

IEAs rapport til G20 om Hydrogen

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The Future of Hydrogen

Seizing today's opportunities

Exploring the Role of Oil and Gas Technology in Energy Transitions

GOT Value Proposition



IEA Convening Power

With the IEA global convening power GOT is well placed to engage key stakeholders on strategic issues world wide.



Unique Forum

As a permanent IEA Technology Collaboration Programme GOT drives a broad dialogue multinationally.



Global Thought Leader

Through a unique public-private forum IEA GOT pursues global thought leadership with nations, industry and the international research community.



PARIS2015
COP21-CMP11

Exploration - Field Development - Production - Transport to Markets - Gas & Energy

Samarbeid med IEA i Paris: Emerging Leaders

Tema: Hva betyr energifremtiden for vår kompetanse?



Kilde: IEA GOT

Samarbeid om strategiske analyser: Hydrogen

Ledende globale aktører innen hydrogen samlet i IEA i Paris i februar '19



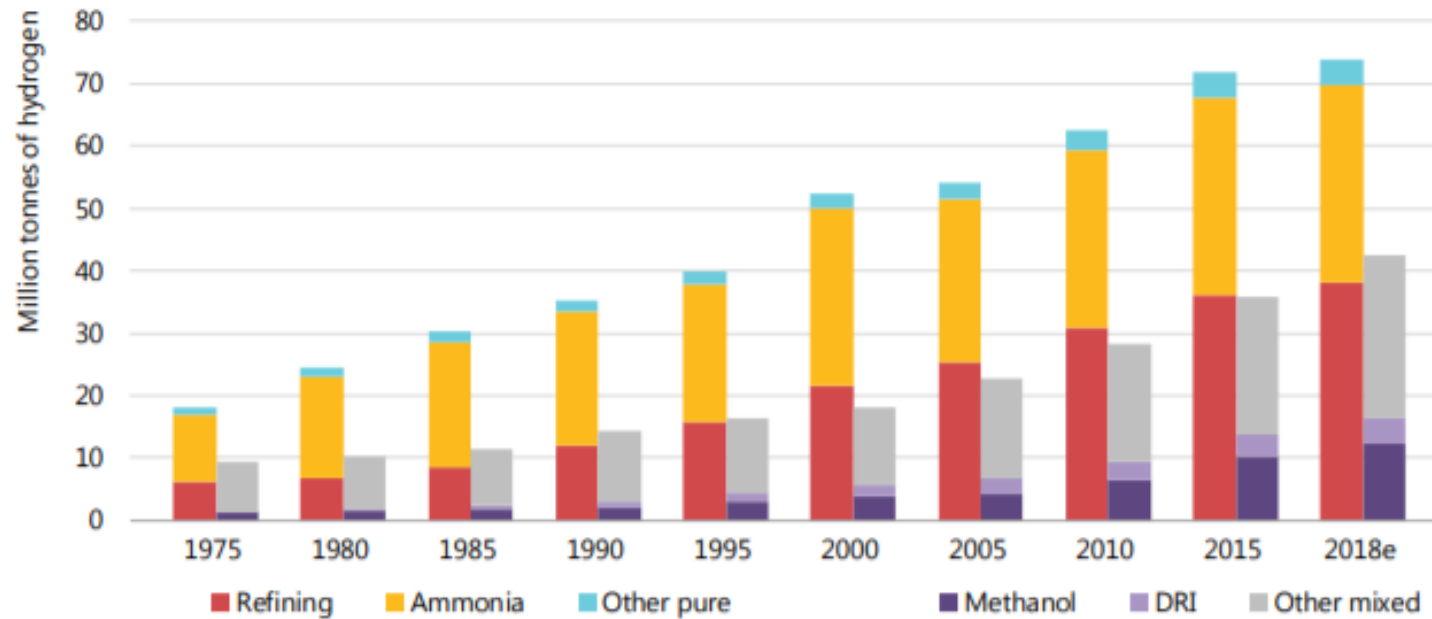
Rapport:

- Status
- Fremtidsperspektiver
- Fire mulighetsområder
- Syv anbefalinger

Kilde: IEA

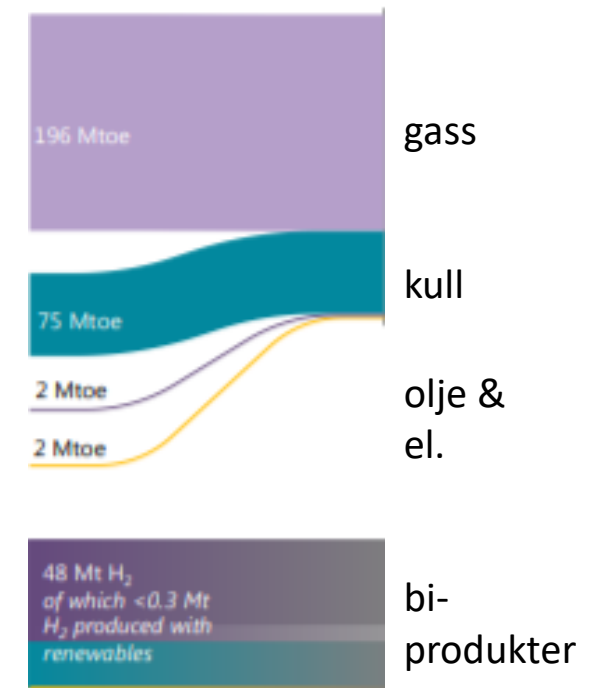
Hydrogen frem til nå

Etterspørsel, 1975 - 2018



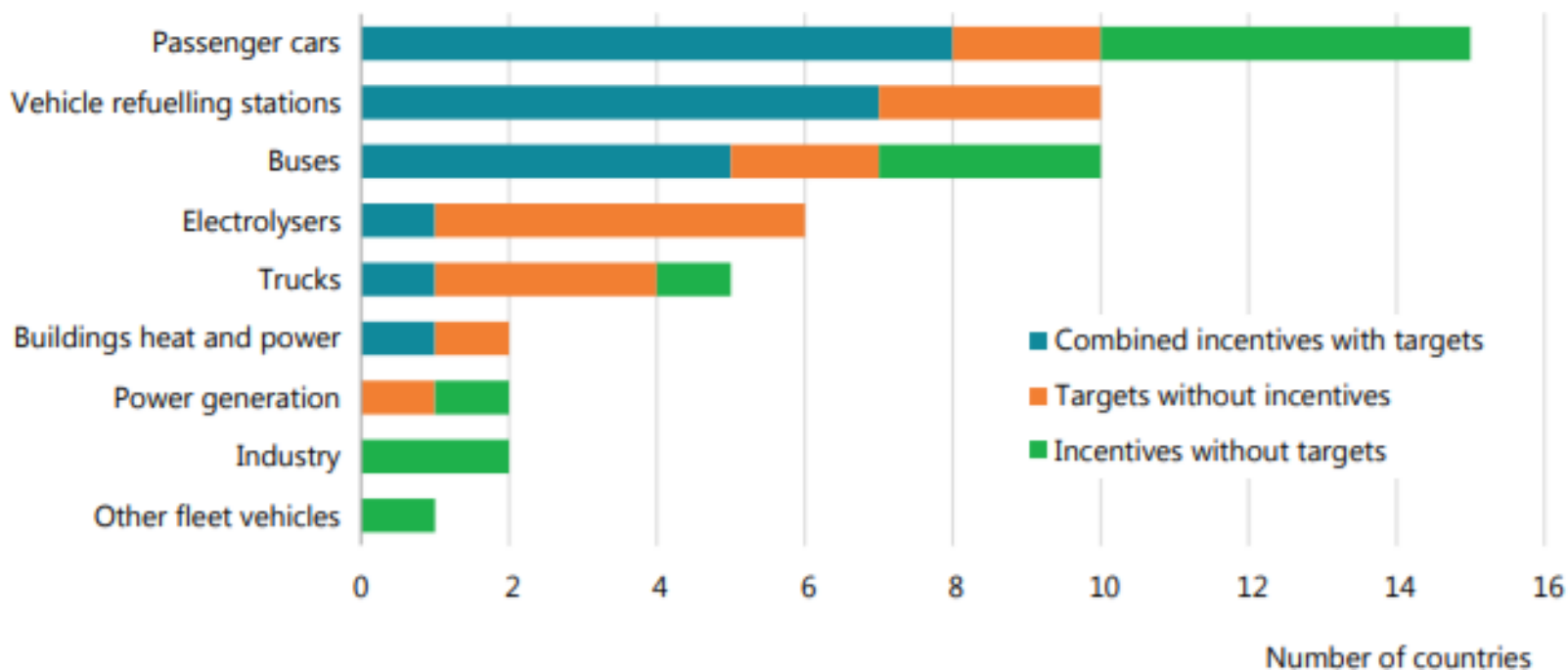
Kilde: IEA, the Future of Hydrogen

Produksjon (i dag)



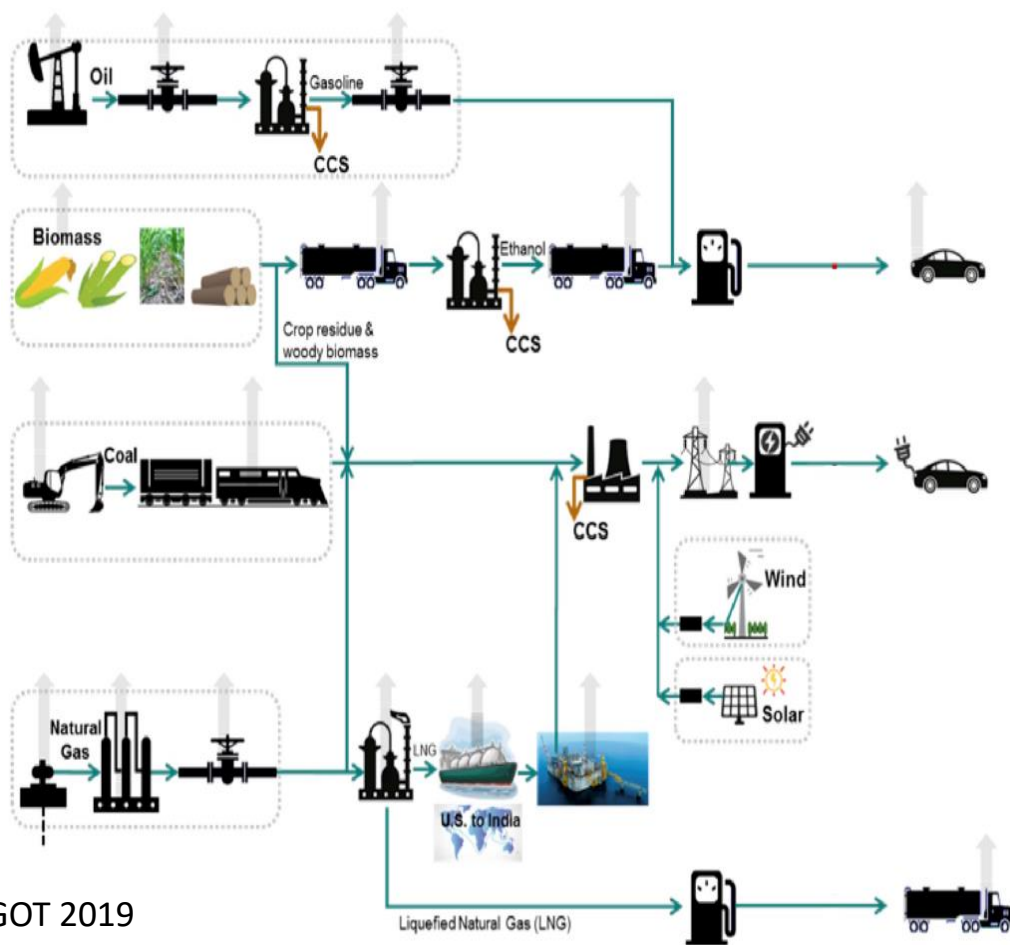
Offentlige tiltak

Incentiver & mål, etter område



Et 20-talls land har eller er i ferd med å etablere strategier, nye mål og aktiviteter omkring hydrogen nasjonalt. IEA følger utviklingen knyttet til muligheter, politikk og internasjonalt samarbeid.

Uviklingen av en hydrogenøkonomi fremover



Kilde: MIT/IEA GOT 2019

Bredere etterspørsel:

Kraft

Varme

Transport

Muligheter for «krevende» utslippskutt:

Stål

Kjemikalieprod.

Sement

Gjødsel/ammoniakk

Luftfart,
Maritim

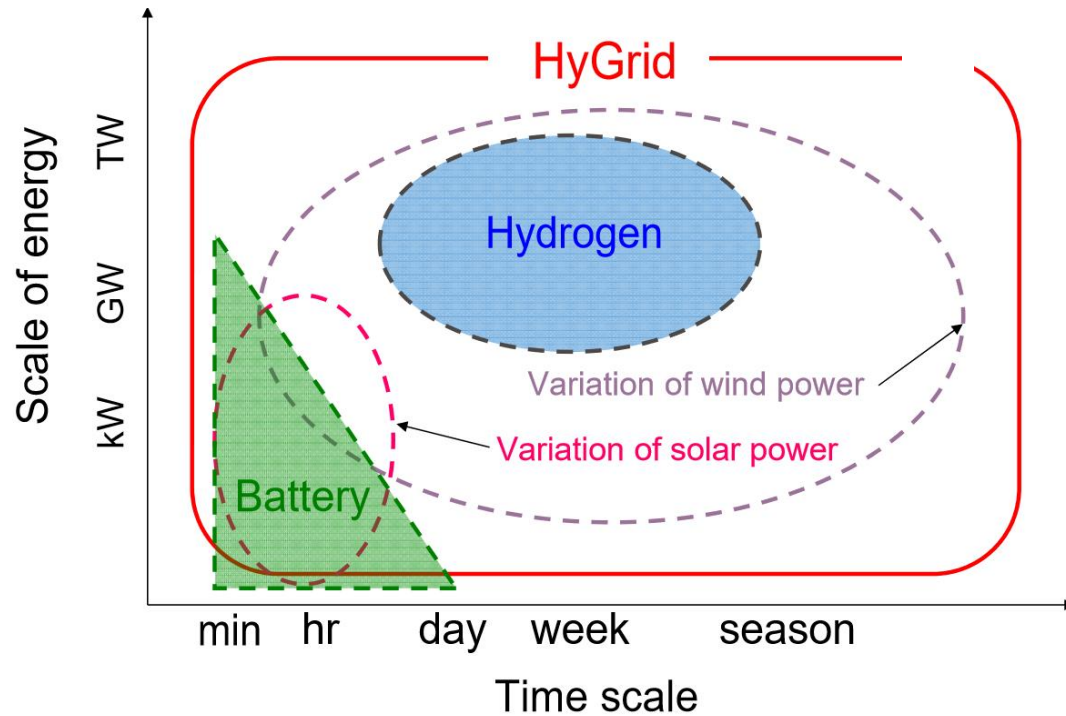
Industrielle prosesser

Kilde: the Future of Hydrogen, IEA 2019

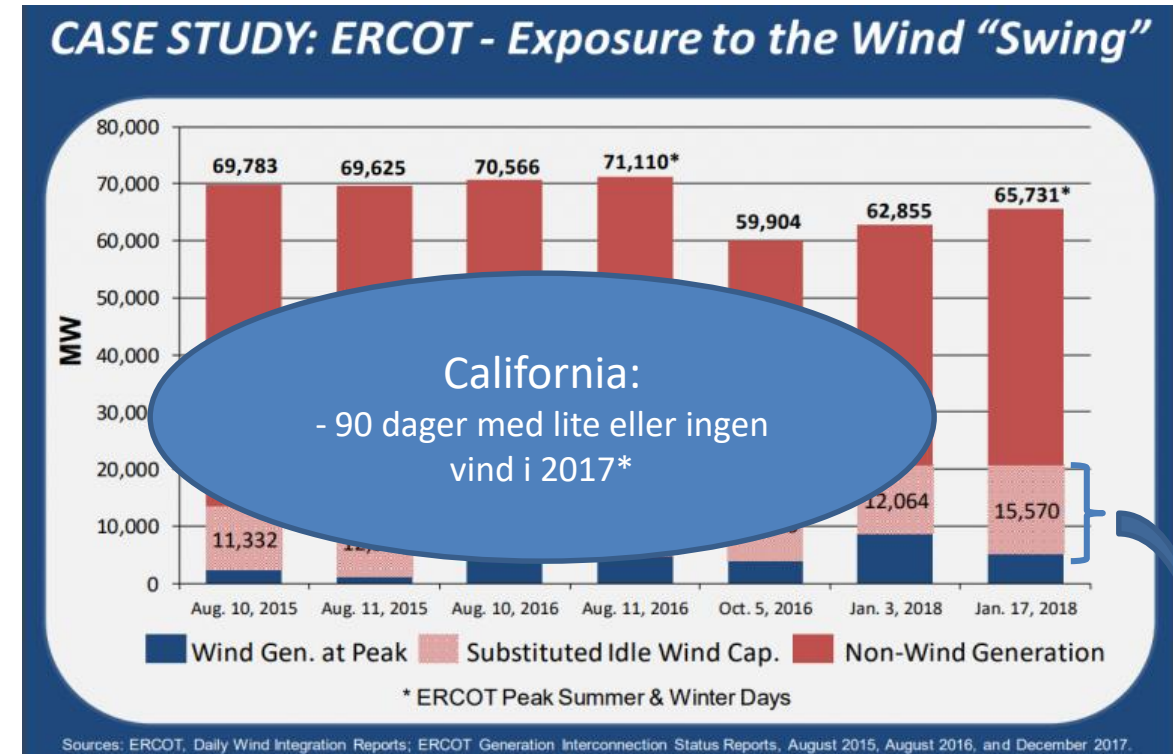
Potensialet for hydrogen kan økes gjennom bredere etterspørsel, og kan gi økte muligheter for kutt i CO₂-utslipp i sektorer hvor dette er særlig krevende i dag.

Hydrogen en viktig stabilisator når andelen variabel energi økes

Hydrogen som stabilisator



Kapasitetsutnyttelse, vindkraft i Texas



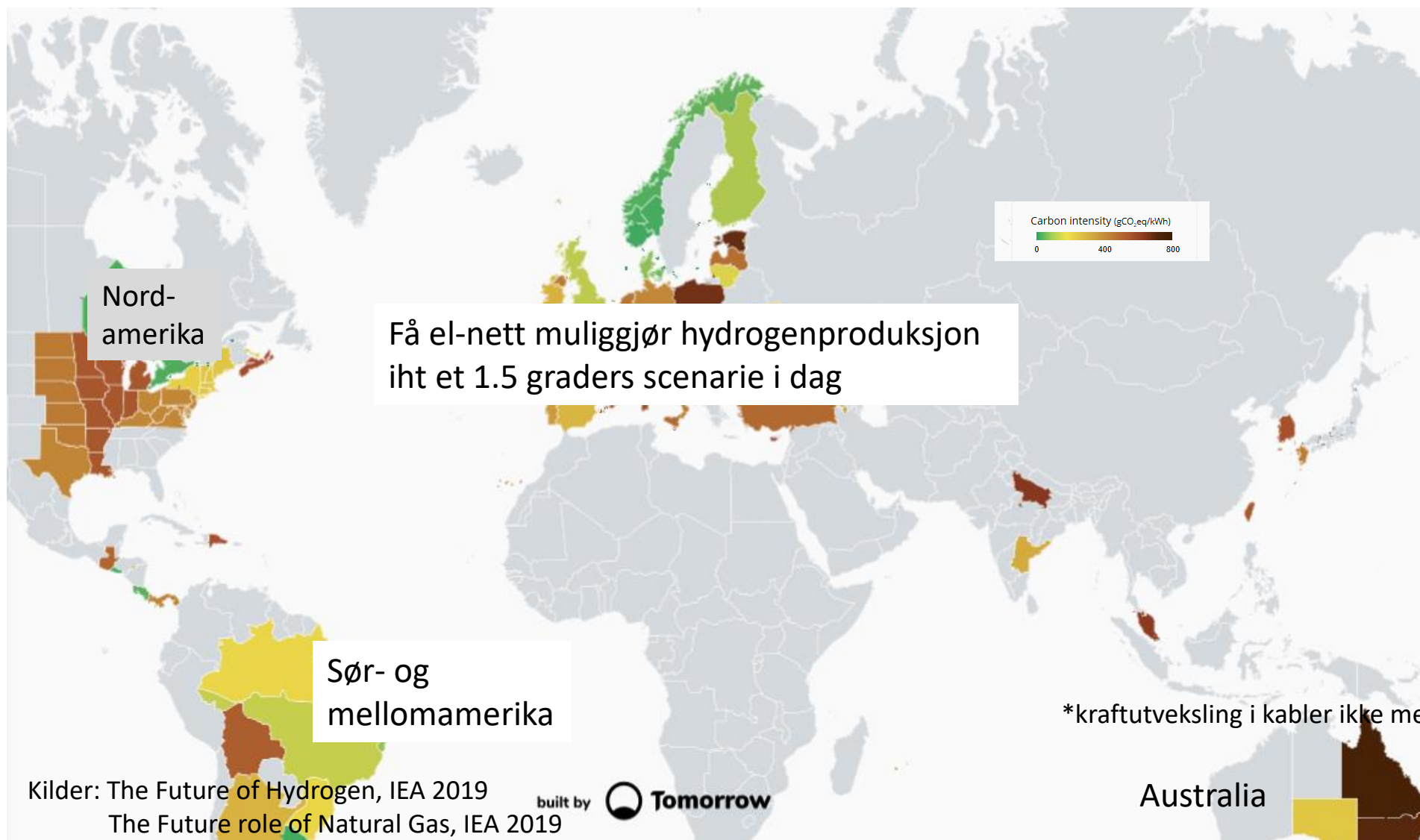
Behov for back-up

*akkumulert

Kilder: Kawasaki, Equinor, ERCOT/Texas, NREL

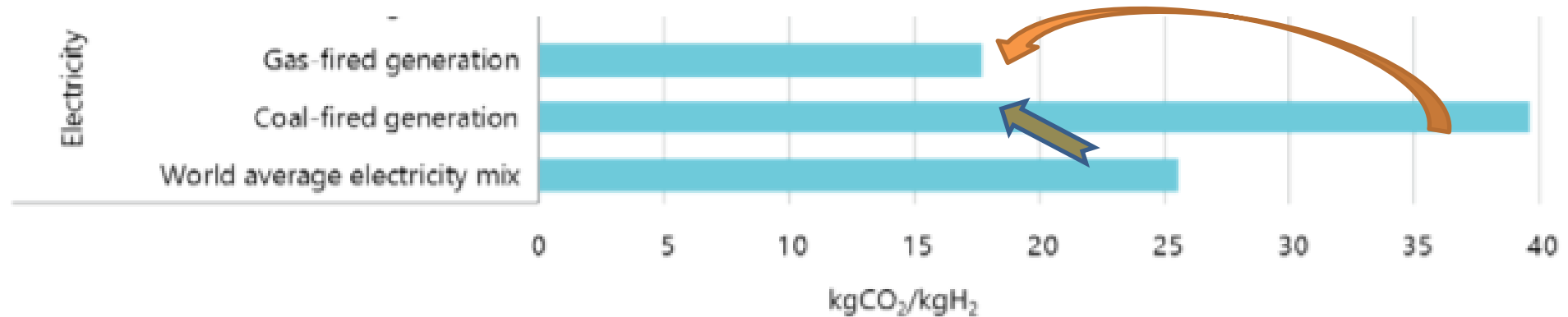
Hydrogen og lavkarbonsamfunnet (OECD++)

Karbonintensitet i el-nett i OECD++



CO2-intensitet, hydrogen basert på el. globalt

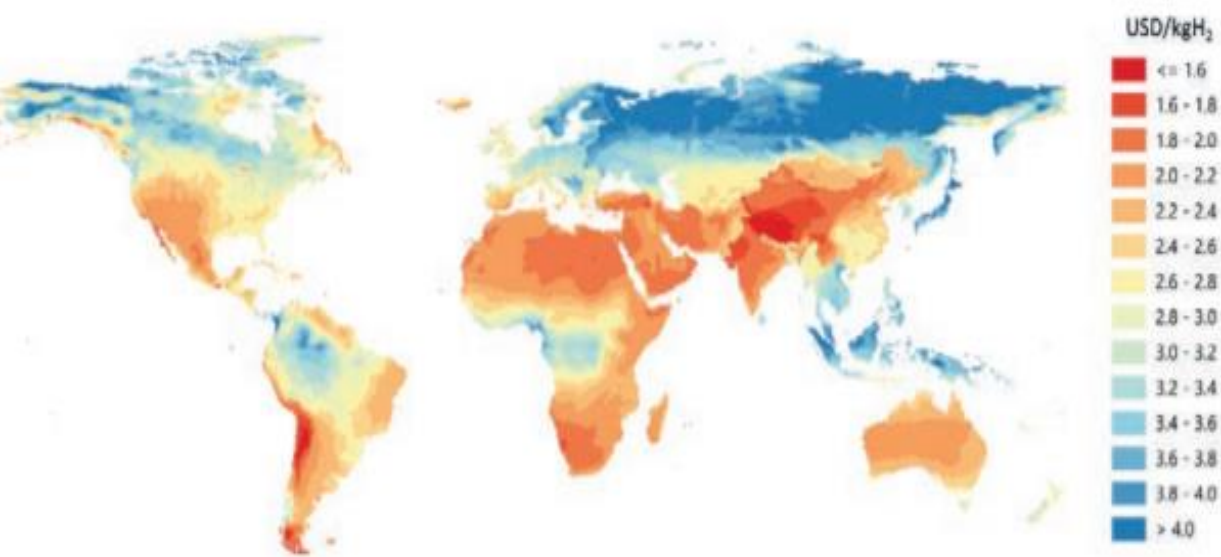
CO2-intensitet, global el-mix vs el. fra gass og kull



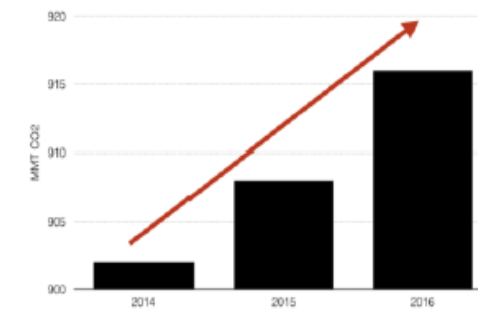
Overgang fra kull – gass fra 2010 til 2018 har redusert globale CO2-utslipp > 500 mill. tonn

Kostnader og energiskift

Kostnader for hybride løsninger, sol og vind på sikt



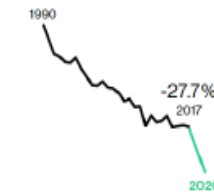
Tyskland og energiskift



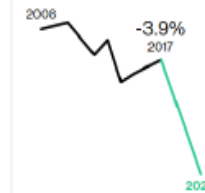
German Emissions Rising

Germany Set to Miss 2020 Climate Goals

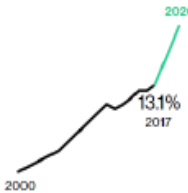
Reduce greenhouse gas emissions by 40%



Reduce primary energy consumption by 20%



Increase share of renewables in energy consumption to 20%



Sources: German Environmental Agency, AG Energiebilanzen e.V.

Kilder: the Future of Hydrogen, IEA 2019, German Environmental Agency, Environmental Progress

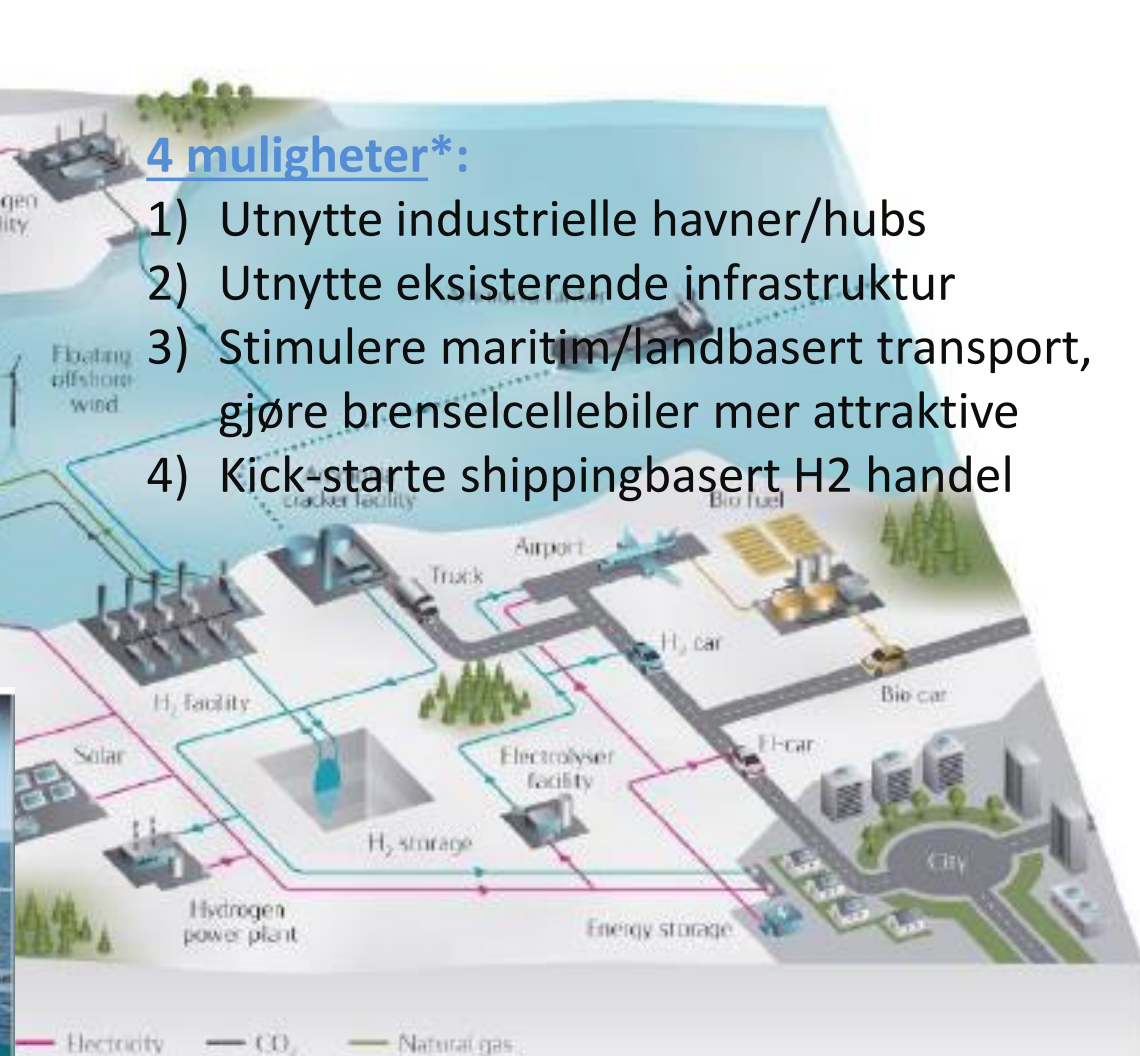
Fire «tidlig-muligheter» for hydrogen

4 muligheter*:

- 1) Utnytte industrielle havner/hubs
- 2) Utnytte eksisterende infrastruktur
- 3) Stimulere maritim/landbasert transport, gjøre brenselcellebiler mer attraktive
- 4) Kick-starte shippingbasert H₂ handel



Kilde: NORWEP

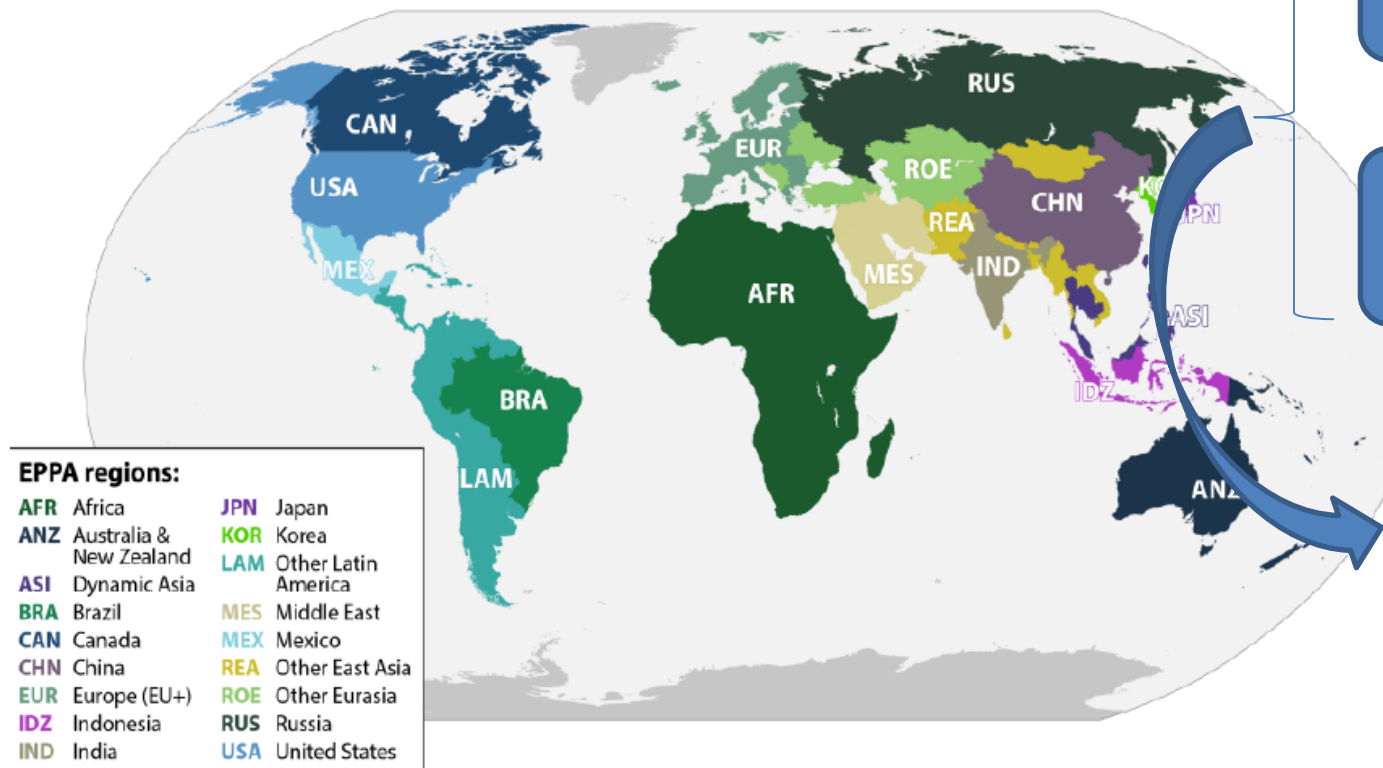


*Kilde: Future of Hydrogen, IEA 2019

Energy Choice: Analyse & dialog om langsiktige energivalg for land

IEA GOT globalt flaggskipprosjekt, 2019 – 2021++

Inndeling, regioner & land



Energivalg:

Energivalg i utvalgte land



Implikasjoner for industri og teknologi

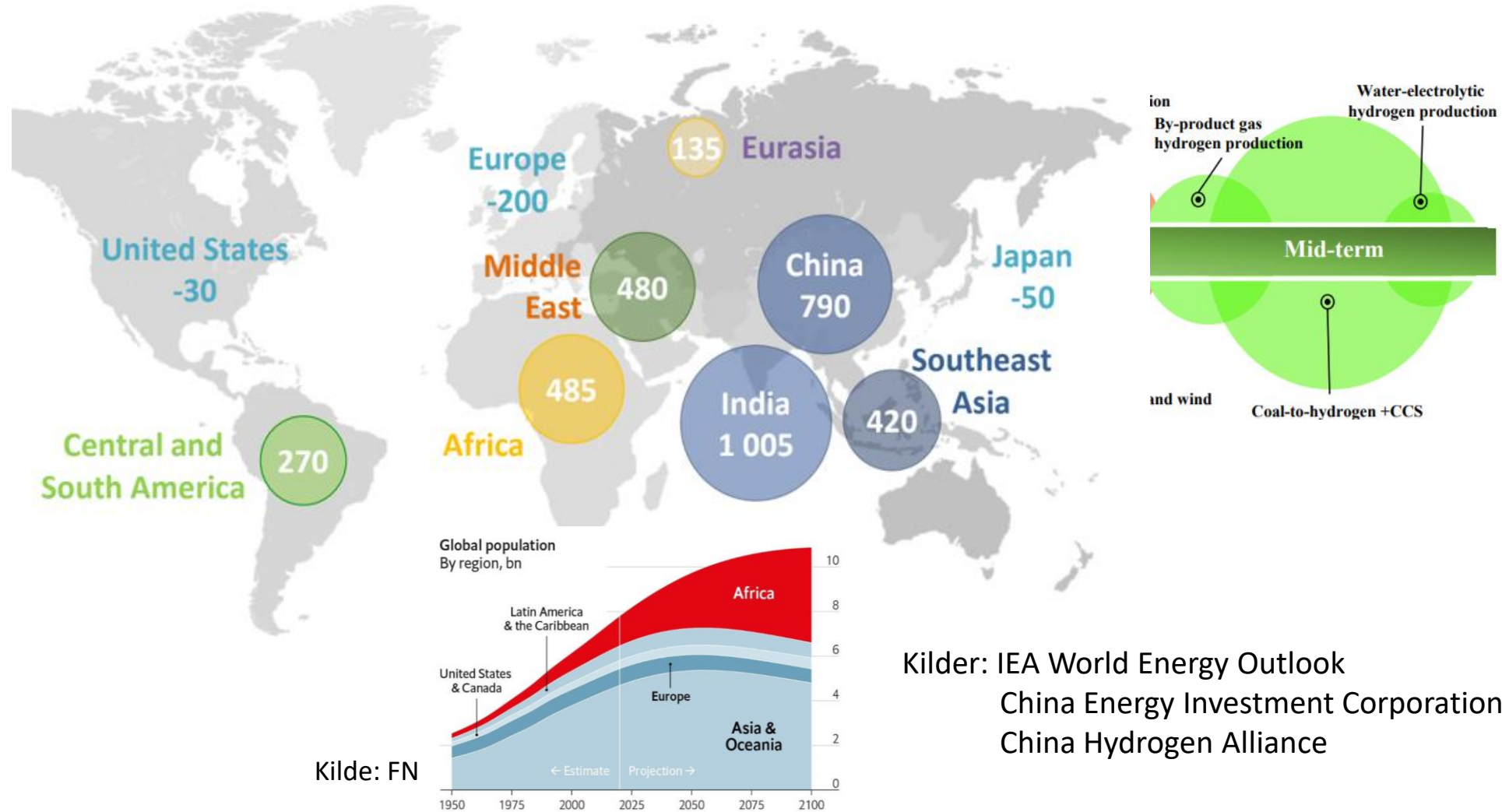
Analyse av
opsjoner,
implikasjoner
og *valg*

Kilde: MIT EPPA-modell

Global energietterspørsel mot 2040 og hydrogen i Kina

Etterspørselsvekst 2016 – 2040 (Mtoe)

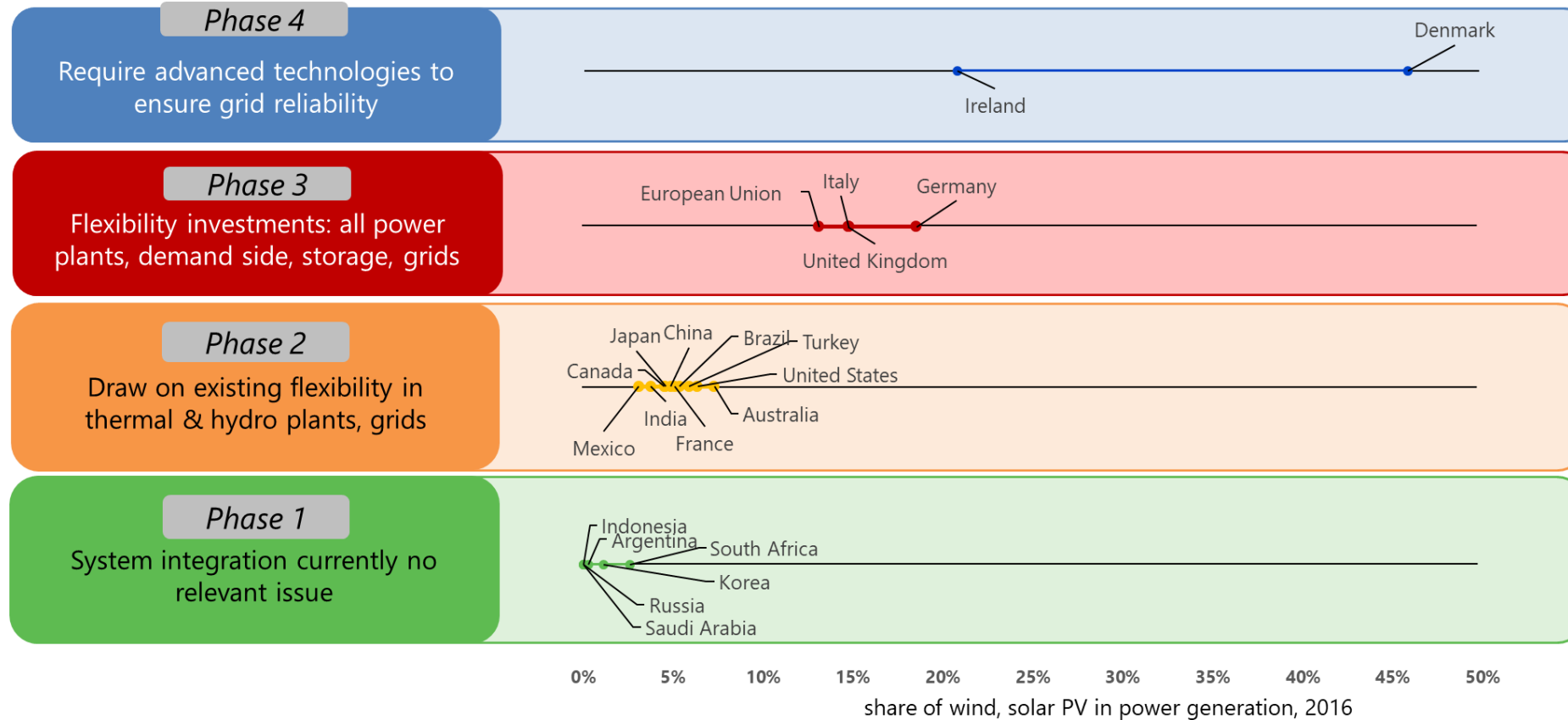
Kina/H₂



Kilder: IEA World Energy Outlook
China Energy Investment Corporation/
China Hydrogen Alliance

Fire steg i utviklingen av integrerte energimarkeder

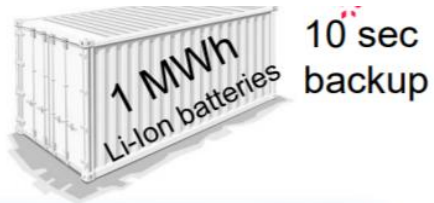
Four phases of wind and solar integration



Kilde: IEA

Hydrogenproduksjon og lagring

Lagring/fleksibilitet



20.000 x 20ft (2,5 days backup)



440 MWh hydrogen m/CCS
– ubegrenset back-up

Kostnader, hydrogenproduksjon etter energikilde



Elektrifisering i Nordsjøen – en ledende hub for neste generasjons hydrogen

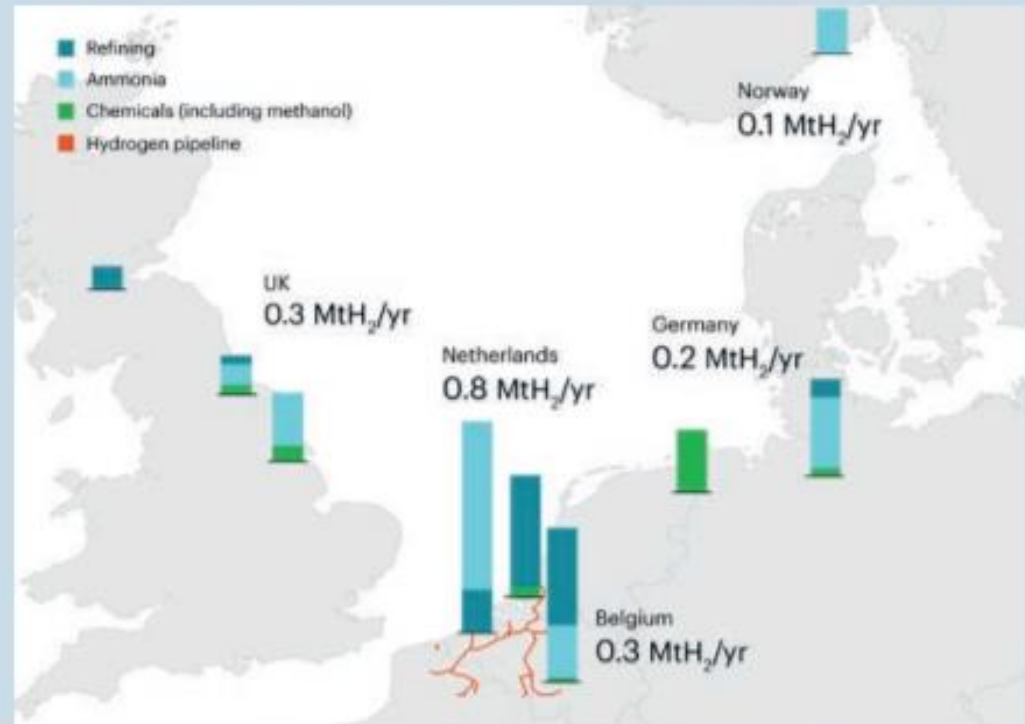
TNO innovation
for life

NORTHSEA ENERGY VISION

- › Electrification of the platform will enable the development of an offshore grid
- › After electrification the Northsea can be a clean energy source combining offshore wind and offshore gas.
- › The connected gas and electricity grid used for energy balancing, transport and storage (H₂)
- › On the long term infrastructure can be re-used or re-purposed, p.e. for CO₂ storage or aquafarming

● Wind short term
● Wind medium/long term
● Gas to wire
● Electrification of
● Conversion and
● Offshore service
— Power cables

North Sea hydrogen demand capacity by sector and pipeline infrastructure, 2018



Notes: This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area. Tjeldbergodden in Norway, which consumes 0.1 MtH₂/yr for methanol, not shown on map.

Sources: Air Liquide (2019), "Supply modes"; CF Industries (2017), More Ways to Win: 2017 Annual Report; Integraal waterstofplan Noord-Nederland (2019), Investeringsagenda Waterstof Noord-Nederland; Roads2Hy.com (2007), "European hydrogen infrastructure atlas" and "Industrial surplus hydrogen and markets and production"; Yara (2018), "Annual production capacity"; data provided directly to IEA by Port of Rotterdam.

IEAs anbefalinger

Anbefalinger:

- Etablere en rolle for hydrogen i nasjonale energistrategier
- Stimulere kommersiell etterspørsel etter hydrogen
- Redusere investeringsrisiko for «first-movers»
- Støtte forsknings- og teknologi for å redusere kostnader
- Eliminere unødige regulatoriske barrierer
- Styrke internasjonalt samspill; standarder, utveksling av «best practice» & deling av infrastruktur på tvers av landegrenser.
- Fokuserer på «tidlige» muligheter, spore teknologifremdrift

Takk for oppmerksomheten!

IEAs Hydrogenrapport: www.gotcp.net/news