SOUTH AFRICA

DDP SOUTH AFRICA

COUNTRY FACTSHEET

This document presents a synthesis of key results of the decarbonization scenarios developed for South Africa. It describes the key national and sector level techno-economic transformations to 2050, their main socio-economic aspects and resulting emission profiles. It also highlights some main policy implications and challenges, investment insights and necessary developments in international enablers.

Hilton Trollip, Bryce McCall, Fadiel Ahjum.

DDP

The DDP is an initiative of the Institute for Sustainable Development and International Relations (IDDRI). It aims to demonstrate how countries can transform their economies by 2050 to achieve global net zero emissions and national development priorities, consistently with the Paris Agreement. Analyses are carried out at the national scale, by national research teams. National research teams openly share their methods, modelling tools, data and the results of their analyses to share knowledge between partners in a collaborative manner and to facilitate engagement with sectoral experts and decision-makers.

About this project

Thanks to the support of the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), and building on the Deep Decarbonization Pathways (DDP) Initiative and the collaboration with the 2050 Pathways Platform, an IDDRI-led consortium with outstanding partners in four emerging economies has developed granular deep decarbonization pathways to 2050 for Brazil, India, Indonesia and South Africa. These pathways have been brought to public debate and domestic decision-making processes. Methodological insights from this work are shared with researchers and practitioners around the world and with members of the 2050 Pathways Platform to support their process of developing long-term strategies.

High-level characterization of DDS trajectory

Drivers	2020	**2030**	2040	**2050**	
GDP Growth (in relation to 2020)		**22%**	60%	**121%**	
GDP/capita ($USD 2015/capita)	4,001	**4,402**	5,317	**6,944**	
Emissions	2020	**2030**	2040	**2050**	
CO_2	362	**291**	101	**103**	$MtCO_2$
GHG	443	**369**	174	**177**	$MtCO_2e$
CO_2 Cumulative from 2020		**3.54**	5.58	**6.49**	$GtCO_2$

Dates

CO_2 Peaking date	Before 2020
CO_2 Peaking date	Before 2020
CO_2 Net Zero date	After 2050
GHG Net Zero date	After 2050

with LULUCF without LULUCF

IDDRI

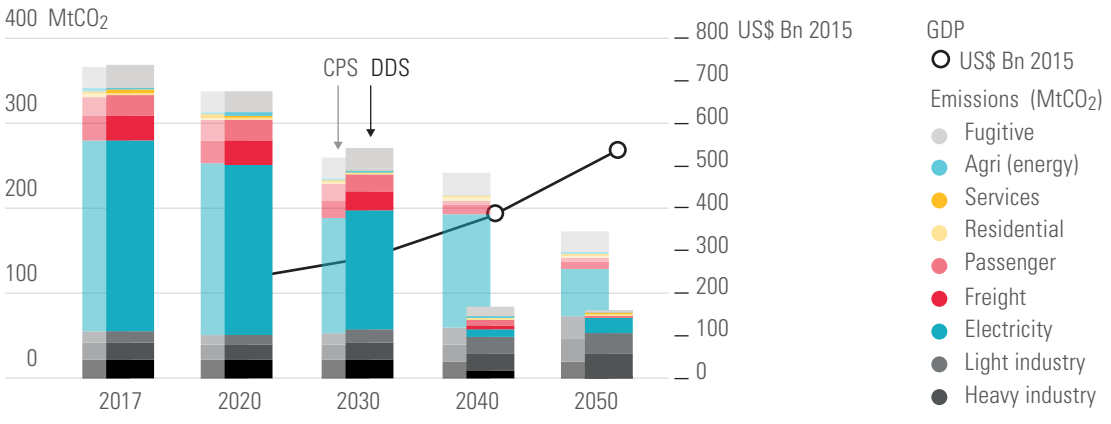
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

ECONOMY-WIDE TRANSFORMATIONS

- Two scenarios were modelled using the SATIMGE[1] model: the current policy scenario (CPS) and the deep decarbonization scenario (DDS). CPS 'implements' existing government policy in the model and has no emissions cap imposed. For DDS, an 8Gt cumulative emissions cap is imposed to identify least-cost mitigation options and associated energy system, economic and emissions pathways to explore approaching net zero by 2050.
- The most striking overall result that jumps out in **Figure 1** is that, comparing DDS vs. CPS over 2020-2040, **with little difference in GDP**, CPS decarbonization is moderate from 337-241 $MtCO_2$pa of combustion emissions whereas DDS decarbonization is substantial, from 337-83 $MtCO_2$pa.
- Another very striking overall result is that, by far, the largest contributor to achieving economy wide decarbonization from 2020-2040 of 337-83$MtCO_2$pa is due to almost complete electricity sector decarbonization from 200-11 $MtCO_2$pa.
- A further striking overall result is that in the DDS, substantial decarbonization takes place by 2040 and the bulk of residual emissions by 2040 is industry. Emissions reductions 'stall' in 2040 with little change to 2050.
- About half of the 83Mt combustion CO_2 residual emissions could be mitigated with known technology but at substantial additional costs and this is not modelled.
- Beyond this half, most of the 'last-mile' remainder of residual emissions, including non CO_2 GHG emissions, is in heavy industry processes where solutions are uncertain now but expected over the next twenty-thirty years. We do not focus on these residual emissions and thus the existing DDS is a proxy for a 2050 net-zero CO_2 pathway.
- While there is litte GDP difference between CPS and DDS, there are large differences in investment requirements and specifics of sectors and decades which are highlighted in sections below.
- **One particularly significant highlight for short-term strategic policy action is that from 2020-2030 DDS and CPS economy-wide energy CO_2 emissions pathways are very similar** with a drop from 337-270 for DDS and 337-259 for CPS. A transition from coal-fired to renewable electricity accounts for 90% of this decarbonization. The implications for short-term policy are detailed in more detail in the Electricity section below. **The primary implication is that the DDS is on a least-cost pathway from 2020-2030**. These are only modelled direct financial costs. Substantial social and transition costs mainly linked to coal phase-out are not included and are highly relevant.

1 SATIMGE: energy systems model (SATIM) linked to a detailed economic model developed at the Energy Systems Research Group, University of Cape Town. Detailed bottom-up modelling (SATIM) of the energy system (including all economic and consumption activities involving combustion) is done linked to an economy-wide computable general equilibrium (CGE)

Figure 1. Sectoral energy CO_2 emissions and GDP

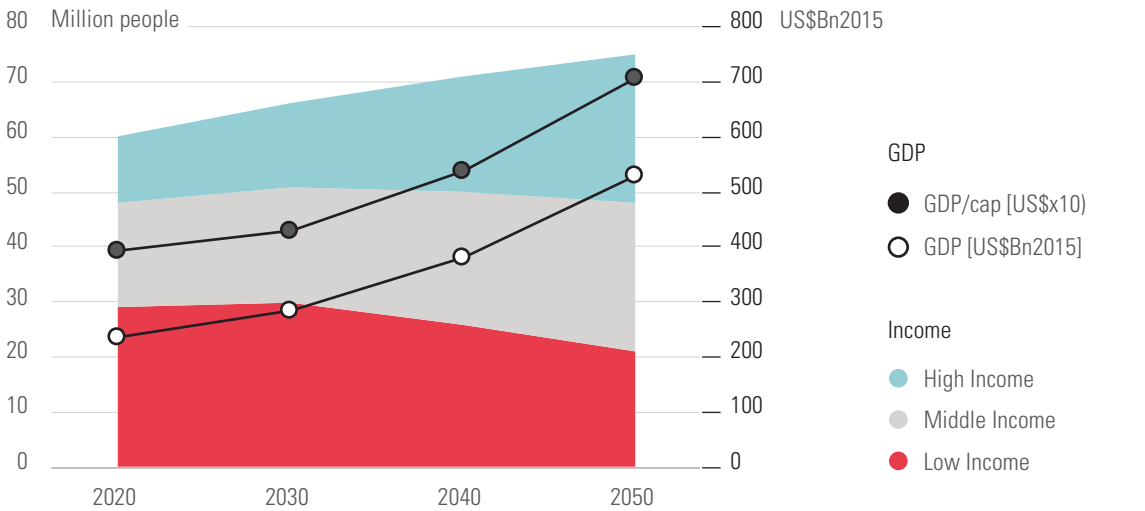


KEY NATIONAL-SCALE SOCIO-ECONOMIC ASPECTS

2020-2050: GDP/cap increases 150%. Existing severe poverty, inequality and unemployment are reduced.

- There are aggregate benefits across the economy: these can be substantially increased and more fairly distributed but only with specific deliberate dedicated policies.
- There are severe costs in concentrated groups of coal workers, communities and companies: these can be mitigated with dedicated policy.
- Shift to services sectors continues. Inter-linkages with minerals extraction and energy intensive light and heavy industry remain.

Figure 2. Housing type and GDP/cap



INTERNATIONAL KEY ENABLERS

The core national political challenge to the transition is a political economy and governance impasse within vicious cycle severe increasing poverty and unemployment, economic and investment stagnation. To overcome the impasse, a Presidential Climate Commission has begun formulating the details for a Just Transition (JT) with a first set of concrete results planned for December 2021.

JT Plans involving international climate finance are expected in at least three (linked) areas: social transition costs in concentrated coal-dominated geographic areas and industries; enhancing and re-distributing benefits of shifts to low-emissions technologies, and; trade cooperation in energy intensive trade-exposed goods. The President communicated an initial sum of US$11Bn to the UNFCC. Eskom, at the centre of the national JT, is the monopoly, state-owned coal-based state-owned electricity utility at the centre of the 'creative destruction' that cannot cover interest on its debt, which has been a major factor in downgrade of sovereign debt to junk and has announced its own Just Energy Transition which it plans to present at COP26.

Decarbonization of emissions intensive trade exposed industries (EITEIs) with complex transnational value chains such as chemicals and steel will require global sector decarbonization to enable early participation of small economies such as South Africa. Specific example of this cooperation would be a combination of access to technology, participation in lead markets that have been created in the EU to drive decarbonization of these industries and open and fair markets for zero/low embodied emissions commodities and goods.

SECTORAL SYSTEM TRANSFORMATIONS

Electricity techno-economics 2020-2030: For fifteen years there has been an increasingly severe electricity supply shortage; the 85% coal-based electricity generation system of some 40GW cannot cover costs and is in financial crisis. The core of the techno-economic least cost solution to the shortage and meeting electricity demand until 2030 is addition of 20GW of wind and PV electricity generation and is on a DDS pathway. From a techno-economic perspective, emissions mitigation is a co-benefit of a least cost electricity plan.

Electricity policy 2020-2030: While the techno-economic transformation at national electricity system level appears 'simple', the transition from coal-fired generation to renewable energy electricity involves 'transition costs' above direct costs in the techno-economic modelling.

Transition costs involve reduction of 30% in coal burned, closures of coal power stations and shelving official government plans for new coal power stations. Without dedicated policies to alleviate these 'transition costs', there will be substantial loss of mineral-rights asset values, revenues and jobs, with huge social costs in communities and local economies that depend on coal.

This is being taken up in the just transition (JT) process under direction of the Presidential Climate Commission (PCC).

Electricity policy 2020-2040: DDS pathway results in no coal generation by 2040 and an addition of 62GW of wind and PV. This is not least cost for the electricity system and involves additional investment of R400Bn to achieve the emissions reductions. A further 50% reduction in national coal consumption and closure of all coal power stations exacerbate transition costs, and social costs. Financing R400Bn additional investments is a challenge.

A Just Transition Transaction (JTT) involving international support to assist with these costs is at the centre of an international process underway-see international enablers section.

Industry techno-economics: Decarbonizing coal based petroleum fuels / petrochemicals industries has potential macro-economic scale impacts that are entangled with multiple industrial, trade and financial/economic systems. Publically accessible data/analysis makes 'external' formulations of solutions for their decarbonization problematic.

DDP-South Africa has conducted a 'deep dive' demonstrating potential for a first step in decarbonizing primary iron production orientated towards export-see International enablers section.

Transport techno-economics: Regardless of modal share, which is highly uncertain, surface transport is almost fully decarbonized solely owing to evolving cost differentials between internal combustion engines, energy storage, hydrogen and electric drive technologies. DDS and CPS are similar except for (uncertain) cost trajectory of battery electric light commercial vehicles in the 2035-2040 timeframe.

Figure 3. Power generation capacities for DDS

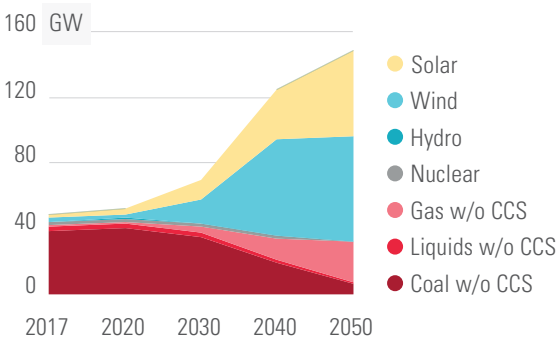


Figure 4. Transport and freight transport emissions drivers