

Summary Meeting Minutes

Working Group 1 ‘Standardisation, Certification, Creditability & Tradability’ & Working Group 2 ‘Supply Chain Development and Risk Management’

09.02.2023, 2 p.m. – 3:30 p.m.

I. Background and Goal¹:

This meeting took place as part of the H2Global Working Groups 1 ‘Standardisation, Certification, Creditability, and Tradability’ and 2 ‘Supply Chain Development and Risk Management’. It showcased the results of the structured interviews and workshops conducted with members of the working groups to present an overview of the green ammonia supply chain with the goal to acknowledge the complexity of kicking-off all parts of the supply chain. Using the green ammonia supply chain as an example, the meeting discussed aspects such as production, transformation, processing, transport, distribution, and end-use.

Team Consult members Jens Völler and Madjid Kübler, Ludwig Möhring, and Dr Kirsten Westphal with her team at the Analysis and Research Division of H2Global Stiftung presented the findings of the research for a new policy brief (“Commercial Interfaces as a Challenge for Building Hydrogen Supply Chains”). An important purpose of the meeting was to hold an exchange on the relevant aspects of the research and incorporate feedback from working group members into the final publication of the policy brief.

II. Presentation:

1. Green ammonia supply chain (Dr Kirsten Westphal):

¹ The working groups’ primary goal is to provide knowledge and recommendations to the public and, within the framework of its statutory purposes, to policy makers in order to support a rapid market ramp-up of green hydrogen and its derivatives. For compliance reasons, the accumulated knowledge will be published on our website and papers will be prepared in order to place the results in a broader context.

- The very generic supply chain of green ammonia is presented. The figure is based on the results from structured interviews with donors and workshops in the working groups.
- The green ammonia supply chain is separated in several different entities:
 - Hydrogen electrolysis
 - Grid-bound/ non-grid bound transportation
 - Ammonia synthesis
 - Condenser and storage
 - Shipping
 - Terminal
 - Near-consumption storage
 - Cracker/ dissociator
 - Last mile transportation
 - End-use
- The processes, technologies, and procedures in the supply chain involve a diverse set of actors operating under different jurisdictions. Similarly, commercial viability, first-mover risks, and incentivization are other areas that require attention.

2. Coordination requirements (Dr Kirsten Westphal):

- The need to bring together different actors for coordination across the supply chain – upstream, midstream, and downstream – is of high importance. Among this list of challenges is also the need to stimulate both the demand and supply side in parallel, building up commercial interfaces, lack of synchronicity, the need for long-term Sales/ Purchase Agreements (SPAs), creating certainty for both upstream and downstream players, mitigating counterparty risks, developing index pricing, technical product specifications, standardization, certifications, and provisions for force majeure, among others.

3. Coordinator production / Upstream (Dr Kirsten Westphal):

- The role of the coordinator is to coordinate all relevant activities in the supply chain on the upstream side at least until the export terminal.
- The coordinator is likely identical to one of the entities, e.g., the producer of ammonia.
- The coordinator can incorporate several of the entities or be a joint venture of different entities.

- The aggregator / coordinator upstream has requirements that include:
 - Mitigation of price risks
 - Mitigation of counter party risks
 - Bankability of the project
 - Capacity requirements e.g., utilization profile and lot size.
- Similarly, the terminal operator also has a set of requirements which include:
 - Bankable investments and secured / guaranteed utilization
 - Mitigation of counter party risks
 - Mitigation of force majeure risks
 - Technical requirements with regards to infrastructure.
- Potential solutions to the requirements and the instruments that can be used are:
 - Long-term capacity bookings
 - Ship-or-pay contracts
 - Provisions for force majeure
 - Fixed capacity tariffs
 - Capacity and route specifications e.g., tanker size or shipping route
 - Clear technical specifications for the product.

4. Coordinator Mid-/Downstream (Dr Kirsten Westphal):

- The role of a mid-/downstream coordinator is to coordinate all relevant activities in the supply chain from the import terminal to the end user.
- Such a coordinator can be e.g., a commodity wholesale company or an existing large end-user.
- The coordinator can also incorporate several of the entities (e.g., by establishing special-purpose subsidiaries) or be a joint venture of different entities, especially in the market ramp-up phase if infrastructure unbundling is not a requirement. The mid-/downstream coordinator has some of the same requirements as upstream coordinators:
 - Price and counterparty risk mitigation
 - Capacity requirements e.g., lot size and utilization profile.
- Potential solutions to the requirements and the instruments that can be used:
 - Capacity specifications e.g., tank size
 - Long-term capacity bookings

- Fixed capacity tariffs
- Use-or-pay contracts
- Provisions for force majeure
- Clear technical specifications regarding the product.

III. Discussion:

- **Participant:** H2Global is providing OPEX related support. If you focus on import terminals (e.g., ammonia is toxic and specialized storage facilities are needed) you would require CAPEX support. Have you taken that into account? Someone who wants to build up an import terminal will be uncertain about the volume expected to enter the market. And then another question is about where exactly the product is headed to? As such, significant CAPEX risks need to be accounted for during the analysis.
 - **Dr Kirsten Westphal:** These issues have been taken into consideration for the analysis and the final report will include them.
- **Ludwig Möhring:** Uncertainty and risks can be managed in established markets at the respective commercial interfaces, but things are more complicated during the build-up phase of a new market, when parallel investment along the value chain and across various commercial interfaces (e.g., producer – shipper – importer – end-user) is required. Commercial and political trust is needed and must commercially support the respective commercial interfaces. This kind of trust and support is required to make the investments, which will be underpinned by long-term contracts. If things go wrong and further risks emerge, e.g., availability of product (ammonia/H₂), then backup solutions are needed as well, e.g., delivery of replacement hydrogen. Contracts can help manage some risks but not all. So, someone needs to step in, such as governments, to create the certainty that contracts will be honored, and goods be delivered.
- **Timo Bollerhey:** I want to comment with regards to CAPEX, OPEX or funding schemes / support schemes. We had many discussions in the past about maybe being able to apply the H2Global principle on the infrastructure side. Because there could also be a way looking forward, that you provide the right offtake scheme so that there is investment certainty to build the needed infrastructure and that some intermediary is present to play the same role for the infrastructure part. You provide long term usage or capacity in the sense that you book capacity (e.g., in terminals) and the intermediary takes the risk of not being able to fill that capacity, or that risk would be mitigated and left to the

market. That could perhaps be a way of applying an offtake perspective also for infrastructure finance.

- **Ludwig Möhring:** I think this is an excellent point, also in terms of execution because it's very close to how markets operate under normal circumstances. What we could have, is a kind of commercial 'White Knight' in the market who is prepared to take on the commercial risks around the long-term infrastructure / CAPEX requirements. You can then offer this to the market and the market has the certainty that it has access to that infrastructure capacity. This is extremely important to make contracts at fair commercial conditions.
- **Dr Kirsten Westphal:** We need to be precise what kind of infrastructure we are referring to because a hydrogen pipeline network is a different topic. The idea would be to first create the infrastructure in the next 10-15 years and create the investment certainty, so the market is able to absorb the risk. So, the infrastructure would be available between 2035-2040 when there is capacity demand.
 - **Ludwig Möhring:** What you are suggesting is what we are seeing in the gas market. In the LNG terminals, there is someone investing and then the 'White Knight' comes in and makes sure that the CAPEX risk of those who invested into that terminal are guaranteed the necessary income. This does not need to happen forever but would be of great help in the crucial early years of the market build-up.
- **Dr Kirsten Westphal:** We need to collect some of the recommendations that are very precise about which parts of the infrastructure we are discussing. The instruments and support schemes will be very different depending on whether we are talking about ammonia or in the case of the hydrogen grid where proposals are already running against each other. Advice and recommendations from the members of working group on this would be very useful.
- **Participant:** The easiest option would be sticking to the infrastructure that currently exists e.g., for ammonia. It's just a question on the certification and transportation side. In the European context, the number of players in these domains are rather limited.
 - **Ludwig Möhring:** So, what you are saying is we can learn from it? In terms of how it has been setup?

- **Participant:** The dimension of H2Global that we are talking about is a drop in the ocean for those players. They can easily manage it if we are not too complacent. If we stick to simplicity in the certification, then those few players can handle that. So, they could be natural coordinators for vast amounts of ammonia.
- **Participant:** The current ammonia terminals are in the hands of existing ammonia players. So, they have strategic interests, and they may not want new trade happening through their terminals. With regards to building up the infrastructure, I would strongly recommend doing that with a player that does infrastructure as a service and has no interest in the molecule itself. Otherwise, there will be a commercial conflict.
- **Dr Kirsten Westphal:** Parts of the green ammonia supply chain can also be regulated to give businesses third party access with non-discriminatory rules.
- **Participant:** The existing terminals are in private hands of ammonia producers, traders, and off takers. Why would they facilitate and enable a new supplier to trade through their terminals that are already under heavy use? I would be concerned about the practical feasibility of getting space in those terminals when they are already occupied for other reasons.
- **Ludwig Möhring:** From a competition perspective, (grey) ammonia is a niche business. But it is now becoming an important commodity. So, all this equipment / terminal suddenly becomes an essential facility. Politicians may look at it in a different way, i.e., consider, e.g., 3rd party access to such facilities – this happened to gas infrastructure 20 years ago. Understandably, the existing companies would not like to share their facilities, but this may not be legally sustainable. We can learn from existing facilities and supply chains, but we will also need to build substantial new infrastructure to enable the market build-up. This will come along with state regulation regarding 3d party access.
 - **Dr Kirsten Westphal:** That is an important part of the paper since we begin with the technical details and then move on to the relevant actors and their interests, which may be contradictory.
- **Participant:** If the first deliveries of green ammonia need to happen in 2025, then building ammonia crackers in Europe will not happen, and neither will the landing facilities be prepared. This can happen for methanol, but not for ammonia since it is a more difficult molecule to handle. We must engage these players, and I see little reason why they would oppose this. They recognize that their businesses need to be decarbonized, and

their business models require them to import and use these green molecules in their chain.

- **Participant:** Companies like Yara are profit driven, but they are (partly) government-owned, and I believe they are serious about decarbonization, so I do not see them blocking imports of green ammonia via their terminals.
- **Participant:** For example, considering the supply chain from Australia, not just the shipping but also the import facilities in western Europe should be organized by the producers, allowing them to supply to multiple customers across Europe.
 - **Dr Kirsten Westphal:** That is why we have two options for the delivery points.
 - **Ludwig Möhring:** We will see different interests in the market. There is a producer who wishes to maintain control over the destiny of the product as opposed to other free on-board deliveries where the aggregators decide where the products will go. We may have big industrial and consumer players who want to have a position at the terminal. Like in the gas business, there would be aggregators at the gate who would receive products from multiple suppliers; then building on such supply portfolio they can provide the product to the market.
- **Dr Kirsten Westphal:** Another important question would be at what point in time will the coordinators start aggregating.
- **Participant:** It is easy to pick up small volumes at the source instead of buying large amounts from aggregators at one point.
- **Participant:** An import terminal is typically under the purview of the harbor authorities. They can play the role of a coordinator to divide the shipments into smaller volumes. I do not think an exporter will take on this role.
 - **Dr Kirsten Westphal:** At what point in time do you see that happening?
 - **Participant:** When the product will be traded. It is also important that there are multiple producers, there should not be any limitation.
- **Participant:** Green ammonia and LH2 terminals would be regulated under the so-called 'Hydrogen and gas package' in the future.
 - **Dr. Kirsten Westphal:** Regulation will change a lot with regards to the motivations, the interests of the relevant actors, and the business cases. This is why it is very important to establish a level playing field.

- **Participant:** We can learn from the experience with financing the LNG import terminal in Stade. So, the question is how you can finance this if you don't know how much import will be there, the cost, the price, and no current off-takers. So, the whole case is made bankable with government guarantees. The missing link is who is the first mover and that must be the government.
 - **Ludwig Möhring:** I agree. In the build-up phase, someone needs to step in to take over the risks, so that FID can be taken. With regards to the coordinator role in the downstream context: this role could also be taken over by big end users in the build-up phase – simply to enable the build-up. It is a different question though, whether they are interested in such a commercial role long term. – Furthermore, with regards to pricing, there is a missing money problem in the build-up phase, i.e., if end-consumers cannot afford to pay the price demanded by the aggregator, the entire value chain is flawed. These issues need to be addressed early on. One of the roles of H2Global is exactly the management of such issues.
- **Participant:** We all agree on the importance of green ammonia. Third party access to infrastructure is necessary and the state should play an active role in granting concessions and finalizing the demand for what is needed in the economy.
- **Dr Kirsten Westphal:** Do we have institutions in place for the green ammonia infrastructure? We have institutions in place for gas infrastructure planning, or electricity. There is a need for parallel infrastructures. Most discussions are focused on H2 pipelines, but derivatives are also very important.

IV. Further procedure:

- The policy brief “Commercial Interfaces as a Challenge for Building Hydrogen Supply Chains” has been published and is available on the H2Global website.
- If there are ideas for speakers or desirable input for the upcoming session from among the participants, participants are asked to provide feedback on them to the team of H2Global Stiftung.