

14. South Africa: Carbon-Intensive Economy and a Regional Renewable Energy Frontrunner



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Due to its strong reliance on coal, South Africa is a middle-income country with very high per capita emissions. As host of the Conference of the Parties (COP) in 2011, the country has embarked on a significant change of trajectory for its energy sector. In its climate mitigation efforts, it has introduced renewable energy auctions and furthermore focuses on carbon capture and storage as well as energy efficiency. South Africa's regional activities concentrate on renewables, grid integration and energy access in Southern Africa.

In international rankings of carbon dioxide emissions per capita, South Africa fluctuates between 10th and 15th position (Global Carbon Atlas, 2016). As most of South Africa's energy is currently derived from coal, this emerging middle-income country contributes increasingly to global emissions.

Nonetheless, South Africa is active in addressing climate change. In 2011, the country hosted the COP17 in Durban and embarked on a significant change of trajectory for its energy sector, notably by implementing a renewable energy programme. The South African Renewable Energy Independent Power Producer Procurement Programme (REI4P), which prioritises the inclusion of power derived from renewable energy sources, such as solar- and wind-powered stations, has gained traction among international energy stakeholders.

With a demonstrated interest in increasing the share of renewable energy to transform into a green economy, South Africa's priorities remain those of an emerging country. With about 15 percent of households lacking formal access to modern energy services (Statistics South Africa, 2016), it has to close the remaining gaps in electricity access among its population, while creating and transforming jobs in its energy sector and adjusting to industrial- and market-driven energy demands. In addition, the country experienced recurrent power cuts that were not only an inconvenience for the daily lives of South Africans but substantially limited the growth of the national economy. This has revealed that South Africa also needs to focus on better energy infrastructure maintenance, investment and planning. To this end, leveraging investment, with the help of international partners, is key to South Africa's ambitions. The South African Department of Energy has therefore made provisions to add new energy sources to the country's energy mix and attract foreign investment.

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Key challenges for transforming the South African energy sector

After decades of apartheid, with strong inequalities of access among South Africans, today South Africa faces the opening-up of its energy sector to liberalisation and to international players.

Overview of the South African energy policy situation

To date, mineral products and metals prevail as South Africa's largest export earners. Mining and quarrying activities also remain essential to South Africa's industrial development and dominate the country's energy landscape (OEC, 2016). As a result, the energy sector itself is the largest consumer of power and contributor to greenhouse gas emissions.

In a nutshell, most of South Africa's power generation derives from coal, with few gas turbines and small contributions from nuclear and hydro (including pumped storage plants). The country's primary energy mix is barely more diversified and is also heavily reliant on coal. However, since the end of apartheid, South Africa has strived to diversify its energy sources. After a White Paper on Energy Policy in 1998 (RSA, 1998) that aimed to increase energy access and infrastructure, the country released a White Paper on Renewable Energy in 2003 including ambitious targets to diversify the country's energy mix (RSA, 2003). A National Energy Act followed in 2008. Based on the work done by its National Planning Commission, South Africa also developed two baseline documents, the Integrated Resource Plan in 2010 and the National Development Plan in 2012. An Integrated Energy Plan was submitted for public consultation in 2013 and is still pending. Taken together, these documents set the scene for the country's sustainable development, with a cross-sectoral and integrated approach to resource management up to 2030.

With this recent policy framework, South Africa is paving the way to transform its carbon-intensive economy. However, restructuring state-owned energy institutions while finding a new balance in

these institutions between the role of the state and those of a growing diversity of stakeholders (businesses, civil society groups) is not an overnight operation.

Re-structuring Eskom, South Africa's state-owned electricity enterprise

To understand South Africa's energy situation and recent key decisions, it is important to consider the role of the parastatal Eskom and this utility's slow and difficult transformation since the end of the apartheid era (Eskom, 2016).

Until recently, excess capacity, readily available cheap coal and the use of coal-fired power station technology enabled Eskom to achieve one of the lowest electricity costs in the world. During this time, Eskom was a monopolistic, state-owned enterprise with few regulatory processes. In 2002, Eskom was turned into a public company (RSA, 2001). However, the South African state has chosen to remain a majority stakeholder, and Eskom has maintained its monopoly in providing electricity to the country. Eskom's mandate includes growing national energy production capacity and increasing access to energy services for South Africans. The government claims that five million households have been connected since the end of apartheid. In 2007, the country ran out of additional capacity, partly due to a lack of investment and delays in constructing new energy infrastructures. Faced with woeful shortages in 2008, Eskom introduced infamous load-shedding practices – some of which continued until 2015 – to maintain and protect the national grid's integrity.

The 2008 energy crisis also triggered a change in energy price structure. Eskom was compelled to begin increasing power supply tariffs to support its investment in maintaining and expanding energy infrastructure. Today, South Africa ranks among the top twenty countries with the highest electricity delivered prices (Statista, 2016). In turn, this has significant socioeconomic impacts on the post-apartheid South African energy landscape, with energy services weighing heavily on the domestic budget.

South Africa also suffered from external factors, such as the international sanctions against Iran, a key provider of crude oil to the country. It is thus no surprise that the potential of other energy sources, such as shale gas and nuclear, has gained traction in the country after its 2008 experience of energy shortages. Following a cautious moratorium on the exploitation of shale gas in 2011, which was lifted a year later, the South African Government gazetted new regulations, and private companies such as Shell, Falcon and Bundu have recently received exploration licences. However, South Africa's supporting infrastructure (service industries and pipelines) remains insufficient to enable a similar success to the US shale gas revolution (RSA, 2012). There is also discussion on expanding South Africa's existing nuclear infrastructures.

Developing renewable energy to decarbonise South Africa

While shale gas exploration and new nuclear power plants are under debate in South Africa, the country has already embarked on harnessing its renewable energy potential. National renewable energy targets for 2030 have been set at 17.8 GW (with an interim goal of 7 GW by 2020), which would represent 21 per cent of South Africa's future power capacity mix (RSA, 2010).

Developed in 2011 as an auctioning system, the REI4P programme has raised commissioned renewable energy capacity to 6 329 MW (see Figure 1), which is close to the DoE interim target of 7 GW by 2020; of this, 1 860 MW have begun commercial operation.

Table 1: Main results of the South African REI4P

RES technology	Window 1 2011-12	Window 2 2011-13	Window 3 2013-15	Window 3 (2 nd phase) 2013-2015	Window 4 2014-2015	MW Total
Onshore wind	649	559	787	-	1363	3358
Solar						
CSP	150	50	200	200	-	600
PV	627	417	435	-	813	2292
Biomass	-	-	17	-	25	42
Landfill gas	-	-	18	-	-	18
Small hydro	-	14	-	-	5	19
Total (MW)	1 426	1 040	1457	200	2206	6329
Selected bidders	28	19	17	2	26	92

Source: DoE REI4P, <http://www.ipprenewables.co.za>

Further benefits of the REI4P mostly relate to job creation and significantly cheaper renewable energy prices. The South African Government has also reiterated its interest in technology transfer, as well as in the transformation of its energy market skills to match new energy technology development.

South Africa's energy policies have successfully scaled-up renewable energy and introduced independent power producers to the national bulk electricity market. Today, South Africa has the largest installed renewable energy capacities on the African continent (IRENA, 2016). However, Eskom has expressed several concerns about the Department of Energy's wish to pursue the REI4P beyond its initial target.

Beyond renewable energy: South Africa's additional actions

Using a peak, plateau and decline approach (from 2020 to 2030), South Africa's Intended Nationally Determined Contribution (INDC) has selected a specific set of priorities and short- to long-term actions. There is a strong focus on the energy sector, notably on clean energy and energy efficiency. Transport is also a key component, including the intent to increase public transportation.

According to the Department of Environmental Affairs the energy sector accounts for approximately 75 percent of national emissions (RSA, 2014). Besides the pursuit of the REI4P, developing carbon capture storage technologies and enhancing energy efficiency are key elements of the South African's INDC. This includes further actions to increase the use of energy-efficient lighting in buildings and streets, for example, and to favour energy-efficient appliances, notably for cooling and heating.

The transport sector accounts for 13 percent of the country's greenhouse gas emissions (RSA, 2014). As stated in South Africa's INDC, a modest investment in public transport infrastructure started at USD 0.5 billion in 2012 and is expected to increase at five percent annually. In addition, a green transport strategy

is currently being developed. Some preliminary objectives include the conversion of 10 percent of the national fleet to electric and hybrid vehicles, and the use environmentally sustainable low-carbon fuels by 2022.²

In addition to these sector-based mitigation actions, there has been an on-going discussion in the country about the establishment of a carbon tax. The National Treasury has made several announcements toward its implementation, but progress has been delayed by the economic recession combined with firm opposition from business stakeholders, notably the mining and industrial sectors.

South Africa's aspiration to secure national energy supply while growing a green economy is sustained by undeniable advantages, such as a structured legislative energy framework, a favourable environment for investments and a growing renewable energy market. All these elements could also be beneficial to bolstering South Africa in its key position on the regional energy scene.

South Africa's leverage in energy cooperation: a regional focus

While South Africa is a key energy player in the region, its presence on the international energy scene remains limited. Securing national supply and developing the regional market have been prioritised so far. Eskom supplies 96 percent of electricity in South Africa, and is also the regional leader, with almost 80 percent of total regional supply and demand within the Southern African Development Community (SADC) (SADC, 2010). However, following Eskom's shortfalls during the 2008 crisis, several SADC member states have decided to work more closely on securing national energy supply, independently of South Africa and Eskom.

Are South Africa's energy priorities aligned with regional strategies?

In 2007, SADC energy ministers warned that the region would soon run out of surplus capacity if

² Personal discussion with representatives from the South African Department of Transport at the last consultation on climate change in South Africa, 28 July 2016.

planned projects were not commissioned and implemented on schedule (UN General Assembly, 2008). With a regional total installed power capacity of around 60 GW, the region has a regular operating power capacity of about 46 GW, of which renewable energy contributes approximately 23 percent. More than 75 percent of regional operating capacity comes from South Africa. More importantly, regional power generation is derived from coal, while hydro accounts for approximately 20 percent of the region's electricity. Except for South Africa, power generating capacity and electrification rates are extremely low among the SADC countries, which rely heavily on biomass. The quality of energy access is also highly differentiated at the national level (SADC, 2010).

Overall, the most striking regional challenges are, first, how unequally developed national energy networks are among SADC countries; second, a heavy regional reliance on coal; and third, the regional Member States' lack of investment in a regional framework to align their policies and initiatives. In response, a Southern African Power Pool was created in 1995 among the national power utilities operating in the region. This successfully managed the integration of the coal-based grid of its southern members and the hydro-based grid of its northern members via transmission facilities in Zambia and Zimbabwe.³ Enforced regional market mechanisms within the power pool have also facilitated short-term electricity supply contracts between national power utilities. In turn, such contracts have enabled the operation of an interconnected regional power system, notably to deal with short-term imbalances experienced by national power utilities (Maupin, 2013). Simultaneously, the SADC has promulgated a regional energy protocol (SADC, 1996), along with other sector-specific strategies and plans. South Africa ratified this regional protocol; two years later, the first post-apartheid South African energy policy clearly mentioned the need for South Africa's energy policy to be compatible with the SADC regional energy protocol (RSA, 1998).

More recently, the SADC has also embarked on an ambitious regional Renewable Energy Strategy and Action Plan to gear the region towards the development of its untapped renewable energy, notably by developing off-grid solutions (SADC, 2010). Under SADC supervision, a regional Centre for Renewable Energy and Energy Efficiency (SACREEE) was recently opened in Namibia. It can be argued that in most SADC countries the use of renewable energy sources is not recent;⁴ nevertheless, there is no doubt that these power sources are flourishing at present. In 2013, renewable energy represented 32 percent of the region's additional power capacity and 59 percent one year later (IRENA, 2015).

At present, South Africa is considering not only expanding renewable energy uses – notably their remarkable diversity of sources in the region and their implementation at various scales – but also a change in power generation and the energy mix model, which would include off-grid solutions and competitive energy trading. Specific divisions, regional legal instruments and sub-organisations have been implemented to manage energy issues regionally. In brief, power pooling and associated regional plans are becoming instrumental for South Africa in contributing to a regional electricity market including renewables on the one side, and on the other to increase the share of power derived from renewables. On this basis, regional responses now speak more adequately to meeting regional electricity needs.

South Africa's modest contribution to decarbonising the regional energy system

While South Africa and Eskom have been instrumental in the deployment of renewable energy nationally, this is less arguable across the region, where the SADC possesses the regional mandate to facilitate, and eventually achieve, the deployment of renewable energy regionally.

³ A power pool is a mechanism for facilitating the exchange of energy between electricity generating companies. Five power pools currently exist across the African continent. The SAPP members include the national power utilities of Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mozambique, Namibia, South Africa, Zambia and Zimbabwe.

⁴ Large-scale hydro schemes, such as the Kariba and the Cahora Bassa dams, have produced power for the northern part of the SADC region since the 1960s.

However, South Africa's renewable energy programme is an example of good practice for other SADC countries. In this regard, South Africa's actions in transforming its energy sector could provide an interesting model for other SADC countries. South Africa has successfully managed to balance national deployment of renewable energy – including at the small scale and with a diversity of sources – while retaining an interest in large-scale regional projects.

As a result, South Africa and Eskom have worked on the revival of the Grand Inga hydropower project. Since 2011, South Africa and the Democratic Republic of Congo have established a cooperative framework to develop the potential of the Inga site. Should the Inga 3 dam and associated power station reach completion, the two countries' national power utilities – Eskom and the Congolese SNEL –⁵ would be the primary participants and beneficiaries after funding, construction and management of this hydropower project.

South Africa and the Democratic Republic of Congo have successfully paved the way to establish an energy-related cooperative framework. Nonetheless, significant behavioural shifts seem necessary to succeed in increasing energy access and availability for the two countries within the region. So far, the absence of a regional multilateral approach remains a concern. To this end, it is urgent to engage the Zambian and Zimbabwean authorities to initiate negotiations on transmission lines from the Congolese Inga hydro power plants to South Africa. This will also become a first step towards ensuring the building and rehabilitation of the regional network.

It remains to be seen whether South Africa plans to rely partly on regional electricity trades to balance its emissions. While the country holds an undeniable strategic position within the regional energy scene, most of this electricity is still derived from national resources, despite South Africa's commendable ambition to transform its energy system and promote regional integration.

Impulses coming from South Africa

Firstly, South Africa has developed relevant legislation that interlinks the overarching goal of sustainable development with the country's specific energy and climate change challenges. South Africa's strong framework of policies and strategies could provide inspiration for other countries in the region.

Secondly, South Africa has been cautious about exploring new energy sources and adopting recent water-intensive energy technologies such as shale gas and hydraulic fracturing. The ways in which South Africa has – and continues to – exercise caution, notably given its water constraints, could inspire countries facing similar challenges in transforming their water and energy sectors, if they are to emerge environmentally unscathed.

Thirdly, the REI4P illustrates South Africa's commitment to placing the country on a green economy pathway. Despite several pitfalls, such as the difficulties encountered in connecting newly operational power plants to the national grid through Eskom, the REI4P constitutes an interesting example of how middle-income emerging economies might balance economic growth and decarbonisation.

⁵ The *Société Nationale d'Electricité* is the Congolese national power utility.

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