Event summary by CECP-project

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First EU-India Green Hydrogen Forum

The European Commissioner for Energy, H.E. Ms. Kadri Simson, visited India on 7th and 8th September 2022. The Commissioner's visit to India aimed at giving a further boost to the EU-India clean energy and climate dialogue, which has been intensified since the adoption of the EU- India Clean Energy and Climate Partnership (CECP) in 2016. The cooperation with India in the area of the clean energy transition and the implementation of the Paris Agreement is a key priority for the European Union (EU).

On 8th September 2022, H.E. Ms. Simson opened the First EU-India Green Hydrogen Forum, together with H.E. Mr. R.K. Singh, Hon'ble Minister of Power and New and Renewable Energy, Government of India. This new forum was agreed between the EU and India in the Energy Panel on 1st December 2021. The event was co-organized by the EU and the Ministry of New and Renewable Energy (MNRE), Government of India, in close cooperation with the Confederation of Indian Industry (CII) and Hydrogen Europe. In the event high-level speakers from Europe and India discussed policies and the regulatory framework to promote the production and use of hydrogen in the EU and India. Further, international trade of hydrogen and the state of play of existing and upcoming hydrogen projects in the EU and India and ways to create and finance a pipeline of projects in India.

The event was attended by 150+ participants from the EU, EU Member States, Minister of Power, MNRE, Hydrogen Europe, Solar Energy Corporation of India (SECI), International Renewable Energy Agency (IRENA), various financial institutions, research bodies, academia, not for profit, etc. This was followed by business to business (B2B) networking between EU and Indian companies.

1.1. Inaugural session - policy and regulation to promote production and uptake of hydrogen in the EU and India

Mr. Indu Shekhar Chaturvedi, Secretary, MNRE welcomed the dignitaries, speakers and participants and highlighted that the green hydrogen forum is an important step towards EU-India cooperation on green hydrogen. Green hydrogen has immense promise for the world's decarbonization efforts and it is for this reason that several major economies have formulated ambitious plans and strategies. At present, hydrogen produced from electrolysis represents only a tiny fraction of the 75 million tons of hydrogen consumed annually. IRENA estimates that by 2030, the total hydrogen demand will grow to over 200 million tons with electrolysis contributing to over 80 million tons. To enable this, the installed electrolyser capacity will also have to increase considerably.

EU-India cooperation is important for progressing in all these areas and there is a need to work closely on harmonization of standards. There are two major challenges:

- The rapid building of infrastructure that would be required for use and trade of green hydrogen,
- Financing untested technologies making it difficult to raise competitive capital for green hydrogen and green ammonia.

H.E. Ms. Kadri Simson, European Commissioner for Energy addressed the First EU-India Green Hydrogen forum considering it to be a milestone in the development of a strong co-operation on green hydrogen between EU and India. Solar and hydrogen energy are both game changers for the energy transition. The global energy system has been impacted by the Russian invasion of Ukraine. It demonstrated that the EU cannot rely on Russia as their partner in energy. The clean transition is a strategic investment in energy security because any additional energy EU generates from solar, wind, hydropower or biomass means less dependence on fossil fuels. Also, India and EU both have targets to achieve net zero, i.e. by 2050 for EU and by 2070 for India and to achieve this, both are on the way towards more sustainable energy sources. Two years ago, the EU published the European hydrogen strategy, with a goal of 10

million tons of hydrogen by 2030. To ramp up EU's efforts on hydrogen, the EU came out with "RE-power EU" plan. To become fully independent from Russian fossil fuels, there needs to be 45% renewable energy in energy mix for EU by 2030. This is significantly more than the current agreed target of 32% and includes an additional 10 million tons of renewable hydrogen bringing the goal to 20 million by 2030.

There are pending investments in the range of 320 to 460 billion euros to cover all parts of the value chain- renewable electricity production, electrolyser, hydrogen transfer, storage and distribution funds. To achieve this, strong international cooperation must be the way forward for a number of reasons:

- To develop a global hydrogen market including harmonized safety and environmental standards, there is a need to set up a framework bilaterally with partners like India;
- Operating across the globe that also means a collective effort to help the transition in partner countries;
- Trade cooperation.

H.E. Mr. R.K. Singh, Minister of Power and New and Renewable Energy, Government of India, stated that India is increasing manufacturing capacities of green hydrogen and there is a huge opportunity for the EU to get supplies of green hydrogen from India at competitive prices (compared to China) which could also help it to diversify its energy sourcing. India will produce large quantities of green hydrogen at the lowest price and will need electrolysers for producing 50GW hydrogen initially. India has a transparent bid system, dispute resolution mechanism which has encouraged key funds globally to invest here. He urged the EU representatives to have an open market competition and also shared that the current 4 GW manufacturing capacity of electrolysers is not sufficient in the world. Since the electrolyser is expensive and it cannot be used for just one shift, it is advisable to use it for two or three shifts. This indicates need for round the clock green power, where energy storage will play a key role. It should also be considered that hydrogen is not viable for storage as on conversion from electricity to green hydrogen, the energy loss is 30 percent. He mentioned that hydrogen may not be viable for transport, except for long-range heavy duty transport vehicles.

He also discussed the policy of offshore wind energy touching upon the parameters for bids for offshore, providing free transmission lines for offshore wind and the plan to collect pooled electricity from offshore wind energy projects.

1.2. Session 2 - special addresses Indian and European Industry

Mr. Vineet Mittal, Co-Chair, CII Renewable Energy Council and Chairman Avaada Group, thanked the dignitaries. He reflected that green transition is a matter of faith and from an Indian context, the government is not only coming out with a mandatory requirement to have the green hydrogen purchase obligation on industries like city gas distribution, oil and gas, fertilizer, steel, etc, but also consolidating the demand and coming out with standard bidding guidelines and purchase agreements through SECI. The industries can sign green hydrogen contracts with a state-owned entity which is bankable, making it lucrative for bankers to fund and for investors to invest. He also said that India should not be dependent on only one country for their raw material and resources supply. To reach the goal of 20 million renewable hydrogen by 2030, the EU needs to have some relaxations on the green hydrogen policy. He also urged EU to partner with India bilaterally for a 10-million-ton contract at fixed price which will translate into 50 million ton of green ammonia and may provide 25 years of stability.

Mr. Jorgo Chatzimarkakis, CEO, Hydrogen Europe said that the EU is working on hydrogen strategy and green deal for which the COVID-19 pandemic and Russia-Ukraine war acted as a catalyst. Since, this is an emerging area, and EU needs 20 million tonnes of green hydrogen by 2030, they should not limit to one

particular technology to produce green hydrogen. He invited Indian participation in the electrolyser production as India is the biggest steel producing country in the world. He said that hydrogen adds a big element of geopolitics into the game and recommended to read the book "hydrogen is the new oil".

1.3. Session 3 - International trade in hydrogen: prospects and needs for certification of green hydrogen (Moderator: Ms Sonja van Renssen, Editor-in-Chief, Energy Monitor)

Mr. Herib Blanco, IRENA delivered a presentation on prospects for international trade in hydrogen. He mentioned that hydrogen can be carried in multiple forms such as liquid hydrogen, through ammonia and liquid organic hydrogen carriers or pipelines and for each of these, there is a need to produce hydrogen, reconvert it to carrier and the again convert to hydrogen. Each conversion step leads to additional energy losses and additional cost. Hydrogen can be converted to other carriers such as ammonia, methanol, steel and synthetic fuels and an advantage of that is that the transport cost of those commodities is lower, more cost effective and there is no need to reconvert it to hydrogen.

The other key message he gave was that over a period of time, importers will have multiple choices at a narrow cost range and therefore the trade flows will be largely defined by the geopolitical factors such as bilateral relationships, status of the exporting country, level of policy support, etc.

Ms. Daria Nochevnik, Director Policy and Partnerships, Hydrogen Council spoke about the topic "Towards robust tradeable certification systems for hydrogen". She started by discussing the hydrogen sustainability program, challenges and mitigation measures for hydrogen certification.
The typical challenges include:

- Divergence between purposes of certification system;
- Market fragmentation;
- Lack of fungibility of certificates/barriers to cross border trade.

The mitigation measures include:

- Capturing the learnings, standards, certification systems and policies;
- Identification of criteria for mutual recognition/fungibility;
- Roadmap and checklist for certification systems.

She highlighted that the hydrogen council is working towards an International Organization for Standardization (ISO) standard methodology for assessment of greenhouse gas (GHG) emissions of hydrogen and is helping to foster cross-border cooperation between the relevant governments and international organizations to make sure that they move towards mutual recognition and provide solutions for mutual recognition between those schemes to foster the development of global cross-border markets for hydrogen.

High level panel discussion (Moderator: Ms Sonja van Renssen, Editor-in-Chief, Energy Monitor)

Question: Europe wants to import a lot of hydrogen assuming the regulations allow it to do so. What potential do you see for green hydrogen coming into Antwerp and basically as a port how ready are you for this?

Response: Mr Daljit Singh Kohli, India Representative, Port of Antwerp-Bruges said that Europe will definitely be importing a lot of green hydrogen and Antwerp is one of the largest ports in Europe and has a very big chemical cluster that will capture around 50 percent of the carbon dioxide which will be

stored and again reused to produce methanol. The production of green hydrogen at the port can produce ~350 tons of green hydrogen every day. The port aims at forming a coalition with industry players to import green hydrogen molecules from countries which have abundance of sunlight and wind energy.

Question: How are you going to deliver 10 million tonnes of hydrogen to Europe by 2030?

Response: Mr Vineet Mittal, Co-Chair, CII Renewable Energy Council and Chairman Avaada Group, mentioned that it will be possible through India's vision of being energy independent. Another contributor would be India's location where the Thar desert alone can power the entire South Asia through solar and if the grid was connected with other neighbouring nations then along with wind, renewable energy could have contributed 15 – 16 hours of daily supply. Avaada's location of green ammonia manufacturing plant can ship large capacities through sea itself. India has a large grid and the peaking power requirements can be easily met through solar and wind hybrid. India can provide EU the stable price for next 25 years because cost structure is frozen on day one and the stable policy along with the interstate transmission system and banking facilities acts as a boon to the whole sector, not just to Indian buyers but to the European buyers.

Question: What potential supply and demand do you see for green hydrogen imports into Europe from India?

Response: Mr Tapas Kapadia, CEO, RWEST India said that India has all the potential and resources, but there is lot to be done to reach fixed price contract for 25 years.

Question: How are you going to ensure hydrogen certification will count as green for Europe and how optimistic are you about the certification initiatives?

Response: Mr Rajat Seksaria, CEO, ACME replied that the reasons for limited traction on ground for real projects is the element of technical certification, the technology and getting the commercial model right. The market is now accepting the fixed pricing for 25 years over market pricing or spot pricing a year back. He also said that regulation is a key parameter and there is a need to have the particular benchmarks to be set.

Question: How important is green hydrogen certification for you to grow your business?

Response: Mr Roeland Baan, CEO, Topsoe mentioned that countries can make choices whether they want to go for totally zero carbon or for low carbon as what is accessible and affordable for them. The second thing is that a lot of the hydrogen will be produced where there is an abundance of cheap renewable power. Currently, hydrogen itself as a traded commodity globally is going to be a huge challenge and drawbacks are enormous such as the technology and infrastructure are missing. Hence, hydrogen will be traded as a derivative - specifically ammonia as well as methanol. Also, it makes more sense for India to produce added value products with low carbon solutions in order to be much more competitive in the western markets.

Question: Is there going to be scope for exports from India and can certification help?

Response: Mr. Vikram Kapur, Chief Growth Officer, Renew Power said that outside of China, Asia's largest renewable energy company is Renew Power in terms of operating capacity. India has all the potential to produce and export green hydrogen such as:

- 20 million tons of green hydrogen will require ~400 to 500 GW of renewable energy capacity to be built that requires an existing ecosystem, contractors, planners, laborers, etc. It takes a decade to build what India already has;
- India is going to be the module supplier in near future due to favourable government policies;
- India has 200 GW of grid that allows to produce the green electron in the most efficient region of the country and then transport in a very environmentally friendly way.

Q: What's scope do you see for cooperation on standards between India and the EU?

A: Mr Rajeev Sharma, DDG, Bureau of Indian standards said that the government is going to spend around three thousand crore rupees on green hydrogen project. Bureau of Indian Standards (BIS) in the year 2002 had formulated standard on hydrogen fuel- for example liquid hydrogen fuel, hydrogen fuel quality, product specification, standards for the vehicles for various kinds of components such as pressure regulators, valve pressure regulating devices and so on. EU and India may come on a single platform for a single standard for the entire world to follow so that the aim and the purpose and the climate change is addressed.

1.4. Session 4 - State of play of existing and upcoming hydrogen projects in the EU and India - creating and financing a pipeline in India (Moderator: Ms Shuva Raha, Head - New Initiatives, Council on Energy, Environment and Water (CEEW))

Mr Bart Biebuyck, Executive Director, Clean Hydrogen Partnership, expressed that he is impressed by the developments in this sector and pleased to hear the openness of India to work with Europe. There is still a need to do research and drive down the cost of this technology to make sure that this technology is competitive with the fossil fuel industry. Clean hydrogen partnership has three main partners:

- Hydrogen Europe-Industry members;
- Hydrogen Europe-Research community;
- European Commission.

The research community is focusing on three main points in the hydrogen production:

- Infrastructure;
- Distribution;
- Storage.

Europe today has about 56 hydrogen valleys identified, out of which there are around 14 hydrogen valleys that are advancing. He called up to India to make a number of hydrogen valleys as this is the way in which both can scale up very fast. Also, safety should be kept in mind in carrying out all the innovations and developments.

Mr Lalit Bohra, Joint Secretary, MNRE thanked the dignitaries, speakers and participants. He said that India with its vast RE potential and land resources is likely to emerge as a major producer to some of the least cost green hydrogen and green ammonia globally. This will cater to decarbonization of the domestic industry and mobility applications and also enable India to emerge as a major exporter. Recognizing the potential of the green hydrogen, Government of India is working towards developing a comprehensive national hydrogen mission. The mission aims towards development of a green hydrogen ecosystem by providing a bouquet of financial incentives and non-financial interventions to both supply and demand side support as well as creation of robust framework for research, innovation, regulations

and standards. He also shared that even before the launch of the mission, significant hydrogen project have been initiated by the private and public sector in India:

- In 2021 India's first green ammonia plant was commissioned in Bikaner Rajasthan.
- 500 megawatt (MW) PEM electrolyser manufacturing capacity has been set up in Bengaluru.
- Gas Authority of India Limited has initiated a pilot project for blending hydrogen in natural gas pipeline in city of Indore.
- NTPC, the largest power producer in the country is in process of setting up India's first green hydrogen mobility project in Leh.
- Indian Oil Corporation Limited (IOCL) in collaboration with L&T and Renew Power have announced formation of a joint venture company for developing the green hydrogen ecosystem in India.

India has also proposed to build a hydrogen hub similar to the hydrogen valley concept in Europe co-locating bulk production and utilization of the hydrogen to optimize cost and achieve economy of scale.

High level panel discussion (Moderator: Ms Shuva Raha, Head - New Initiatives, Council on Energy, Environment and Water (CEEW))

Question: What are the one or two critical things that are needed from the Indian and from the European side?

Response: Mr. Tulsi Tanti, Chairman, CII Renewable Energy Council and Chairman and Managing Director (CMD), Suzlon Group, said that India has a huge potential and capacity to execute the large-scale projects. The best part is the fully established supply chain in India in the wind sector. India is already exporting wind turbines to more than 30 countries. It is a great opportunity for India to convert this renewable energy into the hydrogen. There will be challenges faced while using this technology. The three biggest areas of challenges are: financing, capacity for the manufacturing of the electrolysers and logistics. There are the areas where EU and India can join hands to work together.

Question: How can EIB facilitate this ecosystem building?

Response: Mr. Edvardas Bumsteinas, Head of Asia and Pacific Division, Global Partners Department, European Investment Bank (EIB), said that hydrogen is a new area and financing is clearly a big part of the puzzle. For bankers, the key is the bankability of projects because there are a lot of pilots and experiments and to make them bankable, there is a lot of upstream work that has to be done. Together with European partners, EIB is putting together a special facility for India and for Indian promoters, that will be implemented by GIZ.

Question: How multiple countries can work together cross boundary on financing?

Response: Mr. Thierry Lepercq, Founder of Soladvent, HyDeal project said that there are two things that will play a key role:

- first hydrogen is a commodity and need to be cost effective like fossil fuels.
- second thing is development in the system- upstream, midstream and downstream.

Question: How do you put collaborative stream of upstream, midstream & downstream together for the technology and the partnership and to deliver those volumes at that low cost?

Response: Mr Derek Michael Shah, Senior Vice President, L&T, said that there is a need of collaborative effort in the exchange of technologies and manufacturing facilities in order to simplify the value chain. L&T has one of the largest manufacturing facilities in India with high-end manufacturing capacity. After collaborating with European companies to set up manufacturing facilities of electrolysers in India, L&T might be able to set up one of the largest electrolyser units. L&T already has set up first green hydrogen plant in India which has a solar power plant, own electrolyser and they produce hydrogen to fire the furnaces inside their manufacturing unit.

Question: How Reliance Industries is planning to set up hydrogen manufacturing in India?

Response: Mr. Kapil Maheshwari, Leader - Renewable Energy & Green, Reliance Industries Limited shared that Reliance Industries is looking at the whole green hydrogen ecosystem in a very holistic way. They are coming up with four giga factories co-located that would cover all the required items in the value chain to produce green hydrogen. One factory would be for polysilicon to solar modules, another factory for battery storage, third one would be for electrolyser, the fourth for fuel cells and fifth one for the power electronics. In addition, they are targeting to be net zero by 2035.

Question: How do you see competition as-is it like a collaborative competition and how are you going to feed into this?

Response: Mr Christian von Olshausen, CTO, Sunfire said that the value chain of a technology company or original equipment manufacturers includes the concept development, manufacturing and after sales. Ramping this technology to the scale, which is required globally, provides a great chance to utilize the capacities which are available globally. India provides a favourable ground for cooperation to find the best that each one can bring to the table and also ensure that the technology is used locally and internationally. Europe is currently experiencing the consequence of being dependent on point sources and is looking at setting up hydrogen globally from a technological and from a value chain point of view. He also shared that Sunfire have friendly competitors and is happy to have them.

1.5. Session 5 - Perspective on way forward

Dr. Seshadri Chari, Distinguished Member of Governing Council, Research and Information Systems (RIS) thanked the guests, speakers and panelists and shared that the event was very useful for the coming years. He shared two important learnings from the session. First one is banking, where green hydrogen producers can bank their excess supply with the local power distributors for a period of about 30 days and people who bank can buy back at a fixed price whenever they need. The second most important subject that drew the attention was certification and regulatory framework. He said that since hydrogen fuel is an emerging technology, there is a need to first have a regulatory framework and then think about development of standards. Also, there is a for a greater cooperation needed in research and development of safety norms and risk management.

Mr. Matthieu Craye, DG Energy, European Commission thanked MNRE, CII and Hydrogen Europe for organising such an insightful session. He said that there is a need for working together on concrete strategic hydrogen projects and also to come up with a pipeline of projects that would be supported in the frame of this cooperation as a valuable part of such future cooperation. He concluded by highlighting key focus areas such as securing supply chains and the development of hydrogen ecosystems.

First EU-India Green Hydrogen Forum
Date: 8 September 2022 (Thursday) - **Time:** 09.30 - 16.00
Location: Leela Palace, Grand Ball Room, Delhi

Inaugural session - Policy and regulation to promote production and uptake of hydrogen in the EU and India	
09.30-10.00	Registration
10.00-10.05	*Welcome remarks* Mr Indu Shekhar Chaturvedi, Secretary, Ministry of New and Renewable Energy, Government of India
10.05-10.15	*Keynote address* H.E. Ms Kadri Simson, European Commissioner for Energy
10.15-10.25	*Keynote address* H.E. Mr R.K. Singh, Minister of Power and New and Renewable Energy, Government of India
Session 2 - Special addresses Indian and European Industry	
10.25-10.33	*Special address* Mr Vineet Mittal, Co-Chair, CII Renewable Energy Council and Chairman Avaada Group
10.33-10.41	*Special address* Mr Jorgo Chatzimarkakis, CEO, Hydrogen Europe
Session 3 - International trade in hydrogen: prospects and needs for certification of green hydrogen	
10.41-10.49	*Introductory remarks* Presentation on prospects international trade in H2 Mr Herib Blanco, International Renewable Energy Agency (IRENA)
10.49-10.57	*Introductory remarks* "Towards robust tradeable certification systems for hydrogen" Ms Daria Nochevnik, Director Policy and Partnerships, Hydrogen Council
10.57-11.40	*High Level Panel Discussion* Moderator: Ms Sonja van Renssen, Editor-in-Chief, Energy Monitor From the EU: - Mr Daljit Singh Kohli, India Representative, Port of Antwerp-Bruges - Mr Tapas Kapadia, CEO, RWEST India - Mr Roeland Baan, CEO, Topsoe From India: - Mr Vineet Mittal, Co-Chair, CII Renewable Energy Council and Chairman Avaada Group - Mr Rajat Seksaria, CEO, ACME - Mr. Vikram Kapur, Chief Growth Officer, Renew Power - Mr Rajeev Sharma, DDG, Bureau of Indian standards
Session 4 - State of play of existing and upcoming hydrogen projects in the EU and India - creating and financing a pipeline in India	
11.40-11.48	*Introductory remarks* Mr Bart Biebuyck, Executive Director, Clean Hydrogen Partnership
11.48-11.54	*Introductory remarks* Mr Lalit Bohra, Joint Secretary, Ministry of New and Renewable Energy, Government of India
11.54-12.35	*High Level Panel Discussion* Moderator: Ms Shuva Raha, Head - New Initiatives, Council on Energy, Environment and Water (CEEW) From EU:

	- Mr Edvardas Bumsteinas, Head of Asia and Pacific Division, Global Partners Department, European Investment Bank (EIB) - Mr Glenn Llewellyn. VP, Zero Emission Aircraft at Airbus - Mr Christian von Olshausen, CTO, Sunfire - Mr Thierry Lepercq, Founder of Soladvent, HyDeal project - Mr Patrick Cnubben, Director Strategy Hydrogen, New Energy Coalition From India: - Mr Kapil Maheshwari, Leader - Renewable Energy & Green, Reliance Industries Ltd. - Mr Derek Michael Shah, Senior VP, L&T - Mr Tulsi Tanti, Chairman, CII Renewable Energy Council and CMD, Suzlon Group
Session 5 - Perspective on way forward	
12.35-12.43	Dr Seshadri Chari, Distinguished Member of Governing Council, RIS
12.43-12.50	Mr Matthieu Craye, DG Energy, European Commission
- Lunch -	
12.50-14.00	Leela Palace
- B2B Meetings -	
14.00-16.00	Leela Palace