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Briefing Paper 10

# The Paris Agreement and South Africa's just transition

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This paper is part of a series of briefing papers that examine the climate change policies of the countries key to the Paris Agreement and its effective and ongoing implementation.

## Executive Summary

This briefing paper explores the relationship between South Africa's Paris pledge and the concept of a just transition. We deploy this concept as a frame of reference or 'lens' to help us suggest what we believe to be appropriate (and necessary) and inappropriate policies under a changing climate system in a carbon constrained world. We conclude that the just transition concept, once elevated and centralised in government decision-making, has the potential to generate policies that would deliver environmental gains (eg GHG reductions) as well as socio-economic gains (eg employment, poverty reduction) for South Africa. The result would be a just transition to—what is now referred to in South African narratives—a 'wellbeing economy'.[1]

**Key findings:**

- Political, economic, social and ecological transitions in South Africa have had varying successes. In the coming decades, under a changing climate system in a carbon constrained world, the concept of a just transition or a 'wellbeing economy', may provide a useful guide to government decision-making in key policy areas.
- One key policy area is electricity generation. We find that an electricity generation mix dominated by coal-fired electricity generation is incompatible with the just transition concept or a wellbeing economy. By contrast, the concept is significantly compatible with policies that seek to expand installed renewable electricity capacity.
- A second key policy area is food supply. We find that a food supply mix that encourages the intensification of South Africa's food production system is largely incompatible with the just transition concept. By contrast, the concept is more compatible with a roll-out of an agro-ecological food production system.

## Introduction

The Paris Agreement, which entered into force on 4 November 2016, aims to strengthen the global response to the threat of climate change 'by holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels', and achieving net zero emissions in the second half of the century.[2] However, the Parties to the Agreement emphasise 'with serious concern the urgent need to address the significant gap between the aggregate effect of Parties' mitigation pledges in terms of global annual emissions of greenhouse gases by 2020 and aggregate emission pathways consistent with holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels'.[3] The next few years are therefore absolutely crucial to closing the gap between where we are currently heading (an increase of 2.7-3.7°C) and where we need to be to achieve the goals of the Paris Agreement.[4]

At the Fifteenth Conference of the Parties (COP15) to the United National Framework Convention on Climate Change (UNFCCC) held in Copenhagen in 2009, South Africa made a *voluntary commitment* to reduce GHG emissions below business-as-usual (BAU) levels by 34% by 2020 and 42% by 2025.[5] South Africa's Paris Agreement pledge or Nationally Determined Contributions (NDC), submitted to the UNFCCC on 25 September 2015, and ratified on 2 November 2016, *committed* the country to a long-term peak, plateau and decline (PPD) trajectory in which total GHG emissions will be in a range between 398 to 614Mt$CO_2$e in the years 2025 and 2030 , equivalent to a target range of between 20-82% above 1990 levels by 2030[6](excluding land use, land-use change and forestry [LULUCF]).[7] Thus, South Africa has progressed from a pledge to reduce emissions relative to BAU, to an absolute emissions range for 2025 and 2030.[8] However, there is significant uncertainty about the precise target that will be introduced within this large range.

By 2020, the Parties to the UNFCCC are invited to either communicate a new NDC[9], or re-communicate or update their existing NDC.[10] The Facilitative Dialogue (FD) in 2018[11] provides a vital opportunity to provide the information, conditions and political signals necessary to empower Parties to enhance their ambition by 2020. The FD process presents an opportunity for South Africa to confirm a precise emissions reduction target, once again improving the country's policy response to climate change. Climate modellers from the University of Melbourne, Potsdam Institute for Climate Impact Research and International Institute for Applied Systems Analysis have calculated the *average* of South Africa's *fair share*[12] of the global emissions reduction burden, and found that South Africa would need to limit emissions to 2% above 1990 levels by 2030 to ensure consistency with the 2°C goal, and 24% below 1990 levels for the 1.5°C goal (excluding LULUCF).[13]

## A transition for a changing climate in a carbon constrained world

South Africa is familiar with transitions.

The country's democratic transition of 1990-1994 relaced deep division and bitterness, brutally enforced by ruling authorities, with its first socially-mixed, economically open, democratic and culturally expressive society.

A profound structural transition in the national economy accompanied the birth of democracy. Government policies in this period focused on deregulating of capital inflows and outflows, exchange rate stabilisation, privatisation of key economic sectors, export-orientated growth and the lowering of trade barriers to consolidate the country's position in global markets.[14] Due to South Africa's extremely low national saving base it was believed that this transition was necessary to generate rapid economic growth and deliver social dividends including job creation.

The country's key economic indicators surged in its wake. For instance, the average annual rate of economic growth between 1980 and 1993 was only 1.4%. By contrast, the average rate was 3.4% between 1994 and 2013, with an average annual high of about 5% between 2004 and 2007.[15] National GDP by 2012 was 77% larger in real terms relative to 1994. Similarly, export growth per year increased from 2% to 5% between 1980 and 2000, cooling slightly to 4% between 2001 and 2007.

However, while economic growth in this period (1994-2008) was sufficient to support rapid fiscal spending on key social problems inherited from the apartheid era (especially welfare, education, health and housing), it did not result in massive reductions in unemployment and poverty.[16] Indeed, the number of unemployed people increased from 2 million in 1995 to 4.1 million in 2009. And based on a R524/month poverty line, 53% lived in poverty in 1995, declining only marginally to 48% by 2005.[17]

South Africa's economy has struggled to regain its early momentum. In 2015 economic growth slumped to little more than 1%, and in 2016, growth limped in at 0.5%. In 2016, debt reached almost 50% of GDP (from about 26% in 2008), the Rand continued its trend of depreciation—the nominal effective exchange rate of the Rand has lost around 50% of its value since 2010—all culminating in the country's credit-rating being reduced to one notch above junk in that year.[18] So far in 2017, growth has oscillated between 0.6% and 1.1%; and in April rating agency *Standard&Poor* downgraded South Africa's credit rating to BB+ or junk status.

Similarly, key social indications have flat lined or moved in a negative direction. South Africa's present inequality measure (Gini coefficient) is 0.69, consistently one of the highest values in the world.[19] Unemployment stands at 26.6%, a post-apartheid high. Unemployment among black South Africans is 39% compared to 8.3% among whites. Reports indicate that South Africa has one of the most unequal education system in the world.[20] For instance, of 200 black pupils who start school just one can expect to do well enough to study engineering at university, while ten white kids can expect the same result. And since 1990 undernutrition in children under the age of 5 years old has *increased* from 9% to 12%.[21]

The fourth transition—accompanying political, economic and social transitions, which have had varying successes as we have seen—is an ecological transition. Section 24(b) of South Africa's Constitution, signed into force by Nelson Mandela, obligates South Africans to 'secure ecologically sustainable development'.

However, this requirement has had little impact on the country's prevailing energy and resource intensive economic growth path. Soil depletion is widespread, and growing, and 82% of freshwater eco-systems are officially classified as threatened, with severe and prolonged droughts expected to intensify. South Africa's national water resources have some of the highest toxin levels outside of China. Significant loss of biodiversity has been recorded.

Furthermore, South Africa is the most carbon-intensive major developing economy in the world, apart from Russia. Per capita $CO_2$ emissions hover between 8 and 20 tonnes, a figure twice as high as China, and 4-5 times higher than Brazil, Indonesia and India; and similar to Britain and Germany.[22] South Africa's NDC of 2015 recognises the potentially severe impact of unmitigated climate change on the country:

> South Africa is especially vulnerable to its [climate] impacts, particularly in respect of water and food security, as well as impacts on health, human settlements, and infrastructure and ecosystem services.[23]

In sum, in many ways, the great democratic transition of the mid-1990s has not yet translated into an equitable and ecologically sustainable South Africa.[24]

What is needed, in our view, is the elevation and centralisation of a novel concept to guide policymaking. Given the context outlined above, it is imperative that any new concept can help: 1. enable a socio-economic transition *and* 2. achieve the country's climate change objectives.

The concept of a *just transition* fulfils these requirements. We define a just transition as a transition that reconciles the sustainable use of natural resources with a pervasive commitment to *sufficiency* (ie a convergence between high and low levels of personal consumption toward a mid-range level across South Africa).[25] The end result would be a 'wellbeing economy'.

A transition of this nature, we believe, can act as an engine (rather than obstacle) to strong, inclusive and ecologically sustainable economic growth.

In what follows, we deploy this concept as a *frame of reference* or 'lens' to help us suggest appropriate (and necessary) and inappropriate policies for a changing climate system in a carbon constrained world.

We begin with electricity supply.

## Electricity supply

At present, South Africa is a coal-dependent and carbon-intensive economy. According to the Department of Energy (DoE), about one quarter of the country's coal production is exported, regularly placing it in the 'top five' coal exporters in the world. The remaining three quarters are used domestically, where, the International Energy Agency (IEA) found, 90% is used for power generation—a share that exceeds the global average of 40%.[26] By 2030, the DoE forecast, 89 500MW installed power capacity will be added, of which 46% will be coal, 21% renewables and 13% nuclear, and the balance from other sources such as gas, pumped storage and hydropower.[27]

This coal-focused electricity path seems to sit uneasily with global trends. Indeed, internationally many reports suggest that coal is in terminal decline. The IEA's *Coal Information Overview* Report of 2017 for instance has found that: 'world coal production declined in 2016 by 458Mt, which is the largest decline in absolute terms since IEA records began in 1971.' The primary reason for this decline, the Report continues, was because 'electricity generation from coal-fired power plants in OECD countries fell by 6.1% to a new low of 3029TWh in 2016'[28] as well as falls in China, and growing concerns about climate change.

A revival in coal's fortunes seems highly unlikely. The IEA's *World Energy Outlook* (WEO) Report of 2016 predicts that coal's share in China's and India's power mix over the period 2017-2040 will fall from 75% to 45%, and 75% to 55% respectively.[29] While coal demand in the European Union and the United States (which together account for around one-sixth of today's global coal use) will fall by over 60% and 40%, respectively, over the same period. Indeed, coal use globally falls back to levels last seen in the mid-1980s, at under 3000 million tonnes of coal equivalent per year. In sum, the IEA explain: 'there is no global upturn in demand in sight for coal'.

Renewable electricity by contrast is expanding across the globe. In the same IEA report that predicts the decline of coal, it also says 'globally, renewable energy sees by far the fastest growth' out to 2040. In the four largest power markets (China, the United States, India, and the European Union) variable renewables become the largest source of generation between 2030 and 2035, it adds. Solar photovoltaic (PV) sees its average cost cut by a further 40-70% by 2040 and onshore wind by an additional 10-25%. Subsidies per unit of new solar PV in China drop by three-quarters by 2025, and solar projects in India are competitive without any support well before 2030. All the while, the Report continues, household electricity bills remain 'virtually unchanged'.

South Africa is in a good position to take advantage of this global shift. For example, in 2016, a team of international experts in electricity generation, including, Professor Harald Winkler, the University of Cape Town's Energy Research Centre (ERC) Director, released a report that found:

> Maintaining a feasible energy supply system to meet the growing needs of industrial, commercial and residential sectors while meeting an energy emissions constraint requires significant decarbonisation in the electricity sector [in South Africa]. The widespread use of solar photovoltaic on commercial and residential properties, as well as additional concentrated solar power capacity, are plausible given South Africa's vast solar radiation resources... solar technologies are poised to make a large contribution to the decarbonisation of electricity supply in South Africa given the technical feasibility, commitment in stated policy and currently competitive tariffs.

By contrast, in a different study[30] the ERC members concluded that government investment in coal-based enterprises:

- will be increasingly difficult to recoup as global pressures to reduce emissions occurs under the Paris Agreement
- runs the risk of perpetuating a reliance on coal-fired generation that may potentially extend far beyond the point at which low-carbon technologies present a viable and cost-effective alternative
- will inevitably result in 'higher electricity prices' for consumers, rendering them an even larger component of 'already meagre low-income household budgets'.

The cost/benefit equation becomes more favourable for renewables if South Africa's solar and wind farms are situated in areas with 'quality resources'. Studies have shown that a concentrating solar power plant in the best locations in South Africa will generate at least 20% more power for the same capital investment than locations with a similar solar resource in Spain, 2400kWh/m2 versus 2000kWh/m2.[31]

In addition, South Africa's two new large coal-fired power plants—Medupi and Kusile—are running over time and budget. For example, construction on Medupi power-station commenced in 2007 with an expected completion year of 2011; its new completion year is 2019, almost three times longer than initially planned; while costs have spiralled to over R150 billion, double the initial estimate. Delays and rising costs means that the government will have less money to invest in social services (Eskom, the monopoly electricity supplier, will build and run them, while the government will cover the financial costs.)

Renewable electricity also has significant employment potential.[32] To date, these jobs have accumulated in countries rapidly transitioning to low pollution energy systems, namely, China, Germany and India. Employment is generally spread between operations, manufacturing, module assembly, and construction/installation. While limited jobs exist in the operational phase of PV—also requiring high-skilled candidates—the manufacturing, module assembly, and installation phases, as well as the on-going refurbishment and expansion phases, offer, some claim, an average of 30 jobs per peak MW installed capacity, the overwhelming majority of which are relatively low-skilled. This is good news for South Africa's poor and those with limited formal education.

However, it also needs to be noted that these renewable energy infrastructures are decentralised relatively small systems that get constructed in a large multiplicity of small urban towns scattered around South Africa. All independent power producers are required to spend a specified portion of turnover and profits on development projects within a 50km radius of each plant. This has significant job-creation impacts that need to be added to those jobs directly created by the construction and operation of these plants.[33]

While coal-based enterprises have been a strong employer in the past in South Africa, government statistics assert that 'employment in the coal mining industry rose by 75% between 2002 and 2012'[34], as the world shifts to low pollution energy systems, these jobs may rapidly decline.

Coal-fired power in South Africa also creates negative (and positive) social dividends.

On the one hand, for example, most coal-fired power stations and coalmines in South Africa are located near black communities. Professor Emeritus, Jacklyn Cock, from the University of Witwatersrand, writes:

> A form of environmental racism persists. Most black South Africans continue to live on the most damaged land, in the most polluted neighbourhoods near coal fired power stations, steel mills, incinerators and waste sites. Many are without access to clean air, water and services.

In addition, a World Bank study released in 2011 found that most studies into the economics of coal fired power plant (CFPP) electricity generation did not consider external costs such as health impacts, water pollution and climate pollution.[35] The study posits that if these costs were included, CFPPs would unequivocally be one of the most expensive forms of electricity.

On the other hand, one of the most successful post-apartheid policies in South Africa was the requirement that basic services were extended to all citizens, which saw, among other things, the percentage of households connected to electricity rise from 35% in 1994 to 87% in 2016. Coal fired power made this happen.

However, critics argue that the overreliance on coal-fired power has been the principal cause of recent power outages, which has caused considerable economic damage across the country.

In particular, 2015 was bad year. Frequent 'load-shedding' periods as Eskom, South Africa's monopoly state-owned electricity supplier, described them meant that their daily electricity reports would read like a weather forecast: 'there is a medium probability of load shedding today and tomorrow, with a higher probability on Thursday and Friday' Eskom tweeted.

The upshot of South Africa's unstable electricity supply was that investment declined, business activity slowed (eg in 2015 factories often shut as a result of power outages), which ultimately applied the brake to economic growth and social inclusion in the country. Indeed, some economists calculate that since the 1990s power supply problems have trimmed a whole percentage point a year from economic growth.[36] Supply shortages can also result in a low quality of life as well as social and economic exclusion.[37]

Renewable electricity's environmental credentials are first class. Given southern Africa's high vulnerability to unmitigated climate change—which for South Africa involves economic and trade risks on the one hand and geo-political and security risks on the other—in our judgment, it is squarely in the country's national interests to ensure that the Paris Agreement goals are reached (eg not breaching a 2°C warming scenario). South Africa can be part of the solution.

South Africa already has quality domestic policies in place to expand renewable electricity supply, most notably the Renewable Energy Independent Power Producers Procurement Program (REI4P).

This large infrastructure program is an extensive initiative to install 17.8GW of electricity generation capacity from renewables—solar, wind, biomas, biogas and hydropower—over the period 2012-2030. It has proven quite successful to date. But with some tweaks, such as revisions to the bidding and procurement process as well as a tightening of the local content provisions (to drive local manufacturing), it can deliver even stronger social, environmental and economic benefits. For example:

- reduces South Africa's high carbon footprint
- addresses the escalating costs of the coal-fired electricity
- takes advantage of the declining costs of solar and wind
- generates local employment and manufacturing
- delivers regional development and black economic empowerment
- helps resolve unstable electricity supply.[38]

But expanding the renewable component of South Africa's electricity mix also requires the formation of an interlinked domestic and international coalition of supporters, as well as effectively drawing upon multilateral funding mechanisms and foreign public and private donors/investment.

For example, a coalition that could potentially help expand South Africa's renewable energy infrastructure and capacity would perhaps include members of the international and domestic social justice and environmental movements, some trade unions (which have been significantly influential on renewable expansion so far), independent renewable electricity providers, and Germany and Denmark (which have been key donors in the early stage of South Africa's renewable industry and played a considerable role in shaping the REI4P).

Chinese investors are also currently looking to expand their involvement in South Africa's renewable industry. These investors/firms see South African markets as an opportunity to upgrade from equipment producers to project owners/operators, and have extensive financial support and detailed market analysis available from agencies like the China Development Bank. These investors/ firms also view South Africa as a lower political and economic risk in comparison to other African countries, and are attracted to the current RE I4P as an example of good stable policy and plans.[39]

Policymakers in South Africa should also explore the opportunities that exist under the UNFCCC framework. For example, South Africa hosts only 22 projects funded through the UN's Clean Development Mechanism (CDM), whereas countries such as India and China have attracted over 5000 registered CDM projects. There are several domestic reforms that could potentially make South Africa a more attractive destination for CDMs including: upgrading infrastructure, stronger anti-corruption policies, increasing the availability of equity investment and debt finance, increasing the skills base among the labour force, increasing transparency in project approval procedures, and finally, improving the quality of project validation and verification agencies that sign-off on projects and thereby allow the credits to be released.[40]

In this section, we have found that policies that encourage the expansion of coal-fired power are clearly incompatible with the just transition concept. They have limited socio-economic advantages and their outputs pose a considerable risk to the local environment and the Paris Agreement goals. By contrast, renewable electricity generation is highly compatible.

## Food production

Globally, the complex and interlinked eco-systems that make food production possible (eg water, soils, climates, nutrient cycles and pollination) are steadily deteriorating.[41] In Africa approximately 65% of the soil previously suitable for agriculture is now considered to be degraded, while water stress and severe drought are set to increase in the coming decades due to climate change.[42] South Africa's soil/climate combination leaves only 12% of the country suitable for production of rain-fed crop, with only 3% considered truly fertile land.[43]

Meanwhile, the global population is expected to grow from 7.3 billion today to 9.7 billion by 2050.[44] For South Africa, the population is expected to grow almost 2% per year, from 56 million today to 82 million by 2035. Food production or imports must more than double to feed South Africa's expanded population. In addition, as populations around the world, including South Africa, become wealthier, they will demand more food, greater diversity of food, and more protein-based food—which requires more resources to produce.

As a result of declining yield and rising demand, the United Nations Environment Programm (UNEP) and World Bank expect that food prices will rise through to 2050.[45] These rises will most heavily impact on the poor. Between 2004-2008, the massive and rapid rise in global food prices forced millions of the poorest people in the world deeper into poverty.[46] During South Africa's 2015 drought, the worst in 35 years, eight of South Africa's nine provinces and the southern and central areas of Mozambique were declared partial drought emergencies. Massive crop failures were experienced across the region and more than 640 000 cattle were estimated to have died. This sent staples soring, impacting most heavily on poor South Africans, who are mostly black. Temperatures in southern Africa are expected to rise to between 1.5°C and 3°C by 2050 which will severely affect food production and again cause rising food prices for those that can least afford it.[47]

The upshot of rising food price is increases in global hunger. The United Nations inter-agency report, *The State of Food Security and Nutrition in the World*, released in September 2017, has found that 'after a prolonged decline, world hunger appears to be on the rise again. The estimated number of undernourished people increased to 815 million in 2016, up from 777 million in 2015'. Sub-Saharan Africa has the highest proportion of hungry, affecting 20% of the population. And in South Africa the 'prevalence of undernourishment in the total population' has increased from 4.2% to 4.6% between 2004 and 2016.[48] Much of the recent increase in food insecurity, the report has found, can be traced to the greater number of conflicts, 'often exacerbated by climate-related shocks'.

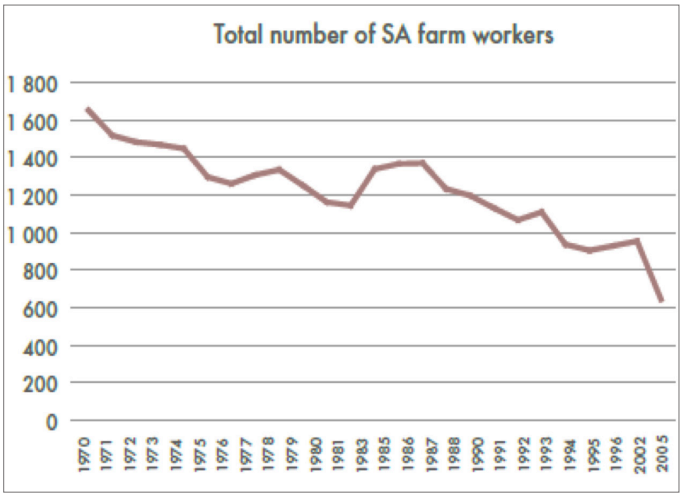
In sum, the eco-systems that support food production are declining, while populations that consume food are increasing. The upshot of this is rising food prices and rising hunger. What are the main pathways to solve these interlinked problems?

The dominant, and orthodox, response is to intensify food production systems, which has its origins in the 1960s.

Since the so-called 'Green Revolution' in the 1950-1960s, the dominant solution to increase food production has been to apply more nitrogen, phosphorus and potassium fertiliser per hectare; as well as add chemical inputs (mostly derived from oil), deploy hybrid seeds and establish mechanised irrigation systems.[49] Initially, the application of this so-called 'high external input' (HEI) package successfully increased food production. But recent evidence has found that stable fertiliser deployment is beginning to produce less food. Some suggest soil nutrient exhaustion is behind the drop.

In the 1970-1980s many countries, including South Africa, began to privatise and deregulate their national, state-centred agricultural systems. This was a reaction to rising food prices, declining yield, and expanding middle classes who demanded more protein in their diets (neoliberalism's march was also a driving influence).

Deregulation and corporatisation of South Africa's agriculture systems accelerated during the democratic transition from 1990-1994; accompanied by a strong push to open South Africa's economy to international competition.[50] This combination of factors led to the concentration of agribusiness and farms, as well as the reduction of farm labour.[51] By 2005 Monsanto controlled 30% of the global market for key vegetable seed.[52] The 60 000 commercial farms (alias for 'white farms') of 1995 had been reduced to 45 000 by 2002.[53] Meanwhile employment data shows that total farm employment declined from about 1.6 million in 1971 to 628 000 in 2005. Casual employment also increased leaving workers and their households insecure and vulnerable.[54] Given the population increase over that time, agriculture's contribution to employment dropped from 8.3% to 1.3% in relative terms.[55] Indeed, between 1993 and 2006, 40% of farm workers lost their jobs in South Africa.




Source data: Agricultural Statistics 2008

In contrast, between 1994 and 2007, South Africa's agricultural exports increased more than five times, while imports in HEI products increased sharply.

Also in the 1990-2000s, supermarket chains rapidly increased their grip on retail food sales, with South Africa leading the world in 2002 when nearly 60% of all food was sold through supermarket chains; only 10 years earlier South Africa had been below 10%. Retail deregulation saw local retail economies quickly dominated by large supermarkets chains, that have since 1994 undermined the economic base of the network of rural trading stores that in many ways constituted local hubs in the region's agrarian economy (eg local millers, labour recruitment, postal and telecommunication services).[56]

The intensification of food production on existing cropland, without expanding global cropland area, is the dominant proposal believed to hold the key to reconciling the need to increase food production without massively increasing land/resource usage out to 2050. It entails the increased deployment of HEI systems, further consolidation of farmlands, and the expanded deployment of genetically modified plant varieties.

The Food and Agriculture Organisation has constructed a scenario to 2050 that envisages an 'intensification' of agricultural production on existing land without expanding cropland area by more than 9% (which is approximately 120Mhr). This somewhat chimes with some analysts who have calculated that to produce enough food for the global population croplands will need to expand by at least 120Mhr by 2030. However, there is little consensus whether the intensification approach will be socially just or ecologically sustainable.

An alternative pathway is called the agro-ecological approach. This novel approach is dissimilar to the HEI approach in two important respects:

1. It involves working *with* rather than *against* nature and understanding that the ecosystems are indeed complex and integrated and treating them as such.
2. Small farms are generally more productive per hectare than larger farms and therefore must become the focus of policy.[57]

In addition, these two aspects are themselves interdependent and need to be understood in relation to one another.

While there is scope for agrochemicals to be included in the agro-ecological approach (eg the use of potassium where soils are depleted), a good way to think of the distinction is that the HEI approach atomises natural processes and seeks to remedy them individually (ie by applying a particular chemical) while the agro-ecological approach advocates a holistic understanding of the complex interactions between ecological and social systems.

At its core, the agro-ecological approach draws on traditional farming methods, including that of African farming systems. But today they are technically advanced knowledge-intensive systems referred to as 'sustainable', 'organic', 'biological' and 'natural' farming systems.

A core, and actionable, component of this approach involves the restoration of previously arable lands that now suffer from degraded soil.

Africa has the second largest area of degraded soil in the world (after South East Asia). In fact, up to 65% of Africa's soils are degraded, 321Mhr of which are considered 'seriously degraded', and probably too expensive to rehabilitate. But 170Mhr are 'lightly degraded', which could in fact be cost effective to rehabilitate. Projects to achieve this would require investment and workers.

As a labour-intensive and rural industry agriculture has an important role to play in job creation and poverty alleviation in South Africa.[58] Indeed, The Department of Agriculture's Medium Term Strategic Framework emphasises agriculture as a focus of job creation. Some analysts convincingly argue that to achieve this goal labour-intensive sustainable food production systems and activities such as hand weeding, harvesting, and composting and tending to livestock should be encouraged and directed through government policies.[59]

Other positive side effects of this approach to agriculture include improved 'natural capital' such as increased water retention, reduced soil erosion and more agro-biodiversity. It also has the potential to boost social capital, including better internal social organisation and connectedness to external institutions (eg reconnecting with age-old traditions of seed banking and exchange); and improved human capital including better health, reversed urban migration, improved status of women and advances in decision making and problem solving capabilities.[60]

Countries where the agro-ecological approach has taken hold include Cuba during the years on US sanctions; Bolivia which has explicitly sought to reject the western model of farming; China whose drive to become an 'ecological civilisation' includes organic farming systems. The UNEP found that the agro-ecological approach in sub-Saharan Africa would be the most effective way to ensure food security.[61]

Can this approach 'feed the world'? In our view, it probably has a better chance than the current HEI approach (including GMO solutions). Researchers from the University of Michigan agree by way of concluding: 'organic production has the potential to support a substantially larger human population than currently exists'. Further, they have found that 'agricultural land base could eventually be reduced if organic production methods were employed'.[62] This was due to the reversal of soil degradation and subsequent increase in yield resulting from eliminating fertiliser and chemical inputs.

A variation on this may include developing a mixed system (agro-ecological with limited inputs when required). Field experience suggests a mixed approach can double or triple yields on small farms in developing countries. However, both approaches or the mixed approach would struggle to feed a global population who are all consuming the current high-fat western diet.

To sum up:

- The over use of HEI agriculture (including mechanisation) as well as farm and agribusiness consolidation that emerged from the Green Revolution, may have been responsible for doubling yields since 1960, but the ecological damage for which it continues to be responsible (eg reduced soil fertility, soil erosion, polluting water supplies, poison fragile ecosystems, exposes farmers to toxins and contributes to climate change through GHG emissions)[63] is undermining the ecosystems on which future production depend.[64]
- Employment losses and the dismantlement of small communities are also causalities of this agenda.
- Input costs for intensive farming are increasing, and are largely subject to fluctuations in the oil price, raw material and exchange rate changes, leaving the farmer with little control over his/her affairs.[65]
- Importing these farming practices from northern hemisphere countries can prove problematic for Africa; for example, ploughing, one of the oldest methods of controlling weeds is ideal for water-logged European soils, but in a South African

context it results in dry, sun baked, compacted soils highly vulnerable to top-soil erosion—this process also releases $CO_2$ into the atmosphere.

- Irrigation can reduce soil fertility by building up salts in the soil. An estimated 260 000ha of irrigated land in South Africa is affected by salt.[66]

We believe that an argo-ecological system of food production would deliver many more social-economic benefits, as well as environmental—including GHG reductions—under a changing climate system in a carbon constrained world.

## Conclusion

History has shown that democratic, economic and social transitions in South Africa have not delivered an equitable and ecologically sustainable society. This paper has tried to show that a *just transition* may.

We have showed that the just transition concept is highly incompatible with policies that seek to solve the country's electricity supply shortage by expanding coal-based enterprises across South Africa—such as building new coal-fired power stations, upgrading and expanding accompanying transport systems, for example, rail and ports, and providing support to coal-mining operations. By contrast, the concept is significantly compatible with policies that seek to expand installed renewable electricity capacity to a point where they dominate the projected electricity supply mix.[67]

We have also showed that the just transition concept is largely incompatible with a policy pathway that encourages the intensification of South Africa's food production system. By contrast, the concept is more compatible with an agro-ecological food production system.

It is important to note that we have not presented an 'either-or' argument here. Rather, it is an argument about which approach to electricity supply (coal-based or renewable) and food production (HEI-based or Agro-ecological) should dominate each system out to 2050, and beyond.

An underlying argument cutting across the two sectors is that South Africa needs and should develop in a different way to the northern hemisphere countries.

Elevating the just transition concept, or 'wellbeing economy', to a central position in government decision making—a 'lens' through which to view appropriate (and necessary) policies—can distinguish South African policymaking from the northern hemisphere, and by doing so, help drive a change toward a more socially inclusive and ecologically sustainable South Africa, as well as help the world achieve the Paris Agreement temperature goals of an outer limit of 2°C or safer 1.5°C target.

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