

Decarbonising Maritime Transport: Policy and Technology Update

Kyriakos Maniatis PhD

Independent Consultant

Biomass conversion and low carbon renewable & recycle fuels



University of Piraeus
Dept. Maritime Studies

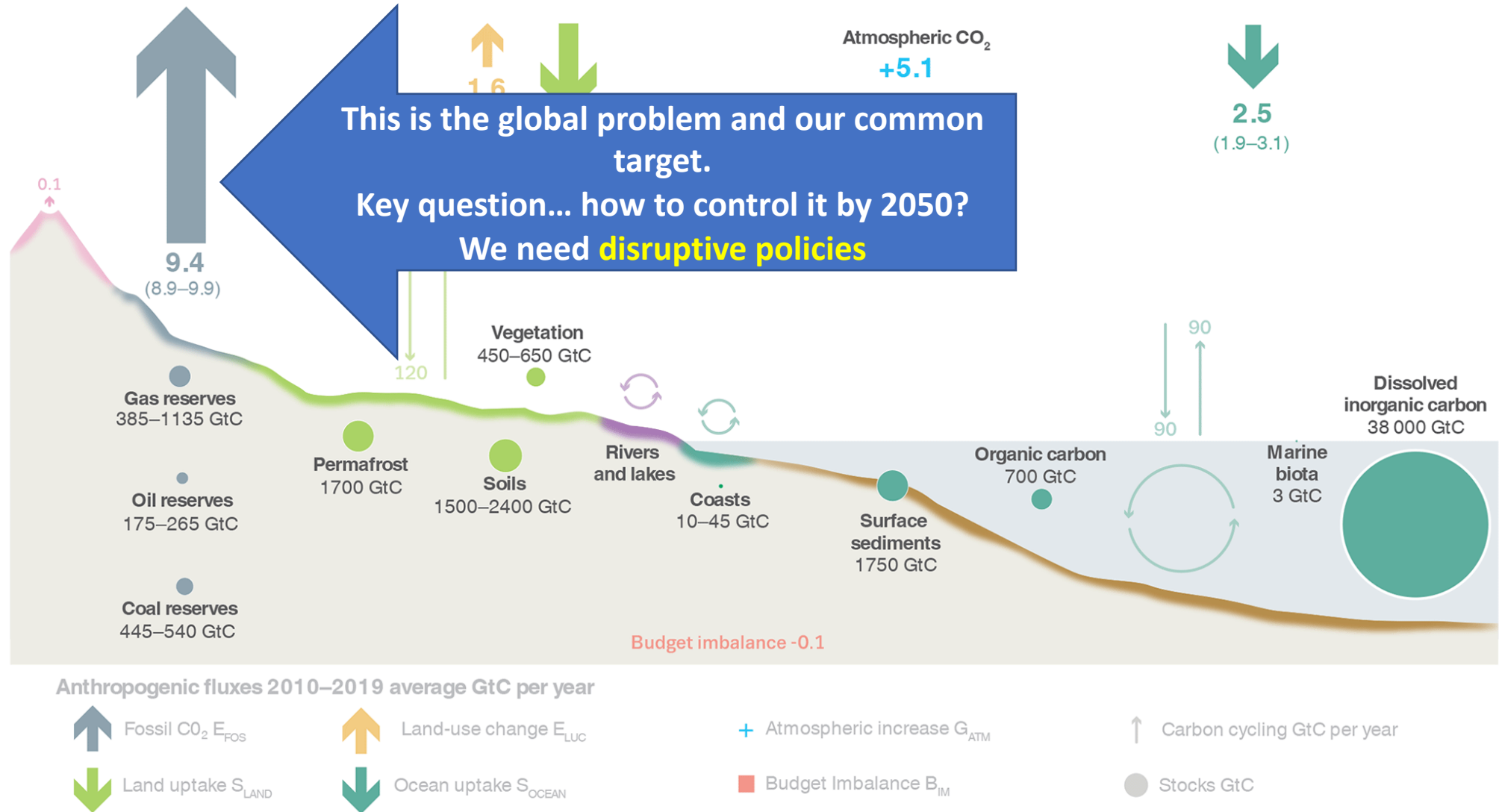
Alternative Energy Sources in the Shipping Industry

30 June 2021



Hellenic Naval Academy
Dept. Naval Sciences

The global carbon cycle



This is the global problem and our common target.
Key question... how to control it by 2050?
We need **disruptive policies**

Earth System Science Data,
Global Carbon Budget 2020.

During the 2010–2019 period the additions of CO₂ from fossil fuels averaged 9.4 Giga tons Carbon/year (GtC/y),

IMO Green House Gas reduction strategy

IMO has **adopted mandatory measures** to reduce emissions of greenhouse gases from international shipping, under IMO's pollution prevention treaty (MARPOL) - the Energy Efficiency Design Index (EEDI) mandatory for new ships, and the Ship Energy Efficiency Management Plan (SEEMP).

Key ambitions:

1. Carbon intensity of the ship to decline through implementation of further phases of **the energy efficiency design index (EEDI) for new ships**.
2. To **reduce CO2 emissions per transport work, as an average across international shipping, by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008**.
3. To peak GHG emissions from international shipping as soon as possible and to **reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008** whilst pursuing efforts towards phasing them out as called for in the Vision as a point on a pathway of CO2 emissions reduction consistent with the Paris Agreement temperature goals.



Mission Statement for Zero Emission Shipping Mission, June 2021:

We need commercially viable zero-emission fuels for ocean-going vessels entering the global fleet by 2030, making this a decisive decade to set international shipping on an ambitious zero-emission trajectory.

Shipping is the backbone of international trade. Measured by emission per freighted ton/mile shipping is already a very climate efficient mode of transport compared to other modes of transport, **yet it is responsible for 2-3% of global GHG emissions today**. As the demand for international seaborne trade grows in line with global economic growth, **emissions from international shipping may increase 50% by 2050 under business-as-usual scenarios**.

The Zero-Emission Shipping Mission's tipping point is that **by 2030 ships capable of running on well-to-wake zero-emission fuels such as green hydrogen, green ammonia and green methanol, and advanced biofuels make up at least 5% of the global deep sea fleet measured by fuel consumption and that at least 200 ships primarily use these fuels across the main deep sea shipping routes**.

The Zero Emission Shipping Mission:

Co-leads:

Denmark, The United States, Norway, Global Maritime Forum, Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping

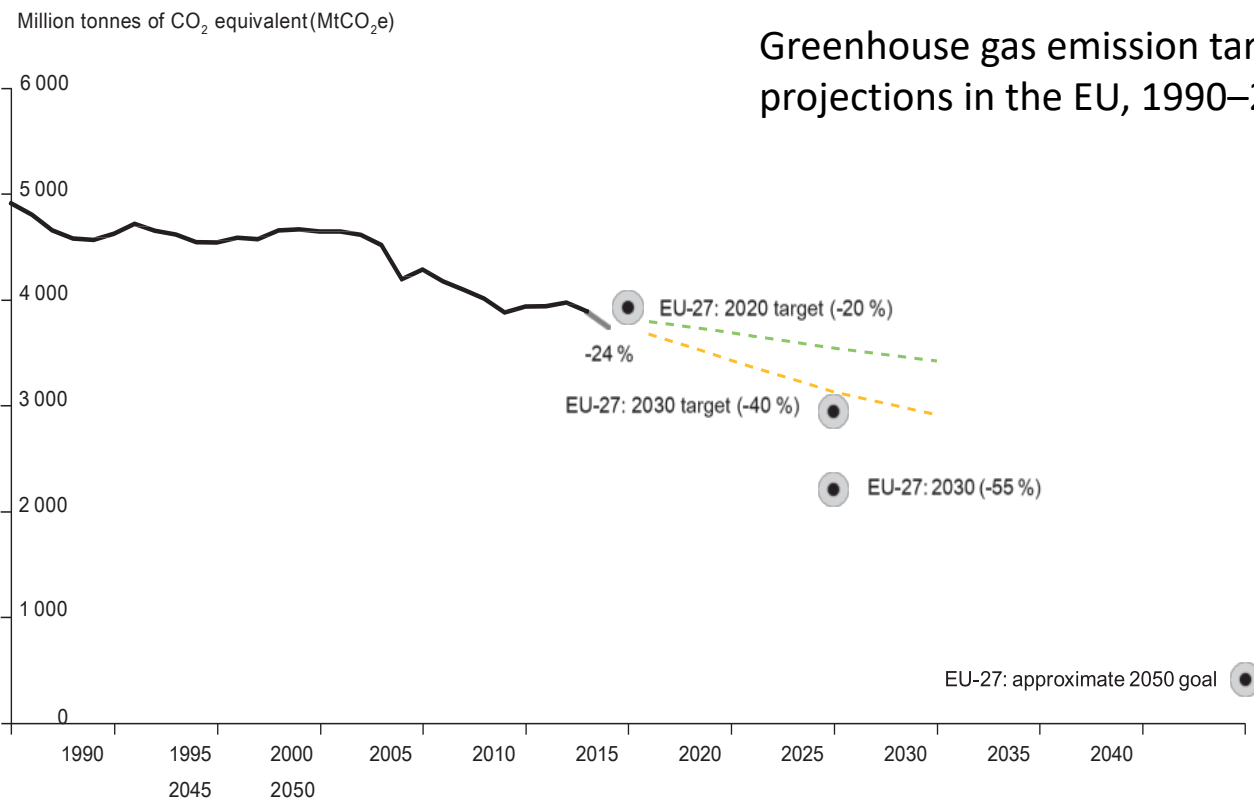
Core group:

Morocco, The United Kingdom, India, Singapore

Support group:

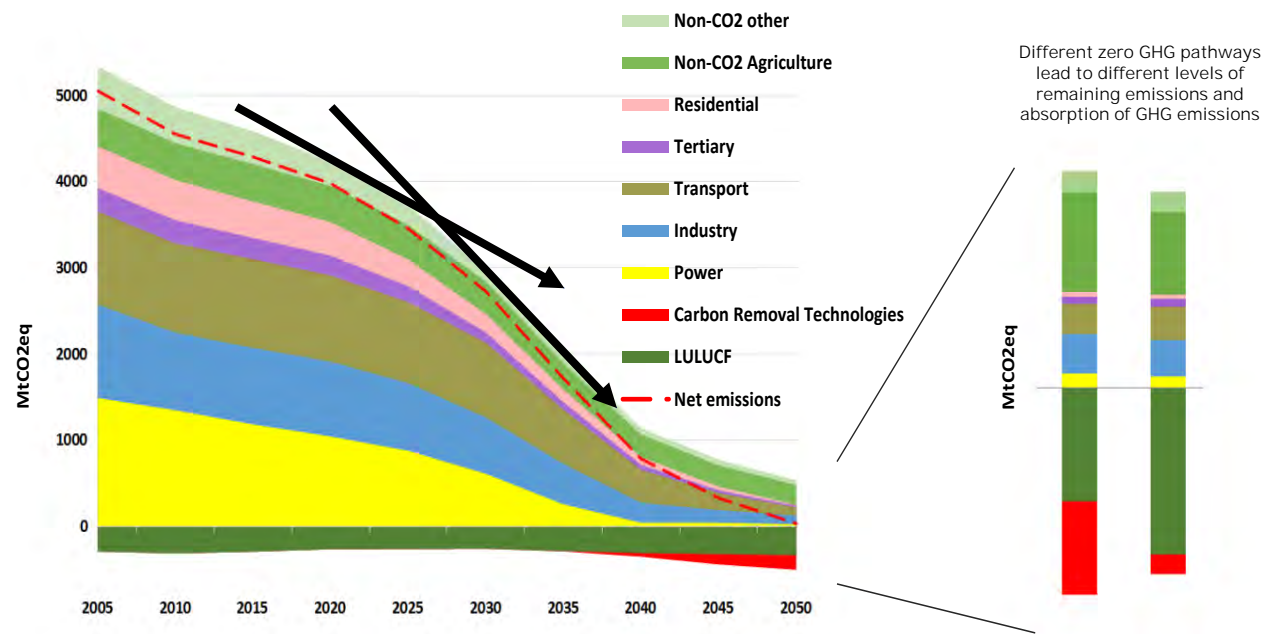
France, Ghana, South Korea

Greenhouse gas emission targets, trends and EU Member States' MMR projections in the EU, 1990–2050, European Environmental Agency



- EU-27: Historical greenhouse gas emissions
- - - EU-27: Projections with existing measures (WEM)
- - - EU-27: Projections with additional measures (WAM)

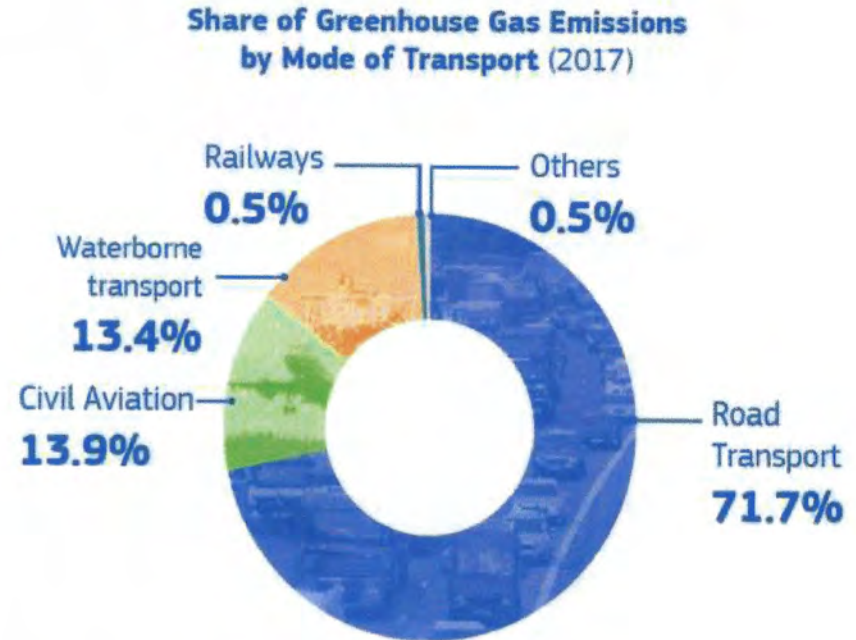
EU GHG emission trajectory for 1.5 °C



Different zero GHG pathways lead to different levels of remaining emissions and absorption of GHG emissions

European Union's Green Deal and Transport

- Transport accounts for a **quarter of the EU's GHG emissions** and these continue to grow.
- The Green Deal seeks a **90% reduction** in these emissions by **2050**.
- Waterborne contribute to **13,4% of the transport emissions**, resulting predominantly from international maritime transport.



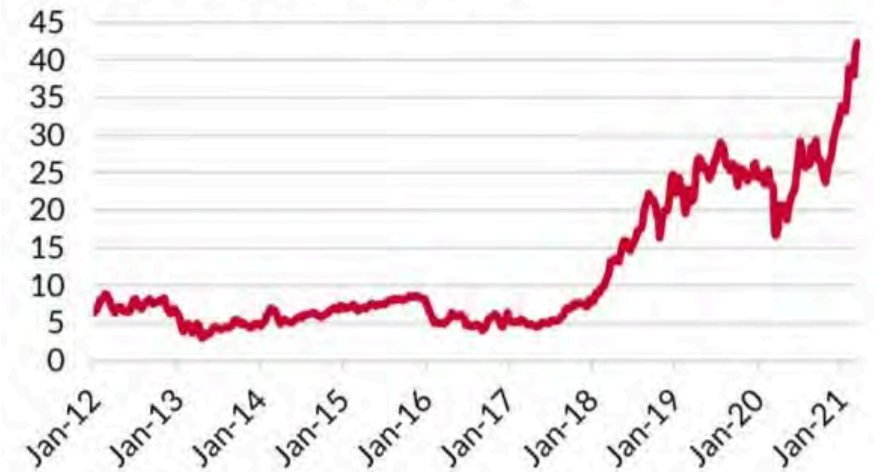
Source: Statistical pocketbook 2019

European Union's Green Deal and Maritime Transport

CO2 tax for maritime. Fossil-fuel subsidies should end and, in the context of the revision of the **Energy Taxation Directive**, the Commission will look closely at the current tax exemptions including for aviation and **maritime fuels** and at how best to close any loopholes.

- the Commission will propose **to extend European Emissions Trading scheme (ETS) to the maritime sector.**

EU ETS Carbon Market Price



- The Commission will take action in relation to maritime transport, including **to regulate access of the most polluting ships to EU ports and to oblige docked ships to use shore-side electricity.**

FuelEU Maritime.

This initiative is meant to be part of a broader “basket of measures” to decarbonise maritime transport (but not specifically mentioned in the Green Deal).

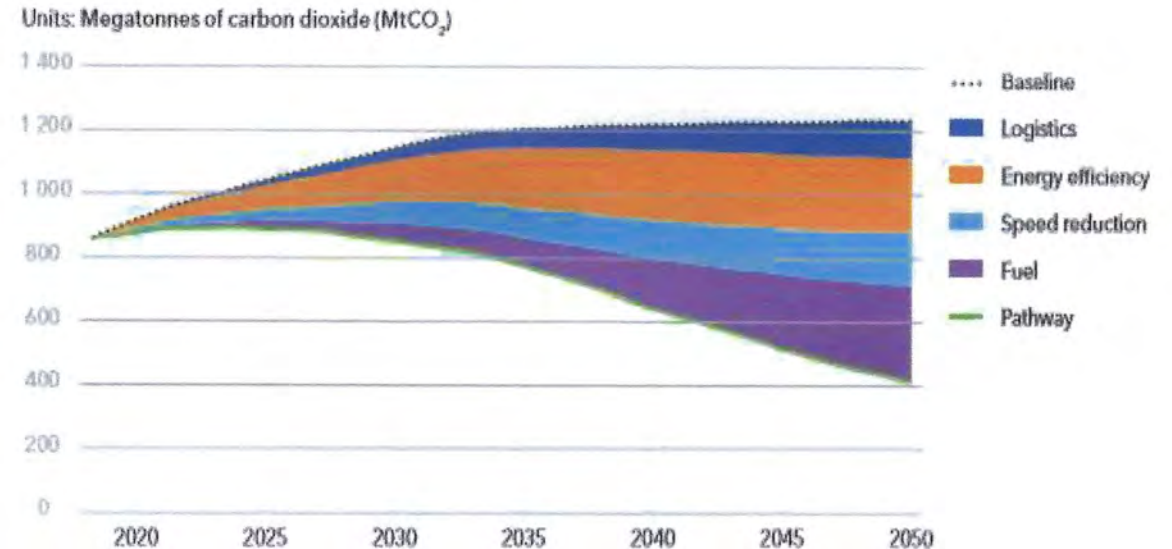
The initiative aims at reducing emissions from maritime transport **by accelerating the uptake of sustainable alternative fuels and power in operation and at berth. Ensuring a much more diverse fuel mix and a higher penetration of sustainable alternative fuels is critical to bring maritime transport in line with the European ambition of climate-neutrality by 2050.**

Strategies to reduce maritime emissions

Meeting the climate targets would require **a combination of options** to effectively reduce emissions.

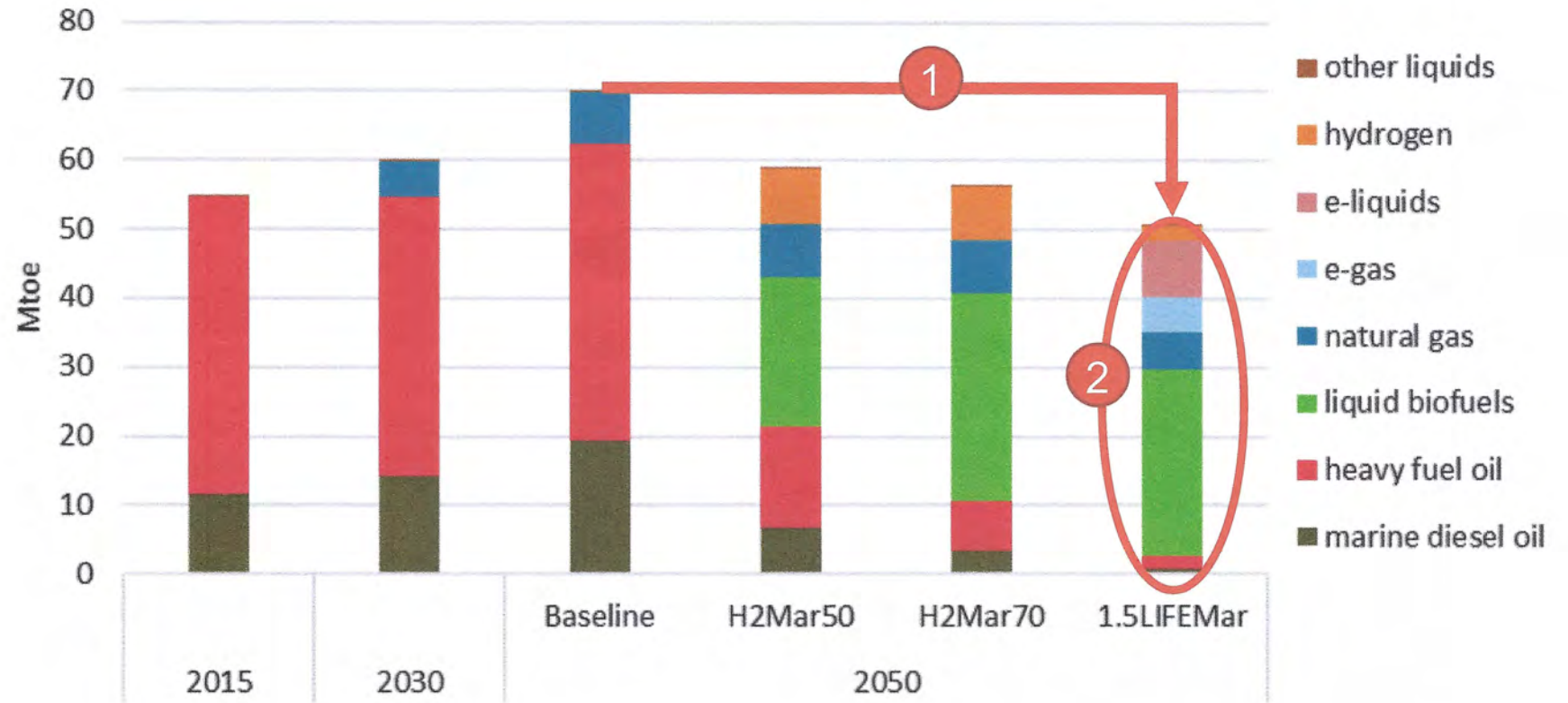
These include among others:

- Energy efficiency (covering logistics, design, technical improvements and operations)
- **Greater use of sustainable alternative fuels of energy**



DNV-GL (2019) | Maritime Forecast to 2050

Strategies to reduce maritime emissions: Fuel mix



There is need for significant change in the fuel mix used in shipping.

Liquid biofuels provide the higher share contributing more than 50%.

Source: PRIMES.

EU refining industry 2050 potential scenario

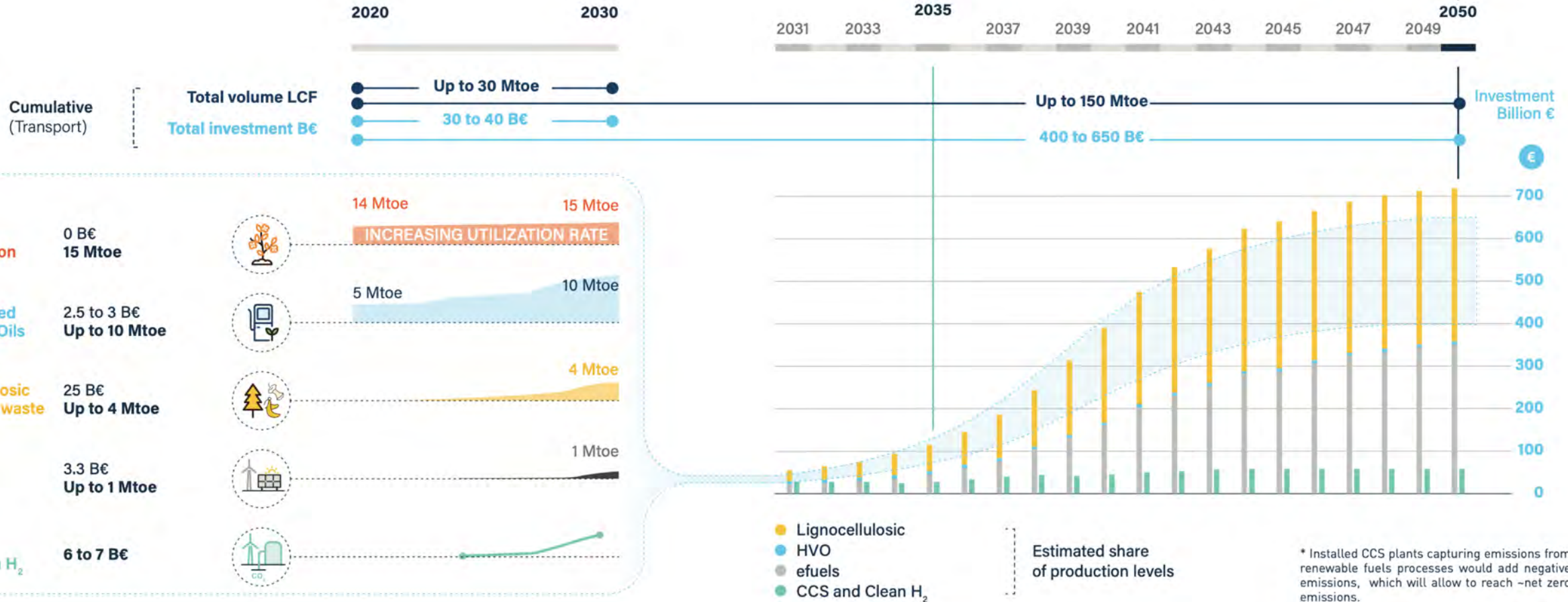
(% GHG red. vs 100% fossil)

TRANSPORT

-100 Mt
CO₂/year
REDUCTION

AVIATION & MARITIME
-50%
CO₂ EMISSIONS

ROAD TRANSPORT
-100%
CO₂ EMISSIONS*



Available low carbon fuels

The use of low carbon fuels in maritime transport has been minimal for the moment....

A plethora of fuels that can be used with no clear winner....

Short terms runners are LNG, liquid advanced biofuels and biomethanol....

Medium term runner is ammonia....

Long term runners are fuel from close coupled CCUS, efuels and hydrogen.

All are more expensive than current bunker fuels....

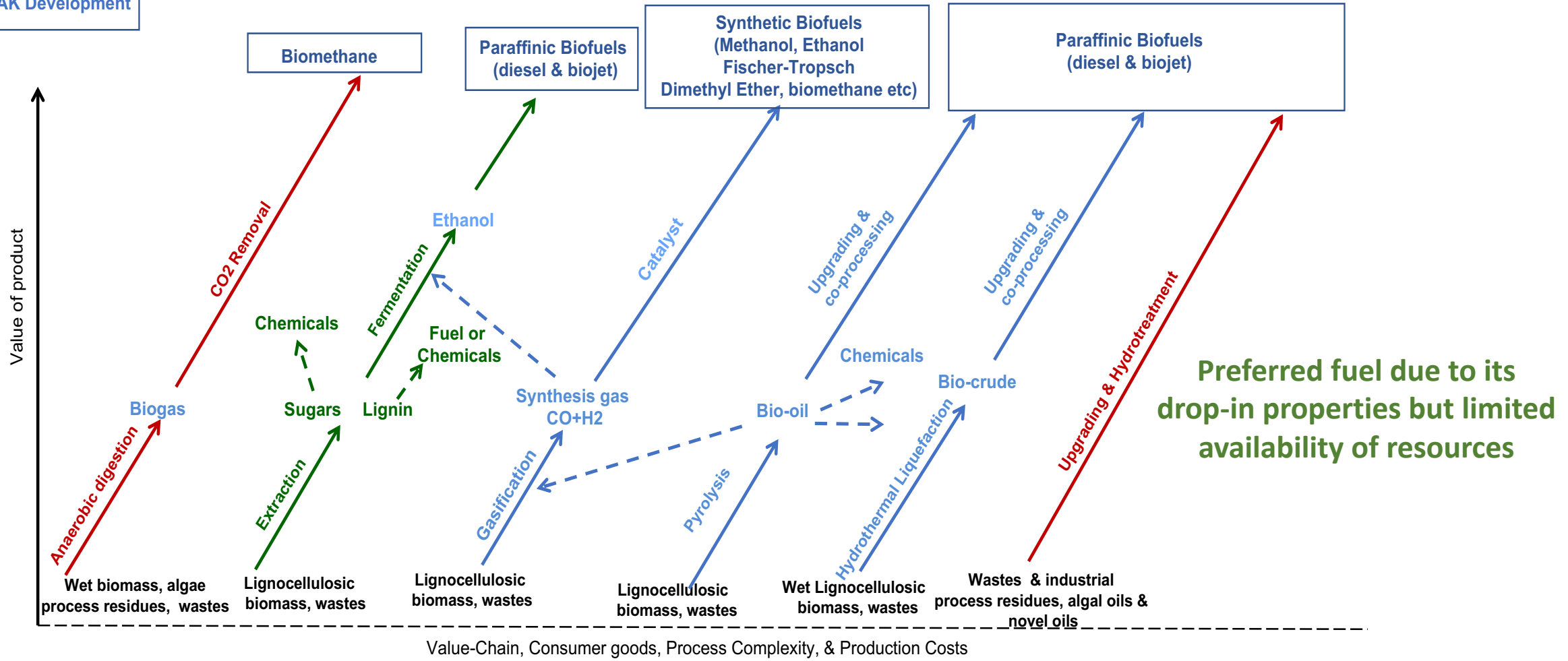
Shipowners prefer market based measures (like the CORSIA in aviation)....however the effectiveness of such measures is questionable.

Key to graph
Commercial
FOAK Deployment
FOAK Development

Available technologies for advanced biofuels

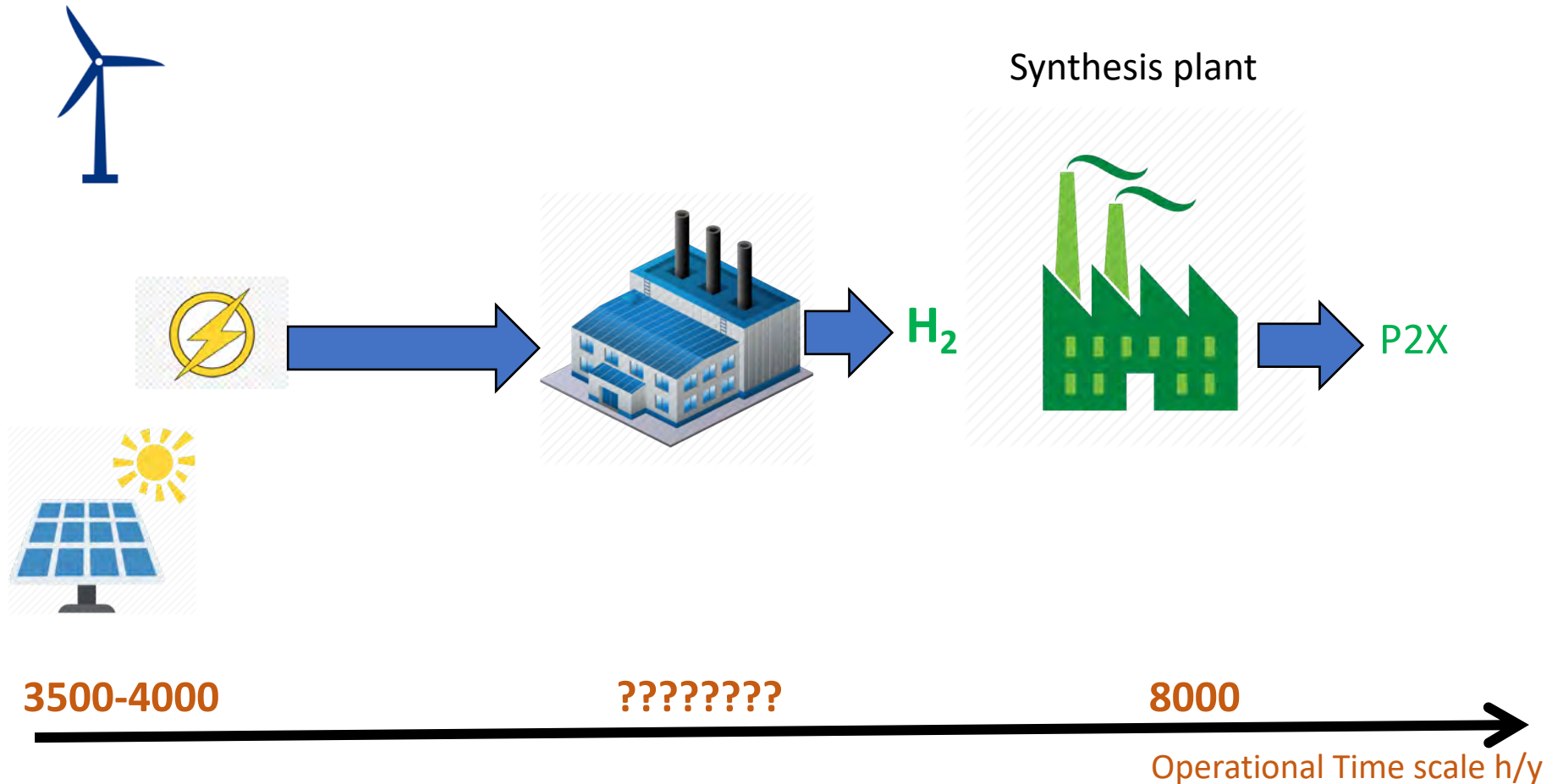
Biological Processing

Thermochemical Processing

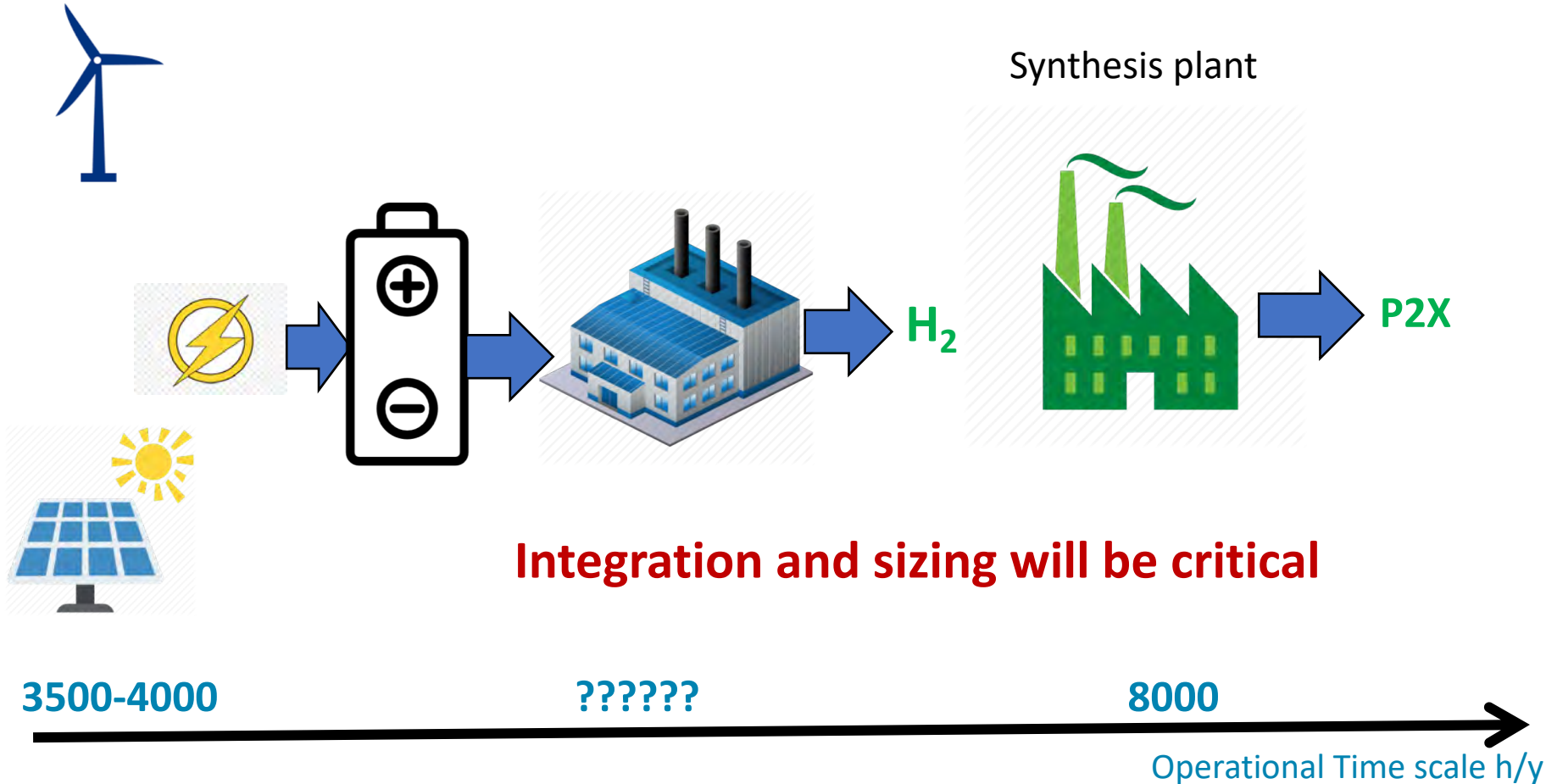


Adding value to biomass by processing to advanced biofuels and to biochemicals

Available technologies for renewable fuels



Available technologies for renewable fuels



The need for disruptive policies

Significant progress has been achieved on advanced biofuels, methanol, ammonia synthesis, electrolysis batteries etc, and several technologies are approaching commercialisation.

However, their cost remains very high.

CCS/CCU remain still elusive and little progress has been reported.

Promoting the use of renewable and low carbon fuels, although a successful policy so far, is inadequate to ensure the 1.5 °C scenario by 2050.

This can only be ensured if new legislation will be enacted to actual limit and reduce the use of fossil carbon fuels on a fixed, continuous and determined road map to 2050.

The EU oil Majors and several other in the US has put forward their net-zero 2050 strategies. The industry has to undertake a leadership role in close coordination with governments and the civil society.

Concluding remarks

It is not possible to pick a winning green fuel, however, in the short term biofuels is the only reliable option. The shipping industry should start using them.

At present, all green/renewable fuels need a lot of policy and financial support since they compete against fossil fuels.

Should policies be enacted to curtail fossil fuels on a steady, continuous and fixed roadmap, the policy and financial support for biomass, biofuels and bioenergy (as well as all green/renewable fuels) will start to decrease significantly.

Transport decarbonisation in general and maritime transport in particular would benefit significantly.

Biomass could become indispensable for:

Providing sustainable biofuels in transport sectors such aviation, maritime and heavy duty transport,

Stabilizing the power grid,

Greening the natural gas grid with biomethane and eventually hydrogen,

Securing negative emissions via Bio-CCS,

Providing job in rural areas.

Concluding remarks

Waiting till a winner-fuel will emerge in the future is no option.

The shipping industry (like the aviation industry) doesn't like legislation and mandates.....however, the industry has the obligation towards the European citizen to moving fast-forward to decarbonisation.

Unless the industry will sit down with the government and the legislator to discuss effective decarbonisation measures it will be inviting mandates and/or disruptive legislation.

The Greek shipping industry needs to take a more proactive role and lead the global maritime decarbonisation strategies with international organizations, the European Commission and the Greek government.

Thank you for your attention!

Kyriakos.Maniatis@outlook.com

Post COVID-19 Recovery and 2050 Climate Change Targets: Changing the Emphasis from Promotion of Renewables to Mandated Curtailment of Fossil Fuels in the EU Policies

<https://www.mdpi.com/1996-1073/14/5/1347>