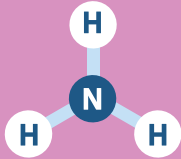


# Green Ammonia (NH<sub>3</sub>)

Green ammonia can be sustainably produced from water, air and renewable energy. It can be stored efficiently as a liquid by compressing or cooling it.

## Chemistry

Ammonia is an inorganic compound composed of a single nitrogen atom covalently bonded to three hydrogen atoms.



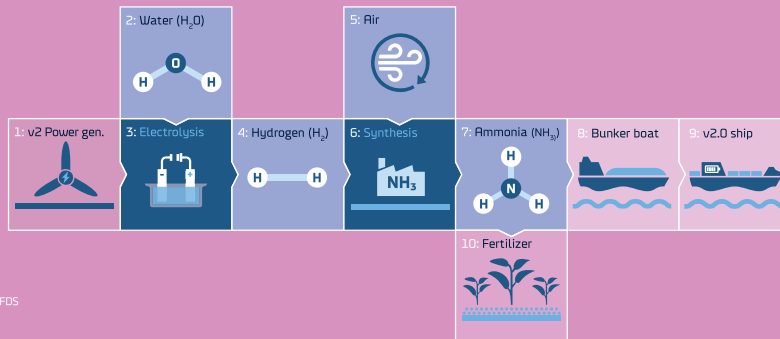
## Characteristics

- Colourless gas with a strong suffocating odour. Causes skin, eye and respiratory burns. May cause blindness. Exposure to high levels may be fatal.
- Potential explosion hazard in confined spaces. Use sufficient vapour ventilation to prevent vapour build-up.
- Ammonia has alkaline properties and is corrosive. Ammonia gas dissolves easily in water to form ammonium hydroxide, a caustic solution and weak base.

## Production and consumption

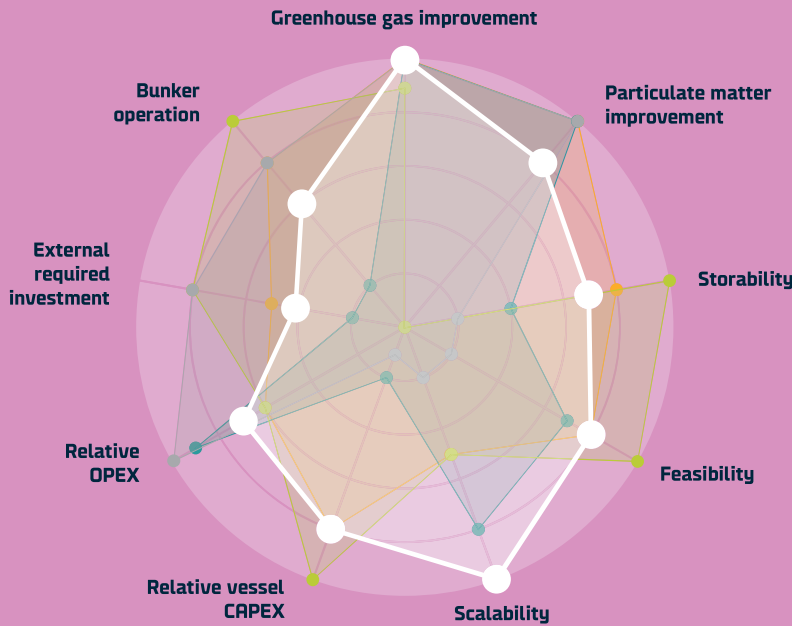
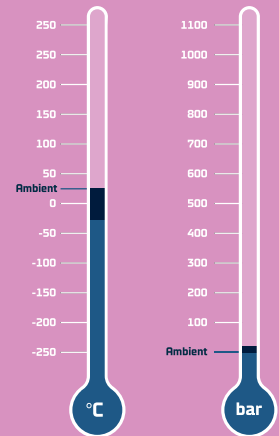
Green ammonia is made by using renewable electricity to split water into hydrogen and oxygen via an electrolysis process. The hydrogen, and nitrogen captured from the air, is synthesised into ammonia using the Haber-Bosch process. The ammonia is delivered to ships using dedicated ammonia bunker vessels.

Fertilizer production requires huge amounts of ammonia and accounts for a significant percentage of global CO<sub>2</sub> emissions. Fertilizer production can be decarbonized by switching from black to green ammonia. Significant synergies between shipping and fertilizer production are expected, which will help to bring the scale needed for getting the cost of green ammonia down.



Learn more online about green ammonia, check out relevant DFDS projects and join the dialogue.

## Storage Temperature and Pressure



## Energy density

	MJ/L	MJ/kg
Hydrogen (pressure)	4.7	120
Hydrogen (cryogenic)	9.7	120
Ammonia	11.3	18.4
Ammonia -33°	11.3	18.4
Methanol	15.6	19.7
Pyrolysis (MASH)	35.8	36.5
Electricity	3.6	0.7
HFO	42.1	42.6
LNG -162°	20.3	48

## Magnolia Seaways

Gothenburg - Immingham

	M³	Tons
Hydrogen (pressure)	707	28
Hydrogen (cryogenic)	343	28
Ammonia	294	181
Ammonia -33°	294	181
Methanol	213	169
Pyrolysis (MASH)	93	91
Electricity	923	4747
HFO	79	78
LNG -162°	164	69

