Knowledge grows

Energiforsk webinar: Vätgasens möjligheter för jordbruket

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This is Yara – the world's leading fertilizer company and a provider of environmental solutions

Our Mission

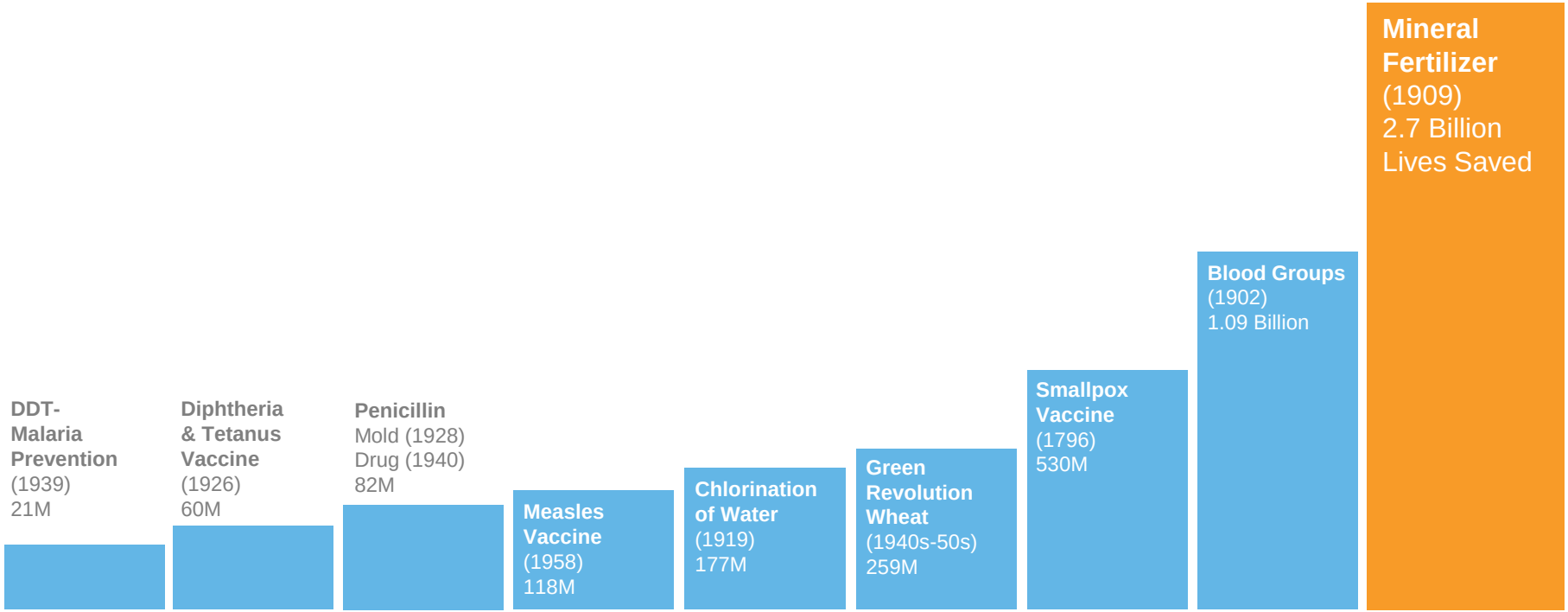
Responsibly feed the world and protect the planet

Our Vision

A collaborative society; a world without hunger; a planet respected.

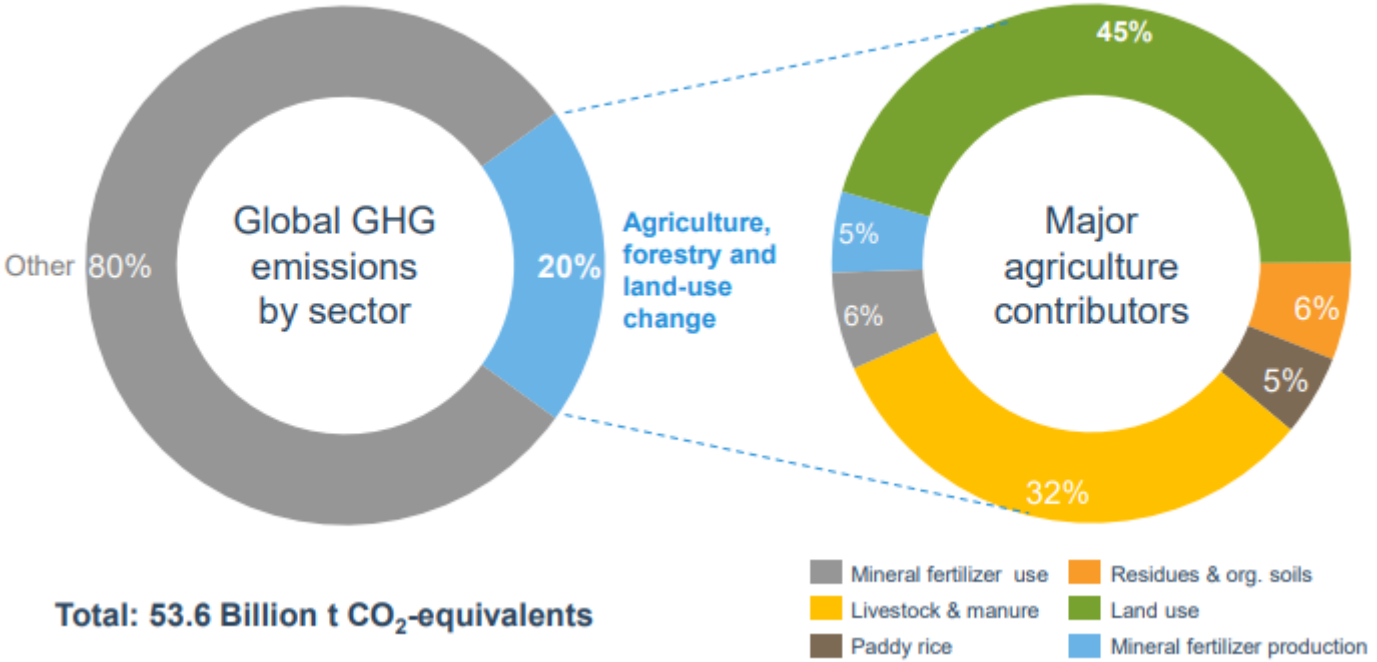
Lifesaving Innovations

The single most important development in global health. By far.



*www.medigo.com/blog/infographics/lifesaving-innovations/

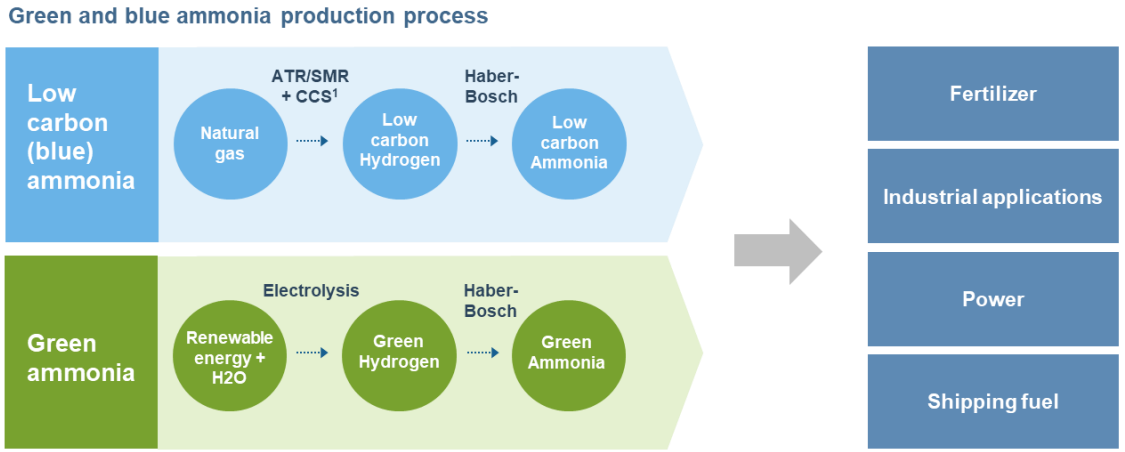
Agriculture is a major source of GHG emissions; Yara aims at contributing to major GHG reductions within its field of action



Source: FAOSTAT (2020)
Calculated based on IFA and FE for 2015; not disaggregated from industry in FAOSTAT

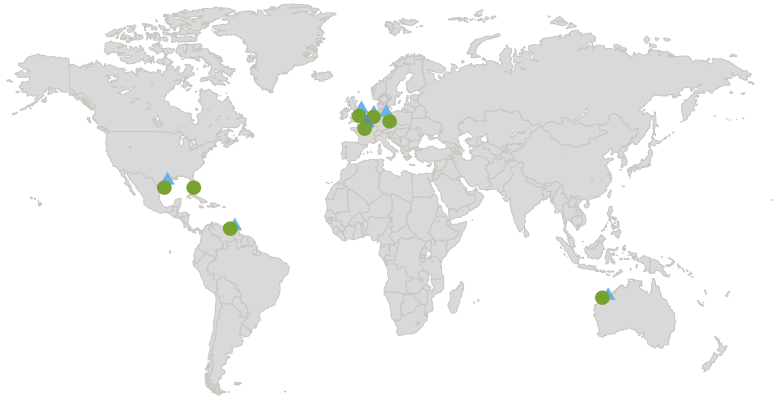
Ammonia is the most promising hydrogen carrier and zero-carbon shipping fuel

- Ammonia is a better hydrogen carrier than hydrogen (ships at -33°C vs. -253°C, higher energy density)
- Ammonia has existing and mature production and storage technologies
- Yara is the global ammonia champion; a leader within production, logistics and trade



1) ATR: Autothermal Reforming, SMR: Steam Methane Reforming, CCS: Carbon Capture and Storage

Yara has a unique starting point to capture value



▲ Exporting plants
● Terminals plants

Producer	• Major ammonia producer: ~ 8.5 mt production across 17 units • Leading operational know-how, with world record production runs • Higher energy efficiency compared to other producers
Trader	• Global trader with own back-up supply system with >20% market share[1] – 4 fully-owned ammonia export plants in Europe, ~ 1 million tons – Ammonia export capacity outside Europe ~ 2,7 million tons – Industrial Solutions truck/train logistics expertise
Fleet & storage	• Ammonia maritime transport capacity > 200 kt • Own ammonia storage capacity 580 kt • 18 marine ammonia terminals

1) Based on global deep-sea ammonia trade

Short-term: Pipeline of green ammonia pilots laying the foundation for full scale plants

Pilbara

- Cooperation with Engie
- Scale of 3.5 kilotons of green ammonia / 10 MW
- Project is in concept selection
- First industrial scale carbon neutral ammonia produced from solar power
- Targeting energy and materials value chain in Australia/Japan
- Commercial startup scheduled for early 2023

Sluiskil

- Cooperation with Ørsted
- Scale of 70 kilotons of green ammonia / 100 MW
- Project is in feasibility
- Pioneering project using offshore wind to produce renewable hydrogen and reduce CO_2 emissions
- Commercial start scheduled for 2025

Porsgrunn

- Cooperation with NEL (5 MW)
- Scale of 20 kilotons of green ammonia / 5+20 MW[1]
- Project is in concept selection
- First electrolyzer project of industrial scale with system integration into an existing ammonia plant
- Commercial startup scheduled for early 2023

1) 20 MW being tendered

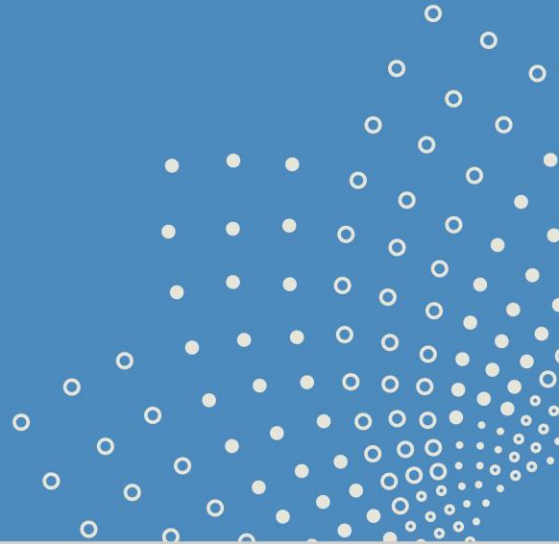
Long-term: World-scale project possible in Porsgrunn, with the right partners and regulation

Full electrification of ~500 kt ammonia unit can **remove ~800 kt CO_2**. Renewable power supply from Norwegian grid, leading to **100% hydrogen asset utilization**

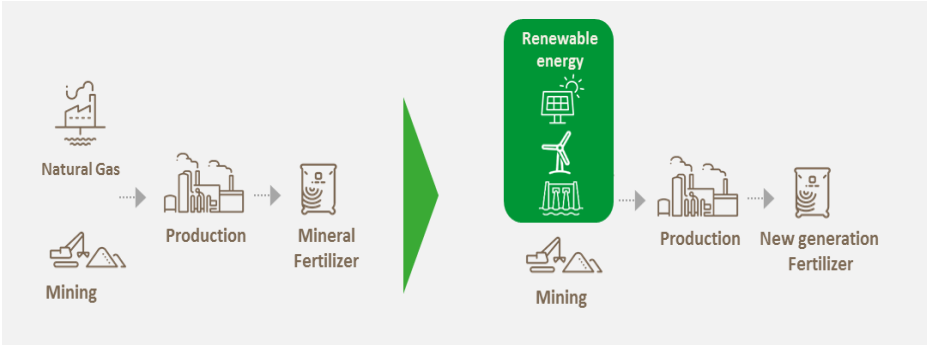
The project would eliminate one of Norway's largest stationary CO_2 sources and significantly contribute to **Norway reaching its Paris agreement commitments**

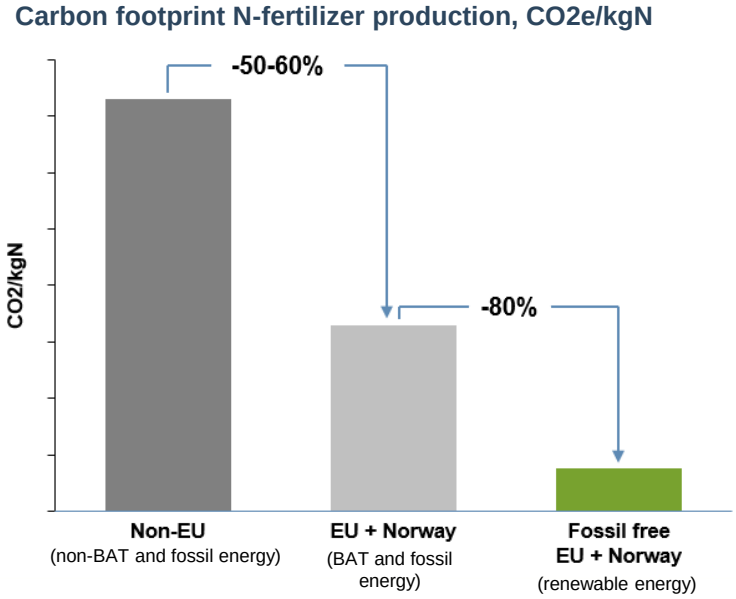
Public funding required to bridge the cost gap in first projects. The **cost of green ammonia is significantly higher than of conventional product**

Hydrogen and Agriculture

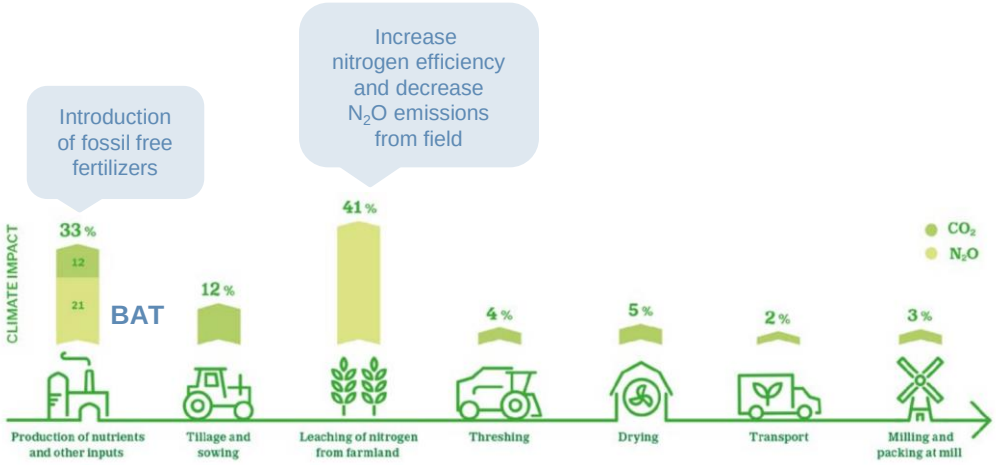


Using renewable energy to produce ammonia, which is the base of all mineral fertilizers, we can achieve a fossil free production process





Towards a fossil free food chain – the collaboration with Lantmännen



Climate impact per kg wheat flour
Source: Lantmännen's Farming of the Future, 2019

- Lantmännen and Yara work together towards a decarbonization of the food chain based on green ammonia from Porsgrunn.
- Focus of the collaboration:
  - fossil free fertilizers for the Swedish market
  - holistic farm management approach (digital tools for precision farming and optimization of yield, verification and documentation of emissions)
- Yara aims to bring fossil free fertilizers to market by the beginning of 2023.

Yara is ready to lead the way as the green ammonia champion in the hydrogen economy

- Yara is ready to deliver fossil free/low carbon products, e.g. to agriculture.
- This transformation will reduce the total CO2-impact of grain farming by 20%.
- Important to include and collaborate with all parts of the food value chain.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