



EU HYDROGEN ONLINE FORUM IN THE UAE HYDROGEN, THE ENERGY CARRIER OF THE FUTURE

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H.E. ANDREA MATTEO FONTANA
**AMBASSADOR OF THE
EUROPEAN UNION TO THE UAE**



H.E. KADRI SIMSON
**EUROPEAN COMMISSIONER
FOR ENERGY**



H.E. SUHAIL AL MAZROUI
**MINISTER FOR ENERGY AND
INFRASTRUCTURE
OF THE UNITED ARAB EMIRATES**



FRANCESCO LA CAMERA
**DIRECTOR-GENERAL
IRENA**



JORGO CHATZIMARKAKIS
**SECRETARY GENERAL
HYDROGEN EUROPE**

**"EU Hydrogen Online Forum in the UAE: Hydrogen,
the Energy Carrier of the Future"**

Summary Report

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Online Forum, Wednesday, 25 November 2020

Summary Report

Renewable hydrogen will play a key role in the context of the energy transition both as a fuel and an energy carrier. Investment in hydrogen will foster sustainable growth, which will be critical for recovery from the COVID-19 crisis.

Governments around the globe are realizing that hydrogen produced from renewable electricity will play an indispensable role in the effort to reach the goals of the Paris Agreement. Hydrogen is a versatile and, in the case of green hydrogen, a climate-neutral energy carrier that can be used to drive down greenhouse gas emissions in sectors that are otherwise difficult to decarbonize.

In this context, a high level "EU Hydrogen Online Forum in the UAE: Hydrogen, the Energy Carrier of the Future" has been organized on 25 November 2020 by the Delegation of the European Union to the United Arab Emirates and the EU-GCC Clean Energy Technology Network.

The online event was joined by approximately 250 participants.

The main aim of Hydrogen Forum was to exchange ideas and bring forward concrete actions to advance the hydrogen agenda in both regions, especially with the aim to create a hydrogen partnership between the regions. High level representatives from leading institutions and companies from the EU and the region including the European Commission, Fuel Cells and Hydrogen Joint Undertaking (FCH JU), Hydrogen Europe, International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE), European Bank for Reconstruction and Development (EBRD), Qamar Energy, ENGIE, FICHTNER and other key actors took part.

Alongside the opening session of the Forum, two technical sessions enriched the programme:

- **Session 1:** Incentives and support programs for renewable hydrogen production and use moderated by Mr. Noe van Hulst, *Chair Elect, IPHE*
- **Session 2:** Storage and Transport of hydrogen and its derivatives moderator by Frank Wouters, *Director, EU GCC Clean energy Technology Network*

Opening Session

H.E. Andrea Matteo Fontana, Ambassador of the European Union to the United Arab Emirates, officially opened the Forum. He declared that the COVID-19 crisis has highlighted the vulnerabilities of our traditional economic model and changed the context for the clean energy transition worldwide. He added that countries can turn the recovery into a once in a lifetime opportunity to build back better. He highlighted that the European Green Deal guides EU green recovery dialogues and cooperation with its partners including the UAE and that through the recovery both regions can press fast forward to the green energy transition and jointly reach the goals of the Paris Agreement and the European Green Deal.

The following speakers then took the floor to welcome participants to the event: **H.E. Kadri Simson**, European Commissioner for Energy, **H.E. Suhail Al Mazroui**, Minister for Energy and Infrastructure of the United Arab Emirates, **Francesco La Camera**, Director-General of the International Renewable Energy Agency (IRENA) and **Jorgo Chatzimarkakis**, Secretary-General of Hydrogen Europe.

H.E. Kadri Simson, EU Commissioner for Energy, noted that Hydrogen is a great opportunity for our economy, for our climate but also for international cooperation.

She added that as the EU is a leading oil and gas importer and If we, the EU, scale up our hydrogen economy, then that demand will by far outweigh our domestic production. H.E also noted that some EU Member States already intend to import green hydrogen to meet that demand. The EU is proposing a global rules space market for hydrogen and at the heart of this market are harmonised safety and environmental standards.

H.E Kadri Simson pointed out that among the regions that have favourable conditions to produce cost-effective hydrogen is the Gulf. The UAE as a regional leader in clean energy is ideally positioned to capitalize on a rapidly expanding renewable hydrogen export market worldwide, which is expected to reach a value of \$300 billion by 2050. The production and export of renewable hydrogen can support the UAE in their goals to push for clean energy and economic diversification, ensuring their strong presence in the energy market. However, for international renewable hydrogen trade to become a reality, remaining obstacles regarding transport and storage technologies, certification schemes, and market design need to be resolved.

H.E. also expressed that in the future such green fuels could be traded in Euro.

During his welcome address, **H.E. Suhail Al Mazroui, Minister for Energy and Infrastructure of the United Arab Emirates** noted that UAE looks at Europe with excitement seeing all of these (hydrogen) projects and plans by the European Union and by several of its allies in Europe and he thought that together they can exchange the learnings and enable large scale projects to contribute to reducing the cost of hydrogen in the future. H.E declared that he is very excited by the recent instruction by H.H. Sheikh Mohamed bin Zayed, Vice chairman of the emirate's Supreme Petroleum Council, Crown

Prince of Abu Dhabi to instruct ADNOC to develop together with the different stakeholders in the country a hydrogen strategy to enable the full potential of hydrogen in the UAE.

From his side, **Francesco La Camera, Director-General of IRENA** stated that an enabling framework will be critical to realise the potential of green hydrogen. He announced the launch of the new IRENA's report "**Green Hydrogen: a Guide to policy making**".

In his presentation, the IRENA's DG highlighted that the key cost driver for green hydrogen is the electricity input of the electrolyser. However, lower investment cost is needed in tandem to achieve competitive green hydrogen. He also added that IRENA sees a lot of promising developments on green hydrogen and emphasized that the EU and the Gulf Cooperation Council are well positioned to move forward with green hydrogen deployment. Mr. Camera concluded that IRENA looks forward to deepening collaboration with the EU and UAE for developing a sustainable energy future, he concluded.

Jorgo Chatzimarkakis, Secretary-General of Hydrogen Europe noted that this forum comes just after the G20 Summit in which Saudi Arabia has announced the transformation of its oil industry to green through the production and usage of green and blue hydrogen. He added that the whole world is moving toward a net zero economy with the adoption of Hydrogen as a new commodity.

He also noted that the EC has had the courage to set a clear target for hydrogen electrolysis, which is 60GW by 2040 and 40GW by 2030, in addition to capacity constructed outside of Europe to be exported to Europe. With this, the EU has developed a green energy strategy based on two legs: (i) the green electricity produced from renewables and (ii) green hydrogen. He emphasised that to reach these goals Europe should replace oil, coal, gas and grey hydrogen by green hydrogen. Also, a certification system for guarantees of origin for the hydrogen is required.

Mr. Jorgo concluded that the EU and the Gulf region have long been engaging a strategic partnership so they can capitalize on it to develop a strong cooperation on green hydrogen.

After the opening session, the Forum's programme featured a high-level roundtable with the participation of above-mentioned speakers. The round table was moderated by **Frank Wouters, Director of the EU GCC Clean Energy Technology Network**.

During the discussion, **H.E. Kadri Simson**, highlighted that Europe is looking to open a competitive market for green hydrogen which will require new and streamlined procedures as well as new standards. She added that this new market should be accessible to all the countries without any discrimination. Countries from Europe have already developed their own H₂ strategies and in addition to domestic production, they are looking to import it from abroad.

H.E Suhail Al Mazroui pointed out that UAE is looking forward to further the cooperation with the EU on several topics related to Hydrogen. Particularly in the field of green hydrogen by using solar energy, improving the production of blue hydrogen,

strengthening cooperation on R&D through joint projects between universities and other scientific institutions and, on the regulatory aspects of hydrogen.

He added that on top of ADNOC, federal and local authorities and other stakeholders including EWEC, AD Power, ADWEA, DEWA, FEWA, Nuclear Power Company, TAQA and the Ministry in charge of energy can be involved in the development of Hydrogen in the UAE and that the ministry can facilitate the access to them.

Francesco La Camera announced that IRENA will publish a new global outlook report in March in which all the figures related to hydrogen costs will be updated. He mentioned that it is necessary to reach a market capacity of 270GW of electrolyzers by 2030 which will require a big effort and a close cooperation between countries. Producers and importers should enjoy the benefits of hydrogen in decarbonizing their economies.

Jorgo Chatzimarkakis added that there is a race towards a competitive H₂ and who would be leading the market in the future. We are looking to the development in China, but Europe is building a strong industry initiative that can keep the leadership for the European H₂ industry and we must keep the pace at this level. He furthermore urged IRENA to update their potential levels for hydrogen, which are among the lowest of all scenarios.

Francesco La Camera said that in their upcoming publications, the potential figures for hydrogen will be updated to reflect recent developments and policy announcements.

Session 1: Incentives and support programs for renewable hydrogen production and use was moderated by **Mr. Noe van Hulst, Chair Elect, IPHE** with the contribution of the following speakers:

- **Robin Mills**, CEO, Qamar Energy
- **Antonio Lopez-Nicolas**, European Commission, DG ENER, Deputy Head of the Renewable Energy Unit
- **Bart Biebuyck**, Executive Director, Fuel Cells and Hydrogen Joint Undertaking

Robin Mills stated in his presentation that the global annual hydrogen export market is projected to reach US\$ 300B by 2050 with a global green demand reaching 530Mt.

MENA has a high export potential due to strategic location high solar radiation, hydrocarbons production, carbon capture potential, and the very low solar LCOEs should enable significantly strong future export demand from the region. Morocco has an advantage due to its proximity to Europe but KSA and UAE also have a big potential.

Early adopters of large-scale PV will become exporters to other countries or regions as well as exporters of green H₂.

The GCC already uses large amounts of grey hydrogen in industry (Refining, Steel, Ammonia, Methanol and GTL).

The UAE has the second largest LNG bunkering hub in the world (Fujairah Terminal) therefore it makes it an ideal location for H₂ export. It is planned to expand its storage by 42 M barrels by 2022.

The lowest cost export option to Europe and elsewhere is ammonia.

Ammonia produced with electrolyzers and ASUs would cost Euro 270-370/tonne to be compared to Euro 300-350/tonne with the SMR process in a study carried out for the Netherlands in 2017.

The policy support in the region is currently limited to R&D with international partners. Individual projects have been initiated in the region particularly in KSA, UAE and Oman.

KSA is building a Green Hydrogen hub in the city of NEOM. Oman is developing a 500 MW green H₂ plant in the port of Duqm for export and green Ammonia with the Belgian firm DEME Concessions. UAE is looking to developing H₂ transport solutions (Hydrogen bus pilot and hydrogen FCEVs).

EU Border Carbon Taxation could be a novel opportunity to introduce carbon pricing in MENA (particularly UAE) as it can support concerned uptake of hydrogen from clean sources. The current EU ETS trading is 25 Euros/tCO₂e which is roughly equivalent to AED 0.25 carbon tax per liter of petrol burned.

Antonio Lopez-Nicolas: The EU is looking for H₂ as a part of a bigger picture/project to achieve climate neutrality particularly for the energy system which represent 75% of the mix. This is what we called the energy system integration. This vision is set up together with renewables, energy efficiency, and direct electrification of some end users sectors

H₂ should play a key role to decarbonise sectors such transport and industry which would be essential to drive forward the decarbonization of the whole economy.

The EC is looking to a range of policies across the board looking at investment policy, demand and supply balancing, enabling elements for market and infrastructure, the role R&D and of course international cooperation has important role to play.

Currently, the EC is developing a set of policies: legislation reviews, infrastructure regulations, RE Directive, Gas Legislative framework, emission trading scheme, energy taxation directive which will be adopted in the next few months.

In addition, we are looking to the terminology and certification issues in order to set up a clear certification system for RE and low carbon fuels. So, transparency is key to build confidence in the H₂ market products.

On the other hand, we are going to develop supportive frameworks among them we can cite the EU funding for Technology& Innovation, quotas in end user sectors to promote Green H₂

The ultimate aim is to create liquid H₂ market places/hubs through direct market base support schemes including competitive tenders.

Bart Biebuyck highlighted that the EC is a very important partner for us as they are putting the money on the table. Today we have 263 projects funded for a budget of €985 million and by end of this year other 23 projects will be added to cross the barrier of €1 billion.

PPP are also important elements for funding projects, so in total €2 billion have been spent in all these projects.

Europe is the world leader in the electrolyser industry. Many projects have been built starting with the 150 KW in Belgium ten years ago and now in Nederland with a 20 MW capacity among others. Recently the EC, in the framework of EU Green Deal, has launched a 100 MW Electrolyser call for proposal.

Also, it is worth mentioning that certification of H₂ is very important. In this context we have created a pilot initiative to develop Guarantee of Origin certification, almost 7000 GO are being registered in the system. The next step will focus on rolling out this platform in the 27 EU member countries while we have created a task force on H₂ production analysis methodology. These two actions are crucial to unlock future cross border trading. We would be more than happy to share experiences with UAE.

On the other hand, we are pushing to have more hydrogen valleys and we have received the full support from the EC to speed up this initiative. There is a hope to build the first Hydrogen city in Europe in the near future.

International cooperation is also key for this reason we have developed the Hydrogen Valley Platform for the world. The UAE is invited to join if it wishes so.

We are witnessing the development of many projects in transport particularly for buses, heavy trucks, fueling stations, and ships while we have started thinking to some ideas/projects in Aviation for the future.

Invited to join the panel, **Cornelius Matthes** from Dii Desert Energy pointed out that international cooperation is key for developing a green hydrogen market. In this context, Dii has initiated the MENA Hydrogen Alliance which aims to bring together private and public sector actors and academia to kick-start a hydrogen economy in the region and to develop local value chains for green molecules. He added that there is a lack of knowledge on the H₂ potential which could be easily tackled with training and dedicated seminars. He added that commercial business cases such as the NEOM initiative in KSA should be duplicated and promoted in the region. Also, the certification process should be intensified to cover the maximum of countries. The same efforts should be made for cost reduction.

Regarding the cooperation between the EU and UAE/GCC, **Robin Mills** recommended scaling up the NEOM initiative particularly for boosting the electrolysers industry. Also, he called for an open dialogue between the key stakeholders from both sides. He added that policy support, specific regulations and economic incentives should be developed to create a sustainable low carbon H₂ market.

From his side, **Antonio Lopez-Nicolas** called for setting a stable regulatory framework for cooperation including the certification process. He added that as the cost of green H₂ is linked to the RE electricity cost it is obvious that the UAE/GCC region has a great economic advantage in producing cheap green H₂. The EU has developed many cooperation instruments such the Horizon 2020 which is open to regional partners.

Bart Biebuyck briefly recommended that for strengthening the cooperation between the EU and UAE/GCC it is important to start developing joint projects. That will allow both sides to learn from each other including how to deal with the certification system.

Session 2: Storage and Transport of hydrogen and its derivatives was moderated by **Frank Wouters, Director, EU GCC Clean energy Technology Network** with the contribution of the following speakers:

- **Florian Klumpp**, EU GCC Clean Energy Technology Network - FICHTNER
- **Christophe Comte**, ENGIE
- **Gabriel de Lastours**, Regional Head of Energy in the Southern and Eastern Mediterranean, EBRD

Florian Klumpp in his presentation stated that Germany and the EU will continue to rely on importing a huge amount of hydrogen and GCC could become a potential exporter.

Florian introduced Fichtner as a consulting company which forms part of the EU GCC Clean Energy Technology Consortium. Fichtner is working in all areas of the hydrogen value chain and is actively contributing to the sector's development.

He added that Germany in the framework of its Hydrogen Strategy is clearly engaged in its Climate Change fight (climate targets for 2030 and its GHG neutrality target for 2050) and will continue to import much of its green energy from abroad through the intensification of international cooperation and partnerships on hydrogen.

He mentioned that there is market movement across the world regarding the production and import-export of hydrogen as a commodity including Germany, Netherlands, Australia, Chile, Russia.. etc.

The same in the GCC, recently KSA has announced its commitment to hydrogen as a new oil. Similarly, UAE is revising its energy strategy to embrace hydrogen as an affordable and competitive commodity.

UAE and Middle East as potential exporters of green hydrogen have many assets and competitive advantages:

- Very low generation cost of electricity from renewable sources therefore, green hydrogen generated in Middle East is very cost competitive (The hydrogen produced in the GCC will be 25% less expensive in comparison with Germany);

- Transport cost for H₂ is relevant for economically viable export and therefore for sustainable energy partnerships.

Transport is considered as an enabler for value chains and an energy partnership. There are 4 main transport options: (i) CH₂ Compressed hydrogen (ii) LH₂ Liquefied hydrogen (iii) Methanol (MeOH) (iv) Ammonia (NH₃).

Transport is also considered as an enabler for value chains and an energy partnership. For an analysis of costs of supplied hydrogen with a demand of 700,000 t/y, from Brazil to the NL it has been demonstrated that costs of transport are in the same range for Ammonia, MCH and LH₂ while the composition of cost is very diverse for the four transport options indicated above.

Similar analysis has been performed with hydrogen imported from different countries to the Netherlands as an importer. It has been shown that there is no significant advantage of countries closer to EU compared to Middle East as the price is relatively constant (total cost of green H₂: Approx. 3-3,5 EUR/kg).

Florian concluded his presentation with the following key messages:

- Germany and the EU: will keep on importing energy from outside Europe, also in the future when these fuels are green. Significant imports of green hydrogen are expected (clear political goal);
- Middle East: export of green hydrogen competitive (approx. 3-3,5 EUR/kg, including costs of transport) against green hydrogen produced within e. g. Germany. Key reasons: inexpensive green power from renewable energies;
- Transport of H₂: Enabler for viable value chains (export) and an energy partnership between GCC and EU. Different transport options and technologies available (cost of transport approx. 1,2-2 EUR/kg).

Christophe Comte underlined that Engie's vision is threefold:

- Hydrogen is seen, as the missing link that will produce a completely decarbonized world;
- Hydrogen solves the problem of how to deal with variable renewable energy because it can be stored and transported over long periods of time;
- Engie is positioned at the heart of this global transformation, providing hydrogen-based solutions powered by renewables to develop carbon-free ecosystems around the world.

In this context, Engie is supporting the emergence of a global hydrogen economy by considering the following step by step process:

- Target right geographies with competitive renewable energy, supportive policies and local ENGIE presence;
- Anchor large-scale off takers through customer solutions in energy-intensive industries such as mining, ammonia, steel, refinery;

- Develop domestic hubs with multi usages, aggregating other end uses: electricity, heavy-duty mobility, process, storage, etc., to increase the value of the solution;
- Replicate the solution and leverage existing assets in storage & pipeline. In the long run, develop international hubs and export green energy to regions with limited RES potential.

On the other hand, he informed that for decarbonization a mass power transportation and more storage is needed thus early hydrogen adopters have a vital role to play for scaling up the market and cost reduction. Though, we need to have more renewables to produce more green Hydrogen,

Regarding the future hydrogen market and on the basis of the Hydrogen Council outlook performed in 2017, Hydrogen could reach 550Mtpa by 2050. That represents a market for hydrogen and hydrogen technologies with revenues of more than \$2.5 trillion per year, and jobs for more than 30 million people globally.

Concerning the storage and transportation in export – from GCC to Europe (Marseille) and Japan (Osaka)-, analysis shown that for the year 2030 and the four (4) value chain LH2, NH3, SM and MeOH, midstream transport costs have a small impact on LCOE of less than 10% but terminalling and conversion are significantly higher.

He added that the green Hydrogen market will also be won in the supply chain and by the mastering of the ammonia cracking in export destinations.

For the inland transportation, a pan-EU hydrogen infrastructure is stretching into all directions with a length of almost 23,000 km. The backbone will consist of 75% retrofitted pipelines, with diameters ranging from 24-48 inch, providing 3-13 GW_{LHV} transport capacity per pipeline. Combined with a fit-for-purpose compression system, the backbone should be able to meet currently expected annual hydrogen flows in Europe by 2040. The European Hydrogen Backbone will enable connection to global hydrogen flows, including North Africa, the North Sea (UK and Norway) possibly Ukraine and Russia.

Gabriel de Lastours stated that EBRD considers hydrogen as an essential industrial feedstock and a promising decarbonised energy vector. But it requires integration and resilience of decarbonised energy systems with transport and storage.

Supporting hydrogen is in line with EBRD's 2018 Energy Sector Strategy and 2020 Green Economy Transition GET 2.1. But implementation should reflect countries' conditions/circumstances.

He added that the 2020-2050 global demand and supply outlook in a Paris Aligned scenario (adapted from ETC 2020, SNAM 2020, IEA 2020) shown that the hydrogen market will reach 800 Mt/year with a mix between green and blue hydrogen and small portion of grey hydrogen. While the demand will be quasi-equally distributed between the transport, industry and building sectors.

The evolution of hydrogen demand uptake will most probably follow the following pathway:

Phase 1 (2020) – early movers: with promoting R&D funding, national/regional subsidies and climate/concessional finance

Phase 2 (2030-2040)– industrial clusters: with the adoption of carbon pricing, industrial decarbonisation policy, green product mandates (e.g.transport emission standards, steel, cement, fertilizers) and blending mandates

Phase 3 (2050)– hydrogen networks: by the adoption of Zero-carbon regulations an sector standards, globalization of the carbon pricing and carbon border adjustments.

In regard to the Hydrogen production cost (excluding transportation, storage, distribution), it was shown that in the South East of the Mediterranean region the cost could reach \$15-20/GJ with a solar PV PPA (EPV: 25 \$/MWh). In Est of Europe, it will cost around \$30-35/GJ with a wind PPA (Ewind: 50 \$/MWh).

He concluded that EBRD is willing to support:

- Close cooperation with institutional partners and technology leaders;
- Country/sector roadmaps for decarbonised fuels targets;
- Technical assistance for hydrogen-proofing of gas infrastructure and projects origination;
- Policy dialogue on market creation and enabling regulations;
- Climate finance and blended finance for early movers.

Annex: [Forum agenda](#)