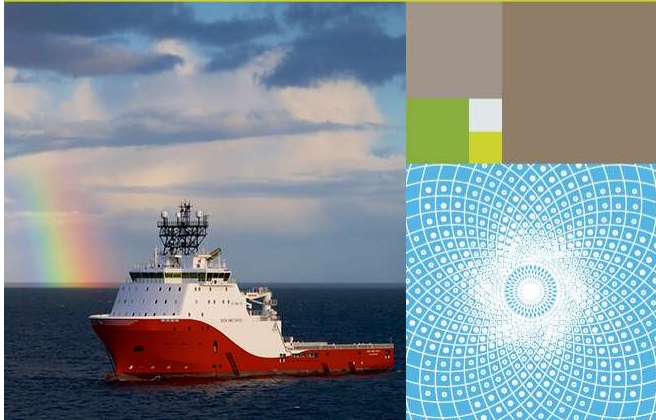




Knowledge grows

# Ammonia the perfect partner

August 2020



## Yara - the Crop Nutrition Company for the Future

**220 million**

people our products help to feed

**20 million**

The number of farmers we collaborate with

**9,000**

Fully branded retail outlets<sup>1</sup>

**870**

Agronomists on the ground

**+60**

The number of countries we operate in

**5 million**

Tonnes of ammonia traded – Global leader

**3 units**

3 Industrial Nitrogen Business Units

**No. 10**

Ranked no. 10 on FORTUNES' prestigious Changing the World List<sup>2</sup>



<sup>1</sup>Owned and operated by external parties  
<sup>2</sup> Fortune List rating dates back to 2017

# Responsibly Feed the World and Protect the Planet

## Our Ambition: towards climate neutrality

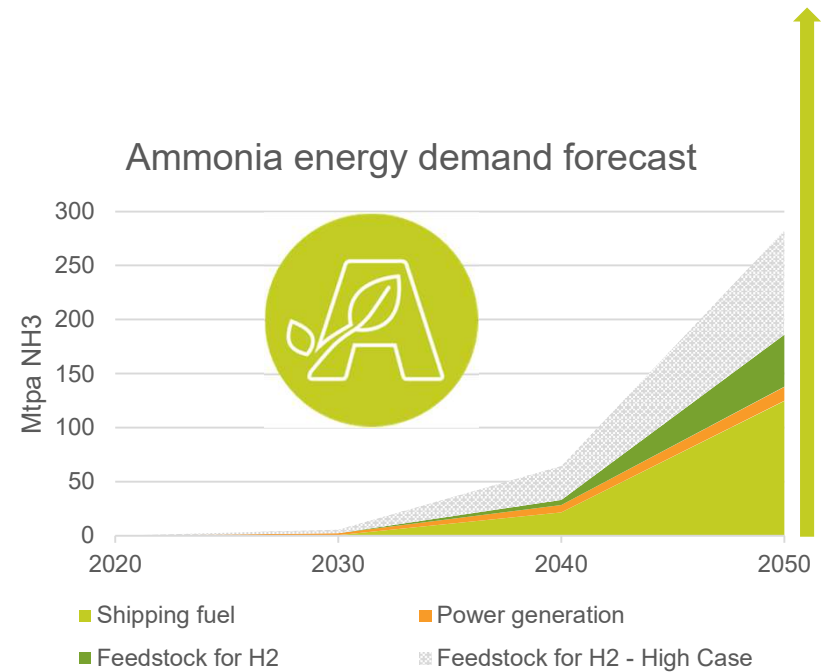


# Clean Energy could triple the global demand for ammonia

- Ammonia Energy is receiving increasing attention and can shift the ammonia market\*

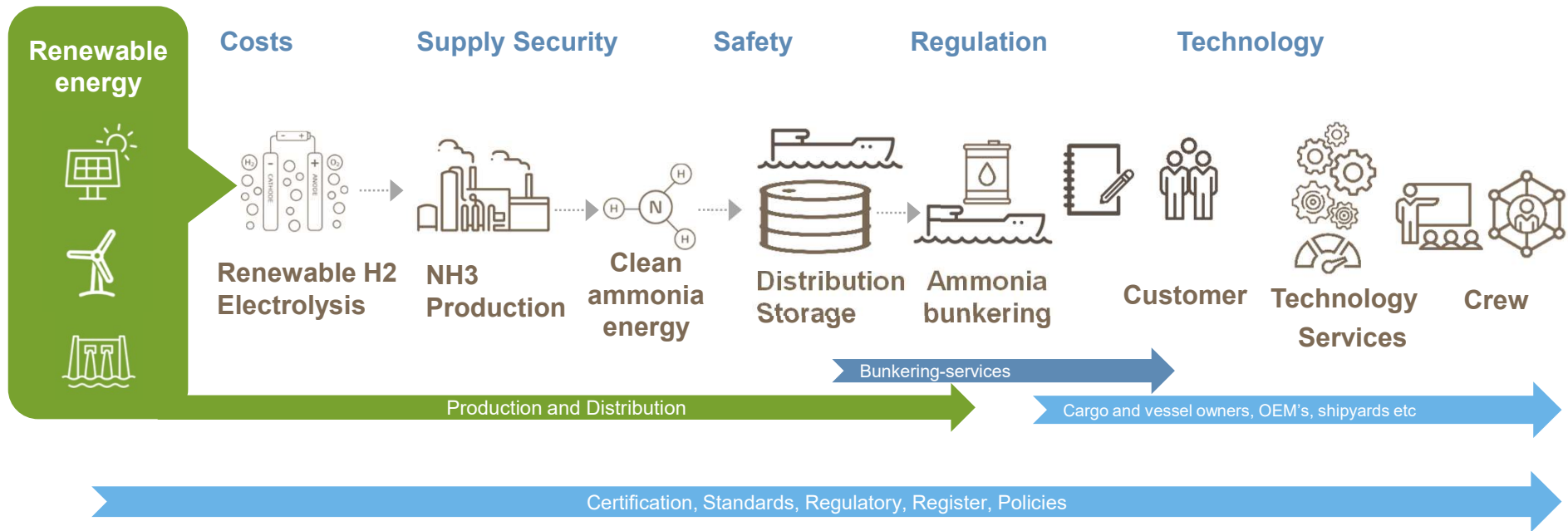


- Power generation**
  - Ammonia for direct power generation
- Shipping fuel**
  - Ammonia as marine fuel  
(DNVGL 25% of 2050 shipping fuel can be ammonia,  
Getting to Zero Coalition: 600-900 million ton)
- H2 carrier**
  - Ammonia as energy storage and transport vector (H2 economy) can emerge as deep decarbonization begins



\* Lloyd's/Umas/IMO/DNVGL/IEA/WEF-GMF-GtZ etc

# Clean Ammonia Marine Fuel – turning barriers into possibilities



# Yara is unique with presence in the whole ammonia value chain

## Producer

- Total ammonia production including JV share ~ 8 million tons / 26 units
- High level of know-how of Yara plants (1 unit now +/- 5 yrs in contin. operation)
- Lower gas consumption compared to other producers

## Exporter

- 4 fully-owned ammonia export plants in Europe (export cap. ~ 1 mln t)
- Yara JV ammonia export capacity ~ 2,7 mil t

## Fleet & storage

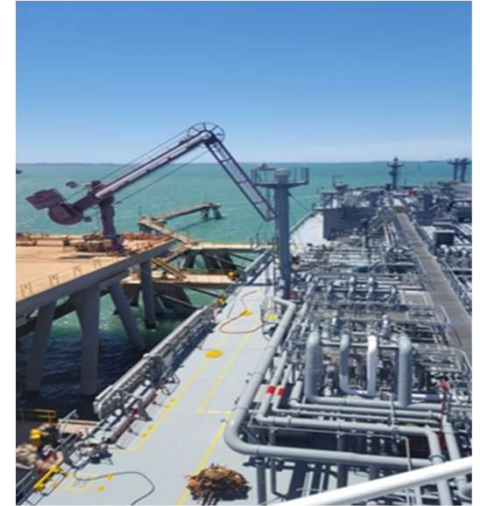
- Yara NH3 maritime transport capacity > 200 kt (momentum)
- Own storage ammonia capacity 580 kt
- 17 marine ammonia terminals

## Importer

- World's largest importer with total imports of ~ 2 mln t / year (2019)
- Flexibility to produce or import ammonia

## Trader

- Truly global
- Truly international
- With own back-up supply system

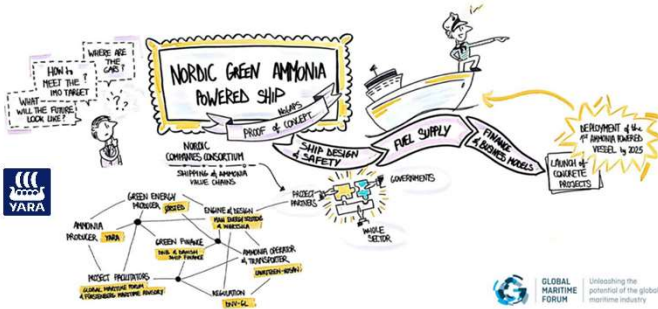


## Yara collaborates to explore and remove barriers

	Security of Supply	Fuel cost	Perception Safety	Regulatory	Technology
Barrier description	<b>Security of supply</b> and <b>scalability</b> of infrastructure	Ammonia energy will need long term high carbon price (stick) and steeper <b>learning curves to scale</b> renewable H2 (carrot)	Perceived ammonia <b>safety risks can be a barrier for uptake</b> of NH3 fuel	<b>Currently no rules for use ammonia as fuel.</b> Best available grey ammonia can compete in GHG LCA emissions already <b>Well-to-Wake</b>	<b>Proven production technology to scale. Ammonia energy use not proven at full scale</b> yet.
How to close the gap?	Starting point is decent with 20 Mtn/ yr global trade. Industry collaboration required to move from grey to green at scale, including bunkering infrastructure	Access to <b>low cost renewable energy</b> and/or large scale development of CCS will be the key to reduce ammonia energy costs	<b>Demonstration projects</b> must learn from global best practice and QRA of existing ammonia production and logistics.	Establish first projects based on transition from grey to low-carbon supported by certification in trade	Starting from hybrid production and grey use in ammonia application (marine, power, heating) Demonstrate marine fuel within 3-5 years

- The key to overcoming the barriers is to identify the viable demonstration concepts
- Yara aims to participate in strong consortia to establish viable demonstration cases in marine fuel
- Yara can offer a fuel value chain perspective as well as expertise in ammonia handling and safety

# Current main public initiatives on ammonia marine fuel



NCE Maritime CleanTech News Events Projects Participants About us Join us

## Major project to convert offshore vessel to run on ammonia-powered fuel cell

23RD JANUARY 2020 | IN NEWS | BY MARIUS KNUTSEN

**Viking Energy**

To become the world's first supply vessel with emission-free fuel solution

## Zero Emission Distribution at Sea ZEEDS

ZEEDS aims to create a network of offshore platforms that uses wind and/or solar to produce, store and distribute zero emissions fuels in a network of clean energy hubs placed near one of the world's busiest shipping lanes.

Partners: Wärtsilä; Aker Solutions; DFDS; Grieg Star; Kvaerner; Equinor

The ShipFC project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 875156. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme, Hydrogen Europe and Hydrogen Europe research.



## Pilotstudie: Color Fantasy på ammoniakk

Color Line har fått med seg teknologiselskaper samt Carnival og andre rederier til å se om ammoniakk kan bli framtidens nullutslippsdrivstoff.



## TO SAMSUNG GEOJE SHIPYARD



MISC, Samsung, LR and MAN join forces to develop ammonia-fuelled tanker project



## Joint Agreement Reached for GHG Zero-Emission Ship

April 30, 2020

ITOCHU Corporation (headquartered in Minato-ku, Tokyo; Yoshihisa Suzuki, President & COO; hereinafter "ITOCHU") announced today that it has come to an agreement with Imabari Shipbuilding Co., Ltd. (hereinafter "Imabari"), MAN Energy Solutions (hereinafter "MAN"), Mitsui E&S Machinery Co., Ltd. (hereinafter "Mitsui E&S Machinery"), ClassNK (hereinafter "ClassNK"), ITOCHU ENEX Co. Ltd. (hereinafter "ITOCHU ENEX") on jointly developing ships equipped with a main engine using ammonia as its main fuel (hereinafter "Ammonia-fueled Engine").

ITOCHU group and Vopak Singapore to sign Memorandum of Understanding to study ammonia marine fuel supply chain in Singapore

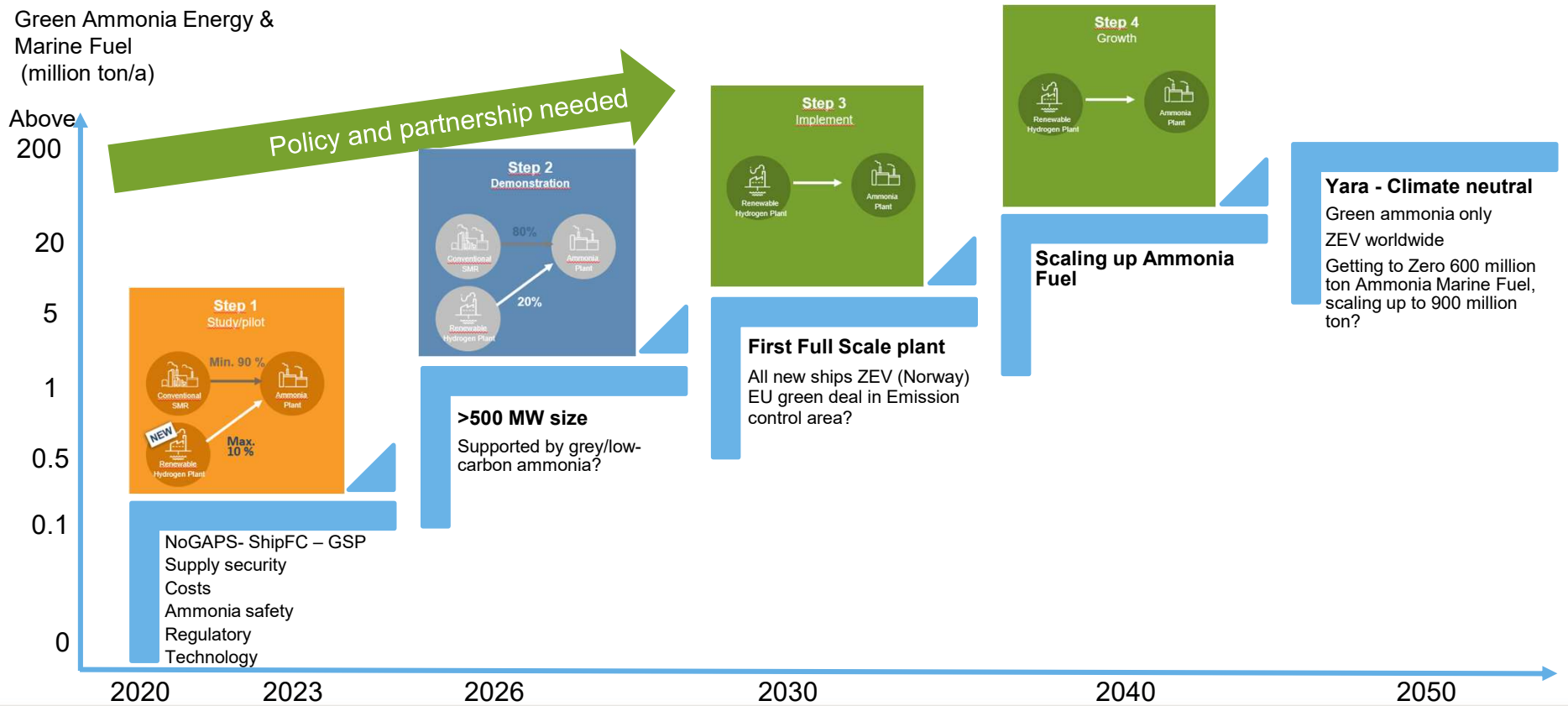
June 12, 2020



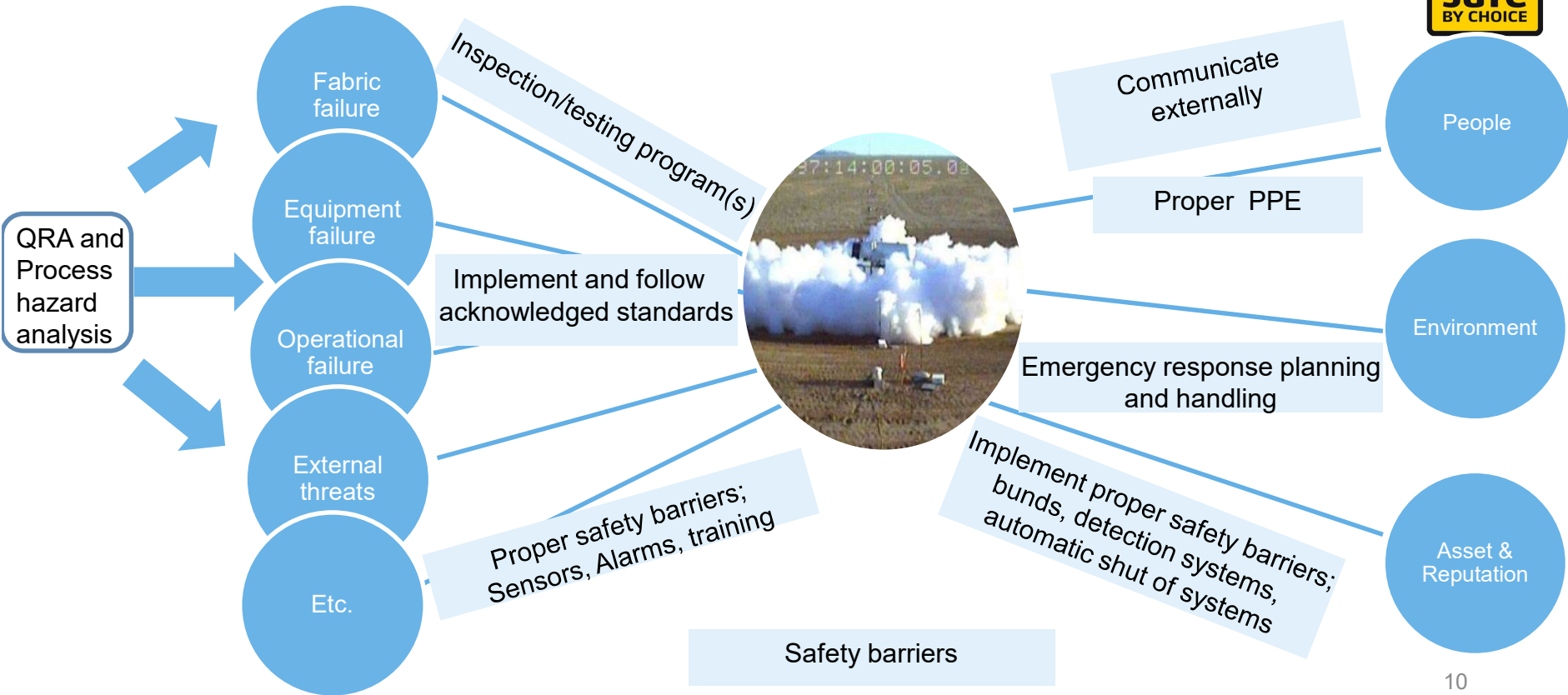


# Step wise approach towards ammonia marine fuel

Green Ammonia Energy & Marine Fuel  
(million ton/a)



# Quantitative Risk Assessment as basis to manage the risk



The future  
will be different...

