The World Power-to-X Summit 2020

SESSION 4 IRENA - Collaborative Framework for Green Hydrogen

1 December 2020 • 16:30 – 18:00 CET

Notes and Recommendations

Background

The International Renewable Energy Agency promotes the widespread adoption and sustainable use of all forms of renewable energy in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity. With this aim, IRENA has supported member states that envision the role of green hydrogen in the energy transition as an enabler to integrate higher shares of renewable energy. As a key global facilitator, the Agency disseminates information among relevant stakeholders to inform the debate and contribute towards knowledge exchange and collaboration among Member Countries.

IRENA organised a Ministerial Roundtable on Green Hydrogen at its 10th Assembly in January 2020, where it was mandated by Members to facilitate partnerships and knowledge exchange among Members and the private sector on the topic of green hydrogen. In response to this request, IRENA launched the Collaborative Framework on Green Hydrogen that is being co-facilitated for the first year by the European Commission and Morocco.

The Framework serves as a vehicle for dialogue, cooperation and coordinated action to ensure the continued deployment of hydrogen from renewable sources to benefit the global renewable energy transformation. The Framework is open to collaboration with partner organisations from the public and private sector as well as existing initiatives to leverage synergies and jointly work on addressing gaps.

The Moroccan Research Institute for Solar Energy and New Energies (IRESEN) and the Mohammed VI Polytechnic University (UM6P) co-organised the World PtX Summit 2020 with the goal of triggering high-level discussions and partnerships to enable green hydrogen opportunities. **IRENA was asked by the organisers to host a session to continue the dialogue from the Collaborative Framework, focussing on standards and infrastructure for green hydrogen.** IRENA is uniquely placed, with its global membership and strong partnerships, to map ongoing work in the establishment of the enabling framework for a global green hydrogen market, identify gaps in the areas of standards and infrastructure and work with partner institutions to address them.

The session saw an engaged discussion among prominent international experts, introduced and closed by the co-chairs of the collaborative framework, Morocco and the European Commission. The session was part of a very successful World PtX Summit, with 2,000 attendees from over 70 countries. A number of key points and areas that require further discussion are outlined in this document.

The event can be watched online here and the agenda for the meeting is provided below.

Agenda

Time (CET)	
16:30 – 16:40	Opening Remarks Badr Ikken, Director-General, **IRESEN, Morocco**
16:40 – 17:50	Standards and Infrastructure for Green Hydrogen Setting the scene by Dolf Gielen, Director, **IRENA Innovation and Technology Centre** Panel Discussion moderated by Anne Held, Coordinator of BU Renewable Energies, Fraunhofer ISI **Participants:** • Bernard Gindroz, Chairman, 'Hydrogen in energy systems', **CENELEC** • Laurent Antoni, CEA, Co-Lead of the H2PA Task Force, **IPHE** • Ilaria Conti, Head of Gas, **Florence School of Regulation** • Norbert Schmitz, Managing Director, **ISCC System GmbH** • Roxana Bekemohammadi-Donahue, Executive Director, **Western States Hydrogen Alliance, USA** • Kilian Crone, German Energy Agency, **dena** • Benjamin Maluenda, Ministry of Energy, **Chile**
17:50 – 18:00	Closing Remarks Hans van Steen, Director, **DG Energy, European Commission**

Theme of the session - standards and infrastructure

Hydrogen logistics can be considered similar to those of natural gas, often being transported over long distances and in large quantities and, accordingly, it is essential that international harmonisation of regulations, codes and standards for transport and storage are established to enable a liquid global market. Such a market can leverage the best renewable energy resources in the world to produce competitive green hydrogen at scale.

As hydrogen is a carbon--free energy vector that can be produced directly from coal and gas (with or without CCS), or via electricity of any source (incl. fossil-based), once produced it is very difficult to ascertain its source as well as the emissions associated with its production. For these reasons, monitoring and verification, **international standardisation** for technical integrity and safety, including certification of CO_2 emissions associated with the production and transport of hydrogen using a system such as Guarantees of Origin (GO), are key for an international market to develop.

Standards are also key to enable the use of hydrogen in existing gas **infrastructure,** as well as the development of **new dedicated hydrogen infrastructure** that enables cost-effective logistics and global trade, similar to the current natural gas pipelines and LNG infrastructure. This is a topic that IRENA is planning to further explore, building on the existing body of work on quality infrastructure for renewable energy.

In light of ongoing discussions around the world on taxing carbon embedded in commodities and goods imported and to ensure domestic decarbonisation efforts are not undermined by carbon leakage, it is

important to be able to track green hydrogen not only *per-se* but also in derivative products such as ammonia, e-fuels and commodities such as iron (directly reduced iron produced with green hydrogen).

Standards

IRENA provides support to its member countries on strategies to adopt and implement international standards, test methods and certifications to promote local and global renewable energy technology markets. Analytical work, interactive tools such as INSPIRE, and capacity building activities have been conducted in this field, focused on solar PV and thermal technologies, wind and grid codes. Activities are conducted in partnership with other expert organisations such as:

- International Electro Technical Commission (IEC);
- German Metrology institute (PTB); and
- International Organization for Standardization (ISO) - responsible for the development of international standards in the field of systems and devices for the production, storage, transport, measurement and use of hydrogen. Recently ISO has started work specifically on Electrolysers. CEN/CENELEC has received the mandate in Europe to develop the GO for hydrogen in the regional context.

Guarantees of Origin

The need to certify green hydrogen and commodities arises from the need to value the lower GHG emissions compared to an agreed baseline, or to price the embedded emissions. This enables the creation of a new market where these lower GHG emissions are valued with a higher willingness to pay and being able to justify the higher production cost. This certification also informs end users about the upstream GHG emissions of their feedstock/fuel use. It is also fundamental for global trading where hydrogen (and derivatives) would cross borders.

Existing (and under-development) certification schemes can be used to track and disclose the carbon content of hydrogen and hydrogen-based commodities, some of which are similar to renewable energy certificates or cross-border tax adjustments that have been considered for CO_2-intensive products. Accounting may be simpler where production, trade and end-use constitute a closed system that includes renewable power generation and electrolysis. These can be either consumed on-site (such as for industrial uses like fertiliser production or direct reduction of iron ore) or directly transported to the customer (via ships, pipelines or trucks) and used separately from other, non-green, hydrogen. However, complexity is increased with open systems where electricity is traded via the grid, hydrogen from different sources is blended in a pipeline system or hydrogen-based commodities are also mixed before transport.

To certify that hydrogen is renewable (green), it is necessary to prove that the electricity used to produce it comes from renewable energy. In Europe, the Guarantees of Origin for renewable electricity are an established mechanism to certify the origin in a structured way and provide electricity consumers with the required proof of origin. An extension of this system to hydrogen produced from renewable electricity is an option. Alternatively, a revised system that can address both electricity and gas origin at once is also an option.

To enable trade, GOs for renewable electricity need to be internationally recognised alongside the trade of hydrogen as a commodity. Article 19 of EU Directive 2018/2001 defines the requirements which GOs must meet. In addition, in the European context, GOs for hydrogen are under development by the CertifHy initiative, that aims to disclose information on the hydrogen production method, including energy source

and greenhouse gas intensity. CertifHy is also leading a working group within the (Middle Eastern – Northern African) MENA Hydrogen Alliance to work towards a hydrogen GO scheme for the region that is compatible with the EU GO scheme. A collaboration with the Moroccan Ministry of Energy, Mines and Environment is also being set up to run a pilot cross border GO transaction. There is also collaboration with the hydrogen association in Chile to have similar standards for certification. CertifHy will also provide input to the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) work group on hydrogen certification to ensure a harmonisation between EU and the international methodology being shaped.

The International Sustainability and Carbon Association (ISCC), traditionally focused on bioenergy-derived fuels, has also worked on the topic with hydrogen from non-biological origins. Other initiatives at a national or regional level have also been undertaken in Australia, Portugal, the United Kingdom and the European Union.

The following considerations are recommended for a hydrogen certification scheme:

- There is a need for a GO system that covers all renewable energy sectors (electricity, methane and hydrogen). The reasons include: this leads to the most efficient solution from a systems perspective (the same marginal cost for the renewable energy across sectors); renewable targets for the EU is in final energy consumption without differentiating by sector; and the energy system can be considered from an integrated perspective due to increasing sector integration.
- Consider statutory instead of voluntary participation with market value rather than informative only (in the EU).
- Establish common definitions based on GHG reduction thresholds are required.
- Any certification system must be transparent (with all inputs fully traceable) and simple (it is acknowledged this a challenge, based on experiences with complexities with green electricity).
- Use a robust methodology, developed in a step-by-step procedure.
- Consider the relationship between the importing and exporting countries and influence on each other's implemented system, such as verification.
- Consider minimum and optional criteria and what are non-negotiable criteria/thresholds. The minimum standard could become as the industry develops (like biofuels) to avoid restricting the market too much, but still ensuring sustainability.
- Start with smaller projects and test some initial processes instead of trying to have the entire scheme in place for large projects.

Key outcomes from the Session

Areas identified in the session as requiring further work are captured below.

Renewable content along supply chain

How to ensure the renewable content of the electricity source when the electrolyser is connected to the grid is a current gap. Some options include using the average renewable share in the grid; excluding the grid from the GO scope and only considering electricity as renewable when it is connected directly. In addition, financial support should only be linked to gases with renewable content. A Power Purchase Agreement (PPA) verified by a GO, may be part of the evidence provided for the renewable energy source.

Additional to the proof of the use of a renewable source, other conditions that need to be ensured include:

- The geographical proximity between electricity and hydrogen production means that hydrogen production should not contribute to grid congestion. This can be alleviated by either co-locating the facilities at the same place or expanding the grid by the same capacity as the renewable facility.

- There needs to be a temporal correlation between hydrogen and renewable power production to avoid the case where an electrolyser is operating with fossil-based electricity, which is challenging if the system relies on current renewable electricity GOs.
- Additionality. Any green hydrogen production should ensure that the associated renewable capacity is additional to avoid displacing more efficient uses of existing renewable electricity. Otherwise, the renewable capacity could, for instance, end up being used for green hydrogen instead of displacing fossil-based electricity in the power sector. There is no perfect way to define this additionality since it relies on establishing a counterfactual scenario. The proposal is to use renewable electricity that is built at the same time as hydrogen production and does not receiving any subsidy.

Grid injection

Currently unanswered questions include:

- When should certificates be cancelled? This could be when the blended gas is finally used or when green hydrogen is injected to the grid (in the EU, CEN/CENELEC is working on this).
- How to resolve the issue of different hydrogen blending limits that can be accepted by the gas infrastructure in different part of the gas grid, as well as in different countries, to enable cross-border trade.
- Regulations and technical and safety aspects of to connecting a hydrogen production facility to the gas grid (into both transmission and distribution networks).

Certification

Certification could be conducted following a modular and progressive approach, using certification processes for each part of the value chain (including upstream emissions, transport and end use) and starting from a regional approach and progressing to global.

There are gaps in other areas other than GO, including:

- Permitting when installing hydrogen refueling stations (potential delay, safety requirements);
- Lack of standards for onshore bunkering facilities for ships given that hydrogen and ammonia are not used as shipping fuels today.
- Missing standards for the transport of hydrogen – on ships as new standards are required both for the transport of hydrogen as cargo and for its use as a fuel.

Lessons from electricity and bioenergy

In the EU there is a need for consistency with the electricity GO system; the revision phase of the GO system could be used to extend the system to hydrogen. It is recommended to consider options to adopt the same scheme for issuing and cancelling the certification in both systems.

There is a larger need, compared to electricity, to use the same standards in both exporting and importing countries, given that hydrogen infrastructure will be mostly new. In addition, a lesson from biofuels is the need to instill credibility and convince the public that using hydrogen will not result in significant harm in other parts of the system.

Way forward

Based on the discussion, IRENA recommends the following activities:

1. IRENA to present an overview of the issues from the event at the next Collaborative Framework meeting and consult with participants how to address the different topics.
2. IRENA can bring countries to the conversation that are not currently involved in other multilateral initiatives and for which certification might be relevant, to map ongoing efforts and facilitate the alignment of different certification processes and principles. The objective is to avoid proliferation of incompatible schemes that might prove to be an obstacle to global trade.
3. Discussions in the Collaborative Framework on Green Hydrogen could be extended to parts of the value chain that are currently not covered by other multilateral initiatives. For instance, focus on upstream emissions, midstream transportation, shipping, storage and end use.
4. IRENA can build upon the experience from certification of renewables and relationships with certification organisations to inform the work done by other multilateral initiatives. IRENA can also ensure compatibility with the certification schemes for renewable electricity.

For further information, please contact HydrogenIITC@irena.org