Regulations, Codes and Standards

in the frame of H2.SA

Promoting the development of a hydrogen economy for South Africa

Presentation at the **NRF-SAASTA HYDROGEN AND FUEL CELL TECHNOLOGY WEBINAR**

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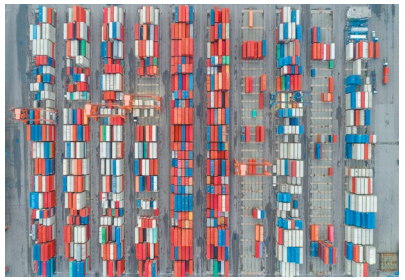
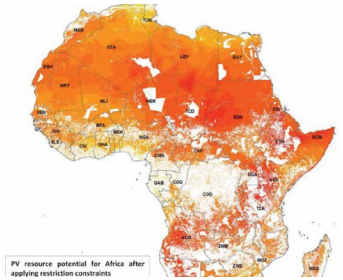
A selection of Rebel H_2 projects

Hydrogen Import Supply Chains

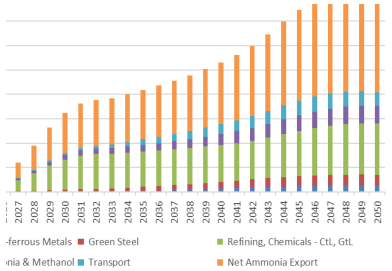


Hydrogen Export

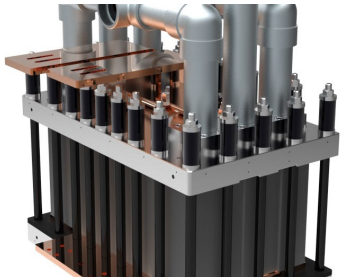


Hydrogen regulations, codes and standards

Hydrogen Economic Impact



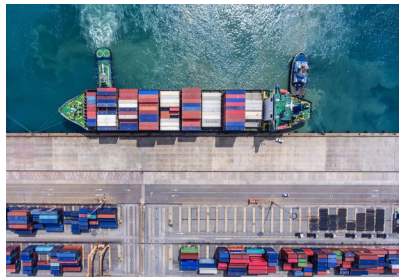
Hydrogen Fuel Cell Industry



Green hydrogen district heating

Hydrogen buses and filling station

Indonesia Hydrogen Fuels for Shipping



Financial advisor for hydrogen production plant

Hydrogen-hub Quick Scan

Solar Farm Voorst

Cabo Verde Solar Investment Program

Citizen Participation Windplanblauw

Red Rock Offshore Wind

Diamer Bhasha Dam

ludwig bölkow systemtechnik

Content

The study was executed within the framework of "Promoting the development of a hydrogen economy for South Africa"

- This study focuses on Regulations, Codes and Standards (RCS) for hydrogen and green H_2 certification
- The approach and methodology consisted of four steps:

A Desktop Study

Reviewing the existing technical regulations, codes and standards (RCS) for production, transport, trade and application in the hydrogen and PtX industry on the international level and on the status quo in South Africa

Stakeholder Interviews

With a range of South African organisations

A Gap analysis

Development of final recommendations

The Desktop Study was conducted using a value chain approach…

	Production	Conditioning	Transport	End Use
Scope of analysis	Hydrogen production ▪ Electrolysis of water ▪ Steam methane reforming	Hydrogen conditioning ▪ Compression ▪ Liquefaction (LH_2) ▪ Hydrogenation (MeOH, LOHC, NH_3)	Hydrogen transport [road, rail, ship] ▪ Compressed gaseous hydrogen trailer ▪ Liquid hydrogen trailer ▪ Hydrogen gas pipeline ▪ Liquid H_2 derivatives transport	H_2 end use ▪ Road vehicles, trains, mining vehicles, etc. ▪ Maritime ships ▪ Aviation ▪ Iron and Steel making
Examples of relevant RCS	ISO 22734:2019 Hydrogen generators using water electrolysis	Machinery Directive 2006/42/EC and standard EN 1012-1	ADR for Europe or globally: UN Model Regulations (dangerous goods transport)	**Road:** UN GTR13 and UN ECE R134 (RSA is signatory to UN1958 & UN1998) **Maritime ship:** IMO **Aviation:** ICAO

...and stakeholder interviews were conducted to validate desktop findings and determine key priorities

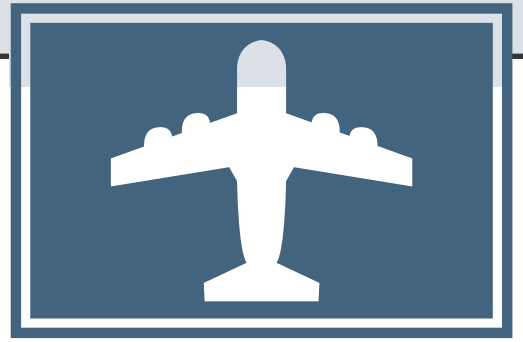
Semi-structured interviews were performed with selected stakeholders covering all relevant stakeholder groups.
Some key insights emerged:

- Regulations, codes and standards have been identified as a key area to develop a green hydrogen economy in RSA
- Hydrogen has been produced in RSA for nearly 60 years and in general RCSs exist within factory battery limits
- However, inadequate RCSs are in place for the distribution, storage and usage of hydrogen outside the factory gates and in newer H_2 applications such as FCEVs and Hydrogen Refuelling Stations (HRSs)
- There is a general view that the development of the green economy in South Africa may be export-led and therefore the certification of green hydrogen and derivatives is a key area to develop and understand

In order to prioritise the recommendations, sample use cases were assessed in view of RCS

1

Sustainable Aviation Fuels (SAF) based on renewable hydrogen



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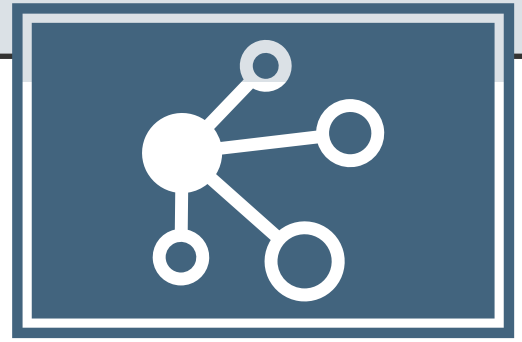
Export of renewable Hydrogen (and Ammonia)



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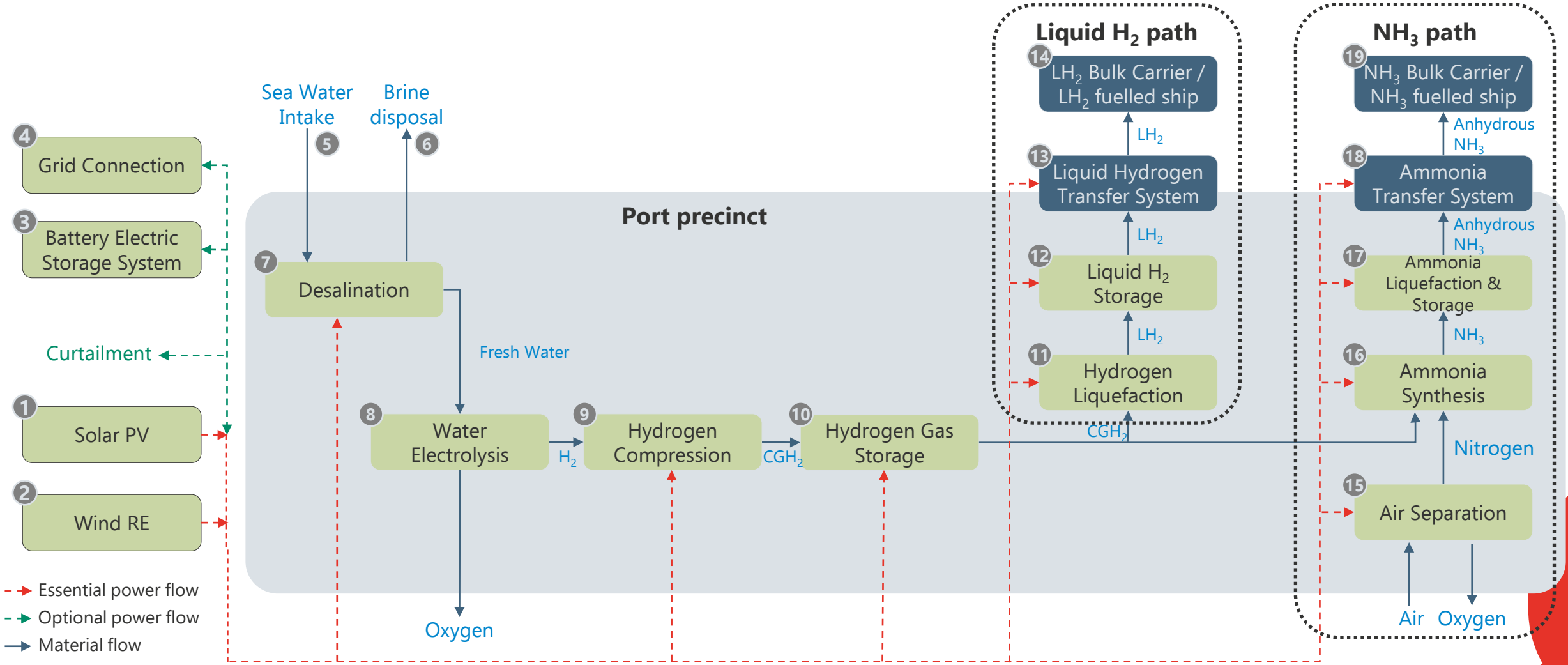
Road Transport

- An approach was suggested of how identified gaps can be bridged or filled, by making use of international technical standards, and certification

Example Use Case: Green liquid H_2/ NH_3 export and shipping fuel process



Example Use Case: RCS for Green H_2/ NH_3/ MeOH export: status quo and gaps

Internationally

Standards: ISO, European and other

- H_2 electrolysis
- H_2 Compression
- H_2 (gaseous) storage
- H_2 Liquefaction
- H_2 (liquid) storage

Regulation

- Country specific permitting for all key processes
- IMO has adopted Resolution MSC.420(97) "Interim Recommendations for Carriage of Liquefied Hydrogen in Bulk".
- IMO IGF code has not yet implemented H_2 for use as propulsion fuel, but is in the process to achieve this.
- MSC 104/15/9: non-mandatory guidelines for safety of ships using ammonia as fuel

South Africa

Standards

- No SANS standards for any H_2 process

Regulation

- Various regulation form the OSH ACT No. 85 of 1993 are applicable including:
  - Hazardous Chemical Substances Regulations, 1995
  - Pressure Equipment Regulations, 2009
  - Construction Regulations, 2014
  - Explosives Regulations, 2003
  - Major Hazard Installation Regulations, 1993
- Gas Act and its regulations exclude H_2 as it is not a hydrocarbon

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Key Findings

International Green H_2 context

- **Various territories** with high renewable energy potential are proactively pursuing **H_2 strategies for own consumption and export,** (e.g. Australia, Chile, Egypt, Morocco, Namibia, Oman, Saudi Arabia, Tunisia, UAE, Ukraine, etc.)
- **South Africa** intends to develop the Green H_2 economy **for domestic use and export**

International progress on RCS across the H_2 value chain and Green H_2 certification

- Internationally, **many relevant standards exist for H_2**, e.g. ISO standards; however, standards work is **underway** in certain areas, e.g. heavy duty H_2 vehicle refuelling protocol to be completed and standardised by ISO 19885-3 end of 2023
- **Green H_2 certification options are available** & applicable to export markets as well as national markets (such as CertifHy™, GH_2, ...)

Status quo in South Africa

- Established RCS for H_2 value chain **inside battery limits**
- RCS **lacking for outside battery limits** and for new technologies or applications
- No Green H_2 Certification
- Hydrogen Society Roadmap highlights **criticality of RCS across the entire H_2 value chain**
- Industry **uptake of Green H_2** is starting

Implications

- A Green H_2 economy **requires a comprehensive approach to RCS** which includes a clear process understanding, and on-going effort to identify and close gaps
- Similarly, **Green H_2 certification** in RSA is **critical for exports of H_2** and downstream products to key markets. Most target markets define requirements ("certification follows the market"). For domestic consumption, international best practice should be followed
- Development of **RCS should be prioritised** based on the use cases; permitting procedures need to be complemented or developed, and step-by-step guidelines provided
- **International RCS and Green H_2 certification initiatives are a global public good** and **RSA should adopt, adapt and contribute** to these initiatives
- Given RSA's distance from international markets, RSA should also focus its attention to Green H_2 derivatives such as Green Steel, Green Cars, etc. Renewable-rich locations such as RSA have **potential for significant competitive advantages on global markets**
- The **required RCS spans multiple government departments' mandates**, buy-in of the departments needs to be enhanced to **take full responsibility** according to the H_2 roadmap. There needs to be **better alignment between the departments** and **strong leadership for coordination and target achievement**
- A **one-stop-shop approach for permitting** should be implemented (e.g. following the principles of "one environmental system" for the mining industry)

Key Recommendations

1. Codes and Standards	▪ SABS should drive a process specifically for hydrogen to address the gaps in the standards landscape
2. Regulations	▪ A **strong coordinator** needs to be appointed for better alignment between the departments & strong leadership for target achievement ▪ The relevant line **departments need to drive processes** to introduce new (or amend existing) regulations ▪ **Regulations shall refer to standards** to the extent possible and suitable in order to make maximum use of expertise in standards ▪ Permitting procedures must be complemented/ developed, **step-by-step guidelines** provided, a **one-stop-shop** approach established
3. Green H_2 certification	▪ Establish understanding of certification requirements in target markets, **select international scheme(s)** satisfying these requirements ▪ Develop **national certification scheme** using internationally recognized methodologies (notably for carbon footprint), or adopt an international scheme as national scheme for H_2 consumed in RSA; define issuing body (South African authority) within national scheme
Recommended overall approach for an agile process for developing the requisite RCS:	▪ RSA to develop **4-6 clusters** where the nascent H_2 ecosystem is nurtured. **International standards** would be applied and where necessary **exemptions** would be granted timeously ▪ After 2-5 years, once RSA has gained the learnings of what worked, and where there are gaps, RSA to **review the international standards for RSA conditions** (while keeping these to a minimum)

Green H_2 certification methodologies and options for implementation for RSA – suggested approach

- In South Africa, sustainability certification of hydrogen (and derivatives: NH_3, methanol, etc.) is not established (yet)
- **Export markets** such as the European Union (RED II) or California (LCFS) have established **requirements** that hydrogen (and derivatives) must fulfil in order to be accepted as "green" (e.g. low carbon footprint, renewable origin, etc.) – also, **certification schemes** are defined. Other future export markets such as Korea, Japan, etc. are currently considering or actively developing such requirements (see next slide).
- Also, independent certification schemes and standards have been developed, or are under development.
- RSA has several **options for implementation; the suggested approach is:**

Establish understanding of certification requirements in **target markets, select international scheme(s)** satisfying these requirements

Develop **national certification scheme** using internationally recognized methodologies (notably for carbon footprint), or adopt an international scheme as national scheme for H_2 consumed in RSA; define issuing body (South African authority) within national scheme

For **SAF (aviation),** CORSIA may provide for short-term incentives; Most downstream green products depend on green H_2 input, yet especially application of SAFs only needs 10% GHG emission reductions → perfect for transition (competitiveness to be confirmed)

- Stakeholders point out that switching to 100% green in one step is a big challenge (see also SAF slides above) ; also, some stakeholders suggest **applying fossil fuels and CCS** (carbon capture & geological storage) for **"low carbon" hydrogen**
- South Africa has gained **experience** in **renewable electricity certification procedures**, which are important for green hydrogen certification, both as conceptual role model, and as essential part of the requirements

H_2 sustainability standards and certification schemes: International overview – national/ regulatory versus independent

EU: H_2 Guarantees of Origin
- Legal basis: RED II art. 19; 2018/21
- National H_2 GO systems under development in some Member States
- CertfiHy established EU-wide

EU: Voluntary Schemes
- Legal basis: RED II art. 25-30; 2018/21
- RFNBOs (H_2, derivatives); incl. imports
- Voluntary schemes (recognition by EC)
- CertifHy to become Voluntary Scheme

California: LCFS
- Established in 2011
- Hydrogen included since 2015
- Including imports

Japan: Guideline
- Published in May 2022
- Focus on blue H_2

UK: Low carbon H_2 standard
- Draft version of 2022

Australia: H_2 Guarantees of Origin
- Under development since 2020

China: H_2 standard
- Established in 2020
- First certification in 2022

Korea: H_2 standard
- Concept presented 2022
- Announced for 2023-25

TÜV SÜD: CMS70
- Established in 2011
- Renewable H_2

CertifHy
- Established in 2019
- Renewable & low carbon H_2

IPHE Working Paper
- Published 2021 (V2 in Dec 2022)
- Renewable & low carbon H_2 (& NH_3)

TÜV Rheinland
- Published in May 2022
- Renewable & low carbon H_2

Bureau Veritas
- Published in May 2022
- Renewable & low carbon H_2

Green Hydrogen Standard
- Published in June 2022 (NH_3 Jan '23)
- Renewable H_2 and green NH_3

I-REC: H_2 code
- Alpha version to be published

H_2 for Net Zero Initiative
- Announced for 2025

Thank you

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