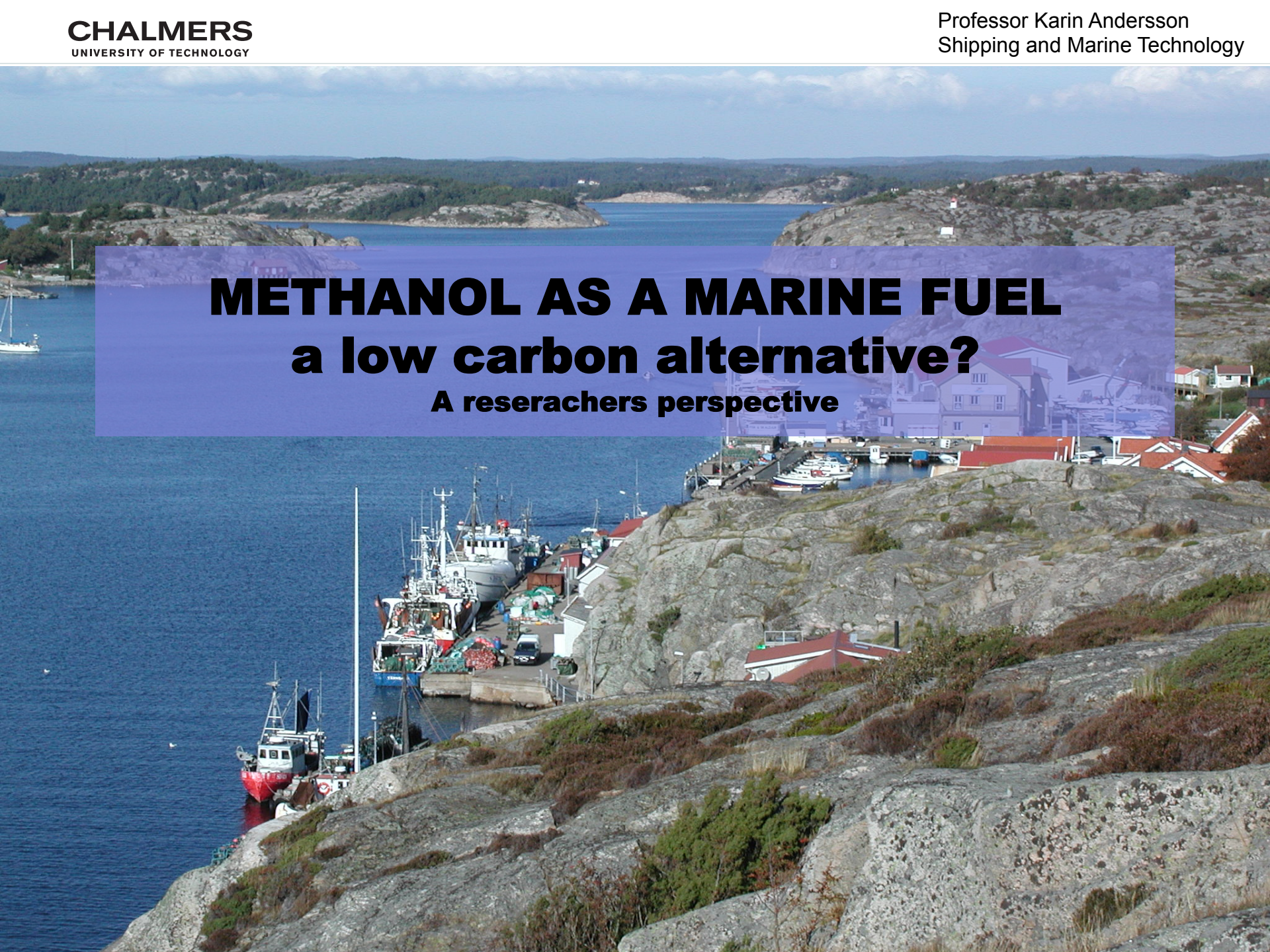




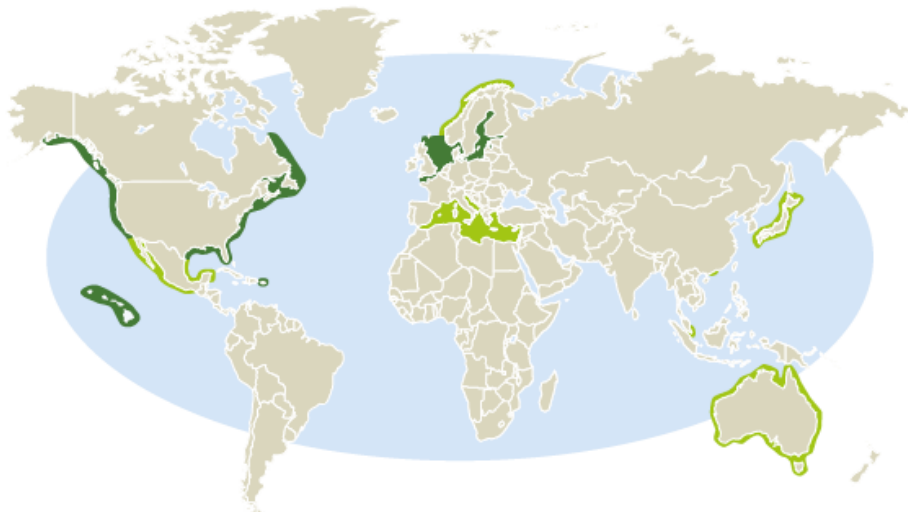
METHANOL AS A MARINE FUEL

a low carbon alternative?

A reserachers perspective

Increased focus on environment and resources in shipping

Shipping is traditionally using large amounts of residual fuel, heavy fuel oil (HFO) often with high sulphur contents.



An Emission Control Area can be designated for SO_x and PM or NO_x, or all three types of emissions from ships, subject to proposal from a Party to Annex VI.

- ECA/SECAs (Emission control areas). Sulphur (0.1%) and NO_x
- IMO - global reduction of sulphur (0.5%) coming (2020?)
- Greenhouse gases, energy efficiency not enough
- Local regulations in shipping lanes and ports
- Competition for oil and other fossil fuels (or Oil price....)
- Competition with other means of transport
-

Shipping and Greenhouse gases

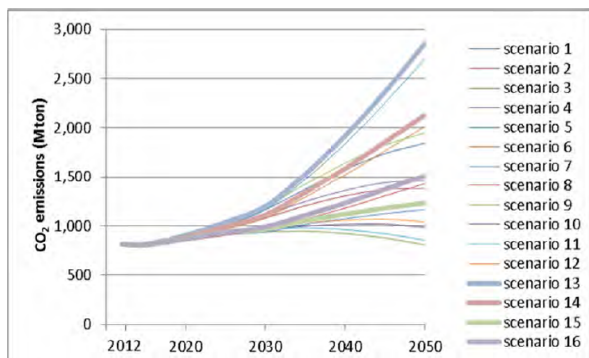
The shipping sector – “treated as a nation” – not included in UNFCCC.

Handled by the IMO (International Maritime Organisation) - shipping industry “**will make its fair and proportionate contribution**”. Two instruments are established:

- **EEDI** (Energy Efficiency Design Index) – compulsory for new-builds
- **SEEMP** (Ship Energy Efficiency Management Plan) – compulsory to have document on board

But still:

- *all IPCC scenarios but one project emissions in 2050 to be higher than in 2012*
- *improvements in efficiency are important but could not yield a downward trend.*



Total annual fuel consumption:

- internationally 300 million tonnes,
- in North Sea/Baltic Sea ECA 20 - 25 million tonnes

Marshalls calls IMO chief a danger to planet earth

Updated at 4:51 pm on 8 October 2015



The Marshall Islands foreign minister, Tony de Brum, has called the secretary general of the International Maritime Organisation a danger to the planet.

He made the comment after Koji Sekimizu spoke out against regulating carbon emissions in the shipping industry.

Koji Sekimizu says any discussion of shipping's contribution to reducing global carbon dioxide emissions is the business of the IMO and not the United Nations Framework Convention on Climate Change.

Asia Shipping Media reports Mr Sekimizu as saying any move to cap shipping emissions would reduce the industry's ability to meet the demands of the global economy and create an imbalance in the industry and must therefore be avoided.



Tony de Brum

Photo: AFP

“..the country with the **third largest shipping registry** and one that is **facing severe negative impacts from climate change** the Marshall Islands feels obligated to call for the most stringent measures to regulate the carbon emissions in the shipping industry”

But Mr de Brum says he is alarmed by the IMO's position.

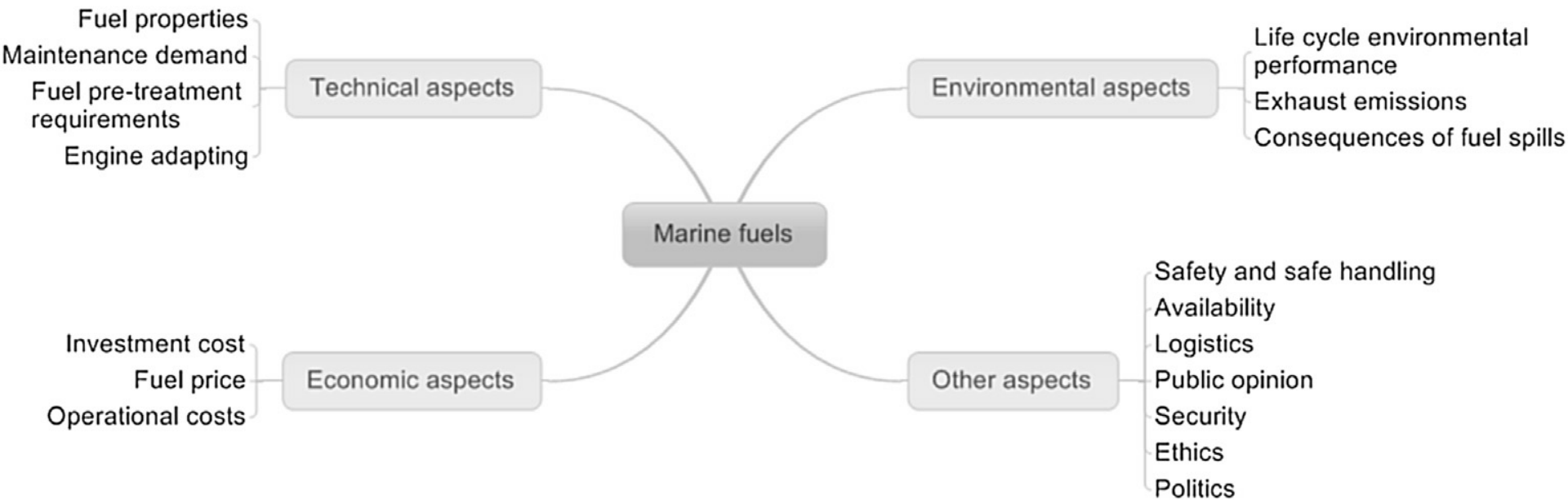
He says as the country with the third largest shipping registry and one that is facing severe negative impacts from climate change, the Marshall Islands feels obligated to call for the more stringent measures to regulate carbon emissions in the shipping industry.

But he says the Marshall Islands should not have to go it alone.

EC, “WHITE PAPER Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system” (2011)

- 30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors
- Low-carbon sustainable fuels in aviation to reach 40% by 2050; also by 2050 reduce EU CO₂ emissions from maritime bunker fuels by 40% (if feasible 50%)¹¹

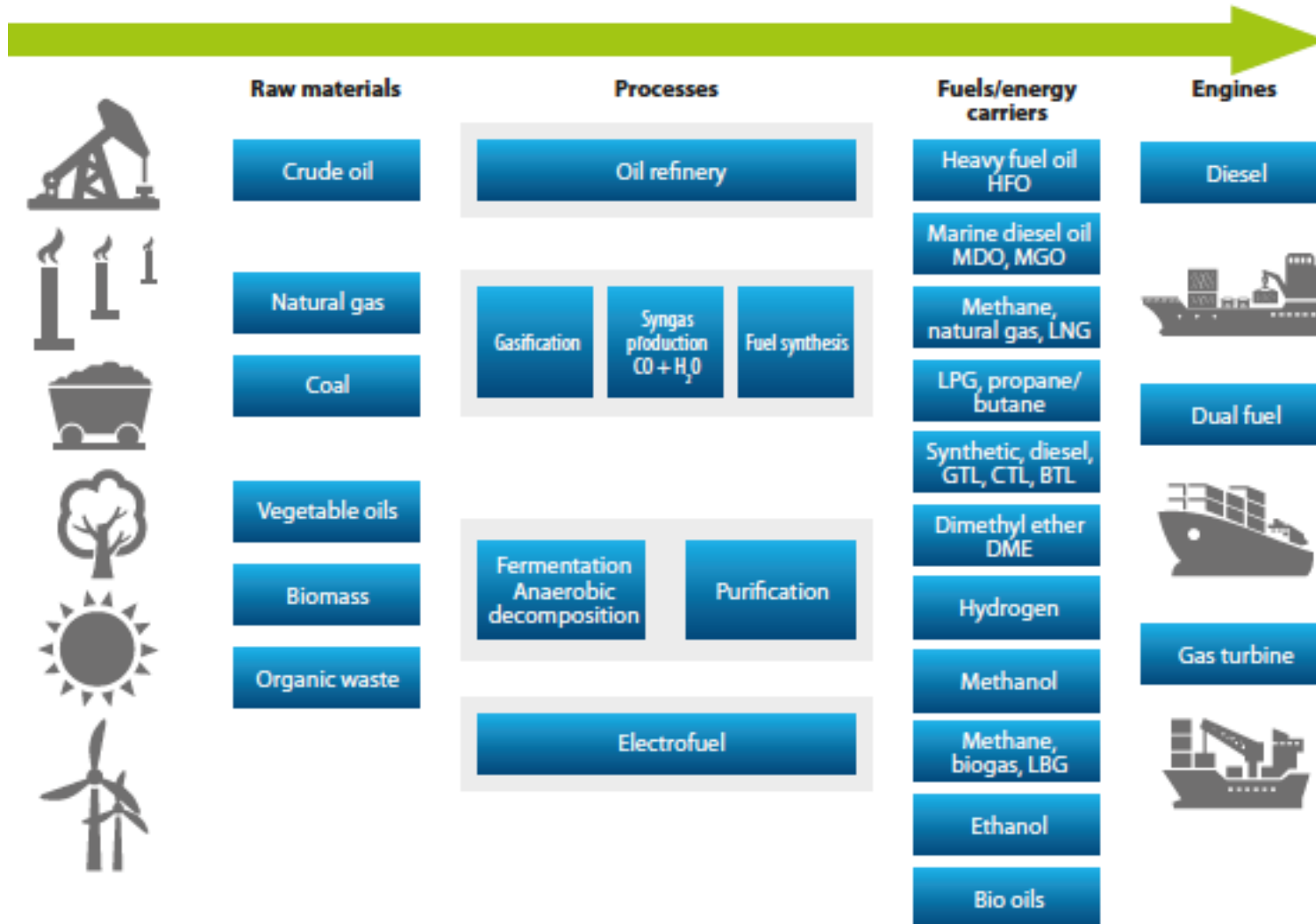
Criteria when selecting fuel



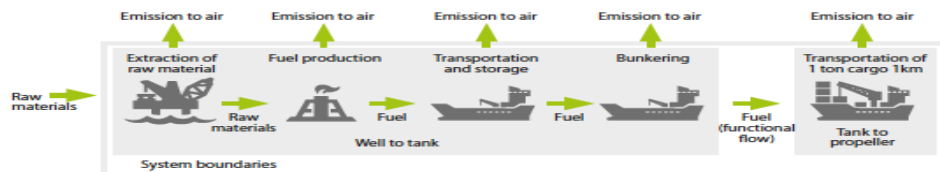
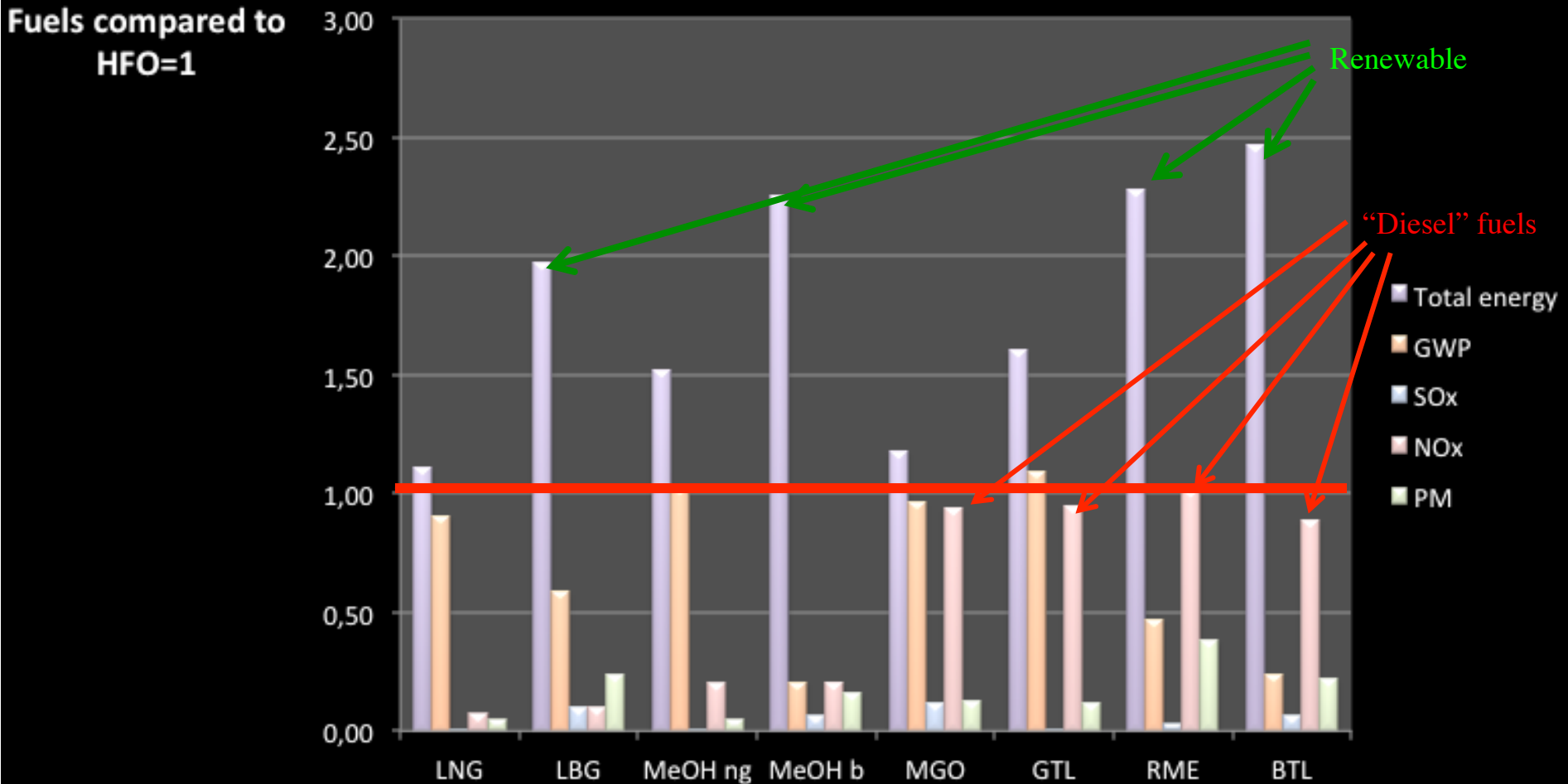
S. Brynolf et al. / Journal of Cleaner Production 74 (2014)

- Price is fundamental
- Regulations are driving change

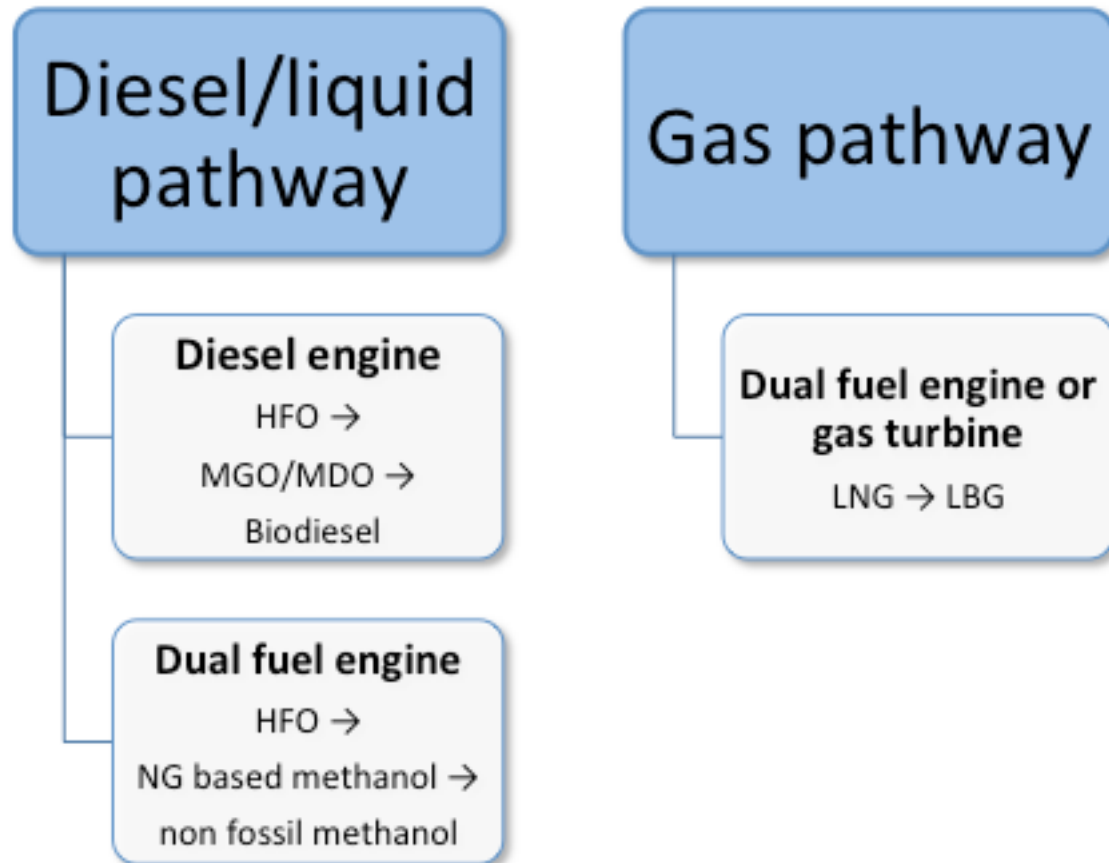
Marine fuel chain



Impact of fuels from well to propeller based on data from Brynolf 2014



Pathways to non fossil fuel



Differs in infrastructure, fuel handling/combustion but also total Energy input and emissions along the fuel chain.....

METHANOL AS A MARINE FUEL

- Fulfills SECA regulation
- Can be used with high efficiency in marine diesel engines after minor modifications using a small amount of pilot fuel (Dual fuel)
- Low Tier II NO_x emissions, can be Tier III, low particle emissions
- Liquid at ambient temperature – easy distribution and use
- Long experience in handling
- Available on chemicals market – today in surplus
- Price has to be
 - Competitive with MGO for SECA
 - Competitive with LBG and biodiesel for non fossil fuel

Methanol is also a good fuel alternative to fulfill the 2⁰ C goal for climate.

Attractive pathway to carbon neutral fuel if produced with good energy efficiency as biomethanol or electrofuel

Applied R&D projects on methanol as marine fuel. Industry consortia

- **Effship (Efficient Shipping with Low Emissions) 2009-2013**
 - Evaluation of alternative fuels and lab tests. Conclusion – Methanol best in terms of availability in existing infrastructure, price, simple engine and ship technology and established applications on land.
- **CleanShip (Clean Baltic Sea Shipping) 2010-2013**
 - Methanol interesting alternative fuel in the Baltic Sea. Sub-project testing fuel cell auxiliary engine with methanol.
- **SPIRETH (Alcohol Spirits and Ethers as Marine Fuel) 2011-2014**
 - Tests on auxiliary engine on board. Conclusion – it is feasible to convert ships to methanol or DME
- **PILOT Methanol 2014 -2015**
 - Conversion of RoPax ferry engine. Full scale test ongoing.
- **MethaShip 2015-2017**
 - Assessment of design of two ships, RoPax and cruise.
- **Conversion of pilot boat 2015**
 - Swedish maritime administration.

Conclusion

- Many energy carriers can be used in present/modified engines
- Important choice - gas or liquid
- Several production paths and raw materials to the energy carriers
- Need for evaluation on systems level to include all impacts and consequences
- Need for energy efficient production process including raw materials for non-fossil marine fuels
- Local conditions, available raw material and infrastructure may be important to choice

Thank you for your attention 😊

