The P4G-Getting to Zero Coalition Partnership: Finding and supporting opportunities to decarbonise shipping in Indonesia, Mexico and South Africa

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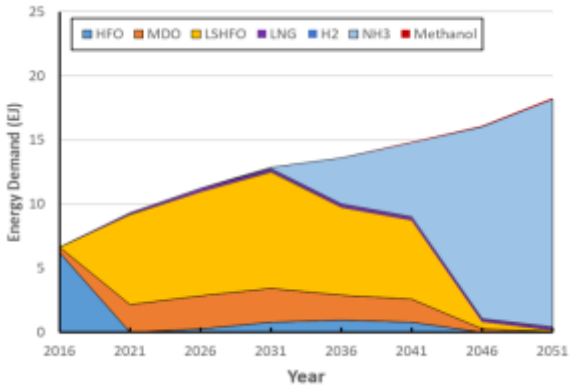
Introduction

Currently, the international shipping industry emits around 2-3% of global greenhouse gas (GHG) emissions and contributes around 12-13% of sulphur and nitrogen oxide emissions to global air pollution [1]. The International Maritime Organization (IMO) has committed to reducing greenhouse gases emissions from international shipping by at least 50% by 2050 compared to 2008 levels. To reach that goal for this difficult-to-abate sector, a shift towards new low- and zero-carbon fuels - such as hydrogen and ammonia- is urgently needed (see Figure 1), along with the deployment of safe and reliable zero-emission vessels, technologies and infrastructure [2].



*1 - **Figure 1:** Shipping energy demand, represented by current and potential maritime fuels, until 2051. A full shipping decarbonisation by 2050 scenario is used [2,3].*

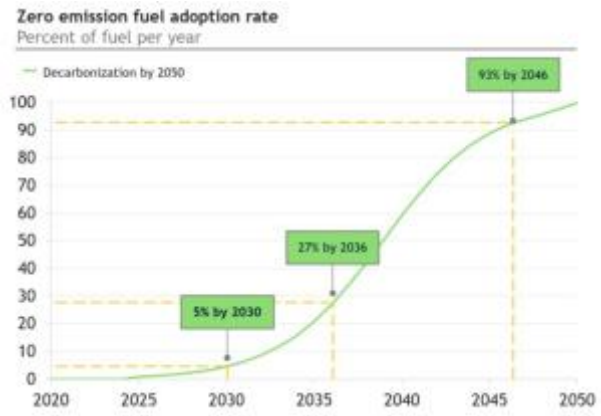
Acronyms

- ***HFO:** Heavy Fuel Oil*
- ***MDO:** Marine Diesel Oil*
- ***LSHFO:** Low-Sulphur Heavy Fuel Oil*
- ***LNG:** Liquified Natural Gas*

- ***H2:*** *Hydrogen*
- ***NH3:*** *Ammonia*

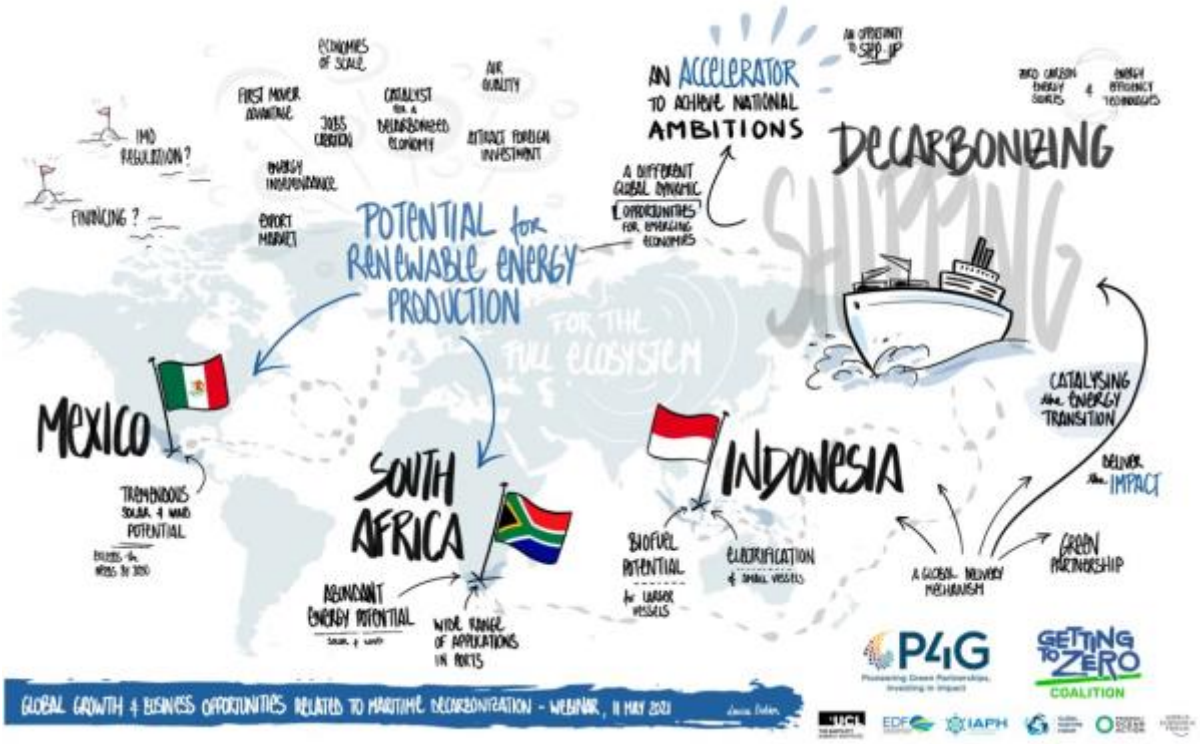
Further it has been suggested that zero emission fuels need to make up 5% of the shipping fuel mix by 2030 to enable a decarbonisation in line with Paris Agreement goals and the IMO ambitions [4] (See Figure 2).

The global potential for renewable energy production is enormous and can power the global shipping fleet by producing green synthetic fuels. Further, there are important opportunities for **emerging market economies** such as new income from production and exports of clean energy solutions, energy security, decarbonising national industry, equitable job creation, innovation and IP generation.



2 - ***Figure 2:*** *Required zero-carbon fuel adoption rate for shipping until 2050 to comply with shipping decarbonisation ambitions [4].*

Taking into consideration the renewable potential and the need to decarbonise shipping, the project **P4G-Getting to Zero (GtZ) Coalition Partnership** aimed at identifying **concrete, actionable business and development opportunities** that can bring sustainable and inclusive economic growth in **Indonesia, Mexico and South Africa** while building regional networks that contain the voices of key stakeholders in the energy, academic and shipping sector.



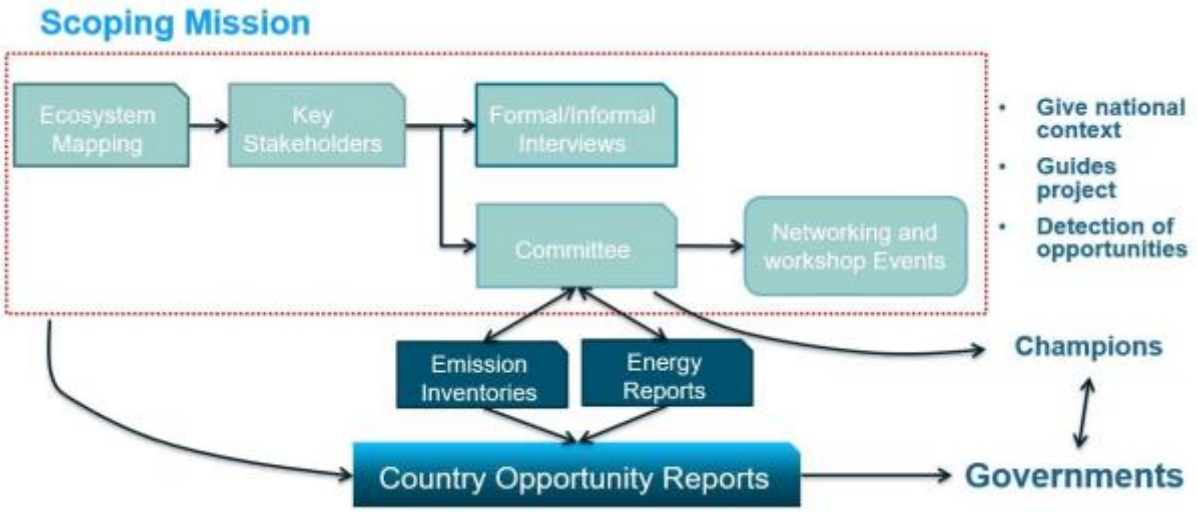
3 - ***Figure 3:*** *The P4G-GtZ schematic*

Materials and Methods

The P4G-GtZ Coalition Partnership took a mix-method approach to find concrete and actionable business and development opportunities.

On the quantitative front, hourly GPS data from the ship's Automated Identification System were coupled with a technical model - which contained engine type, specific fuel consumption and emission factors - to determine route densities, energy demand and emission inventories in Indonesia, Mexico and South Africa. The extensive method used can be read in detail in Jasper et al. [1]. This information was then used by to determine the size of the maritime market in each country while assessing the renewable potential to manufacture green fuels such as hydrogen and ammonia. The energy reports [5,6] brought together technical findings, the countries' current policies, infrastructure and ambitions to decarbonise.

On the qualitative front, the approach created ecosystem maps for each of the countries allowing to engage key stakeholders from industry, government, academia, NGOs, investment banks and associations that could unlock areas of opportunities, enhance the network and understand in more detail the countries' context. The second stage was the development of a questionnaire that tackled shipping decarbonisation, energy priorities and the detection of barriers and opportunities. The questionnaires were used to have formal interviews with the different stakeholders but at the same time the nature of the project allowed to have further informal conversations that added to the project narrative. This process allowed to determine strategic stakeholders with opportunities that could be further developed. These were invited to form part of the project's strategic committee which has the purpose to guide the project within the national context (see Figure 4). A further step in the project built workshops and networking events to integrate stakeholders with opportunities.



4 - Figure 4: Flow of activities and deliverables for the P4G-GtZ Coalition Project.

The project still has nine months to finish and aims at delivering Indonesia energy report (due in October), the countries' emission inventories due to shipping, country opportunity report with the concrete and actionable opportunities which will be submitted directly to each of the countries. Finally, the project would look for champions within the committee to grow and evolve the network and the detected opportunities.

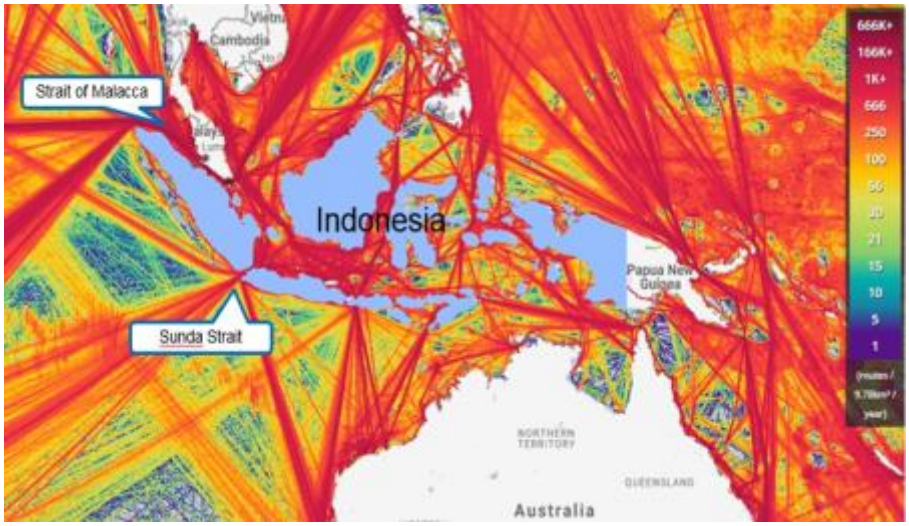
Results and Discussion

Indonesia

The scoping exercise threw more than 60 stakeholders with 25 different formal and informal conversations with key Indonesia stakeholders. Important stakeholders detected were the Department of Transport, Danish Embassy in Jakarta, national shipbuilder association

From the energy reports and data analysis, Indonesia, due to its insular nature and reforestation ambition, should continue to be a bunker supplier. This does not mean that they have to be a major producer of zero-carbon fuels, since the renewable potential should focus on decarbonising Indonesia's electrical grid. But it does mean that Indonesia will need the infrastructure and supply chains to allow zero-carbon vessels to bunker. The largest business opportunity is that Indonesia can benefit of the high-density traffic to sell zero-carbon fuels taking advantage of the potential affordable hydrogen/ammonia economy produce from Australia (see Figure 5).

For small boats, electrification is the most obvious avenue. The government needs to develop pilot programs integrating the views of the boat user, since it is the most important barrier, while using decentralised electrical grids using available renewable energy.



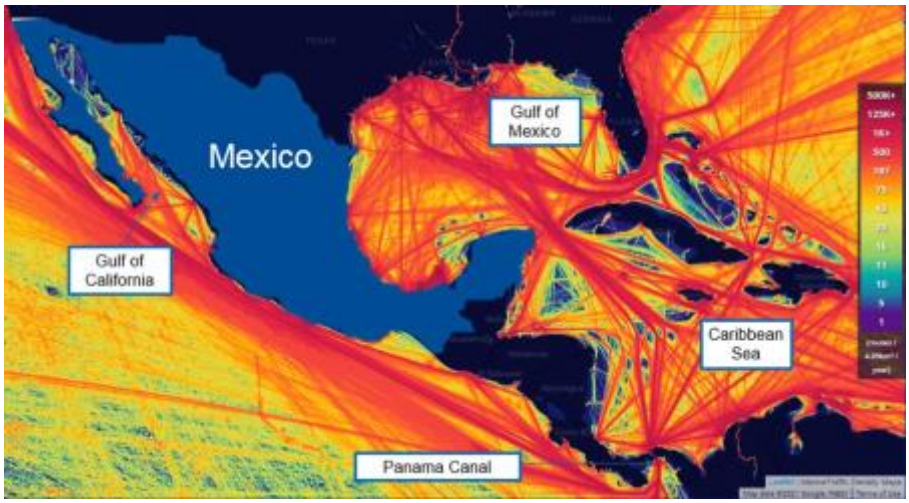
*5 - **Figure 5:** Indonesia maritime traffic for the 2018 year. The image highlights the main shipping routes. Source: Ricardo Energy and Maritmetraffic.com*

Mexico

The scoping exercise detected more than 180 stakeholders which allowed to have more than 85 formal and informal talks with key stakeholders. From this exercise, it was detected that there are a number of plans and companies aiming at producing green hydrogen and ammonia. Here shipping demand was seen as extra demand to scale-up production and derisk the investment. Important stakeholders detected were Cemex, Port of Manzanillo and Puerto Vallarta, Tabasco and Baja California states, INECC, SEMAR among others.

The study has identified hydrogen and ammonia as the most suitable options for large commercial vessels such as tankers, containers and bulk carriers, while small vessels such as port service vessels can be supplied through electrification. The renewable energy potential along with the advantageous locations of ports gives Mexico the opportunity to play a crucial role in driving the zero-carbon shipping fuel transition. Further, only with transforming Mexico's renewable potential it will be possible to supply with zero-carbon fuels the 5% of the international fleet that is needed to start the shipping transition.

Areas of interest that can trigger the shipping decarbonisation are seen in Manzanillo, Baja California Peninsula and the Mexican Caribbean (see Figure 6).

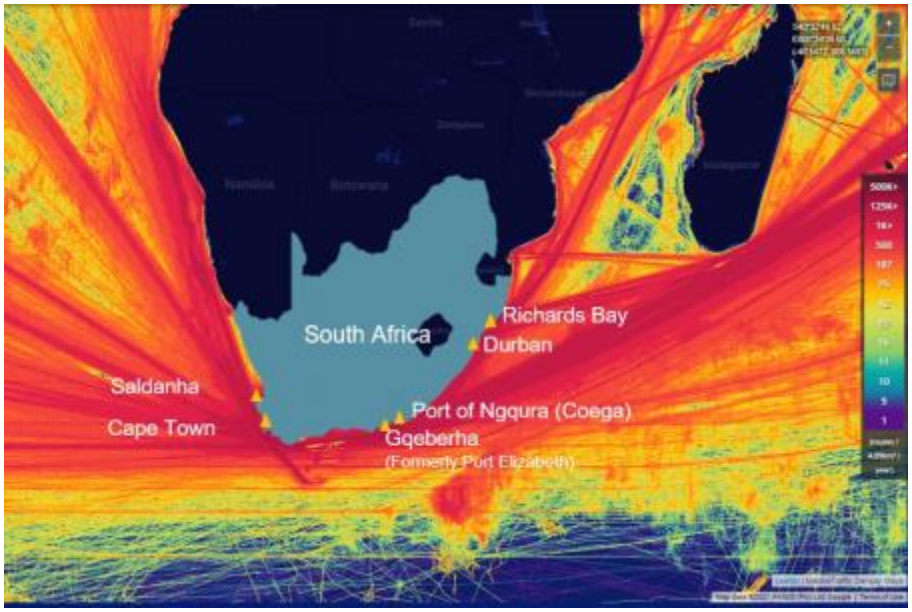


*6 - **Figure 6:** Mexico's maritime traffic for 2018 with important geographical areas highlighted [5].*

South Africa

From the scoping exercise 100 stakeholders were detected in South Africa of which it was possible to hold 45 different conversations with the most representative stakeholders. Important stakeholders detected were Durban and Boegoebaai ports, the mining company Anglo American, Engie and the Platinum Valley project.

South Africa captures the majority of the maritime traffic that does not pass through the Suez Canal and hence offering the potential to support the shipping transition to hydrogen and ammonia. South Africa's wind and solar potential is in the thousands of TW per year and allows to cover its energy demand while having surplus to supply the shipping sector. As well, South Africa has important ports near the busiest maritime regions but investment is needed to allow port to produce and store hydrogen-based bunkering fuel (see Figure 7). Different to the other countries, South Africa has a strong policy in favour of the hydrogen economy with the upcoming Hydrogen Society Roadmap setting the scene for investment and future policy while South Africa taking the opportunity to create an opportunity that can generate equitable green jobs.



7 - ***Figure 7:*** *South Africa maritime traffic for 2018 with the relevant ports around the critical shipping traffic lanes [6].*

Conclusion

Throughout the P4G-GtZ Coalition Partnership it has been possible to engage with key stakeholders on the energy and shipping transition in Indonesia, Mexico and South Africa. With data analytics and

understanding each countries' perspective it has been possible to present useful data visualisation to grasp the size of the shipping market that future green hydrogen-based fuel could capture to then trigger the shipping pathway to a lower carbon future. All while incorporating opportunities of development and equitable green job generations.

From the renewable potential and policy context South Africa and Mexico are well-placed to play important role in decarbonising shipping while Indonesia could benefit from the high maritime traffic and cheap hydrogen from neighbours that allow ships to bunker zero-carbon fuels.

The work done recognises that clear opportunities exist but further work in reducing barriers and canalising investment are required to allow developing nations to participate during this decade on the beginning of the shipping transition.

Acknowledgements

The authors want to thanks P4G and partners for supporting the work presented here. Similar gratitude goes to all stakeholders that the project has engaged since thanks to their commentary and discussion it is possible to have a clear national context were opportunities and development is possible. The effort to decarbonise and avoid the worst of climate change will come through extensive and transparent collaboration were the win-win situation needs to be central to any effort.

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