



GETTING TO ZERO COALITION

Webinar Summary: Grasping the Trillion-Dollar Market Opportunity

Global Opportunities for Zero Emission Fuels Exports Workstream, April 24, 2020

On April 24, 2020, the Environmental Defense Fund, Ricardo Energy & Environment and the Getting to Zero Coalition organized a webinar for members of the Getting to Zero Coalition. The recording of the webinar and the slides used by the experts can be found [here](#).

Speaker:

H.E. Juan Carlos Jobet Eluchans – Minister of Energy, Chile

Expert presentations:

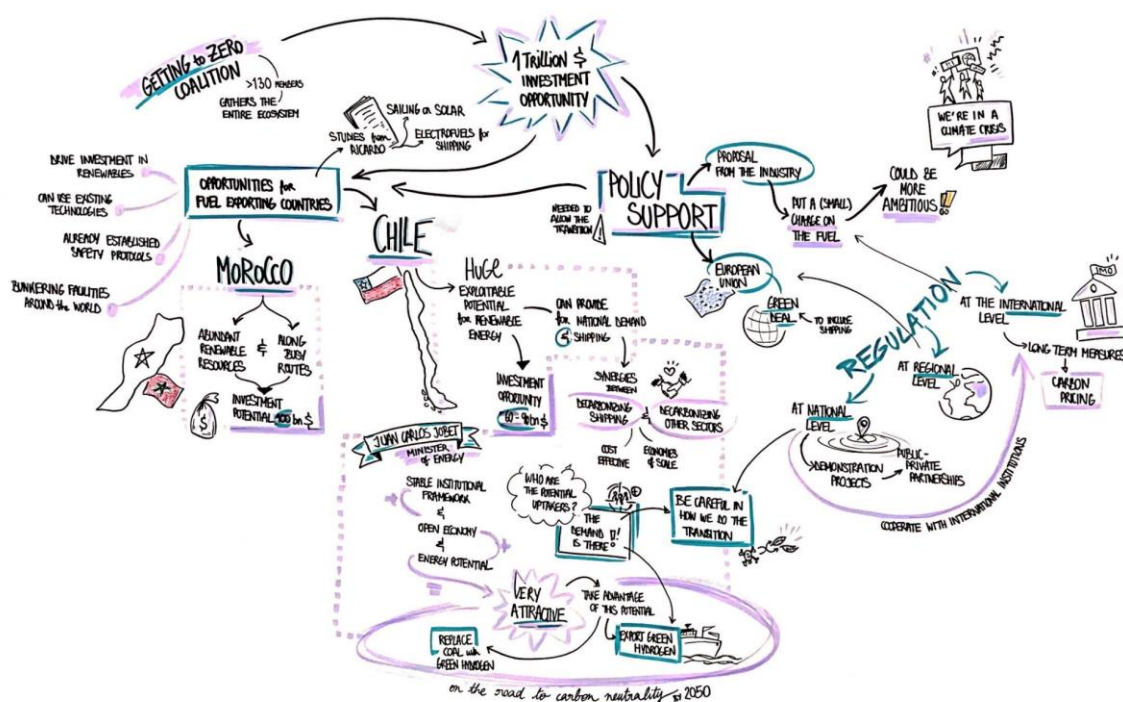
Aoife O'Leary, Director – International Climate, Environmental Defense Fund Europe

Nick Ash, Principal Consultant, Ricardo

Panelists:

Dr Tue Johannessen, Senior Innovation Portfolio Manager, A.P. Møller – Maersk

Benjamín Maluenda Philippi, Specialist - Energy Planning and Regulatory Impact Assessment Division, Ministry of Energy.





Context

Decarbonizing shipping by 2050 is expected to require investments of 1.4-2.0 trillion dollars, 87% of which will be on shore. This trillion dollar market opportunity is waiting for industry stakeholders and participants to make the first move. In this context, four benefits of using green electrofuels to decarbonize shipping was identified:

1. Electrofuels will drive investment in renewables
2. The deployment pathway can begin almost immediately using present and familiar technologies (i.e. internal combustion engines)
3. There are established safety protocols for storing and transporting ammonia and methanol as these are already traded on an international basis
4. Bunkering facilities could be located around the world wherever there are sufficient renewable energy resources

Grasping the Trillion-Dollar Market Opportunity in Chile and Morocco

Potential for renewable energy in Chile

The exploitable potential for solar energy that can be converted into electricity in Chile was compared to the quantity of renewable electricity that would be required to supply fuel to ships visiting Chile's ports on an average day in 2018 (hydrogen: 270GWh, ammonia: 290GWh) and the average daily electricity consumption in 2018 (210GWh). This indicated that Chile has a huge exploitable potential for renewable energy, having an estimated solar potential of 6.000GWh per day.

The level of investment required to produce sufficient quantities of hydrogen and ammonia to fuel the ships visiting Chile's ports in 2018 was also estimated, showing a 60-80 billion US dollar investment potential for hydrogen and slightly more for ammonia. A case study in the Port of Mejillones, Chile, showed that four electrofuels production plants would need a combination of solar PV, concentrated solar and wind farms to be able to produce sufficient amount of fuels required on an annual basis. The different sources of renewable energy with a grid connection and energy storage facilities would enable the plants to operate continuously and reliably.

Lastly, a study exploring how zero-carbon shipping routes could catalyze investment in sustainable industrial development within Central and South America is being carried out and will be published in summer 2020. It will look specifically at potential shipping routes that can be decarbonized completely.

The advantages of Morocco as a potential producer of alternative fuels for shipping

Morocco holds several key advantages for investment in the production of electrofuels for shipping:

- The country's advantageous location, located along busy shipping lanes
- Abundant renewable resources with significant possibilities to expand
- Established inorganic chemistry sector

The exploitable potential for renewable energy in Morocco is vast, where the theoretical potential of solar and wind reaches around 48 terawatt hours per day, to be compared with the amount of renewable electricity needed to supply container and dry bulk vessels passing through Morocco's port in 2017 with green ammonia (300GWh/day) and the average electricity consumption in 2017 (92GWh).

The levels of investment required range from around 90 billion US dollars up to 120 billion, depending on what future capital costs would look like.

Policy solutions for zero-carbon shipping

For electrofuels to be able to compete with conventional fuels, the need for policy measures for zero carbon shipping was highlighted. Policy measures and funding support is necessary to achieve return on investment, making it worthwhile investing in green technologies. The EU Commission has made shipping a part of its Green Deal, and there is hope that the EU will be able to propose a useful and ambitious model or policy that can pave the way for a favorable agreement within the IMO.



Panel discussion

The panel discussions covered topics such as the challenging timeline of achieving commercially viable solutions, Chile's work on a national strategy on hydrogen and the importance of aggregate demand.

Maersk has a commitment of having commercially viable solutions in place by 2030. This rather tight timeline underscores the importance of figuring out suitable pathways that can be achievable over the next few years, of analyzing these and thereafter moving projects ahead that put away technological uncertainties. Given that the magnitude of these uncertainties is huge, as it relates to different segments of the supply chain, it is even more important to achieve end to end demonstrations of the entire value chain, to start working in time.

Chile's current work on a national strategy on hydrogen was highlighted, gathering early lessons and thoughts which will be helpful in defining policies down the road. Chile's opportunity of decarbonizing not only shipping, but other industrial sectors as well, can help achieving economies of scale. Chile is currently partnering with development banks, looking for potential off-takers for clean fuels.

Lastly, the question of how to aggregate demand was discussed. Decarbonization of shipping, being an entire economic transition, is likely to offer synergies with the decarbonization of the entire country. Regional and national demonstration projects are already underway, and policies and frameworks are required to be able to scale these.

Key takeaways from the Minister of Energy in Chile

Thanks to Chile's stable institutional framework and low levels of corruption, the country has experienced great economic development over the last couple of years. The combination of institutional features, Chile's massive energy potential and their free trade agreements with most of the world's economies, have attracted many foreign direct investments in the energy sector and is key to the success of the considerable increase of Chile's installed capacity of renewable electricity.

Chile, having the highest solar radiance in the world and strong potential in wind energy, has led to a potential of 1.7 thousand gigawatts which implies 70 times more electricity than is being consumed today. The challenge is to find ways to export that electricity, and Chile sees big potential in green hydrogen as the way to go about that.

With regards to Chile's potential for renewable energy, two main opportunities were emphasized:

1. Reduce Chile's CO₂ emissions through green hydrogen. Even though Chile is not a major emitter, accounting for less than 0.3% of all global emissions, it can set an example for other nations.
2. Find ways to export green hydrogen, using market mechanisms to make Chile an attractive country to invest in, helping other nations to reach their own carbon neutrality goals in alignment with Article 6 of the Paris Agreement.

Chile is aiming at having its first national green hydrogen strategy ready this year, working with both the public and private sector. Crucial is to learn from other people and organizations carrying out these types of projects globally. "We have the institutional framework and the clean energy potential, but we need to cooperate to make sure that things happen" says the Minister.

Even though many things seem to be in place for Chile, there is currently not enough domestic demand for green hydrogen. That demand needs to come from the international community, and the country therefore sees great potential in cooperating with international companies to develop pilot projects in the areas where clean energy resources exist. The Chilean government is happy to support projects that can help them navigate the cost curve and work on a trial and error basis to move the decarbonization of shipping, as well as the decarbonization of other sectors, forward.



Q&A

Several questions sent in by the audience were addressed during the webinar. A few additional questions, with answers provided by the experts, can be found below:

Carbon pricing and policy

Question	Response by Aoife O'Leary, EDF
ICS stated a couple of years ago that up to \$50 per ton of CO ₂ would be bearable in the industry, up to \$150 per ton of fuel, at this level a ringfenced tax would deliver the \$50-70 billion per year for decarbonization. How do we move to this position and how does the current historically low oil price change the policy dynamic?	The shipping industry has proposed a levy of \$2 per ton of fuel to support research and development. This is a first step and, if implemented, it will create a framework to put this kind of a mechanism in place. However, it requires a step up in ambition in order to have any impact on shipping's emissions. The lesson we can take from the Covid-19 crisis is that governments can and will act decisively when necessary and we will see a renewed ambition to act on climate when this is over. The current oil price is certainly not helping to bridge the price gap between conventional and zero-carbon fuels. However, this is most likely temporary. The manufacture of electrofuels will be decentralized (spread all over the world, unlike the extraction of oil which takes place only in certain regions). A shipping sector reliant on alternative fuels would be less reactive to fluctuations in the oil price.
We sorely need a clear pathway from today's fuels to the new carbon-neutral fuels. How do you see that forming in the IMO and/or the EU?	There is no silver bullet that will decarbonise the shipping sector but rather complementary and overlapping policies that will need to be implemented at both the EU and IMO level. The discussions need to focus on measures to incentivise zero-carbon alternative fuels and technologies such as carbon pricing. The money collected from the price should be used to fund the deployment of zero emissions ships and the production alternative fuels. Shipping has long planning horizons and ships that are built today will still be on water in 2050. It is therefore crucial that a robust and comprehensive policy package is adopted as soon as possible to give a clear signal to ship owners about the future of the sector to allow them to make the appropriate investments.
If what is actually needed is a carbon tax of \$200+, why consider only \$2 a tonne over 12 years (the ICS proposal). Is there a risk to agree to this given that there is no global agreement on how revenue from MBMs is spent?	The \$200 per tonne of fuel is a figure based on the total estimated costs of the transition to clean shipping by UMAS. We think that the ICS proposal is useful to bring the discussion about carbon pricing to the IMO but it needs to be much more ambitious. The IMO member states will have to agree on how revenues from a carbon pricing measure would be spent. There is a strong case for those revenues to be spent within the shipping sector on the deployment of zero emissions ships and the supply of alternative fuels with special consideration given to the equity of the transition in those parts of the world where assistance would be required.



New sources of fuel supply, new trade routes, geography

Question	Response by <i>Nick Ash, Ricardo</i>
We can presume that the 'current' bunker ports like Singapore, Fujairah, ARA, Los Angeles etc. will not be the bunker ports of the future. Where would the new bunker ports of the future be located and how would those locations impact on global trade routes? Could this shift result in unintended consequences for example additional land transport requirements?	There is nothing stopping the current bunkering hubs from increasing their capacity to provide zero-carbon fuel infrastructure. However, since zero-carbon electrofuels require large amounts of renewable electricity, it is anticipated that bunkering hubs would emerge in locations that have significant vessel traffic as well as abundant renewable resources nearby. This is likely to be the least-cost approach and is the reason that countries like Morocco and Chile have been chosen as representative case studies. If there is demand from zero-carbon vessels, then the barriers to entry for provision of bunkering are relatively low for nations with commercial ports and good renewable energy resources.
According to the presentation, future electro-fuel supply will be distributed globally, rather than in a few hubs as today. Would that reduce the challenges in transporting fuel from production the site to the end-user?	Indeed. As mentioned in the response above, renewable electrofuels will allow for a more distributed bunkering network, with price advantages to locations that have abundant renewable resources nearby. This should give vessel owners and operators more flexibility in their bunkering strategies and ultimately provide them with a larger and more diverse market for fuel.
How do the results of the Ricardo study on Chile's potential compare against the official expansion plan of the power sector in Chile? And how ambitious does Chile need to be in its hydrogen strategy in comparison to its official expansion plan for the power sector?	The Electrofuels for Shipping report notes that Chile has high ambitions for expansion of renewable energy in its electricity network. It is important to note that the basis of Ricardo's analysis is that renewable electricity capacity for electrofuels will not be diverted from electricity consumers, but will be built in addition to the capacity required to reach Chile's decarbonization goals for its electricity network. As described in the webinar, Chile's vast renewable potential far exceeds the sum of the projected maximum demand from a fully decarbonized electricity grid and the power required to produce electrofuels for a fully decarbonized fleet of commercial vessels. Although Chile's hydrogen strategy is still being formulated and its levels of ambition for exporting hydrogen are not yet known, there is unlikely to be a shortage of renewable potential to meet the aggregate demands for renewable electricity to the grid, electrofuels for shipping and hydrogen production for other applications.