Portfolio Committee on Trade, Industry and Competition

Briefing by the dtic on the Green Hydrogen Commercialisation (GHC) Strategy and other Green Fuels

19 November 2024

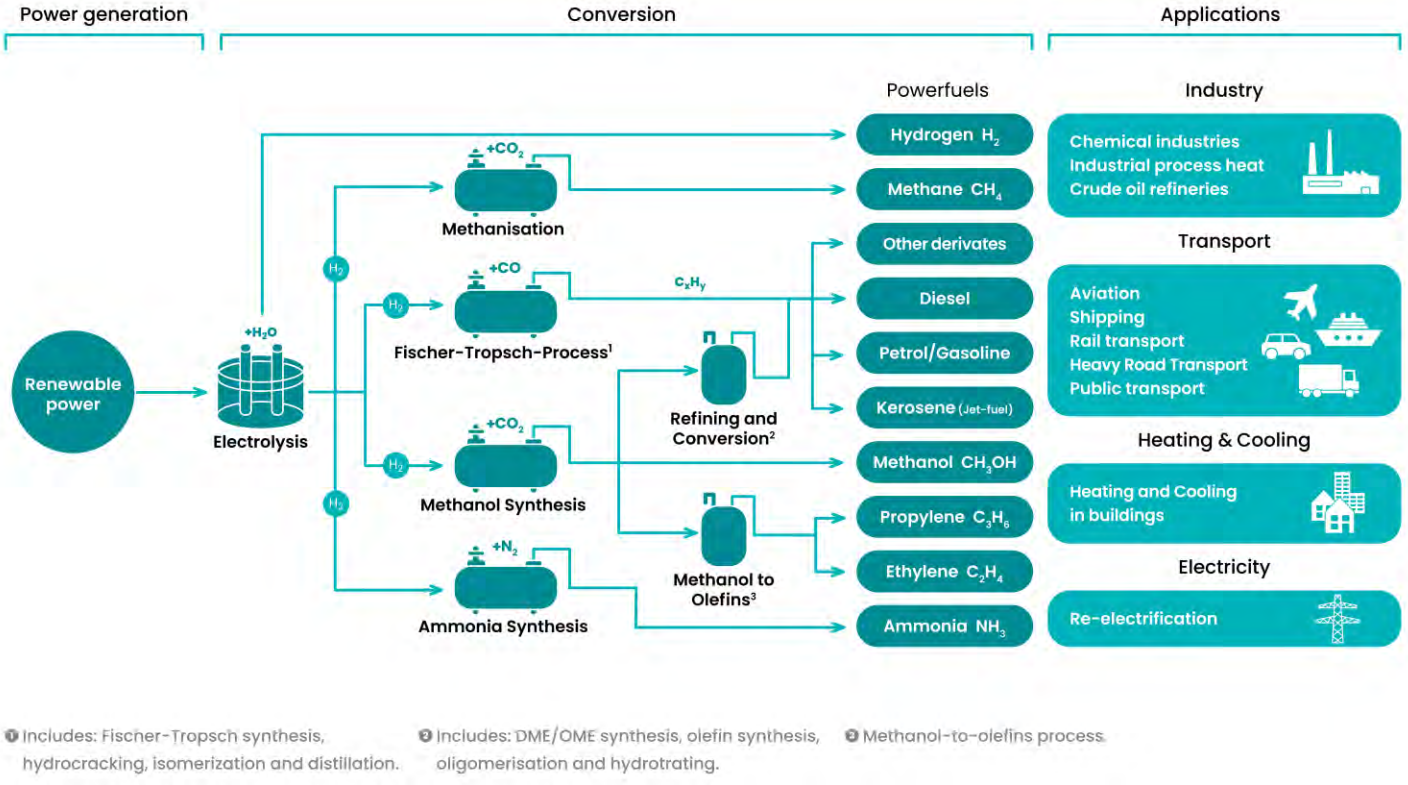
Objectives

- South Africa has made a commitment to decarbonise and to position itself to commercially benefit from this global shift to greener technologies.
- The Portfolio Committee has raised concerns about the viability of commercialising green hydrogen, given the country's unique set of socio-economic and resource challenges.
- The intention of this meeting is to have an initial engagement with **the dtic** on the Green Hydrogen Commercialisation Strategy.
- This could be the precursor to further oversight, such as a colloquium or workshop with other stakeholders.

Main argument for GH_2

- Green hydrogen does not compete with grid electricity, because, to be considered 'green' it has to be made with additional renewable electricity. Existing renewable electricity and coal-based electricity does not qualify. (Determined by country/international standards, regulations and certification)
- Green hydrogen does not compete for scarce water, because we can use desalinated sea water (not surface water) to provide the feed water to make the hydrogen.
- Green hydrogen is a way of exporting sunshine and wind, which South Africa has in abundance.
- Green hydrogen-based fuels are more expensive than fossil-based fuels. That said, South Africa can make hydrogen-based fuels cheaper than Europe or Japan - the largest customers (IDC Estimates South Africa is the second cheapest country after Chile).
- The most attractive green-hydrogen-based fuel market is sustainable bunker fuel for maritime shipping.
- The Member States of the International Maritime Organisation (IMO), of which South Africa is a member, have adopted the IMO GHG strategy, which requires that:
  - By 2030, 5% (stretch target for 10%) of energy used in shipping should come from zero-GHG sources and by 2050, it must be 100%
  - South Africa is on a major shipping route, with good renewable resources and available land, and 8 commercial ports

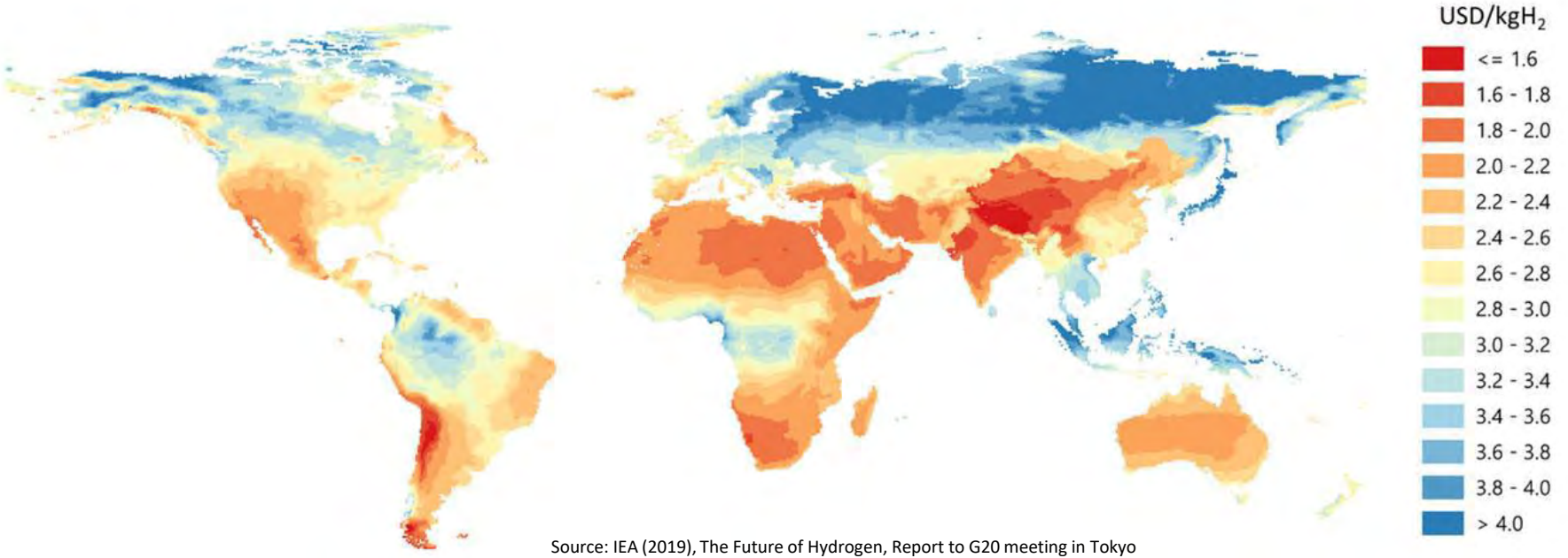
What are Power fuels?
All based on H_2 from the electrolysis of water using RE



❶ Includes: Fischer-Tropsch synthesis, hydrocracking, isomerization and distillation.
❷ Includes: DME/OME synthesis, olefin synthesis, oligomerisation and hydrotrating.
❸ Methanol-to-olefins process.

https://www.powerfuels.org/powerfuels/

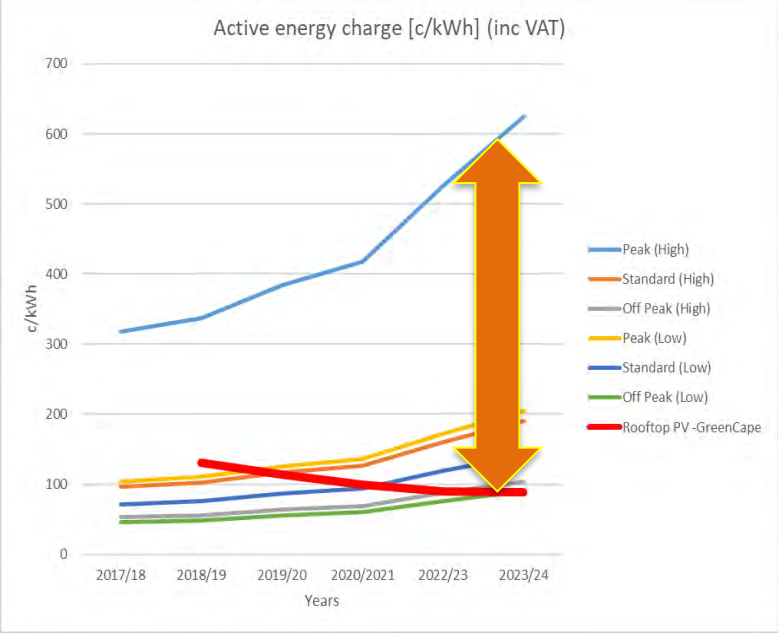
SA has good solar and wind resources - Green Hydrogen Opportunity



Source: IEA (2019), The Future of Hydrogen, Report to G20 meeting in Tokyo

Access to secure and affordable energy

Affordable energy and a balanced energy pricing has numerous benefits, when compared to a pricing model with a large gap between peak and off-peak rates.



Roll-out of renewable energy will reduce peak price, improve carbon intensity and grow economy

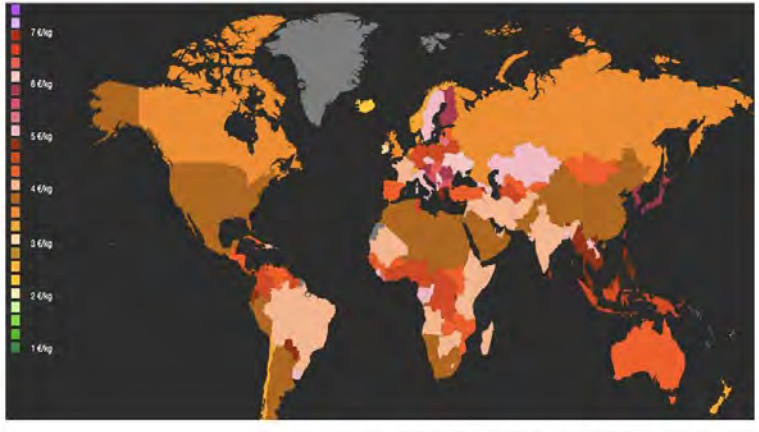
- **Stabilizes Consumer Costs** - Valuable in regions with large socio-economic disparities, as it reduces the financial strain on small businesses that may not be able to shift their energy usage easily.
- **Increases Productivity** - Affordable, stable energy allows industries to operate efficiently without needing to schedule production around high-cost peak times.
- **Ensure that energy remains accessible** to all socioeconomic groups and less disparity in access.
- **Encourages Energy Efficiency and Conservation** - When energy is both affordable and consistently priced, consumers tend to adopt efficient practices. If peak prices are high, some might simply avoid usage altogether during peak times rather than invest in efficiency measures. Affordable energy promotes long-term, habitual energy-efficient practices, rather than just reactive behaviour.
- **Increase resilience** – reduce impact of other shocks

South Africa's potential to be lowest cost producer

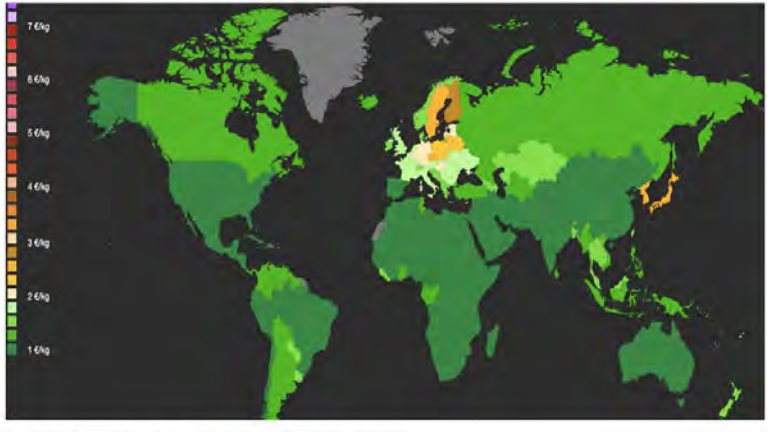
SA GH_2 could approach the $1/kg GH_2 mark by 2050, equivalent to indigenous low cost energy, making South Africa **one of the competitive industrial economies**, however South Africa will differentiate itself by using proprietary Fisher Tropsch technology to target export of sustainable aviation fuel and will manufacture electrolysers and fuel cells using PGMs available locally

Levelised Cost of Hydrogen (LCOH) comparable with the lowest cost producers in the world

Global Green Hydrogen Pricing - 2025*



Global Green Hydrogen Pricing - 2050*



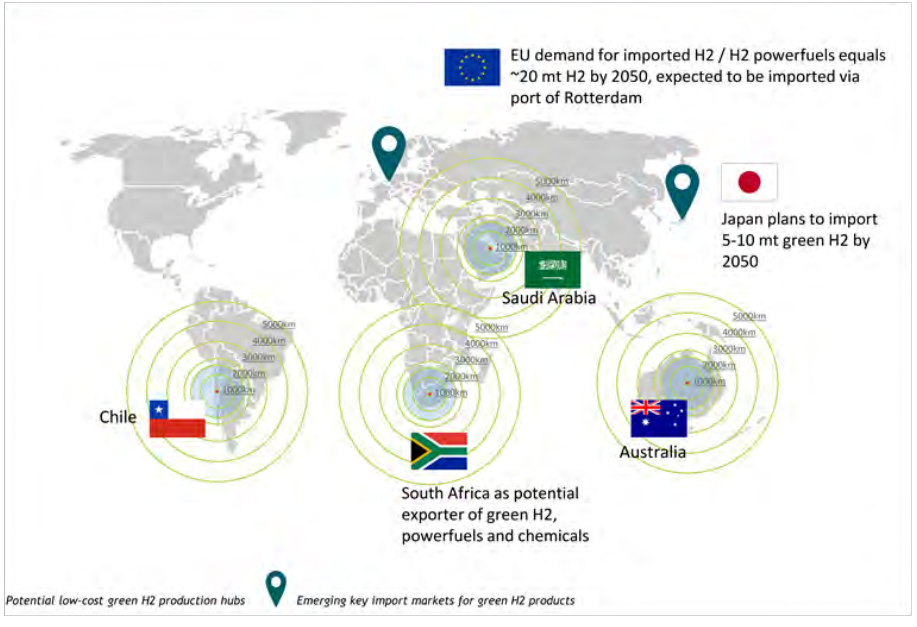
*PwC research (2021) | based on an analysis of various renewable energy sources and electricity generation / hydrogen equipment cost reductions worldwide

- Although far from the GH_2 importing markets in Europe and Asia, South Africa has the potential to make up the cost differential through greater efficiency and government support programmes.
- In 2025, the initial focus will be on the export of GH_2 at competitive prices as domestic use will not have reached commercial parity with local fuels. As GH_2 prices decline, a broader domestic transition will unfold.

Strategic implementation – Targeted Export Market

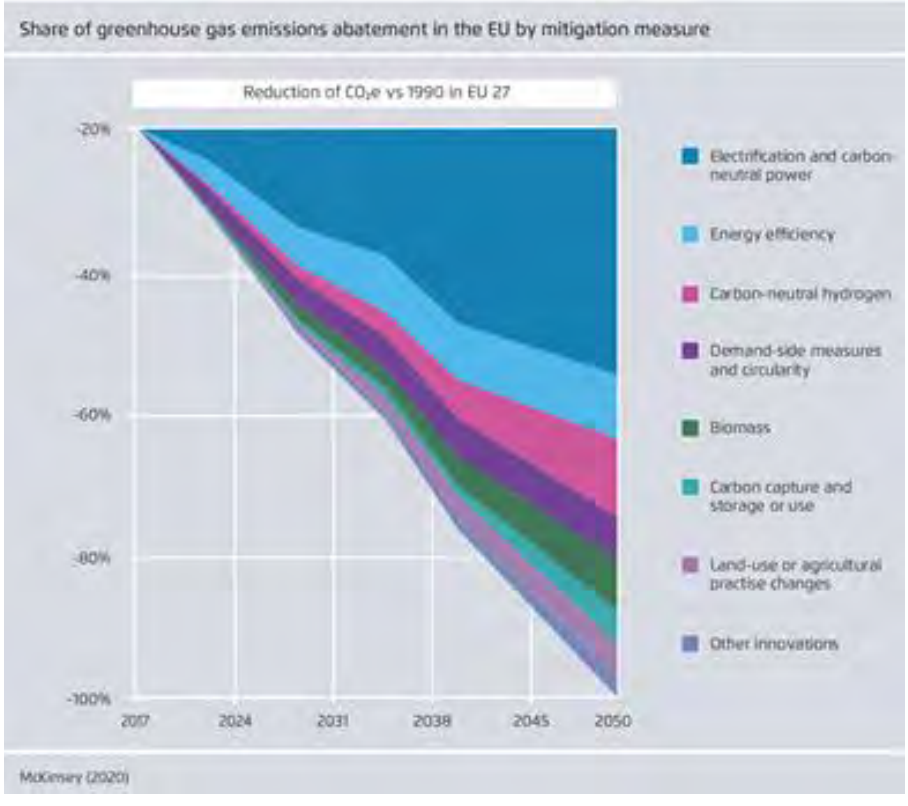
Significant additional GH_2 demand could arise from supply of GH_2 products to Europe and Japan where imports of 25-30mt GH_2 is expected by 2050

- **Import Markets** for GH_2 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_2.



Source : NBI BUSA BCG, October 2021, "The green H2 opportunity in South Africa"

Green Hydrogen (PtX)- EU



- The conversion of electricity from renewable sources into gaseous or liquid energy carriers is known as green hydrogen, or power-to-X (PtX).
- In sectors, where direct electrification is not feasible, green fuels allow a smooth transition from fossil to sustainable energy sources – as they can be used in existing storage and propulsion systems.
- Green hydrogen does not emit polluting gases either during combustion or during production.
- Storable: hydrogen is easy to store, which allows it to be used subsequently for other purposes and at times other than immediately after its production.
- Aviation - Synthetic e-kerosene from PtX would be the most efficient way to do so since it could make use of the existing infrastructure.

Commercialisation leverages the Hydrogen Society Roadmap

Hydrogen Society Roadmap

GH_2 Commercialisation Strategy

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

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

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:
- 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**

- Skills and R&D
- Regulations and Policy
- Finance
- Technology Partners
- Raw Materials
- Masterplan
- Foundation for projects
- Hydrogen Hubs
- Additional project development
- Mobility projects

The GHCS has prioritized applications and defines the key enablers

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

1 TARGET EXPORTS	2 STIMULATE DOMESTIC MARKET	3 SUPPORT LOCALISATION	4 SECURE FINANCING	5 PROACTIVE SOCIO ECONOMIC DEVELOPMENT
Target exports of green hydrogen and green chemicals by leveraging on South Africa's proprietary Fischer Tropsch technology and utilising financing support mechanisms including grants, concessional debt and contract for difference/price subsidies to improve the financial viability of these projects	In parallel to the export strategy, develop projects along the value chain to stimulate demand for green hydrogen in South Africa. "Low hanging fruit" opportunities to be prioritised to provide confidence in the domestic market. Examples include green steel, fertiliser, hydrogen valley mobility programme and sustainable aviation fuel projects.	Develop local industrial capability to produce fuel cells, electrolyser, ammonia cracking and balance of plant equipment and components by leveraging on South Africa's PGM resources. Together with demand stimulation this will drive longer term GH_2 price reduction allowing penetration in various sectors.	"Crowd in" and secure funding from various sources and in various forms including grants, concessional debt and contract for differences.	Maximise development impact (incl. skills and economic development and social inclusion). Ensure gender equality, BBBEE and community participation. Maximise job creation and alternative options for potential job losses.

6 ROLE OF GOVERNMENT IN POLICY AND REGULATORY SUPPORT

Position GH_2 as a key early contributor to decarbonisation and a just transition in the country programme of work being collated by the JET-IP Task Team ensuring a fair proportion of climate finance is sourced to enable development of this industry. Prioritize the execution of the green hydrogen commercialisation strategy and the development of a national GH_2 infrastructure plan. Drive the required policy and regulatory changes required to sustain long term growth of the new hydrogen industry. Mobilise and coordinate the Government support required to support the development of this new industry for South Africa.

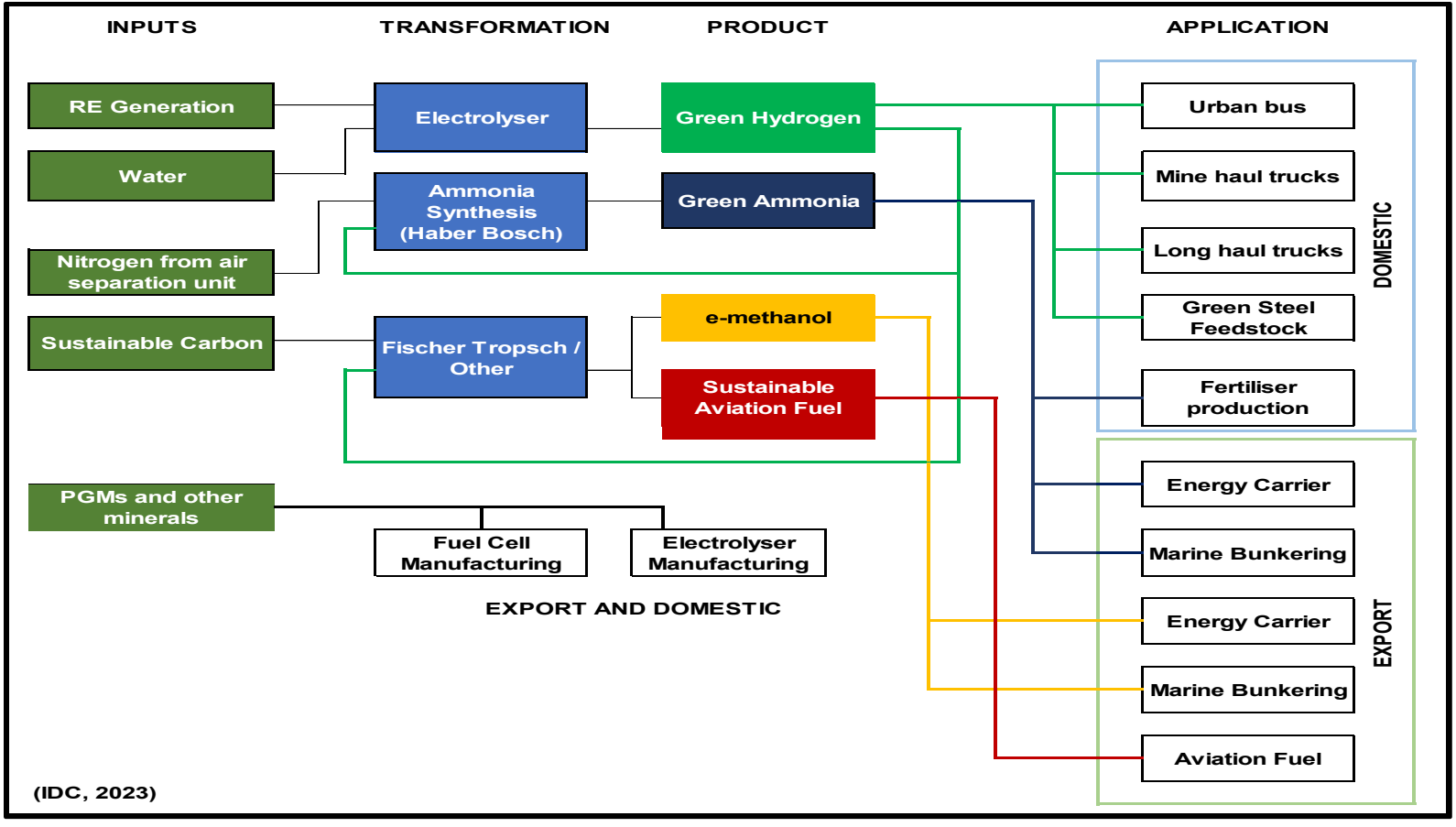
Markets for South African producers of GH_2

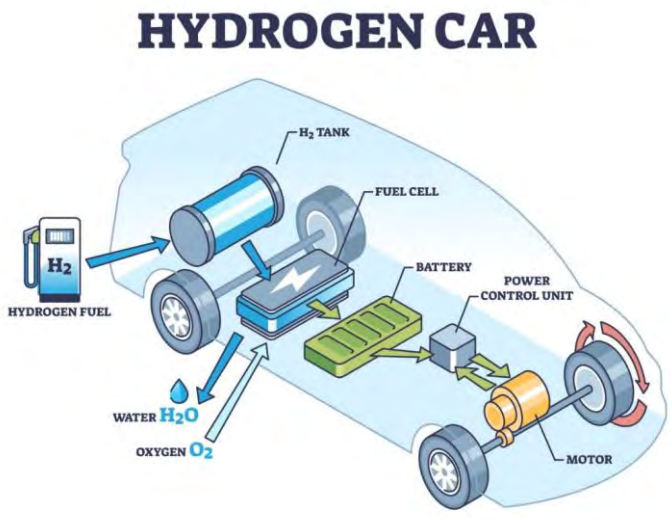
1. **Export market**: competing on price delivered in EU, Far East
2. **Local market inland**:
   i. Consumers prepared to pay the premium for clean fuel - Mining for example
   ii. Competitive: Fertilizer (green ammonia)

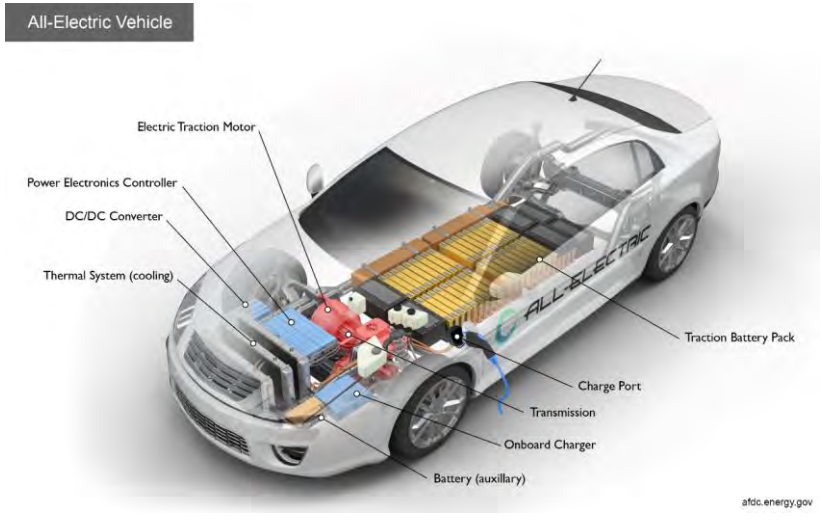
3. **Border market:**
   i. Refueling aviation calling at SA
   ii. Refueling Shipping: Market created by IMO MEPC 80 (July 2023) - Net-zero by 2050, 5% zero-carbon by 2030.

Fuels options:
New engines & vessels: Green Ammonia (CMB, Fortescue) and Green Methanol (Maersk)
Existing fleet: Green Fischer-Tropsch PtL

Prioritized applications will ensure we address export market and domestic utilisation





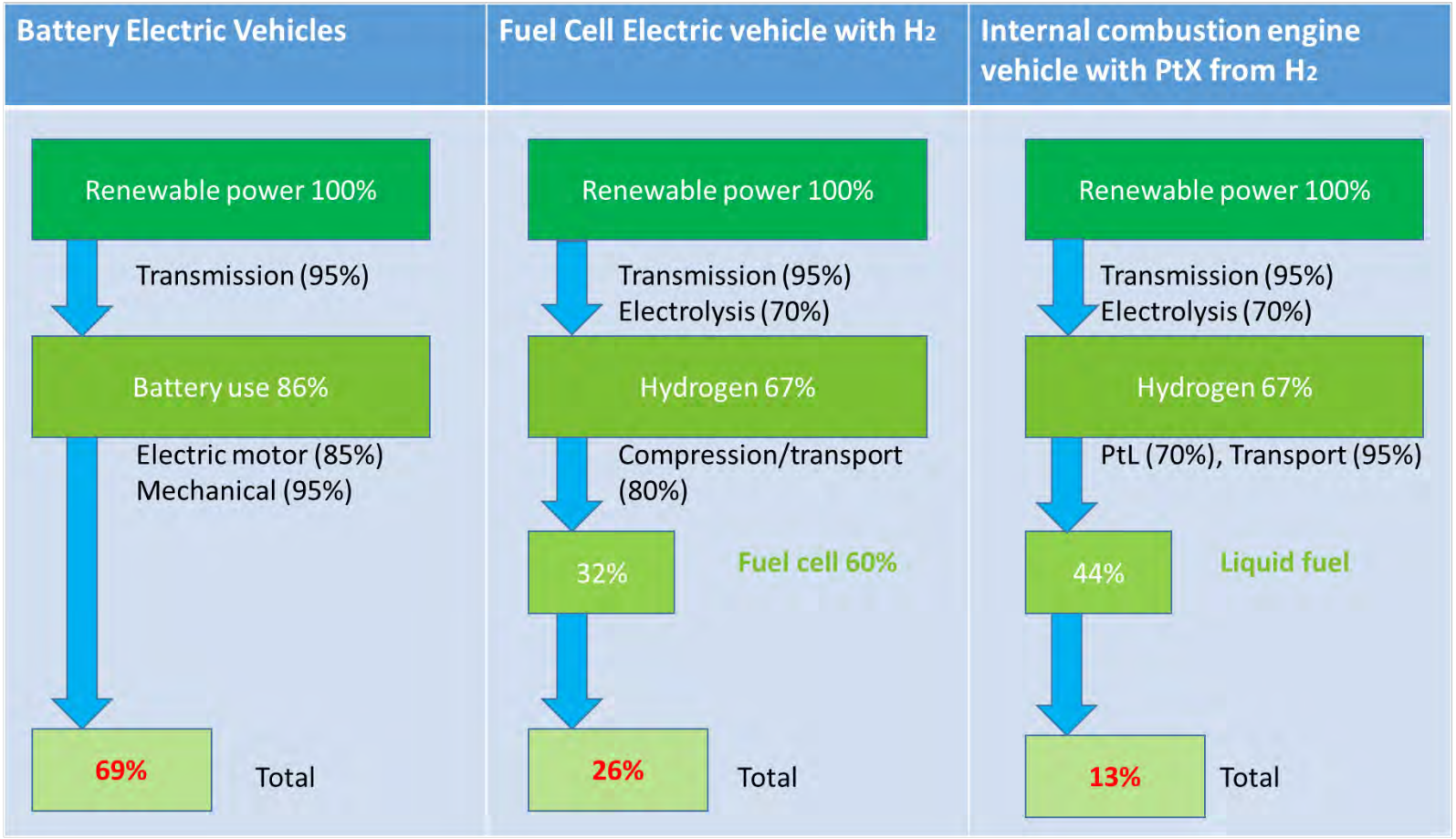


Both vehicles have electric motors

A battery is a device that stores electrical energy in chemical form and converts it into electrical power to drive motor.

A hydrogen fuel cell is an electrochemical device that generates electrical energy through the reaction between hydrogen (stored in a tank) and oxygen. As long as you have access to the hydrogen fuel, you have access to electricity.

Individual and overall efficiencies for cars with different vehicle drive technologies



Showcasing Projects

Green Ammonia Production for export

HIVE COEGA GREEN AMMONIA PROJECT

Hive Energy and Built Africa are developing a $4.6bn Green Ammonia Plant. The plant will have a dedicated power supply at the Coega Special Economic Zone, alongside the Port of Ngqura. The plant will produce approximately 780,000 tons per year of green ammonia for the export market. This project is working together with Cerebos in a mutually beneficial way, which entails Cerebos providing the project with desalinated, demineralized water while the project will supply green energy to Cerebos

Fuel Cell Manufacturing

PROJECT PHOENIX

Mitochondria Energy is planning to build a hydrogen fuel cell manufacturing facility in the Vaal Special Economic Zone (SEZ) in partnership with the IDC, DTIC and DBSA. Mitochondria's plans involve developing manufacturing capacity to build units totaling 250 MW a year, with plans to eventually ramp up to 1 000 MW a year, dependent on demand at the time.

Showcasing Projects

Green Steel Production

AMSA SALDHANA GREEN STEEL PRODUCTION

ArcelorMittal South Africa (AMSA) is investigating the viability of restarting the Saldhana Bay operations to produce green steel with green hydrogen. AMSA plans to be the first African green flat steel producer using green hydrogen by producing direct reduced iron (DRI) via the Midrex facility at its Saldanha Works

Sustainable Aviation Fuel

HYSHIFT SUSTAINABLE AVIATION FUEL IN SECUNDA

Sasol as part of a consortium known as HyShiFT, is developing a sustainable aviation fuel (SAF) project in Secunda. Other partners in the consortium include German-based renewable energy company Enertrag and chemicals company Linde and South African company Hydregen. The project entails using green hydrogen and sustainable carbon to produce SAF for the export market.

21 GH2 projects listed in the JET-IP along the value chain

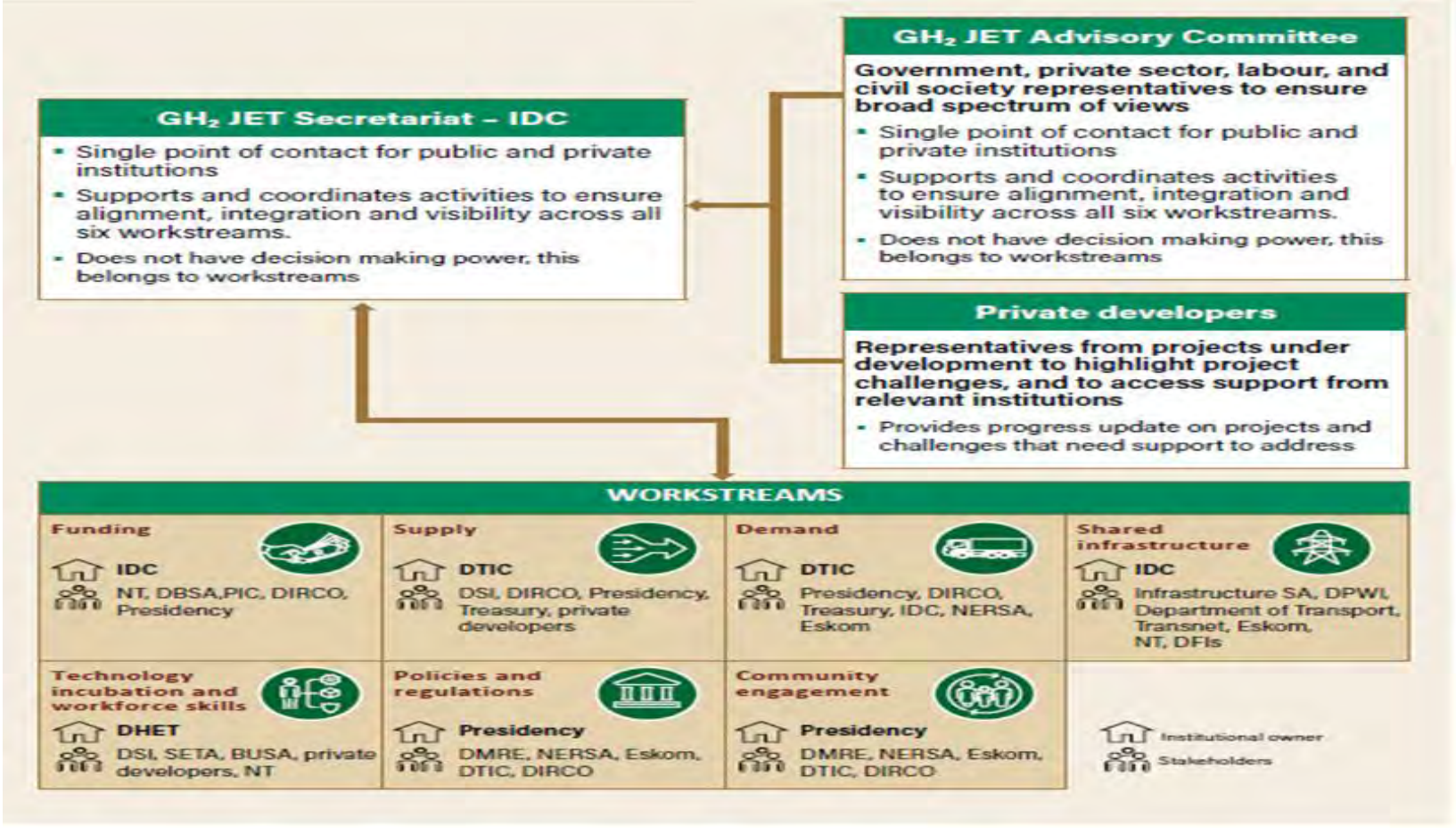
Upstream production	Midstream manufacturing	Downstream applications
1. Prieska Power Reserve green ammonia (NC, *R10bn*) 2. Hive Coega Green Ammonia (EC, *R105bn*) 3. Enertrag Indigen Project (e-methanol) (EC) 4. Enertrag Postmasburg Project. (Ammonia) (NC) 5. Boegoebaai green hydrogen and ammonia production and infrastructure development (NC, *R150bn + R 13bn*) 6. Mainstream green hydrogen (WC) 7. Atlanthia green ammonia (WC) 8. Ubuntu solar and green hydrogen park (NC) 9. Phelan green hydrogen (WC) 10. Sasolburg 60MW green hydrogen production (GP, *R350m*)	11. Project Phoenix Fuel Cell Manufacturing (GP, *R1,2bn*) 12. Isondo Precious Metals (IPM) equipment manufacturing (GP) 13. IPM and NCP hydrogen refueling stations (GP) 14. Care-O-Sene – catalyst for SAF production (MP)	15. HyShift sustainable aviation fuel production (MP, *R8bn*) 16. Project Rhynbow (LP, GP, KZN, *R6,6bn*) 17. SA Hydrogen Valley ((LP, GP, KZN) 18. AMSA Saldhana Steel DRI (WC, *R13,2bn*) 19. Renewstable – hydrogen for baseload electricity (MP) 20. Green hydrogen mobility N7 corridor (WC, NC) 21. Omnia Sasolburg green ammonia and fertilizers (GP)

Showcasing projects' status – Government Gazette List

In December 2022, Minister of Public Works and Infrastructure, gazetted the nine projects that have received Strategic Integrated Projects and are progressing well

No.	Project	Status
1	HySHiFT, sustainable aviation fuel production in Secunda	Successfully progressed to next phase of the H2 Global bidding process
2	Prieska Energy Cluster green ammonia production in the Northern Cape	Feasibility study in progress (2025 commission date)
3	Boegoebaai GH_2 Port in the Northern Cape	Master planning completed and 3 potential port developers announced
4	Ubuntu GH_2 Project in the Northern Cape	Pre-feasibility study completed
5	Atlanthia Green Hydrogen production at Saldhana Bay	Pre-feasibility conducted
6	Upilanga Solar and Green Hydrogen Park in Northern Cape	Bankable Feasibility Study in progress
7	Sasolburg Green Hydrogen Programme in the Free State	Successful production of green hydrogen
8	Hive energy Green Ammonia in Eastern Cape	Pre-feasibility study completed
9	Hydrogen Valley Programme - Limpopo, KZN and Gauteng corridors	Various stages of feasibility, Rhynbow project completed pre-feasibility study

GH_2 JET-IP Governance and Institutional Arrangements Role of dtic, IDC and other departments as per JET-IP



Establishment of Viable Biofuels Value Chain (the case for sugarcane)

On noting that the feedstock protocol for biofuels also recognizes sugar cane among others, the following progress has been made with regards to facilitating the sugar value chain:

The Sustainable Aviation Biofuels Value Chain:

- The Sugar Masterplan (SMP) is charged with the establishment of viable downstream sugar value chain diversification opportunities and unblocking challenges has identified Sustainable Aviation Fuel (SAF) as a viable option.
- SMP has finalised a bankable pre-feasibility for SAF funded by IDC and South African Sugar Association
- A regulatory and certification roadmap is being considered and is expected to be in place by 2027 when the first large scale biofuels is expected to be produced in S.A.
- Boeing has displayed interest as a potential off taker of SAF.
- So, the market for SAF is both local and international.
- However, the current Biofuel Regulatory Framework and the Mandatory regulations do not seem to include SAF (at least not directly).
- As such, this calls for a need to have government rethinking alternative policy and support mechanisms for this emerging environmental good and market segment.

THANK YOU