



ERRA Benchmarking Report: Guarantees of Origin & Certification for Hydrogen and Renewable Gases

ERRA Gaseous Fuels Markets and Economic Regulation Committee (GF COM)

Prepared by:
Dr Givi Adamia

Former Secondee of ERRA
Deputy Director of the Legal Department at the Georgian National
Energy and Water Supply Regulatory Commission (GNERC)
Affiliate Assistant Professor of Caucasus University

Agenda of the Presentation

Introduction to the Topic

Hydrogen: A Visionary Energy Solution for Tomorrow

Production of Hydrogen

Logistics of Hydrogen

Understanding Certification for Hydrogen

Key Attributes of Guarantees of Origin (GO)

Conclusion

Discussion

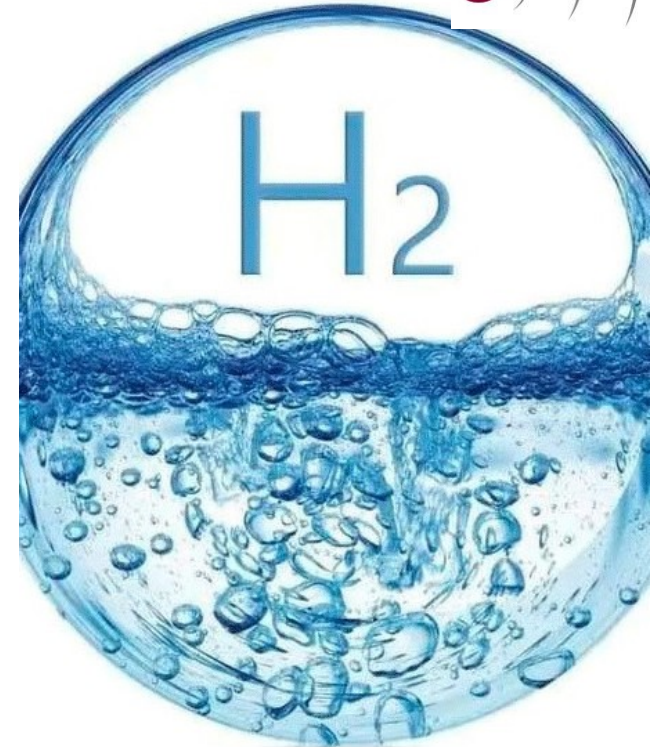


Introduction to the Paper

- **1. The focus of the Paper:**
 - Providing a general overview of hydrogen's role in the energy transition.
 - Exploring the importance of hydrogen certification and Guarantees of Origin (GO).
- **2. Key Objectives:**
 - Highlighting the sustainable potential of hydrogen and renewable gases.
 - Discussing the necessity of a robust certification system for hydrogen.
- **3. Scope of the Paper:**
 - Non-technical Overview: Focusing on policy and certification rather than deep technical details.
 - Covering the fundamentals of hydrogen production, storage, and transportation.
 - Examining key attributes of Guarantees of Origin (GO) for hydrogen.



Hydrogen: A Visionary Energy Solution for Tomorrow



1. Hydrogen's Role in the Energy Transition:

- A clean and sustainable alternative to fossil fuels.
- No greenhouse gas emissions—only water and heat are produced.

2. Key Advantages:

- Environmental Impact: Helps achieve climate neutrality by reducing reliance on fossil fuels.
- Versatility: Can be used across various sectors, including industry, transport, and power generation.

3. Current Global Trends:

- Increasing attention and investment from governments and private sectors.
- EU's proactive stance on developing hydrogen policies to meet climate goals by 2050.

4. Challenges to Overcome:

- Cost of production and infrastructure development.
- Ensuring widespread use of renewable hydrogen rather than "dirty" hydrogen.

Production of Hydrogen



1. Hydrogen's Abundance:

- Hydrogen is one of the most common elements in the universe but is rarely found in pure form on Earth.
- It is typically combined with other elements, such as in water (H_2O) and methane (CH_4).

2. Methods of Hydrogen Production:

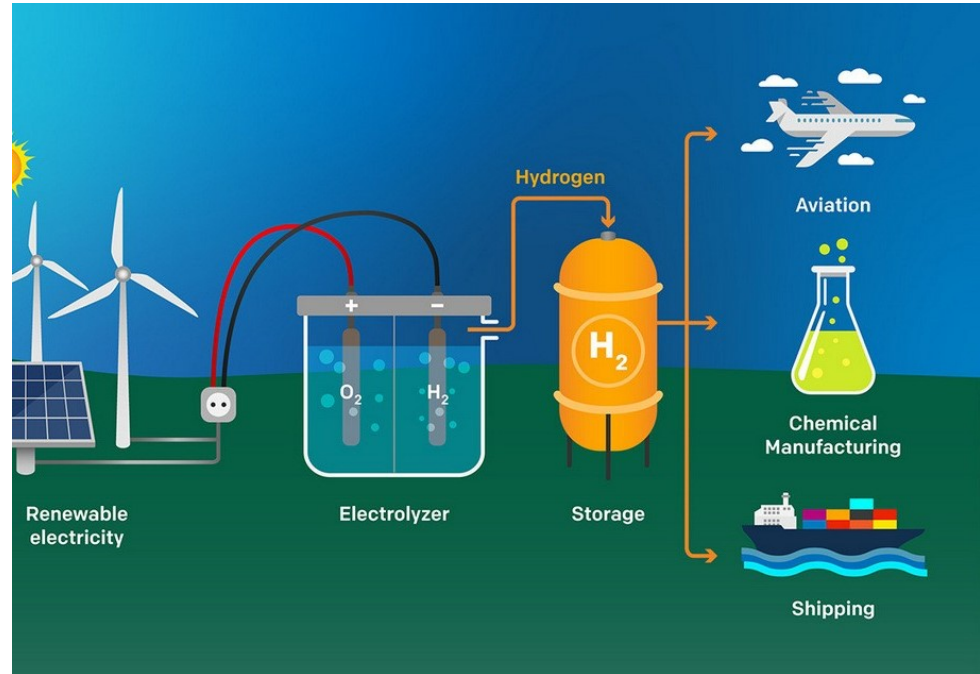
- At least 22 hydrogen production methods exist, 19 directly producing hydrogen and 3 as by-products.
- Fossil Fuel-Based Methods:
 - Steam Methane Reforming (SMR): Most common method, producing "grey" hydrogen with high CO_2 emissions or "blue" hydrogen if CO_2 is captured.
 - Other methods include Partial Oxidation, Autothermal Reforming (ATR), and Gasification.

3. Green Hydrogen Production:

- Water Electrolysis: Uses electricity to split water into hydrogen and oxygen. The sustainability depends on the energy source.
- Electrolysis from renewable energy sources produces green hydrogen; nuclear energy produces low-carbon hydrogen.

4. Key Considerations:

- Environmental Impact: The shift to green hydrogen is essential for reducing greenhouse gas emissions.
- Principle of Additionality: Requires the creation of new renewable energy capacity to ensure true environmental benefits.



"Dirty" vs. "Clean" Hydrogen



"Dirty" Hydrogen:

Grey Hydrogen: Produced primarily via Steam Methane Reforming (SMR), where CO₂ is emitted into the atmosphere.

- ✓ Most common method (96% of global production as of 2021).
- ✓ Cost-effective but associated with significant carbon emissions.

Blue Hydrogen: Similar to grey hydrogen but with CO₂ capture and storage (CCS), reducing emissions.

A step toward cleaner production, but still reliant on fossil fuels.



"Dirty" vs. "Clean" Hydrogen

"Clean" Hydrogen:

Green Hydrogen: Produced via Water Electrolysis using renewable energy sources (wind, solar, hydro).

No CO₂ emissions during production.

Considered the key to achieving carbon neutrality.

Low-Carbon Hydrogen: Produced through electrolysis using nuclear energy or other low-carbon sources.

Lower carbon emissions compared to fossil-fuel-based methods but not fully renewable.



"Dirty" vs. "Clean" Hydrogen

conclusion:

- Transitioning from "dirty" to "clean" hydrogen is essential for reducing global greenhouse gas emissions.
- Green hydrogen, backed by renewable energy, represents the future of sustainable hydrogen production.



The Logistics of Hydrogen



Overview: Effective logistics are crucial for successfully deploying and utilising hydrogen.

- Storage
- transportation

The Logistics of Hydrogen

Storage of Hydrogen:

Methods:

Compressed Hydrogen: Stored at high pressures in cylinders or tanks.

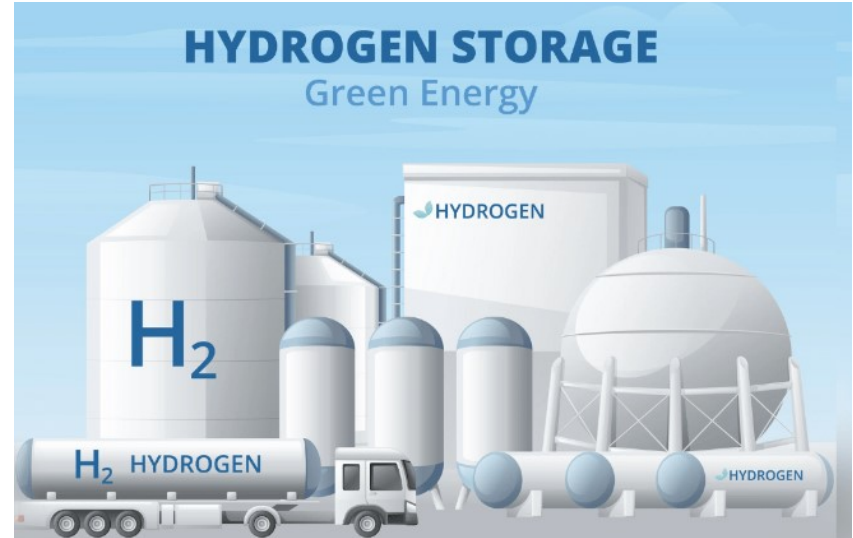
Liquefied Hydrogen: Cooled to extremely low temperatures to become a liquid.

Chemical Storage: Hydrogen is stored in compounds like metal hydrides or ammonia.

Challenges:

High energy requirements for compression and liquefaction.

Safety and material considerations for long-term storage.



The Logistics of Hydrogen



Transportation of Hydrogen:

Modes:

- Pipelines: Dedicated pipelines for continuous, large-scale hydrogen transport.
- Road and Rail: Use of specialized trailers or containers for smaller quantities.
- Ships: Transport of liquefied hydrogen via maritime vessels for international distribution.

Challenges:

- Infrastructure development and maintenance.
- Safety concerns due to hydrogen's flammability and leakage risks.

The Logistics of Hydrogen

conclusion:

- The efficiency of hydrogen logistics impacts its overall feasibility and cost-effectiveness in the energy market.
- Ongoing advancements in storage and transportation technologies are crucial for scaling up hydrogen use.

Understanding Certification for Hydrogen

Key Importance of Certification:

- Ensures **transparency**: Differentiates between “dirty” and “clean” hydrogen.
- Provides **verified information** to consumers about the hydrogen’s origin and production methods.
- Plays a vital role in enabling **sustainable hydrogen markets** by verifying the renewable or low-carbon nature of hydrogen.





Further Importance of Hydrogen Certification

Guarantees of Origin (GOs):

It is essential to **disclose the hydrogen mix** and demonstrate the proportion of green hydrogen in the total supply.

Helps **suppliers and end users** ensure compliance with renewable energy targets and sustainability commitments.

Support Mechanism: Promotes renewable hydrogen production by helping non-subsidized producers gain market credibility.

Critical Attributes of Guarantees of Origin



Traceability:

Key Characteristics of Hydrogen GO:

Ensures detailed information on hydrogen's origin (renewable or non-renewable energy).
Tracks production and delivery, providing transparency in the hydrogen supply chain.

Benefits of Traceability:

Enables consumers to differentiate between green and non-renewable hydrogen.
Supports regulatory compliance for entities using green hydrogen.
Helps producers gain a competitive advantage by highlighting their green hydrogen credentials.
Assesses environmental impact by tracking hydrogen's life cycle and emission savings.

Steps to Ensure Traceability:

Certification confirming renewable nature by recognised bodies.
Detailed records of production, transport, storage, and distribution.
Use of advanced digital platforms to ensure secure and tamper-proof records.
Regular audits by independent third parties for accuracy and reliability.

Critical Attributes of Guarantees of Origin



Tradability:

Definition:

Tradability refers to the buying and selling of hydrogen GOs independently of the physical hydrogen itself.
Enhances flexibility in the hydrogen market, enabling stakeholders to meet regulatory and sustainability commitments.

Key Features of Tradable GOs:

Issued for each unit of hydrogen produced from renewable or low-carbon sources.
Traded like carbon credits or renewable energy certificates on dedicated platforms.
Supported by independent certification bodies that verify production standards.

Benefits of Tradability:

Increases market liquidity by involving a wide range of stakeholders (producers, consumers, investors).
Facilitates price discovery, helping the market value clean hydrogen based on demand.
Provides additional revenue for producers by creating new income streams through GO sales.
Supports regulatory compliance and sustainability goals for companies and governments.

Challenges:

Harmonizing standards across regions and regulatory frameworks.
Developing robust market infrastructure (trading platforms, registry systems).
Integrating hydrogen GOs with other environmental markets (e.g., carbon credits).

Critical Attributes of Guarantees of Origin



Transparency:

Definition:

Transparency is essential for trust, accountability, and informed decision-making in the hydrogen market.

Critical Areas of Transparency:

Production Processes: Disclosing hydrogen production methods (e.g., from wind, solar, or fossil fuels with CCS) ensures understanding of environmental impacts.

Emissions Measurement & Reporting: Transparent reporting on production, storage, and transportation lifecycle emissions enables comparison between hydrogen types.

Cost Structures: Disclosing costs helps stakeholders assess economic feasibility compared to conventional fuels.

Regulatory Compliance:

Clear and concise communication of regulations and safety protocols is a formality and a critical factor in building a secure and confident environment for hydrogen as a safe, sustainable energy carrier.

Public Engagement:

Effective communication and public engagement are not just about disseminating information, but about making stakeholders feel included and valued. This support is crucial for attracting investments and shaping policy development in the hydrogen market.

Data Integrity:

Ensuring reliable, secure data systems prevents unauthorised access and maintains transparency in the hydrogen supply chain.

Critical Attributes of Guarantees of Origin



Credibility:

Foundation of Trust:

Ensures transparency and trustworthiness in the hydrogen market.

Provides assurance to consumers, businesses, and regulatory authorities regarding hydrogen's origin and environmental impact.

Robust Certification Process:

Independent certification bodies conduct audits to verify compliance with environmental standards.

Audits ensure adherence to criteria like renewable energy sources, carbon footprint, and sustainability principles.

Transparency in Issuance and Tracking:

Digital registry systems and clear documentation enable traceability from production to consumption.

Reduces the risk of fraud and misrepresentation.

Consistency and Harmonization:

Standardized issuance and trading criteria ensure uniformity across regions.

Harmonization efforts facilitate international trade and maintain credibility across jurisdictions.

Governance and Oversight:

Regulatory authorities ensure compliance with best practices and industry standards.

Builds confidence among market participants.

Technological Advancements:

Blockchain and digital platforms ensure secure, immutable, and transparent transactions.

Reduces risk of data manipulation and strengthens market integrity.

Conclusion



Key Takeaways:

Hydrogen's Versatility:

A key energy carrier for decarbonising industries, transportation, and residential sectors.
Vital for global climate goals and ensuring energy security.

Transition to Clean Hydrogen:

Moving from "dirty" to clean hydrogen production is essential.
Challenges exist, but renewable energy integration and carbon capture technologies provide solutions.

Infrastructure Needs:

Storage and transportation are critical for the broad adoption of hydrogen.
Infrastructure development is vital for scalability and efficiency.

Guarantees of Origin (GO):

GO frameworks are essential for verifying hydrogen's environmental credentials.
Robust certification, transparency, and credibility are key to building trust and enabling international trade.

Key Attributes for a Hydrogen Market:

Traceability, transparency, and credibility form the core of a functioning hydrogen market.
These attributes promote market liquidity, aid decision-making, and ensure integrity.

The Path Forward:

A sustainable hydrogen economy requires innovation, regulatory clarity, and global cooperation.
Strategic investments across the value chain will unlock hydrogen's potential for economic growth and environmental stewardship.