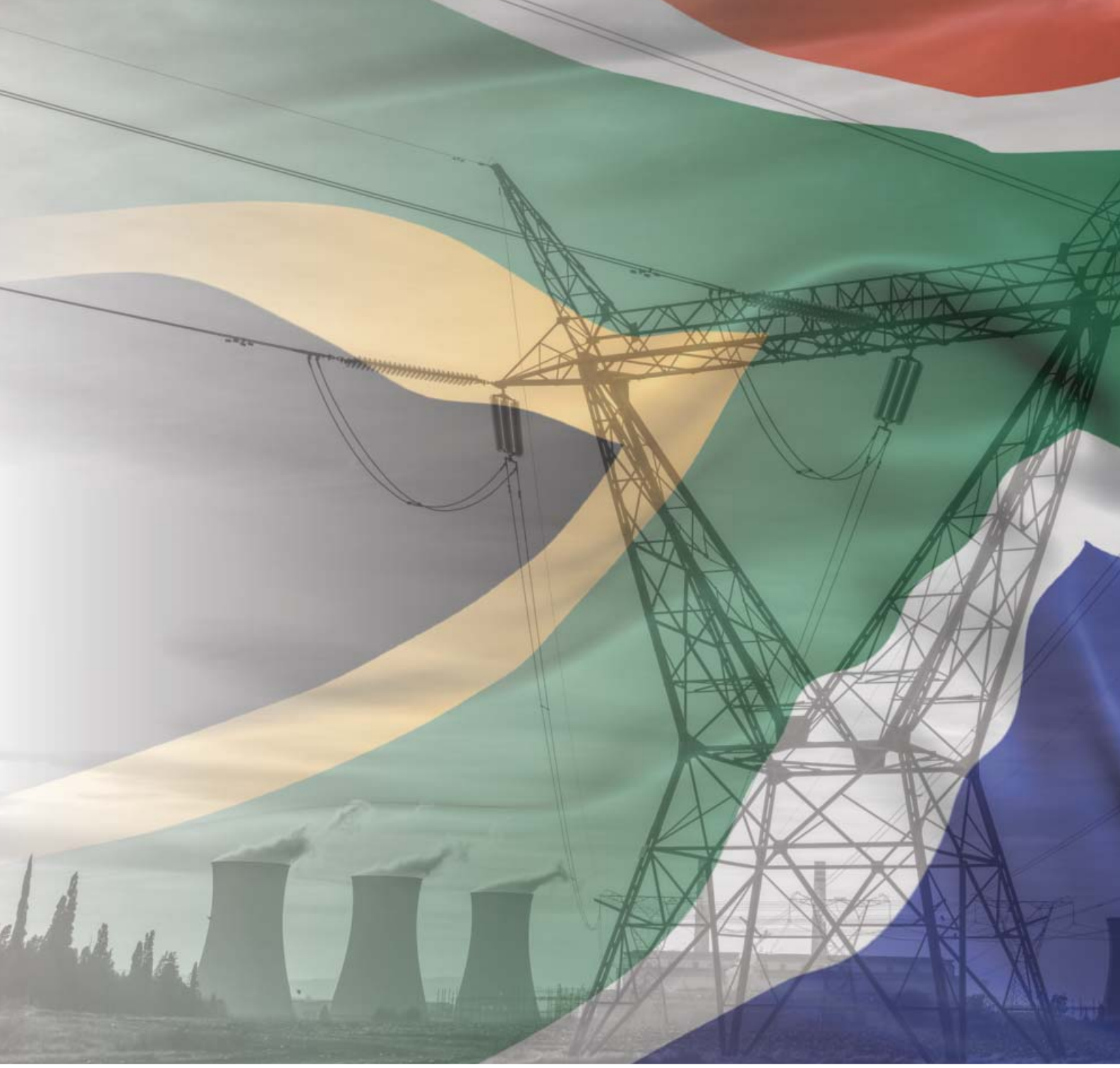


SOUTH AFRICA'S JUST ENERGY TRANSITION INVESTMENT PLAN (JET IP)

for the initial period 2023–2027

THE PRESIDENCY
REPUBLIC OF SOUTH AFRICA

MESSAGE FROM PRESIDENT CYRIL RAMAPHOSA

Across the world, we have seen the devastating impact of climate change particularly on the poorest and most vulnerable. In South Africa, we have experienced the loss of life and destruction of livelihoods from worsening fires, floods and droughts. Unless the entire international community addresses the root cause of climate change by reducing greenhouse gas emissions, our people will increasingly be vulnerable to its effects.

South Africa's commitment to tackling climate change is long-standing and unwavering. It is borne out of the understanding that although developing economies have made little contribution to global warming, we must all contribute our fair share to addressing it. Our Nationally Determined Contribution, submitted in 2021, sets out an ambitious emission reduction trajectory that is compatible with the Paris Agreement. It requires international support for its achievement.

Our commitment to implementing a long-term and well-managed transition to a low carbon economy is now concretised in this Just Energy Transition Investment Plan. The plan takes its direction from South Africa's energy and climate policies. These policies reflect our determination to diversify our energy mix and ensure that our transition to a low-carbon economy contributes to our efforts to tackle inequality, poverty and unemployment.

The plan is clear that there is no trade-off between tackling climate change and supporting economic growth. Instead, a just energy transition can attract investment, create new industries and jobs, and help us to achieve energy security and climate resilience.

We invite international and local investors to partner with South Africa to turn our vision of a better, sustainable future for South Africa and the world into a reality.

TABLE OF CONTENTS

PREAMBLE

South Africa's Just Energy Transition Investment Plan (JET IP) for the initial period of five years (2023-2027) gives effect to the historic Just Energy Transition Partnership (JETP) forged at the UNFCCC's (United Nations Framework Convention on Climate Change) 26th Conference of the Parties (COP26) between the government of South Africa and the governments of France, Germany, United Kingdom (UK), United States (US), and the European Union (EU) (forming the International Partners Group [IPG]). The JETP followed engagements between the parties on the unique economic and social challenges inherent in transitioning South Africa's fossil fuel-dependent economy in a just manner. The JETP supports South Africa in achieving the most ambitious emissions reduction range as stated in the country's updated Nationally Determined Contribution (NDC) of 420-350 megatonnes of carbon dioxide equivalent ($MtCO_2$-eq) by 2030. A distinguishing feature of the JETP is the centrality and commitment of the partners to enable a 'just transition', thus recognising the direct and indirect impact that the energy transition has on livelihoods, workers, and communities.

The vision and objectives of the JETP are articulated in a Political Declaration[1], which aim to *"establish an ambitious long-term partnership to support South Africa's pathway to low emissions and climate resilient development, to accelerate the just transition and the decarbonisation of the electricity system, and to develop new economic opportunities such as green hydrogen and electric vehicles amongst other interventions to support South Africa's shift towards a low carbon future."* The Political Declaration provides that the IPG will mobilise an initial US$8.5 billion between 2023 and 2027, subject to concurrence on an investment framework. This catalytic financing is in turn intended to leverage a much greater level of resources from both private and public sources.

In order to give effect to the JETP, a Presidential Climate Finance Task Team (PCFTT), established by President Ramaphosa in February 2022, was tasked with engaging the IPG and analysing the offer, with a view to advising Cabinet (through an Inter-Ministerial Committee [IMC]) on its composition, affordability, and alignment with South Africa's ambitions and priorities in relation to its climate change risks. An independent JETP Secretariat, supported by the Climate Investment Funds (CIF), provided technical and convening capabilities for developing the investment framework, under the guidance of the PCFTT and IPG. Figure 1 illustrates the relationship, mandate, and accountability of these structures.

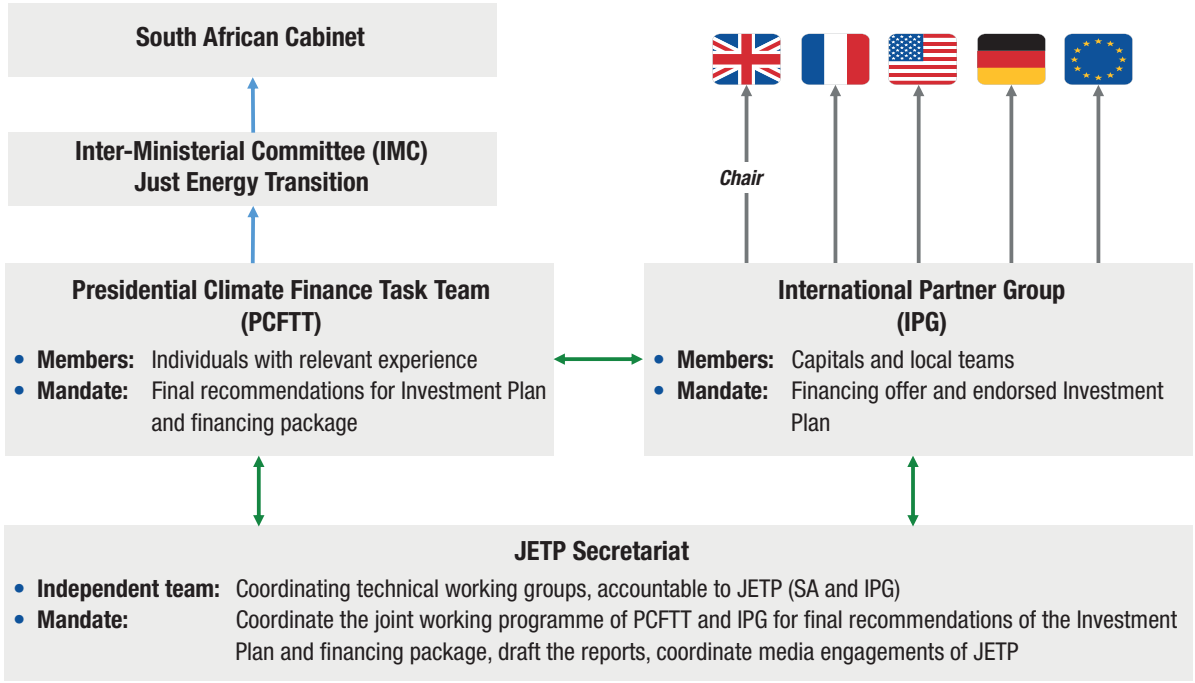
The South African government and its IPG partners recognise the milestone achieved during 2022 in developing this JET IP, which is important for advancing the partnership and attracting resources

[1] Paragraph 17 of the Political Declaration.

from other funding sources. The initial portfolio described in this JET IP, focuses on the priorities essential for catalysing a sustained just energy transition within the next five years in order to achieve the country's economic, social, and economic outcomes over the coming decades. It also considers how best the initial IPG offer of US$8.5 billion may be utilised.

The JET IP represents one milestone in a longer-term process and the partners will continue working together into 2023 and beyond. Such work includes the development of a comprehensive implementation plan, informed by more detailed information on the financing structures, timing of financial flows, and other implementation modalities, which will, inter alia, address governance, accountability, results monitoring, and evaluation mechanisms to ensure the achievement of desired and impactful outcomes, with refinements where necessary in response to unfolding conditions. This work will be informed by continued close collaboration between South Africa and the IPG, with regular progress reports on the JET IP being provided going forward.

Figure 1. JET IP governance



The JET IP was developed over the course of 2022, in a dynamic context, along with several supportive policies and processes being launched, including the Just Transition Framework adopted by Cabinet in August 2022 and far-reaching energy sector reforms that are unlocking investment in renewable energy. The JET IP was developed through a country-owned, country-led, and engagement process, which involved a series of technical working groups and stakeholder discussions with youth, labour, business, civil society, local government, and faith-based organisations. It drew on South Africa's extensive knowledge base amongst policymakers, academia, civil society, and business. The South African government has undertaken to maintain an open dialogue with the stakeholders, facilitated through the Presidential Climate Commission (PCC), to enhance the efficacy and impact of the JET IP, especially during the implementation phases ahead.

The South African government and the IPG are committed to an enduring relationship, whereby the priorities outlined in the JET IP and their resource needs guide the long-term partnership and contribute towards further resource mobilisation. The IPG offer of ZAR128 billion (US$8.5 billion)[2] is an important contribution to the overall ZAR1.5 trillion presented in this JET IP and all parties acknowledge that further public and private resources will be needed. In particular, JETP recognises the essential contribution required from the private sector and the role of philanthropic capital in contributing to the financing gap expressed in this investment plan, including developing approaches to support the just transition in affected regions of South Africa. All forms of finance are necessary to enable a sustained drive towards meeting South Africa's targeted longer-term economic, social, and environmental outcomes.

[2] Exchange rate used throughout the JET IP: 15:1.

EXECUTIVE SUMMARY

INTRODUCTION TO THE JET IP

South Africa's Just Energy Transition Investment Plan (JET IP) for the five-year period, 2023–2027, sets out the scale of need and the investments required to support the decarbonisation commitments made by the Government of South Africa.

The JET IP is in line with South Africa's updated Nationally Determined Contribution (NDC) which was lodged with the United Nations Framework Convention on Climate Change (UNFCCC) prior to its 26th Conference of the Parties (COP 26) in Glasgow in November 2021, and South Africa's Long-term Low-Emissions Development Strategy (LEDS) submitted to the UNFCCC in 2020. The NDC commits the country to reducing its emissions to within a range of 420-350 megatons carbon dioxide equivalent ($MtCO_2$-eq) by 2030. This target is consistent with a fair contribution by South Africa to the Paris Agreement's long-term temperature goal contained in its Article 2.1(a), whereby a target of 420 Mt in 2030 is consistent with a fair contribution to a 2-degree temperature goal, while a target of 350 Mt in 2030 is consistent with a 1.5-degree temperature goal. At the time of submitting this revised NDC, the South African government indicated that its ability to meet the bottom range would depend on the level of financial investment available to support its transition to lower-carbon technologies.

The JET IP is premised on South Africa's National Development Plan (NDP) 2030,[3] with its focus on tackling the country's systemic challenges of poverty, inequality, and unemployment. Accordingly, South Africa's energy transition is an opportunity for the country to drive industrial development, innovation, and economic diversification. It will take place over a number of decades in a well-planned manner, within the framework of the country's energy, climate, and other relevant policies, using both public and private sector resources, and is highly dependent on the scale and nature of financial support it can secure from the international community to complement domestic resources. The JET IP is thus an invitation to international and local investors and donors to partner with South Africa on the just energy transition journey.

The Political Declaration which was signed between the Government of South Africa and the Governments of France, Germany, United Kingdom (UK), United States (US), and the European Union (EU) (collectively, the International Partners Group [IPG]) at COP26, gave rise to the establishment of the Just Energy Transition Partnership (JETP). It undertook to *"Establish an ambitious long-term*

[3] South African Government, 2012, National Development Plan 2030: Our Future – Make It Work.

partnership to support South Africa's pathway to low emissions and climate resilient development, to accelerate the just transition and the decarbonisation of the electricity system, and to develop new economic opportunities such as green hydrogen and electric vehicles amongst other interventions to support South Africa's shift towards a low carbon future."

The Political Declaration envisaged, subject to the concurrence on an investment framework, the IPG to mobilise an initial US$8.5 billion over three- to five years to support the achievement of South Africa's low-carbon future in line with the most ambitious NDC scenario possible. The Political Declaration[4] resolved to establish a partnership comprised of South Africa and international partners, to enable:

- *"The accelerated decarbonisation of South Africa's electricity system to achieve the most ambitious target possible within South Africa's Nationally Determined Contribution (NDC) range to the extent of available resources;*
- *South Africa's efforts to lead a just transition that protects vulnerable workers and communities, especially coal miners, women and youth, affected by the move away from coal;*
- *South Africa's nationally determined efforts to successfully and sustainably manage Eskom's debt, define the role of the private sector, and create an enabling environment through policy reform in the electricity sector, such as unbundling and improved revenue collection;*
- *Local value chains (including Micro, Small and Medium Enterprises) to benefit from new areas of economic opportunity; and*
- *Opportunities for technological innovation and private investment to drive the creation of green and quality jobs as part of a prosperous low emission economy."*

3 South African Government, 2012, National Development Plan 2030: Our Future – Make It Work.

Following the signing of the Political Declaration, a Presidential Climate Finance Task Team (PCFTT) was announced by President Ramaphosa in February 2022 to engage the IPG, advise and develop South Africa's JET IP, and make recommendations on the financing package to an Inter-Ministerial Committee (IMC) convened for this purpose and chaired by the Minister in the Presidency. The IPG and the PCFTT are supported by a JETP Secretariat.

In the context of the JET IP's identified scale of need for investment in the priority sectors of Electricity, New Energy Vehicles (NEVs) and Green Hydrogen (GH_2), the JET IP outlines how the IPG pledge of US$8.5 billion will be allocated to these priorities in South Africa over five years, as set out in Table 1.

Table 1. JET IP Financing needs per sector and priorities to be supported by IPG funding

ZAR (US$) billion	Electricity	NEV	GH_2
JET IP Financing needs Total: *1 480 (98.7)*	1 030 (68.7)	128 (8.5)	319 (21.3)
IPG Total: US$ 8.5 billion indicative allocation to the JET IP			
Infrastructure	6.9	0.2	0.5
Planning and implementation capacity	0.7		0.2
Skills development	0.012		
Economic diversification and innovation	0.022		
Social investment and inclusion	0.016		

The partnership between South Africa and the IPG is thus a steppingstone towards the country's broader just energy transition plans. It seeks to galvanise and leverage further resources from the domestic and international community to support South Africa's larger five-year JET IP needs and the country's just energy transition over a longer time horizon.

4 Paragraph 17 of the Political Declaration.

JET IP OVERVIEW

South Africa faces considerable climate and energy-related risks. These include shortages of electricity supply, under-investment in the electricity system, as well as physical, social, and transition risks. High carbon-intensity of production and economic dependency on fossil-fuel value chains require specific interventions to manage and mitigate the consequences of transition, particularly for impacted workers, communities, small business, and exporters' exposure to carbon trade barriers. At the same time, embracing new economic opportunities in green technologies can drive industrial development, innovation, and economic diversification, leading to a sustainable and economically resilient future, characterised by decent work, social inclusion, and lower levels of poverty.

In considering the implications of a transition to a low-carbon economy and a climate-resilient society by mid-century, the concept of a just transition is centre stage. Following widespread consultations amongst government, business, organised labour, and civil society, the Presidential Climate Commission (PCC) concluded the Just Transition Framework which was adopted by Cabinet in August 2022 to guide South Africa's overall approach to the climate transition.

To support the goals of energy security, just transition, and economic growth, South Africa has developed this JET IP to clarify its priority investment requirements over the next five years in the electricity, NEVs, and GH_2 sectors. Just transition initiatives (particularly arising from the electricity sector's transition in the Mpumalanga Province) are elaborated within these sectors, and two cross-cutting priorities have been identified for skills development and municipal capacity as key components of the JET IP. The summary of the JET IP funding requirements is presented in Table 2.

Table 2. JET IP funding requirements per sector, 2023–2027

Funding requirements 2023–2027	ZAR billion (US$ billion)
Electricity Sector	711.4 (47.2)
New Energy Vehicle (NEV) Sector	128.1 (8.5)
Green Hydrogen (GH_2) Sector	319 (21.2)
Skills development	2.7 (0.18)
Municipal capacity	319.1 (21.3)
TOTAL	**1 480 (98.7)**

ELECTRICITY SECTOR

In the electricity sector, the infrastructure investment priorities are:

- to manage the decommissioning of the retiring coal generation fleet, in line with a revised Integrated Resource Plan (IRP), and in tandem with the development of renewable energy generation at scale and pace;
- to timeously strengthen the transmission grid infrastructure to accommodate the shift to renewable energy; and
- to modernise the electricity distribution system.

The JET IP's portfolio of interventions, if adequately financed, will provide critical support to South Africa's efforts to achieve the lower end of the NDC target range in 2030 (350–375 $MtCO_2$-eq), while also delivering upstream manufacturing employment and innovative models for social inclusion in electricity generation. Demand-side management interventions will play an important role in achieving these outcomes, as will investments by the private company, Sasol to achieve significant emissions reductions as part of the national effort.

The South African government remains committed to achieving the lower end of the NDC target range by 2030, to which the successful financing and implementation of this JET IP's large-scale portfolio of emissions-reduction initiatives will be a material contribution.

This electricity decarbonisation effort must address the whole coal belt and be accompanied by priority investments in the areas of Mpumalanga Province where coal plants are closing, in line with South Africa's energy policy. This requires a Provincial development plan guiding a new economic trajectory for Mpumalanga's sustainable, long-term regional transition away from coal, contributing to economic resilience in its communities, the restoration of its environment, the creation of more and better jobs, and an increase in human capacity and capabilities to capture new economic opportunities in the local geographies where plants and mines are shutting down. The JET IP proposes that these be achieved through:

- repowering (with clean technologies) and repurposing coal plants;
- restoring and repurposing coal mining land;
- developing local infrastructure;
- promoting economic diversification to support local livelihoods, enterprises, and job creation;
- supporting workers to transition out of coal; and
- investing in training, placements, and career opportunities for youth and workers currently in the coal value chain.

The five-year investment needs for the electricity sector transition have been estimated as set out in Table 3, Table 4, and Table 5 below. Table 3 itemises the electricity infrastructure investment need, while Table 4 itemises the Mpumalanga-specific investment needs and Table 5 itemises just transition investments for the sector.

Table 3. National electricity sector's infrastructure investment needs, 2023–2027

National electricity sector's infrastructure investment needs	ZAR billion
Coal plant decommissioning	4.1
Transmission	131.8
Distribution	13.8
New solar photovoltaic (PV)	233.2
New wind	241.7
New batteries	23.1
TOTAL	**647.7**

Table 4. Mpumalanga's just transition investment needs, 2023–2027

Mpumalanga's just transition investment needs, 2023–2027	ZAR billion
Repurposing coal plants	3.4
Repurposing coal mining land	13
Improving infrastructure for development	12.3
Diversifying local economies	24
Caring for the coal workforce	5.6
Investing in youth and preparing future generations for the transition	0.75
Planning for success	0.3
Instituting policies for post-mining redevelopment	0.05
Building capacity for success	1
TOTAL	**60.4**

Table 5. Electricity sector's just transition investments, 2023–2027

Electricity sector's just transition investment needs, 2023–2027	ZAR billion
Manufacturing and localising the clean energy value chain	1.60
Piloting social ownership models	1.65
TOTAL	**3.25**

NEW ENERGY VEHICLE (NEV) SECTOR

In the NEV sector, the focus of the JET IP is on transitioning the automotive sector value chains as the global shift to electric vehicle production gains momentum, building NEV supply chain localisation, and setting the base for NEV manufacturing and component manufacturing, to protect sector employment and promote new growth in sustainable manufacturing. The JET IP demonstrates how initiatives to incentivise investments in NEV-charging infrastructure, and the conversion of public transport and private vehicles to NEVs, will accelerate the decarbonisation of the transport sector and support healthier and more equitable cities through clean and efficient public transport. While more work is needed to plan this significant transition, a five-year investment need for the NEV sector has been estimated as set out in Table 6.

Table 6. NEV sector's investment needs, 2023–2027

NEV sector's investment needs, 2023–2027	ZAR billion
Industrial development and innovation	41.4
Public transport	6.1
Mobility emissions abatement	6.8
Early adoption and innovation	1.8
Technical assistance	1.6
NEV deployment support	70.4
TOTAL	**128.1**

GREEN HYDROGEN (GH_2) SECTOR

In the GH_2 sector, investment is focused on key interventions to set South Africa up to become a world-leading exporter of GH_2 by incubating local GH_2 ecosystems; undertaking critical planning, feasibility, and proofs of concept; and developing the necessary skills. This will support new job creation, valuable exports, and in the long run, the domestic decarbonisation of key emissions-intensive industries. While more work is needed to plan for this new industry potential, the five-year investment needs for development of the GH_2 sector has been estimated as set out in Table 7.

Table 7. GH_2 sector's investment needs, 2023–2027

GH_2 Sector investment need 2023-2027	ZAR billion
Project Feasibility costs	
Aviation Fuel	0.10
e-methanol	0.12
Fuel Cell	0.16
GH and Green Ammonia	3.70
Green Steel	0.20
Hydrogen Mobility	0.10
Infrastructure	0.13
Subtotal	**4.51**
Capital costs (for above projects)	
Aviation Fuel	8.00
e-methanol	12.00
Fuel Cell	1.40
GH and Green Ammonia	109.30
Green Steel	13.20
Hydrogen Mobility	6.60
Infrastructure	13.00
Subtotal	**163.50**
Port project development	1
Port infrastructure capital	150
TOTAL	**319.01**

CROSS-CUTTING INVESTMENTS

The first cross-cutting investment set out in the JET IP is the development of a national skills plan for a just energy transition and the future of work to ensure that skills are in place to match the growth in new clean sectors and support worker transition. The five-year investment need for skills development has been estimated as set out in Table 8.

Table 8. Skills development investment needs, 2023–2027

Skills development investment needs 2023–2027	ZAR billion
Skills hub/platform for JET and the Future of Work (high-level coordination)	0.05
Pilot Skills Development Zones in Mpumalanga, Eastern Cape, Northern Cape	1.6
Mobilise allocations to JET from existing public and private post-school education and training (PSET) funding per annum	1
TOTAL	**2.65**

The second set of cross-cutting investments targets specific support for municipalities to navigate the energy transition and play a dynamic and responsive role in the energy system for the benefit of the communities they serve. This requires functional distribution grids that can accommodate an increasing penetration of renewable energy generation at different scales and connect all residential, public, commercial, and industrial energy users. It also requires the establishment of a financially sustainable service delivery model that provides for equitable access by the whole grid community, all local energy users, including small businesses and low-income and energy-poor households. The initial five-year investment priorities for municipalities have been estimated as set out in Table 9.

Table 9. Municipal investment needs, 2023–2027

Municipal investment needs, 2023–2027	ZAR billion
Infrastructure: Distribution maintenance	200
Infrastructure: Distribution modernisation for NEVs	73
Infrastructure: Electrification backlog	45
Operational: Demand-side management	0.5
Operational: Energy access design	0.1
Capability and capacity	0.23
Collective planning	0.03
Municipal revenue modelling	0.2
TOTAL	**319.1**

FINANCING THE JET IP

The success of the JET IP will depend on the scale and availability of concessional finance, including grants from relevant sources. Limited public finance must be strategically deployed in order to mobilise larger volumes of financing, particularly from the private sector and previously untapped sources such as institutional investors.

The ZAR1.48 trillion (US$98.7 billion)[5] financing targeted for the JET IP is categorised under infrastructure, planning and implementation capacity, skills development, economic diversification and innovation, along with social investment and inclusion, as set out in Table 10.

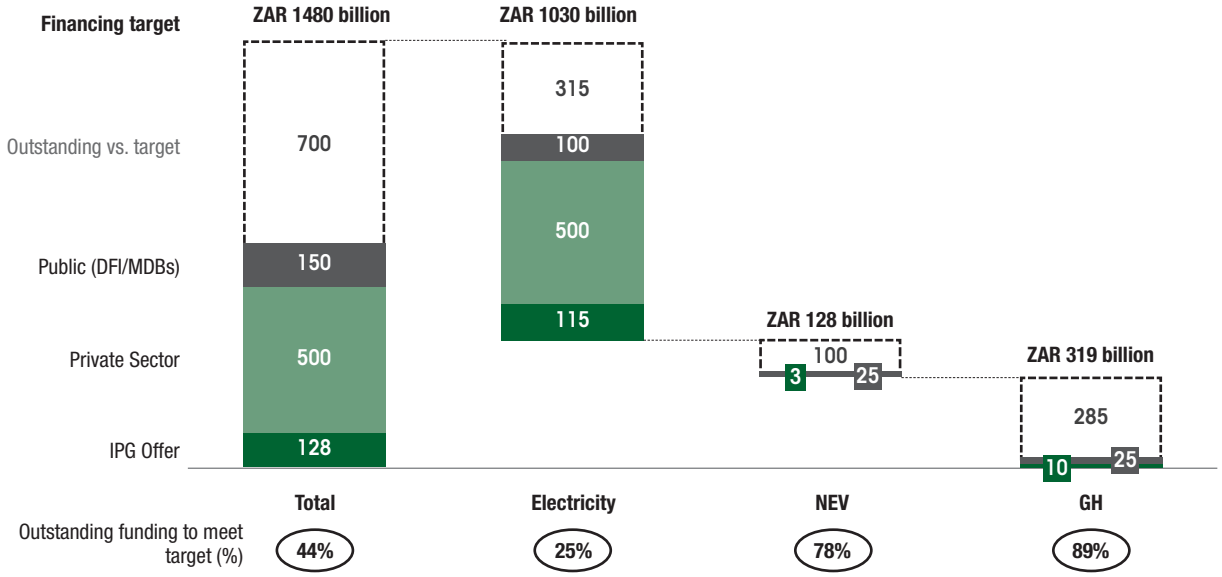
Table 10. Financing needs of the JET IP for the period, 2023–2027

ZAR (US$) billions	Electricity	NEV	GH_2	Subtotal
Infrastructure	978	83	313	1 374
Planning and implementation capacity	2.14	2	5.5	9.9
Economic diversification and innovation	40.4	43	–	83.4
Social investment and inclusion	9.6	–	–	9.6
Skills development			2.7	2.7
Subtotal	1 030.4 (68.7)	128 (9)	319 (21)	
TOTAL				**1 480 (98.7)**

[5] Exchange rate used throughout the JET IP: 15:1.

The estimated availability of funding per sector and source, together with the outstanding funding to meet targets, is depicted in Figure 2.

Figure 2. Projected funding needs and estimated availability by source



Priorities for financing from the IPG's US$8.5-billion pledge in the next five years have been allocated as set out in Table 11.

Table 11. Allocation of US$8.5 billion pledge for the period, 2023–2027

IPG US$8.5 billion allocation, 2023–2027	Electricity	NEV	GH_2
Infrastructure	6.9	0.2	0.5
Planning and implementation capacity	0.7		0.2
Skills development	0.012		
Economic diversification & innovation	0.022		
Social investment and inclusion	0.016		

The partnership between South Africa and the IPG realises an important scale of initial financing which will be deployed as catalytic investments in the JET IP. For this reason, the JET IP's priority focus for investment in state-owned infrastructure is to upgrade the transmission grid and the distribution networks to enable them to take up the renewable energy that will be generated largely by the private sector in the coming five years. This critical network infrastructure investment will leverage large-scale private investment in renewable energy, supporting both energy security and decarbonisation. In parallel, it is particularly important to seek ways, with the IPG partners, to scale up grant funding in support of the just transition investments that need to be made in the communities and workforces affected by the transition to renewable energy generation.

From the needs identified, the required grant and concessional financing is far greater than supply for this initial period of the JET IP. The scale and pace of concessional capital that can be made available in response to the JET IP, both for the initial period and beyond, will be critical in ensuring that JET objectives are met. It will require that the most optimal financing instruments are applied from across the widest range of development and climate financing sources in a manner that is affordable, sustainable, optimises the use of public funds, and leverages private sector investment at scale.

The partnership between South Africa and the IPG provides a first phase of investments in South Africa's managed energy transition. South Africa welcomes international and local investors and donors to become partners in its pursuit of a just transition to a sustainable and resilient economy.

IMPLEMENTING THE JET IP

South Africa's just energy transition will be a managed, phased, long-term process of economic, social, and environmental change. It will involve multi-year, multi-sectoral, and multi-jurisdictional initiatives with many stakeholders, including significant capacity building to manage the scale of the just energy transition. Implementation of the first five-year JET IP must therefore be based on solid foundations for a sustained, focussed, and visible effort across government, civil society, trade unions and the private sector that is able to adapt as needed over time. The Implementation Plan, to be developed in full with relevant timelines upon approval of the JET IP, will be grounded in existing South African institutions and systems and will adopt both local and global best practice in identified disciplines. Its cornerstones will be:

- **Strong governance arrangements** to ensure leadership, oversight, transparency, safeguards, and accountability at the various locations of JET IP delivery;
- **Robust management arrangements** for planning, performance, reporting, and communications at various locations of the JET IP delivery;
- **Monitoring, Evaluation, and Learning Framework** for the measurement of success and continuous improvement; and
- **Risk Management Framework** for identifying potential risks and implementing mitigation measures to reduce material risks to the JET IP.

Features of the JET IP implementation arrangements include:

- **Ministerial oversight,** governance, and political coordination;
- **National government oversight,** coordination of the country-wide JET IP to update national plans, mobilise ongoing financing, and monitor and report national results;
- **Institution-specific funding agreements** between the providers of finance and implementing institutions;
- **National Treasury**-managed sovereign loan agreements with providers of finance;
- **National intermediary institutions** (for example, the Development Bank of Southern Africa [DBSA] and the Industrial Development Corporation of South Africa Ltd [IDC]) managing disbursements of capital from providers of finance to municipalities, private companies, and non-governmental organisations (NGOs);
- **Community-level governance and trade union structures** for ongoing needs identification, visibility of projects progress, monitoring, and learning;
- **Social partner organisations** playing intermediary roles in social support investments; and
- **Private sector investors** in renewable energy infrastructure, just energy transitions, social support, NEVs, and GH_2, will also contribute to national results monitoring.

SCOPE AND OBJECTIVES OF THE JET IP

South Africa presents its Just Energy Transition Investment Plan (JET IP) for the five-year period 2023-2027, which sets out the scale of need and the investments required to support the decarbonisation commitments made by the Government of South Africa in line with its updated Nationally Determined Contribution (NDC) lodged with the United Nations Framework Convention on Climate Change (UNFCCC) prior to its Conference of the Parties 26 (COP 26) in Glasgow in November 2021, and South Africa's Long-term Low-Emissions Development Strategy (LEDS) submitted to the UNFCCC in 2020.

The JET IP is premised on South Africa's National Development Plan (NDP) 2030[6] with its focus on tackling the country's systemic challenges of poverty, inequality, and unemployment. It is located within an evolving climate response and energy policies, strengthening collaboration between the public and private sectors, and in the overall drive for sustainable development. Periodic updates to the JET IP will respond to shifts in global and national initiatives on the climate crisis and the just energy transition imperatives, and to South Africa's sustainable development challenges.

The JET IP aims to reflect the aspirations and ambitions of the South African government and its social partners in enabling a just energy transition, as an essential basis for South Africa's commitment to reduce greenhouse gas (GHG) emissions to 2030 and beyond as set out in its updated 2021 NDC. As such, it presents the initial building blocks for managing South Africa's just energy transition and broader climate response, recognising that: (i) the energy transition has significantly disruptive social and economic consequences for a country which is heavily reliant on fossil fuels; and (ii) the just energy transition gives rise to valuable new economic opportunities for South Africa. Both require support from the international community. It also locates the Just Transition considerations and in particular the need to support affected workers and communities through the transition as a central and critical concern and a key area for investment, including in reskilling, skills development, SME development and social support.

The JET IP identifies the initial priority investments to transition the electricity sector to a low-emissions trajectory. It also looks to develop green industrialisation opportunities in this sector and in the new energy vehicles (NEVs) and green hydrogen (GH_2) sectors.

[6] South African Government, 2012, National Development Plan 2030: : Our Future – Make it Work.

The JET IP identifies the initial investments that will have the greatest prospect of supporting the achievement of the current NDC target and longer-term decarbonisation, and it embeds the 'just transition' approach from the start in line with the country's Just Transition Framework.[7] In so doing, it sets out the investments needed over the next five years to establish a phased low-emissions development trajectory in line with the Paris Agreement and in the context of the country's national circumstances and policy, while both mitigating the social and economic impacts of decarbonisation and embracing the new economic opportunities.[8]

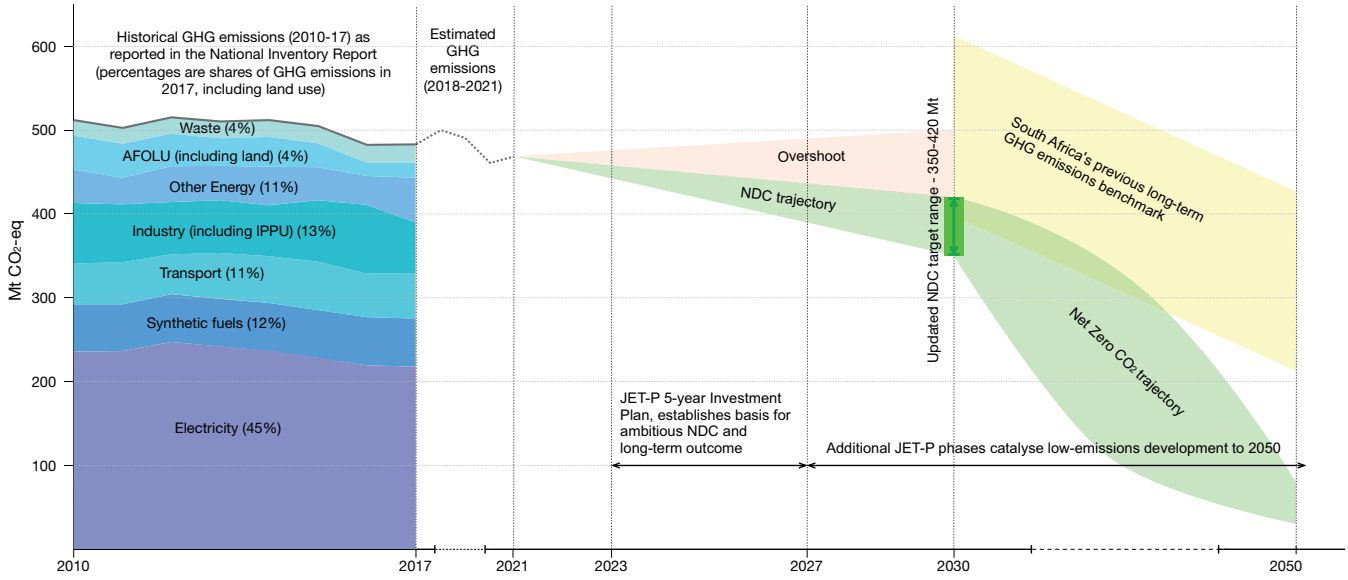
The JET IP is thus located within the context of international climate agreements, commitments, and institutional arrangements, in particular, the obligation on the developed world to support developing countries in their climate change mitigation and adaptation needs contained in the Paris Agreement and associated decisions, and specifically Article 4.5, which recognises *"…that enhanced support for developing country Parties will allow for higher ambition in their actions."*

South Africa's NDC lays out an ambitious goal for 2030, which is contingent on the provision of finance and other support that positions the country to achieve the best possible outcome in relation to the NDC. This is challenging and requires substantive actions over the next five years, which, if adequately resourced and implemented, will facilitate the "most ambitious possible" outcome in 2030. An equivalent level of ambition in support for South Africa from the international community is thus also required to achieve this outcome.

The outcome in 2030 and beyond depends strongly on what South Africa is able to achieve within this five-year time frame, and this, in turn, depends on the effective commitment and mobilisation of the necessary resources.

7 PCC (Presidential Climate Commission), 2022, A Framework for a Just Transition in South Africa.
8 https://newclimateeconomy.report/.

Figure 3. South Africa's GHG emissions up to 2017 by major sources, and estimations to 2021 (left), and 2030 NDC target range and long-term decarbonisation pathway (right)



South Africa's updated 2030 NDC target range and long-term trajectory to net-zero CO_2 emissions are considerably more ambitious than the previous long-term GHG emissions benchmark. JET IP investments are designed to catalyse climate action that will put South Africa on a path to meet its NDC targets in the most ambitious way possible and propel its low-emissions development trajectory to 2050.

Source: *Energy Systems Research Group, University of Cape Town.*

Figure 3 presents historical emissions (of which the electricity sector comprises 45%), the updated 2030 NDC target, and the long-term pathway to net-zero CO_2 emissions around 2050. The five-year investment plan is designed to achieve the most ambitious outcome possible in 2030 and establish the basis for long-term decarbonisation.

The scale of need is far greater than the initial financial offer mobilised by the IPG, and therefore, the JET IP seeks to identify how this initial offer can support a sequencing and scaling of activities that attract, leverage and crowd-in larger financing from domestic and international public and private sources. It also assumes that many areas identified for low-carbon investment will be attractive to the private sector and thus suggests that strategically deployed concessional and public finance can leverage such private investment.

The JET IP is a subset of comprehensive country climate transition planning in relation to climate change mitigation and adaptation. There is already a significant body of policy and regulation that supports the JET IP, with multiple initiatives underway.

The JET IP is designed to:

- Highlight the **actions and investments required for South Africa's economic and social diversification** away from a predominantly coal-based economy, including the creation of new industries, employment, skills, and livelihoods in geographies and sectors most affected by the transition, in particular, to ensure that the resources are available to support the workers, communities, and businesses whose livelihoods are negatively affected by the transition;
- Locate the **targeted IPG investments within the context of broader country planning for a just transition** towards a sustainable, inclusive, and climate-resilient economy, including an emissions reduction trajectory that strives to achieve the lower range of South Africa's updated 2021 NDC;
- Identify the **early and catalytic investments required** in the sectors identified in the Political Declaration over the next three- to five years;
- Identify the **indicative costs** of these priority interventions and the time scales within which they are required;
- Specify key interventions and the scale of financing required to support workers, communities, and **sectors affected** by the transition;
- Set out the **prioritisation and financing principles** that will guide the investments;
- Identify the potential for **private sector investment** opportunities and partnerships with the public sector; and
- Confirm the **enabling policy and regulatory framework** that is in place to support the implementation of South Africa's just energy transition.

The JET IP is derived from existing research, data analytics, published studies, bodies of information, policy documents, and financial information which has been collated and analysed for the purpose of compiling the JET IP. Drafting was subjected to scrutiny and analysis by experts in the respective fields, including government officials, and updated on the basis of input received. A multi-phase consultation process was also followed, as summarised in Annexure A.

The JET IP, with its priority allocations for the five-year period, was endorsed by the South African Cabinet and by the IPG in October 2022.

CONTEXT

South Africa is one of the most carbon-intensive developing economies in the world, emitting 0.6kg CO_2 per dollar of Gross Domestic Product (GDP), and the largest carbon emitter in Africa, driving 40% of the continent's total emissions. South Africa is also one of the most unequal country in the world, with the top 10% of the population owning 86% of the aggregate wealth, over 30% of the population unemployed, youth unemployed exceeding 65%, and 55% of people living in poverty.[9] The economy is fragile, growth rates have slowed over the last decade, and the optimal debt-to-GDP ratio is under strain.[10] Given this context, South Africa's climate response must support initiatives that result in positive developmental outcomes in relation to these challenges.

This section describes South Africa's major climate risks, the country's approach to a just energy transition, the approach to inter-sectoral decarbonisation investments, the enabling policy context for a just energy transition, and recent developments in reforms to the electricity sector.

2.1 CLIMATE RISKS FACING SOUTH AFRICA

The electricity sector is the source of almost half of South Africa's GHG emissions, and the ageing fleet of coal power plants (39 gigawatts [GW]) is being retired over the next three decades, with 22 GW due to be decommissioned by 2035.[11] This has significant implications for security of energy supply nationally, as the rate at which new generation capacity is currently being added to the grid is not keeping pace with the rate at which coal generation capacity is being retired. In addition, the current lack of sufficient new capacity is increasing the frequency of unplanned outages, as coal plants nearing the end of their lives are utilised more intensely. These unplanned outages, combined with a lack of reserve capacity, are currently impacting the economy severely. Coal fleet closure will directly impact about 90,000[12] coal workers in the mines and power plants of the poverty-stricken Mpumalanga Province where the sector is concentrated, having dire consequences for the extended number of livelihoods supported by workers in the sector, both in Mpumalanga and elsewhere in the country. The impact in the coal value chain is even greater, where coal-dependency exposures in the manufacturing, transport and

9 SA Quarterly Labour Force Survey Q1, 2022.
10 National Treasury Budget Review, 2022.
11 Eskom, 2022.
12 TIPS (Trade & Industrial Policy Strategies), 2020; Makgetla and Patel, 2021.

agriculture sectors will threaten the livelihoods of many more families and communities. These social risks must be addressed for a successful energy transition to take place.

South Africa's JET IP thus seeks to build the country's resilience in the face of its physical, social, and transition climate risks.

2.1.1 PHYSICAL RISKS

The Intergovernmental Panel on Climate Change (IPCC) reports show that global warming and its effects will proceed twice as fast on the African continent, with rapid desertification, bush encroachment, extreme seaboard storms, and more frequent and intense fires and floods (as experienced recently in South Africa). The country's National Adaptation Strategy[13] emphasises the need to mainstream climate adaptation measures into government planning and budgeting to build resilience across society.

2.1.2 SOCIAL RISKS

With high levels of inequality, unemployment, and poverty, the impacts of climate change for the poor are particularly severe, requiring social safety nets that will build resilience in vulnerable communities. The fossil fuel intensive and coal-based economy creates large challenges in the scale of the energy transition required for decarbonisation, with material implications for workers, communities, municipalities, and businesses that currently operate within or depend on the coal value chain.

2.1.3 TRANSITION RISKS

In addition to the substantive transition risks associated with decarbonising the coal sector, South Africa's trade systems are vulnerable because of the degree of carbon embedded in its commodities and products. Where trading partners are accelerating efforts to decarbonise, this directly affects demand for South African commodities, impacting the balance of payments and competitiveness. It is estimated that US$50 billion is the value at risk for the South African economy arising from the energy transition.[14] The anticipated introduction of carbon border tax adjustments on imports and other similar measures, in keeping with net-zero pledges, in EU, US, and UK, will expose more than 50% of South Africa's export value to increasing carbon tax levies.[15]

[13] https://www.environment.gov.za/sites/default/files/docs/nationalclimatechange_adaptationstrategy_ue10november2019.pdf.
[14] Climate Policy Initiative, 2019, Understanding the Impact of a Low Carbon Transition on South Africa.
[15] World Integrated Trade Solutions, 2018.

2.2 SOUTH AFRICA'S APPROACH TO A JUST ENERGY TRANSITION

The just transition focus in South Africa aims to achieve a quality life for all South Africans in the context of climate change. Cabinet recently approved the National Just Transition Framework – developed through a multi-stakeholder engagement led by the PCC, and building on the inclusion of a just transition in the 2011 White Paper, Chapter 5 of the National Development Plan, a previous work by the National Planning Commission (NPC) on just transition pathways,[16] along with extensive work on the topic by other governmental[17] and non-governmental institutions.[18] Notably, in 2021, the Just Energy Transition framework by the Department of Mineral Resources and Energy (DMRE) identified the need for inclusive, people-centric interventions to deliver a just transition in the mineral and energy value chains. The DMRE framework notes the importance of managing the socioeconomic impacts of an energy transition for coal-dependent towns in order to minimise and mitigate against social risks and protect the vulnerable, while maximising the opportunities of structural transformation.[19]

While the scope of defining a just transition varies internationally,[20] the National Framework for a Just Transition provides a definition of a just transition that is appropriate to South Africa's context:

> *"A just transition aims to achieve a quality life for all South Africans, in the context of increasing the ability to adapt to the adverse impacts of climate, fostering climate resilience, and reaching net-zero greenhouse gas emissions by 2050, in line with best available science. A just transition contributes to the goals of decent work for all, social inclusion, and the eradication of poverty. A just transition puts people at the centre of decision making, especially those most impacted, the poor, women, people*

16 RSA (Republic of South Africa), 2011 National Climate Change Response White Paper; RSA, 2015/2021, NDC; NPC, 2012, 2019.

17 For example, the National Employment Vulnerability Assessment (NEVA) and Sector Jobs Resilience Plan (SJRPs) of the Department of Forestry, Fisheries and Environment (DFFE); DMRE's JET Framework; and Mpumalanga's Draft Transition Strategy; the work of Eskom's JET Office.

18 COSATU (Congress of South African Trade Unions), 2011, 2022; Life After Coal (LAC)'s, [[Open Agenda on Just Transition; Hallowes and Munnik, 2019; Burton et al., 2017, 2019; Montmasson-Clair et al., 2022; Montmasson-Clair, 2021; Makgetla and Patel, 2021; Lowitt and Mokoena, 2021; Mohlakoana and Wolpe, 2021; Maseko, 2020, 2021; Hermanus et al., 2022; Swilling and Anneke, 2012; NBI (National Business Initiative) / BUSA (Business Unity South Africa) / BCG (Boston Consulting Group), Just Transition Pathways Process; TIPS (Trade & Industrial Policy Strategies) JT webinar series; and Marais et al., 2021.

19 DMRE, 2021, Towards a Just Energy Transition Framework in the Minerals and Energy Sectors.

20 See Montmasson-Clair, 2021 and COSATU, 2022 for a review of divergences. However, international convergence can be found in the goals of (i) decent work for all; (ii) social inclusion; and (iii) eradication of poverty. More recently, decarbonisation efforts have emphasised the importance of energy transitions being "just," thereby signalling the need to put people at the centre of decision-making and access to opportunities, as economies phase down fossil fuel use and move towards greener energy and industrial systems. For examples, see international approaches to just transition in the work of the International Trade Union Confederation [ITUC], the International Labour Organization [ILO], and in the UNFCCC).

with disabilities, and the youth–empowering and equipping them for new opportunities of the future. A just transition builds the resilience of the economy and people through affordable, decentralised, diversely owned renewable energy systems; conservation of natural resources; equitable access of water resources; an environment that is not harmful to one's health and well-being; and sustainable, equitable, inclusive land use for all, especially for the most vulnerable."[21]

The principles of procedural, distributive, and restorative justice lie at the core of the approach set out in the National Framework,[22] in which three major areas of policy intervention are identified, namely, (i) social protection, (ii) human resource development and skills development, and (iii) industrial development, economic diversification, and innovation.

Based on the national just transition definition, principles, and priorities, the JET IP proposes the following working definition of a just *energy* transition for the purposes of programme implementation for the next three to five years:

"A just energy transition in South Africa builds resilient economies and people to meet the NDC targets. It does so by (i) accelerating affordable, decentralised, diversely owned renewable energy systems; (ii) restoring previous and future ecosystems and natural resources impacted by coal mining and energy production; (iii) reskilling present workforces and educating future ones in green and other new and viable development pathways; (iv) building new productive models for comprehensive economic transitions; and (v) supporting various impacted constituencies to play an active role in decisions and implementation of energy transition programs (be it government or non-government actors)."

Just energy transition interventions in South Africa thus need to consider, first and foremost, the impacted and vulnerable groups, including:

- Direct workers at risk from energy transition changes;
- Indirect workers in associated value chains, as well as induced jobs and economic activity in affected regions;
- Local communities who may bear the brunt of environmental and social externalities, induced by the coal phasedown or the shift away from other fossil fuels;
- Small Medium and Micro Enterprises (SMMEs) and the self-employed who are part of both formal and informal value chains; and

21 PCC, 2022, A Framework for Just Transition in South Africa.
22 PCC, 2022.

- Those currently excluded from the existing structure of the economy (due to education, gender, race, or disability).[23]

Yet just energy transition interventions in South Africa can also be anticipatory in fostering new opportunities for specific groups, including for:

- Youth and future generations, particularly through new employment in green and emerging clean technology areas[24]; and
- Existing underserved communities who may have human and natural capital in which to locate decarbonising and innovative new industries.

Therefore, interventions in this JET IP have three arenas of action:

- Interventions within coal-producing and coal-reliant areas to spearhead diversification and socio-economic transition for those most impacted by the phase down of coal, in line with energy policy. This is especially important given the high concentration of distributional impacts that will be felt in Mpumalanga over the period covered by this IP and hence guides prioritisation in terms of timing.[25] It also draws on international experience in managing just transition for coal regions through a place-based economic development strategy that addresses distributional impacts through a package of interventions to promote regional transition. It specifically addresses the localised impacts to ensure restorative and distributive justice for coal communities;
- Interventions within communities negatively affected by the shift away from internal combustion engine (ICE) vehicle manufacturing and maintenance, as required; and
- Interventions across a multitude of forward-looking productive sectors in multiple localities (including in the electricity, the NEV, and the GH_2 sectors) to support decarbonisation and promote economic diversification and industrial development at a national level, building South Africa's economic resilience and embracing new opportunities.

23 See also Youth Climate Action Plan, 2021.

24 Youth Climate Action Plan, 2021.

25 DMRE (2021) notes that a key JET objective is to manage the decarbonisation process "in a manner which not only replaces lost work opportunities but promotes economic development, creating new and sustainable options, which initially prioritizes the coal regions to mitigate the prospect of 'ghost mining towns" and which targets vulnerable groups.

2.3 SOUTH AFRICA'S APPROACH TO INTER-SECTORAL DECARBONISATION INVESTMENT

The JET IP focuses on three priority sectors for its initial five-year period: Electricity, NEVs, and GH_2. This is a deliberate strategic decision, based on a clear understanding that as South Africa's electricity sector decarbonises, there are significant gains to be made by unlocking growth in the NEV and GH_2 sectors at the same time. Moreover, South Africa's exports from 'hard to abate' sectors and of ICE vehicles will be negatively affected by the proposed border tax adjustments of some of the country's main trading partners, if accelerated mitigation measures in these sectors are not implemented. As the energy transition advances globally, emerging experience demonstrates some key features in this regard:

- More complex linkages between sectors will develop, as zero-carbon electricity use replaces the use of fossil fuels in industry, transport, and other sectors, and thus the benefits of an integrated energy policy approach, which integrates energy policy closely with other key policy areas such as industrial policy, are very significant;
- Technologies can become progressively cheaper through economies of scale and where policies mitigate investment risks and / or technological breakthroughs. When they pass below the cost levels at which such technologies become pervasive, the technologies are described as 'disruptive' and are said to have passed 'tipping points'. Sector coupling can mean that tipping points in different technologies can reinforce each other.
- Clean energy investments scale up most rapidly when they experience certainty about demand for their production. Security of demand mitigates investment risk.
- Investments in existing storage technologies such as pumped storage; emerging technologies which include utility-scale batteries at all scales; thermal storage in concentrating solar power (CSP) plants and elsewhere; and other potential technologies such as GH_2 will enable faster uptake of renewable electricity generation in electricity systems and will become more and more important as the electricity system is decarbonised.

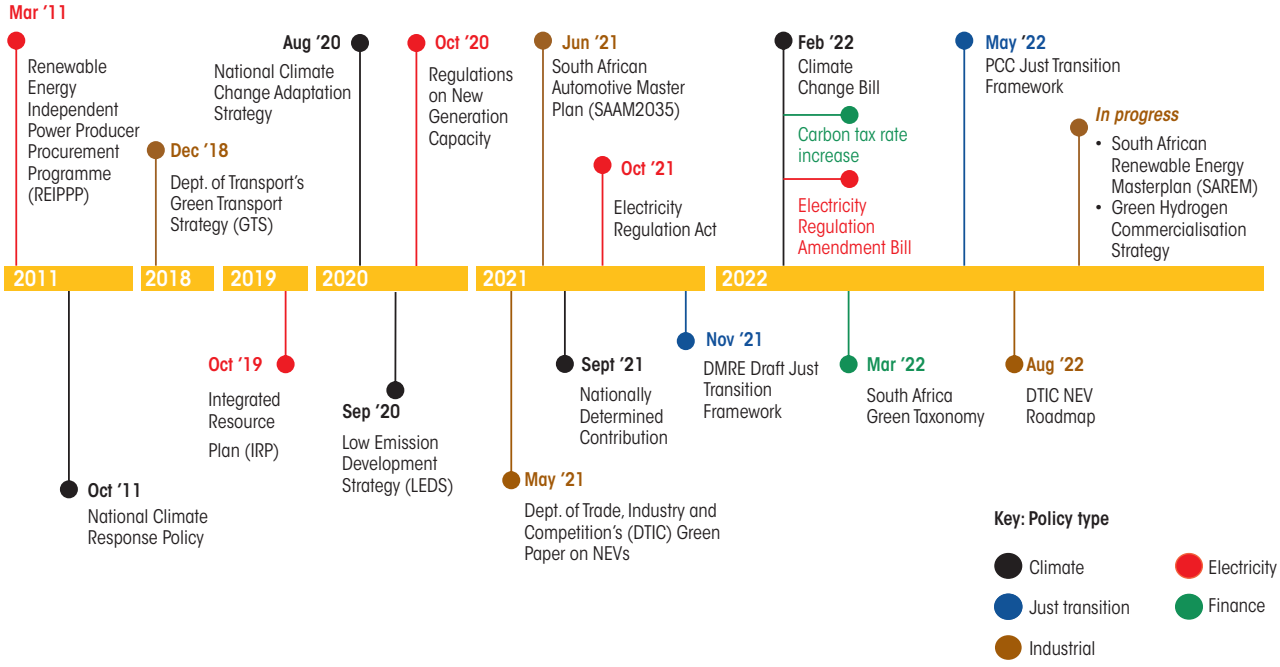
Applying these trends to South Africa's decision to drive the JET IP investments simultaneously in electricity decarbonisation, NEVs, and GH_2, the following observations are likely to be key features of the country's JET in the years ahead. The decarbonisation of the electricity sector in South Africa, the development of NEVs, and the development of GH_2 production are synergistic, just as they are in many other countries.

- An acceleration of investments in renewable electricity capacity is necessary to end the current load shedding and restore energy security to the South African electricity system, and once this has been achieved, this accelerated investment rate will need to be maintained to maintain energy security, meet South Africa's energy and climate policy goals, and support synergistic policies including localising the renewables value chain.
- The increased usage of NEVs and the increased demand for GH_2 in South Africa (or for export) have the potential to provide considerable additional security of demand for renewable electricity.
- It is possible that NEVs can be used for electricity storage for the electricity grid (vehicle-to-grid [V2G]), while GH_2 is a potential form of long-duration renewable energy storage and a potential replacement for fossil-fuelled peaking plants. These potential sources of storage may significantly lower the cost of ensuring grid stability, as the share of renewable energy generation increases.
- GH_2 (and its derivative, green ammonia) are potential substitutes for natural gas and coal in industrial processes such as steelmaking. They may also play an important role in the future electricity grid. GH_2 will likely contribute to the decarbonisation of electricity and industry, and in doing so, create additional employment to further offset any job losses resulting from reduced coal use.
- Global market trends can be expected to play a major role in these developments. For example, the cost of electrolysers for GH_2 production is likely to fall globally, as the use of GH_2 scales up. The same can be said for electric vehicles, storage technologies in general, and power plant turbines that can run economically on GH_2 or green ammonia.
- The increased application of carbon taxes by developed countries in cross-border trade (for example, EU's Carbon Border Adjustment Mechanism [CBAM]) will put a premium on decarbonising electricity and industry in South Africa to protect global competitiveness.
- It is also possible that there will be a greater global provision of concessional climate finance to developing countries to offset any loss of competitiveness from those carbon taxes.

2.4 ENABLING POLICY AND REGULATORY FRAMEWORK FOR A JUST TRANSITION

The Government of South Africa, together with key constituencies and stakeholders across society, has developed, and continues to establish, comprehensive policy, regulatory, institutional, and governance frameworks that address climate risks. Taken together, they constitute the enabling framework for climate related investments in adaptation, mitigation, and the just transition, demonstrating South Africa's resolve to embark on a fundamental restructuring of the electricity sector to ensure equitable and affordable access to clean energy, address energy poverty and competitiveness, and build the human capital for a new energy economy. Key components of the enabling policy framework are depicted in Figure 4.

Figure 4: Key policy milestones enabling a just energy transition



2.4.1 CLIMATE-RELATED POLICIES

- South Africa's National Climate Response Policy[26] was issued in 2011 to inform both mitigation and adaptation planning. The country's Low Emission Development Strategy (LEDS)[27] sets out a long-term decarbonisation trajectory for key economic sectors and identifies actions required to achieve this.

[26] https://www.gov.za/sites/default/files/gcis_document/201409/nationalclimatechangeresponsewhitepaper0.pdf.
[27] https://unfccc.int/sites/default/files/resource/South%20Africa%27s%20Low%20Emission%20Development%20Strategy.pdf.

- South Africa's Climate Change Bill[28] was tabled before Parliament in 2022 and is currently being considered by the Parliamentary Portfolio Committee on Environment, Forestry and Fisheries. The Bill sets out a comprehensive set of institutional arrangements to ensure strong coordination both within and across the three spheres of government, the private sector, academia, and civil society, as well as establishing systems to manage mitigation and adaptation policies and actions. Among other measures, the Bill provides for the mandatory implementation of a carbon budgeting system and for the establishment of sector emissions targets across the economy. To this end, a Sector Emissions Targets framework[29] has been developed to guide government's approach to allocation and implementation.
- South Africa's updated NDC was communicated to the UNFCCC secretariat in October 2021.[30] It addresses the country's climate change ambitions on mitigation, adaptation, and a just transition in a comprehensive way. The updated NDC is framed within the context of the Paris Agreement, and it addresses the implementation support to be provided by developed countries in terms of Articles 9–11 (finance, technology, and capacity building) and the degree of mitigation ambition that can be achieved by a developing country. In this context, South Africa has committed to achieving an emissions target in a range between 420 and 350 $MtCO_2$-eq by 2030, dependent on the level of support received. The updated NDC was approved by Cabinet after a substantive national consultation that was led by the Department of Forestry, Fisheries, and the Environment (DFFE) and the PCC.
- The National Climate Change Adaptation Strategy was approved in 2020.[31]

2.4.2 ELECTRICITY-RELATED POLICIES

- The Integrated Resource Plan (IRP) 2019[32] sets out a long-term view of the electricity sector and its generation mix and guides investments in new generation capacity. The IRP 2019 is currently being updated by the Department of Mineral Resources and Energy (DMRE).
- South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPP) is considered to be world-class, having procured 6 422 megawatts (MW) of renewable electricity capacity in 10 years through four bid windows, with another two bid windows in progress.
- Since 2008, the DMRE has promoted energy efficiency (EE) and implemented a range of strategies for demand-side management (DSM) measures in cooperation with Eskom, public sector institutions, and the private sector.

28 https://www.gov.za/sites/default/files/gcis_document/202203/b9-2022.pdf.
29 DFFE (Department of Forestry, Fisheries and Environment), 2021, Framework for Sectoral Emissions Targets.
30 https://unfccc.int/sites/default/files/NDC/2022-06/South%20Africa%20updated%20first%20NDC%20September%202021.pdf.
31 DFFE, 2020, South Africa's National Climate Change Adaptation Strategy.
32 http://www.energy.gov.za/IRP/2019/IRP-2019.pdf.

- The Electricity Regulation Amendment Bill was published for comment in early 2022.[33] This legislation provides for the establishment of an independent transmission company which will act as the system and market operator. The legislative reform, which supports the ongoing restructuring of Eskom and the establishment of an independent Transmissions System Operator, will enable the emergence of a competitive electricity market. Over time, this will allow multiple generators to sell electricity in a day-ahead market in addition to long-term agreements, as well as to participate in markets for balancing and ancillary services. The rules of a future market will be determined by a market code. A revised Electricity Pricing Policy provides for an unbundled tariff (separating energy from use-of-system charges) to support this reform. While Eskom will continue to generate electricity itself, these reforms will introduce competition from private generators.
- The Regulations on New Generation Capacity were amended in October 2020 to allow municipalities to procure electricity independently for the first time, with at least five large municipalities now in various stages of renewable energy procurement.
- The 2021 amendment to Schedule 2 of the Electricity Regulation Act raised the threshold for electricity generation projects that do not require a license from 1 MW to 100 MW. This amendment has unlocked a significant pipeline of projects, predominantly from the mining and heavy-emitting sectors and has also allowed private generation projects to sell electricity to one or more customers, in addition to self-generation. Moreover, the requirements for registration with the National Energy Regulator of South Africa (NERSA) have been simplified, with the process now averaging 19 days. In July 2022, the President announced that the 100 MW licensing threshold was being removed altogether as part of wide-ranging interventions to address the electricity crisis (see 'Recent developments' sub-section below).

2.4.3 JUST TRANSITION-RELATED POLICIES

- The NDP sets the basis for South Africa's just transition policies in that it places people's livelihoods at the centre of the climate change response and envisions a low-carbon future as being integral to South Africa's development path.
- The PCC was established in 2019 following an agreement between the social partners in the National Labour and Development Council (NEDLAC). It is a multi-stakeholder body, with Commissioners nominated by societal constituencies and appointed for five years. The PCC's mandate is to develop a country strategy for the Just Transition and to ensure that frameworks, policies, and measures will achieve this outcome. After wide consultations, the PCC has concluded a Just Transition Framework[34] for the country that has been approved by South Africa's Cabinet. It is based on procedural, restorative, and distributive justice to be the tests

[33] https://cer.org.za/wp-content/uploads/2022/02/ELECTRICITY-REGULATION-AMENDMENT-BILL-10.02.2022-DMRE.pdf.
[34] https://www.climatecommission.org.za/just-transition-framework.

of interventions intended to support workers and communities affected by climate actions. It is premised on the understanding that just transition interventions must be designed so as to ensure that "no-one is left behind."

- The DMRE has published a Draft Just Transition Framework to support the decarbonisation of the mining and energy sectors in a socially acceptable manner that contributes to the economic development of the country, focussing on the issues related to workers in the coal value chain and specifically coal miners, the economic development of coal dependent regions, mitigating impacts on vulnerable groups such as youth and women associated with fossil fuel value chains, as well as access to modern energy services.[35]

2.4.4 FINANCE-RELATED POLICIES

- The Ministry of Finance has introduced a carbon taxation system.[36] In the 2022 Budget Speech, the Minister of Finance stated that *"The Carbon Tax is the main mechanism used to ensure we lower our greenhouse emissions. The (headline) carbon tax rate was increased from R134 to R144 effective from 1 January 2022. The first phase of the Carbon Tax, with substantial allowances and electricity price neutrality will be extended to 31st December 2025. However, in line with our commitments at COP 26, the (headline) carbon tax rate will be progressively increased every year to reach US$20 per tonne. In the second phase from 2026 onwards, the carbon tax will have larger annual increases to reach at least $30 by 2030 and the allowances will rapidly fall away."*
- National Treasury published the South African Green Taxonomy in March 2022 as part of South Africa's Sustainable Finance Initiative, providing a classification system that defines the minimum set of assets, projects, activities, and sectors that are eligible to be defined as 'green' in line with international best practice and national priorities. It can be used by investors, issuers, and other financial sector participants to track, monitor, and demonstrate the credentials of their green activities. National Treasury has also embarked on a Climate Budget Tagging pilot.

2.4.5 INDUSTRIAL-RELATED POLICIES

- The South African Renewable Energy Masterplan (SAREM) is in the process of being finalised by the DMRE. It addresses the potential for a sustainable renewables industry in South Africa, assesses which value chains could be competitive, and makes proposals for the development of the industry.

35 DMRE. 2021. Towards a Just Energy Transition Framework in the Minerals and Energy Sectors.

36 https://www.gov.za/sites/default/files/gcis_document/201905/4248323-5act15of2019carbontaxact.pdf.

- The South African Government sees the development of a GH_2 economy in South Africa as a key element of a just transition and has developed a Roadmap[37] to position the country's competitive advantage in the sector, its support for the decarbonisation of the country's heavy industrial base, and opportunities for new export markets, value chains, jobs, and skills. A Green Hydrogen Commercialisation Strategy has also been developed and it is under Cabinet consideration.
- Policy direction has been provided on the advancement of NEVs in South Africa through the South African Automotive Master Plan 2035 (SAAM2035),[38] the Department of Transport's Green Transport Strategy (GTS) 2018-2050,[39] the Department of Trade, Industry and Competition's (DTIC) Green Paper on NEVs[40] and the recent announcement of an NEV Roadmap.[41]

2.5 RECENT DEVELOPMENTS IN ELECTRICITY POLICY

Recent developments in South Africa's electricity policy mark a rapid shift in the sector and are intended to bring about structural changes that will allow for a large-scale increase in renewable electricity generation capacity. This is an evolving process, and future iterations of the JET IP will reflect the outcomes and impacts of such changes and their contribution to a just energy transition:

- Eskom has made available parcels of its land for lease with access to transmission infrastructure in a competitive process for generation investments by the private sector. The first round of bidding for the land leases was oversubscribed. The 18 winning companies are due to enter into wheeling agreements with Eskom to deliver a total 1 800 MW to their respective off-takers. No government guarantees are required. Eskom plans further rounds of land lease auctions to enable more private renewables investments. This confirms the market's ability to price and absorb risks in bringing capacity to the grid without impacting the fiscus.
- The preferred bidders for Bid Window 5 of the Renewable Energy Independent Power Produce Programme (REIPPPP) were announced in October 2021, consisting of projects totalling 1 608 MW of wind and 975 MW of solar PV. Another 1 600 MW of wind and 1 000 MW of solar were announced in April 2022 for Bid Window 6. This confirms South Africa's intent to manage a rolling process of REIPPP bid windows resulting in utility scale renewable plant.

37 https://www.dst.gov.za/images/South_African_Hydrogen_Society_RoadmapV1.pdf
38 DTIC, 2018, Geared for Growth. South Africa's Automotive Industry Master Plan to 2035: A Report of the South African Automotive Master Plan Project.
39 DOT, 2018, Green Transport Strategy for South Africa (2018–2050).
40 DTIC, 2021, http://www.thedtic.gov.za/wp-content/uploads/EV_Green_Paper.pdf.
41 Minister of Trade, Industry and Competition presentation to the Presidential Climate Commission, August 2022.

- The South African Local Government Association (SALGA), together with many of its member municipalities, are promoting increased procurement of renewable electricity at a municipal level, advocating for municipalities to roll out embedded generation schemes to purchase electricity from independent power producers (IPPs), and are working on the development of a national wheeling framework that would expedite the use of renewable electricity. This confirms the growing opportunity for distributed renewable energy investments.
- In July 2022, the President of South Africa announced a suite of measures to address the electricity supply crises. These include accelerated procurement of new generation capacity, enablement for a large increase in private investment in generation capacity, enablement for business and households to invest in rooftop solar, and further steps in the transformation of the electricity sector. In particular, the President announced that:
  - The licensing thresholds for embedded generation are removed completely, enabling private investments in large, utility-scale generation projects.
  - Bid Window 6 for wind and solar power will be doubled from 2 600 MW to 5 200 MW.
  - Further requests for proposals will be issued for battery storage and gas power generation.
  - The IRP is to be reviewed to reflect the need for additional generation capacity and South Africa's climate commitments.
  - Special legislation is being developed and expedited to address legal and regulatory obstacles to new generation capacity, and regulations are being streamlined or waived where possible, including for solar projects in areas of low and medium environmental sensitivity.
  - Environmental authorisations have been waived for the development of new transmission and distribution lines and substations in areas of low and medium sensitivity and within strategic electricity corridors.
  - A pragmatic approach will be taken to local content requirements for near-term renewable energy investments, with the designated local content for solar panels reduced from 100% to 35% for Bid Window 5.
  - To incentivise rooftop solar, Eskom will develop feed-in tariffs for the purchase of surplus electricity from residential customers. National Treasury is undertaking further work on tax incentives for investment in small-scale embedded generation.
  - A law-enforcement team is working with Eskom to address crime and corruption.
  - Eskom restructuring into three entities will be enhanced with the appointment of boards for the transmission and generation entities. The transmission grid will remain state-owned.
  - The Minister of Finance will outline a sustainable solution to the Eskom debt in the Medium-Term Budget Policy Statement in October 2022.
  - Government will use climate funding provided through the JETP to invest in the transmission grid and repurpose coal power plants that have reached end of life.

The JET IP and its priority investments for the next five years are built on the foundation of this enabling policy environment.

PORTFOLIO OUTCOMES AND PRIORITISATION CRITERIA

South Africa's JET IP represents an evolving portfolio of interconnected and mutually enhancing just energy transition programmes and projects designed by the South Africa government to position the country, subject to available financing, to achieve the most ambitious possible outcomes within the range of the updated NDC and in the context of a just transition that supports economic growth and development. A key feature of the portfolio's design in all three priority sectors (electricity, NEVs, and GH_2) is that it embeds the principles of distributive, restorative, and procedural justice which are the pillars of South Africa's official Just Transition Framework.

The targeted outcomes and prioritisation criteria set out below are central to the design of the JET IP and will inform implementation planning and sequencing of its programmes and projects in the coming years.

3.1 PORTFOLIO OUTCOMES

South Africa's targeted environmental, social, and economic outcomes embody a longer-term vision to be achieved over decades, while the prioritisation criteria influence the sequencing of the investments, particularly in the first five-year period. The financing principles, set out in Section 5, also inform the quality and quantity of resources required to achieve these outcomes.

Environmental outcomes: The JET IP responds to South Africa's commitment to reduce its GHG emissions as communicated in its NDC pathway.

Transition:	Absolute reduction in GHG emissions against predetermined baselines.
Location:	Spatial priorities relative to site- or issue-specific risks.
Pace:	Aligned to meet the NDC target range and the 2050 net-zero emissions goal.
Co-benefits:	Improved air quality and positive health and well-being impacts.

Social outcomes: The JET IP recognises the direct and indirect impacts of the energy transition on the livelihoods of affected communities and workers.

Transition:
- social safety nets due to timing differences with job displacement and losses,
- regional development reflecting on multiplier effects of localisation, value chain development, and linkages to SMME development,
- resilience of municipalities to infrastructure and related impacts, and
- skills ecosystems to support innovation and broad access to transition-related investment opportunities for youth, women, and SMMEs.

Location: Spatial priorities relative to site or issue-specific risks.

Pace: Rate of investment in social programmes synchronised with rate of decommissioning, repurposing, and repowering.

Co-benefits: Inclusive, direct access to finance and equitable ownership structures (where applicable) offering wealth accretion within reasonable time frames.

Economic outcomes: The JET IP is grounded in the NDP and thus seeks to contribute to the achievement of national and regional economic goals, including immediate measures to address the energy supply crisis and manage fiscal constraints.

Transition:
- energy security through essential clean power infrastructure,
- affordable and accessible clean energy to the poor and vulnerable,
- economic growth through diversified industrialisation programmes,
- complementary industries essential to support low-emissions interventions,
- new economic growth and new jobs in the transport, automotive, agriculture, and high-emitting sectors, and
- regional food security and water use sustainability.

Location: National-, regional-, and community-level interventions as relevant.

Pace: Relative to national imperatives and global shifts, particularly of trading partners.

Co-benefits:
- contribution to South Africa's NDP such that it reduces the fiscal burden, offering equitable risk-sharing between public and private sectors,
- contribution to the national tax base, and
- reduces reliance on state-supported subsidies and social grants.

Governance: The JET IP is premised on robust governance of portfolio implementation, as further elaborated in Section 7.

Transition:	Embed sound processes of decision-making and accountability, with clear mechanisms to ensure good governance.
Pace:	Demonstrate that JET IP programmes and projects set exemplary governance standards from the outset, tracking performance in all relevant indicators.
Co-benefits:	A knock-on good governance effect in all institutions associated with the JET IP.

3.2 PRIORITISATION CRITERIA FOR THE USE OF FUNDS

The JET IP initiatives set out in Section 4 have been identified based on sectoral analysis and planning work done by a wide range of South African institutions and experts (public, private, and civil society). If resources were available to execute at the scale and pace described in this JET IP, South Africa would make considerable strides in its just energy transition by shifting its trajectory of GHG emissions in a manner that captures opportunities for social justice and distributive economic growth.

Mindful of limited resources and acknowledging certain constraints in execution capacity, the portfolio has been prioritised to achieve the highest probability of moving South Africa towards its NDC commitment and those that can be delivered efficiently and effectively for the benefit of vulnerable communities, workers, and municipalities immediately at risk. As more resources are mobilised for the JET IP over time, it will be possible to roll out the investment plan at a higher pace of delivery. The pace of delivery on the JET IP will increase, as certainty on resourcing and implementation plans materialise.

Prioritisation is particularly needed for South Africa to respond to the IPG's pledge of US$8.5 billion between 2023 and 2027. Given that the overall scale of need for the identified sectors in this period is estimated at ZAR1.5 trillion (US$98.7 billion), it is essential that the IPG contributions be deployed to the most catalytic and ready programmes and projects in the JET IP's portfolio of needs.

The following prioritisation criteria apply for programmes and projects to be financed under the JET IP during the initial period 2023-2027 and will influence the sequencing of IPG resource allocations with due regard to available financing instruments:

- **Be catalytic and complementary:** The programme / project should demonstrate how it responds to the transition needs, unlocks other investments in the JET IP, and/or increases the speed and scale at which these can happen, and contributes to the country's immediate energy security needs.

- **Set the foundations for addressing the NDC's GHG reduction targets:** The programme / project should demonstrate its impact on GHG mitigation, either directly or indirectly.
- **Deliver just transition outcomes:** The programme / project should have tangible socio-economic benefits for communities, workers, and youth affected by the energy transition.
- **Be ready to implement:** A proposed *capital project,* should demonstrate an advanced stage of due diligence, technical, and financial feasibility study approval by the implementing institution; and a proposed *operational project* should demonstrate the implementing institution's management and governance capacity to execute.

The investment priorities – elaborated in Section 4 for the electricity, NEV, and GH_2 sectors – have applied these prioritisation tests and fulfill them to varying degrees.

The results of prioritising programmes and projects under the JET IP are set out in Sections 5 and 6, along with financing principles. These results will inform further engagements between South Africa and the IPG partners to conclude subsequent financing agreements of the IPG-supported components of South Africa's JET IP from 2023 to 2027.

The financing features that will affect the catalytic impact of each investment will be in respect of (i) price (below the market cost of capital); (ii) patience (the investor's willingness to defer returns on the invested capital); (iii) the ranking position of the capital (its level of subordination); (iv) administrative fees charged or waivered; and (v) whether sovereign guarantees or other forms of collateral are required. These features of the IPG offer have, therefore, also informed the identification of JET IP priorities for five years of investment under the JET IP.

More granular prioritisation criteria will be developed for the JET IP portfolio at programme and project levels between the South African government, the implementing institutions, and the intended beneficiaries in due course, cognisant of targeted environmental, social, and economic outcomes.

THE JET IP PORTFOLIO

4.1 INTRODUCTION

This section of the JET IP sets out the portfolio of catalytic and ready JET investments for 2023–2027 that need to be made in:

- the Electricity sector (4.2), which includes:
  - infrastructure investments,
  - just transition investments in Mpumalanga's coal communities, and
  - just transition investments in the electricity sector;
- the NEV sector (4.3);
- the GH_2 sector (4.4); and
- cross-cutting initiatives (applicable to all three sectors above) that are foundational for a successful JET IP delivery:
  - Skills development for JET (4.5), and
  - Municipal capacity for JET (4.6).

Table 12 summarises the JET IP portfolio's investment needs over the five-year period. Given the early stage of planning in the case of the NEV and GH_2 sectors, the just transition elements will need further development.

Table 12: JET IP Portfolio summary of investment needs, 2023–2027

JET IP financing requirements, 2023–2027	ZAR billion
4.2. Electricity Sector	711.4
Infrastructure investments	647.7
Just transition investments in Mpumalanga's coal communities	60.4
Just transition investments in the electricity sector	3.25
4.3. New Energy Vehicle (NEV) Sector	128.1
4.4. Green Hydrogen Sector	319
4.5. Skills development	2.7
4.6. Municipal capacity	319.1
TOTAL	**1 480**

4.2 ELECTRICITY SECTOR

4.2.1 INTRODUCTION

This section of the JET IP contextualises reasons for the centrality of South Africa's electricity sector in the country's approach to building a low-carbon economy; the economic importance of the sector; and the impact of decarbonisation initiatives on coal workers and communities in the Mpumalanga province. It identifies the catalytic low-carbon investments that are required in the electricity sector, and the investments that are needed to support and transform the livelihoods of those who are most affected by the transition away from coal.

Two annexures to the JET IP provide background to the assumptions, costings, and technical analyses that have informed the preparation of this section:

- **Annexure B:** Electricity Sector Modelling Assumptions, Technical Analysis, Committed/ Planned Capacity, and Eskom JET Project Pipeline; and
- **Annexure C:** Methodological Notes on Just Transition Priority Areas and International Lessons on Coal Transitions.

4.2.1.1 ELECTRICITY: A PRIORITY FOR DECARBONISATION

The most recent South African GHG Inventory (for the year 2017)[42] reports that the electricity sector is the most important key category in the inventory – a position which the sector has occupied since national GHG emissions in South Africa have been formally estimated. The electricity sector's emissions comprised 43% of South Africa's GHG emissions in 2000, and 45% in 2017.[43]

Almost all these GHG emissions are produced by 15 large coal-fired power plants owned and operated by Eskom and one small privately-owned coal plant which provides power to City Power – the Johannesburg city utility. These plants are due to retire over the next three decades as they reach their end of life, except for the two newest plants, one of which is still not fully operational. Eskom's proposed schedule for retiring these plants specifies that up to 2030, Komati, Camden, Hendrina, Grootvlei, and Arnot will be closed, and by the end of 2030, Tutuka and Kriel will be closed.

These closures will reduce the overall capacity of Eskom's coal fleet from around 38.8 GW in March 2021 to 33.9 GW at the beginning of 2030, and 29.3 GW at the end of 2030. By the end of 2050, only the two youngest coal plants (Medupi and Kusile), and one unit of the older Majuba plant, will remain operational as currently envisaged.

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42 South Africa's most recent GHG inventory can be accessed below. The inventory reports GHG emissions up to and including the year 2017: https://unfccc.int/sites/default/files/resource/South%20Africa%20%20NIR%202017.pdf.

43 Calculated in relation to total GHG emissions including land use emissions.

Historically, the coal-fired electricity plant has been the cheapest means to generate electricity in South Africa (excluding externalities), but this has changed over the last decade, in common with the rest of the world, and renewable energy – specifically wind and solar PV – is now cheaper than coal power. South Africa is blessed with extremely good solar and wind resources. As Eskom's coal plants retire, the current economics of the electricity sector imply that coal generation will be replaced by renewable electricity generation capacity plus open cycle, combined cycle plants, and/or storage plants to support the grid. However, this will require a very large expansion of the transmission grid, since these renewable energy resources are located around the country, and particularly in provinces remote from Mpumalanga, where most of the electricity generating capacity is located.

Retiring coal plants will lead to a decline in GHG emissions in the electricity sector, but not at sufficient speed to meet the lower range of South Africa's 2030 NDC target. The rate at which GHG emissions from the electricity sector decline, within the context of the coal plant retirement schedule, will therefore depend on the utilisation rate of the remaining coal fleet. This in turn will depend on the rate at which renewable electricity plant can be added to the South African electricity system (which would include utility-scale plant, and distributed generation in the residential, commercial, and industrial sectors) and on the success of energy efficiency programmes, which will alleviate pressure on the remaining coal fleet and provide opportunities to decarbonise the sector more rapidly.

In addition, mitigation studies, recently undertaken to support the update of South Africa's NDC, indicate that in absolute terms, the electricity sector will be the source of the largest share of mitigation to 2030,[44] and in addition, long-term decarbonisation will require the electrification of other sectors which currently use fossil fuels, such as the transport sector. Decarbonisation of the electricity sector will not only address the current electricity supply crisis, through rapid investment at a large scale in new renewable electricity capacity, but also create opportunities for industrialisation, regional development, facilitate a managed, just transition in the electricity sector, and result in massive infrastructure investment, much of which will be financed through the private sector.

4.2.1.2 KEY ECONOMIC AND SOCIAL CONSIDERATIONS

The South African economy is more electricity-intensive than other comparable developing economies, which is due largely to South Africa's mining and minerals processing sectors. Although economic growth has been focused for the last 15 years on less electricity-intensive sectors of the economy (which has led to electricity demand remaining static for over a decade), South Africa

[44] See Figure 15 in Annexure B.

aspires to make effective use of economic development opportunities arising from the green economy, nationally and internationally, including the manufacture of electric vehicles, the manufacturing of green hydrogen, green iron and steel, and the exploitation of the large reserves of minerals South Africa possesses which are central to the global green economy. The electrification of energy services such as process heat which are currently provided by coal is also a prerequisite for South Africa's long-term decarbonisation and international competitiveness; this includes the need to protect South Africa's automotive industry by an accelerated shift to manufacturing NEVs. South Africa's abundance of high-quality renewable energy resources will position the country favourably in the coming international green economy of energy intensive goods and services, as well as for the decarbonisation of road transport via a shift to electric vehicles (EVs) and other potential zero-emissions vehicles.

Shifting from the current technology model for the electricity supply sector (large coal plants built adjacent to coal mines) to a low-carbon distributed[45] model, based primarily on renewable energy, will also significantly change the linkages between the electricity sector and the rest of the economy. Currently, the sector is tightly linked to coal mining and its associated infrastructure and geographies, including the applicable transport infrastructure. Though the future electricity system will have little or no connection to the coal mining sector, it will have linkages to a range of value chains underpinning the low-carbon energy system, including new local industries to supply and assemble renewable energy equipment and associated equipment and infrastructure. In addition, the regional development impacts of the current electricity supply sector are almost all focused in one area of the country (Mpumalanga Province), though renewable energy installations will be distributed widely in all provinces and in some areas where there is currently very little economic activity. In the long term, this will give rise to many regional sustainable development opportunities and create more employment opportunities than currently exist in the electricity sector. But it is imperative that the transition from the current system to the future system is a just one, which creates new economic opportunities for workers and communities in areas where economic opportunities will decrease as a result of the shift from coal-based electricity to electricity produced with very low or no associated GHG emissions, including artificial GHGs.

There are three other considerations which need to be addressed at the same time. The first of these is energy efficiency. Both national and international research has shown the benefits of energy efficiency programmes, which include the lowering of investment costs in generation capacity and in the transmission and distribution grids, as well as significant employment benefits. The current electricity crisis has again focused attention on demand-side management, and in addition to the continuation of existing programmes, government intends to establish a programme to save 600 MW by 2030. The technical analysis underpinning the update of the NDC in 2021

[45] While renewable energy-based electricity generation will be far more distributed than current systems, with a potentially high proportion of electricity being generated on site, there are also proposals for supergrids stretching across continents (for instance, from north Africa to northern Europe) to make use of different renewable energy resources with different generation profiles.

found unequivocally that the DMRE's draft post-2015 National Energy Efficiency Strategy (NEES) would if implemented, significantly reduce investment requirements for meeting the 2030 target and has positive economic outcomes.

The second is Eskom's current debt burden, which is at least partly due to non-cost reflective tariffs over the last three decades. In addition, local authorities which distribute electricity are often in a similar financial state, which in turn exacerbates Eskom's debt burden through non-payment. While Eskom's debt burden is being addressed jointly by Eskom and National Treasury, the current regulatory reform process (proposing amendments to the Electricity Regulation Act and the DMRE's draft electricity pricing policy update) aims to address the need for transparent and cost-reflective tariffs to prevent another debt crisis and ensure the financial sustainability of the sector, provide effective price signals to both consumers and investors in a transformed electricity sector, and provide affordable electricity to South African households and industry.

The third comprises the urgent need to address energy poverty through enhanced access to affordable electricity for poor households. While household electrification is much more advanced in South Africa than in the rest of the continent, energy poverty in South Africa is widespread[46] and a lack of affordable services leaves people dependent on wood, coal, paraffin, candles, and dung. In 2018, about 600 000 households, or 2 million people, were in extreme energy deprivation, relying on paraffin for much of their domestic energy use. Use of such fuels results in severe health impacts from indoor air pollution, burns, poisonings, shack fires, and deaths, with the burden of firewood collection and health impacts from indoor and local air pollution most often falling on women and children.[47]

South Africa has successfully connected households to the grid over the past three decades and continues to allocate support to households to enhance electricity access through the Free Basic Electricity (FBE)[48] initiative and the Integrated National Electrification Programme (INEP), spending over ZAR16 billion in 2020–2021. However, relatively high electricity connection rates of around 85% masks limitations of affordability and use for households, while unelectrified areas persist in both rural and in new informal settlements. Given the key role that access to electricity plays in human development and the especially gendered impacts of lack of access, resolving constraints to access is integral to the improvement of people's livelihoods and just transition outcomes, poverty alleviation, and reduced inequality.[49] International support is needed to expand government's response and address barriers to affordable access.

[46] About half of all households were considered energy-poor in 2012. Source: DoE (Department of Energy), 2013, A Survey of Energy Related Behaviour and Perceptions in South Africa: The Residential Sector, Pretoria: DoE, http://www.energy.gov.za/files/media/Pub/DoE- 2013-Survey-of-EnergyRelated-Behaviour-and-Perception-in-SA.pdf

[47] Ashley Van Niekerk, David Kimemia, Mohamed Seedat, and Harold Annegarn, 2022, "Energy Impoverishment and Burns: The Case for an Expedited, Safe and Inclusive Energy Transition in South Africa." South African Journal of Science 118 (3/4), doi.org/10.17159/sajs.2022/13148.

[48] Fifty kilowatt-hours (kWh) per month are provided to poor households for free, provided that the relevant local distributor has implemented the initiative. This amount of free electricity is not sufficient to cover thermal energy demand, particularly cooking.

[49] Tracy Ledger, "Broken Promises: Electricity Access for Low-Income Households: Good Policy Intentions, Bad Trade-Offs and Unintended Consequences," Energy and Society Working Paper #2, Public Affairs Research Institute, https://pari.org.za/broken-promises-good-intentions-bad-trade-offs-and-unintended-consequences/.

4.2.1.3 INVESTMENT IN RENEWABLE ENERGY IN SOUTH AFRICA TO DATE[50]

The overwhelming majority of investment in renewable energy in South Africa has occurred through the Renewable Independent Power Producer Procurement Programme (REIPPPP), established in 2011, which auctions required new renewable electricity capacity in a series of 'bid windows', in which winning projects are awarded long-term power purchase agreements (20 years), which up to now, have been guaranteed by government.

So far, most of the new capacity from the first five bid rounds and one small projects round (1,2,3,3.5,4) is in operation, including 18 MW of landfill gas, 52 MW of biomass generation, 80 MW of small hydro, 600 MW of CSP, 2 371 MW of PV and 3 466 MW of wind power. The outcome of bid window 5 has been announced, which consists of 1 000 MW of PV and 1 600 MW of wind, and the capacity which will be auctioned in bid window 6 was doubled from 2 600 MW to 5 200 MW in a recent announcement by President Ramaphosa.

South Africa is accelerating greater private investment in generation capacity. In 2021, government announced the raising of the licensing threshold to 100 MW under Schedule 2 of the Electricity Regulatory Act. This has unlocked a pipeline of more than 80 confirmed private sector projects with a combined capacity of over 6 000 MW. These reforms have fundamentally changed the electricity generation landscape. The recent removal of the licensing threshold for embedded generation, paves the way for investment in larger, utility-scale projects that will rapidly add new renewable energy generation capacity to the grid.

50 Data sourced from http://redis.energy.gov.za/power-producers/.

4.2.1.4 REQUIRED JUST ENERGY TRANSITION FOR MPUMALANGA COAL COMMUNITIES

Without active intervention, coal-dependent regions will suffer significant social and economic impacts from South Africa's energy transition and specifically the phasedown over the next three decades of its coal value chain. In addition, these areas, and in particular Mpumalanga, are currently impoverished and suffer negative environmental impacts from coal mining and combustion, including air and water pollution and the coal mining-related destruction of high-value agricultural land. A just transition is an opportunity to address both current development challenges and impacts from a coal phasedown.

Decarbonisation of the electricity system, involving the retirement of Eskom's coal fleet and reduced operating hours, and hence a reduction in coal use for electricity generation, will be coupled with reduced coal use in other key demand sectors, notably coal-to-liquids. The impacts of the transition will be concentrated in Mpumalanga Province, which produces 83% of the country's coal and where 12 out of 15 of Eskom's coal-fired power plants are found, in two districts (Gert Sibande and Nkangala).[51] This means that 85% of South Africa's coal mining jobs can be found in Mpumalanga Province.[52]

The Provincial economy is heavily dependent on coal for employment, the municipal rates base, and community development activities. The Province grapples with in-migration, high levels of poverty, air and water pollution and degraded land, and high vulnerability to climate impacts. Mpumalanga has levels of unemployment above the national average, with especially high youth unemployment overall and for women in particular.[53] Almost half of the province's population lives below the lower-bound poverty line[54] and there are low levels of educational attainment and skills. The coal sector provides direct jobs to almost 90 000 people in mines and power plants in the Province, and there are indirect jobs for people who provide goods and services to the coal sector, which supports a significant portion of induced jobs and other economic activity.[55] In addition to the above contributions, coal is an input into key industries in the region, including synthetic fuels,

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51 South Africa produces approximately 250 Mt of coal per year, with approximately 70 Mt exported. Eskom uses approximately 110 Mt and Sasol approximately 40 Mt. In the past, coal exports were of a significantly higher grade than Eskom's average grade; however, the differential in calorific value has shrunk, as the demand for coal exports has shifted to Asia. Nonetheless, Eskom typically uses higher- ash coal than is exported.

52 Quantec, cited in Makgetla and Patel, 2021.

53 Statistics South Africa (StatsSA): 58.7% in 2021 and 66.5% for young women. See also Mpumalanga's Phase 1 Transition Strategy (Mpumalanga Provincial Government 2021). Labour-sending areas also face above-average levels of unemployment, namely the Eastern Cape. In 2022, Mpumalanga, the Eastern Cape, KwaZulu-Natal (KZN), and Limpopo all had unemployment rates over 50% using the expanded definition (StatsSA 2022). Available at https://www.statssa.gov.za/publications/P0211/Presentation%20QLFS%20Q1%202022.pdf.

54 In 2019, 47.3% or approximately 2.1 million of Mpumalanga population lived below the lower-bound poverty line of ZAR810 per month (MPG 2021).

55 See the Sector Jobs Resilience Plan (SJRP) for the coal value chain, as well as Makgetla and Patel (2021), for a discussion of value chain employment.

petrochemicals, and steel. These are demand sectors that will also face reductions in their coal use in the coming years in response to global trends, and which are large employers.[56] The entire value chain (from mining and electricity production to end-use sectors) employed almost 200 000 people in 2020.[57]

Over the next 15 years, Eskom expects to decommission and repurpose 22 GW of coal-fired power plants in the Mpumalanga Province, as shown in Table 13.

Table 13. Eskom's planned coal power plant closures to 2035

Power station	Closure date	Local municipality	District municipality	Associated mines
Grootvlei	2026-2027	Dipaleseng	Gert Sibande	Multiple
Hendrina	2023-2025	Steve Tshwete	Nkangala	Multiple
Komati	2022	Steve Tshwete	Nkangala	Multiple
Camden	2023-2025	Msukaligwa	Gert Sibande	Multiple
Arnot	2026-2029	Steve Tshwete	Nkangala	Multiple
Kriel	2026-2030	Emalahleni	Nkangala	Kriel
Tutuka	2030	Lekwa	Gert Sibande	New Denmark
Duvha	2031-2034	Emalahleni	Nkangala	MMS
Matla	2030-2034	Emalahleni	Nkangala	Matla

The total impact of an ambitious NDC trajectory for coal plant closures and reduced operations will be a considerable decline in the country's coal demand for electricity generation by 2030: from 113 Mt in 2021 to 55-60 Mt in 2030.[58] In the upstream sector, three types of direct employment impact will need to be addressed over the period to 2030:

- Downscaling of coal plants and stagnant exports means that young workers are not entering the coal mining workforce as they would have otherwise as new jobs do not materialise. Between 4 500 -7 500 new jobs will not materialise;
- Older workers typically exit the sector before official retirement age. Over the decade, almost 18 500 older workers will leave coal mining, and many will require social support; and
- There will be between 3 000 and 9 000 additional job losses due to decreasing coal demand over the period 2020-2030, especially from 2025 onwards.[56]

56 NBI (National Business Initiative), 2022; see also the "Green Hydrogen" section. Coal plants, mines, and coal-using industries in the KZN, Limpopo, and Free State Provinces will also require just transition interventions, for the most part, post 2030.

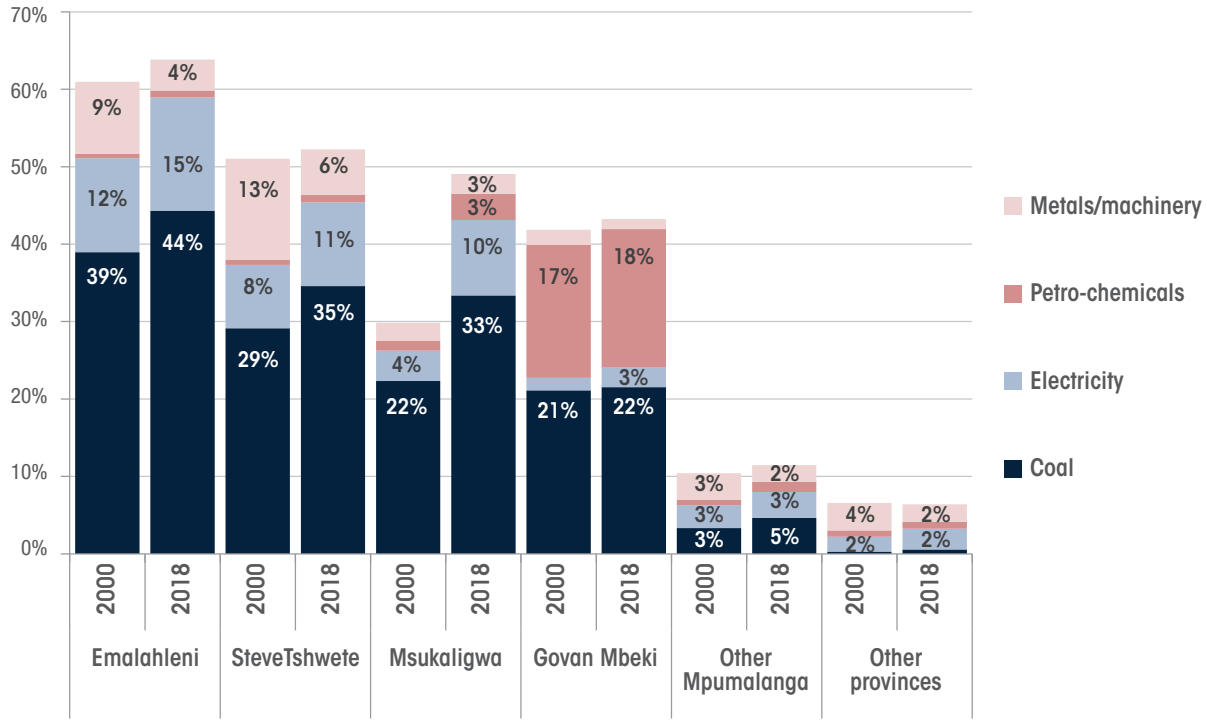
57 Makgetla and Patel (2021), based on Quantec.

58 JETP-IP Secretariat's analysis – see Annexure B for information on methodology and assumptions.

59 Analysis based on modelling that is consistent with the low NDC range in 2030 and applies the methodology in Schers and Burton to decompose workforce impacts; assumes no reduction in coal exports, which would exacerbate these impacts.

Besides direct employment effects, major impacts will be felt in local municipalities which depend on coal for economic activity. Over 70% of South Africa's total value added from coal comes from just four towns - eMalahleni (Witbank), Steve Tshwete (Middelburg), Govan Mbeki and Msukaligwa (Ermelo).[60]

Figure 5. Gross value added in the coal value chain as percentage of total in coal towns, 2000 and 2018



Source: *Makgetla and Patel, 2021.*

In Steve Tshwete, 35% of the municipal economy is associated with coal mining and in eMalahleni this is 44%. Coal employment accounts for 26% of jobs in Emalahleni, 17% in Steve Tshwete, 14% in Msukaligwa, and 11% in Govan Mbeki local municipalities.[61] The loss of relatively higher-wage jobs (with pensions and unionisation benefits) and the economic activity associated with the coal value chain, would have significant negative impacts on these four municipalities and thus requires focused attention on just transition planning. An important issue is to maintain basic social and community services which often rely on coal economy contributions through donations, payments, and tax revenues.

Furthermore, municipal sustainability, finances and service delivery are at risk. Eskom coal plants and mines provide water, electricity, and waste services to associated communities and support many community-related activities. As economic activity declines, this will reduce the rates base and increase demand for municipal support for households, putting further strain on municipal budgets and capacity.[62]

60 Patel et al., 2020; Makgetla, 2021.
61 TIPS, 2020.
62 This is an important consideration at the municipal level that requires further analysis.

Finally, many decades of coal mining and use have undermined the health of the population and polluted soil and water. Air pollution non-compliance has been the subject of legal challenge. Degraded land, as well as subsidence and dumps, limits alternative uses for land. Alongside water shortages and quality challenges, this hampers economic diversification and livelihood opportunities.[63] There are almost 800 derelict and ownerless mines which are a major cause of acid mine drainage, while un-remediated mines can attract informal mining, with associated challenges. Considerable and ongoing challenges with mine rehabilitation may be exacerbated by coal downscaling.

Major currently existing structural impediments to a just transition in Mpumalanga include:

- High unemployment and lack of appropriate skills for workers, communities, and youth to transition to new sectors and build local livelihoods.
- Poor infrastructure (such as transport infrastructure, digital and energy access) and environmental degradation constrains economic diversification opportunities. Resolving infrastructural constraints is key to attracting private sector investment.
- The existing financial ecosystem does not address just transition projects: early stage, small-scale (less than ZAR100 million), higher risk, or novel technology-based projects, due to structural limitations in the finance sector and limited availability of grant financing, emphasising the need to crowd in new external grant and concessional financing.[64]

Mpumalanga also has important advantages that can support the just transition, including:

- An existing industrial base and experienced workforce;
- Excellent wind and solar resources, and proximity to electricity load centres, with extensive transport and transmission infrastructure that can be used to support new initiatives in clean energy and other sectors;
- Provincial and local planning initiatives (such as Provincial stakeholder forums on Just Transition and the Climate Change Forum) and institutional capacity to deliver transition projects including Provincial entities such as the Mpumalanga Green Economy Cluster, as well as Eskom and private sector initiatives;

63 MPG, 2021; Dabrowksi and de Klerk, 2013; and Esterhuyse and Buschke, 2021; mining-related issues were also raised at the Presidential Climate Commission's (PCC) stakeholder engagements in Mpumalanga, in publications by civil society groups working with communities such as groundWork and in the National Mine Closure Strategy and JET Framework by the Department of Mineral Resources and Energy (DMRE).

64 S. Lowitt, 2021, "Finance and The Just Transition," Working Paper for PCC, TIPS.

- Emerging lessons from Eskom's repurposing initiatives at Komati;
- Strong civil society presence and active community engagement;
- Natural capital such as mining lands, that if repurposed, could support new employment and investments in a range of productive sectors (clean energy and high-value agriculture, housing[65]) while also building green tourism for generations to come.

Without careful planning and implementation, and given the high rates of unemployment, poverty, and inequality, the loss of employment and economic activity associated with the coal value chain will have significant negative impacts.[66] At the same time, the coal value chain and its associated negative impacts limit the potential for economic diversification into new sectors and constrain investment in new clean sectors.

Addressing structural constraints to enable economic diversification is a key goal of the thematic areas outlined below. The programmes outlined below must be implemented and funded in tandem, as the comprehensive package of interventions will support a place-based and just energy transition.

65 Gaylor Montmasson-Clair, Lauren Hermanus, Mohamed Patel, and Peta Wolpe, 2022, Beyond Coal: Opportunities to Diversify the Economies of Emalahleni and Steve Tshwete Local Municipalities, TIPS/Just Urban Transitions.

66 National Employment Vulnerability Assessment (NEVA); Sector Jobs Resilience Plan; Inputs to the PCC.

4.2.2 CATALYTIC ELECTRICITY SECTOR INVESTMENTS REQUIRED IN INFRASTRUCTURE

Support will be required to decommission and repower and repurpose coal plants, to remediate and repurpose associated coal mining infrastructure, to invest in the transmission grid, to invest in new generation and storage capacity, and to update the distribution networks.

The catalytic investment needs, for which implementing institutions are ready to execute over the next five years are set out below and summarised in Table 14 as follows: Investment in decommissioning; investment in new generation capacity; investment in the transmission grid and Eskom's distribution network infrastructure.[67]

Table 14. National infrastructure investment requirements for the South African electricity sector, 2023-2027, and 2023-2035.

ZAR billions	2023-2027	2023-2035	Notes on who would invest
Coal plant decommissioning	4.1	19.3	Eskom – These Eskom estimates are based on the cost of decommissioning of plants set to retire over these time frames, and are additional to the investment costs of repowering and repurposing projects contained in Eskom's project pipeline.
Transmission	131.8	373.2	Eskom-owned and operated.
Distribution	13.8	127.5	This investment requirement covers both Eskom and Municipal distribution systems, but EXCLUDES the current maintenance backlog in Municipal distributors. (see Section 4.6).
New Solar photovoltaic (PV)	233.2	418.5	This includes utility scale PV AND distributed PV. Most investment is expected to come from the private sector, with some investment from Eskom in its repowering and repurposing programme.
New Wind	241.7	874.3	Apart from an extension of Eskom's Sere Windfarm and additions through its JET repowering and repurposing programme, this will be built and operated by the private sector.
New Batteries	23.1	44.2	Eskom has just awarded a contract to deliver phase 1 of a battery storage project. Other battery capacity may be built by Eskom or the private sector.
TOTAL	**647.7**	**1 857**	
New open cycle gas turbine (OCGT) / combined cycle gas turbine (CCGT)	15	169.7	Eskom, local authorities, and/or the private sector. Not included in the JET IP.

[67] The investment required in municipal distribution infrastructure is set out in Section 4.6.

4.2.2.1 INVESTMENT IN DECOMMISSIONING

In alignment with energy policy, Eskom plans to close seven coal plants by the end of 2030 and two more by 2035, out of a total of 15. Coal plant-decommissioning costs reflect what Eskom has currently provided for in its planning. These costs exclude the costs of repurposing or repowering retired plants and other infrastructure investments.

4.2.2.2 INVESTMENT IN NEW GENERATION CAPACITY

The retirement of coal plants, the existing supply deficit, as well as growth in electricity demand, will necessitate considerable investment in new generation capacity by the country – which will include Eskom, local authorities who own and operate electricity distribution systems, by the private sector, and others. In addition, rapid investment in new capacity will also address the current electricity supply crisis. New renewable electricity and other required capacity will be procured through the existing REIPPP programme from the private sector, via bilateral contracts or other market mechanism (in terms of the reforms announced by the President recently in connection with addressing the electricity crisis, and the institutional reforms proposed in the Electricity Regulation Act Amendment Bill), or in the form of commercial, industrial, and residential embedded generation.

Both the current supply crisis and the need to meet climate change mitigation objectives and compliance challenges, in relation to air pollution regulations, necessitates the addition to the electricity system of around 50 GW of new renewable electricity capacity to the grid, plus the associated gas/battery/storage capacity to ensure security of supply and grid stability. The IRP 2019, which is in the process of being updated by the DMRE, envisages the addition of around 30 GW of renewable electricity capacity by 2030, including 2.5 GW of imported hydro capacity from the region.[68] In the absence of the latter, more renewable electricity capacity will be required within this timeframe, and the current status of the electricity system requires rapid addition of new capacity.

Thus, over the 2023-2027 period, to resolve the electricity supply crisis and to keep pace with investment requirements to meet South Africa's NDC targets and long-term decarbonisation objectives, it will be necessary to add around 6 GW of new renewable electricity capacity to the grid each year, as well as the required gas/storage capacity. This is a no-regrets option; apart from relieving the current pressure on the existing coal plants, the short lead times for wind and solar PV plants imply considerable flexibility in capacity additions. The changes recently announced by

[68] The IRP 2019 proposed that this power be sourced from the Grand Inga hydroelectric scheme in the Democratic Republic of Congo, which would also require the strengthening of the long-distance transmission corridor. The contracting of hydroelectricity from the region at this scale, by 2030, and at the price assumed in the IRP is no longer considered plausible (https://issafrica.org/iss-today/can-tshisekedi-really-revive-grand-inga), and will also potentially pose energy security risks.

President Ramaphosa to the electricity regulatory environment, and specifically, further changes to Schedule 2 of the Electricity Regulation Act, also offer an opportunity for embedded generation at scale as well as for contracting electricity supply directly from renewable electricity generators, onsite or via the grid.

Adding capacity at this rate, however, will require considerable strengthening and extension of the transmission grid. In the short-term, there is potential to connect more than 6 GW of new capacity in Mpumalanga,[69] including repowering Eskom's retiring coal plants, and under Eskom's recently announced land lease programme, and this can be extended to 12.3 GW by 2027 in the northern area with investment in 27 additional transformers.

4.2.2.3 INVESTMENT IN THE TRANSMISSION GRID AND DISTRIBUTION NETWORK

Large-scale and rapid investment in renewable energy, particularly in the Northern and Eastern Cape, will require unprecedented annual levels of investment in the transmission grid, since the grid was primarily designed to move electricity from a very concentrated area in Mpumalanga to the rest of the country, due to the geographic concentration of coal resources. Renewable energy resources however are widely distributed throughout the country, and especially in the Northern, Western and Eastern Cape provinces, with considerable opportunities in other provinces.

Similarly, large-scale investment will be required in distribution grids to facilitate the connection of new REIPPPP utility-scale projects, to enable large-scale distributed generation, to further electrify households, communities, and businesses and provide for offtake agreements between large and small generators and consumers via smart grids, including tackling the backlog of investment in the distribution sector, and to enable new technologies such as electric vehicles to be deployed in an optimal manner. Part of the distribution system is owned and operated by Eskom and part owned and operated by municipalities throughout the country. The scale of investment required in backlog maintenance, upgrade and modernisation of the municipal distribution infrastructure networks is discussed in Section 4.6.

In common with other countries, large-scale integration of renewable electricity capacity into the grid poses challenges that require investment in additional grid infrastructure. The long-term decarbonisation of the South African electricity system, and of the economy in general, will require the rate at which renewable electricity plant is added to the grid to increase even faster in the 2030s and 2040s. Rapidly increasing the transmission grid's capacity to accommodate additional renewable electricity plant around the country is therefore also a no-regrets investment. The lead

[69] From Eskom's Generation Connection Capacity Assessment 2024.

times required for the development of new transmission corridors, and/or the strengthening of existing corridors, which include challenges such as securing servitudes over long distances, means that the associated projects should be initiated as soon as possible. If this transmission investment is not expedited, there is a very real danger that the regional capacity of the transmission grid will be the main bottleneck both to the expansion of the electricity system and its decarbonisation.

Eskom's Transmission Development Plan (2022-2031)[70] (TDP) proposes a series of investments to strengthen and extend the transmission grid over the period 2022-2031, to connect the additional capacity envisioned in the IRP. The TDP's updated[71] version of the IRP expansion plan envisages 20 GW of renewable electricity capacity by 2028 and 30 GW by the end of 2030, whereas the amount of renewable energy required to achieve an outcome in 2030 towards the lower end of the NDC target range would require around 50 GW of renewable electricity capacity by 2030. Eskom has indicated that to achieve its strategic objectives, the investments specified in the current TDP will need to be accelerated and expanded, and a revision of the plan is therefore anticipated.

4.2.2.4 REQUIRED AGGREGATE INVESTMENT IN ELECTRICITY INFRASTRUCTURE

The investment requirements for the electricity sector for an ambitious just transition are presented in Table 14. These are modelled estimates and would require further elaboration at a project level. The investment requirements in the table are consistent with a national GHG emissions level of 375 $MtCO_2$-eq in 2030, which is towards the lower end of South Africa's NDC target range for 2030. The GHG emissions pathway, underpinning this outcome, is both fair and ambitious in terms of the Paris Agreement and is consistent with South Africa's NDC target range in 2030, and with a long-term pathway to net zero CO_2 emissions around 2050, considering South Africa's national circumstances and development imperatives.

Eskom has already done detailed project-level costing for some of the investment requirements in the table, and these are included in Annexure B. Eskom's project pipeline consists of 141 projects and comprises a subset of the required investments across the sector reported in the table below, comprising ZAR5 billion for 950 MW of battery storage, ZAR35 billion for 2550 MW of PV, ZAR13 billion for 600 MW of wind power, and ZAR131 billion for transmission infrastructure. The total cost of these projects is estimated to be ZAR42 billion in the 2023–2027 period and ZAR191 billion in the 2023-35 period.

Most of the investments in PV and battery storage form part of Eskom's repowering / repurposing of retiring coal plants. The project pipeline is also included in the Annexure B. Since the estimates

[70] Available at https://www.eskom.co.za/wp-content/uploads/2022/03/TDP2022-2031Rev1.pdf.
[71] Updated to take into account delays in procuring the new capacity specified in the IRP.

by Eskom and others of the new renewable electricity plant capacity which will need to be connected to the grid are significantly higher than the IRP 2019, an updated TDP will require considerably more investment in the following five-year period. Since Eskom is currently being restructured into three entities, corresponding investments will be made by the three entities with due regard to the resolution of Eskom's current debt crisis.

Around ZAR648 billion (US$43 billion) will be required in investment in the 2023–2027 period and ZAR1.86 trillion (US$124 billion) in the 2023-2035 period, across the sector, including new generation plant and transmission and distribution infrastructure, and decommissioning of coal plants.

Most generation investment will likely come from the private sector or other non-state entities, including some investments from community- and worker-owned trusts,[72] via the REIPPPP or its successor, via bilateral contracts, and / or via commercial, industrial, and residential embedded generation, whereas transmission and distribution infrastructure will most likely be invested in by Eskom and local authorities.[73] The investment requirements in the table for wind and solar PV include both utility-scale and distributed generation. It is not possible, at this stage, to disaggregate these over the relevant period. Where there is more granular detail, this is provided in the Annexure B.

[72] These could include local community trusts or other forms of ownership. It is also possible that local authorities may invest in their own capacity.

[73] Currently, as part of the legacy of apartheid planning, half of the distribution system is operated by Eskom and the other half by local authorities. Current policy is to maintain public ownership of both transmission and distribution.

4.2.3 REQUIRED JUST TRANSITION INVESTMENT IN MPUMALANGA COAL COMMUNITIES

The priority areas outlined below seek to ensure sustainable, long-term regional transitions in coal-dependent Mpumalanga. Transition outcomes should contribute to economic resilience in communities, restoration of the environment, creation of better jobs, and ensuring human capacity and capabilities. To achieve a just transition will require major investments in the enabling conditions that permit and encourage a wide variety of investments across multiple sectors.

There are four interdependent priority areas:

- Repurposing coal power plants and coal mining lands;
- Economic diversification;
- Transition of workers and communities; and
- Enabling conditions for the transition.

While designed specifically for South Africa, these areas draw on international best practices and experiences in supporting just transitions in coal regions around the globe.[74] They also respond to government-identified priority interventions in the DMRE's JET Framework and to current work addressing coal phase down and achieving just transition outcomes.[75]

The investment needs for just transition initiatives in Mpumalanga are summarised in Table 15.

[74] Elizabeth Ruppert Bulmer, Kevwe Pela, Andreas Eberhard-Ruiz, and Jimena Montoya, 2022, Global Perspective on Coal Jobs and Managing Labor Transition out of Coal: Key Issues and Policy Responses, Washington, DC: World Bank, https://openknowledge.worldbank.org/handle/10986/37118; Sandeep Pai, Mary Margaret Aller, Kira O'Hare, Ian Barlow, Hugh Searight, Rahul Madhusudanan, and Mike Ward, 2021, Understanding Just Transitions in Coal-Dependent Communities, Washington DC: CSIS (Center for Strategic and International Studies) and CIF (Climate Investment Funds), https://www.climateinvestmentfunds.org/cif_enc/sites/cif_enc/files/knowledge-documents/understanding_jt_coal_dependent_communities.pdf; World Bank Group, 2018, Managing Coal Mine Closure: Achieving a Just Transition for All. Washington, DC: World Bank, https://openknowledge.worldbank.org/handle/10986/31020.

[75] Multiple studies summarised in PCC's (2022) Framework for a Just Transition in South Africa include the Congress of South African Trade Unions (COSATU) Blueprint; the Life After Coal Open Agenda https://lifeaftercoal.org.za/about/just-transition/open-agenda; and work by TIPS, Stellenbosch University, the University of Cape Town (UCT), amongst others, as described in the introduction to the JT section above.

The investment needs for just transition initiatives in Mpumalanga are summarised in Table 15.

Table 15. Summary of JET IP investment needs for Mpumalanga coal communities, 2023–2027

Investment needs	Description	ZAR billion
Repurposing coal plants	Social investment to support local communities and supply chain developments for new energy technologies	3.4
Repurposing coal mining land	Remediating and repurposing coal mining land for new public and private use	13
Improving infrastructure for development	Infrastructure upgrades in roads, water, digital, energy access, education, and training facilities, to attract investors and improve lives	12.3
Diversifying local economies	Creating and supporting small-scale livelihood opportunities in surrounding communities and nurturing new economic pathways for coal mining regions through new investments and support for incubators, accelerators, and early-stage ventures	24
Caring for the coal workforce	Managing workforce transitions through reskilling, support for mobility, retraining, redeployment, placement, and temporary income support	5.6
Investing in youth and preparing future generations for the transition	Tackling youth unemployment through education, soft skills training, work experience opportunities, and placements	0.75
Planning for success	Conducting a comprehensive assessment of coal asset closures to support provincial and municipal preparedness	0.3
Instituting policies for post-mining redevelopment	Promoting policy alignment and ensuring financing for responsible mine closures and pathways for post-mining rehabilitation and repurposing	0.05
Building capacity for success	Providing budget support to relevant government agencies; budget support for establishing a local secretariat; along with technical assistance and project funding linked to demonstrations, pilots, incubators, and accelerators.	1
TOTAL		**60.4**

The Just Transition investments in each priority area outlined below will need to be phased as follows:

PHASE 1 (YEARS 1–3):

- Secure an immediate impact with kick-start/demonstration projects in communities where coal power plants and related mine activities are set to close first. This may necessitate establishing a project preparation facility to work with organisations whose projects require commercialisation support. In addition, targeted capacity-building initiatives will be launched with local and regional authorities and their agencies to ensure readiness for implementation, with monitoring and evaluation of the first phase rollout.
- Build local skills intelligence to identify new employment and livelihood opportunities (demand analysis), skills that workers and community members possess (supply side), skill gaps, and upskilling / reskilling needs and opportunities. Build capacity for provision of training and start implementation of skills development programmes.
- Design mobility schemes for workers and their families who voluntarily choose to leave employment in the coal community and relocate elsewhere. Baseline studies, preferences surveys, and other instruments would be deployed early to identify worker preferences for a post-coal life.
- Complete in the relevant stages, feasibility studies for infrastructure related to the closing or decommissioning of coal power plants, closing, and repurposing of mines (derelict or abandoned); environmental and social assessments as required by law. This will include community and stakeholder engagement on activities, such as land use planning and future use scenarios. Catalytic mine land-repurposing projects at well-developed stages of development will commence.
- Identify sources of finance for ongoing social infrastructure where such privately funded structures and services will decline due to the transition (for example, hospitals, clinics, schools, digital infrastructure which is currently funded by mining companies).

PHASE 2 (YEAR 4 ONWARDS):

- Execute major infrastructure works related to the closure, decommissioning, and repurposing of coal power plants and mining lands; scale up reskilling, retraining, and outplacement programmes; provide large support schemes to indirect workers; and develop SMMEs. A mid-term review – with surveys, focus groups, and interviews amongst all impacted local stakeholders will be needed to assess the just transition effectiveness of interventions.

Figure 6. Just Energy Transition Priority Areas

	Repurposing coal plants & mining lands	Economic Diversification
Phase I Pre-closure planning 1.5 years	• Review legislation pertaining to reclamation and repurposing • Assess abandoned mine and coal plant assets to be closed and decommissioned • Develop land use repurposing strategies • Prepare special spatial plans for future use scenarios • Community consultations on future use scenarios • Review and possibly amend health, safety and environment and technical standards for closure and decommissioning • Begin private sector mobilisation	• Review existing national and regional development plans, strategies and policies • Perform interviews and focus group discussions in coal communities on the 'future without coal' vision • Identify most promising sectors • Design SMME support programme • Work with stakeholders to identify a pipeline of pilot projects for early transition implementation • Develop monitoring and evaluation (M&E) system that involves local actors in implementation oversight • Call for proposals to implement pipeline
Phase 2 Coal mine and powerplant closure 3+ years	• Repurposing works commence • Apply careful monitoring mechanism for environmental legacy issues	• Roll out of economic diversification programmes
Phase3 Regional transformation 10+ years	• Repurposing and on-going mobilisation of private investment through public-private partnership	• On-going economic diversification programmes

	Workers and Communities	Enabling conditions
	• Assess worker profiles and user-needs of both direct and indirect coal value chain workforce • Review social protection programmes in view of identification of gaps • Develop pre-layoff plan, including income support, active labor market policies and institutional capacity building of service delivery agencies • If schedule of closures in place, work upstream with first 5 year closures to discuss plans and map priorities • Design youth education, placement and employment programme and public employment schemes	• Reform laws, policies and regulations relevant to a Just Transition (labour, environment, energy, mining) • Establish timeline for mine and coal plant closures • Map stakeholders and develop stakeholder engagement strategies • Identify (from existing) fiduciary agency for JET IP programme management and implementation • Establish Special Purpose Entity to manage repurposing • Analyse fiscal analysis of revenue loss due to sector wind-down (national and local effects) • Identify complementary funding sources programmes
	• Provide social assistance (including temporary income support) to workers • Active market policies for workforce transition, including re-skilling, education, and mobility incentives • Early retirement benefits	• Coordinate JET IP implementation through institutional arrangements, including budget oversight M&E system at work
	• Provide longer term education to help preparing workers for future jobs	• Coordinate closure and decommissioning activities amongst relevant actors • Hand over mining lands and coal assets for repurposing

ENERGY SYSTEM

PRIORITY AREA 1: REPURPOSING COAL POWER PLANTS AND COAL MINING LAND

1.1: REPURPOSING COAL PLANTS

The capital investments required for decommissioning and re-powering the targeted coal plants is set out in the investment packages in Section 4.2.2 above and Table 39. The estimated costs of the just transition components of repurposing the coal plants are based on those prepared to date for Komati and scaled for the larger facilities.

- JET IP: Social investments to support local communities and supply chain developments for new energy technologies
- Financing instruments: Grants and concessional financing
- Expected result: Power plants will be closed and repurposed according to international industry best practices.

1.2: REPURPOSING COAL MINING LAND

Current potential for new economic and social development is impeded by the environmental liabilities of improperly closed or abandoned coal mines, with far-reaching impacts on communities (for example, increased water and food insecurity). The objective of these investments is to ensure appropriate remediation and repurposing for new public and private uses with respect to three distinct categories of coal mining lands: (i) abandoned mines; (ii) closed mines; and (iii) operating coal mining lands. The first investment focus will be on a few selected ownerless mines that can act as 'proof-of-concept', followed by coal mining areas set to close in the near term alongside coal plant closures.

- JETP IP: Pilot mine closure and repurposing with a view to redevelopment of land for future public and private use.
- Financing instruments: Grants, in combination with project, concessional, and private financing.
- Expected result: Land repurposed and new investments identified and catalysed.

PRIORITY AREA 2: ECONOMIC DIVERSIFICATION

2.1: IMPROVING INFRASTRUCTURE FOR DEVELOPMENT[76]

As concluded in recent research, an important factor that facilitates successful economic diversification away from coal in coal-dependent regions is enhanced connectivity, whether transport or digital infrastructure. Quite simply, attracting new business investments and professional talent to the declining coal regions of South Africa requires appropriate market and digital connectivity, supported equally by underlying investments in infrastructure such as water, electricity, housing, and other core services. The objective of investments here is to ensure that the necessary infrastructure foundation is in place to attract and retain new businesses and talent and enable new investments in emerging productive sectors.

- JET IP: Improve and strengthen necessary infrastructure for economic trade and development. This will include extensive provincial road rehabilitation and maintenance, expanded digital connectivity, investment in water treatment facilities, irrigation improvements, ecological infrastructure, access to modern energy services, informal settlement upgrading and sustainable housing.
- Financing instruments: Loans for public infrastructure, loans and grants for public employment and energy access.
- Expected results: Increase in trade and people flows, long-term investment attraction.

2.2: DIVERSIFYING LOCAL ECONOMIES

Many current enterprises will be impacted by coal closures (including trucking, rail-related services, accommodation, food, caring, and others). The objective of this investment subcomponent is to bring enterprise supply and demand together for economic diversification away from coal.

To address supply, a series of interventions is proposed to assist current businesses pivot towards greener opportunities in new productive sectors, to work with new emerging SMMEs and to strategically use public employment initiatives that can lead on to and/or interface with sustained private or self-employment for job seekers.[77]

To address demand, a series of interventions is required to identify areas of growth in local markets, based on actual potential, and nurture their development. Support may include incubators, accelerators, and early-stage ventures to create next-generation opportunities and entrepreneurs.

[76] Current investment estimates cover water treatment and sanitation, estimates for road infrastructure rehabilitation, along with the expansion of digital infrastructure and digital connectivity.

[77] This could include, for example, the Social Employment, Waste Innovation, Waste Innovation Enterprise Finance, Waste Technology Innovation Support, the Ecological Infrastructure Fund, and municipal maintenance / upgrading public employment programmes, amongst others that may be identified as needed in Mpumalanga.

Productive sectors to consider include climate-smart mining and minerals beneficiation, biodiversity, agriculture, water projects, tourism, circular economy, and manufacturing (including centres of excellence, industrial parks, and projects).[78] Additionally, provide support for small scale, local livelihood opportunities in surrounding communities.

- JET IP: Support for analysis on informal enterprise impacts (the hustle economy) and risks, support for a wide range of innovative projects and new markets based on diversification strategies under development and identified projects. Create the supply through support to SMME development and training.
- Financing instruments: Grants and concessional loans for public, private, and local community-led initiatives with pilot projects/proofs-of-concept social employment opportunities and scaling initiatives; support for enterprise development training; and seed funding for micro enterprises.
- Expected results: New industries, businesses, skills, employment, and livelihoods.

PRIORITY AREA 3: WORKERS AND COMMUNITIES

3.1: CARING FOR THE COAL WORKFORCE

There will be a range of coal industry workers affected (directly and indirectly) by the closure of mines, coal power plants, and supporting firms. Needs for transition will be handled differently for each group according to national labour laws and provisions made by respective employers. The objective will be to manage the direct and indirect workforce transition through redeployment, reskilling, retraining, support for mobility/relocation, placement support, and temporary income support including short-term assistance.[79]

- JET IP: Implement the recommendations of the Sector Jobs Resilience Plan (SJRP)[80] for the coal value chain, in addition to the short-term transition assistance required by law. Surveys of those affected will identify their preferences, opportunities, and constraints. Enhanced retirement and retrenchment packages (including health packages) and income support mechanisms should be designed and delivered to ensure adequate social protection for affected workers. Redeployments through the Public Employment Programmes including placement of contractors in proposed in the 'Working for Mine Rehabilitation' programme and through public employment schemes. Mobility re-skilling, enterprise development where appropriate.

78 DMRE, 2021.

79 South Africa has an extensive social support system, including social grants, unemployment insurance, etc. However, existing measures are not sufficient to address regional structural changes and value chain vulnerabilities at the scale facing the country in the energy transition. How current social safety nets can be enhanced and targeted at vulnerable groups is a key area requiring further analysis, policy development, and financial innovation to address.

80 https://www.tips.org.za/images/TIPS_for_DEFF-dtic_-_SJRP_for_the_coal_value_chain_final_May_2020.pdf.

- Financing instruments: Grants for reskilling, retraining, surveys, and planning. Concessional financing for retrenchments, mobility, short-term assistance, redeployments, placement support, and enterprise development.
- Expected results: Coal industry workers' livelihoods protected. Resources allocated by Sector Education and Training Authorities (SETAs) for reskilling and retraining of coal value chain workers.

3.2: INVESTING IN YOUTH AND PREPARING FUTURE GENERATIONS FOR TRANSITION

Over half the youth in Mpumalanga communities are unemployed and the coal value chain decline will further narrow employment opportunities as the sector downscales. The objective is to address present-day youth unemployment in coal mining communities and mitigate further declines for future generations. Interventions range from targeted education and soft-skills training; opportunities for work experience including public employment initiatives and placement schemes; and a dedicated set of funds for youth-implemented transition projects. These interventions would be complemented by support to youth-focused networking and experience-sharing platforms for coal sector transition, lifting the South African experience to the global stage.

- JET IP: Focus on three interrelated areas of human capital development: (i) education and soft-skills training linked to direct work experience; (ii) active involvement in transition pilot project implementation; and (iii) networks and platforms to enhance the voice and agency of youth as well as enable their contribution to policy.[81]
- Financing instrument: Grants.
- Expected Result: New-generation skills and employment linked to indicators in the projects supported.

[81] Responding to the youth engagements held by PCC, as well as the Youth Climate Action Plan, 2021 (https://saiia.org.za/wp-content/uploads/2021/10/The-South-African-Youth-Climate-Action-Plan-2021.pdf), including the proposal for youth climate councils to support climate governance and democratic participation.

PRIORITY AREA 4: ENABLING CONDITIONS FOR A JUST TRANSITION

4.1: PLANNING FOR SUCCESS

There is currently uncertainty for stakeholders, including local government and communities, about the timelines of coal closures. The objective is to undertake a comprehensive assessment of coal power plant closures and potential related mine closures, including related details of available financial provisions, social and labour plans, rehabilitation, and social transition plans. The resulting plan will enable assessment and management of the socioeconomic impacts of coal phase down. This will support provincial and municipal preparedness, planning for post-mining land use, and economic diversification.

The draft National Mine Closure Strategy (2021)[82] and the Just Energy Transition Framework both indicate the importance of an integrated approach to mine closure planning and post-mining use.

- JET IP: Work with DMRE and other stakeholders to develop a plan and timeline for coal mine closures.
- Financing instruments: Grants.
- Expected results: Integrated plan and timeline that aligns with the ambitious trajectory of the NDC.

4.2: INSTITUTING POLICIES FOR POST-MINING REDEVELOPMENT

Complex requirements across departments and levels of government have made formal mine closure challenging. The DMRE draft National Mine Closure Strategy elicited calls from civil society for rehabilitation and proper closure of mining areas, and for alignment in implementing mine closure policies across government. The objective is to enable policy alignment and ensure financing for responsible mine closures and pathways for post-mining rehabilitation and repurposing.

- JET IP: Support DMRE and DFFE to assess available resources in rehabilitation funds and develop a financing model for rehabilitation of derelict, ownerless, abandoned and closing mines. Support policy alignment to address planning, regulatory, and financial barriers to successful mine closure. This includes finalising national and regional closure strategies that simplify implementation and close existing loopholes to ensure just transitions.
- Finance instrument: Grants.
- Expected results: Contradictions and loopholes identified and addressed. National and regional mine closure strategies finalised.

[82] DMRE, 2021, "National Mine Closure Strategy," https://www.gov.za/sites/default/files/gcis_document/202105/44607gen446.pdf; and DMRE, 2021, Just Energy Transition (JET) Framework. The JET Framework notes that a sector-wide assessment is needed for the purposes of JET planning.

4.3: BUILDING CAPACITY FOR SUCCESS

Implementation of the IP will require significant coordination and monitoring skills to ensure its success. In addition, municipal and provincial government and structures may require additional resources to support implementation effectiveness. This sub-priority area will ensure sufficient resources are made available to: (i) establish the institutional mechanisms to support implementation of the Mpumalanga IP priority areas; (ii) coordinate with mining companies, municipalities, workers, and communities to ensure the Mpumalanga IP priority areas are aligned with integrated development plans; (iii) host regional and local Just Transition forums to raise awareness of the programmes that are in place. In addition, the JET IP may support a small number of demonstration projects to catalyse stakeholders around the just transition agenda in South Africa.

- JET IP: Perform stakeholder engagement and outreach in a consistent manner; build capacity for integration of the District Development Model; the Integrated Development Plans; Local Economic Development plans; and the Social and Labour Plans as a way of ensuring integration, funding the municipalities during the transition, and ensuring continuity of service delivery in affected towns.
- Finance required: Budget support to relevant government agencies; budget support for institutional mechanisms; and technical assistance linked to demonstration, pilots, incubators, and accelerators.
- Expected results: Municipal and District plans positioned to manage the transition.

4.2.4 REQUIRED JUST TRANSITION INVESTMENTS IN THE ELECTRICITY SECTOR

While a significant portion of just transition investments in the short term will support coal communities in Mpumalanga, there are also key interventions needed in the electricity sector more broadly, to promote the goals of the National Just Transition Framework and which will take place across multiple locations/sites outside of Mpumalanga. Their implementation will contribute to achieving a socially just, inclusive, and jobs-rich future through maximising the development potential of the power sector infrastructure investments, contributing to industrial development and innovation (including expanded manufacturing[83]), and restorative and distributive justice for vulnerable households and workers.

The investment needs for this aspect of a just transition are summarised in Table 16.

Table 16. Summary of Electricity Sector Just Transition Investments

Investment Package	Description	2023–2027 ZAR billion
Manufacturing and localising the clean energy value chain	Expanding capacity in the clean energy value chain, including renewable energy, battery storage, transformers, lines, components, and associated value chains	1.60
Piloting social ownership models	Testing diverse models for the social ownership of electricity generation and building capacity in communities to participate effectively	1.65
TOTAL		**3.25**

4.2.4.1 INVESTMENT IN THE CLEAN ENERGY VALUE CHAIN

Insufficient local manufacturing capacity in renewable energy and associated inputs reduces the potential for job creation in the value chain, while the growth potential of private procurement is not being captured. The cost of capital is a key constraint. Manufacturing of key components – including renewable energy localisation, battery storage, transformers, lines, components, and expansion of associated value chains such as critical minerals – can support industrialisation, job creation, and inclusive ownership, and enable infrastructure rollout to proceed smoothly.[84]

- JET IP: Finance to enable increased local manufacturing of key components.
- Types of financing: Grants, concessional and commercial loans.
- Expected results: Increase in local manufacturing and job creation.

[83] A key investment in a just transition will be in skills and training and the expansion of the local manufacturing capacity to support these priorities. The South African Renewable Energy Masterplan (2022) indicates that local manufacturing can contribute ZAR420 billion to the country's GDP and create 36,500 new direct jobs by 2030 through investments to meet the IRP 2019's renewable energy capacity, indicating potentially far greater positive benefits for a low NDC-compatible renewable energy rollout.

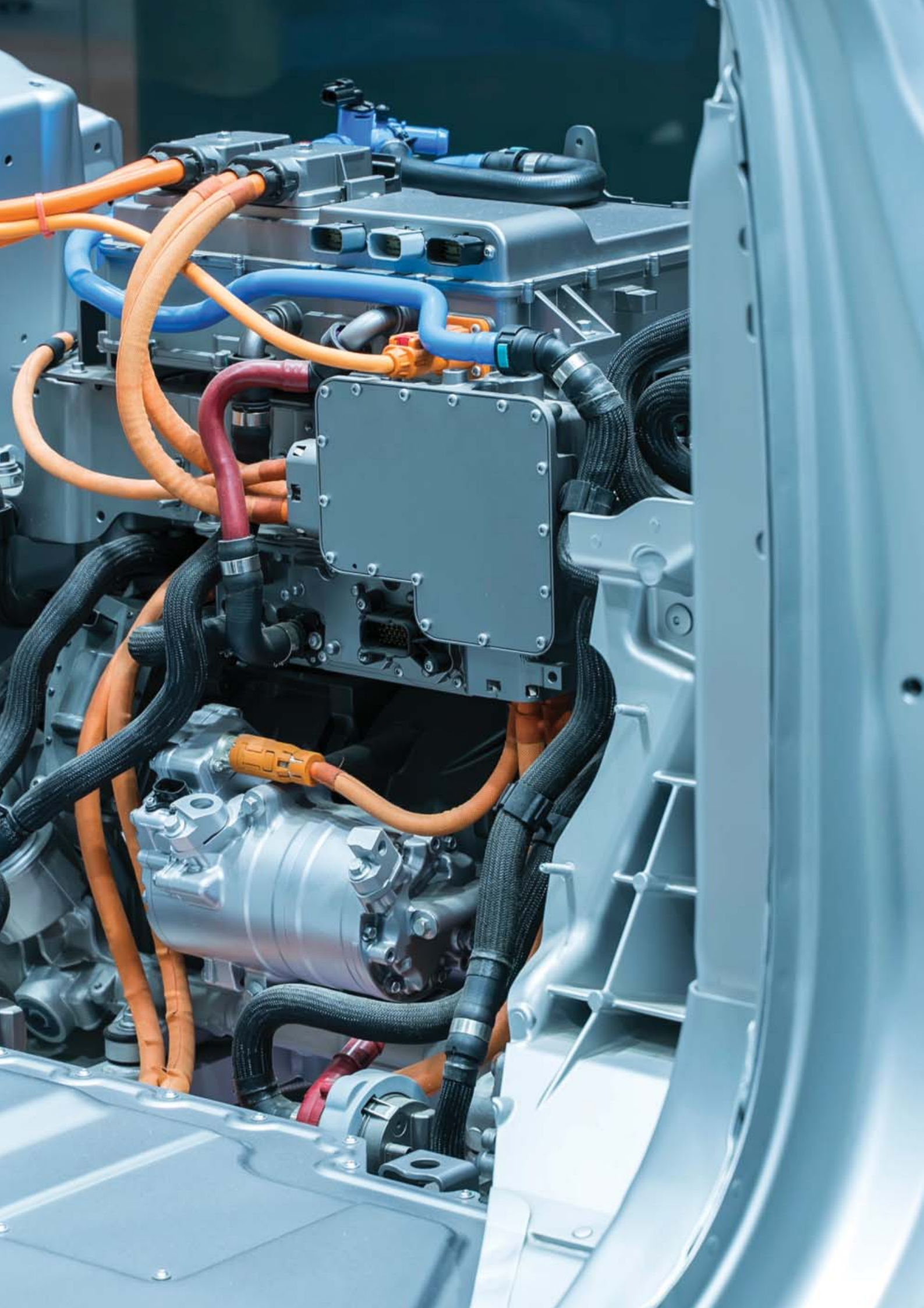
[84] Battery storage and minerals investment needs are captured in the NEV section 4.3 to avoid double-counting.

4.2.4.2 PILOTING ALTERNATIVE MODELS OF ELECTRICITY GENERATION OWNERSHIP

Alternate forms of ownership of electricity generation assets have the potential to contribute to ensuring that growth in new low-carbon sectors is inclusive and brings benefits for vulnerable groups. These include community ownership of embedded generation infrastructure, share options for workers in renewable plants, cooperative forms of ownership, and schemes to ensure that the benefits of utility-scale renewable infrastructure provide energy access to people living in adjacent areas.

This initiative will enable innovation and learning in the development of diverse ownership models, with the purpose of advancing inclusivity and benefits to vulnerable groups. It will involve: research to identify and assess diverse models, financing modalities, institutional and other barriers; capacity development support and community engagement; support for testing a community of practice in community/social ownership (recognising the diversity of models, with advantages and disadvantages and emerging lessons); testing of scalability in differing social and geographic circumstances; options for community participation in utility-scale renewable energy projects; options for household/ cooperative/community ownership; and related options for small-scale enterprises.

- JET IP: Grants and concessional financing to support research on diverse ownership models and financing options; development of feasibility studies; and identification, implementation, and monitoring of two or three pilot projects, including support for participants to enhance their capacity.
- Outcomes: Viable models for diverse ownership of new electricity generation assets; potential for enhanced energy access and income generating benefits for vulnerable households.
- Types of financing: Grants. Concessional and commercial loans.
- Expected results: Community ownership in renewable energy increased; sustainable models identified.



4.3 NEW ENERGY VEHICLES SECTOR

4.3.1 CONTEXT

The South African automotive manufacturing sector is a major GDP and jobs contributor, constituting ZAR259,7 billion or 5.7% of SA GDP in 2020; 17.3% of manufacturing output; and employing 508 957 people. But it is under threat of obsolescence from the technology transition from Internal Combustion Engines (ICE) to New Energy Vehicles (NEVs). More than 60% of South Africa's production is exported to other markets, with 77.1% (2021) of exports destined for the UK and the EU which are introducing legislation to bar the sale of ICE vehicles, rapidly accelerating towards NEV only and net zero markets, placing the sustainability and competitiveness of local manufacturing at risk.

There are significant interdependencies between the automotive manufacturing sector and transport sector decarbonisation. The rapid global transition to NEVs presents both an existential challenge and a significant opportunity for the South African automotive industry. The majority of South African production is for internal combustion engines (ICE) vehicles, with some Hybrid EV (HEV) production. The UK and the EU are also considering the introduction of a cross-border carbon tax on imports, further challenging the industry which, due to relatively carbon-intensive electricity, could be subject to higher taxes on vehicles exported to those markets. This further requires the decarbonisation of South African automotive production towards green manufacturing.

Globally, the transport sector is one of the largest consumers of fossil fuels and a significant contributor to GHG emissions but is rapidly transitioning to NEVs, with 17 countries already having passed 20% penetration of new vehicle sales being electric, supported by fiscal subsidies.

The South African transport sector represents the third highest emissions contributor (57 Mt of CO_2 per annum or 10,8% of national GHG emissions) to South Africa's carbon emissions profile; and is an important focus for emissions reduction interventions to achieve the NDC targets. Of these emissions, road transport is responsible for 91.2%, which is the decarbonisation focus of this Section of the JET IP.

The South African transport sector faces key challenges which inhibit inclusive economic development and incur significant environmental, health, and safety externalities: An unequal and inefficient public transport sector; low use of rail for the transport of freight; and ageing infrastructure with a high maintenance backlog. Many of the core elements of a transport transition – including

electrification, integrated public transport systems, urban densification, and shifting freight from road to rail – have the potential to address both the socio-economic and environmental ambitions of the country, as espoused in the NDP.[85]

The manufacture and assembly of components and vehicles contributes 4-5% of South African GDP (with economic multiplier). In 2021, the local automotive manufacturing sector generated sales of approximately ZAR309 billion, making it the fourth largest manufacturing sector in the country by sales. The industry paid ZAR32 billion in formal wages in 2021 and it supports an ecosystem of ancillary industries and indirect jobs in three provinces, namely: Eastern Cape, KwaZulu-Natal, and Gauteng (26% of manufacturing employment in the Eastern Cape; 41% of manufacturing employment in Nelson Mandela Bay; 27% in Buffalo City; 13% in Tshwane; and 9% in eThekwini). It supports total employment of 508,957, far exceeding the coal mining sector. The export of vehicles and components from South Africa accounts for approximately 15% of all export revenue. In 2019 and 2020 the automotive industry accounted for US$4 billion and US$1.1 billion greenfield investment in the country, respectively. South Africa's automotive sector ranks 21st in global vehicle production, supplying both export and domestic markets, but faces key challenges in the energy transition in its ability to:

- finance the technology pivot to NEV manufacturing platforms and capability;
- remain globally competitive in NEV production due to lower barriers of entry for the new NEV manufacturers;
- decarbonise South Africa's industry in line with Net Zero and to meet global Original Equipment Manufacturer (OEM) and market requirements;
- finance the domestic NEV adoption and the rollout of battery-charging infrastructure, as well as the investment support and incentives for middle-income affordability; and
- finance the recapitalisation of mid-tier to smaller suppliers of ICE-specific components to produce NEV technologies.

Although the passenger EV market remains small (less than 1 004 units sold in 2021), the commercial sector NEV-related initiatives and developments are growing off a low base, despite being nascent. Industry bodies and programmes – such as the national uYilo eMobility Programme (aiming to enable, facilitate, and mobilise electric vehicle mobility in South Africa),[86] the Electric Vehicle Industry Association (EVIA) (aiming to facilitate the greater deployment of e-mobility in South Africa), and Green Cape which tracks and reports on EV-related companies and projects – are assisting with driving the transition. The Green Cape Finance Accelerator (CFA) programme, co-funded by the UK government, has seen close to US$179 million in applications for low-carbon transport solutions in 2022.

85 RSA. (2011). National Development Plan 2030 - Our Future-Make It Work.

The bus, mini-bus taxi (MBT), and light commercial vehicle (LCV) segments are witnessing increasing efforts and commitments to deploy EVs and build manufacturing capacity across their value chains.[87,88,89] Investments in the local lithium-ion battery value chain are also being explored for both stationary and mobile applications.[90,91]

Despite clear policy direction towards a decarbonised and sustainable sector, implementation plans and technical resources for an integrated sector transition need further development and resources. Given South Africa's ICE vehicle exports market relative to global competitors, it is evident that the country is a global player in the automotive sector but that preserving such market share, and associated employment, through the energy transition and NEV adoption will be challenging and will require a deliberate investment support programme. The role that the South African automotive sector can play in the transition of transport sectors in other African countries should also not be underestimated, given the rise in exports on the continent.

Long lead-times and investment cycles by OEMs mean that decisions need to be made soon to mitigate South Africa's exposure to these risks and the country will therefore, need to rapidly establish conditions for the deployment of as many locally produced NEVs as possible. This may require a review of the existing South African Automotive Masterplan (SAAM), 2021–2035.

The NEV element of the JET IP is focused on supply chain localisation, the manufacturing of NEVs and local markets, along with support for the adoption of NEVs and the alignment of infrastructure investments to projects, in order to provide both sector stability and new growth through green product manufacturing. It also demonstrates that incentivising the accelerated NEV adoption in South Africa will contribute to the decarbonisation of the logistics sector and the transition of the automotive manufacturing industry. South Africa's JET pathway for the transport sector thus requires that synergies be clarified between private sector investments, government spending, and incentive programmes, to prioritise and sequence JETP IP financing for the acceleration in local NEV manufacturing and local NEV use. Success will require national coordination and cross-sectoral collaboration.

86 uYilo, 2022, "Projects," https://www.uyilo.org.za/projects-uyilo/.

87 https://www.businessinsider.co.za/golden-arrow-solar-power-and-new-electric-buses-made-locally-2022-7.

88 GreenCape, 2022, 2022 Electric Vehicles Market Intelligence Report, https://www.westerncape.gov.za/110green/files/atoms/files/EV_MIR_29_3_22_FINAL.pdf.

89 https://www.eng.sun.ac.za/news/first-electric-minibus-taxi-is-coming-to-south-africa/.

90 Gaylor Montmasson-Clair, Anthony Dane, and Lesego Moshikaro, 2020, Harnessing Electric Vehicles for Industrial Development in South Africa. TIPS Research Report for Department of Trade, Industry and Competition and the National Association of Automobile Manufacturers of South Africa, Pretoria: TIPS.

91 The Megamillion Energy Company, 2022, https://www.tmec.africa/project.

4.3.2 FOCUS AND SCOPE

Without a deliberate and coordinated local effort, South Africa's transport sector will be on a trajectory that is inconsistent with NDC by 2030 and net zero by 2050. Table 17 summarises what is included and excluded from the scope of the NEV investment plan. The focus is on battery electric vehicles (BEVs). Fuel-cell electric vehicles (FCEVs) are discussed with reference to GH_2 in Section 4.4.

Table 17: Scope of the NEV (BEV) applications

Subsector	Scope
Private passenger (cars)	Included
Public passenger (buses)	Included
Public passenger (MBTs)	Included
Government fleets	Included
Commercial vehicles – light	Included
Commercial vehicles – heavy	Partially included in the analysis, but is not included in the investment plan. Not categorised as a potential 'early adopter'; there remains significant uncertainty regarding optimal technologies (BEV, FCEV, green fuel ICE); and FCEV applications are considered in Section 4.4 GH_2
Industrial NEVs	Excluded: Limited scale (low relative contribution to transport emissions); BEVs currently being deployed with a good business case (such as underground mining); limited potential for additionality; some opportunities for fast tracking
Rail	Excluded: Limited potential to convert diesel trains to electric; priority focus is on improving current rail services to attract more cargo to South Africa's existing electrified rail network; industrial locomotive applications limited
Air transport	Excluded: Hard-to-abate sector with limited mitigation opportunities in the short term; BEVs not expected to play a significant role
Maritime transport	Excluded: Hard-to-abate sector with limited mitigation opportunities in the short term; BEVs not expected to play a significant role

The Political Declaration includes EVs as a priority for the JET IP. In addition to this technology shift focus, other mitigation measures could attract concessional finance and deliver significant just transition outcomes in the form of reduced transport costs for the poor, improved access to economic opportunities and services, and improved mobility services (quicker, safer, and more comfortable). A just transition needs to ensure that decarbonisation is undertaken in a way that contributes to such changes. In the case of transport, this includes a reduced need for motorised transport services through improved urban design, improving access, and reducing transport costs for poor and vulnerable people.

The NEV investment plan focuses on the automotive industrial sector, with respect to a just transition (preserving and potentially growing the automotive sector's contribution to the economy and mitigating some of the negative

92 NBI-BCG, forthcoming, Just Transition and Climate Pathways Study for South Africa: Decarbonising South Africa's Transport Sector.

transition impacts on the liquid fuel sector, including alleviating any job losses). There are also other parts of transport decarbonisation that are relevant in a just transition (Table 18) and should be considered for investments targeting transport decarbonisation.

Table 18. Just transition considerations relevant to transport decarbonisation

Sector / subsector	Just Transition Considerations
Electricity sector	Increased electric vehicle adoption will stimulate the growth of the electricity sector, potentially supporting higher numbers of jobs and other economic benefits. EV charging-related investments in the grid could enable greater energy access and security. At a point where dual flow or vehicle-to-grid (V2G)[93] becomes a reality, EVs will enable greater deployment of variable renewable power in the system. The EV-charging infrastructure, linked to off-grid or microgrid systems, will also add utility to these systems and provide additional mobility options to remote communities.
Liquid fuel sector	A just transition to NEVs is embedded in the just transition of the country's petrochemicals sector. NEVs will reduce the demand for liquid fuels. While the decrease in petrol / diesel consumption will lead to a reduction in government revenue, this will be compensated by a decrease in the imports of crude, petrol, and diesel (in the short term). However, the closure of refineries will lead to an increase in the imports of kerosene / jet fuel and other hydrocarbon products.[94] Jobs and economic activity associated with the downstream value chain (wholesale and retail) will be most at risk. Ports and import facilities will need to be modified / upgraded to handle a changed liquid fuel import product mix and increased volumes. Local production of GH_2, along with lower- and zero-carbon fuels, could mitigate negative EV-related impacts on the liquid fuel value chain.
Mining and materials sector	Fuel-cell electric vehicles (FCEVs) and the development of a green hydrogen economy will increase the demand for Platinum Group Metals (PGMs), but BEVs will reduce the demand for PGMs used in auto catalysts in ICEs (which account for 39% of the global platinum demand). BEVs, the expansion of the electricity system, and the green hydrogen economy will increase the demand for energy transition minerals, such as copper, cobalt, manganese, and lithium. South Africa will benefit from an increase in the demand for manganese and other precursor minerals; as such, it may need to import certain minerals, which are available in the region. Projects are underway to produce higher-purity minerals. The electricity system expansion and the local GH_2-related production will significantly increase the demand for iron and steel, cement, and construction services.
Health sector	Improved air quality will lead to a reduction in health expenditure and an increase in labour productivity.
Other sectors and passengers	Lower transport costs will benefit energy-intensive sectors and increase the disposable income of all South Africans, but these aspects will benefit the wealthy more, unless coupled with efforts to broaden access and ensure a just transition. To avoid a regressive impact, there needs to be a focus on swaying entry-level buyers (upper-middle-income households) to purchase EVs, instead of ICE vehicles, and on electrifying public transport to extend the benefits of e-mobility to low-income and lower middle-income households. Enhancing the competitiveness of freight rail will have positive knock-on impacts on inland prices and export competitiveness, while increasing the demand for cement and steel, with positive short-term impacts on the construction sector.

[93] V2G allows electric vehicle batteries to discharge power back into the grid when needed, making the batteries an energy storage resource in addition to a mobility device.

[94] Anthony Dane, Dave Wright, and Gaylor Montmasson-Clair, 2019, Exploring the Policy Impacts of a Transition to Electric Vehicles in South Africa. https://www.tips.org.za/research-archive/sustainable-growth/green-economy/item/download/1736_f8c5c661120534142e46b3fec6d5a810.

4.3.3 THE VALUE PROPOSITION FOR SOUTH AFRICA'S TRANSITION TO NEVS

4.3.3.1 ECONOMIC GROWTH AND INVESTMENT

The automotive sector is a significant source of foreign earnings, contributing to the balance of payments for the economy. Aligning domestic and export market transitions will enable greater investment, reskilling of workers, and economic growth. This aligns well with governments phased approach for transitioning the automotive sector and creating jobs. The economic benefits will also be a product of tradeoffs between a considerable loss of fuel and road-related taxes and a stable inflationary environment due to the decoupling from oil prices.

A transition to NEVs will further support the reduction of USD-denominated fuel imports, which is in line with government policy, as road users switch to ZAR-based wind and solar electrical energy. The impact on jobs is indeterminate in the context of the fuel sector, whilst there are fears of jobs losses, the responsibility must be shared by the private sector and government. Private sector fuel companies from developed nations must contribute significantly to the just transitions of developing countries as an appropriate mitigation plan for the liquid fuels transition. This can include supporting skills development and investing in energy delivery products and services, for example, charging devices and investing in biofuels or synthetic fuels refineries.

4.3.3.2 JUST TRANSITION

Sustaining the economic benefits and jobs associated with the automotive manufacturing sector is a priority. In 2020, the automotive industry had an estimated 186,536 direct jobs, 118,837 indirect jobs, and 203,583 induced jobs, thereby contributing to a total of 508,957 jobs to South Africa's economy.[95] The impact of the NEV transition on automotive manufacturing, associated supply chains, and socioeconomic metrics such as jobs, skills, and income has been researched by various parties. Industry and government are preparing for the introduction of NEVs, with global OEMs evaluating investment support available from both traditional and new automotive manufacturing countries. Early commitments by global OEMs for the local production and assembly of NEVs are critical to ensuring the retention of key automotive export markets and critical jobs in the sector. The impact of the NEV transition on the petroleum industry supply chain (import facilities, refineries, transportation, wholesale, retail, and related suppliers) is uncertain, but plans being devised for just transition mitigation measures need to be developed.

[95] Source: Industrial Development Corporation (IDC)

4.3.3.3 DECARBONISATION

Even if using the current carbon-intensive Eskom electricity for charging, the NEV efficiency gains and inherently lower carbon footprint will significantly contribute to decarbonising the transport sector. As such, the outlined transition targets in the JET IP are forecasted to achieve a reduction consistent with the lower range of the NDC targets.

The adoption of NEVs will support South Africa's ambitions and those of its largest trading partners (UK and Europe), which have set targets of banning ICE vehicles by 2030 and 2035, respectively, and protect South Africa's current motor vehicle exports to these markets. Regionally, the ability of South Africa to produce NEVs and export to the rest of Africa will support the decarbonisation plans of many African countries.

4.3.3.4 GREEN / SUSTAINABLE MANUFACTURING

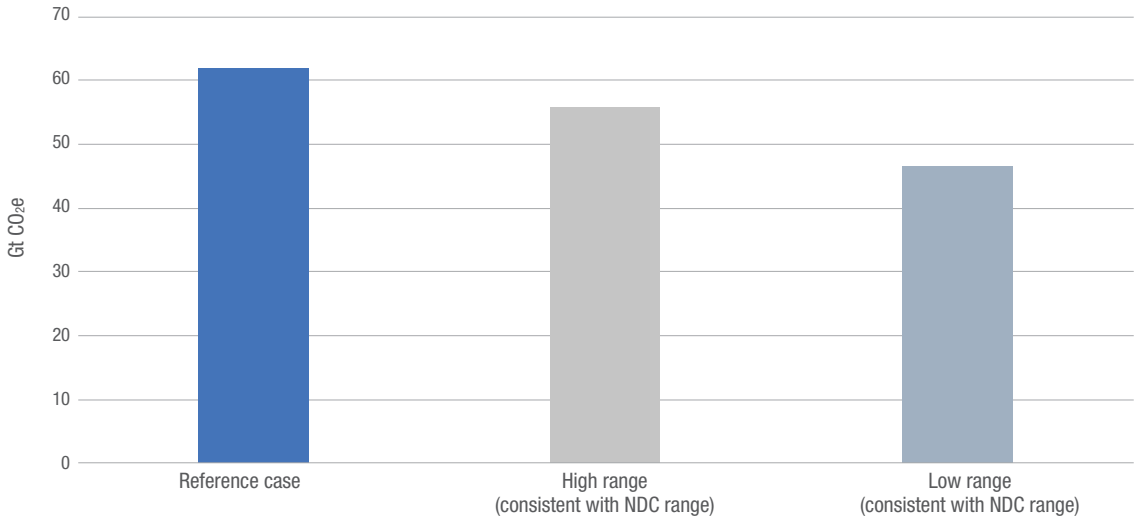
NEVs (and the associated value chain comprising the component manufacturing, extraction, and beneficiation of the battery minerals value chains) will be an integral part of the broader green economy, thereby impacting local investment in technology and skills innovation.

Special Economic Zones (SEZs) can be used as anchors or hubs and present high implementable value propositions for tying together the strings for sustainable manufacturing.

The carbon intensity of batteries will require the sustainable management of the battery value chain and potentially see the regional production of batteries for mobility and stationary applications. However, given the high cost of the investment required, significant grant and concessionary funds will be required for South Africa to participate in the battery value chain.

To meet road transport emissions reductions consistent with South Africa's NDC (Figure 7), a high-level approximation was modelled of how an NEV deployment in the different segments of transportation could contribute, as shown in Table 19. Additional mitigation options, notably demand-side measures and modal shifts, will also play a part in meeting the transport component of the NDC.

Figure 7. Road transport's GHG emissions consistent with South Africa's NDC by 2030



The NDC does not specify a target for the transport sector. The above range provides a reference point which is representative of transport decarbonisation pathways consistent with the NDC range; it is based on the modelling that determined a range of least-cost scenarios for decarbonisation across the economy. As such, it is contingent on measures being implemented in other sectors of the economy.

4.3.4 NEV PENETRATION POTENTIAL

While policy and regulatory measures for unlocking the NEV penetration continue to receive attention by the South African government, the NEV sector investment approach for the JET IP has considered short-term catalytic interventions for the next three to five years as well as medium-term trends to 2030. The approach considered what level of domestic NEV penetration is possible within the segments included in this analysis. Modelling was conducted to assess the GHG implications and investment requirements associated with the following scenarios:

- **Scenario 1:** price parity[96] in 2027 – this could be achieved through various measures, depending on the segment, including tariff reforms, lower costs of capital, incentives, and subsidies, amongst others.
- **Scenario 2:** delayed transition – this could occur due to policies and existing barriers stifling the market's ability to deploy NEVs.
- **Scenario 3:** ambitious local vehicle deployment associated with the planned local manufacturing – this assesses the possible extent to which the current NEV project and investment pipeline translate into a local deployment of NEVs, excluding exported vehicles (See Table 19 and Table 20).
- **Scenario 4:** conservative local vehicle deployment is associated with the planned local manufacturing (see Table 19 and Table 20).
- **Scenario 5:** one million NEVs are on South Africa's roads by 2030 – this is informed by research and expert opinion suggesting that this would be an ambitious, but feasible, penetration level.

This top-down approach serves to evaluate the potential of NEVs for decarbonising transport within the short term and the requirements (see Table 19), but also to sense check and understand the contribution of the bottom-up plan for producing vehicles for the export and the local markets. The bottom-up approach identifies existing and potential projects, using market and available information, as presented in Table 19. Thirdly, the figures are aligned with the investment themes identified and the NEV segments likely to have the most material impact are presented in Table 17.

The investment plan is focused on the local automotive value chain production as a key requirement of a just transition. It will contribute to achieving South Africa's NDC and net-zero ambitions, as well as provide further support that will be needed to achieve the levels of decarbonisation associated with Scenario 1.

[96] The capital cost premium on NEVs, relative to ICE, is one key factor limiting the uptake of NEVs. While not the only factor, the model used this lever to explore the potential of fast-tracking deployment and assessing the GHG emissions implications, as well as the "funding" that would be required to cover this premium.

The plan is in line with the NEV Roadmap of the Department of Trade, Industry and Competition (DTIC) that includes the following phases:

- **Phase 1:** Focus on the assembly of NEVs primarily for export, while preparing for local sales; and finalise the NEV components for local manufacture and pilot projects.
- **Phase 2:** Growing the domestic consumption market by expanding the local NEV component manufacturing sector. This will help facilitate the shift to full electrification.
- **Phase 3:** Focus primarily on the domestic market for NEVs, especially BEVs and fuel-cell technologies.

The JET IP is aligned with DTIC's NEV roadmap and provides a holistic support package for the industry (mainstream and infant). The phased approach by government will create an enabling environment for NEV production and address resource mobilisation, focusing on at-risk exports.

The current policy tools may be augmented, subject to budgetary constraints and additional proposed tax incentives.

To accelerate this plan, and fast track deployment of locally produced NEVs in the South African market, the country needs additional support.

The scenarios assume NEV penetration based on either fast-tracking purchase price parity through measures such as vehicle subsidies (Scenario 1), assuming a range of locally produced vehicle deployment on South Africa's roads (Scenarios 3 and 4) or exogenously assuming a total of 1 million NEVs on the roads by 2030 (Scenario 5). The GHG emission pathways for the road sub-sector are shown in Figure 8 and the abatement impacts and investment requirements per NEV penetration scenario are shown in Table 19.

All scenarios are potentially consistent with the upper and lower bounds of the NDC target, recognising that technology shifts (to NEVs) represent one of several measures to reduce road transport emissions, and that the NDC does not have sector-specific targets. On their own, Scenarios 1 and 5 can potentially achieve the high range consistent with the NDC target (55.7 $GtCO_2e$) but not with the low range (46.4 $GtCO_2e$). This highlights that other long-term measures (notably demand-side measures and modal shifts) need to be implemented, in conjunction with measures to increase NEV deployment.

Figure 8. GHG emission pathways for the road transport subsector, per scenario

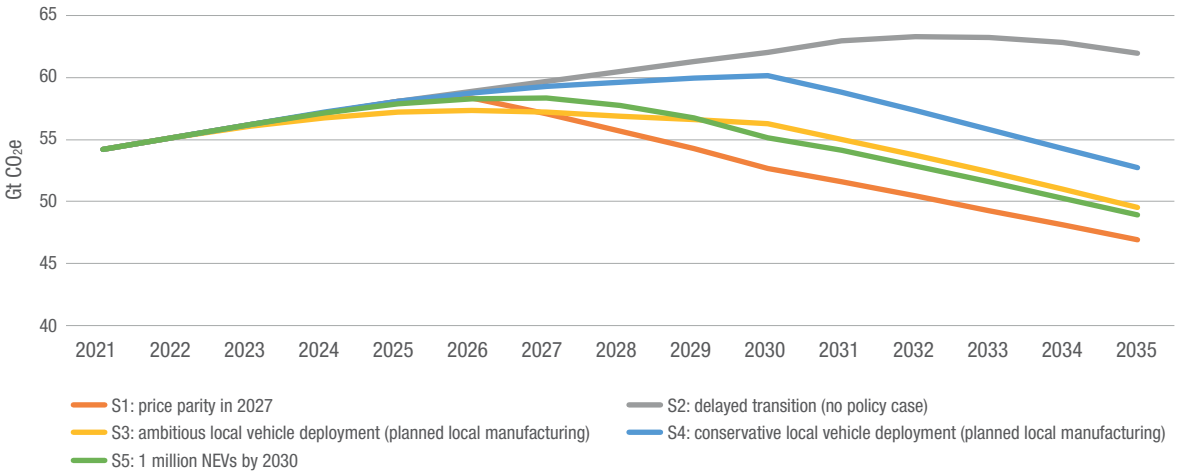


Table 19. GHG impacts and investment requirements per NEV penetration scenario

Scenarios*	$GtCO_2e$ (road)		Abatement ($GtCO_2e$)**		Number of NEVs ('000)		Investment required ZAR million
	2030	2035	2030	2035	2030	2035	2030
S1: price parity in 2027	52.68	46.91	9.36	15.08	1 790	4 534	70 369
S3: ambitious local vehicle deployment (planned local manufacturing)	56.25	49.54	5.79	12.45	1 474	4 195	78 715
S4: conservative local vehicle deployment (planned local manufacturing)	60.19	52.72	1.85	9.27	161	2 958	0 180
S5: 1 million NEVs by 2030****	55.16	48.90	6.88	13.09	1 003	3 833	41 199

* This includes scenarios exploring the NEV penetration relative to the delayed transition (Scenario 2).

** relative to the delayed transition scenario (no policy case).

*** This includes marginal costs on the vehicles (the NEV purchase price premium relative to ICE vehicles per year up to 2030 multiplied by the number of NEV sales per year) and the charging infrastructure costs for the given NEV penetration (this includes the cost of private chargers, per segment, and 30% of the cost associated with deploying the necessary number of public charging stations. 30% is what the industry suggests is needed to fast-track investments and ensure adequate coverage including in areas where public charging stations are not likely to be profitable. The remaining investment will be made by the private sector in response to the market).

**** This pathway is synonymous with achieving NEV purchase price parity in 2030.

Scenario 1 is associated with 26% of all vehicle sales up to 2030 (63% of sales in 2030) (see Table 19 and Annexure D) requiring a total investment of ZAR74.2 billion over the period to fast-track purchase price parity and ensure adequate coverage charging infrastructure including public charging (DC and AC) aligned with global benchmarks of 1 station per 20 BEVs on the road. This is comparable to the TIPS estimates that the annual cost of purchase price subsidies will need to

reach ZAR12.4 billion to reach 20% of new private passenger sales by 2030. They further estimate that the complete transition of the MBT sector to BEVs will require a subsidy of about ZAR21.2 billion (time period not provided).[97]

Policies and measures still need to be developed. Options include tariff and incentive reforms, ICE sales bans, passenger transport incentives (for example, subsidies, adjustments to the Taxi Recapitalisation Programme, conditional bus operator subsidies and licences, and public procurement programmes), and project development vouchers (CAPEX vouchers for major implementations per category). and various other measures to be explored, in parallel, to reduce the upfront capital cost of NEVs and address other barriers.

Public policies should not discriminate between technologies, which all have a role to play. Moreover, a trial-and-error approach, leveraging pilots as well as phased mechanisms, would be sensible in the short term. This would enable government and relevant stakeholders to tailor support packages in line with market responses as well as address any drawbacks or shortcomings.[98] These packages should be considered, together with supporting measures, in related sectors, notably electricity, automotive, and liquid fuels. Importantly, the rollout of NEVs needs to be done in tandem with an investment in adequate infrastructure (electricity grid and/or hydrogen network). In all cases, strong partnerships are needed, as well an iterative approach, to ensure appropriateness within the South African context.

NBI-BCG suggests that the total cost of ownership (TCO) price parity could be achieved as early as 2023 for private passenger cars, 2025 for MBTs, and 2023 for LCVs, with the removal of import tariffs on BEVs. But the uptake will not be a function of price alone. The limited experience in deploying NEVs in the country and the uncertainties regarding the market uptake of NEVs need to be considered. Adequate charging infrastructure will be important in addressing some of these uncertainties. While public charging infrastructure can be rolled out by private developers where there is a profit to be made, investment is needed for unprofitable charging networks to ensure adequate coverage, including poorer areas. Fast-tracking these investments to address range anxiety, for example, requires funding to incentivise investments ahead of market requirements. The estimates of the total investment required for the public charging infrastructure by 2050 range from ZAR100–184 billion. These estimates exclude some of the 'soft costs' such as the need for grid connection advisors, which will likely increase as the easy-to-implement sites (on private land) get exhausted and the more complicated installations on public land are needed.

97 TIPS, 2022, "Towards an Inclusive Rollout of Electric Vehicles in South Africa," Policy Brief 3/2022.

98 Gaylor Montmasson-Clair, Anthony Dane, and Lesego Moshikaro, 2020, Harnessing Electric Vehicles for Industrial Development in South Africa. TIPS Research Report for Department of Trade, Industry and Competition and the National Association of Automobile Manufacturers of South Africa, Pretoria: TIPS.

4.3.5 REQUIRED NEV SECTOR INVESTMENTS

Table 20 shows a snapshot of NEV projects and investments targeted over the next three to five years, based on market intelligence and local project initiatives.

Based on the above analysis, a summarised investment proposal has been developed for the JET IP's support of the growth of South Africa's NEV sector. The planned investments are in the following focus areas:

- **Just Manufacturing Transition:** Supply chain investments to support the retention and growth of jobs for the automotive sector, as it transitions to NEV. Such jobs include assembly and component supply chain jobs in existing and new products. This segment also has strong linkages to the energy sector for localising energy storage inputs, such as batteries and fuel cells.
- **Public Transport (Public Buses and Taxis):** This is an area where both the national government and local (city) governments could advance procurement and incentives. It includes the private fleets providing passenger services to local government (for example, Golden Arrow and Putco); and MBTs that are a large component of the transport sector and the largest private transport sector in South Africa, serving lower-income households.
- **Mobility emissions abatement:** This area addresses the decarbonisation of the NEV market segments for goods and services logistics, private transport, and government fleets.
- **Early Adoption and Innovation:** Supporting investments in early adoption projects for NEV and developing local supply chain and innovation ecosystem may also entail collaborations and partnerships with international research institutions and sharing intellectual property and patents.
- **Charging and renewable infrastructure:** Amongst others, this area is seen as cutting across all the funding programmes.
- **Technical assistance:** Considering the integrated nature of pivoting the automotive sector where projects are not standalone or greenfield developments, a robust sector transition framework is needed. It should incorporate accurate studies to guide policy transformation and implementation to ensure just and sustainable outcomes.

A vibrant vehicle manufacturing sector is critical to a sustainable South African economy and jobs but depends on an integrated domestic and export demand pivot to NEVs. Without investment stimulus, domestic demand will lag significantly behind export demand to the detriment of an integrated manufacturing sector. Therefore, early domestic NEV demand is critical to both sustaining a vibrant vehicle manufacturing industry and achieving emissions reduction targets.

The retention of jobs in the current vehicle value chain and the retraining / upskilling of labour for the new NEV production lines will be vital to enabling a just transition. A just transition within the context of a sustainable automotive and transport sector must preserve current levels of economic activity by transitioning to NEV production and growing such new capacity to, at the minimum, offset those activities facing technical obsolescence and job losses. Enhancing local content and manufacturing, research and development, mineral beneficiation (new energy minerals), and local business development offers further growth opportunities for South Africa.

The just manufacturing transition is based on a few credible assumptions, as set out below:

(i) The industry typically invests close to ZAR11.5 billion per annum,[99] and for NEVs, the investment is anticipated to be significantly higher (more than 40%). As such, it would need grant support of up to 50% of the capital investment.

(ii) It can be assumed that each OEM will have at least 1 NEV in production within the next 5 years, given that most OEMs export to the USA, UK, and EU markets.

(iii) The emphasis on green manufacturing for NEVs will add another layer of investment that will require grants and concessionary finance support. For example, Ford has invested in renewable infrastructure, with other OEMs expected to follow suit.

(iv) South Africa's fiscal constraints will limit and strain the current Automotive Investment Scheme (AIS) policy tool that will be required to support the transport decarbonisation transition.

(v) Newer OEMs have indicated that they will produce NEVs in South Africa for both the local and export markets.

Table 20. Proposed JET IP NEV investment programmes, 2023–2027

Funding Programmes	Description	ZAR billion
Industrial development and innovation	Supply chain investments for the NEV value chain, including existing automotive component supply chain and the energy storage value chain for both mobility and stationary applications	41.4
Public Transport	Support investments in public transport such as buses, taxis, and fleets; Funding the charging infrastructure and energy storage (including associated infrastructure); Supply chain investments in the local assembly	6.1
Mobility emissions abatement	Decarbonising the NEV market segments for goods and services logistics, private transport, and government fleets; Charging infrastructure and energy storage (including associated infrastructure)	6.8
Early adoption and Innovation	Supporting investments in early adoption projects for NEV and the development of a local supply chain and innovation ecosystem – the support will also include the sharing of intellectual property, patents, and technology partnerships between IPG and South African institutions, innovators, and entrepreneurs; Charging infrastructure and energy storage (including associated infrastructure)	1.8
Technical assistance	Sector research and planning to accurately assess integration and interdependencies; market opportunities and timing; detailed socioeconomic and techno-economic studies to support investment planning, just transition planning, reskilling programmes; and R&D support	1.6
NEV deployment support	Funding to reduce the NEV purchase price (to fast-track price parity to 2027) and the private cost of charging infrastructure, and to facilitate the fast-tracking of the public charging infrastructure deployment (scenario 1).**	70.4
TOTAL		**128.1**

* Associated infrastructure includes structural investments for public transport hubs, security related Investments, electrical distribution investments at a municipal and town level; the funding pool at an instrument level will consist of guarantees, grants, concessionary funding, risk capital, government incentives, tax rebates and credits, and the reduction of or zero-rating of import tariffs, as appropriate;

\# Infrastructure is defined as investments that provide an enabling environment for the adoption of NEVs. It can range from infrastructure for research and innovation, business support, and decarbonisation to electricity infrastructure and critical inputs for the NEV transition such as components and battery cell component manufacturing and assembly. The battery cell manufacturing has been split equally amongst manufacturing, decarbonising, and innovation programmes.

** The full investment requirement for public charging infrastructure by 2050 is likely to exceed ZAR184 billion. This does not include investments in grid capacity and any local electricity generation capacity.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4.4 GREEN HYDROGEN SECTOR

4.4.1 INTRODUCTION

The green hydrogen (GH_2) economy presents new opportunities for South Africa. It can enable the transition of key carbon-based and international trade-exposed sectors, protect the competitiveness of downstream industries, allow and enhance exports, boost GDP, support domestic decarbonisation, and create jobs. Internationally, GH_2 and its derivatives are increasingly seen as an important part of the solution to addressing GHG emissions in hard-to-abate sectors, including the transport industry, petrochemical industry, iron and steel industry, cement industry, and in the longer term, the power sectors. According to the International Energy Agency (IEA), for the world to limit global warming to below 1.5°C, GH_2 will need to account for 10–20% of the global energy mix.

It is evident from the recent exponential increase in electrolyser sales and project investments that commercialisation of this industry is well under way. However, there is still a need for significant investment in technology commercialisation, supporting infrastructure, and supply chain development to build competitive business cases and scale up. GH_2 production costs will need to be progressively decreased to become competitive with the cost of grey hydrogen. To decrease these costs, additional cheap renewable electricity is required. It is thus important that South Africa develops a supporting policy and an investment framework to allow for the rapid installation of renewable electricity capacity for GH_2.

To reach climate targets in line with the Paris Agreement, these investments must be initiated at speed. GH_2 is critical to decarbonising the economy, with the potential to remove 10–15% of South Africa's carbon emissions, while protecting and growing major downstream industrial sectors such as chemicals, cement, iron, and steel. The foundation to scale the GH_2 economy must, therefore, be established in South Africa by 2030 for GH_2 to become a globally competitive industry that supports the world's decarbonisation efforts and establishes new global energy trade routes.

Failure to develop the GH_2 sector carries significant social and economic risks associated with the global market in these value chains. The high carbon intensity of synthetic fuels (12% of national emissions) creates carbon border tax adjustment (CBAM) risks for the chemicals sector, where 90% of emissions from the petrochemicals and chemicals sector are caused by Sasol's Secunda and Sasolburg operations.[100] As in coal and power, the transition could have severe economic consequences, if not managed well, given the petrochemicals contribution to the country's GDP and employment. In 2019, the petrochemicals sector contributed approximately ZAR232 billion

[100] NBI, 2022, Decarbonizing South Africa's Petrochemicals and Chemicals Sector.

(6.22%) to GDP and accounted for approximately 169 000 direct and 693 000 indirect jobs, with a quarter of the direct jobs linked to Sasol (~28 000), AECI (~8 000) and Omnia (~3 500).[101] Furthermore, Secunda is a key element in the coal value chain. With proposed reductions of 9 Mt by 2030, there will be significant mining-related impacts. Other domestic sectors also rely on the development of GH_2 to support their transition and protect or grow exports, including iron and steel and potential green iron ore[102] exports. GH_2, therefore, offers a means to maintain existing competitive advantages in decarbonised sectors, while providing new export potential. There is a clear role for concessional finance to enable South Africa's industry to transition without job losses that would otherwise be caused by CBAM, while also contributing to energy supply security in end-markets.

Promoting a GH_2 export industry, including the platinum group metals (PGMs), electrolyser and fuel cells components, green iron ore and steel, and derivatives such as green ammonia and sustainable aviation fuels, can increase GDP by 3.7% by 2050, translating to an increase in absolute GDP of almost ZAR400 billion.[103] Furthermore, GH_2 has important economy-wide linkages that can create new decent jobs. This includes higher renewable energy rollout and associated manufacturing; the manufacturing of electrolysers for domestic use and exports; growth and maintenance in the mining of PMGs; jobs in transport, storage, and distribution of products; along with the operation, maintenance, and servicing of equipment. In scenarios with GH_2 exports and associated industries, up to 1.8 million more jobs could be created economy-wide by 2050 than in scenarios without GH_2 exports and use.[104] Thus, GH_2 and its derivatives have a key role in South Africa's just transition. It is estimated that 6–10 Mt per annum (Mtpa) of demand for local production could be in play by 2050, creating a market worth more than US$20 billion. This has the potential to create more than 650 000 job years in construction and more than 50 000 permanent jobs in operations and maintenance.[105]

In building the infrastructure necessary to capture this opportunity, the investment required is estimated to be in the region of US$133 billion to fund more than 100 GW of dedicated renewable electricity capacity (both wind and solar) and more than 60 GW of electrolyser capacity.[106] This allocation of new renewable electricity capacity will need to be either included in the updated IRP or as part of an associated energy plan for GH_2.

100 NBI, 2022, Decarbonizing South Africa's Petrochemicals and Chemicals Sector.
101 NBI, 2022, Fadiel Ahjum, Catrina Godinho, Jesse Burton, Bryce McCall, and Andrew Marquard, 2020, A Low-Carbon Transport Future for South Africa: Technical, Economic and Policy Considerations.
102 Hilton Trollip, Bryce McCall, and Chris Bataille, 2021, "How Green Primary Iron Production in South Africa Could Help Global Decarbonization," Climate Policy 22 (2): 236–47, doi.org/10.1080/14693062.2021.2024123.
103 NBI, 2022, Just Energy Transition Pathways.
104 World Bank, forthcoming, South Africa Energy Background Report.
105 DTIC, 2022, Green Hydrogen Commercialisation Strategy.
106 Ibid.

4.4.2 SOUTH AFRICA'S GH_2 VALUE PROPOSITION

South Africa has key structural competitive advantages in the production of GH_2 and its derivatives, including:

- High-quality, large-scale renewable energy potential, with its combination of wind and solar capacity factors being amongst the best in the world. This puts South Africa on par with countries such as Chile, Saudi Arabia, and Australia, which are also investing in the GH_2 opportunity.
- South Africa's central global geographical location enables exports to both Europe in the west and Japanese, South Korean, and other markets in the east.
- Sufficient land that is not in competition with agriculture or residential uses to meet this scale of renewables. In the renewable energy development zones alone, there is enough land to produce approximately 10 Mt of GH_2, with approximately 1.1 million hectares (MHa) required being about 20% of the Regional Economic Development Zones (REDZ) total land availability.
- The production of GH_2 also has synergies with water security, as desalination plants are only a fraction of the cost of the final product (less than US$0,01/kg of H_2 produced). Therefore, there is potential to overbuild desalination plants, allowing for the provision of fresh water to water-insecure communities. This also ensures that GH_2 does not compete with water security and the need for water in other sectors of the economy.
- South Africa has unique expertise in the beneficiation of GH_2 into e-fuels. The proprietary Fischer-Tropsch technology, used in Sasol's Coal-To-Liquids (CTL) facilities at Secunda, is a key asset and knowledge base for the sector's development. It creates the possibility for the local beneficiation of GH_2 into derivative CTLs, including e-Ammonia, e-Methanol, and sustainable aviation fuel. This is critical for power-to-liquid applications and can serve as a catalyst for large-scale local demand. It also helps to unlock export potential as export markets are expected to be driven by the trade of GH_2 derivatives.

These structural competitive advantages will be combined in a unique way to address South Africa's export market potential, stimulate domestic demand via the decarbonisation of local hard-to-abate sectors, and localise equipment manufacturing and mobility applications.

4.4.3 DEMAND DRIVE AND MARKET FOCUS

South Africa's GH_2 demand is made up of a range of local and export use cases that could anchor the demand for GH_2 production. This includes ammonia production, methanol production, use in refineries, green steel production, mobility applications such as heavy-duty road transport, rail, shipping, aviation, heat generation, and ultimately power generation. Ammonia and e-methanol production will be prioritised for the export market. Converting from grey hydrogen to GH_2 use in

refineries can also be leveraged as a quick win in the decarbonisation of the petrochemical sector and the production of sustainable aviation fuel. This transition from grey to GH_2 will be enabled by the development of the GH_2 certification.

By 2030, local demand is still expected to be limited, with approximately 0.2 Mtpa driven by sustainable aviation fuels, vehicle mobility, and green steel. Domestic demand will accelerate as price parity gets closer to fossil fuels. Co-located production projects (in the mining sector and green steel) will have accelerated commercial value due to lower infrastructure and supply chain dependencies, and hence lower costs. Domestic potential is estimated at 2–3 Mtpa by 2040, with the upside being as high as 6 Mtpa. This includes hydrogen demand in the Hydrogen Valley programme, which could reach up to 185 kt GH_2 by 2030.

Export market demand can be exploited by taking advantage of pricing subsidies, for example, the H_2 Global scheme. South Africa will have to secure a long-term global market share and competitive trade positions against competition from other exporters to anchor initial production and the supply infrastructure. Export potential is estimated at 2 Mtpa by 2040, with upside as high as 8 Mtpa in the longer term. If supply can scale in line with forecasts, export demand could reach up to approximately 0.7 Mtpa by as early as 2030. South Africa, together with other sub-Saharan countries, will need to advocate for guaranteed offtake volumes to take advantage of the diversity of the import requirements of REPowerEU, which may be further accelerated by dynamics in Europe that are driving demand for GH_2. The ambitions of REPowerEU are aimed at EU importing 10 Mtpa of GH_2 by 2030.

4.4.4 NATIONAL COORDINATION AND INFRASTRUCTURE PLANNING

For South Africa to realise its competitive advantage and successfully capture a share of the global export market, a local GH_2 ecosystem needs to be incubated. This requires significant investment into production and skills development, along with a complex and coordinated system of supporting infrastructure.

Broadly, three supply options can be considered in building the GH_2 industry, with tradeoffs amongst capacity factors, land availability, efficiency, cost, and supporting infrastructure. The first option is the co-location of the electrolyser (GH_2 production), the demand for GH_2, and renewable electricity generation at the same site. The second option is to locate the electrolyser and renewable electricity generation at the same site, but not at the same site as the GH_2 demand, which would require a pipeline to transport the hydrogen to where it is needed. The third option is to locate the electrolyser at the site where there is demand for GH_2, but wheel the renewable electricity over the transmission / distribution grid from a renewable electricity plant located elsewhere. This option should not compete with the electrical grid infrastructure for electricity generation. The optimal configuration across South Africa requires a coordinated infrastructure approach to build long-term national competitive advantage and accommodate forward-looking integrated infrastructure access, while also ensuring the provision of the required additional grid infrastructure.

These tradeoffs can have a significant impact on the cost and subsequent competitiveness of the GH_2 produced. To maximise competitiveness, South Africa needs to develop an optimal ecosystem of supply-demand hubs and

supporting infrastructure, including ports, storage, pipelines, grid infrastructure, and SEZs. This will require a nationally coordinated and collaborative approach between the private sector and government.

Getting this coordinated approach right will also unlock a large-scale infrastructure development programme, involving more than 100 GW of renewable electricity capacity and approximately 60 GW of electrolyser capacity over the next 30 years. Being able to build the required infrastructure development capacity and capabilities will be foundational to enabling the speed needed to capture the GH_2 opportunity and ensure the competitive localisation of value chains.

4.4.5 RECENT GREEN HYDROGEN INITIATIVES

Work is underway in South Africa to realise the ambition of the country becoming a global GH_2 major. The initiatives include:

- The Department of Science and Innovation (DSI) has developed a Hydrogen Society Roadmap and is launching a study to determine the critical skills needed for GH_2 industrialisation.
- The DTIC established a GH_2 Panel and commissioned a GH_2 commercialisation study aiming to take recommendations to Cabinet in 2022.
- Infrastructure South Africa (ISA) has recognised GH_2 as a priority opportunity for industrialisation and earmarked a new port at Boegoebaai as a potential strategic infrastructure project to enable exports from the Northern Cape in the longer term.
- South Africa and Germany have formed a bilateral relationship in recognition of South Africa's GH_2 potential. In its effort to source GH_2 and support South Africa's development, the German government, through KfW (Credit Institute for Reconstruction) and GIZ (German Agency for International Cooperation), is providing co-funding to selected GH_2 projects in South Africa in the form of grants, technical assistance, project development funds, and concessionary debt.
- South Africa's private sector has been swift to act on the GH_2 opportunity, with both local and multi-national players conducting feasibility studies and developing pilots. Anglo American has introduced the world's largest GH_2-powered truck in their Mogalakwena mine.
- There are a further 18 projects in development, with a total estimated feasibility cost of ZAR4.5 billion and ZAR163 billion required for capital expenditure.[107] This excludes the Boegoebaai port project – a potentially large-scale export programme with expected development costs of ZAR1 billion and a full run rate cost of ZAR150 billion over the project lifecycle; and excludes upgrades that may be required at the Ports of Ngqura, Saldhana Bay, and Richards Bay. These projects span a range of use cases and require significant capital deployment for the early incubation of South Africa's GH_2 ecosystem.

[107] IDC (2022).

4.4.6 CHALLENGES

The challenges associated with development of this new GH_2 industry include scaling up in time to address market needs, ensuring that regulations and policies are globally aligned, dealing with social risks, and sourcing the quantum and types of finance required for catalytic projects. These challenges necessitate national coordination, cross-sectoral collaboration, and international alliances to address the following factors:

- **Coordinated planning of supply-demand hubs.** This development of a national GH_2 infra-structure must be informed by both quantitative and qualitative modelling to identify the optimal supply locations to fulfil expected demand. A coordinated infrastructure development plan (for shared infrastructure such as pipelines, grid, ports, and rail) will have a significant impact on delivered costs and optimal utilisation of shared infrastructure assets. In addition to quantitative fundamentals, the analysis should consider co-location opportunities, scalability, existing infrastructure, and access to critical feedstocks such as water and sustainable sources of carbon. This would inform a comprehensive infrastructure and supply chain scaling plan. The development of such an infrastructure plan does not preclude or inhibit the development of 'no regret' pilot projects already underway. Coordinated planning and alignment need to take place at an intergovernmental level.
- **Access to innovative, low-cost green financing solutions.** South Africa's high cost of debt can inhibit the commercial viability and global competitiveness of the GH_2 projects, which have inherently high upfront capital costs and low-return expectations in the short run. Coordination among the public and private sectors and the international community will be required to develop catalytic blended finance instruments to unlock private sector funding. Mechanisms, such as contracts for difference or price subsidies (to bridge the affordability gap) and grant funding (to de-risk early-stage pilots), need to be sourced.
- **Establishment of a globally aligned policy and regulatory framework.** Well-defined targets and incentives can help create the policy certainty required for private sector investments. This can be complemented by developing internationally compatible 'guarantee of origin' schemes and clarifying 'green' requirements. Advocacy is important to ensure that key offtake markets have the policy support of the South African environment and the just transition. This can go further through securing offtake and technology-sharing agreements under bilateral arrangements with South Africa's key trading partners.
- **Building sustainable and long-term competitive advantage through skills development and localisation.** South Africa needs to ensure that it has the capabilities and capacity to deliver the GH_2 economy by implementing training programmes from grassroots level throughout the workforce. Public and private efforts will need to be aligned with scale interventions in upskilling and reskilling for both new job market entrants and existing employees. Localisation can be used to identify opportunities across the GH_2 value chain. These include building capabilities for low-cost and reliable access to renewable energy, harnessing engineering expertise in beneficiation processes, mobilising South Africa's PGM resources in the GH_2 technology value chains, and employing green industrialisation as a differentiator for industrial growth.
- **GH_2 pricing.** By 2030, the levelised cost of GH_2 across hubs is expected to be approximately US$4 per kg GH_2, which is still more expensive than grey hydrogen – at a green premium of US$2–2.5 per kg. Although learning curve projections support a reduction in the key price drivers (renewable electricity costs and electrolysers

costs), until this materialises, government support, grants, and concessionary funding will be needed to address the price premium and the cost of capital.

4.4.7 REQUIRED INVESTMENT IN GH_2 SECTOR DEVELOPMENT

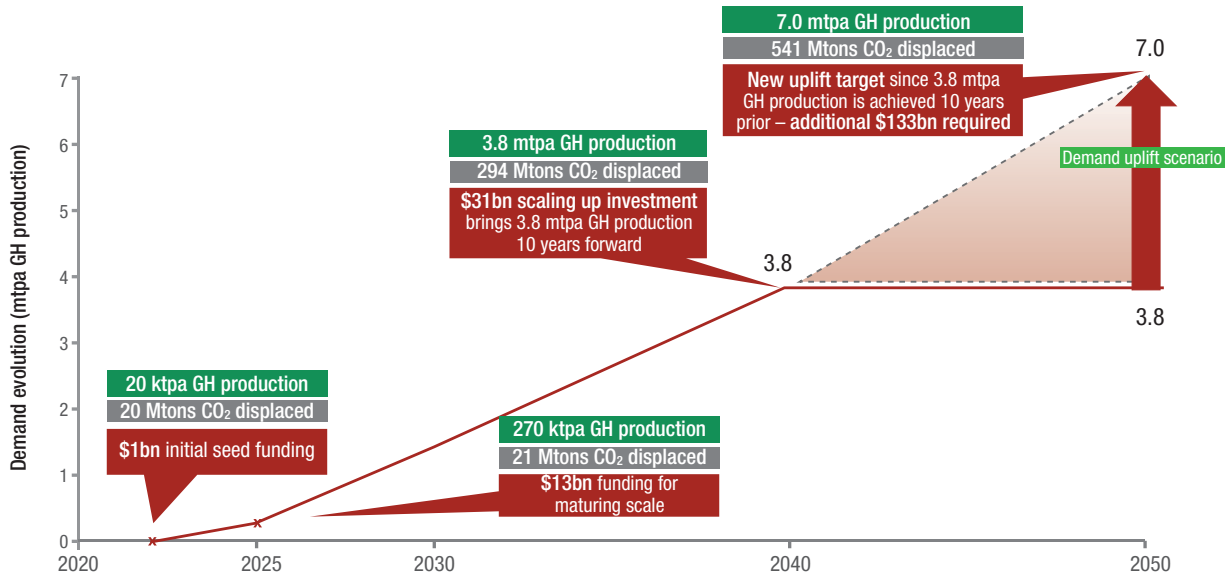
For the 2023–2027 period, investments are needed for the following areas:

- Financing for feasibility studies on catalytic projects and pilots along the GH_2 value chain that can serve as proof-of-concept. These have been identified in the GH_2 commercialisation action plan and include the production of GH_2 and derivatives for both export and domestic consumption, green steel production, and mobility programmes.
- Establishment of localised capacity for local electrolyser and fuel cell manufacturing facilities, noting the global supply bottleneck for these components and South Africa's PGM expertise. A feasibility study is underway to establish a local fuel-cell manufacturing facility, and a factory is being constructed to manufacture fuel-cell and electrolyser components. Projects need to be developed to establish local gigawatt-scale electrolyser capacity to enable a longer-term advantage for South Africa.
- Enablement of bi-lateral relationships with key off-take markets to align supportive policies and regulatory conditions, establish offtake agreements, and promote technology sharing.
- Establishment of off-take agreements and commitment towards specific off-take targets from projects.
- Financial support for implementation of the GH_2 national commercialisation action plan and infrastructure planning including:
  - Identification of the optimal supply-demand hub structure and related infrastructure planning; and
  - Alignment between local stakeholders and communication with international stakeholders on South Africa's GH_2 potential.
- Support for the research and skills development to enable GH_2 economy growth including:
  - Technical and vocational education and training (TVET) colleges on fuel-cell training;
  - Technical training programmes on key skills across the H_2 value chain; and
  - Incentivising of the private sector to reskill employees and invest in research and development for local capacity.
- Public awareness and engagement:
  - Raising public awareness of the new GH_2 industry; and
  - Addressing any concerns related to safety, job losses, and the just transition.

- Implementation of the South African Renewable Energy Master Plan (SAREM), updating of the Integrated Energy Plan (IEP), the Integrated Resource Plan (IRP), and energy planning for GH_2, which will entail a scale-up of renewable electricity generation at unprecedented speed with aligned capability building.

The planned scaling up of the investment required is shown in Figure 9. The Green Hydrogen Panel estimates that US$1 billion investment could expedite GH_2 exports of 20 Ktpa. Within three to five years, several GH_2 projects – both for export and local markets – will come online, increasing the GH_2 scale to 270 Ktpa, requiring capital of US$13 billion displacing 21 Mt of CO_2. The target of 3.8 Mtpa by 2040 will require a total investment of US$164 billion by 2040. Between 2040 and 2050, South Africa can aggressively pursue deeper decarbonisation by seeking a GH_2 demand uplift to 7 Mtpa, which will displace 541 Mt CO_2 and require an additional investment of US$133 billion. The emissions, calculated from the investment date to the end of the decade (assuming three years of development and seven years of operations), could result in annual emissions reductions of between 18% and 20% of South Africa's annual carbon emissions. The summary of the GH_2 investments required is shown in Table 21.

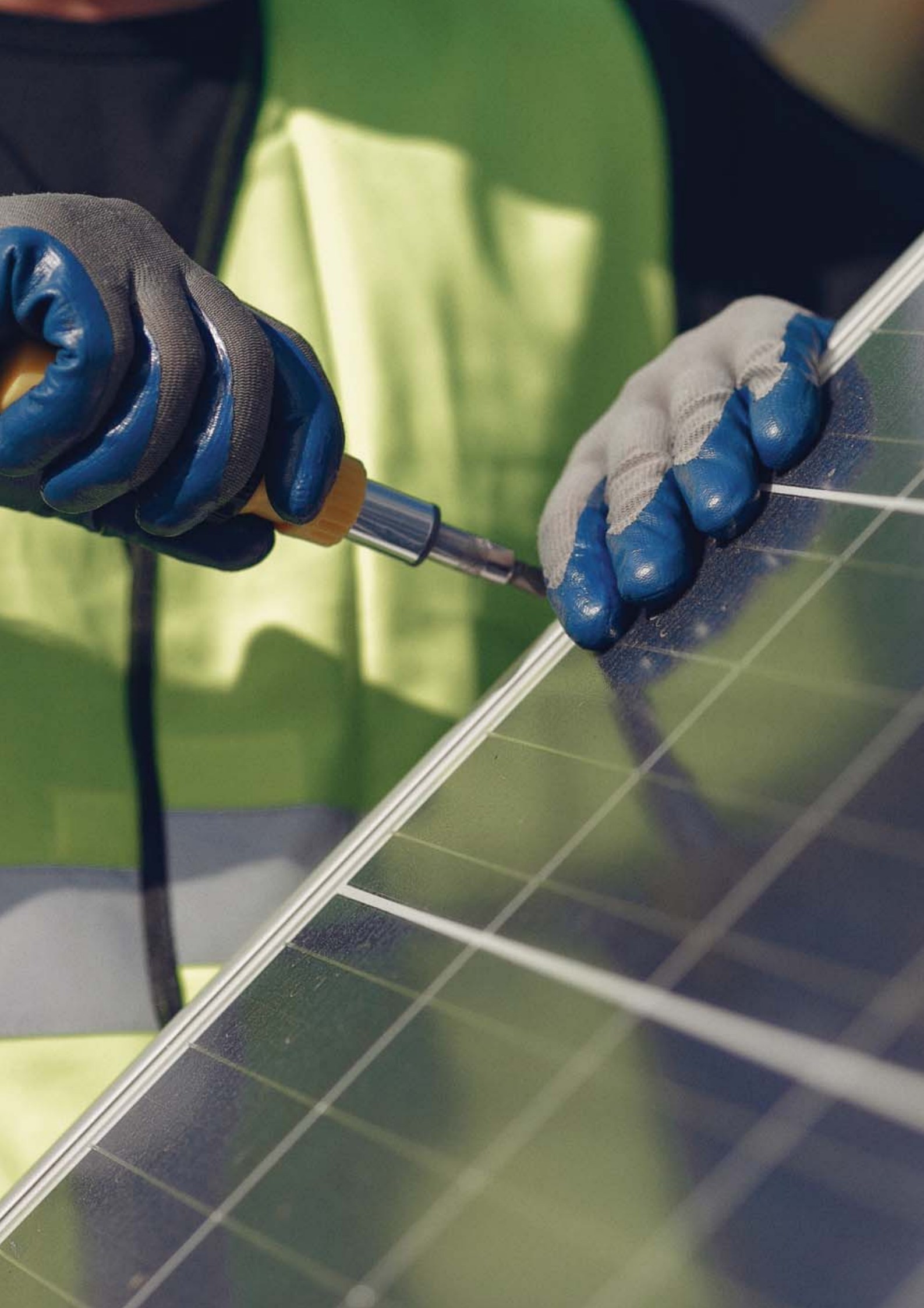
Figure 9. GH_2 investments scaling up



Source: *Green Hydrogen Panel, 2022, Green Hydrogen Commercialisation Strategy, May 2022.*

Table 21. Green hydrogen sector – Summary of JET IP investments

Investment needs 2023-2027	Description	ZAR billion
Early-stage project development: 18 private sector projects in development.	**Project Feasibility costs**	
	Aviation Fuel	0.10
	e-methanol	0.12
	Fuel Cell	0.16
	GH and Green Ammonia	3.70
	Green Steel	0.20
	Hydrogen Mobility	0.10
	Infrastructure	0.13
	Total	**4.51**
	Capital costs (for above projects)	
	Aviation Fuel	8.00
	e-methanol	12.00
	Fuel Cell	1.40
	GH and Green Ammonia	109.30
	Green Steel	13.20
	Hydrogen Mobility	6.60
	Infrastructure	13.00
	Total	**163.50**
Port Development	Port project development	1
	Port infrastructure capital	150
TOTAL		**319.01**



4.5 SKILLS FOR A JUST ENERGY TRANSITION

4.5.1 CONTEXT

The Framework for a Just Transition in South Africa[108] indicates that to align economic, social, and mitigation, and adaptation measures, it must be translated into an implementation plan with detailed employment and skills strategies. Four dimensions of skills development are identified, all of which are crucial to justice within the energy transition:

- **Reskilling and upskilling:** This area is focused on existing adult workers so that they are better equipped to navigate the transition. It involves a skills analysis to identify demand, setting up substantive short- and longer-term training programmes, the recognition of prior learning, the promotion of just energy transition labour market policies, the creation of new job opportunities, especially with lower levels of foundational skills, digital innovation, and more.
- **Aligning the skills development system with the anticipated labour force needs of the future:** This area is focused on green jobs to support a just transition. It involves sophisticated anticipatory skills development and labour market intelligence to respond to demand, as well as strengthening skills system innovations across the JET value chains and its associated ecosystem. This does not refer to a narrow band of technical skills only. It also requires in-depth engagement and collaboration with industry, the provision of bursaries, the upskilling of trainers and lecturers, and a flexible approach to skills development from both demand and supply perspectives. A number of initiatives are currently being piloted through the Presidential Youth Employment Initiative and its Demand-Led Skills Programme which is in early-stage roll-out.
- **Ensuring foundational skills throughout the education system:** This area is required to improve the adaptative capacity of the broader workforce. It involves curriculum transformation and teacher capacity development in the schooling and post-schooling systems (especially TVET educators' competencies), the restructuring of employer-provider relations, along with the expansion and diversification of learning pathways.
- **Addressing gender, inequality, and social exclusion:** This is required in both the provision of education and training opportunities as well as access to employment. Particular attention will be given to transitioning women, youth, and other vulnerable groups from education and training into decent work, including equal access to promotions to management and leadership roles.

Importantly, skills development for the JET is a key enabling factor and should be given impetus by mechanisms that can successfully and proactively bridge the skills system, its planning and

[108] PCC (Presidential Climate Commission), 2022.

implementation mechanisms, and the JET sectors, which include electricity, NEVs, and GH_2. It is important to start identifying the skills required and build a skills development roadmap, as it can take between five and 10 years to 'ready' the skills system for new value chains and competences. This means that the skills system needs to be preparing ahead of the energy transitions and technological developments. Lecturers need to be trained, curricula need to be developed and tested, and work placements need to be set up.

Due to the cross-cutting nature of skills interventions needed for JET, it will be challenging to establish strong coordination and planning mechanisms. The complexity is exacerbated by the need to unpack skills in extended and connected value chains, including the coal value chain,[109] renewable energy value chains,[110] the GH_2 value chain,[111] the value chains associated with vehicles,[112] and interlinked value chains such as platinum mining and manufacture.[113]

Skills identification, anticipation, planning, and implementation for JET requires both national level strategic support and local level alignment with emerging priorities and opportunities. Furthermore, enabling structures to support the smoother articulation between skills development and their use to access and create employment and livelihood opportunities is a priority.

The White Paper on Post-School Education and Training,[114] which has informed several skills strategies and plans in South Africa sets the vision for greater integration within the post-schooling sector (universities, TVET Colleges, Community Colleges, Sector Education and Training Authorities [SETAs), the National Skills Fund [NSF), amongst others) to support accessible quality education and enable sustainable livelihoods.

The intersection of complex extended value chains and the need to work across the education and training ecosystem requires that many departments within government and many stakeholders in civil society, business, and labour will need to work together to plan and implement a just transition, along with the cultivation of the skills needed. Key relevant departments within government include the Department of Higher Education and Training (DHET), the SETAs, DSI, DTIC, and DFFE – all of whom have made commitments to developing skills for sustainable development and the future of work.

109 Neva Makgetla and Muhammed Patel, 2021, The Coal Value Chain in South Africa, TIPS.
110 Naima Rassool et al., forthcoming, Assessment of Local Skills for the South African Renewable Energy Value Chain. Green Cape.
111 DSI, 2021, Hydrogen Society Roadmap for South Africa 2021.
112 Gaylor Montmasson-Clair, Anthony Dane, and Lesego Moshikaro, 2020, Harnessing Electric Vehicles for Industrial Development in South Africa, TIPS and Change Pathways.
113 DTIC, 2020, The South African Steel and Metal Fabrication Master Plan 1.0: Support for the Steel Value Chain.
114 DHET, 2013, White Paper on Post-School Education and Training.