Distributing hydrogen from offshore wind farms as a fuel for ships

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There is a global interest for hydrogen as a complementary energy medium for industrial and mobility applications. In the offshore sector, coupling between wind farms and hydrogen production units is under active consideration. One key aspect of the on-going reflections is the production and distribution of hydrogen at sea. Offshore distribution of renewable hydrogen or ammonia, close to their production area, could be a great opportunity both for the wind industry and the shipping industry, optimising the supply of green energy for maritime transport. The purpose of this panel discussion was to explore the mutual benefits and challenges for the set-up of a network of offshore renewable hydrogen and or ammonia filling stations.

Emmanuel-Marie PETON - MEET 2050 Institute

In the last few years, the International Maritime Organization and the European Union adopted regulatory frameworks to decarbonize maritime transport by 2050. This is a huge challenge because the global world fleet represent 1,050,000 ships that consume 2,090 million tonnes of fuel. In this context, the French Maritime Cluster decided to launch a coalition with all the stakeholders of the sector that defined the common data sharing needs and drew a national roadmap. It also led to the creation of the MEET 2050 Institute. Reaching net-zero emission by 2050, means we need to change ships, equipment, and infrastructures, but also that we have to produce alternative energies and to build an associated supply chain. And we must finance all this. So, we have technical and financial issues to address. Hydrogen is one of the technical solutions depending on the kind of ships. That is why we are working with public authorities and the maritime industry about electrification, hydrogen, and e-fuels production to create French technical and industrial offers to decarbonize shipping.

Marie ROBERT - France Energies Marines

OPHARM is a collaborative research project involving a broad range of public and private partners. The main conclusions will be publicly disseminated in March 2023. The initial idea behind this project was to build a hydrogen roadmap for the offshore wind industry. We will identify production and delivery configurations we should not set up and those that seem favorable with the associated gaps in knowledge and areas of research. In the context of our discussion, we will focus on the configuration where production and delivery are made at sea. There is no electricity connection to shore anymore if it is fully dedicated to distribution of offshore hydrogen. There is colocation of production and consumption. There is potentially a large market for the wind farm operators and large producers for the shipping sector. We have to be careful about the off-grid aspect, the dependence of the wind farm operator on one type of customer, and the difficulty of bunkering operations. In terms of order of magnitude, we have calculated that five 15 MW-turbines are required to provide the yearly consumption of a small containership.

Annie LE GAL LA SALLE - Institut des Matériaux de Nantes

Three of the existing electrolysers technologies are relevant for marine applications: alkaline electrolysis, proton exchange membrane electrolysis and solid oxide electrolysis cells. Marinisation involves working with sea air and water which contain compounds that can cause side reactions and electrode ageing which reduce the yield of hydrogen production. Several solutions are currently explored: mixing the advantages of the alkaline electrolysis and proton exchange membrane electrolysis cells, direct osmosis water splitting, and development of solid oxide electrolysers. For all these solutions there are remaining challenges, but offshore operation of electrolysers and fuel cells is possible and pertinent for the development of renewable energies. Low temperature technologies are more adapted to small ships and offshore installations, whereas high temperature technologies may be more convenient for harbours and heavy ships. Simultaneous development of these technologies is needed. Research activities must be carried to reduce the costs, but also to improve security and acceptability.

Emeline BELIN & Gwenaëlle BENOIT - Sofresid Engineering

SEAGUEL is a concept of offshore hydrogen refuelling station developed by Sofresid Engineering upon SOV ship owner request. Its first use case study is resulting from the willingness of a wind farm operator to decarbonize their own wind farm, starting from the decarbonization of the service operation vessels (SOV) operating on the wind farm for the maintenance activities. SEAGUEL encompasses 5 different functions, which are seawater treatment, water electrolysis, hydrogen compression and storage, and ships fuelling. It faces 3 main constraints: the compactness of the solution with current equipment available on market, the optimisation of the gas station in accordance with the ship operations, and the remote control to minimise people on board. In this first application, SEAGUEL was designed to be installed in 30 m depth. It may provide 2T per day of green hydrogen and the storage unit has a 15T-capacity. Now, developments are focused on leverage of the user cases and optimisation of the concept. In the longer term, perspectives are oriented towards production of fuels derived from the green hydrogen. In parallel, other hydrogen hub concepts are also investigated, like a mobile barge to deliver power for docked vessels or massive floating hydrogen production assets (circa 500MW capacity).

David OTARISHVILI - RWE

RWE portfolio contains 10 GW of renewables, and among that 3.3 GW of offshore wind. The company is the second offshore player globally. The offshore wind turbines are rapidly growing in size and power. Its growth target in electrolyser capacity is + 2 GW by 2030. There are several project RWE is pushing like AquaVentus in Germany whose objective is to operate offshore electrolysers with a total capacity of 10 GW with electricity from offshore wind farms by 2035. Another key project is H2opZee in the Netherlands where RWE is collaborating with an oil & gas industry to see how to reuse the existing oil & gas infrastructures (including platform and pipelines) and integrate offshore wind in the value chain to produce big scale hydrogen and deliver it to the shore. RWE's ambition is to be net zero by 2040. This involves reaching 50 GW of installed wind and solar capacity by 2030, achieving 95% of EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) from core business as of 2023, investing 50 billion gross cash by 2030 and having £5 billion of EBITDA from green energy by 2030.