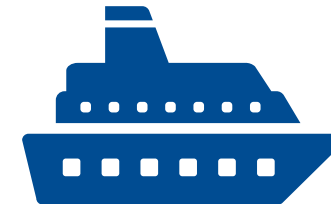


Which fuel to select?



TUGS,
ROAD FERRIES,
LOCAL TRANSPORT



FERRIES,
SHORT VOYAGES,
SCHEDULED TRAFFIC



DEEP SEA
SHIPPING

	Volumetric density [MJ/L]		LHV [MJ/kg]	
	w. storage	net	w. storage	net
BATTERY	2		0,3	
CH₂ (700 bar)	est. 4	4,8	est. 7	120
LH₂ (-253 °C)	est. 6	8,5	est. 14	
AMMONIA	10	11,4	11	18,6
MGO	36	41	41	43

Marine fuels

Ammonia is expected to take a major role specially in deep sea shipping

Projected Marine Fuel Use to 2050

As the shipping industry reduces greenhouse-gas emissions, as mandated by the International Maritime Organization, ammonia and hydrogen are projected to be the leading alternatives to traditional oil-based fuels by 2050.

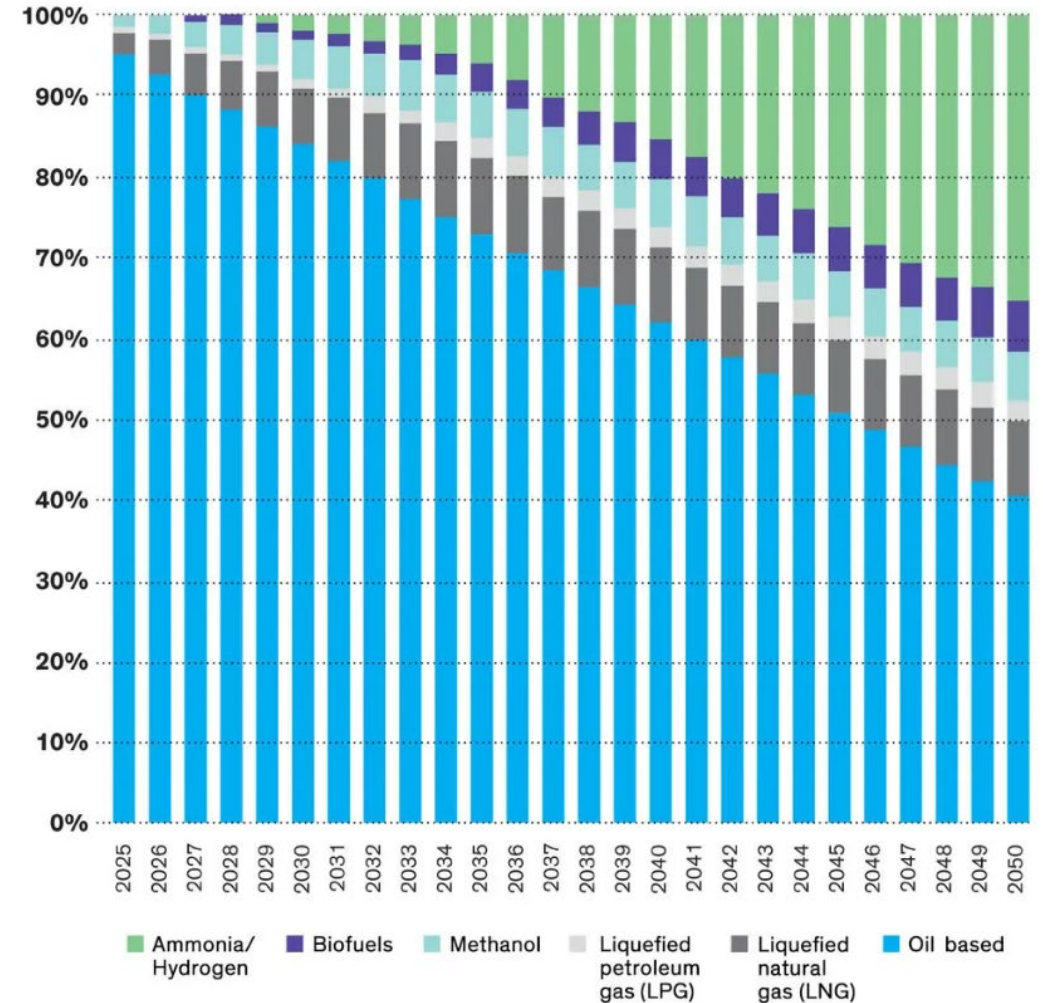
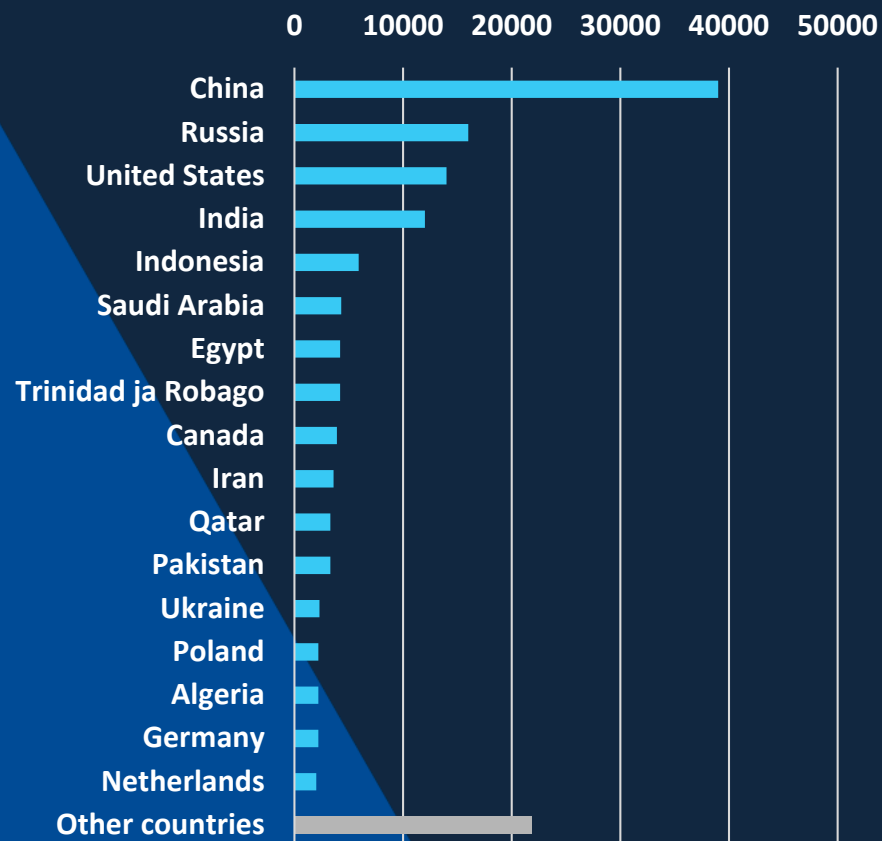


ILLUSTRATION: MICHAEL SOLITA. SOURCE: AMERICAN BUREAU OF SHIPPING

Source: <https://spectrum.ieee.org/why-the-shipping-industry-is-betting-big-on-ammonia>

Ammonia production geographically

Ammonia production worldwide in 2021



Source: statista.com

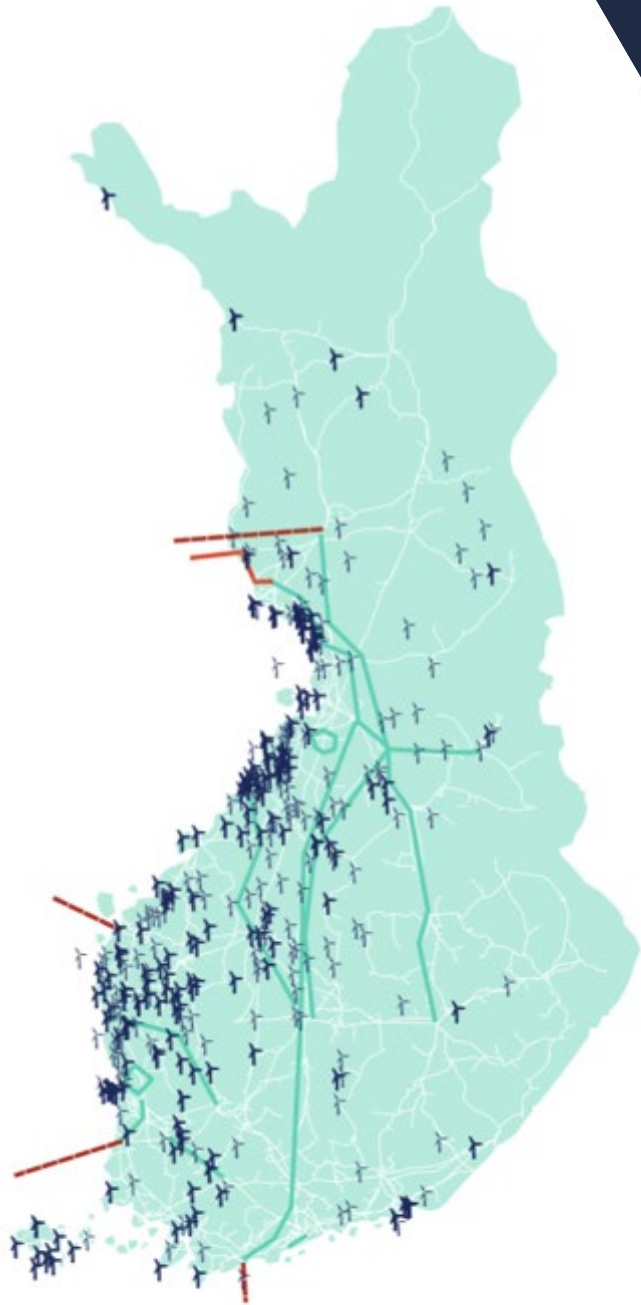
China, Russia, US and India holds over 50% of the world

Production in EU is highly depended on Russian natural gas

The key elements of ammonia:

- Security of supply – independency from China and Russia
- Food production – main use of ammonia is fertilizers
- Energy storage, transportation and grid balance
- Textile manufacturing
- Nitrogen oxide emission abatement (AdBlue)
- Future marine fuel for deep sea shipping
- Current ammonia production is mainly gray causing considera

Finland is well positioned to produce green ammonia



- Competitive electricity price
- Favorable conditions for wind power and Strong electricity network
- Utilization of the excess heat in district heating network
- Availability of clean water
- Predictable regulation
- Existing use of ammonia
- Central Europe is easily achieved with exports on ships

**GREEN
NORTH2
ENERGY**

#Hydrogen

Hydrogen and ammonia production in Naantali

**Green hydrogen
economy from Green
North2 Energy**

TSE



Thank you!