GREEN HYDROGEN
SOUTH AFRICA

POLICY PAPER

Green Hydrogen Competitive Market

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POLICY PAPER

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ACRONYMS

BCG	Boston Consulting Group
CO_2	Carbon Dioxide
DBSA	Development Bank of Southern Africa
DFI	Development Finance Institution
DTIC	Department of Trade, Industry and Competition
EU	European Union
EUR	Euro
FT	Fischer-Tropsch
GH	Green Hydrogen
GH_2	Green Hydrogen
GHCS	Green Hydrogen Commercialisation Strategy
H_2	Hydrogen
IDC	Industrial Development Corporation
IEP	Integrated Energy Plan
JET	Just Energy Transition
JETP	Just Energy Transition Partnership
KfW	Kreditanstalt für Wiederaufbau
MDB	Multilateral Development Banks
MoU	Memorandum of Understanding
NBI	National Business Initiative
PtX	Power to X
REC	Renewable Energy Certificate
RED	Renewable Energy Directive
RFI	Request for Information
SAH2	South Africa Hydrogen
TDP	Transmission Development Plan
UK	United Kingdom of Great Britain and Northern Ireland
USD	United States Dollar
zaRECs	South African Renewable Energy Certificates

1. Executive Summary

This briefing note comments on South Africa's progress in establishing a competitive green hydrogen market and provides recommendations for further supporting market development. South Africa is in a unique position to develop its green hydrogen sector, given a suite of comparative advantages, including world class solar and wind resources, large-scale land availability, significant platinum group metal stocks, historical experience in the industrial-scale Fischer-Tropsch (FT) process, as well as existing port and other logistics infrastructure.

Over the past two years, a series of new funding mechanisms, including the SAH2 Fund and the Just Energy Transition Partnership (JETP), have been pledged by developed nations to support the growth of South Africa's green hydrogen market. The country has seen increasing interest by European Union (EU) partners to develop green hydrogen trade relationships, representing potential export opportunities to trade partners that are in a position to pay a green premium for products. Sasol's current production and consumption of significant levels of grey hydrogen presents a unique and strategic existing domestic source of demand which presents the opportunity to build up a domestic supply portfolio, involving numerous new market entrants.

However, numerous policy, regulatory, and financing barriers remain to the scaling of both the export and domestic markets, which will need to be addressed in order to harness South Africa's green hydrogen opportunity. Creating markets is not a new challenge in the global developmental agenda. This note identifies clear policy direction, supportive regulatory frameworks, and financial incentives as critical success factors for market development.

Within this context, the briefing note outlines:

- Current green hydrogen market conditions in South Africa.
- International examples of conducive policy frameworks and financing mechanisms.
- Key market challenges in South Africa and the potential means of addressing these challenges, including:
  - Developing a green hydrogen white paper
  - Supporting critical network industry reforms and development
  - Aligning transmission and distribution grid planning and deployment with green hydrogen ambitions

  - Utilising development funding effectively to create financial incentives across the green hydrogen value chain, including in project preparation, financing, and operations phases
  - Developing clear certification and regulatory standards for green hydrogen.
- The importance of supporting existing domestic industries to transition as a means to stimulate the domestic green hydrogen market is highlighted, including through reducing the cost premium of green hydrogen relative to grey derivatives.

2. South Africa's current green hydrogen market context

This section provides a high-level overview of the current green hydrogen landscape in South Africa, including key policy and market developments since the compilation of the comprehensive report, *Analysis and recommendations for improving the regulatory framework and strategic planning basis in South Africa in the context of a favourable policy for green hydrogen / PtX production, application and export,* for the Infrastructure Investment Office of the Presidency in 2021.

South Africa's Green Hydrogen Commercialisation Strategy (GHCS) has since been approved by government in 2023. The GHCS builds on South Africa's Hydrogen Society Roadmap and represents South Africa's latest and most developed policy-relevant document. The GHCS proposes the following noteworthy strategic recommendations for growing South Africa's green hydrogen market, including:

- *To prioritise exports during the early stages of market development,* with the objective of securing South Africa as a preferred provider to global markets, specifically the EU/UK. The strategy proposes that South Africa should target 2–7 million tonnes per annum (Mtpa) of green hydrogen-related exports but does not provide indicative timelines within which this scale should be achieved.
- *To urgently establish clarity in the regulatory environment* for green hydrogen market players, including developing relevant 'green' certification standards and codes based on international best practice, and making clear the role of the state in supporting the green hydrogen market, for example, through streamlining approval and permitting processes within government departments.
- *To take a 'Hydrogen Hub' approach.* Building on South Africa's Hydrogen Society Roadmap[1] and Hydrogen Valley Feasibility Report[2], the strategy identifies a series of green hydrogen 'hubs', based on potential for a high concentration of future hydrogen demand, access to low-cost renewable energy production sites, and potential contribution to a just transition (i.e., an economic development plan that brings positive social impact, particularly to more vulnerable communities; Figure 1)[3]. The strategy suggests that domestic demand could grow to 2–3 Mtpa but provides no industry targets or timelines.

1 https://www.dst.gov.za/index.php/resource-center/strategies-and-reports/3574-hydrogen-society-roadmap-for-south-africa-2021

2 https://www.dst.gov.za/index.php/resource-center/strategies-and-reports/3508-hydrogen-valley-feasibility-study-report-october-2021

3 *Whilst coastal 'hubs' will be geared towards production of green hydrogen and derivatives for exports, the Vaal Triangle hub (orange and green dots in Figure 1, inland) will be driven by domestic industries which utilise grey hydrogen switching to green hydrogen as feedstock, including Sasol's Secunda and Sasolburg activities relating to petrochemicals and synfuels production.*

- *To continue securing international funding commitments* for grants, concessional finance and export credit programmes to lower the cost of developing green hydrogen projects and crowd in other forms of capital.
- *To harness available finance and pricing mechanisms* that can reduce the cost premium associated with green hydrogen relative to grey alternatives, such as the H2Global contract-for-difference auction mechanism.

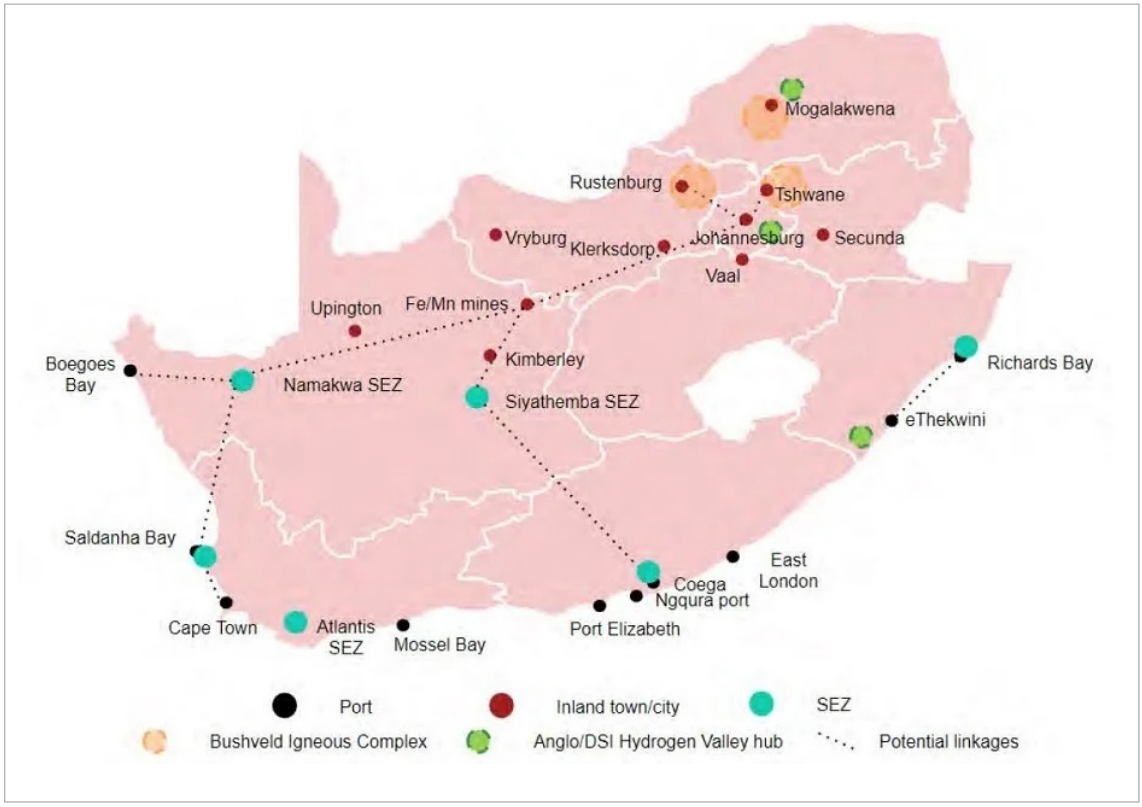

Figure 1: Geographic Location of Potential Green Hydrogen Hubs (Source: dtic, 2022)

A set of 19 green hydrogen projects[4] have thus far been identified and gazetted as strategic infrastructure projects in line with the Infrastructure Development Act, meaning that they have been recognised as projects of 'significant importance' and that their implementation will be prioritised through streamlining permitting and approval processes. Thus far, a core set of nine projects at 'early business case' or 'intermediate business case' level have been registered and issued their Strategic Infrastructure Project letters. In general, most projects require further feasibility analysis and development, as well as additional support in securing off-take agreements in order to become bankable. Due to the nascent nature of the industry and high price of green hydrogen production relative to grey alternatives, concessional finance is a critical component for getting projects over the line.

4 https://www.gov.za/speeches/minister-patricia-de-lille-gazettes-infrastructure-projects-significant-importance-country

Developed country governments have pledged funding support under the Just Energy Transition Partnership (JETP) and other blended finance initiatives:

- KfW Development Bank has pledged EUR 23 million in grant or concessional funding to support 11 South African green hydrogen projects identified through a request for information (RFI) process[5]. KfW will supply these funds in partnership with the Industrial Development Corporation (IDC) with whom it has signed a memorandum of understanding (MoU) to jointly support the development of the South African green hydrogen industry. It is worth noting that the KfW RFI process was made available to the market into somewhat of a green hydrogen 'policy vacuum' and was successful at stimulating the development of projects to bid into the RFI process. Unsurprisingly, many of these projects were in the very early stages of development and required additional feasibility analysis which could have been further supported with technical assistance funding.
- The UK, under its JETP commitment, is making grant funding available to South Africa for technical assistance for project development[6], which will be welcome given the early-stage nature of many green hydrogen projects within the industry.
- The SAH2 fund has been launched which will aim to secure USD 1 billion of blended finance from private and public financial institutions, domestically and internationally, to accelerate the 'development and construction of large-scale green hydrogen infrastructure assets'[7]. Partners include the Dutch government through Invest International, Climate Fund Managers, Sanlam, DBSA, and IDC. The quantum of the funding from each partner, as well as the form (grant, debt, or equity) has yet to be determined[8].
- The SA-German Hydrogen Task Force has been established to support knowledge and information exchange, bilateral contracts between South African producers and German off-takers of green hydrogen derivatives, and 'assisting grey hydrogen producers in their transition from grey to green hydrogen' which has particular significance for South Africa's carbon intensive industrial economy and Sasol as a large existing producer and consumer of grey hydrogen. This task force also proposes investigating funding mechanisms to support the market ramp up of green hydrogen and PtX value chains, for example through 'region-specific' H2Global tenders for sub-Saharan Africa[9].

Climate risk is steadily growing in the South African economy, presenting substantial threats to the operations of major industrial emitters. Large emitters, including refineries, chemical and fertiliser production facilities, iron and steel manufacturers,

5 https://www.news24.com/fin24/climate_future/energy/sas-new-green-hydrogen-projects-get-funding-from-germany-20221128

6 https://www.news24.com/fin24/climate_future/solutions/uk-to-back-sas-green-hydrogen-plans-with-grant-funding-20221122

7 https://www.dbsa.org/press-releases/unveiling-sa-h2-fund-south-africas-dedicated-green-hydrogen-fund

8 https://climatefundmanagers.com/2023/06/20/unveiling-the-sa-h2-fund-south-africas-dedicated-green-hydrogen-fund/

9 https://www.gov.za/speeches/minister-electricity-dr-kgosientsho-ramokgopa-signs-joint-declaration-intent-german

and cement producers face enormous pressure to decarbonise their operations. This is primarily driven by the need to reduce their exposure to the adverse financial impact of carbon pricing mechanisms, including South Africa's own carbon tax and the carbon border adjustment measures implemented by the EU and other international entities. The escalating urgency to reduce carbon emissions has significantly increased the demand for green power, as well as green feedstocks and fuels such as green hydrogen.

Box 1: Sasol is an example of an industrial player with the need to transition from grey to green

Sasol, responsible for a large portion of South Africa's overall emissions, is an example of an industrial player that will need green hydrogen to play a key role in its decarbonisation journey. Sasol's latest climate strategy signals ambition to transition its operations from grey to green, however, implementing this ambition will likely pose a significant challenge. Utilising 2.6Mtpa[10] of grey hydrogen per annum, which it derives predominantly from coal, Sasol is the largest producer and consumer of grey hydrogen in South Africa (and indeed globally). It is no wonder that Sasol is the second largest corporate emitter in South Africa after Eskom (South Africa's coal-power utility) and hosts one of the largest point sources of CO_2 in the world at its Secunda Coal-to-Liquids plant[11]. As a result, Sasol faces enormous pressure to decarbonise and reduce its exposure to carbon pricing mechanisms in order to secure the sustainability of its business. The corporate will find it increasingly difficult to access financing for business-as-usual coal-based operations. Sasol's systemic importance and integration into the fabric of South Africa's economy means that there would be significant fiscal ramifications if its business were to become stranded. Therefore, efforts to support Sasol's transition from grey to green production is of paramount importance from a macroeconomic perspective[12].

Given Sasol's existing FT expertise, infrastructure and assets, and interlinkages into the broader chemicals and transport value chains, the corporate has been identified as an important strategic player in South Africa's green hydrogen market, with its own transition having potential to spearhead decarbonisation efforts in other sectors. In its climate change communications[13], Sasol has committed to both medium- and longer-term decarbonisation targets. In the medium-term, the company aims to reduce its Scope 1 and 2 emissions by 30% by 2030 from its 2017 baseline. From 2030 onwards, it plans to accelerate options for substituting its current fossil-based feedstock with a combination of green hydrogen and sustainable carbon to transform its product slate to green products, enabling it to reach a target of net zero emissions by 2050. Sasol has indicated that it will have to rely on some form of public or concessional finance to make the capital investments required for this transition.

10 *Based on expert engagements and https://meridianeconomics.co.za/our-publications/transitioning-secunda-sasolburg-and-south-africas-petrochemical-value-chain/*

11 *https://www.iisd.org/system/files/2020-10/subsidies-south-africa-coal-liquid-fuel.pdf*

12 *https://meridianeconomics.co.za/our-publications/transitioning-secunda-sasolburg-and-south-africas-petrochemical-value-chain/*

13 *https://www.sasol.com/sites/default/files/2022-08/Sasol%202022%20CDP%20Climate%20Change.pdf*

3. International context: policies, regulations, and financing

3.1 Success factors for a well-functioning green hydrogen market

Key success factors for creating a well-functioning green hydrogen market include[14],[15]:

- **Clear policy direction** with short-, medium- and long-term plans, and indication of key focus areas (domestic versus export markets), including supply and demand targets.
- **Clear and consistent regulatory frameworks** that define the standards, rules, and roles of different actors (state and private sector) in the green hydrogen market and value chain. These provide certainty to project developers and investors, whilst ensuring competitive behaviour and safeguarding regarding production, handling, and trade of green hydrogen.
- **Financial incentives,** including early-stage technical assistance funding, tax incentives, and pricing mechanisms that reduce the cost differential of green hydrogen versus grey alternatives. Concessional and blended climate finance is recognised as playing an integral role for scaling up financial incentives.

The following section provides some international context from a policy, regulatory, and financing perspective for Chile and Namibia, two of South Africa's comparators in the green hydrogen market.

3.2 Chile

Chile has recognised an opportunity to venture into the green hydrogen market, off the back of their maturing and successful renewable energy development. The Chilean government established a National Green Hydrogen Strategy in 2020 to enable increased hydrogen production which will primarily support the decarbonisation of the country's mining and commodity sectors, along with other carbon-reliant local supply chains[16]. The strategy aims to secure approximately 13% of the world's green hydrogen production, with the government already pledging USD 50 million in funding to support projects to advance hydrogen initiatives. Chile is also receiving support from multilateral development banks (MDBs), globally, in the form of loans and grants to

14 https://gh2.org/sites/default/files/2022-11/Development%20finance%20-%20green%20hydrogen%20priority%20actions%20-%20Nov%202022.pdf

15 https://gh2.org/sites/default/files/2023-04/GH2_Getting%20the%20Right%20Blend_2023_digital.pdf

16 https://energia.gob.cl/sites/default/files/national_green_hydrogen_strategy_-_chile.pdf

support feasibility studies and pilot projects on green hydrogen production and use[17]. The key objectives of the Chilean strategy will be to first replace imported ammonia for local production and grey hydrogen in oil refineries, as well as hydrogen use for local heavy and long-distance transportation. In the long-term, hydrogen production will scale-up production to establish export markets for use in marine and aviation transport. The national strategy also outlines divisions of responsibility as well as joint actions in relation to government and the private sector[18].

Chile does not have a specific legal framework for green hydrogen, however, this is currently being established. The Chilean government has identified several existing laws and standards that are potentially relevant to the green hydrogen industry and supply chain, and it is also planning to establish a green hydrogen certification scheme to ensure the quality and traceability of the product.

The World Bank recently approved a USD 150 million loan to the Chilean Production Development Corporation which will be used to crowd in additional private sector finance and establish a blended finance fund for green hydrogen projects and developing risk mitigation instruments[19].

3.3 Namibia

Namibia's Green Hydrogen Council introduced a strategy at COP27 to align with the Paris Agreement, aiming to achieve net-zero emissions by 2050. The strategy intends to make Namibia a net energy exporter, playing a vital role in regional energy security. It also emphasizes global outreach and hydrogen diplomacy to attract investors and partners[20]. Key aspects of the strategy include creating an industry development structure, enacting regulations through the Synthetic Fuels Act, launching pilot projects, establishing ownership models for infrastructure, implementing training programmes, and fostering local participation in the hydrogen economy.

The strategy has a target for hydrogen production of 10–12 million tonnes per annum equivalent by 2050. Namibia's Hyphen Hydrogen Energy ammonia pilot project is a significant project on a global scale targeting 5–7GW of renewable energy capacity and aiming for operations in 2026[21]. The overall investment in the project is projected at USD 9.4 billion, with the Namibian government considering a 24% equity stake.[22]

17 https://www.weforum.org/agenda/2023/01/how-chile-is-becoming-a-leader-in-renewable-energy/

18 https://energia.gob.cl/sites/default/files/national_green_hydrogen_strategy_-_chile.pdf

19 https://www.worldbank.org/en/news/press-release/2023/06/29/chile-to-accelerate-its-green-hydrogen-industry-with-world-bank-support#:~:text=Washington%20D.C.%2C%20June%2029%2C%202023,to%20carbon%20neutrality%20by%202050.

20 https://drop.sun.ac.za/files/2023/07/2023-06-29-A-Regulatory-Framework-for-Green-Hydrogen-Production-in-Namibia-Final-Soft-Copy-version.pdf

21 https://www.slrconsulting.com/public-documents/hyphen-project/

22 https://www.engineeringnews.co.za/article/namibia-agrees-to-take-up-24-stake-in-10bn-green-hydrogen-project-2023-06-21

Financial support, including EUR 40 million from the German government for pre-feasibility assistance, underscores international cooperation in Namibia's green hydrogen journey.

3.4 Insights for South Africa

South Africa can draw insights from countries like Chile and Namibia who have made significant inroads towards establishing their green hydrogen markets. Clear policy direction, well-defined industry targets, and clear division of responsibilities between public and private players are critical elements for establishing market certainty and therefore harnessing investment. Furthermore, a clear and coherent framework of legal and regulatory codes and standards (and how these interlink) with existing frameworks and codes must be established early on. South Africa must adopt a green hydrogen certification scheme soon to ensure product quality and traceability. Furthermore, harnessing development finance effectively will play a pivotal role in attracting further investment and mitigating financial risks. South Africa has a good track record of securing development finance assistance but must now ensure that it can effectively channel this funding in order to deliver projects—with the appropriate investors and partners—on the ground.

4. Addressing Key market challenges

There is currently a large gap between where the South African green hydrogen sector is now and a competitive, well-functioning green hydrogen market and value chain. Moving from the country's high level green hydrogen aspirations as announced in various political and other public fora to projects and activities on the ground will require multiple levels of policy and regulatory reform, targeted incentives, and investment risk mitigation. This section outlines key challenges to developing a competitive market and some initial recommendations for addressing these challenges, based on the findings of the report for Presidency.

4.1 Develop a green hydrogen white paper to send clear market signals

Building on the efforts of the Hydrogen Society Roadmap, South Africa's GHCS has been approved, providing an overarching framework for the development of a green hydrogen market. However, industry experts have commented that a gap in the strategy is a lack of clear policy targets for green hydrogen pricing and volumes in the short- and medium-term (e.g., 2030, 2040) which would serve as important market signals for project developers, investors, and broader players in the green hydrogen value chain.

As recommended in the Report for the Presidency, it would be prudent to develop a green hydrogen white paper setting out an indication of the relevant regulatory standards and certification scheme that green hydrogen activities will be subject to, directives around the role of public and private sectors across key elements of the green hydrogen value chain, and realistic pricing and volume targets over time based on views of current and forecast export-based and domestic demand. The white paper would best be produced under the ambit of the Department of Trade, Industry and Competition (dtic) as a follow-on from the GHCS.

Another critical recommendation would be to ensure that green hydrogen sector expansion plans are integrated into existing national energy and transmission policy and planning processes. In our view, the most appropriate way to integrate green hydrogen demand and supply targets is within the Integrated Energy Plan (IEP) process and the national Transmission Development Plan (TDP). This would require a revitalisation of the IEP development process which has been dormant for almost a decade, and an update of the TDP to reflect grid capacity expansion requirements to support South Africa's green hydrogen ambition (more on this below).

4.2 Support network industry reforms and development

Concern has also been expressed by experts around the implicit reliance in the GHCS on well-functioning network infrastructure (ports, rail, power grid, roads), much of which remains critically underinvested in South Africa. The strategy provides no clear way forward in terms of division of roles for government and state-owned entities (e.g., Transnet, Eskom) and the private sector in developing the requisite infrastructure required for green hydrogen market activities. These roles will need to be clarified and support bolstered for ongoing network infrastructure reforms underway, championed by Operation Vulindlela[23], which aims to promote efficient development and operation of network industries, including through private sector involvement.

In addition, a specific Network Industry Development Plan is likely required in order to corral focus around developing critical network infrastructure required for the rollout of renewable energy capacity to support energy security and green hydrogen ambitions, which harnesses the roles of both public and private sector players.

4.3 Align transmission and distribution grid planning and deployment with green hydrogen ambitions

South Africa's power grid infrastructure at transmission (high voltage) and distribution (low voltage) levels is heavily constrained. Urgent efforts are required in order to rollout new and upgrade existing grid infrastructure to enable the required generation capacity to come online to address severe power shortages. The current TDP does not yet account for South Africa's green hydrogen ambitions, which will of course require significant additional power generation capacity to be connected to the grid. The TDP will need to be updated to reflect a rapidly growing renewable energy pipeline commensurate with that required to enable South Africa to achieve its nationally determined contribution and support the development of a growing green hydrogen sector. Eskom, who has traditionally been responsible for financing transmission investments, is no longer in a position to do so due to its financial and operational woes. New transmission and collector grid construction and operation models will need to be developed that leverage private capital, such as independent transmission project models, in order to implement the scale of transmission infrastructure rollout required.

Eskom should, in consultation with relevant private and public stakeholders in the renewable energy and green hydrogen industry, model and develop a more ambitious JET-aligned TDP for South Africa. In this TDP, grid capacity should be aligned to the scale

23 https://www.stateofthenation.gov.za/operation-vulindlela

of renewable energy required to meet South Africa's power sector decarbonisation targets and attain the green hydrogen industry volume targets, which is much larger than the current TDP which was premised on the implementation of the country's latest Integrated Resource Plan (2019)[24]. Furthermore, transmission development models which include private sector participation should be further explored and elaborated.

4.4 Utilise development funding effectively to create financial incentives across the green hydrogen value chain

Funds have been pledged to South Africa by various developed country governments. A key question is how to best structure and blend these sources of funding across green hydrogen value chain activities in order to have the most impact in relation to stimulating a competitive and well-functioning market.

4.4.1 Project preparation

The South African green hydrogen market is still in its infancy, with most projects still in very early stages of feasibility. Many require further feasibility funding in order to become bankable. Technical assistance funding from development finance institutions (DFIs) will play an important role during the project preparation phase. Creating transparent and predictable rounds of technical assistance funding, potentially through an auction type mechanism, could be an important support mechanism for the nascent market. Green hydrogen related projects that meet certain milestones could bid into such an auction to access a portion of the funding for further feasibility and development, thereby reducing early-stage risks for investors in green hydrogen related projects. Projects that achieve success could perhaps be granted a success fee, incentivising the completion and implementation of projects.

4.4.2 Project financing

'First mover' risk is currently a significant hurdle in the South African market and projects reliant on concessional finance to become bankable. International and domestic DFIs can provide capital to projects through grants or concessional loans as outlined in the GHCS, however, they could also provide insurance policies and guarantees to either the project developers themselves or banks financing the projects to de-risk their development.

24 The Integrated Resource Plan is South Africa's key power sector policy document

4.4.3 Tax incentives

National Treasury may also play a role through establishing tax incentives for green hydrogen related equipment and infrastructure. Tax incentives can be a powerful mechanism to stimulate market behaviour. South Africa has instated tax incentives for renewable energy developers in the form of an accelerated tax depreciation allowance. This allows for an accelerated write off of 50%, 30%, and 20% in the first three years. Electrolyser and other infrastructure associated with green hydrogen project development could well benefit from a similar tax incentive. There could also be a case for removing taxes on imports for green hydrogen related equipment and components in the early stages of market development.

4.4.4 Recycling carbon revenues

South Africa's National Treasury introduced a carbon tax in June 2019 with the aim of reducing CO_2 emissions by putting a price on carbon. It applies to entities responsible for emissions exceeding certain specified thresholds, however, exemptions and offsets are available to ease the burden on industries that are particularly emissions-intensive. Earmarking carbon tax revenues for reinvesting in a fund for climate change mitigation projects, including green hydrogen, is a challenging task in the South African context, but would greatly facilitate the deployment of green hydrogen and Power-to-X (PtX) products within South Africa (with spillover effects to the export market). This cost-effective policy intervention would support the creation of a level playing field between fossil and GH_2/PtX products and towards mobilising domestic funding. The main stakeholders to lead this process are the National Treasury and the Ministry of Finance. The IDC may play a role in the administration of the fund. The carbon tax should be progressively increased to align with the net zero target by 2050 and with international carbon prices benchmarks.

4.5 Develop clear certification and regulatory standards

Work is currently underway by the South African Bureau of Standards Technical Committee 197 (SABS TC 197) to establish certification and regulatory standards for the green hydrogen sector, utilising the International Organisation for Standardisation (ISO) methodology. This work should be supported and harmonised with existing regulatory codes and standards that already regulate key components of the green hydrogen value chain and activities, including electricity, pipeline, ports, health and safety, and market competition legislation. Imposing any particular regulations around the pricing of green hydrogen products could result in severe regulatory and market risks for project developers, potentially stifling investment. Therefore, instead, we propose that efforts should be ramped up to bolster the competition authority to provide robust oversight

regarding the supply of green hydrogen products into the market, particularly in the event where there may be an emergence of monopoly suppliers.

Industry experts have expressed the need to expeditiously develop a clear set of project-specific standards, including technical specifications and commercial standards for green and grey products. Fortunately, there are international frameworks from which South Africa can build on, and existing partner relationships between South Africa and other countries (Germany for example) which enable dialogue around standardisation. An appropriate strategy for South Africa may be to align its certification standard with the Europe RED II directive, however, others should also be investigated.

A framework of standards should be developed as soon as is feasible by the SABS TC, through consultations with industry experts (domestic and international), legal experts, etc. An important aspect related to green hydrogen production is certifying the green origin of the power used to produce the hydrogen. A Working Group within the SABS TC 197 is currently developing a definition of what might be considered 'green' in the South African context, and how this might be validated. South Africa does have an existing basis for green electricity certification, South African Renewable Energy Certificates (zaRECs). This is a voluntary system with a set of standards, principles, and rules of operation to allow for the verification of renewable energy production and trade by market participants. It is based on the European Energy Certificate System. Each REC denotes the underlying generation source, location of generation, and year of generation. It is worth interrogating the SA RECs system and methodology for insights and value as part of the efforts by the SABS TC 197 to establish a formalised system for tracking green power wheeled through the interconnected grid system for electrolysis solutions in South Africa.

4.6 Focus on supporting existing domestic industries to transition to stimulate the domestic green hydrogen market

The GHCS rightfully emphasises the prioritisation of green hydrogen-related exports in the early stages of market development. However, the strategy also emphasises catalysing domestic demand, particularly in relation to enabling industries and sectors to meet their climate goals. Supporting the uptake of green hydrogen within existing industrial processes seems an appropriate starting point for the domestic market, enabling new entrants to target an 'existing' demand base (i.e., this includes high-emitting industries that are facing decarbonisation pressures and where transitioning to green hydrogen could be a feasible option for them).

The SA–German Hydrogen Task Force has recognised the importance of 'assisting grey hydrogen producers in their transition from grey to green hydrogen'[25], which we believe is an important step. It is important to fund greenfields projects, however, catalytic decarbonisation opportunities likely lie in transitioning South Africa's heavy industrial activities.

4.7 The role of financial mechanisms to support domestic green hydrogen uptake

A key barrier to existing domestic industries pivoting to green hydrogen is cost. Green hydrogen is still significantly more expensive than grey and even blue alternatives. However, the costs of green hydrogen are expected to decrease in future, driven by technological learning, economies of scale, and reduced market risk perception. Current price estimates for green hydrogen in South Africa range from $4–6/kg[26]. The National Business Initiative and Boston Consulting Group asserts that it is possible for South Africa to produce green hydrogen below $2/kg by 2030[27]. IHS (now S&P) asserts that it is possible to achieve prices significantly below $3/kg[28] by 2030 given current trends in electrolyser production pipelines, and below $2/kg by 2040. In contrast, the cost of grey hydrogen is roughly $1/kg. Mechanisms will be required in the short- to medium-term to close the price differential between green and grey hydrogen.

Contract for difference schemes may play a key role in supporting both South Africa's export and domestic market.

In relation to the export market, schemes such as H2Global of the German Government, which is targeted at offsetting the price difference between grey hydrogen and green hydrogen through a double auction mechanism, have large potential. The H2Global mechanism is aimed at producing its first deliverables by end-2024, providing pricing security for green hydrogen exporters as they support investment decisions through long-term purchase contracts (10 years), and whilst importers gain access to green hydrogen derivatives to support them to achieve their climate commitments.

In terms of the domestic market, it would be prudent to investigate additional innovative financial mechanisms and incentives that could be developed both in capital markets and the development finance space to support green hydrogen uptake and benefit domestic industry development. It is worth interrogating whether an existing pot of

25 https://www.engineeringnews.co.za/article/south-africa-germany-to-establish-a-task-force-to-drive-green-hydrogen-production-trade-2023-06-28

26 https://www.dst.gov.za/images/2021/Hydrogen_Valley_Feasibility_Study_Report_Final_Version.pdf

27 https://www.nbi.org.za/wp-content/uploads/2021/10/NBI-Chapter-2-Decarbonising-South-Africas-Petrochemicals-and-Chemicals-Sector.pdf

28 *An example value of $2.1/kg provided for an onshore wind project.* https://www.spglobal.com/commodityinsights/en/ci/research-analysis/green-hydrogen-will-boost-jobs-drive-lowcarbon-future.html

funds pledged by developed country governments (JETP, SA-H2, etc.) and funds from domestic financial institutions with a developmental mandate (DBSA, IDC, etc.) could be utilised to:

- Develop *domestic* contract-for-difference type mechanisms, similar to H2Global but in a local context, reducing the price differential of green and grey hydrogen for local offtake agreements.
- Establish a guarantee mechanism for green hydrogen projects to underwrite (and de-risk) offtake agreements with domestic industrial players that need to procure green hydrogen and derivatives (e.g., Sasol, Anglo American, Arcellor Mittal) in order to reduce project risk.
- Thinking more creatively, it is worth interrogating whether it is possible to use domestic green hydrogen production and utilisation activities within South Africa as a mechanism for international carbon offsets or under Article 6 arrangements, particularly in situations where it may make more economic sense to trade a carbon offset rather than transport the actual green hydrogen molecules internationally.

These financial mechanisms should be made available broadly to the market to encourage new entrants both on the demand and supply side. Consideration would need to be given as to whom would be the custodian of coordinating the provision of these mechanisms from the funds that are available and administering platforms for a broad spectrum of market players to access them. The dtic, entrusted with the stewardship of industrial policy in South Africa, may be well-suited to play such a role, along with other domestic financial institution partners.

Box 2: The scale of Sasol's transition has significant potential to stimulate the domestic green hydrogen market

Scaling up the domestic market requires a focus on SA's largest existing demand centre for hydrogen volumes (currently dominated by Sasol, specifically Secunda's CTL plant) and replacing this with green hydrogen over a credible, climate-aligned transition period. Other heavy industrial companies—for example refineries, chemical production plants, iron and steel plants, and cement producers—who are internationally linked and therefore need to adhere to international green standards (e.g., a net zero emissions target by a certain date) will also start playing a role in the domestic market. The replacement of fossil-based fuels with green hydrogen alternatives equates to direct, additional carbon emissions reductions. Furthermore, this will serve as a critical 'anchor' demand from which to build up a domestic supply portfolio.

The scale of the requirement of Sasol's transition cannot be understated, with estimates of 40GW+ of electrolysers and 80GW+ of renewable energy required to support the transition of Sasol's product slate, as well as significant amounts of sustainable carbon stocks[29]. This amounts to roughly 2GW of electrolysers and 4GW of renewable energy capacity per year, presenting a massive industrialisation opportunity at a national scale and potentially significant contribution to the JET. At the institutional level, it is reasonable to conclude that Sasol does not have the balance sheet capacity to expend the investments required for this scale of roll out and will therefore likely need to implement the necessary actions via a consortia of players and procure large amounts of green hydrogen and derivatives from many other market participants. This means that supporting Sasol's transition could unlock an enormous opportunity for new market entrants to supply green hydrogen to a secure domestic source.

In the short- and medium-term, where green hydrogen remains more costly than alternatives, this endeavour is likely to require the utilisation of concessional blended financing and other innovative climate financing schemes, and potentially provide guarantees for offtake agreements by Sasol in order to de-risk green hydrogen production projects supplying to corporate markets.

29 *Expert engagement: Mike Levington, Hyd-Re-Gen and https://meridianeconomics.co.za/our-publications/transitioning-secunda-sasolburg-and-south-africas-petrochemical-value-chain/*

5. Conclusion

In conclusion, South Africa stands at a critical juncture in its pursuit of establishing a competitive green hydrogen market. Leveraging its unique strengths, such as abundant renewable resources and established industrial capabilities, the country has the potential to become a global player in the green hydrogen sector. However, substantial challenges must be addressed to transform aspirations into tangible successes. This briefing note emphasises the need for clear policy direction, supportive regulatory frameworks, and targeted financial incentives to foster a well-functioning green hydrogen market.

Over the past two years, international commitments and funding mechanisms have emerged to bolster South Africa's green hydrogen endeavours. The country's strategic positioning for green hydrogen trade, especially with EU and UK partners, signals promising export opportunities. The potential transition of major players like Sasol from grey to green hydrogen signifies an important domestic market opportunity. Despite these encouraging prospects, several hurdles persist, including policy gaps, regulatory uncertainties, and infrastructure limitations. Thus, a multi-faceted approach is outlined in this note, encompassing key recommendations to address these challenges.

To achieve success, South Africa must integrate its green hydrogen ambitions into relevant energy sector planning processes, ramp up efforts to roll out transmission and other network infrastructure at scale, and optimise development finance and other funding sources to incentivise market growth. This note draws on the original report for the Presidency to underscore the significance of harmonised regulatory and certification standards, as well as mechanisms to bridge the cost gap between green and grey hydrogen, especially for domestic players. Furthermore, the importance of supporting Sasol's transition cannot be understated, highlighting the potential of coupling green hydrogen production with existing industrial demand. In navigating these complexities, South Africa has the opportunity to lay the foundation for a thriving green hydrogen market, contributing to its sustainable development goals and positioning itself as a leader in the global energy transition.

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