

# Proposed South African Green Hydrogen (GH<sub>2</sub>) Commercialisation Strategy and implications for equipment localisation

Summary of the Green Hydrogen Commercialisation Panel Report

Date: 06 June 2023

Presentation to Electrolyser & Hydrogen Fuel Cell Event



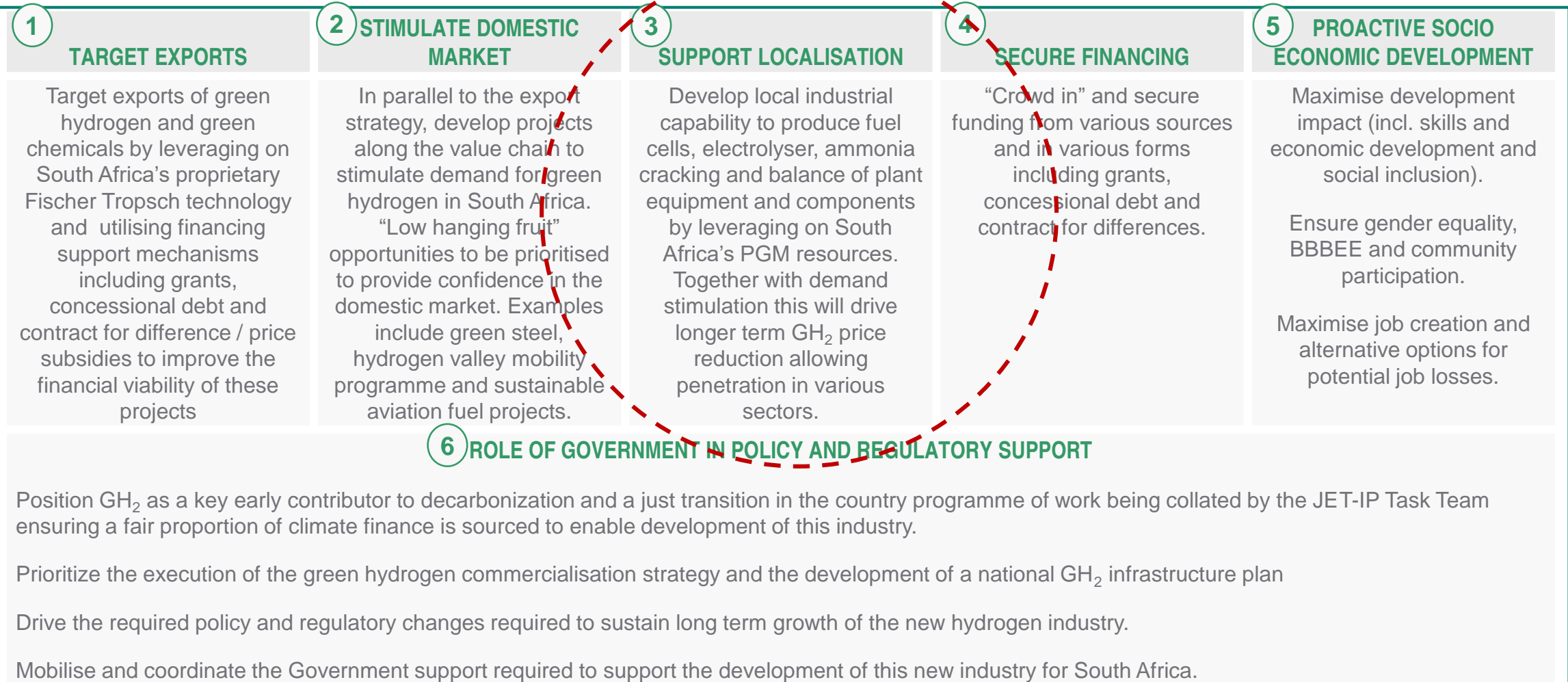


# Preamble

- This Green Hydrogen Commercialisation Strategy (GHCS) builds on the strong foundation of the work undertaken by the Department of Science and Innovation (DSI) with respect to its HySA programme and the recent development and publication of the Hydrogen Society Road Map (HSRM)
- In June 2021 the Minister of Trade, Industry and Competition established the Green Hydrogen (GH<sub>2</sub>) Commercialisation Panel (GHP) which consists of private and public sector champions in the potential green hydrogen value chain and is currently being co-ordinated by the Industrial Development Corporation of South Africa (IDC)
- The objective of the Panel is to specifically focus on the development of a South African Green Hydrogen Commercialisation Strategy and Action Plan which was approved by Cabinet in November 2022 for release to the public for comments.
- Public comments closed on 31 March 2023 and the GHCS is being updated with the comments from the public for re-submission to Cabinet
- The objective of this document is to present the Green Hydrogen Commercialisation Strategy (GHCS) and Action Plan for South Africa

# GH<sub>2</sub> Commercialisation Summary – Strategic Elements

The successful implementation of the commercialisation strategy will depend on the execution of the six key elements :



# Summary actions to be taken by government

<b>1. Strategy</b>	1.1 Position GH <sub>2</sub> as a key early contributor to decarbonisation and a just transition in the country programme of work being collated by the Climate Deal Task Team ensuring a fair proportion of climate finance is sourced to enable development of this industry.	1.2. Expedite International GH <sub>2</sub> National Strategy with international partners (finance, technical, off take)	1.3. Set up a single GH <sub>2</sub> governance mechanism to coordinate public sector and support private sector investment.	1.4. Prioritise the development of a national Infrastructure Plan, including undertake land/ corridor appraisal assessments for dedicated renewables and electrolysis.	1.5. Design and introduce a Guarantees of Origin system to install investor confidence in key import nodes.
<b>2. Industrialisation</b>	2.1. Conduct a detailed PGM potential market study, including local CCM/MEA manufacturing opportunities.	2.2 . Establish relationships with OEMs to attract anchor partnership for investment in SA (electrolysers).	2.3. Develop clear sector coupling plans and techno economic planning of sector impact and transition costs	2.4. Invest in R&D opportunities to advance localisation of specialised skills.	
<b>3. Projects</b>	3.1 Incentivize expedited private sector project investment, with specific focus on early export projects e.g. green methanol, aviation fuel, green ammonia	3.2. Support local demand stimulation and localisation projects including mobility applications, green steel and equipment manufacturing.	3.3 Support development of both coastal and inland port development for green hydrogen	3.4. Develop GH <sub>2</sub> standards and specifications for mobility, production, refueling, storage, transportation and end-use applications based on international best practice standards.	
<b>4. Finance</b>	4.1. Apply for GH <sub>2</sub> funding from International green funds and South Africa investment support to meet GH <sub>2</sub> production of 200 ktpa by 2025/2026.	4.2. Structure/ support green financing instruments and innovative funding with private sector for GH <sub>2</sub>	3. Build up investment fund to prioritize and enable government investment into initial projects.		
<b>5. Skills &amp; R&amp;D</b>	5.1. Develop GH <sub>2</sub> Socio-economic plan to enhance local content inclusion of SMME's and entrepreneurs.	5.2. Engage with training partners and tertiary institutions on GH <sub>2</sub> training			

# Presentation Outline

- 1 **Opportunity Statement**
- 2 The need for a Commercialisation Strategy
- 3 Demand-driven commercialisation
- 4 Competitive Supply
- 5 Strategic ambitions
- 6 Localisation ambitions
- 7 Commercialisation Roadmap and Key Takeaways





# The Opportunity presented by Green Hydrogen for South Africa

The GH<sub>2</sub> economy presents new economic, skills, employment and community opportunities for South Africa



## Global Opportunity

Hydrogen will play a significant role in the transition to a net-zero energy system.

It will establish SA as a future energy market global trader, securing foreign direct investment, earning foreign income and creating economic growth and development

Import Markets for GH<sub>2</sub> to 2050 will be the EU (2050: 11-15 Mt GHpa); Japan (2050: 5 to 10 Mt GHpa); South Korea (2050: 1.0 to 1.2 Mt GHpa) and the United Kingdom (2050: 0.5 to 0.7 Mt GHpa).



## Competitiveness

South Africa's natural endowments of Land, Wind, Solar, Oceans and Green Minerals and existing Petrochemical base can be leveraged.

Together with innovations in the hydrogen sector, a robust financial system, globally recognised renewable energy programme and inclusion of GH<sub>2</sub> as a key element of the Government's energy transition plans

South Africa's clear differentiators are proprietary Fischer Tropsch technology and resources of platinum group metals (PGMs)



## Just Transition

The just energy transition focuses on the transition of South Africa's energy sector as the country navigates the shift away from coal towards cleaner sources of energy

The just energy transition requires that the transition is equitable to all communities and is better for our people and planet.

Transitioning away from fossil fuels will require the training and re-skilling of communities reliant on fossil fuel industry.



## Decarbonisation

- GH<sub>2</sub> will be the global clean fuel of the future and critical to SA decarbonising our economy and ensuring the competitiveness and sustainability of our industries.
- In a global Net Zero environment, "dirty" economies will increasingly be financially penalised
- GH<sub>2</sub> can decarbonize much more than RE alone by replacing fossil fuel inputs in industrial processes

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# A solid historical base supports accelerated commercialisation

1

2007

Development of the National Hydrogen and Fuel Cell Technology Strategy by the Department of Science and Innovation and approval by Cabinet

2

2008-2013

Demonstrator projects include an underground fuel cell powered mining locomotive, solar-to-hydrogen system, battery and fuel cell golf cart, fuel cell generator providing lights for the UWC Nature Reserve

3

2014-2016

Demonstrator projects include: fuel cells for power storage for homes and cellular phone tower base stations; a Hydrogen refueling station; and fuel cell powered forklift.

4

2017

Demonstrator projects include a Green Hydrogen fuel cell system with on-site production and storage and a Hydrogen in Mining test facility.

5

2018

Demonstration projects concluded for Hydrogen production, Liquid Organic Hydrogen Carriers and the use of PGM catalysts for the production of Hydrogen. HySA demonstrated a 2.5kW fuel cell system at Poelano Secondary School

6

2020

The DSI, Hydrogen SA and North West University initiate a process with the South African government to develop a Hydrogen Society Roadmap.

7

JUNE 2021

Presidency announces that GH has been identified as the first of five 'Big Frontier' strategic investment opportunities

8

JULY 2021

The DTIC and IDC coordinated a joint approach to sector planning by establishing a Green Hydrogen Panel

9

SEPTEMBER 2021

Cabinet approves the Hydrogen Society Roadmap developed by the DSI

10

OCTOBER 2021

The drafting of the Green Hydrogen Commercialisation Strategy for South Africa was completed

11

NOVEMBER 2021

At COP 26 in Glasgow, Scotland, South Africa mobilizes funding support for the country's decarbonization

NCEDA releases GH Strategy at COP26

12

FEBRUARY 2022

The HSRM is released to the public marking a momentous milestone for South Africa's hydrogen industry development



# Commercialisation leverages the Hydrogen Society Roadmap

## Hydrogen Society Roadmap

The strategy for Commercialisation, aligns with the objectives and outcomes of, and builds on the strong foundation of the Hydrogen Society Roadmap

### Objectives

- Investment
- Reduced GHG emissions
- Just Labour transition
- Balance of payment
- Energy Security
- Reduced inequality and poverty

### Outcomes

- Creation of export market for SA
- Decarbonisation of transport sectors
- Decarbonisation of energy-intensive industry
- Manufacturing sector for H2 products and excellence
- Green and enhanced power sector and buildings
- \*Hydrogen generation storage and distribution linked to objectives, outcomes and levers of change



science & innovation

Department:  
Science and Innovation  
REPUBLIC OF SOUTH AFRICA



## GH<sub>2</sub> Commercialisation Strategy

### Objectives

- Export Markets
- Domestic Markets (includes applications in hard to abate sectors and mobility)
- Local industrial capability (includes manufacturing of equipment)
- Investment and Finance
- Economic and socio-economic impact
- Affordability of a Just Transition
- Regulatory Environment

### Enablers

- Skills development
- Financing
- Policy and Regulation
- Catalytic projects



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The roadmap for commercialisation provides detail and granularity differentiating between short and long term actions by public and private sectors

### Specific actions identified in the following areas:

70

- Establish Targets and Policy Signals
- Mitigate Investment Risk
- Harmonize standards and remove barriers
- Strategic demonstration and deployment projects
- Promote RDI
- Skills development and public awareness
- Support demand creation
- **Development of a national commercialisation strategy**

### Specific actions identified in the following areas:

257

- Skills and R&D
- Regulations and Policy
- Finance
- Technology Partners
- Raw Materials
- Masterplan
- Foundation for projects
- Hydrogen Hubs
- Additional project development
- Mobility projects
- Manufacturing projects
- Material handling projects
- Stationery and back up power projects
- Refueling and Distribution
- Production / Industrialisation / Manufacturing
- GH<sub>2</sub> Beneficiation and Export



# Role of the Commercialisation Strategy

## Role of a commercialisation strategy ...

- National coordination / shared vision
- Provide policy certainty
- Encourage investors
- Guide decision makers (government, private sector)
- Ensure proactive industry development
- Execution orientated action plan



## ... towards a Vision

Developing a globally competitive, inclusive and low carbon economy by harnessing South Africa's entrepreneurial spirit, industrial capability, strong financial sector and natural endowments



# A customised approach to develop a new GH<sub>2</sub> industry

## 1 Proactive industry planning

- Have a long term strategy
- Develop short, medium and long term action plans
- Setting up a viable and globally competitive sustainable industry

## 2 Create momentum with real examples on the ground

- Balance long-term strategic thinking/planning & immediate implementation of shorter term opportunities

## 3 Value chain and holistic approach

- Holistic approach to address enablers across the value chain
- Enablers will include the non technical aspects e.g. regulations and financing.

## 4 Market Approach

- Address real market needs
- Flexibility to respond to market changes
- Have a multiple market orientation to learn and exploit the different opportunities

## 5 Leverage country strengths

- Utilise country's existing strengths
- Provide a unique global value proposition

## 6 Risk sharing partnerships

- Partnerships are key on different levels to facilitate commercialisation
- Partnerships in a variety of areas (finance, policy, technical, manufacturing, ...)

## 7 Support Catalytic Projects

- Identification, development and implementation of catalytic H<sub>2</sub> projects
- Provide project development funding to catalytic project
- Utilise these pilot projects as industry de-bottlenecking vehicles

## 8 Proactive risk management

- Lessons learnt from other industries
- Balance technology risks
- Develop commercial risk mitigation instruments

## 9 Continual RD&I

- Innovative out of box thinking for long term sustainability and competitive advantage

## 10 Address socio economic needs and just transition

- We cannot leave anyone behind in the process




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# Demand-driven Commercialisation: Market focus

A range of local and export use cases can anchor demand for GH<sub>2</sub> in South Africa

	Application Hydrogen and derived product use	Application Key Configuration				Long-term competitiveness Considered in demand scenario		Potential end-users in SA (non-exhaustive)
Industry	Ammonia production	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	Feedstock	✓ For own demand and export	
	Methanol production	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	Feedstock	✓ For own demand and export	
	Refineries	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	Feedstock	✓ Potential decarb. of PetroSA	
	Steel	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	FC/Comb.	✓ For local steel industry	
	High-Temp Process	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	Combustion	✓ For local glass industry	
Mobility	Light Road	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	FC	✗ BEV assumed dominant alternative	
	Heavy Road	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	FC	✓ FCEV in commercial and public transport HDV as dominant tech	
	Off-highway	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	FC	✓ FCEV in commercial HDV as dominant tech	
	Rail	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	FC	? Potentially relevant (e.g., to replace diesel gen. where grid power unavailable)	
	Shipping (Ocean)	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	FC/Comb.	✓ Ammonia for long-distance maritime shipping fuel demand	
	Aviation (International)	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	Combustion	✓ Green kerosene to meet aviation fuel demand	
Power & Heat	H <sub>2</sub> adapted turbines	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	FC/Comb.	? As part of last mile decarbonisation of power	
	Backup power	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	FC/Comb.	✗ Assumed negligible	
	Long/mid storage	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	FC/Comb.	? As part of last mile decarbonisation of power	
	Grid blending (heat)	H <sub>2</sub>	NH <sub>3</sub>	MeOH	C <sub>x</sub> H <sub>y</sub>	Combustion	✗ Assumed negligible	

1. Indicative example of long-term (2050) cost competitiveness of presented green techs 2. Efficiency improvements not included here, but relevant to all categories, P2G power to gas, P2L power to liquid | Source: BCG

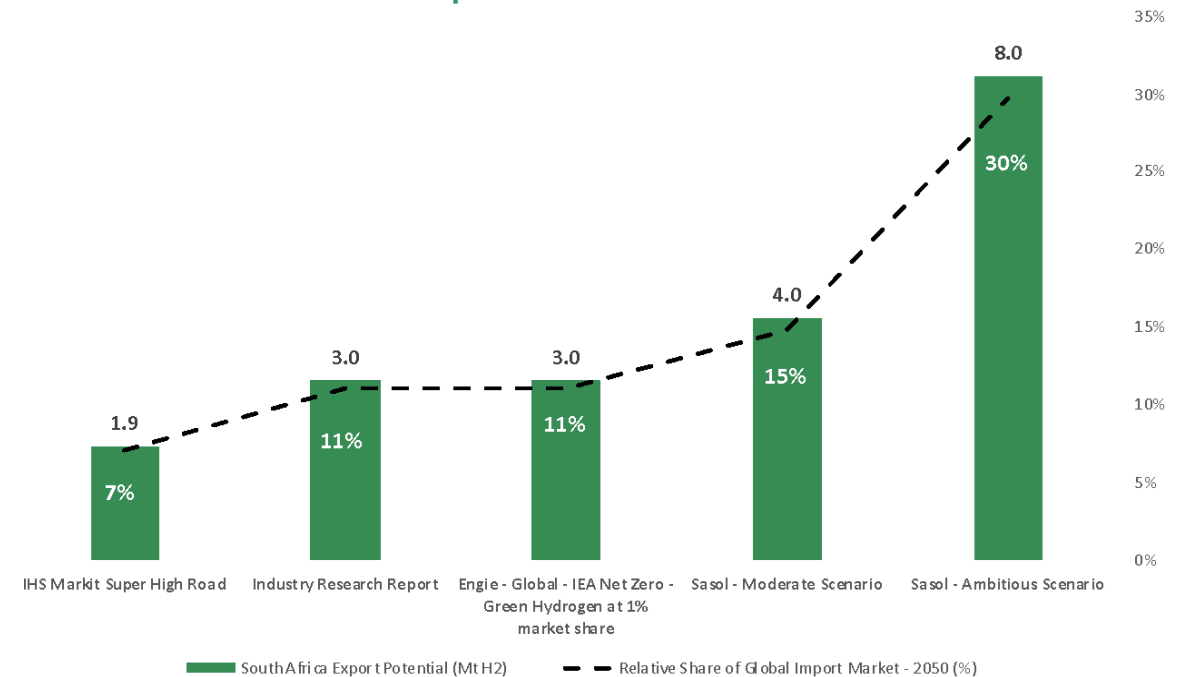
# Demand-driven Commercialisation: Exports

South Africa will have to secure a long term global market share and competitive trade position against competition from other exporters. Export potential is estimated at 2mtpa by 2040 with upside to be as high as 8mtpa in longer term.

- Global Market for GH<sub>2</sub> is forecast to be 300-320 Mt GH<sub>2</sub> by 2050 using the benchmark International Energy Agency's (IEA) Net Zero GH<sub>2</sub> Scenario to 2050.
- There is potential for 91% of this demand (279 Mt GH<sub>2</sub>) to be met within the country or region of demand, with the balance of 9% (27 Mt GH<sub>2</sub>) sourced through imports.
- Import Markets for GH<sub>2</sub> to 2050 will be the European Union (2030\*: 10 mtpa); Japan (2050: 5 to 10 mtpa); South Korea (2050: 1.0 to 1.2 mtpa) and the United Kingdom (2050: 0.5 to 0.7 mtpa).
- **Export Potential:** South Africa is well positioned for global exports with estimates of the potential ranging between 1.9 to 8.0 Mt GHpa. Positioning on the Indian and Atlantic shipping routes could enable 8-10% market share of the global ammonia / methanol fuels market for shipping, equivalent to a further 0.8 to 1.0 Mt per year of GH<sub>2</sub>.

\* Based on the REPowerEU plan (18 May 2022), Europe has increased GH<sub>2</sub> demand projections planning to import 10mtpa by 2030 which was previously planned for 2050.

South Africa - Export Market Assessment Based on Share of Global Import Market

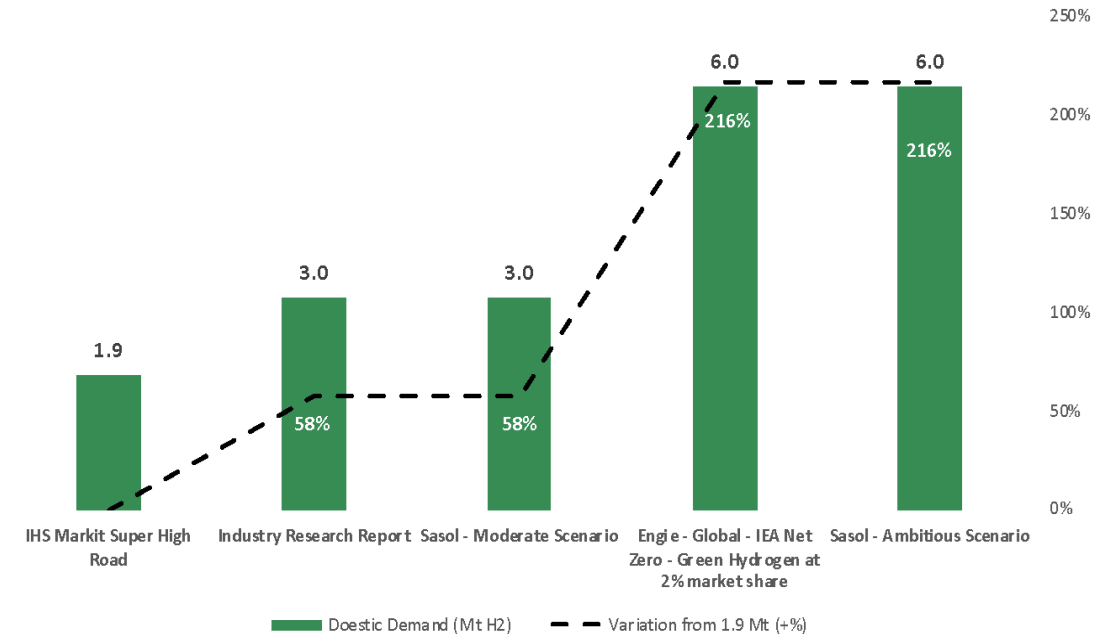


# Demand-driven Commercialisation: Domestic Market

Domestic demand will accelerate as price parity gets closer to fossil fuels. Co-located production projects (eg. Mining sector) will have accelerated commercial value due to lower infrastructure and supply chain dependencies and hence lower cost. Domestic potential estimated at 2 - 3 mtpa by 2040 with upside as high as 6mtpa

- Domestic Market: The domestic market for GH<sub>2</sub> has the potential to range between 1.9 to 6.0 Mt GHpa.
- South Africa's potential to move higher on the range is price sensitive and will require specific co-ordination and intervention between the public and private sector to ensure higher efficiency at scale.
- Broader domestic penetration will take longer due to affordability but co-located projects have expedited commercial benefits due to lower infrastructure cost and dependencies
- **Affordability considerations:**
  - Considering GH<sub>2</sub> production cost at 2025 is estimated at \$6/kg, which will be 55% more expensive than Diesel (R17,28/l) and 111% more expensive than Eskom (R1.28/kwh) without considering transition costs for users and applications.
  - Accelerating price parity will be a combination of GH<sub>2</sub> cost and fossil fuel carbon taxes. Even if energy price parity is achieved (estimated by 2030) the total cost of transition must be considered per sector.

## South Africa - South Africa - Domestic Market Assessment



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# Strategic Ambitions : (i) Projected Production Growth Path

Long term growth aspirations could exceed 7mtpa of production by 2050

- \$1bn investment could expedite GH<sub>2</sub> export of 20 ktpa.
- Within three to five years, several GH<sub>2</sub> projects, both export and local, will come online increasing GH<sub>2</sub> scale to 270 ktpa, requiring capital of \$13bn, displacing carbon emissions by 21 Mtons of CO<sub>2</sub>.
- The target of 3.8 mtpa by 2040 will require total investment of \$164 bn by 2040.
- Between 2040 and 2050, South Africa can aggressively pursue deeper decarbonisation by seeking a GH<sub>2</sub> demand uplift to 7 mtpa. This will displace 541 Mtons of CO<sub>2</sub> and increase investment support to \$133bn.
- Emissions calculated from the investment date to the end of the decade (assuming 3 years of development and 7 years of operations) could result in annual emissions reduction of between 18 to 20 % of South Africa's annual carbon emissions.

## PRODUCTION TARGETS

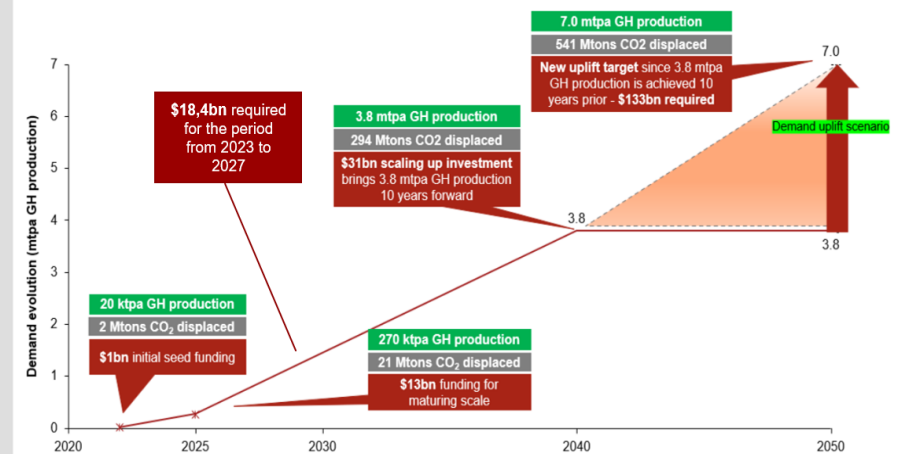
YEAR	2025	2030	2040	2050
TARGET	20	1.0	3.8	7
UNITS	ktpa	mtpa	mtpa	mtpa

GH<sub>2</sub> demand uplift and Capital investment required

### Key insights

- South Africa requires an **initial seed capital of \$1bn to expedite GH export of 20 ktpa**.
- Within three to five years, several GH projects, both export and local, will come online **increasing GH scale to 270 ktpa**, requiring **capital of \$13bn**, displacing carbon emissions by **21 Mtons of CO<sub>2</sub>**.
- **The target of 3.8 mtpa** is originally set for 2050, however, a **scaling up investment of \$31bn** between 2030 and 2040 will enable South Africa to expedite this baseline production **displacing 294 Mtons of CO<sub>2</sub>**.
- Between 2040 and 2050, South Africa can aggressively pursue deeper decarbonisation by seeking a **GH demand uplift to 7 mtpa**. This will displace **541 Mtons of CO<sub>2</sub>** and requires **\$133bn** in investment support.
- Emissions calculated from the investment date to the end of the decade, assuming 3 years of development and 7 years of operations from the date of investment to the end of the decade. **Annual emissions reduction from 7 mtpa GH equals 76.8 Mtons CO<sub>2</sub>, or between 18 to 20 % of South Africa's annual carbon emissions.**

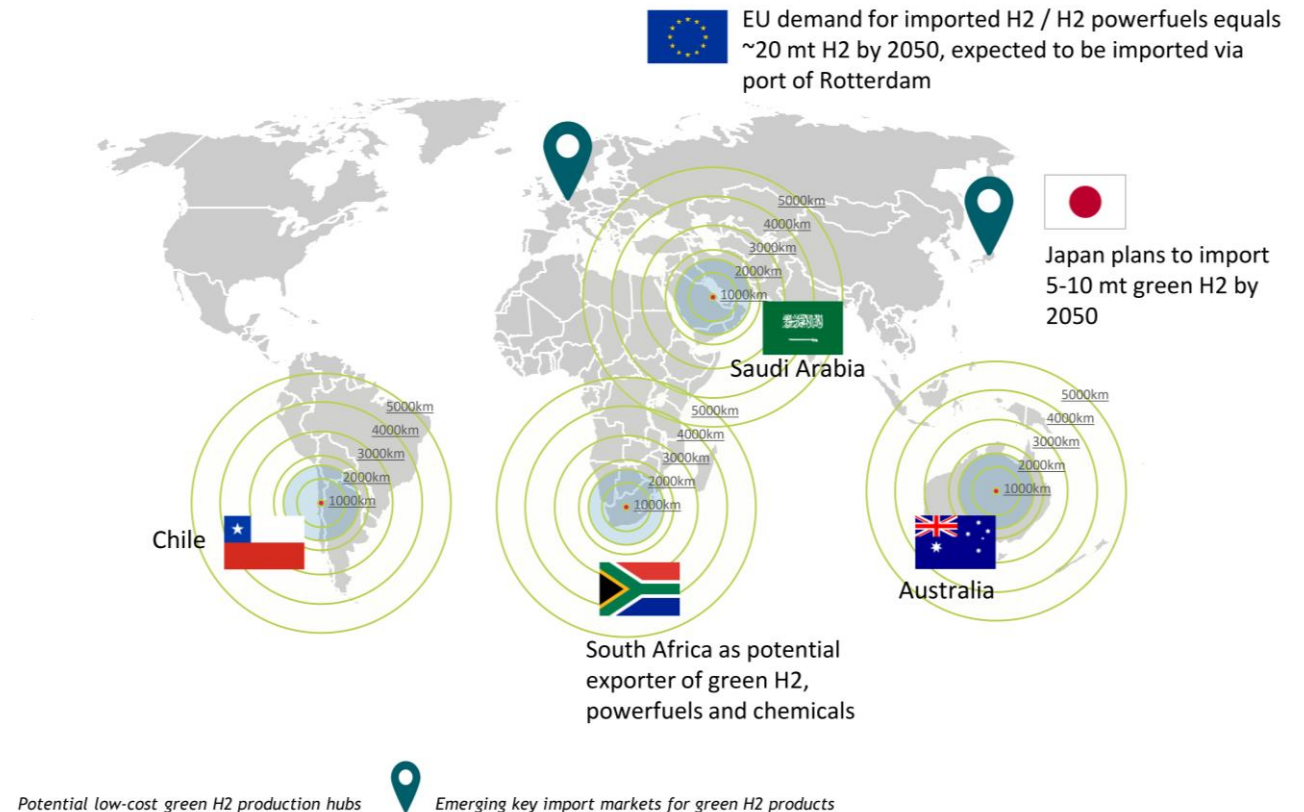
### GH demand uplift and Capital investment required



# Strategic Ambitions : (ii) Market Focus - Exports

Significant additional GH<sub>2</sub> demand could arise from supply of GH<sub>2</sub> products to Europe and Japan where imports of 25-30mt GH<sub>2</sub> is expected by 2050

- **Import Markets** for GH<sub>2</sub> to 2050 will be the European Union (2050: 11-15 Mt GHpa); Japan (2050: 5 to 10 Mt GHpa); South Korea (2050: 1.0 to 1.2 Mt GHpa) and the United Kingdom (2050: 0.5 to 0.7 Mt GHpa).
- **Export Potential:** South Africa is well positioned for global exports with estimates of the potential ranging between 1.9 to 8.0 Mt GHpa. Positioning on the Indian and Atlantic shipping routes could enable 8-10% market share of the global ammonia / methanol fuels market for shipping, equivalent to a further 0.8 to 1.0 Mt per year of GH<sub>2</sub>.



Source : NBI BUSA BCG, October 2021, "The green H<sub>2</sub> opportunity in South Africa"

# Strategic Ambitions : (ii) Market Focus – Domestic Market

GH<sub>2</sub> Vision will progressively unfold penetrating multiple markets

**2023 to  
2025**



Mining & Industry

Road transport, primarily Fuel Cell Vehicles (FCVs) with a focus on Heavy- Duty Vehicles (HDVs). Pilot projects already underway including hydrogen-powered trucks (Anglo Platinum's Mogalakwena mine), the Hydrogen Valley (835km industrial and commercial mobility corridor) and Sasol and Toyota South Africa Motor's partnership exploration of a mobility ecosystem.

**2025 to  
2030**



Industry

Chemical and Industry, notably the non-ferrous metals, green steel, and cement sectors, which will need to decarbonize to remain globally competitive. Early opportunities in Green steel are under consideration.

**2028 to  
2030**



Methanol

Green ammonia and methanol, which will replace current production from high carbon techniques. Ammonia is widely traded globally and regarded as an attractive transport vector for exporting and trading in green hydrogen.

**2030**



Sustainable Aviation  
Fuels

Sustainable aviation fuel offers an opportunity to decarbonise air travel.

**+ 2030**



Balancing

Power Storage and Balancing - Hydrogen being used for long-duration storage based on daily, monthly, and cross-seasonal balancing requirements.

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- 7 Commercialisation Roadmap



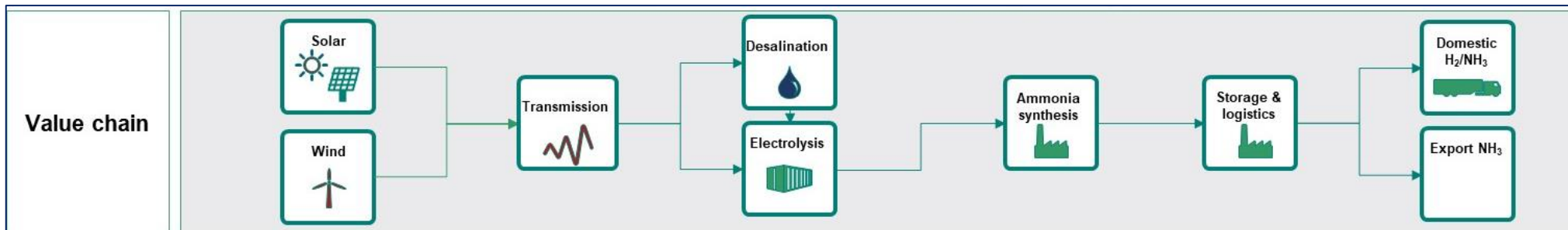


# Localisation can be a phased approach

## Topologies for localisation

Manufacturing topology	Description	Intellectual property
Local subsidiary of foreign company	Can be an OEM or supplier to OEM	OEM / supplier
Local manufacturer: under toll or license	Set up equipment to manufacture	OEM / supplier
Local assembly plant	OEM combines imported and locally made components	OEM / supplier
Local manufacturer partner	OEM / supplier to OEM provides manufacturing support (e.g., tooling, expertise)	OEM / supplier
Local manufacturing partnership	Installs local production line in partner company	OEM / supplier
Local manufacture	Supplier to OEM / balance of plant	Local

# Leverage the value chain synergies



GH value chain							
Economic sectors	Water resources	Renewable energy	Electricity grid and associated infrastructure	Electrolyser and BoP	Compression, storage and dispensing	GH and benefited products	Electricity from Fuel cell & Battery systems
Agriculture	X	X					
Electricity	X	X	X	X		X	X
Construction	X	X	X	X	X	X	X
Resource extraction, Mining	X	X		X	X	X	X
Transportation & communication					X	X	
Manufacturing	X	X	X	X	X	X	X
Trade		X	X	X	X	X	X
Government	X	X	X	X	X	X	X
Finance	X	X	X	X	X	X	X

## Focus area include:

- Raw material mining, processing and beneficiation – battery minerals, PGMs...
- Synergies with RE industry – solar panel, wind towers, BOP...
- Electrolyser / fuel cell stack, system and component
- Automotive manufacturing



# Production ambitions will be ramped up

2024 : Scale up CCM and MEA local manufacturing

2025 : Pilot scale fuel cell manufacturing

Pilot scale electrolyser manufacturing

2030 : Target 1GW of local fuel cell and electrolyser manufacturing capacity

2040 : Increase investment in local component manufacturing targeting 25% of global market

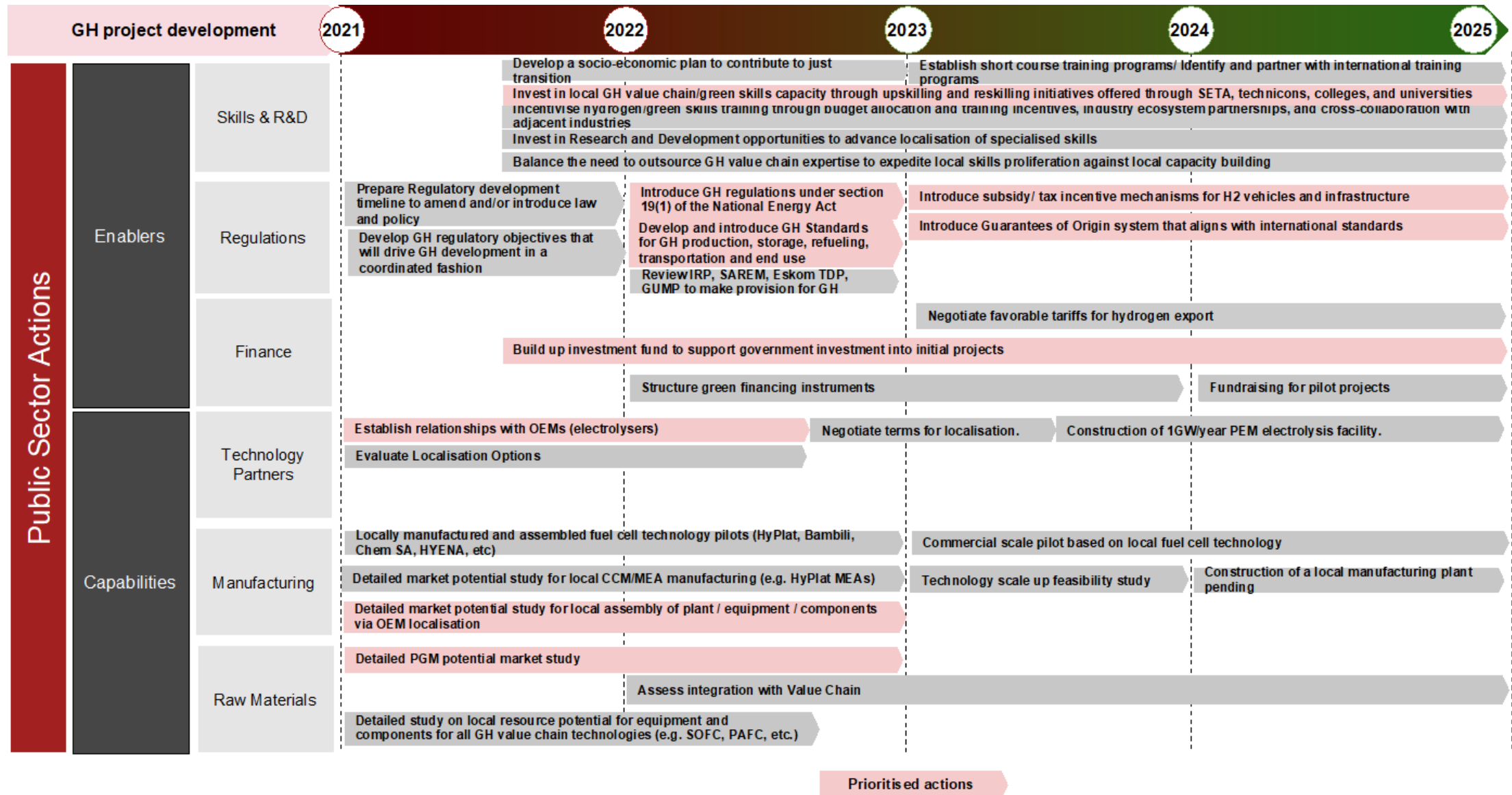
2050 : Support investment in ~15GW fuel cell and electrolyser manufacturing

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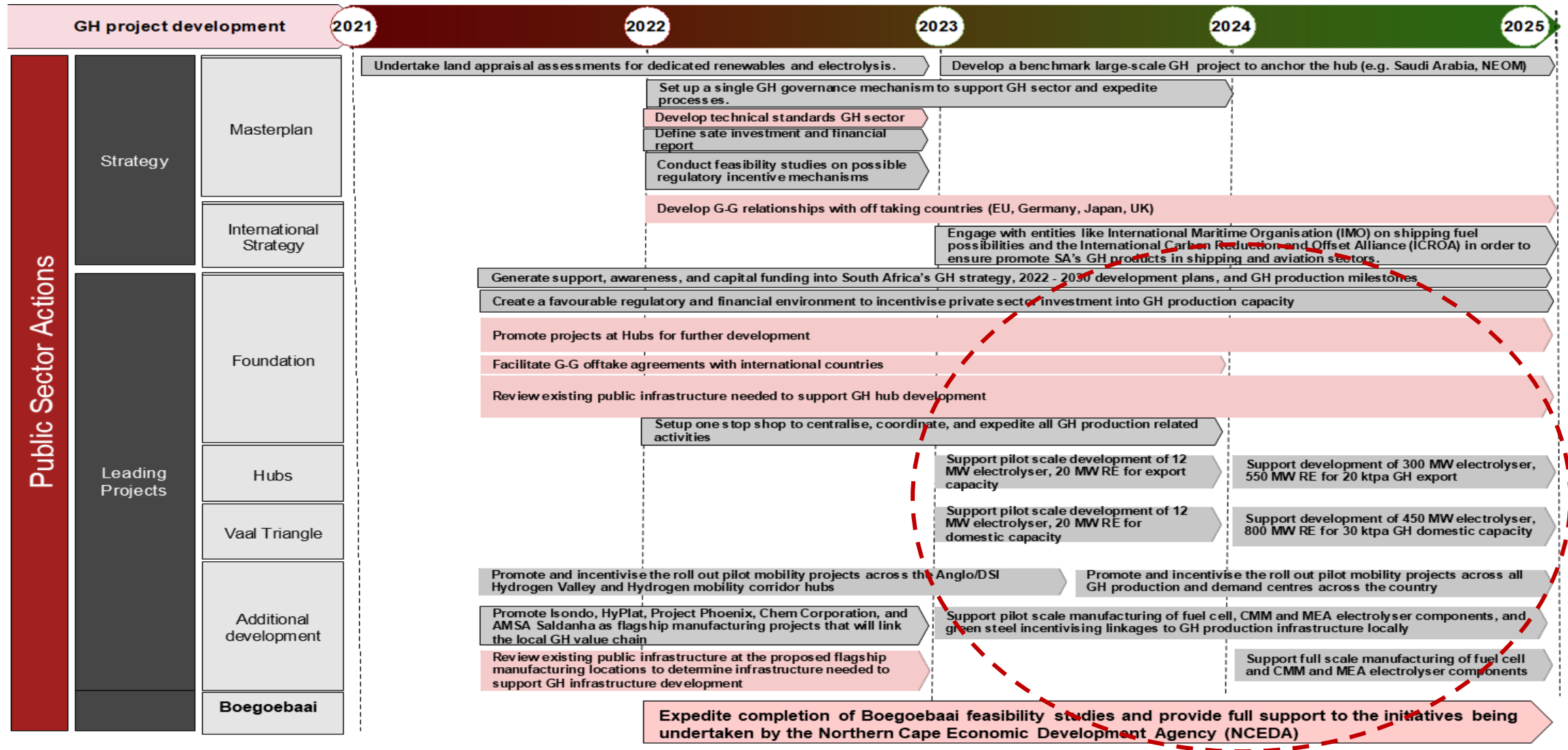
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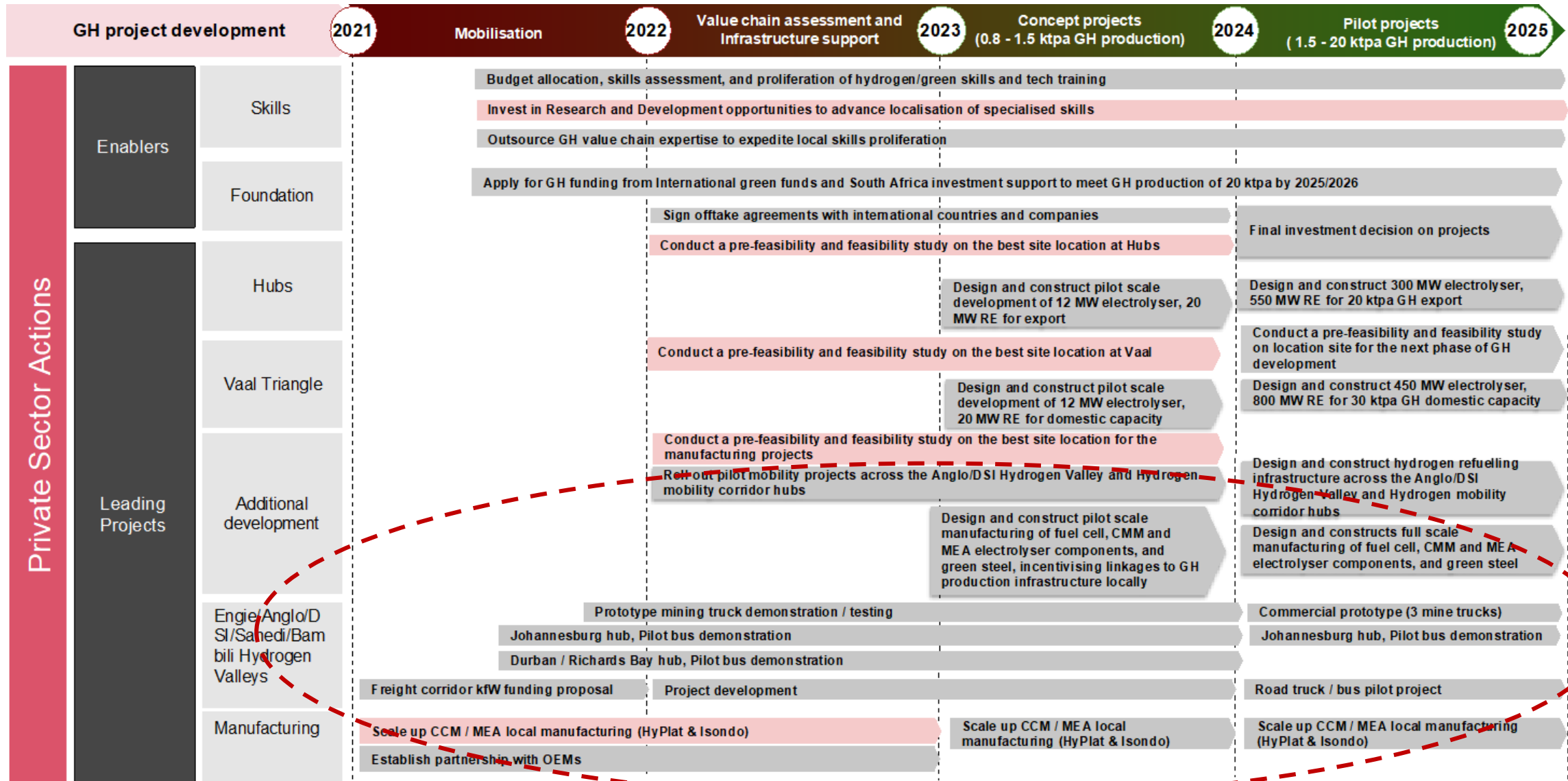
# Detailed Action Plan : Short Term Roadmap : 2022 - 2025



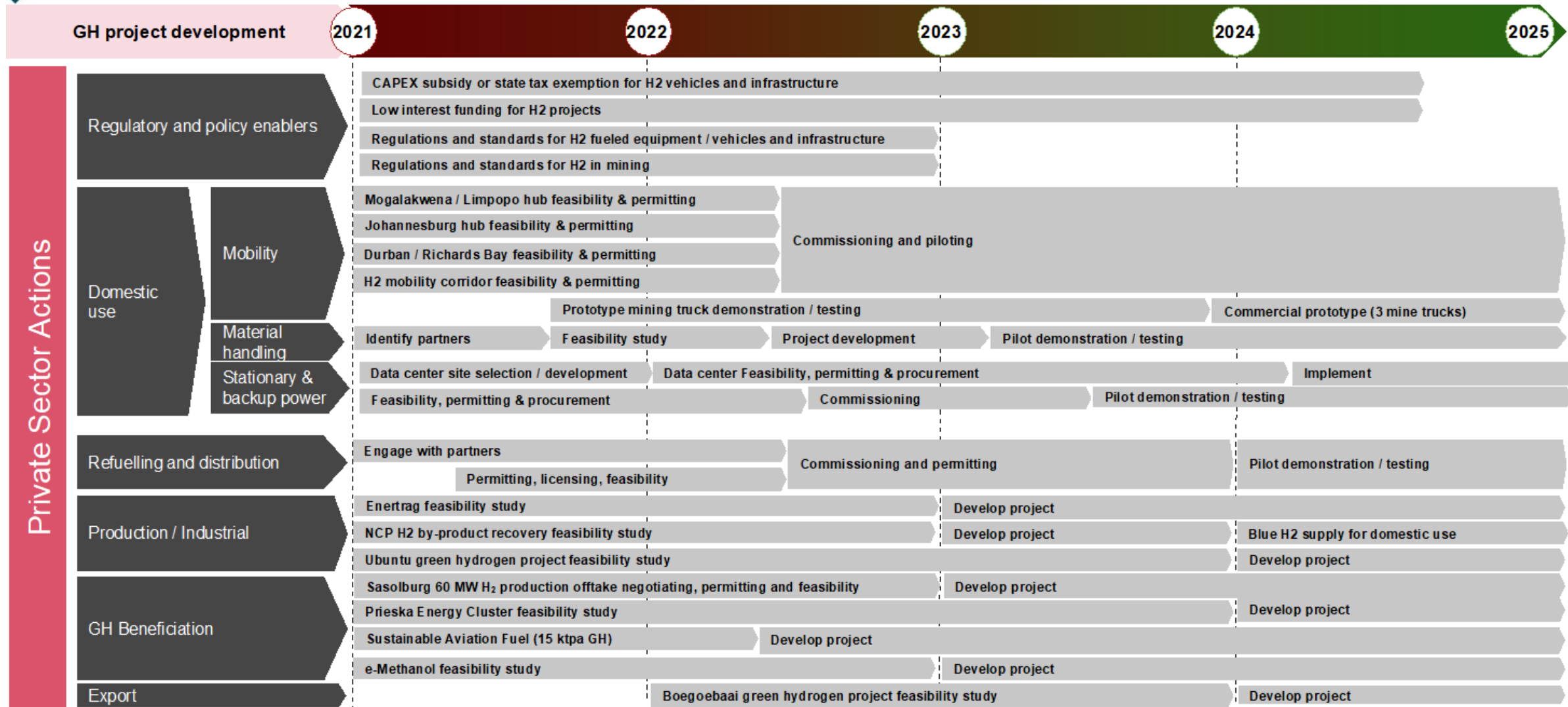
# Detailed Action Plan - Short Term Roadmap : 2022 - 2025



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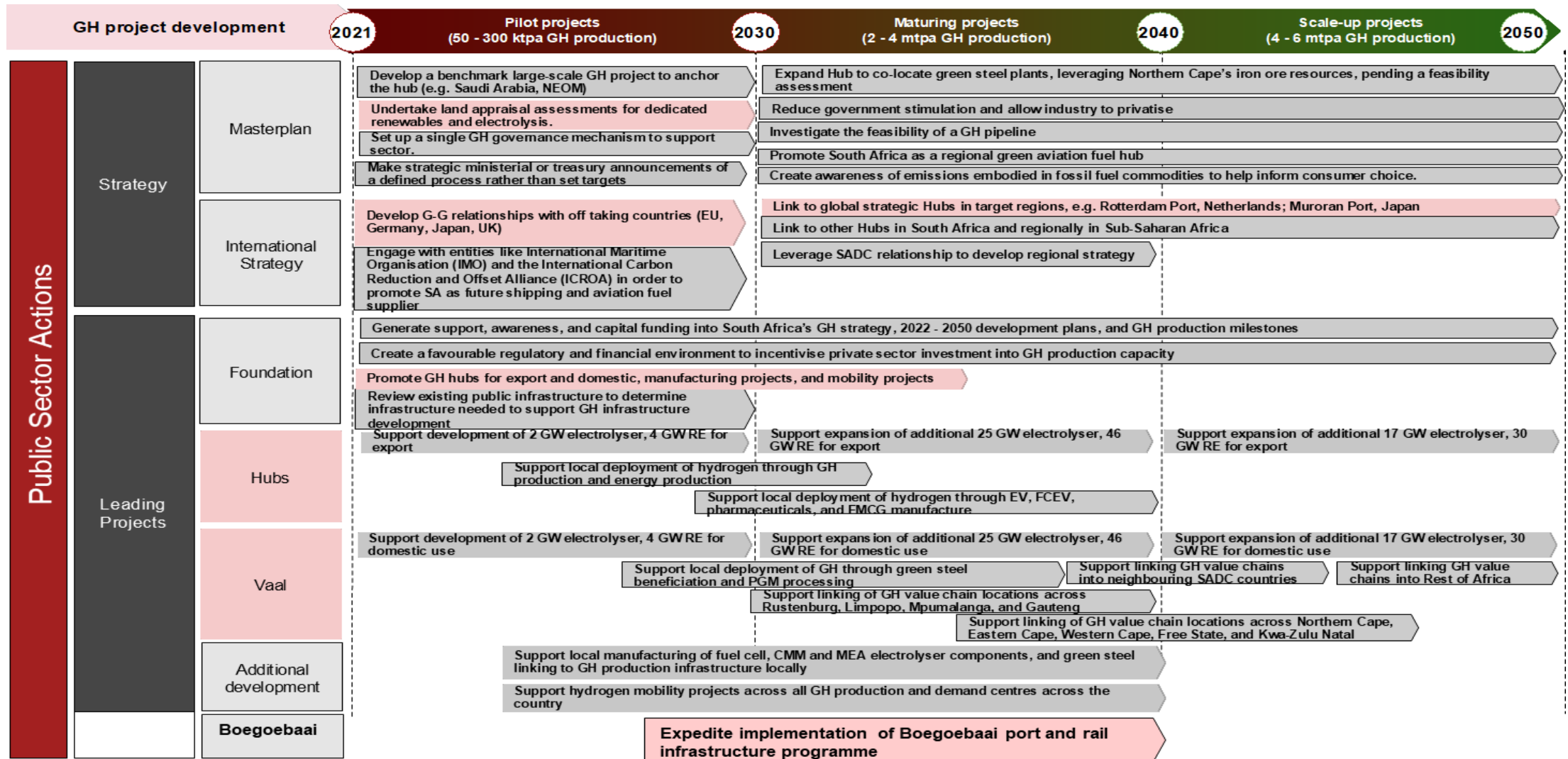




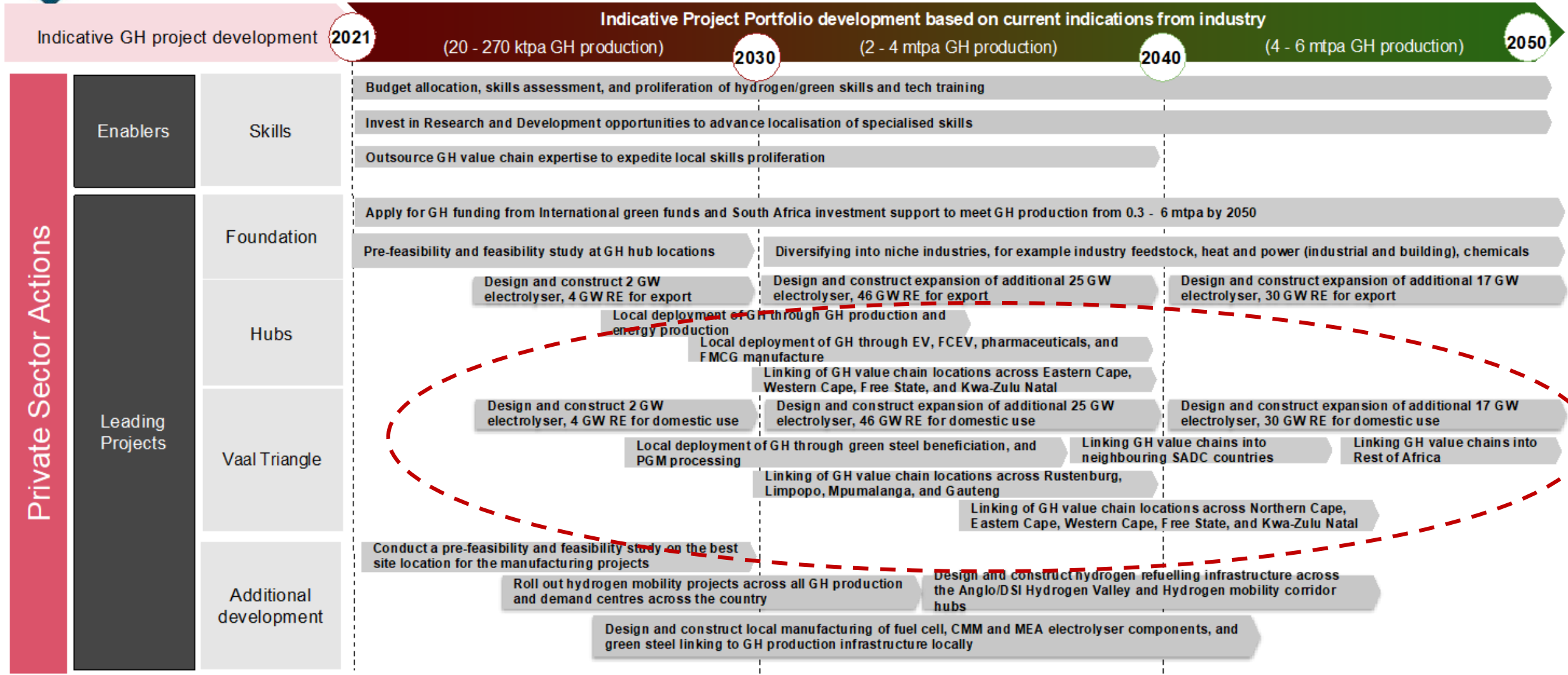
# Detailed Action Plan - Long Term Roadmap : 2022 - 2050

GH project development		2021	Pilot projects (50 - 300 ktpa GH production)	2030	Maturing projects (2 - 4 mtpa GH production)	2040	Scale-up projects (4 - 6 mtpa GH production)	2050	
Public Sector Actions	Enablers	Skills	Implement a socio-economic plan to contribute to just transition						
			Invest in local GH value chain/green skills capacity through upskilling and reskilling initiatives offered through SETA, technicons, colleges, and universities						
			Incentivise hydrogen/green skills training through budget allocation and training incentives, industry ecosystem partnerships, and cross-collaboration with adjacent industries						
			Invest in Research and Development opportunities to advance localisation of specialised skills						
			Balance the need to outsource GH value chain expertise to expedite local skills proliferation against local capacity building						
	Regulations	Implement a revised IRP incorporating GH capacity			Reduce tax incentives as industry matures				
		Introduce GH regulatory framework and standards (production, storage, refueling and transport)			Introduce explicit an implicit carbon pricing and revenue recycling mechanisms to drive investment in GH				
		Introduce regulatory incentives (reduced import duties and tax incentives)							
	Finance	Develop GH Guarantees of Origin system in order to secure product premiums							
		Negotiate favorable tariffs for hydrogen export			Secure long-term off-take arrangement with key countries / customers				
		Build up investment fund to support government investment into initial projects			Blended finance still required, but private sector scaling up			Competitive market financed by private sector	
	Capabilities	Technology Partners	Structure green financing instruments						
			Establish relationships with OEMs (electrolysers)			Manufacture established to support 1GW/year electrolysis capacity.			Expand manufacturing capability to meet demand.
			Auction electrolyser capacity, and invite global participation – min 10 MW (e.g. Chile)						
		Manufacturing	Investigate direct air capture opportunities and biomass						
			Demonstrate clean hydrogen as an input into existing plants and support fuel cell pilots			Expand replicable business model to other countries / regions			
			Promote >1 GW of local electrolyser / FC capacity, which incentivises OEMs to invest in local production capacity						Sector coupling – Long duration electricity storage
		Raw Materials	Invest in local component manufacturers (CCM & MEA) Targeting 15% of global market. Leverage local PGM.			Increase investment in local component manufacturing (CCM & MEA) Targeting 25% of global market.			Increase investment in local component manufacturing (CCM & MEA) Targeting 30% of global market.
			Target PGMs of 536 koz, 65 GW elect, 31 GW FC			Target PGMs of 1,51 moz, 90 GW elect, 145 GW FC			Target PGMs of 3,19 oz, 140 GW elect, 673 GW FC
Prioritised actions									

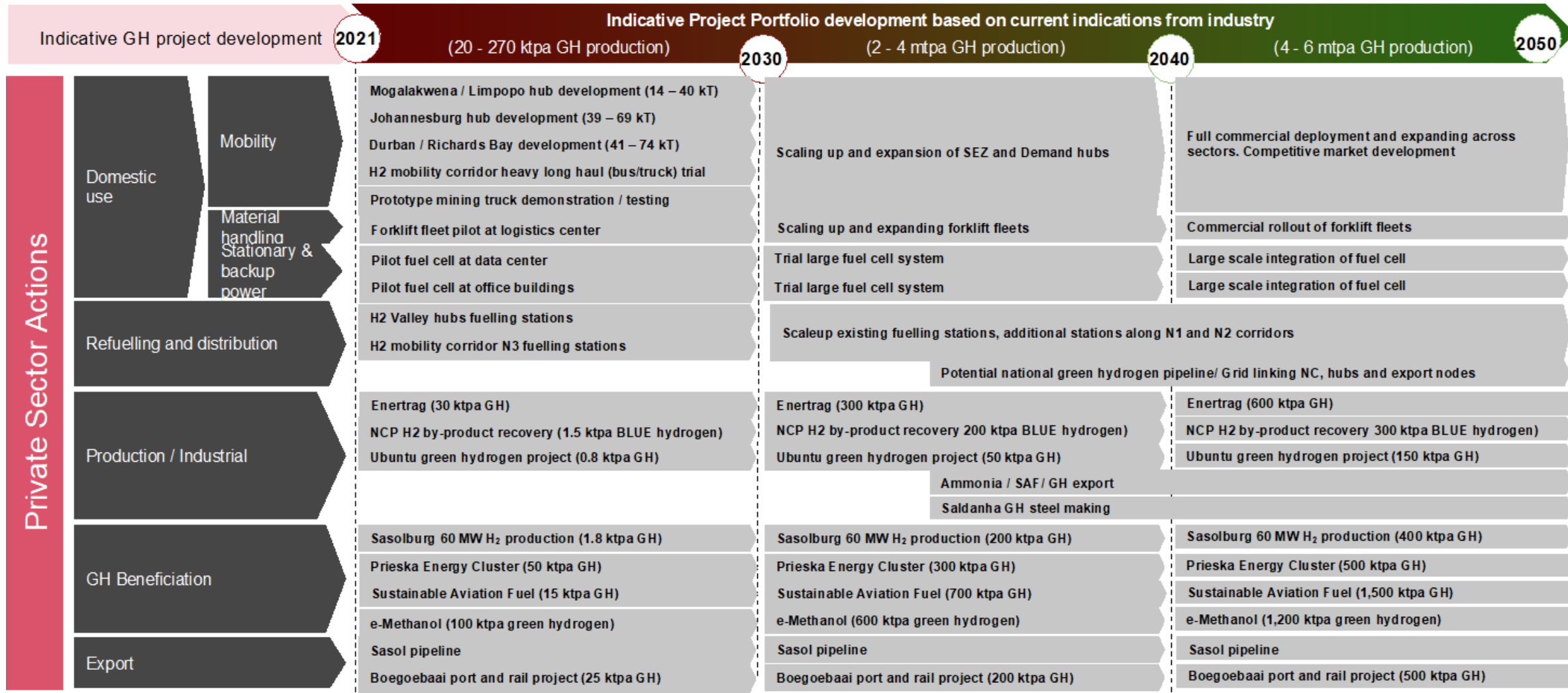
# Detailed Action Plan - Long Term Roadmap : 2022 - 2050



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# Conclusion : The path to achieve our Vision for 2050

## VISION 2050 – A WELL ESTABLISHED NEW SUSTAINABLE GREEN HYDROGEN INDUSTRY FOR SOUTH AFRICA

- The National Hydrogen Commercialisation will build on momentum of HySA programme and the Hydrogen Society Roadmap to position South Africa as a global player in GH<sub>2</sub> and green chemicals
- The development of this **new green hydrogen industry** will support South Africa's Economic Reconstruction and Recovery Plan
- Implementation of the action plans should ensure a just transition tackling gender equality and social inclusion, addressing the triple challenge of poverty, inequality and unemployment.
- Stronger partnerships will be built between Government, the private sector and civil society by creating an enabling environment
- Implementation should drive international partnerships while protecting national interest
- South African should be rebranded as a destination for sustainable investment incorporating Environmental, Social and Governance principles



- Projects along the value chain will be developed and implemented over the next 20 year
- “Needle moving” export revenues will be generated
- Policy and regulatory changes driven by Government will be implemented
- Financial support instruments will be sourced e.g. grants, concessional debt and contract for difference
- Incentives to sustain the development of the industry will be developed
- Skills training programs and institutions will be established
- Socio economic development will take fruition, jobs will be created and the just energy transition will be well on its way
- Significant decarbonization will be achieved in South Africa and across the Globe





# Key takeaways for equipment manufacturing

## 1 Think commercialisation

- Have a long term strategy
- Develop short, medium and long term action plans
- Setting up a viable and globally competitive sustainable business
- Scale, market, technology

## 2 Begin with the market in mind

- Projected market growth
- Export and domestic placement
- Product needs
- Partnering upstream and downstream
- Flexibility

## 3 Have a funding plan

- Debt : Equity – 70:30
- Equity partnership
- Early engagement with funders – DFIs, private, MDBS, commercial banks

## 4 Focus on financial viability

- Early stage financial modelling
- Target pricing, target volumes, breakeven cost, capex sensitivity, other sensitivities

## 5 Synergize country offerings

- Government support policy
- ISA
- SEZ incentives
- Natural endowments

## 6 Be partnership friendly

- Partnerships are key on different levels to facilitate commercialisation
- Partnerships in a variety of areas (finance, policy, technical, manufacturing, ...)

## 7 Proactive risk management

- Lessons learnt from other industries
- Balance technology risks
- Develop commercial risk mitigation instruments

## 8 Sharpen the tech

- Flexibility to keep up to technology changes
- Build into business plan and financial model
- Innovative out of box thinking for long term sustainability and competitive advantage