. In absolute annual GHG emissions, South Africa ranked 17th in the world in 2018 (WRI 2021). Lack of action on climate change has turned this into a crisis needing drastic action, along with the need to shift development paths to net zero in the long term. A just transition process is essential if future development is not to follow historical patterns.

The co-existence of high unemployment and high emissions intensity is not just a coincidence. South Africa's history of segregation and apartheid has had profound implications for its development path. For example, one outcome was an economy heavily based on mining, mineral processing and heavy industry, subsidised by cheap electricity as well as other incentives. This was the so-called 'minerals-energy complex' (Fine and Rustomjee 1996), whose history and effect we examine further in section 2.

The paper explores the following questions:

1) What has been driving the SA economy in terms of low employment and high emissions intensity and how has this been changing over time?

2) How could SA get onto an employment-intensive and low-emissions development path, focusing on industrial and energy policy?

To explore these questions, we analyse how South Africa arrived at its current position and then consider what an employment-intensive and low-emissions development (EILED) pathway might mean. Among many policy priorities, we focus on employment and emissions intensity.

The paper proceeds as follows: Section 2 outlines in more detail the historical development path. We explore the minerals-energy complex, how it has skewed industrial development and dominated the energy economy. In Section 3, opportunities to shift industrial and energy development paths in the future are assessed. We analyse potential areas for intervention and propose policy instruments. Section 4 concludes.

## 2. How the minerals-energy complex historically shaped industrial and energy policy

Historical development in South Africa was dominated by a 'minerals-energy complex', shaping not only energy, but also industrial, policy (Fine and Rustomjee 1996). The seminal work on the political economy of energy by Fine and Rustomjee (1996) argued that the economy had been driven by resource extraction and the development of an associated set of interrelated economic activities, which they referred to as the 'minerals-energy complex' (MEC). As the name suggests, the complex comprises mining, minerals processing and the energy sector, but Fine and Rustomjee also showed how government, influenced by the MEC, took industrial policy decisions that favoured mining, electricity and liquid fuel supply and minerals beneficiation. The establishment of Sasol is an extreme example. Undertaken for strategic reasons, investments in this state-owned synfuel producer were the main reason that the chemical sector accounted for no less than 64% of increments to the manufacturing capital stock for the period 1976 to 1983 (Levy 1992). Incentives facing private-sector firms were biased towards the use of capital-intensive methods (Black and Hasson 2016). These included depreciation allowances and subsidised interest rates.

Beneficiation was underpinned by what was then some of the cheapest electricity in the world (Fine and Rustomjee 1996). This was a capital- and energy-intensive development pathway. The MEC had political influence disproportionate to its contribution to economic output. Historical studies have documented in detail how the MEC shaped both energy (Marquard 2006) and industrial policy, constraining the potential for mitigation (Burton 2011).

Post-1994, the state continued to support key firms in the MEC (Burton 2011). Incentives continued to prioritise mining and minerals, despite industrial policy aims to diversify. These sectors are electricity and emissions intensive, as coal has continued to provide the bulk of electricity. Funding for black economic empowerment has also supported MEC sectors (Burton 2011). Capital-intensive and high-emissions development did not produce socio-economic benefits and employment for the majority.

While the history of South Africa was deeply shaped by Apartheid, and no other country describes the political economy of energy as a 'minerals-energy complex', the aspiration to create employment while reducing emissions is shared by many countries. However, the most recent IPCC assessment of literature on mitigation found that "distributional issues, employment, and social cohesiveness, have limited coverage – despite being among the key Sustainable Development goals that policymakers will consider" (Fleurbaey et al. 2014). More recent studies have begun to close the gap. A study for the ILO found that strategies aiming at net zero $CO_2$ in Latin America and the Caribbean, "by 2030 [with] structural changes in production and consumption patterns can result in 15 million more jobs compared with a business-as-usual scenario" (Saget et al. 2020). La Rovere (2020) explores the possibilities of a low-emission development strategy (LEDS) in Brazil designed to the minimise economic and social effects of decarbonisation by using policies such as governmental transfers (which

under the Lula administration reduced inequality) to reduce inequality. He argues that the Brazilian example, even in the context of becoming an oil producer, can be used as an example for other developing countries to shift from the high-emissions development pathways established by industrialised countries (La Rovere 2020). The author also points to the need for finance for transitions that can credibly claim to be just by creating employment. A just transition transaction has been explored for SA (Meridian Economics 2020; Winkler et al. 2020), in terms of a specific instance of transformative finance (Ward et al. 2020; World Bank 2020).

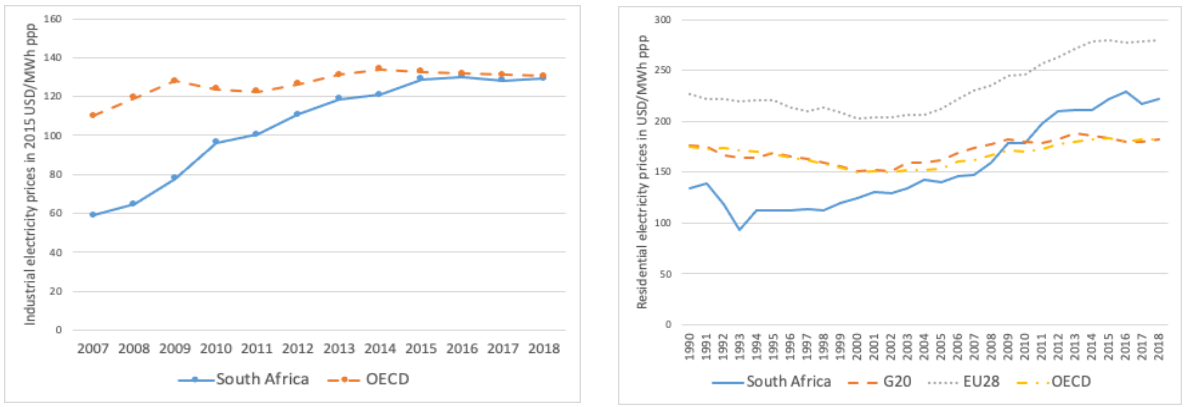
## 2.1 Empirical background: SADC trade

Industrial policy has been a central component of state policy in South Africa, both before and after the democratic transition. However, for a number of reasons the manufacturing sector has performed poorly in terms of both output and employment. Moreover, because of the concentration in heavy industry, it is a major contributor to the high emission intensity.

Under Apartheid, industrial policy favoured capital-intensive firms and Bantu Education contributed directly to a limited supply of skilled workers. The Apartheid government benefitted from its relationship with firms in the MEC. After 1994, the MEC sectors became important in BEE, which was originally intended to meet broader socio-economic objectives, but became limited to the transfer of ownership (Hirsch 2021).

Another contributor to the development path was the cheap electricity based on coal (Figure 1, based on data from the International Energy Agency (IEA)). Electricity prices in industry were significantly lower than in the OECD countries in 2007, but were very similar by 2018. This comparison is shown on the left-hand side of Figure 1, with industrial electricity prices in 2015 USD/MWh on the basis of purchasing power parity. The right-hand panel shows that South African residential customers were paying less than elsewhere from 1980 to around 2010. Since around 2008, however, residential electricity tariffs have increased above inflation, as investments in a new build programme were to be covered by revenue from tariffs. Households are now paying somewhat more than the global average, though still less than in the EU.

**Figure 1: Comparative electricity prices for the industry, 2007-2018 (Panel A) and the residential sector, 1990-2018 (Panel B) (2015 US$ppp/MWh)**




Source: Janoska and Miao (2021 forthcoming), drawing on IEA (2021)

Cheap coal-based electricity underpinned the development of the MEC (Burton 2011). Cheap energy was the result of an extraordinary pricing policy, which itself was based on low-cost (and poor-quality, high-emitting) coal, at prices significantly lower than those paid in other countries. Electricity was low in financial cost terms, not counting the social costs of externalities (Van Horen 1996; Edkins et al. 2010; Nkambule and Blignaut 2012). Apart from low electricity prices, heavy industry received other forms of government support, including export incentives, tax allowances, subsidies for 'strategic' projects and assistance with dedicated infrastructure. In the late 1980s, government policy became more promotive of manufactured exports. The General Export Incentive Scheme (GEIS) was one measure used. It was heavily biased towards capital-intensive sectors (Edwards 2001). A major beneficiary was the steel producer, Iscor, along with other exporters of processed metals and basic chemicals.

Over-capacity of electricity generation in the early 1990s led to efforts to attract heavy industry by offering special discounts on already low Eskom prices (Marquard 2006). This led to the rapid expansion of an already large metals-processing sector and included the Alusaf aluminium smelter, which came into operation in 1996 (Black and Hasson 2016). Perhaps surprisingly, this policy continued well after the democratic transition, and the Developmental Electricity Pricing Programme (DEPP) was introduced to encourage investment by energy-intensive users in 'beneficiation of downstream industries'. This was done by offering low electricity tariffs (the dti 2005). The DEPP is also referenced in broader electricity pricing policy (DME 2008), and see the discussion of the Energy Intensive Users Group (EIUG) in section 2.2 below.

In 2007, when electricity constraints were already becoming evident, Alcan was offered low long-term prices to proceed with the establishment of a new aluminium smelter at Coega. In the end, this was never built as power shortages loomed. More recently, the National Energy Regulator still has a standard application process for negotiated price agreements, which can

include high GHG-emitting processes, such as steel production, aluminium smelting and the recently approved package for carbide production – although the prices are redacted (NERSA 2018). The DEPP policy essentially promoted energy-intensive and trade-exposed (EITE) sectors, which is at direct odds with climate-mitigation objectives and leads to little direct employment.

While the democratic government set a new path for industrialisation, de facto support for heavy industry continued at a high level. Section 37E of the tax code offered accelerated depreciation allowances for steel and other large-scale investments. Heavy industries such as steel, ferro alloys, basic chemicals and pulp and paper were also supported by the Strategic Industrial Projects (SIP) programme (Black and Hasson 2016).

Through its Critical Infrastructure Programme (CIP), the DTI also provided part of the cost of infrastructure deemed necessary for large-scale 'strategic' projects. Much of this went to industrial development zones. Established at vast expense, these zones also sought to attract major capital-intensive projects such as the aforementioned proposed aluminium smelter at Coega.

Import parity pricing by large metals producers limited downstream development. Large monopolistic or oligopolistic firms engaged in the processing of minerals and basic chemicals production were able to exercise market power and charge import-parity prices to downstream producers in South Africa (Black and Roberts 2009; Roberts and Rustomjee 2009). This was counter to the conditions stipulated in incentives such as 37E, which required beneficiaries not to set prices hat resulted in higher margins in the domestic market. The outcome constrained the development of more labour-intensive firms in sectors such as metal products and plastics, for instance.

Another factor that militated against more labour-intensive downstream manufacturing was the lack of skills development. The number of artisans being trained declined from the 1980s to the early 2000s. A World Bank survey showed that the shortage of higher-level skills resulted in much higher wages for artisans, technicians and managers in relation to comparator countries such as Poland and Brazil (Clarke et al. 2007). Barnes et al (2017), in a study comparing South Africa and Thailand, found a similar picture.

The employment intensity of manufacturing has also been affected seriously by the dramatic decline in light manufacturing, especially in the ultra-labour-intensive category, which includes clothing, leather, footwear and furniture. These sectors were adversely affected by trade liberalisation in the 1990s, but employment fell a further 47% from 2000 to 2019 (Black 2021). Many of South Africa's upper middle-income peers show much stronger performance in these sectors. Examples include Turkey and Thailand in garments and Mexico and Malaysia in electronics. South Africa, in contrast, has not only failed to develop export markets, but has been unable to compete in the domestic market. There are a number of reasons for this. In addition to trade liberalisation, the dismantling of the apartheid-era decentralisation programme also had an effect. Labour legislation, in particular the extension of National

Bargaining Council agreements to non-parties, has also had a negative effect on firms, especially in non-metropolitan locations (Nattrass and Seekings 2016). The failure to mobilise investment in light manufacturing is in striking contrast with the massive efforts to develop heavy industry over a period of decades.

In the slow-growing economy, the share of manufacturing in GDP declined sharply to just 11.8% of GDP in 2019. Manufacturing employment peaked in 1981 at 1.79 million, but by 2019 had declined to 1.22 million (Black 2021 forthcoming). The sector has always been extremely capital intensive compared to countries with comparable per capita incomes (Levy 1992; Clarke et al. 2007). Growing capital intensity has compounded the employment effect of low growth. Employment per million rand of manufacturing output (in constant 2010 prices) declined sharply, from 3.1 employees in 1972 to just 0.8 in 2016 (Mercer 2020). Shifts between manufacturing sub-sectors, capital intensification and skill-biased technical change account for this decline. This reflects a pattern of growth that is the result of a number of factors. Two stand out in relation to the scope of this paper – the support for heavy industry and the (not unrelated) decline in light manufacturing.

More recently, the expansion of heavy industry has slowed. There have been a dearth of new investments, as well as plant closures, which have included the mothballing of Arcelor-Mittal's Saldanha Steel plant in 2020. South Africa's historical growth model is no longer viable. Instead, the MEC is unwinding. Its major pillar was cheap (subsidised) electricity. To a degree, this continued post-1994, benefitting electricity-intensive firms for which electricity is a major cost. Even as late as 2011, electricity prices for industrial users were cheaper than in low-cost countries such as Russia, the US and Korea, and one third of the cost in Germany (Black and Hasson 2016). But this growth path became increasingly unsustainable. Higher energy costs and serious supply interruptions have been a key factor, along with rail and port inefficiencies. Coupled with this has been the gradual withdrawal of state support and the poor performance of the mining sector.

The adjustment costs as South Africa transitions to a more 'normal' economy are high. Continued state assistance is very costly and includes support for new coal-fired power plants, subsidies for new privately owned coal plants, public finance directed at coal mining and direct state involvement in coal extraction, as well as regulated prices for liquid fuels that protect the conversion of coal to liquid fuels, sustaining carbon lock-in (Burton et al. 2018b). Increasing levels of debt in state-owned enterprises (SOEs) for electricity (Eskom), transport, aviation and arms manufacturing are putting public finances at risk. While diversifying away from coal has been the energy policy for more than two decades (DME 1998), shifts have only started occurring with climate policy and more competitive renewables since the 2010s.

## 2.2 Energy economy based on subsidised coal-based energy led to high emissions

The MEC shaped the energy sector and policy in South Africa – perhaps more obviously than its influence on industrial policy. Major actors in the MEC depend on coal, which has been the

dominant fuel in South Africa's energy economy. In addition to coal-fired power, about 30% of liquid fuel supply comes from coal to liquids – a single facility run by Sasol. Sales of liquid fuels of 50 million barrels in 2020 were somewhat lower than in the previous year – due to the COVID pandemic – but higher than expected due to a quicker recovery in fuel demand (Sasol 2020). The political economy of energy supply therefore is dominated by a duopoly – Eskom and Sasol. Significant actors include coal mining firms upstream, and electricity-intensive industry downstream.

The country's dependence on coal was entrenched in the 1970s, with massive infrastructure investment in new coal mines, large coal power plants, coal-to-liquid fuel plants and a major rise in coal exports – all developments that were very strongly supported by the state (Burton 2011). Rent seeking around coal has been an important factor shaping the energy sector, requiring management for a transition (Fakir 2017). This also underpinned the rapid expansion of heavy industry, including steel, mineral processing and basic chemicals. Electricity-intensive industry dominated exports (Fakir 2017), even as historically low electricity tariffs started to rise.

A sector jobs resilience plan for the coal value chain found 120 000 workers: two thirds or 80 000 in coal mining, with smaller shares in electricity supply (12 000 in Eskom), 26 000 at Sasol, and 2 000 small coal truckers (Makgetla et al. 2020). Yet employment in coal has declined. Employment in coal mines peaked in the early 1980s, at around 140 000 jobs, declining as capital intensity increased, and had almost halved by 2015 (Strambo et al. 2019). Future projections suggest further declines, driven externally by reduced global demand for SA coal exports, potentially exacerbated by domestic trends to automation and the digital economy. Another study projects that coal sector-based employment will decline by 35% to 40% between 2020 and 2050 (Hartley et al. 2019).

South Africa's electricity sector has long been dominated by coal. Eskom generates more than 90% of electricity supply, with more than 80% coming from coal-fired power stations (Eskom 2019) located in Mpumalanga. There is one nuclear reactor near Cape Town and, since 2010, there has been a rapid growth in renewable energy – mainly wind and solar photovoltaics (PV) distributed more widely across the country. Eskom is a vertically integrated utility and controls transmission as the system operator. Eskom's coal fleet is ageing and unreliable, with load-shedding since 2008. The electricity availability factor published by Eskom dropped from around 85% in 2010 to 67% in financial year 2020 (Eskom 2020a). While wind and solar PV could be built rapidly, the Department of Mineral Resources and Energy delayed relaunching the REI4P programme from 2015 (when bid window 4 was completed) until its relaunch in 2021.

Distributed generation can take the form of small-scale embedded generation (SSEG), where households or firms in commerce or industry generate electricity. SSEG is potentially disruptive to relations between Eskom, as a historically monopoly supplier, municipal electricity supply departments and customers (Filipova and Morris 2018). The SA Local

Government Association called for a "restrictive" limit of 10 MW on SSEG to be increased for several years (SALGA 2018), with the four largest metros in South Africa having a total legally installed capacity of 38.46 MW (Filipova and Morris 2018). SSEG is also one possible form of community ownership of renewable energy, for example in low-income apartment blocks or in "solar farms" with localised energy distribution (Overy 2018). However, the Energy Ministry took several years to increase the limit per installation. As load-shedding resumed in 2020/2021, pressure to increase the limit increased, with various industry associations calling for at least 50 MW per installation. In total, a review of estimates suggested that "at least 5.2 GW per year" was available (Renaud et al. 2020), enabling more SSEG than in the official IRP. In June 2021, President Ramaphosa indicated that the limit would be increased to 100 MW, a measure seen by many observers as overruling Energy Minister Mantashe (Merten 2021). Public reactions were generally positive, although some pointed to the risks of a 'utility death spiral' (increased energy efficiency/distributed generation leading to declining demand, increased tariffs and more pressure on customers to reduce demand (see, for example, Laws et al. 2017)).

Renewable energy has been procured from independent power producers (IPPs) in a programme widely considered a success (Eberhard et al. 2014).[1] The REI4P has requirements for socio-economic development, which also is a significant advance even though its implementation faces challenges (Wlokas 2017). While renewable energy has grown rapidly and has been required to contribute to socio-economic development, it is still a relatively small share of electricity generated. Many older coal plants have units failing – for complex reasons including insufficient maintenance – and even the new units at Medupi and Kusile have not operated consistently due to design flaws. This would suggest a compelling case to build capacity fast – and wind and solar PV have short lead times (nuclear power does not). Yet the political economy has meant resistance from parts of government, some unions and other stakeholders. The fourth bid window of the REI4P was completed in 2015 (IPP Office 2015), but then stalled for six years, with bid window 5 only being announced in April 2021.[2]

Despite recent increases (Figure 1), electricity tariffs are not considered cost reflective by Eskom. Eskom made proposals to restructure tariffs to more fully reflect a 'cost to serve' (Eskom 2020b), motivating that fixed costs need to be costed more accurately with a changing electricity supply industry.

Eskom debt is the largest part of sovereign debt, with guarantees to state-owned enterprises reaching R683 billion by 2019, of which Eskom had the largest facility, at R350 billion (51%). This led the Minister of Finance to state that "SOEs pose very serious risks to the fiscal framework" (Mboweni 2019). Eskom's interest payments are between R20 billion and R28 billion per year (De Ruyter 2020), and the utility is unable to meet these obligations. More

[1] But see Morris et al. (2020) for a critique of policy implementation, especially in relation to industrialisation opportunities.

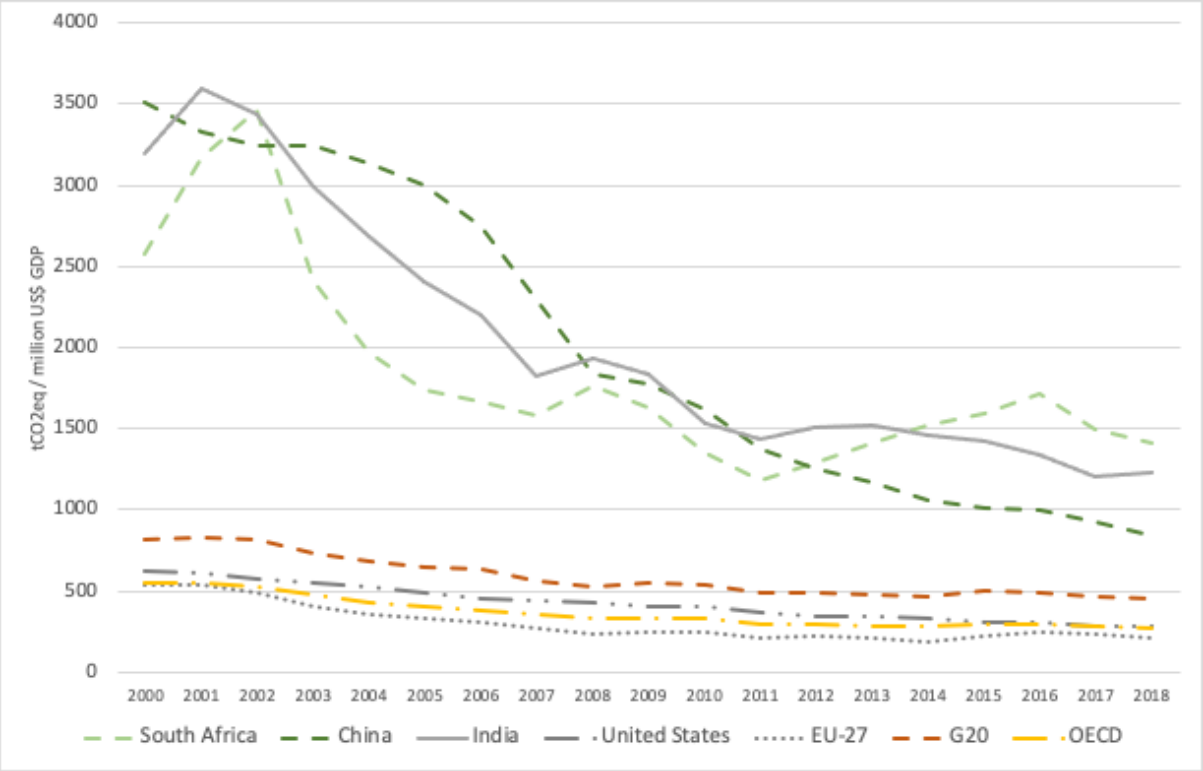
[2] https://www.ipp-renewables.co.za/

recently there has been some early evidence of a turnaround. In May 2021, Public Enterprises Minister Gordhan indicated that Eskom had reduced its debt by R83 billion by paying off mature loans and benefitting from exchange rate movements. However, a massive debt of R401 billion remained (Paton 2021).

A powerful actor in the electricity sector and more broadly is the Energy Intensive Users Group (EIUG). Coordinating large users of electricity, the group accounts for about 40% of electricity demand (EIUG 2021). The EIUG engages with Eskom as 'key customers', seeking favourable tariffs (beyond what would result from distribution costs to large customers being lower).

SA's development path has led to high greenhouse gas (GHG) emissions, four-fifths of which are attributable to energy supply and use. The energy sector, both supply and use, contributed between 78.1% and 81.2% to gross national GHG emissions in 2015 (DEA 2019). Most of the increase (84.8%) in emissions from 2000 to 2015 is due to energy supply and use (DEA 2019). About 83% of the mitigation envisaged for the targets in SA's draft updated nationally determined contribution (NDC) have been modelled to come from electricity (UCT 2021). Consequently, integrating low emissions into energy policy and electricity planning is essential to achieving climate-mitigation objectives. The electricity sector is the largest sub-sector for mitigation, and the integrated resource plan (IRP) has included carbon constraints in the last two iterations (DoE 2011, 2019). This is in line with global trends, with rapid decarbonisation of grid-connected electricity identified as a key mitigation option internationally (Clarke et al. 2014; Rogelj et al. 2018; Davis et al. 2018). Given the historical development of energy and emissions, SA's emissions intensity is high, as shown in Figure 2. In 2018, dividing the emissions of all greenhouse gases (including LULUCF) by economic output as measured by GDP on a purchasing power parity basis, SA's emissions intensity was 2.5 times the global average, about five times higher than in the US, and almost seven times that of the EU. Compared to developing countries with significant coal, SA's emissions intensity is similar to that of India, but higher than that of China. However, as Figure 2 shows, emissions intensity in these countries has been declining significantly since 2000. Brazil is not shown here, having a clean energy matrix with hydro-electricity and biofuels – which may change after the discovery of pre-salt oil.

**Figure 2: South Africa's emissions intensity compared to selected countries and regions (tons of $CO_2$-eq, all Kyoto greenhouse gases, per million US$ of GDP ppp)**




Source: Authors' graph, based on data in WRI Climate Watch[3]

The large negative externalities from emissions of global greenhouse gases and local air pollutants have long been studied as social costs (Van Horen 1996), and the "destruction of the Highveld" continues to be documented and external costs quantified (Hallowes and Munnik 2016; CER 2019). Yet external costs have been internalised only to a limited extent, through a carbon tax at a rate that is too low to transform the energy economy (ERC 2018).

## 3. Opportunities to shift industrial and energy development paths in a new direction

### 3.1 The current situation: Crisis and opportunity

The history of the political economy shaped by the MEC is one in which the country has followed a capital- and energy-intensive development path. This development pathway has brought us to an economy and society with low employment and high GHG emissions. The current situation, characterised by multiple crises, also offers opportunities for change.

[3] Available online at https://www.climatewatchdata.org/ghg-emissions?end_year=2018&start_year=1990

The economy contracted by 7.2% in 2020 as a result of COVID-19, and has recovered partially, with projected growth of 3% in 2021. Even before COVID, public debt had been rising fast – from 26% of GDP in 2008/2009, it increased to 63.5% in 2019/2020. With the huge budget deficit induced by COVID, it increased to 81.8% in 2020/2021 (Burger and Calitz 2021). Under COVID, South Africa – just like other emerging economies with limited fiscal space – has taken on more international debt making use of various COVID response facilities.

To add to the problems of unemployment and low growth, South Africa's energy system is in a severe state of crisis. Since 2008, power outages and rapidly rising prices have curtailed growth and new investment. Due to mismanagement and large-scale corruption, Eskom has drastically underperformed. The transition to renewables has been painfully slow since 2015. The supply crisis has led to desperate measures, such as the recently proposed use of power ships. Although the deal still needs to be finalised, the Turkish firm, Karpowerships, has won bids under the Risk Mitigation Independent Power Producer Procurement Programme (RMIPPP) power purchase agreements for 20 years (Mantashe 2021). While such approaches might be necessary in an emergency, signing such long-term contracts makes no technical or economic sense. Proposals to allow self-generation have been expanded to 10 MW, but despite overwhelming support across social partners, not to 50 MW.

At the same time, the crisis facing the country has created opportunities. As a result of COVID-19, large investments will be made in the reconstruction and recovery plan (Presidency 2020a). This represents a massive reallocation of resources, which can lock South Africa into continued high-emissions, capital-intensive development, or shift to employment-intensive and low-emissions development. Whether the recovery from COVID is 'greened' and how it creates employment will be decisive. The recovery plan includes a section on 'greening' (Presidency 2020a) and is accompanied by a "mass employment strategy" (Presidency 2020b).

The Eskom crisis has precipitated action on unbundling, which has long been debated but is only now being implemented. Ideological positions on market fundamentalism or a developmental state have held back attempts to mediate the genuine differences in interests. Yet the depth of the crisis is now forcing movement and enabling consensus on a way forward. Generation, transmission and distribution are to be divided into separate companies, but still controlled by Eskom Holdings. This will be followed by legal separation (National Treasury 2019). Other suggestions have made to use PIC funds for Eskom and in support of a just transition (AIDC 2020). In these approaches, Eskom would play a role in renewable energy, which would be a dramatic shift from a coal-based incumbent resisting change to the current regime (Ting and Byrne 2020). A new CEO was appointed for Eskom from January 2020, and he has referred to "divisionalisation" (De Ruyter 2020). De Ruyter has established a just transition office within Eskom, marking an important shift by the utility to engage proactively on employment-intensive and low-emissions development. The Finance Minister has indicated that it will be "possible for municipalities in financially good standing" to purchase electricity from independent power producers (Mboweni 2020).

Eskom's need for finance could be met by concessional climate finance, creating an opportunity to support a just transition to net zero $CO_2$. The country, and Eskom as the largest emitter, have both committed in principle to net zero $CO_2$ by 2050 (RSA 2020; Ramaphosa 2021). A just transition transaction has been developed, in which development finance institutions would provide concessional finance, blended with domestic investments (Meridian Economics 2020b). The transaction would fund the accelerated phase-out of coal-fired power, with direct flows to a fund to support social justice for affected workers and communities (Winkler et al. 2020). There is an opportunity to access international climate finance, which would assist in Eskom regaining access to capital markets, relieving pressure on the fiscus, and helping to achieve a long-term goal of net zero $CO_2$.

Another opportunity is that we have passed a 'tipping point' in that the costs of renewable energy (RE) technologies are now lower than coal for electricity. In the past, coal-fired power was considered least-cost in financial terms and modelled as part of 'business-as-usual' scenarios (Winkler et al. 2011), but this has changed as wind and solar PV have become cheaper than new coal. Recent modelling shows significant decarbonisation as part of least-cost pathways; in other words, while past modelling would typically have included a green RE policy case, RE now is part of the modellers' reference case (McCall et al., 2019; Wright et al., 2019). Another study modelled 100% renewable energy by 2050, finding that "pure market economics" – without GHG emissions costs – led to 96% of electricity from renewable energy, and that "a 100% renewable energy system is the least-cost, least-water intensive, least-GHG-emitting and most job-rich option for the South African energy system in the mid-term future" (Oyewo et al. 2019). RE is key to low-emissions development. To what extent it creates employment is a matter to which we return in section 3.4.2 below.

## 3.2 Institutional structures and strategies

Employment-intensive and low-emissions development has the potential to address key development and climate challenges in South Africa. Work has been undertaken on visions as part of national planning in Vision 2030 (NPC 2011) and for climate with a longer time frame, of 2050 (NPC 2019). To realise a vision, institutional structures – both existing and new – need clear functions that would enable specific policy instruments to guide implementation, assessing how they can be combined (synergies and trade-offs), and how to best sequence them.

Existing and new institutions with deliberative and analytical functions could tackle three main challenges – setting strategy, building consensus and coordinating implementation (Dubash et al. 2021). A new institution that has been established is the Presidential Climate Commission (PCC), which could play a key role in coordinating efforts across various sectors of government. This would include vision setting, policy recommendations, facilitating implementation and monitoring.

We argue that a new settlement is needed on employment-intensive and low-emissions development. There may be more generative potential for EILED in the PCC and NPC – the former with a climate focus and the latter paying attention to economic planning. The NPC reviewed developments against its Vision 2030 and found a significant lack of progress. It has since called for promoting "employment creating sectors [including by making] more capital available for labour-absorbing investments" (NPC 2020).

A revised industrial policy would provide a greater focus on light manufacturing, aimed in part at building a competitive advantage in these sectors. This does not mean technological upgrading is unimportant, but growing employment is the best way to upgrade human capital, thereby increasing possibilities in more advanced manufacturing. Subsidies for beneficiation should continue to be phased down, as should subsidies for capital equipment as apply in the automotive industry and other sectors. These resources should rather be applied to training and upskilling in conjunction with the private sector. But, as Tregenna (2015) points out, direct sectoral employment intensity should not be the only criterion for targeting policies that seek to promote a rapid and sustainable expansion of employment. Such policies could retard competitiveness and undermine long-term growth.

Climate policy objectives cannot be achieved in isolation. A developmental approach needs to be taken to climate action. "Climate change is an all-of-government and an all-of-society problem" (Dubash, 2021 forthcoming). For South Africa, a "new energy and industrial policy paradigm is … a prerequisite for an effective mitigation strategy" (Burton 2011). As energy, industrial and climate policy are not aligned, building consensus requires dedicated effort.

## 3.3 The sectoral influence of interventions

Policy interventions to achieve these objectives will have a very differentiated effect, depending on employment and emissions intensity. Figure 3 shows a typology of sectors in a two-by-two box categorised by employment and carbon intensity, resulting in four quadrants (labelled A to D). Quadrant D indicates sectors that have low employment intensity (i.e. are capital intensive) as well as being emissions intensive. The green quadrant (A) lists sectors that are employment intensive with low emissions.

The quadrants provide an indication of the possible sectoral influence of various policies, as well as a guide to where one might intervene. The aim is not to target only some sectors, but to locate interventions in a quantitative mapping of sectors that have both high employment multipliers and low carbon intensity.[4] For instance, higher electricity prices or carbon taxes are likely to have a more negative effect on quadrants B and D. Policies to support employment may have a bigger effect on quadrants B and A.

[4] This section draws on work undertaken for a Master's thesis by Nicola Wills, under the supervision of the authors. We will include a reference to her thesis once it has been published. See also work on employment multipliers by Tregenna (2015, 2010) and recent work on carbon intensity and inequality by Reeler (2021).

**Figure 3: Typology of sectors according to level of employment and emissions intensity**

| Employment intensity | Carbon intensity: High | Carbon intensity: Low |
|---|---|---|
| High | **B.** Textiles (311, 312); Agriculture (11); Fishing (13); Machinery & equipment (356-359); Building construction (502); Metal products excluding machinery (354, 355); Civil engineering & other construction (501, 503-505); Business services (84, 86, 88); Paper (323) | **A.** Other producers/activities (99); Clothing (313, 314, 315); Catering and accommodation (64); Forestry (12); Furniture (391); Leather (316); Wood and wood products (321, 322); Wholesale and retail trade (61, 62, 63); Footwear (317); Food (301-304); Motor vehicles, parts & accessories (381-383); Printing, publishing & recorded media (324-326); Business services (83, 85, 87), Beverages (305); Professional & scientific equipment (374-376); Government (91); TV, radio & communication equipment (371-373) |
| Low | **D.** Gas sector (natural) (2211); Gas (412); Electricity (411); Collection, purification & distribution of water (42); Other mining & quarrying (221, 25); Coke & refined petroleum products inc. nuclear fuel (331-333); Basic chemicals (334); Mining of metal ores (24); Basic precious & non-ferrous metals (352); Basic iron & steel (351, 353); Transport & storage (71-74); Plastic (338); Other chemicals & man-made fibres (335, 336); Non-metallic minerals (342); Gold mining (23); Glass (341); Rubber (337); Electrical machinery & apparatus (24) | **C.** Coal mining (21); Finance & insurance (81, 82); Post & telecommunication (75); Manufacturing n.e.c., recycling (392, 393, 395); Other transport equipment (384-387); Other private services (92, 94-96); Health (med, dent, vet) & social work (93); Tobacco (306) |

Source: Wills (2021)

Based on Figure 3, one therefore could adopt the following schematic approach to encourage change within sectors and shifts between sectors. Policy instruments (described in section 3.4 below) are likely to have different effects across various sub-sectors.

- Grow clean and employment-intensive sectors: Enabling environment for category A (i.e. the 'clean-and-inclusive sectors'). What policies and incentives and enabling conditions can government put in place to realise their full mitigation and labour-absorbing potential?
- Limiting support for capital- and emission-intensive sectors: What plans are needed to phase down subsidies and/or regulate activities in the sectors categorised as D – i.e. 'capital- and carbon-intensive sectors'?
- Jobs in clean sectors: Sectors in C – low employment but high mitigation potential. Is there any way to incentivise an increase in employment intensity within sectors that are 'clean'?
- Clean up employment-intensive sectors: Is there support to include policies for sectors with high emissions intensity but high employment, i.e. sectors in category B? Do the sectors with low mitigation potential have roadmaps to achieve a higher mitigation potential? If so, is this likely in the short run?

A combination of policy interventions might have the combined effect of shifting South Africa's development pathway to increased sustainability. That would mean a move from existing unsustainability, with economic activities in quadrant A being dominant, to a greater contribution to economy and society from quadrant D.

The following section turns to consider policy instruments that could steer the economy towards a more employment-intensive and less emission-intensive development path.

## 3.4 Policy instruments for employment-intensive and low-emissions development

What mix of policy instruments could achieve employment-intensive and low-emissions development (EILED)? The following section explores policy measures that would drive a more aligned energy and industrial policy outcome, increasing employment and reducing GHG emissions.

### 3.4.1 Change incentive structure: Support employment and income by shifting subsidies away from high-emitting activities

Changing the incentive structure, shifting subsidies and appropriate regulation are central components of a strategy for employment-intensive and low-emissions development. As outlined in section 2, the opposite historically has been supported in the political economy – capital-intensive growth, which resulted in high unemployment and emissions. A critical step is a shift of subsidies *from* fossil fuels and energy-intensive industry *to* incentivise employment-rich and high-mitigation activities (for example, cleaner energy). To break down the elements, the proposed shift in development pathway would entail:

- Supporting employment, for instance through an employment subsidy (Pauw and Edwards 2006; Levinsohn et al. 2014);
- Reducing poverty through a universal basic income grant or guarantee (BIG-FRG 2004; IEJ 2021); and
- Shifting subsidies to incentivise employment and low-emissions activities (this paper).

The above could be funded in part by a (transitional) wealth tax and other measures.

#### Supporting employment

The incentive structure (accompanied by appropriate regulation) needs to shift in support of greater employment intensity. It needs to tilt the playing field in favour of employment, especially that of unskilled and semi-skilled workers. This means, for example, subsidising training rather than capital investment and worker housing close to workplaces rather than infrastructure for heavy industry. It may mean more comprehensive wage subsidies, which will change firm behaviour and increase the competitiveness of labour-demanding activities. Wage subsidies could be implemented as payments to workers by the state (direct transfers

or negative income tax), or transfers to employers to cover (part of) eligible workers' employment costs. The latter is also a 'hiring subsidy', as it incentivises firms to employ workers in identified sub-sectors. Another option that is easy to administer would be to increase the deductibility of wages for corporate tax purposes in the case of low-earning employees. This kind of shift would have positive developmental effects, but can also be justified in neoclassical terms – taxing or regulating activities with negative externalities (emission-intensive); and subsidising those with positive externalities (employment-intensive). South Africa has a youth employment incentive, the results of which have been mixed (Ranchhod and Finn 2015; Muller 2021 forthcoming). But a temporary incentive applied only to young workers cannot be expected to shift the demand curve for labour and encourage investment in labour-demanding activities.

On the other hand, it makes no sense, in the light of South Africa's high unemployment environment, to offer incentives for capital investment as have been applied to sections of heavy industry, the automotive industry and other sectors. These subsidies also benefit large firms more relative to smaller firms. Capital subsidies for heavy industry have encouraged the overexpansion of the sector and are inimical to employment. They are partly responsible for South Africa's high emissions intensity. While investment needs to be encouraged, subsidising capital can lead to excessive automation, with adverse employment effects. Where possible, assistance to industry should take the form of training and other employment-supporting measures.

### Reducing poverty (and inequality)

As mentioned above, South Africa has an exceptionally high poverty rate for an upper middle-income country. Unemployment is a major contributor, and the measures mentioned above will have a positive effect. In terms of reducing poverty, the most effective measures currently in place are social grants. The number of recipients has increased from 2.4 million in 1996 to 18 million in 2020. This comes at a huge cost,[5] but it excludes very large numbers of the unemployed and working poor. The question is whether this could be increased, for instance in the form of a basic income grant (BIG) or universal basic income (UBI).[6] In the decade following South Africa's democratic transition, a number of UBI proposals (BIG-FRG 2004) were made, supported by organised labour and other formations (IEJ 2021). The question is back on the agenda, with a number of proposals being put forward. These include a proposal by the ANC's Social Transformation Committee for a staged introduction of a universal grant. This has been taken up by Department for Social Development, which has proposed the roll-out of universal income to the most vulnerable age groups first (IEJ 2021).

The notion of UBI is also attracting growing attention globally (Standing 2017; Banerjee et al. 2019), and variants have been implemented or tested in both developed and developing

[5] The annual cost is currently R182 billion (IEJ, 2021).
[6] We use the term UBI, which is more commonly used internationally.

countries. In the developing world, pilot studies have taken place in Namibia (Haarmann and Haarmann 2012), India and Kenya (Banerjee et al. 2019). The Namibian pilot project, in the village of Otjivero-Omitarra, had particularly striking results. Haarmann and Haarmann (2012) report not only dramatic reductions in poverty, but also a significant increase in economic activity and employment. Given Namibia's extreme inequality and very high unemployment, similar to that in South Africa, its example is perhaps particularly important for South Africa. There are various arguments about why economic activity might increase. Banerjee et al. (2019) argue that universal basic income may relieve certain growth constraints, for example on credit for small-scale investments. Larger incomes circulating among poor communities are likely to give a major boost to the informal sector.

### Shift state subsidies from capital- and energy-intensive to employment and high-mitigation activities

A necessary part of the transition is the phasing out of support for cheap-but-dirty electricity, as in the DEPP, and phasing out subsidies for fossil fuels. This transition is likely to be difficult in the South African political economy; it amounts to unwinding historical subsidies to the minerals-energy complex and incentivising 'normal' industrialisation, where normal means better aligned with SA's undistorted comparative advantage.

Artificially cheap energy constituted large-scale subsidies for heavy industry and also for the mining sector. This energy- and capital-intensive development path has been inimical not only to employment, but to growth itself. In shifting the development path, the withdrawal of subsidies and proper pricing of energy should be a first step. The travails of Eskom have already forced deep restructuring of many energy-intensive users. Electricity prices faced by the mining sector have increased 6.5 times since 2008. This has had a huge influence. According to the Minerals Council, electricity prices account for 24% of gold production costs, 22% of iron ore and 13% in the case of PGMs.[7] Substantial restructuring is already taking place; although South African industrial electricity prices have risen dramatically, they are still comparable to the OECD average (Figure 1). Of course, this adjustment is not a seamless process, as there are huge sunk costs and large numbers of workers employed in these sectors. Policy needs to actively promote new development in activities and sectors that are more aligned with South Africa's real (not distorted) potential comparative advantage. Importantly, these would include activities that are labour demanding and less energy intensive.

Shifting subsidies to support low-emissions and high-employment industries, rather than emissions-intensive coal-fired power, would be one set of tools for employment-intensive and low-emissions development. This could mean phasing out the support for cheap-but-dirty electricity, as in the DEPP, and phasing out subsidies for fossil fuels, and instead incentivising

[7] See 'Mines warn that power price rises threaten development of industry', *Business Day*, 17 March 2021.

employment in low-emissions and employment-intensive activities. Low-emissions activities include 'green energy', particularly renewable. These are an important part of an EILED strategy, but will not on their own create many low-skilled jobs (see 3.4.2 below). There has been limited public debate on fossil fuel subsidies, and "much of the detail is obscured or hidden" – and notably different from public discussion of climate policies (Burton et al. 2018b). Rennkamp and Burton (2018) estimate that fossil fuel subsidies are between R6.5 billion and R29 billion per year. These subsidies could be redirected to fund social grants for 1.4 million pensioners; directly fund job creation in a just transition to a low-carbon economy; boost agriculture; support employment-intensive and low-emissions development; or cover half the cost of fee-free higher education and training (Rennkamp and Burton 2018).

Could electricity tariffs be reformed to support employment-intensive and low-emissions development? Eskom has proposed new retail tariffs that would address cross-subsidisation. The proposals focus on cost-reflective tariffs and argue against inclining block tariffs (Eskom 2020b), which would reverse support for free basic electricity. Given the high levels of Eskom debt, some support for lower-emissions technologies would be welcomed by the utility. The 2021 State of the Nation address included two significant shifts in a short sentence: "Eskom, our largest greenhouse gas emitter, has committed in principle to net zero emissions by 2050 and to increase its renewable capacity" (Ramaphosa 2021). Firstly, a commitment by Eskom to net zero emissions is a clear policy signal, even if only in principle. Secondly, for the last two decades, the policy direction has been that Eskom would not develop renewable energy, whereas President Ramaphosa indicated increased renewable capacity. Subsidies might be applied to repowering coal-fired power stations, i.e. continuing to provide electricity (and utilising existing infrastructure), but from renewable energy sources. It may be politically difficult to switch subsidies directly from fossil fuels to renewable energy. A more feasible option may be to add a levy on power prices to fund the localisation of renewable energy, and to provide training for renewable energy and energy service companies.

### Sources of funding – wealth and other taxes

Incentives and support measures – wage subsidies, universal basic income and incentives for low-carbon jobs – have substantial fiscal implications. For example, a recent study estimated the annual cost of providing those aged 19 to 59 with a monthly R500 UBI grant to be R198 billion per year (IEJ 2021). South Africa's constrained fiscal position, together with the fact that tax rates are already quite high, certainly presents problems for funding major new areas of social expenditure. Here we simply mention some possibilities.

A wealth tax would need to be part of the equation. The IEJ (2020) reviewed a wide range of funding options, including social security taxes, VAT, eliminating deductions by higher income groups for retirement fund contributions, and reductions of expenditure. They also proposed a wealth tax, arguing that it could bring in up to R158 billion per year. Chatterjee and colleagues (2021) provide another estimate, drawing on a progressive tax on the top 1% of the richest South Africans. They argue that such a wealth tax could raise between R70 and

R160 billion per annum. However, these are ambitious projections that run the risk of encouraging emigration by wealthy individuals. Mbewe et al. (2019) also propose a wealth tax for South Africa, but are much more cautious, citing major data and implementation problems and the prospect of outflows of capital. They therefore suggest that it is introduced at a low level – to put in place a new tax and to gather data.

Carbon tax revenues could be used to support mitigation by emissions-intensive firms – and benefit poor households, building support for employment-intensive and low-emissions development. South Africa has implemented a carbon tax at a relatively low rate of R120 per ton of $CO_2$-eq (RSA 2019), which is not sufficient to transform the energy economy (ERC 2018). However, Treasury has signalled that higher tax rates are contemplated for the future. While the National Treasury opposes the 'ring-fencing' of carbon tax revenues, on-budget allocations of the revenue are possible. As part of green industrialisation, there could be spending in two broad categories: firstly to reduce energy poverty and ensure poor households benefit from climate action (Winkler 2017), and secondly transitional assistance to emissions-intensive firms, subject to binding mitigation targets (National Treasury 2017).

### 3.4.2 Employment in renewable energy and regional economic development

Renewable energy can create employment as jobs decline in the sunset industry of coal mining. Increased RE would be part of any employment-intensive and low-emissions development strategy. A study of the employment co-benefits found that the CSIR's least-cost pathway (Wright et al. 2019) could create 1.2 million job years along the renewable energy value chain – more than double the number indicated in the IRP (Hartley et al. 2019).

The shift from coal-based energy carries adjustment costs. Continued job losses are likely along the coal value chain,[8] regardless of a shift to renewable energy. Burton et al. (2018a) trace employment trends related to coal transitions as part of a broader decline in mining jobs in the 1980s and 1990s. They report increases in labour productivity in coal mining into the early 1990s, but these decline from around 2000 (Burton et al. 2018a). Global demand for coal is declining, and this is the key driver identified as driving a decline in employment in South African coal mining (Hartley et al. 2019). Hartley and colleagues (2019) project an employment decline of 35% to 40% from 2020 and 2050. While the existing coal fleet is ageing, many communities depend on coal mines, power stations and downstream beneficiation for their livelihoods (Winkler et al. 2020).

The Renewable Energy Independent Power Producer Procurement Programme (REI4P) has demonstrated some potential for localised job creation. The localisation requirements of the REI4P resulted in the development of renewable manufacturing industries and capacity in

[8] The coal value chain includes coal mines, coal-fired power stations, and down-stream beneficiation (SA-CRM 2013).

South Africa (Hartley et al. 2019). However, the REI4P has experienced stops and starts, and government commitment to continuous and long-term deployment of renewables is necessary to grow localised industries. Localisation of the renewable energy development value chain is important (Overy 2018). Establishing renewable energy manufacturing plants in key districts in Mpumalanga may offset some job losses, but seems unlikely to be sufficient on its own, given that most employment demand in renewable energy is for high-skilled labour. Modelling undertaken by Hartley et al. (2019) found that 7 % of jobs in renewable power generation are in the highly skilled category (> Grade 12). Additional interventions will be required to diversify industry and consider regional competitive advantages (Burton et al. 2019). These could include agriculture and tourism.

Furthermore, a local RE industry is likely to generate jobs mainly during construction, but not that many during operation. RE technologies are imported to a significant extent – wind turbines from Denmark and Europe, solar photovoltaic (PV) panels from China – but South Africa is not in a good position to compete.

### 3.4.3 Build competitive advantage in employment-intensive light manufacturing, energy-service companies and hard-to-abate products

In a diverse, middle-income economy, it is not appropriate to have a single industrial policy objective. But South Africa still faces important choices and the crisis confronting the country calls for a shift in emphasis. South Africa could build a competitive advantage around employment intensity by considering light manufacturing clusters, supporting small and medium energy-service companies rolling out energy efficiency and small-scale renewable energy services, and finding strategic approaches to be part of alternatives to hard-to-abate products.

#### Light manufacturing and special economic zones

As mentioned above, labour-intensive manufacturing has declined, accompanied by significant employment losses. This part of the strategy would build competitive advantage in light manufacturing, both to grow exports and to compete more effectively in the domestic market. This means that industrial and other policies need to place more emphasis on supporting light manufacturing. This could include the development of clusters in special economic zones (SEZs), which have until now had little effect (Yang et al. 2020). Light industries draw on the local, semi-skilled labour force, experience in the region and established infrastructure. Examples of such industries include not only apparel, but also metal products, household semi-durables, electronics assembly and other products.

#### Energy service companies implementing mandatory energy-efficiency standards

Energy efficiency (EE) is an immediate option that saves money and must be a central part of EILED. However, a history of limited adoption of EE suggests that standards have to be

mandatory to scale up EE for rapid decarbonisation. The potential for energy efficiency has long been understood, both in South Africa (ERI 2000) and globally (GEA 2012). EE improvements are cost-effective, can be implemented in the near term, and have multiple benefits, such as reducing adverse environmental and health effects, alleviating poverty, enhancing energy security and flexibility in selecting energy supply options, and creating employment (GEA 2012). Yet major energy users often do not implement EE to its full potential. From an economic point of view, observers have long been puzzled why no-one is 'picking up the $20 bill'.[9] EE would be good for economic efficiency too. South Africa has long had an EE strategy with a modest target of 15% reduction against baseline energy consumption (DME 2005).

Mandatory standards could spur the implementation of EE, for example by focusing on efficient industrial equipment, where in some cases there is an additional cost. Vehicle fuel efficiency standards would be helpful for as long as internal combustion engines continue, with a longer-term shift likely to electric vehicles. An important strategy to create employment in EE would be through the support of energy service companies (ESCOs). ESCOs could be SMEs that provide EE and renewable energy (e.g. solar water heaters, PV panels) to businesses and households.

### 3.4.4 Agriculture – a sector to create low-emissions employment

Agriculture is a very labour-intensive sector, both in terms of employment per unit of output and in terms of its employment multiplier. Agro-processing, while capital intensive, is very employment intensive when measured on a multiplier basis, given its links to agriculture. In South Africa, agriculture's share of output and employment has been declining and, in the case of employment, the decline has been especially rapid. Given the sector's dependence on rural, relatively low-skilled labour, a case can be made for greater support for the sector (Black et al. 2016). In Figure 2, agriculture (11) is in quadrant B, i.e. a sector with high employment and high emissions.

The land sector globally removes almost a third of $CO_2$ emissions by humans, while the food system's share is increasing, approaching a third, and there are many policy measures that reduce emissions with developmental benefits (IPCC 2019). Land is the only sector in which $CO_2$ emissions are *removed*, as well as being emitted by sources; all other sectors are only sources of GHG emissions. Significant co-benefits for agricultural productivity have been found for low-carbon development pathways in India (Sharma et al. 2018). National climate policy identifies mitigation potential mainly in energy supply and use, but includes "options for mitigating non-energy emissions in agriculture and land-use" in a list with the biggest mitigation potential in the medium term (RSA 2011). The approach is to have a broader 'mix

[9] For example, https://www.greenbiz.com/article/are-building-owners-leaving-money-energy-efficiency-table

of measures' for mitigation, partly to include options that have socio-economic benefits, among which employment is a top priority.

In South Africa, agriculture has a particular history and structure. The peasantry was destroyed under colonialism (Bundy 1979). Dispossession is often described as starting with the 1913 Land Act, with grand Apartheid including the forced removal of rural communities – so-called 'black spots' – to 'homelands'. Given several generations that have not made livelihoods by agriculture, agrarian reform is a major undertaking – and would have to be implemented more effectively than land reform. Yet it is hard to think of any other sector that could become a 'job sink' and create low-skilled employment as effectively as agriculture.

From a mitigation perspective, agriculture accounts for a small but non-trivial share of emissions – 9% in 2017 according to the GHG inventory, mostly non-$CO_2$ emissions.[10] That share is relatively high in relation to its contribution to economic output (3% of GDP, Black et al. 2016) and about commensurate with agriculture's contribution of 10% of employment, depending on definitions (Black et al. 2016).

The then Department of Environmental Affairs commissioned an analysis of mitigation potential (DEA 2014) and has since updated the analysis internally, including for emissions from agriculture, forestry and other land use (AFOLU), as a major sector in GHG inventories following IPCC guidelines. The larger mitigation potential lies in land use through measures that enhance the removal of $CO_2$ by sinks through the restoration of subtropical thicket, forests and woodlands, and the restoration and management of grasslands and commercial small grower afforestation. In agriculture, emissions can be reduced through reduced tillage – with 0.035 Mt $CO_2$ in 2020 rising to 0.247 Mt$CO_2$ in 2050.

Since 1990, developments in agriculture have contributed to, rather than ameliorated, SA's unemployment problem. A number of factors apply. There has been a dramatic reduction in support. For example, producer support as a share of gross farm receipts has declined from approximately 15% in 1995 to 2% in 2010 (OECD 2011). This decline has been much steeper than the average decline in OECD support levels, which, in any event, remain very high – at approximately 17% of gross farm receipts. This has contributed to huge employment losses in formal agriculture (Black et al. 2016).

Also, the potential effect in terms of income generation and livelihood support in land reform has not been realised because of the slow pace of land redistribution and its limited effectiveness. Initiatives to improve infrastructure provision in the former reserves have had limited effect. With greater and more focused support, this sector could play an important role in addressing not only rural poverty, but also South Africa's employment problem, without adding significantly to GHG emissions.

[10] AFOLU excluding FOLU: 51 608.40 Gg $CO_2$-eq; total GHG emissions excluding FOLU: 574 696.50 Gg $CO_2$-eq.

Measures for employment-intensive agricultural development that has some mitigation benefit could therefore include increased support for agriculture, as well as policy measures with mitigation potential, mostly in land-use management, small-scale afforestation and reduced-tillage agriculture. Well-designed land reform is critically important and could play a role in increasing employment in agriculture.

## 4. Conclusion

South Africa faces huge challenges as the country attempts to chart a course to address pressing socio-economic issues of high unemployment, rampant poverty and extreme inequality. At the same time, it needs to make a contribution to climate action, which requires a just transition to net zero $CO_2$ by 2050. All this has to take place in an environment of low growth and pressing fiscal constraints, which have been exacerbated by the pandemic.

The first main part of the paper briefly explains how South Africa got to this point. We then go on to chart a way forward with policy proposals that would increase employment intensity and reduce emissions. The focus is on the development path of the economy, especially energy and manufacturing.

Our central argument is as follows. Historically, the economy has been on a development path that gave rise to the minerals-energy complex. Under the MEC, mining and heavy industry received large-scale subsidies. Emissions are particularly high, primarily due to the reliance on coal-based energy. As a direct result, the economy is exceptionally energy and emissions intensive. Also, it is not very employment intensive. Poor employment outcomes are due in part to high capital intensity. They are also the result of the economic costs of a distorted development path, which has locked SA into low-employment and high-emissions development.

It has proven difficult to change this structure, and the adjustment costs are high. There are large investments in place, for instance in coal mining, coal-fired power stations and heavy industry – and 'lock-in' to capital intensity and high emissions. There are also strong political economy interests in support of the current development path. Downstream development in manufacturing has been hobbled by poor education outcomes. The manufacturing sector is unusually capita -intensive and became more so as trade was liberalised, leading to a partial collapse in labour-intensive sectors. In the countryside, capital-intensive, large-scale farming developed alongside a small-scale agricultural sector that has been severely affected by centuries of land dispossession. The small business and informal sectors are tiny compared to peer group countries.

It is widely accepted that growth needs to be more employment intensive and that lowering emissions is an absolute necessity. In fact, the shift has already begun, although not on the terms decision makers would have liked. The minerals-energy complex has begun to unwind as electricity prices rise and supply falters. Rising electricity prices have had a major effect on limiting the growth of electricity consumption (and emissions). The mining sector has also

contracted due not only to declining gold reserves, but also to infrastructure constraints and poor regulation.

A revised industrial policy would provide a greater focus on light manufacturing, aimed in part at building competitive advantage in these sectors. Most importantly, we suggest a shift in incentives that tilt the playing field towards employment-intensive and low-emissions growth. This also means reducing incentives for capital-intensive heavy industry, ending support for cheap electricity, and removing fossil fuel subsidies. Low-emissions development might create employment by supporting small and medium energy service companies to roll out energy-efficient and small-scale renewable energy services. Agriculture can create employment, while contributing to removals by sinks and some mitigation of sources.

An integrated mitigation and development strategy is required to shape (or reshape) the growth path of the economy. This means aligning the two objectives, but does not imply that there are no trade-offs between achieving mitigation and employment objectives. But, just as there is a connection between high-emissions and low-employment intensity, we argue that employment-intensive growth and a low-emissions strategy can complement each other. An EILED path is more aligned with South Africa's real comparative advantage and will produce more rapid growth. This cannot be left to the market, but needs specific and targeted measures. The policy instruments proposed might be thought of as a policy package – coordinated across industrial, energy, climate and other policy domains. If implemented together, with coordination across implementers, the integrated policy package should shift the economy towards employment-intensive and low-emissions development.

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