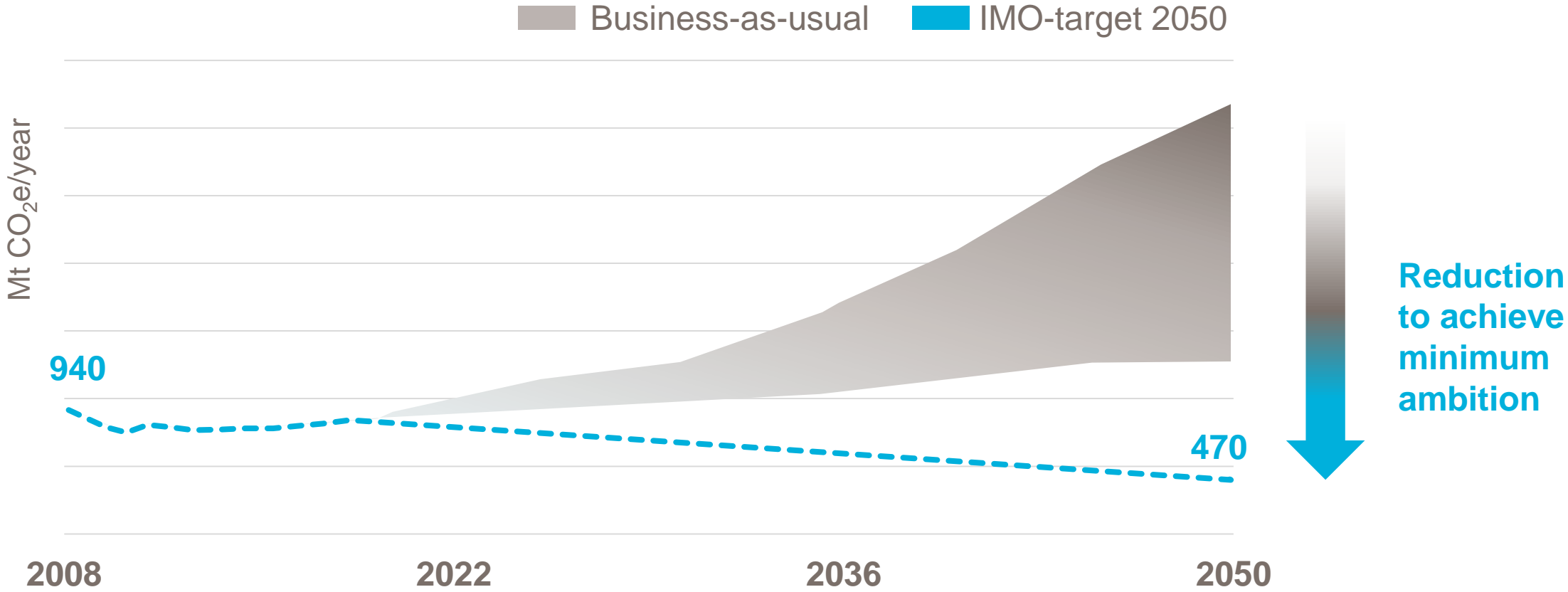






Grønn ammoniakk - ny fornybar industri i Norge?

ULF ERIKSEN
VICE PRESIDENT
4 JUNI 2020

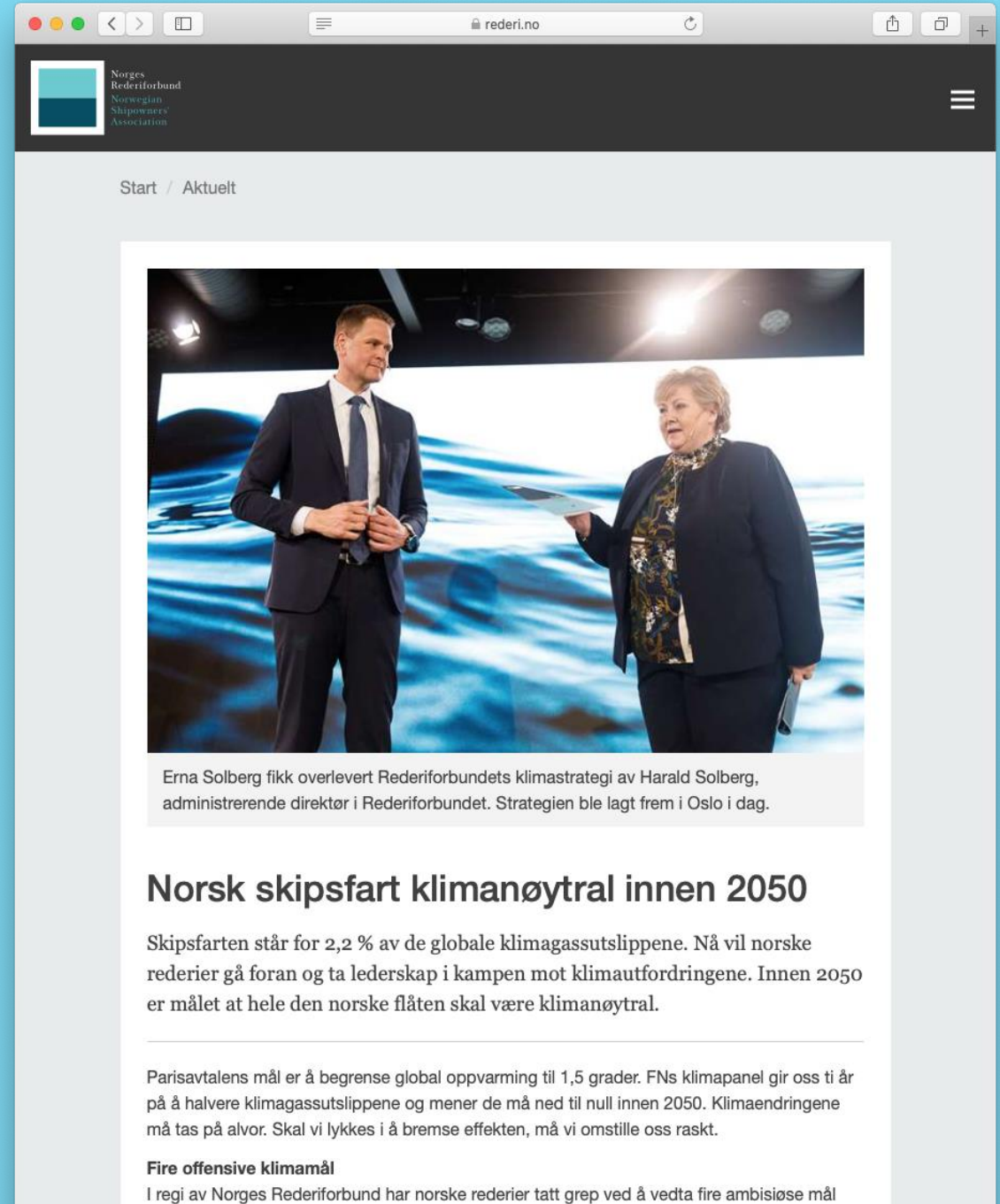
GHG emissions from international shipping, IMO-target:
50% CO₂e-reduction from 2008 to 2050



Norwegian Shipowners' Association more ambitious


-  50% reduction by 2030
-  Only zero emission vessels from 2030
-  Climate neutral 2050
-  International ban from 2050

www.rederi.no/rapporter/



The screenshot shows a web browser window with the URL rederi.no. The page header includes the logo for "Norges Rederiforbund Norwegian Shipowners' Association" and a navigation menu. The main content area features a photograph of Harald Solberg and Erna Solberg. Below the photo is a caption: "Erna Solberg fikk overlevert Rederiforbundets klimastrategi av Harald Solberg, administrerende direktør i Rederiforbundet. Strategien ble lagt frem i Oslo i dag." The article title is "Norsk skipsfart klimanøytral innen 2050". The text of the article states: "Skipsfarten står for 2,2 % av de globale klimagassutslippene. Nå vil norske rederier gå foran og ta lederskap i kampen mot klimautfordringene. Innen 2050 er målet at hele den norske flåten skal være klimanøytral." A sub-section titled "Parisavtalens mål" explains that the goal is to limit global warming to 1.5 degrees, and the industry aims to reach net-zero emissions by 2050. The final section, "Fire offensive klimamål", lists four ambitious goals adopted by the industry.

Start / Aktuelt

 Norges Rederiforbund Norwegian Shipowners' Association

Erna Solberg fikk overlevert Rederiforbundets klimastrategi av Harald Solberg, administrerende direktør i Rederiforbundet. Strategien ble lagt frem i Oslo i dag.

Norsk skipsfart klimanøytral innen 2050

Skipsfarten står for 2,2 % av de globale klimagassutslippene. Nå vil norske rederier gå foran og ta lederskap i kampen mot klimautfordringene. Innen 2050 er målet at hele den norske flåten skal være klimanøytral.

Parisavtalens mål er å begrense global oppvarming til 1,5 grader. FNs klimapanel gir oss ti år på å halvere klimagassutslippene og mener de må ned til null innen 2050. Klimaendringene må tas på alvor. Skal vi lykkes i å bremse effekten, må vi omstille oss raskt.

Fire offensive klimamål

I regi av Norges Rederiforbund har norske rederier tatt grep ved å vedta fire ambisiøse mål

Low or zero-emission alternatives



Requirements for future shipping fuels

CO2-reductions



- LNG insufficient, especially well-to-wake

Energy density



- Batteries only short haul
- Compressed hydrogen a bit longer

Resource availability



- Bio resources limited
- Green fuels require much renewable power

Requirements for future shipping fuels

Safety



- Liquid hydrogen safety challenges: cold, heavy, toxic and explosive
- Liquid ammonia easier

Infrastructure



- Charging and hydrogen infrastructure missing
- Ammonia big, but not made for shipping (yet)

Economy



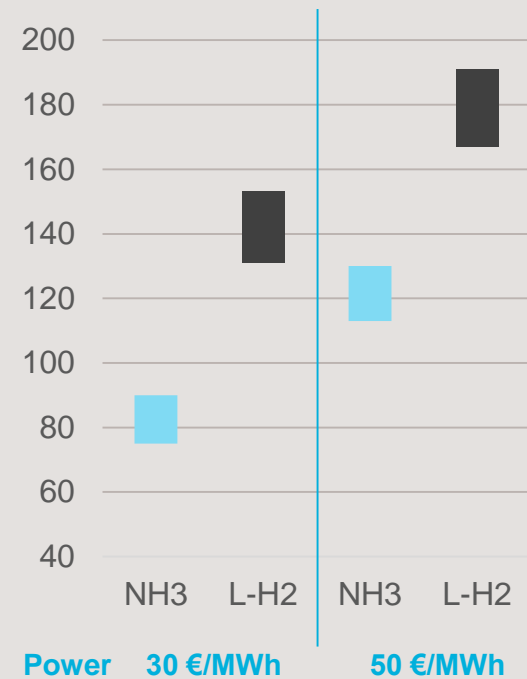
- Green solutions closing up on fossil
- Liquid hydrogen vs ammonia?

Ammonia:

The cheapest high energy-density, zero emission fuel

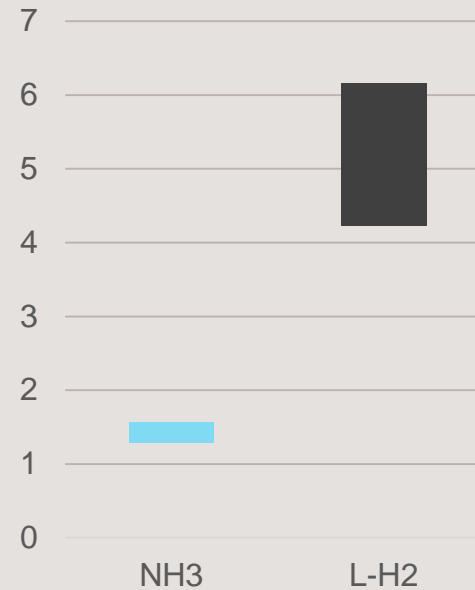
Production cost

Plant gate, EUR/MWh (LHV)



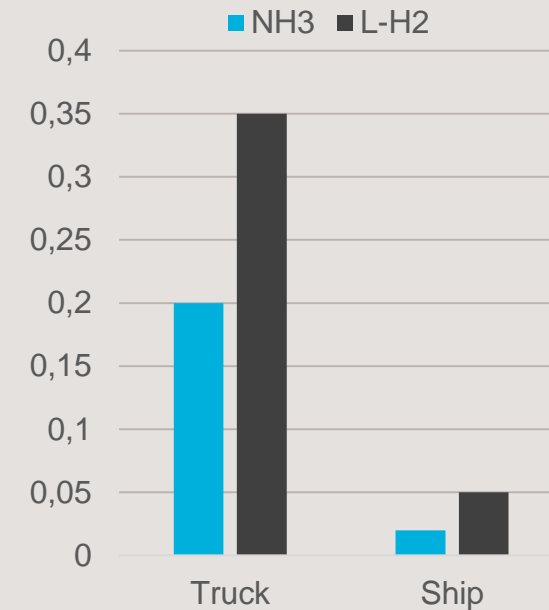
Storage cost

Levelized cost of storage (€/kg)



Transport cost

Cost of transport (€/tkm)

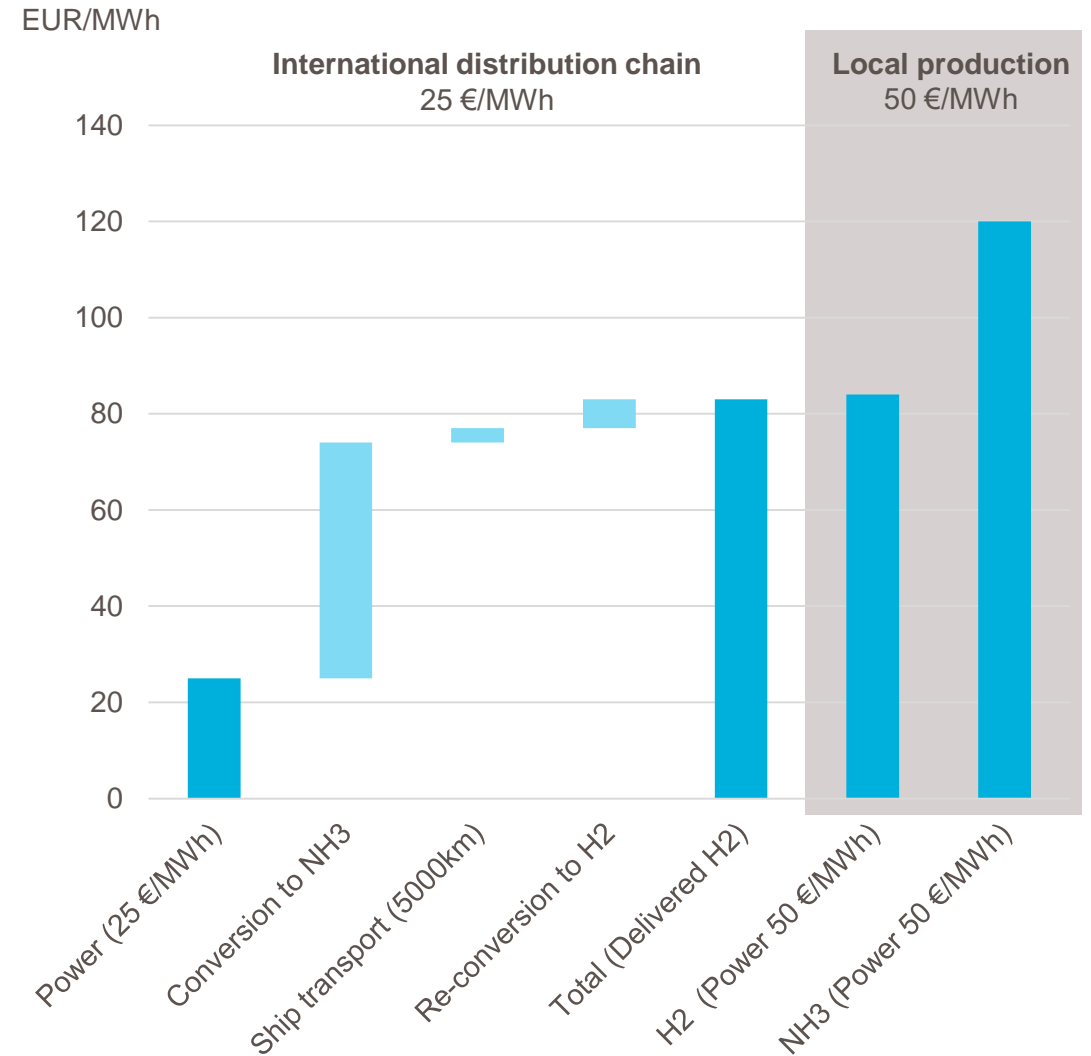


Green ammonia can be an effective, clean energy carrier and allow for international trade

Low storage and transport costs allows for economic shipping over long-distances

- Shipped ammonia converted to hydrogen can be competitive with locally produced hydrogen when power price difference is significant
- Shipped ammonia used directly requires a much lower power price differential to be competitive

International transport ammonia vs. local production



Green ammonia - high potential market

Fertilizer



- Replacing 170 million tons of grey ammonia globally

Shipping



- IMO-targets: global potential for 950 million tonnes
- 0.5-1.3 million tonnes for offshore supply ships in Norway

Export and storage



- Export and store energy
- Difficult to forecast size of exports, current LNG traded market is around 1000 million tonnes

Norge - solid basis for grønt hydrogen og ammoniakk

UTSTYR	ENERGI	AMMONIAKK	SKIPSVERFT	REDERI
  <p>HEXAGON</p> 	  <p>equinor</p>		 <p>FISKERSTRAND™</p>  <p>HAVYARD</p>  <p>BRØDRENE AA</p>	 <p>Color Line</p>  <p>NORLED</p>  <p>Eidesvik</p>

Green ammonia as long haul shipping fuel

- **Relatively easy to handle**
- **Less safety issues than alternatives**
- **Existing infrastructure**
- **Lowest cost**
- **Great opportunity for Norway**





**One of the world's leading
renewable energy companies**



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