

A composite background image showing a snowy mountain range, a city skyline, an offshore oil rig, wind turbines, and an airplane in the sky.

OIL AND GAS IN A SUSTAINABLE SOCIETY

OG21, November 12 2019

Alexandra Bech Gjørsv, CEO SINTEF

My presentation

- Briefly about SINTEF, and our work for oil and gas
- **Sustainability** seen from our work with customers **outside** the oil and gas industry
- **Sustainability** and our customers **within** the oil and gas industry
- Need for a more **ambitious**, bipartisan climate policy



Applied research and innovation,
from ocean space to outer space



2000
Employees



72
Nationalities



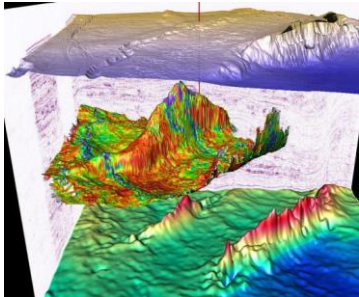
3500
Customers



3,3
Billion NOK

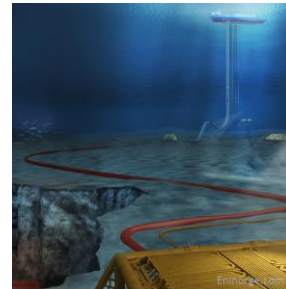
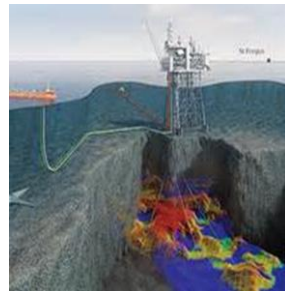
Technology for a better society

We support the entire O&G value chain



Exploration

- Basin modelling
- Geophysical monitoring
- Cost-effective drilling and intervention
- Rock physics and rock mechanics
- Uncertainty in exploration
- Unconventional resources



Field development and operation

- Marine structures and operations
- Floating production systems
- Subsea technology
- Subsea electricity systems
- Multiphase flow technology
- Enhanced recovery
- Well and reservoir
- Energy efficiency and electrification
- Automatization, digitalization and robotization
- Drilling discharges and produced water management
- Oil spill preparedness
- Floating wind energy
- Batteries



Mid- and downstream

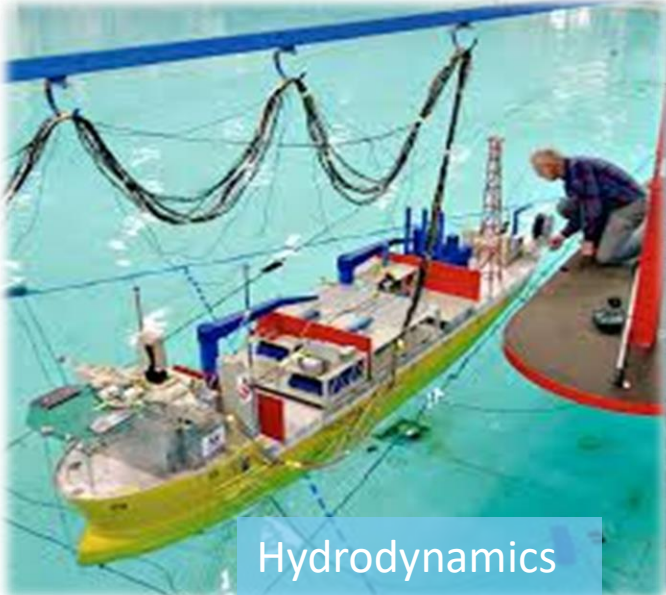
- Gas processing and LNG
- Downstream conversion
- Risk management and cyber security
- CCS
- Hydrogen production and distribution
- Hydrogen market



Late life & decommissioning

- Tail end production
- Decommissioning
- Plug and abandonment (P&A)
- Re-use and recycling
- Life of field extension
- Structural lifetime extension

We offer critical hardware support,...



Hydrodynamics



Subsea and marine operations

Power supply



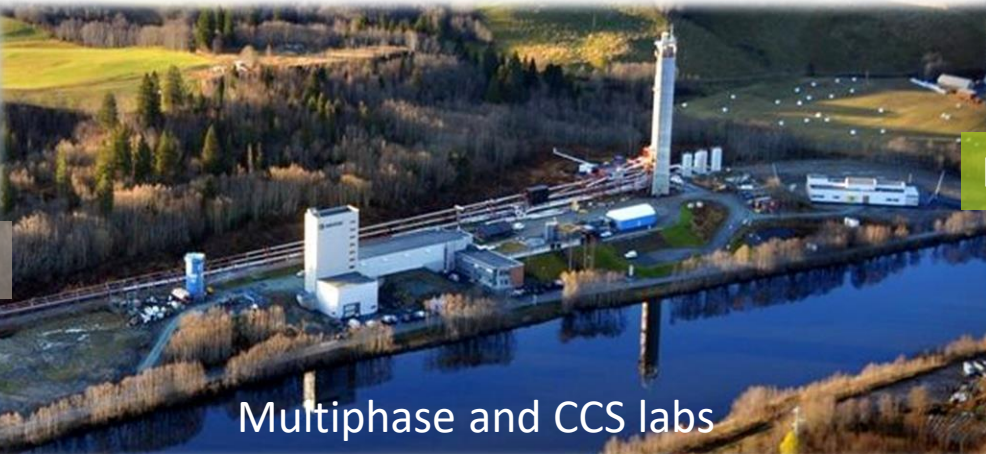
Rock Mechanics



Environmental



Material science

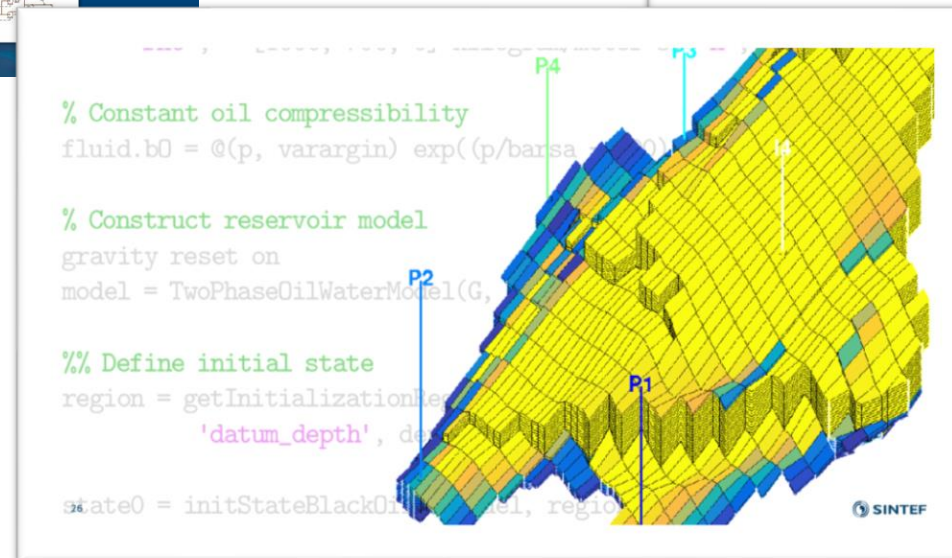
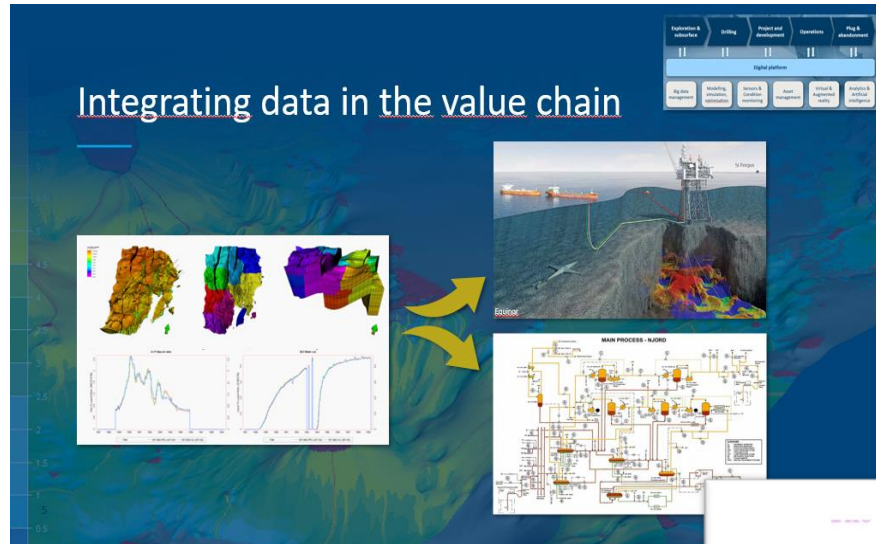


Multiphase and CCS labs



Production systems

... and just as critical software support



We mobilise for change through R&D centers

- "Low emission", 8 year center awarded 2019

2030: 40% reduction in emissions of CO2 equivalents

System integration

Heat & power generation

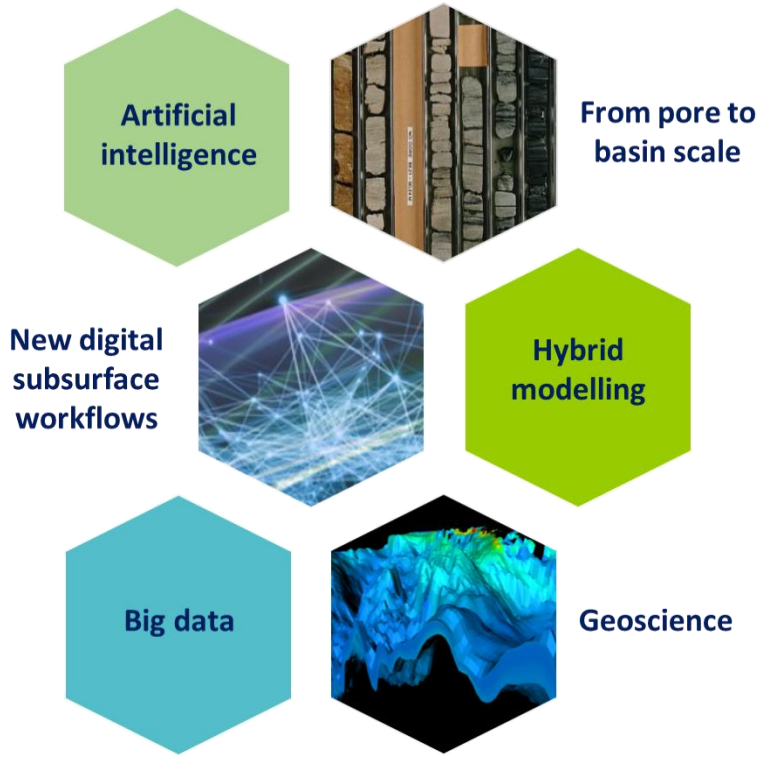
Reduced offshore energy consumption

SINTEF NTNU LOWEMISSION

LOW EMISSION PARTNERS

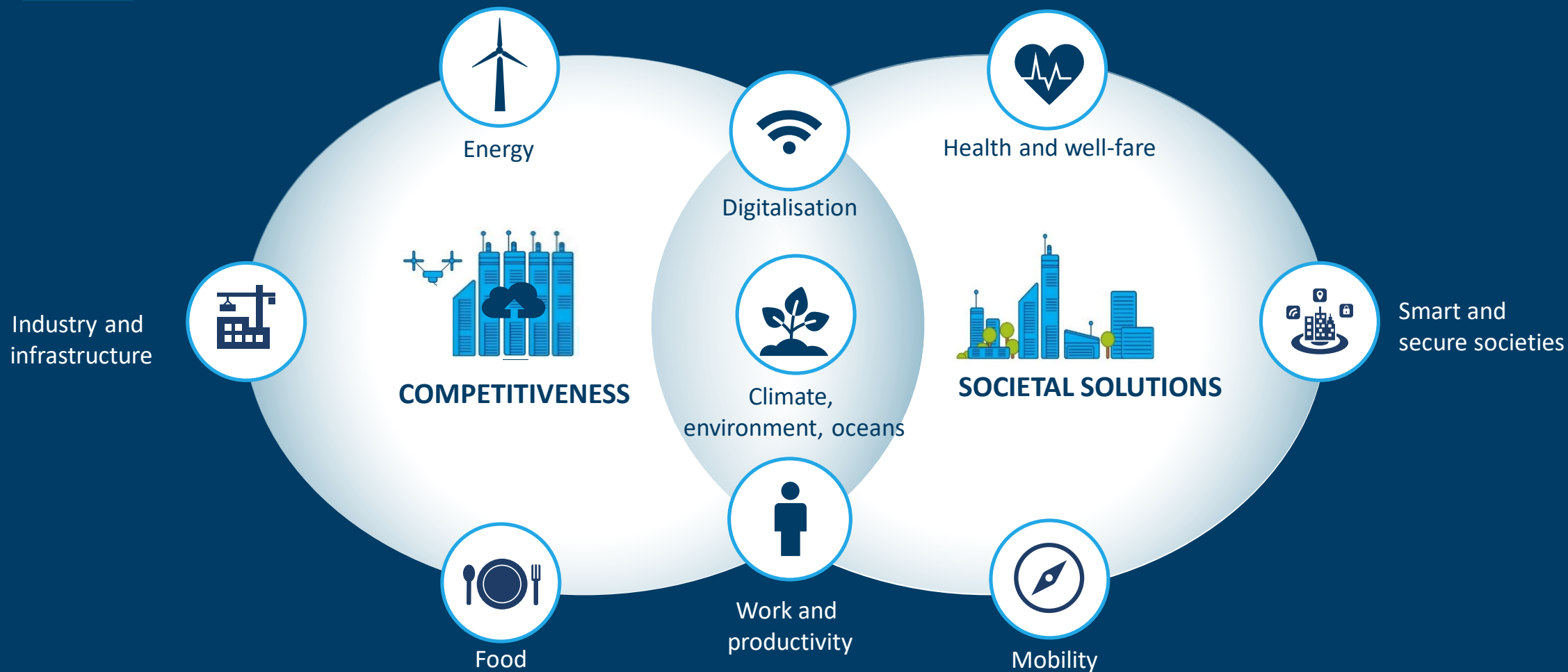
Operators:	Service- & vendors:	Research & development:	Observers:
		<p>Research & development:</p> <p>Associated Research Entities</p>	<p>Observers:</p>
			<p>Public financing:</p>

Hoping for "Digital subsurface" from 2020



Vision: Technology for a better society

Expertise from ocean space to outer space



Our vision: Technology for a better society





SUSTAINABILITY SEEN FROM OUR CUSTOMERS OUTSIDE THE O&G INDUSTRY

Companies see threats, but also opportunities in the megadrivers



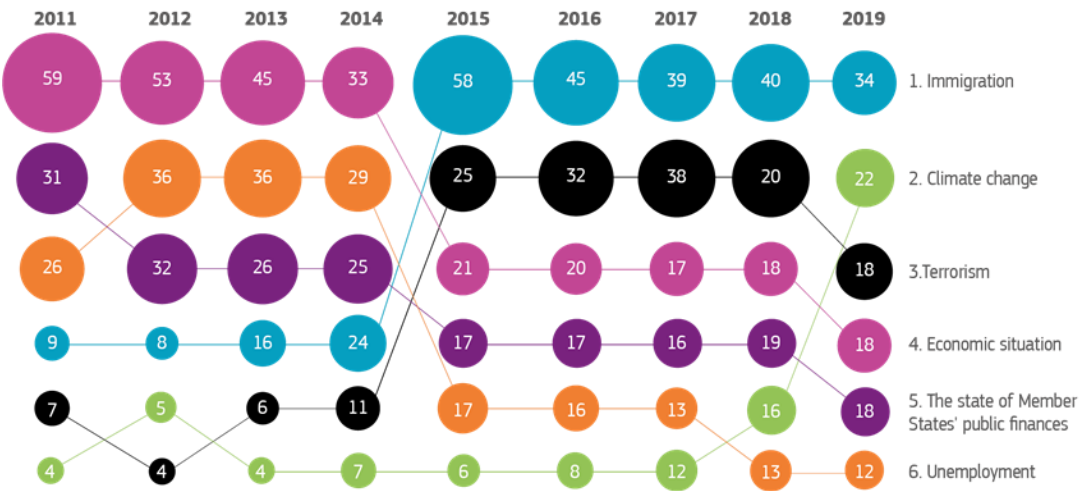
• Climate

• Disruptive digital change

• Growing, ageing, more urban population

• Circular economy

Companies see climate concerns affecting politics in new ways



Note: Most important issues the EU is facing at the moment.
 Source: Eurobarometer; European Political Strategy Centre

search **Bloomberg** »

Politics

Von der Leyen Vows \$1.1 Trillion Green Deal in Pitch to EU

By [Jonathan Stearns](#)
 16 July 2019, 09:34 CEST Updated on 16 July 2019, 14:06 CEST

- ▶ Merkel ally addresses EU Parliament in Strasbourg before vote
- ▶ Christian Democrat appeals to assembly for cross-party support

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25 in history

Companies see a shift in their risk picture

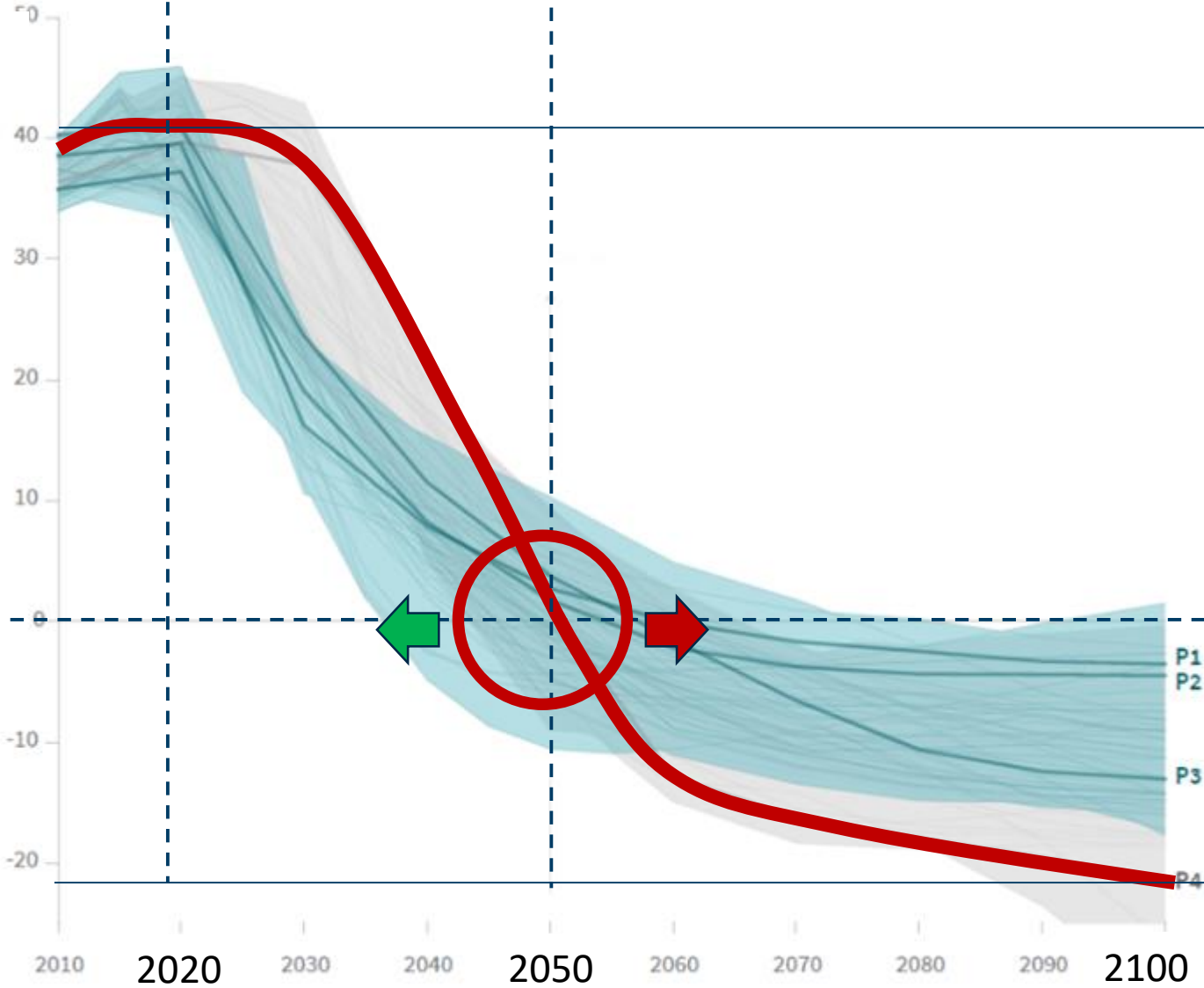
FINANCIAL TIMES | 2019 looks as if it will be the year when environmental, social and governance considerations are moving out of a specialised niche into the mainstream. Financiers and chief executives are realising that it can sometimes be more costly to ignore ESG issues.



Companies see science prescribing deep shifts in all industries



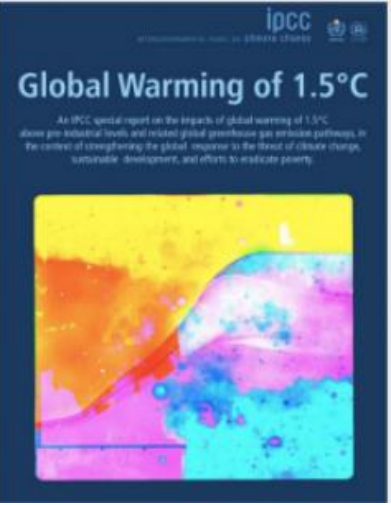
Global total net CO₂ emissions
Billion tonnes of CO₂/yr



Reduce emissions

Net zero CO₂ emissions

Remove CO₂ from atmosphere



Companies position for huge growth in renewable electrification

gtm: Solar Grid Edge Storage Wind Trending Podcasts Downloads

Shell Buys Floating Wind Developer Eolfi

The acquisition gives Shell a second floating wind pilot project and a portfolio of legacy solar and onshore wind assets.

JOHN PARNELL | NOVEMBER 05, 2019




2

AKSJELVE BORS E24+ TIPS OSS

LES MER HER

Freyr vil bygge batterifabrikk til 40 milliarder i Mo i Rana

Freyrs industrieventyr kan bety 2.500 nye arbeidsplasser i regionen, men avhenger av vindkraft. Naturvernere og samer er skeptiske.



energy

Statkraft vant anbud på vindpark i Brasil - skal investere fem milliarder kroner

Det er en milepæl for norsk fornybar-satsing internasjonalt, sier konsersjef Christian Rynning-Tønnesen.

1 min Publisert: 22.10.19 – 19.04 Oppdatert: 17 dager siden



Christian Rynning-Tønnesen, konsersjef i Statkraft, sier prosjektet er en milepæl for norsk fornybarsatsing i utlandet. (Foto: Elin

Towards zero emission transportation

El- og hydrogenlastebiler konkurransedyktige med diesel



Solkraft største energikilde

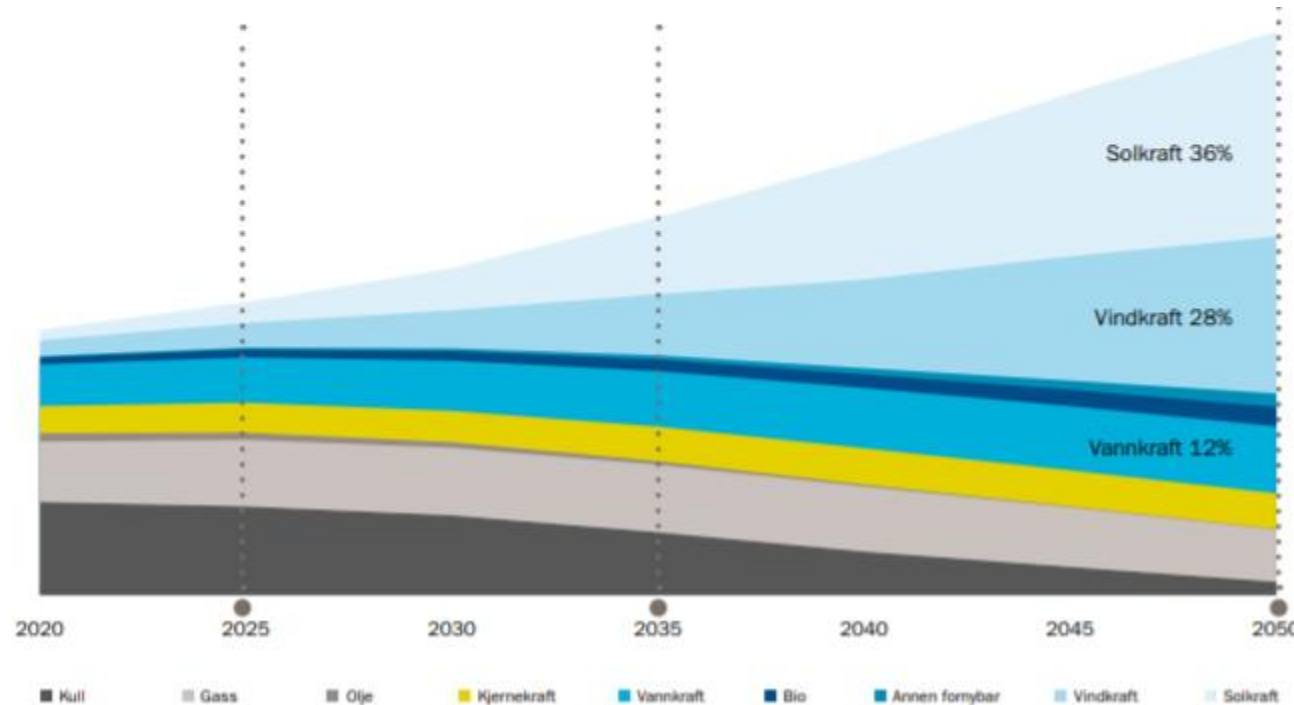


Nær 100 % av nye personbiler og 60% av nye tyngre kjøretøy går på el og H₂



nel • 
H₂ STATIONS

Illustrasjon: NEL



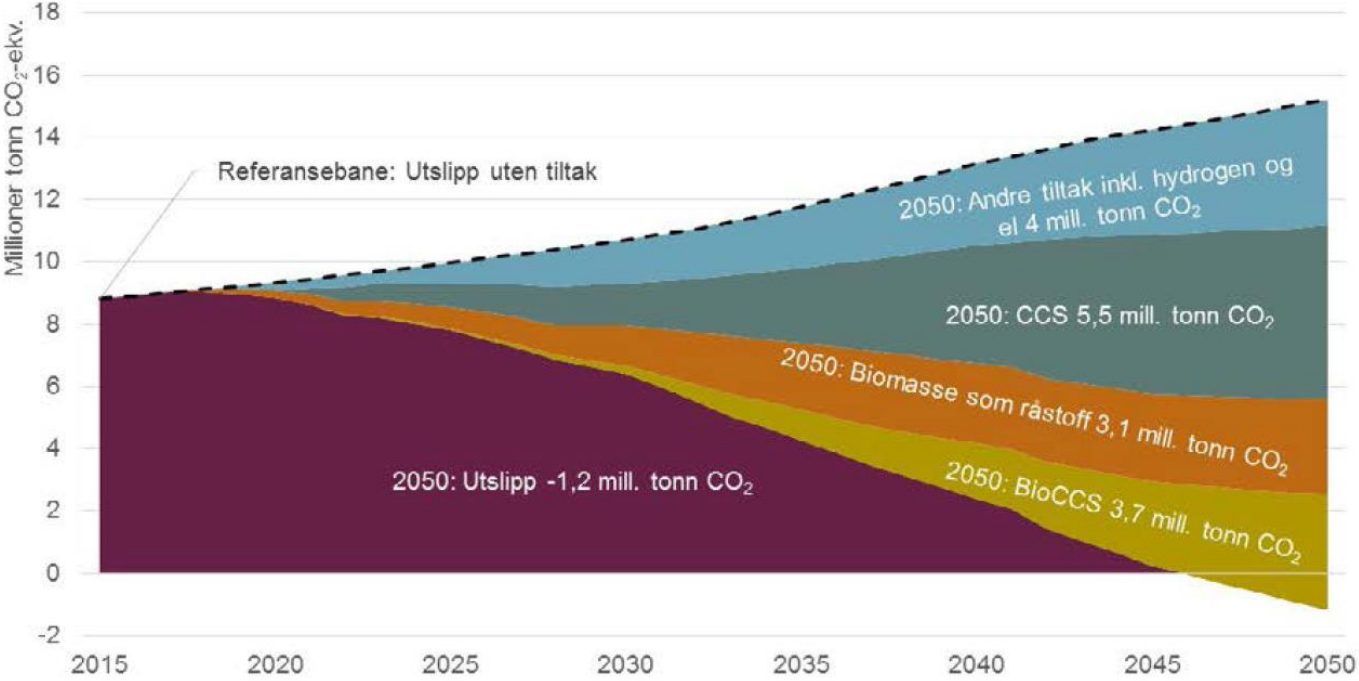
2019



Globale energitrender og norske muligheter

Statkrafts Lavutslippsscenario

Industries form strategies for net zero, and a few for net negative emissions





Renewable carbon in ferrosilicone, absorbing CO₂ from the air

Renewable hydrogen for fertilizer

Yara and Nel collaborate to produce carbon free hydrogen for fertilizer production

In an agreement signed today, Yara and Nel confirm their shared ambition of developing clean hydrogen which would allow Yara to realize low carbon footprint fertilizer production.



Jon-André Lakkø, CEO of Nel Hydrogen and Tove Andersen, EVP Production in Yara signed the agreement at Yara House today.



Knowledge grows

nel •

Renewable hydrogen for refining



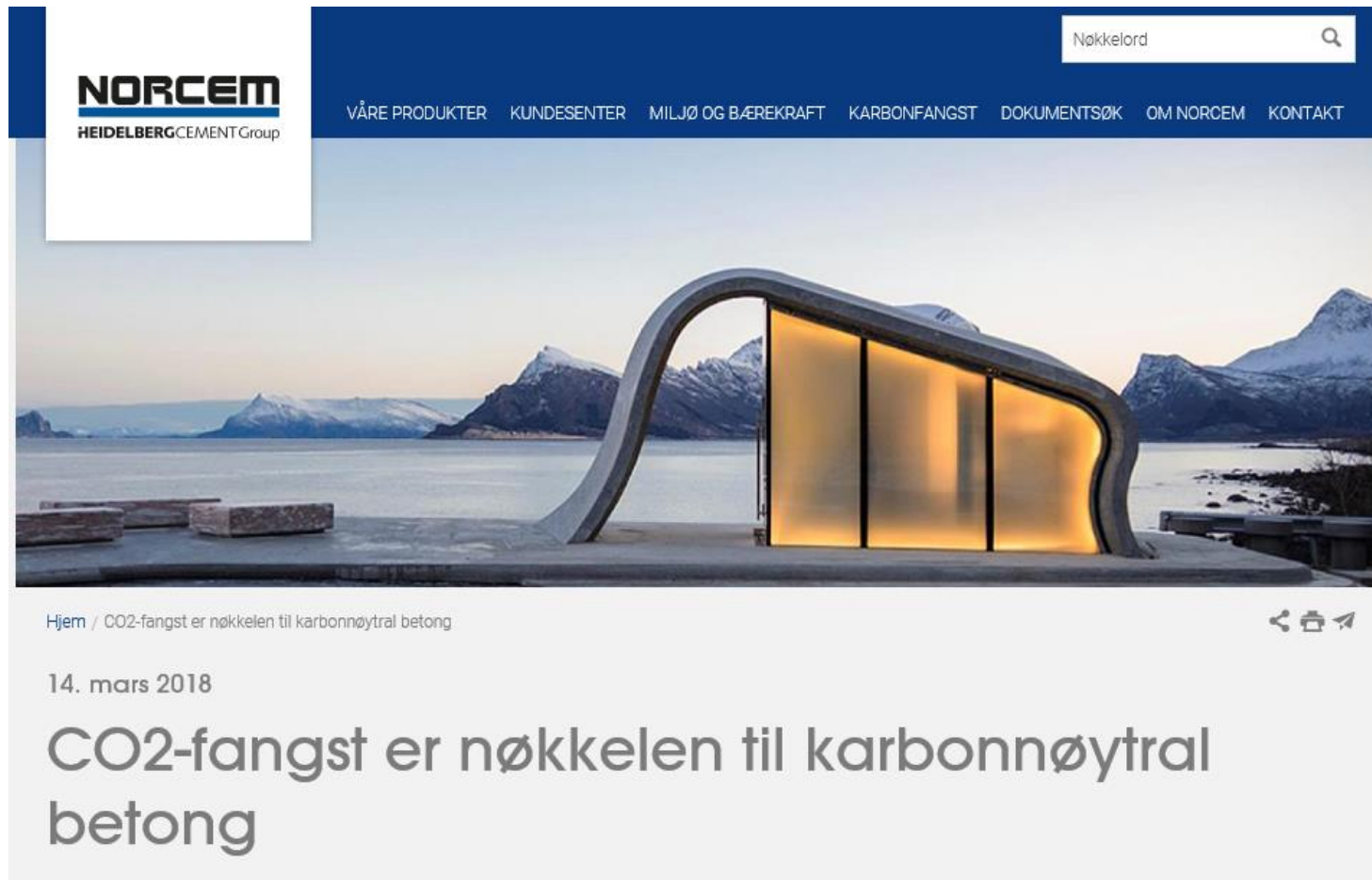
Brussels/Cologne, June 25th, 2019

Construction starts on the world's largest hydrogen plant at Shell's Rheinland Refinery

Ground-breaking ceremony for a new hydrogen electrolysis plant at the Shell Rheinland refinery in Wesseling, Germany, that will help contribute to a cleaner, lower-carbon energy future.

The total investment is at 16 million euros, of which the European Fuel Cell Hydrogen Joint Undertaking contributes 10 million euros, 6 million euros will be contributed by the REFHYNE consortium with Shell. ITM Power. SINTEF. thinkstep and Element Enerav.

CCS for emission free concrete



The image is a screenshot of the NORCEM website. At the top left is the NORCEM logo, which includes the text "HEIDELBERGCEMENT Group". To the right of the logo is a navigation menu with the following items: "VÅRE PRODUKTER", "KUNDESENTER", "MILJØ OG BÆREKRAFT", "KARBONFANGST", "DOKUMENTSØK", "OM NORCEM", and "KONTAKT". A search bar with the placeholder text "Nøkkelord" and a magnifying glass icon is located in the top right corner. The main content area features a large photograph of a modern, curved concrete structure with a large, illuminated window, set against a backdrop of a fjord and snow-capped mountains. Below the photograph, the text reads: "Hjem / CO2-fangst er nøkkelen til karbonnøytral betong". To the right of this text are three small icons: a left-pointing arrow, a square, and a right-pointing arrow. Below the navigation and image is the date "14. mars 2018" and the main headline "CO2-fangst er nøkkelen til karbonnøytral betong".

A new market for climate adaptation

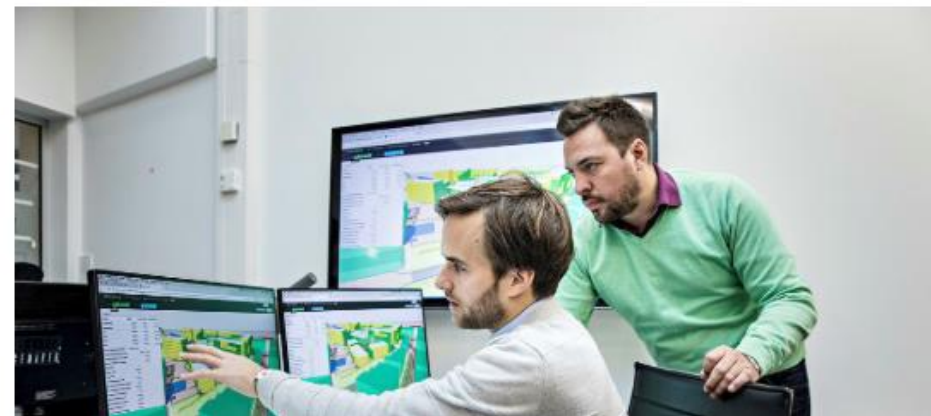


Handel

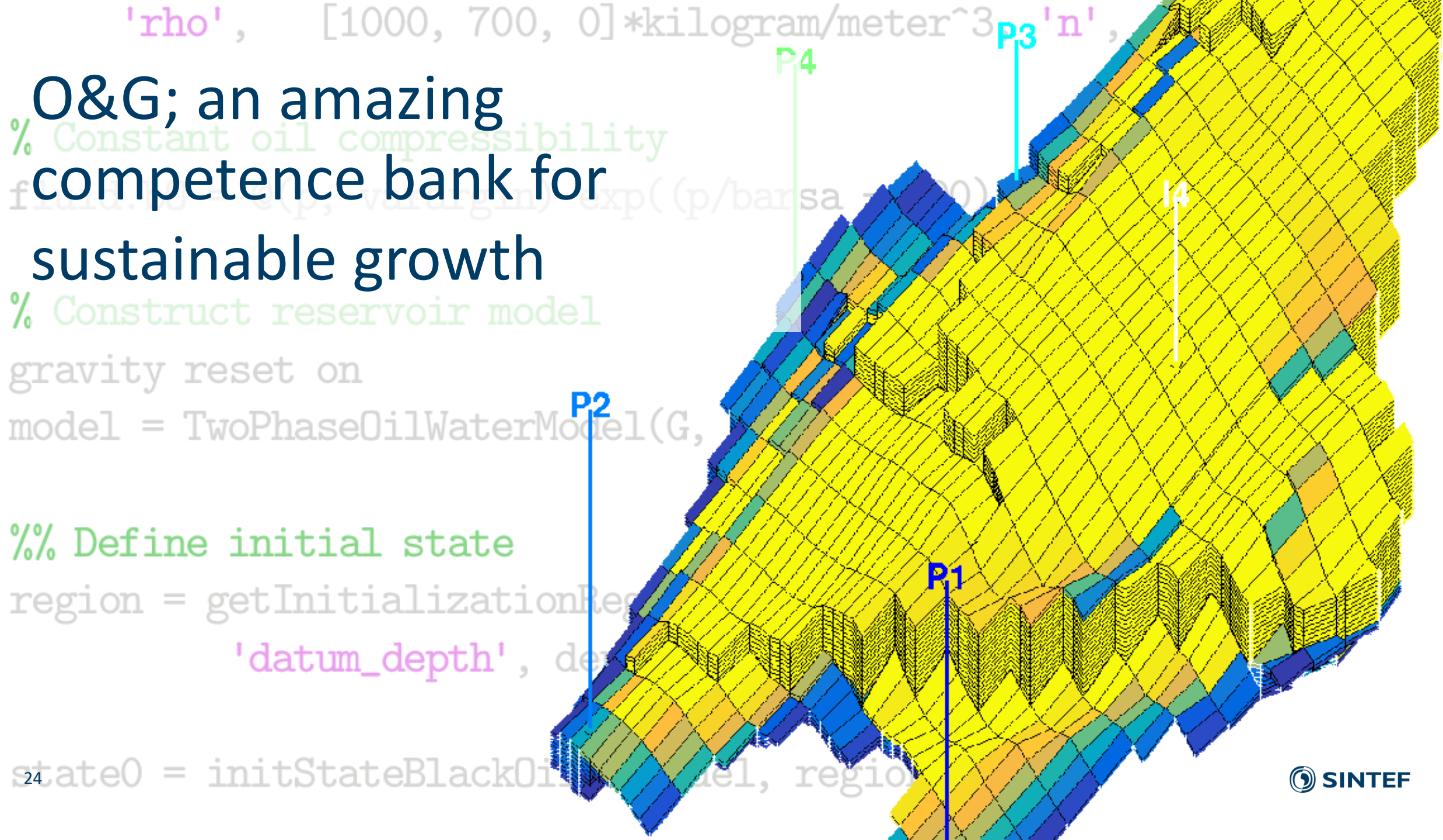
Kunstig intelligens inntar arkitektkontorene

Oppstartsbedriften Spacemaker har på et år vokst til 20 ansatte. Eiendomsmilliardærer og teknologinvestorer satser millioner på at god arkitektur lar seg uttrykke gjennom matematiske formler.

3 min Publisert: 18.10.17 – 20.59 Oppdatert: 2 år siden



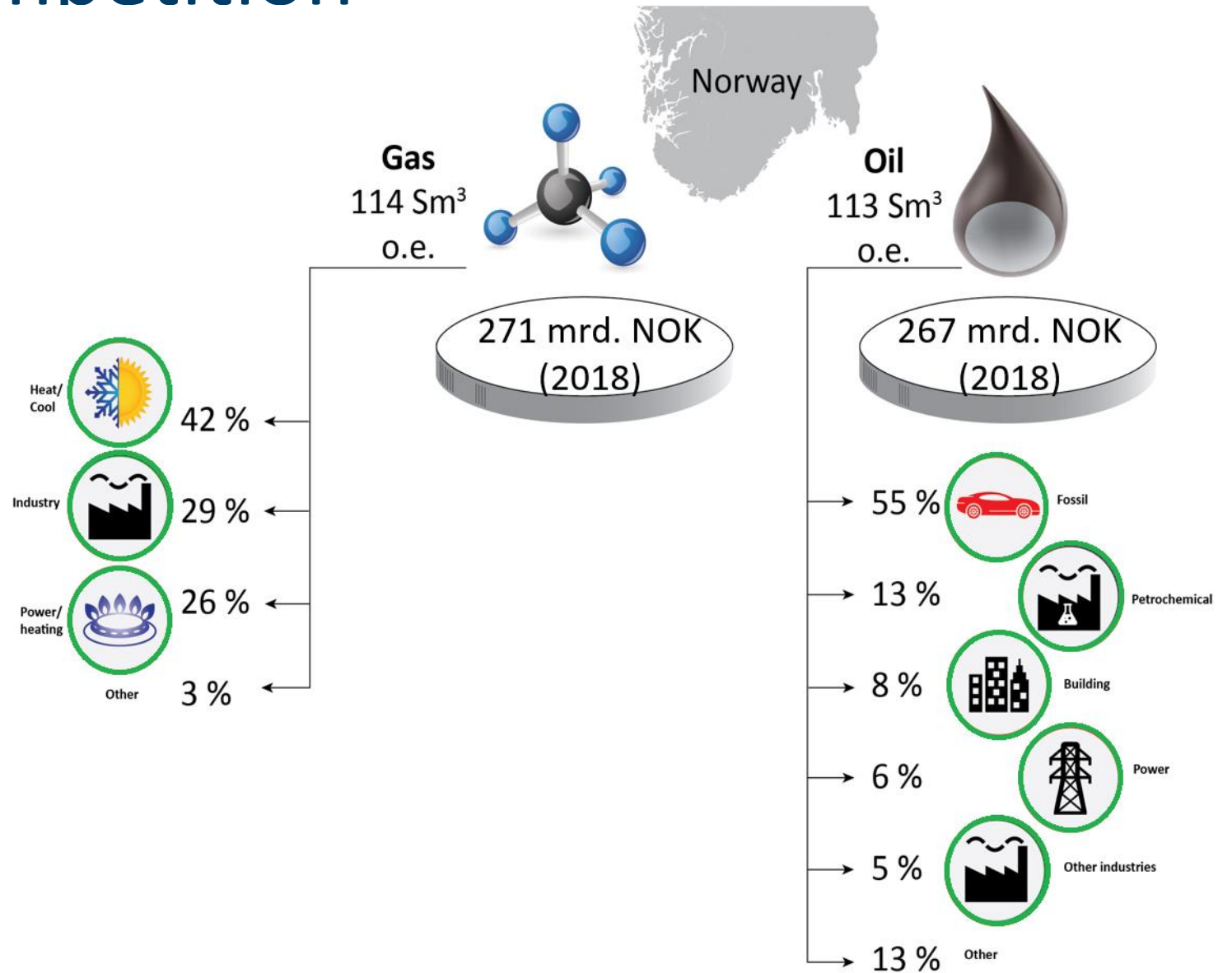
O&G; an amazing competence bank for sustainable growth





SUSTAINABILITY AND OUR CUSTOMERS IN THE O&G INDUSTRY

Zero emission competition in all markets



CUTTING OWN EMISSIONS

2030

Technology enabling 40%
reduction in CO₂ eq. emissions

2050

Move towards zero
emission technology

**All of this without jeopardizing the
industry's competitiveness**

Photo: Equinor

ADRESSING EMISSIONS FROM ALL ANGLES

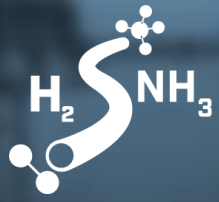
Mix of Technology Solutions with Emission Reduction Potential:



• 10-20%

01110
011100

• 5-10%



• 40-80%



• 1% (on existing vessels)
• 10% (potential on fuel switch)

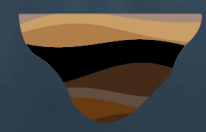


1-100%

Technology X



• 40-80%



• 10-20%



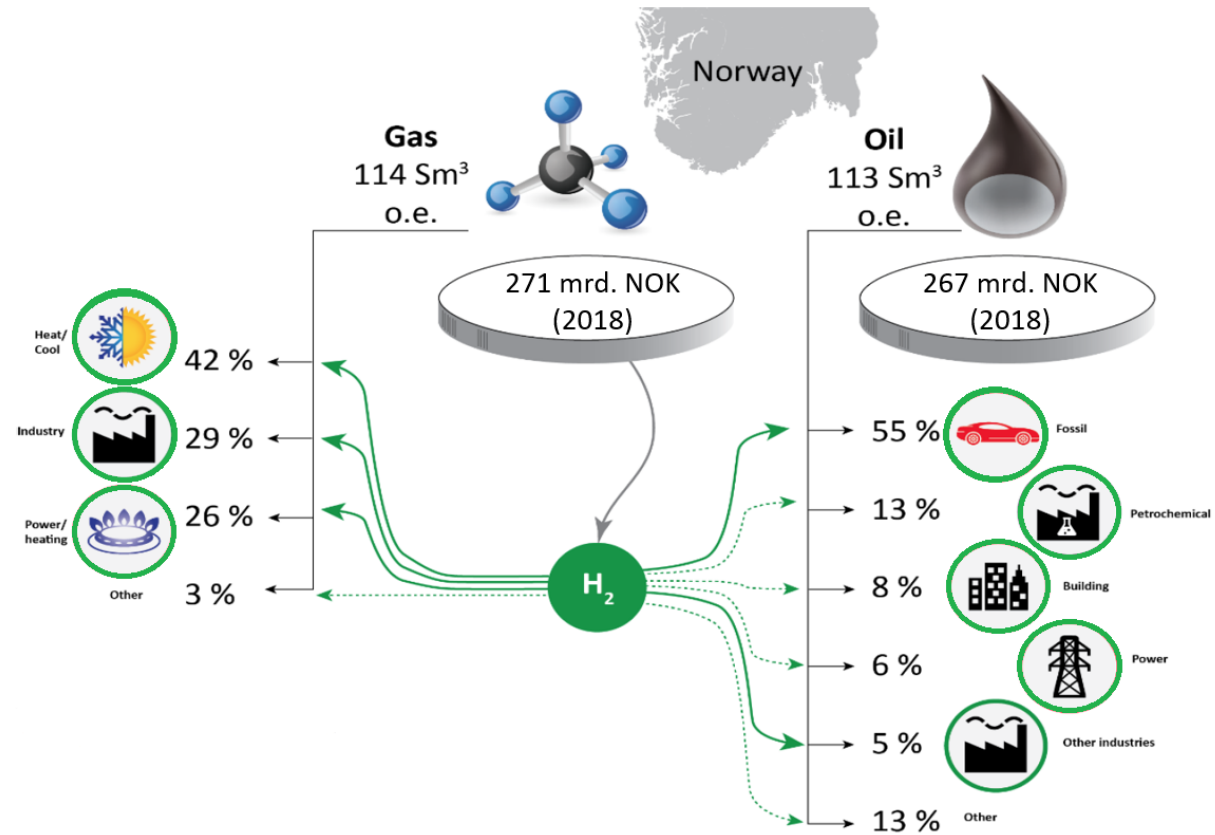
• 40-80%



• 5-10%

Addressing customer emissions

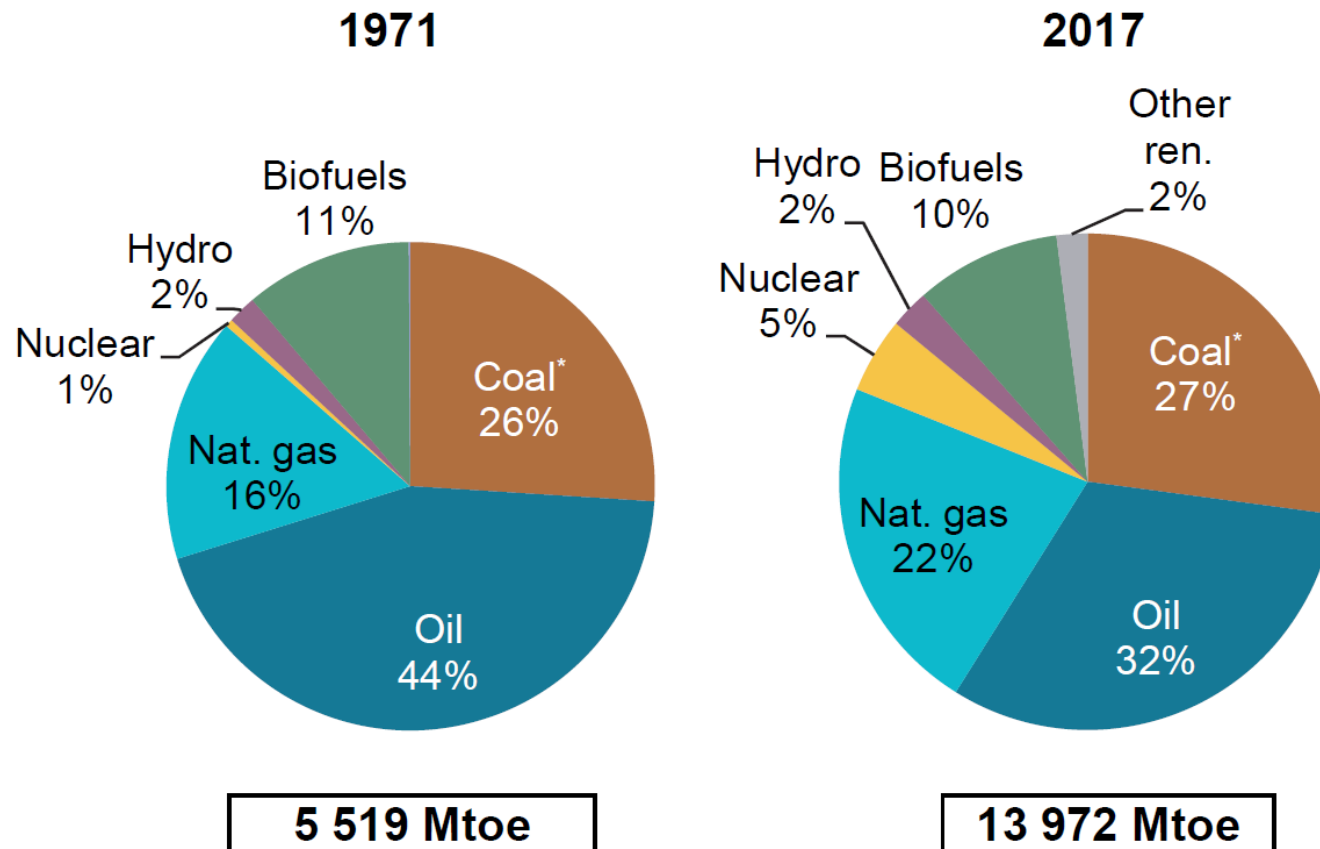
Hydrogen
with CCS
attractive in
all customer
segments



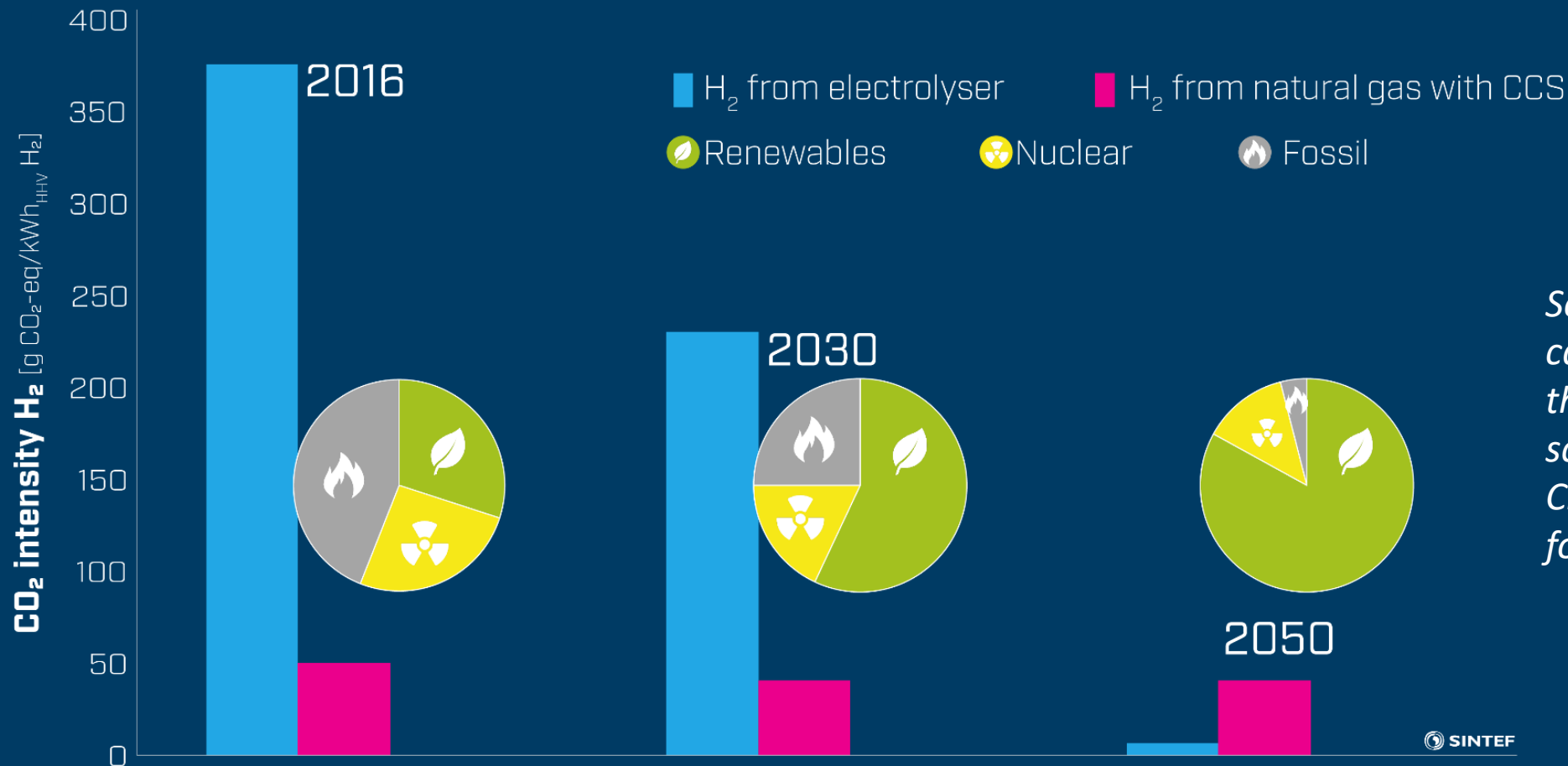
A (too) slow transition.

World energy mix is the same as 50yrs ago!

Figure 6. World total primary energy supply by fuel



Hydrogen with CCS is faster to cut emissions



Sources: IRENA REmap case for 2030 and the decarbonised scenarios from "A Clean Planet for All" for 2050

CCS is key to competitiveness, and to solve climate change

Seven European firms to join Equinor's Northern Lights project in Norway

By NS Energy Staff Writer 06 Sep 2019

CLEAN TECHNOLOGY CARBON CAPTURE PROJECTS AND TECHNOLOGY

The Northern Lights project, located offshore Norway, is being developed by oil and gas giants Equinor, Shell and Total



An underwater photograph of a dense seaweed forest. The seaweed blades are large, yellowish-green, and have a wavy, textured appearance. They are illuminated from above, creating a bright, sunlit effect. The background is a clear, deep blue water. A semi-transparent white text box is overlaid on the upper left portion of the image.

CO₂ offsets by binding carbon in ocean biomass - potentially a huge industrial opportunity

It often starts with R&D

Offshore Wind Outlook 2019

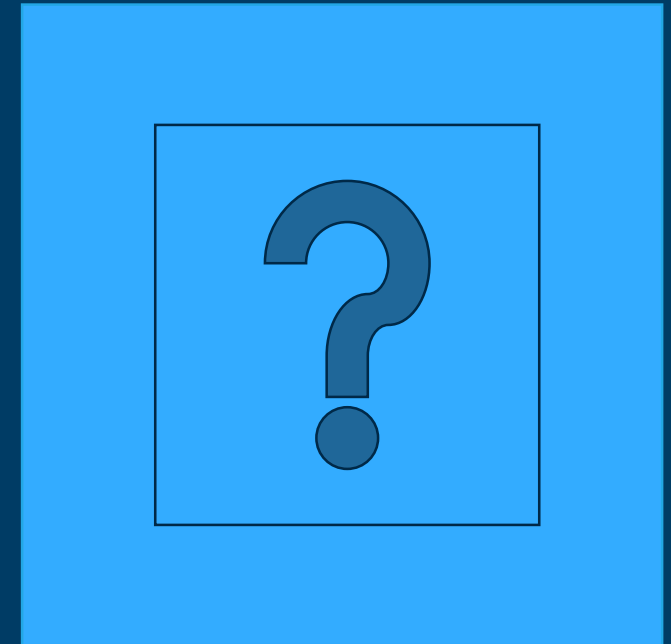
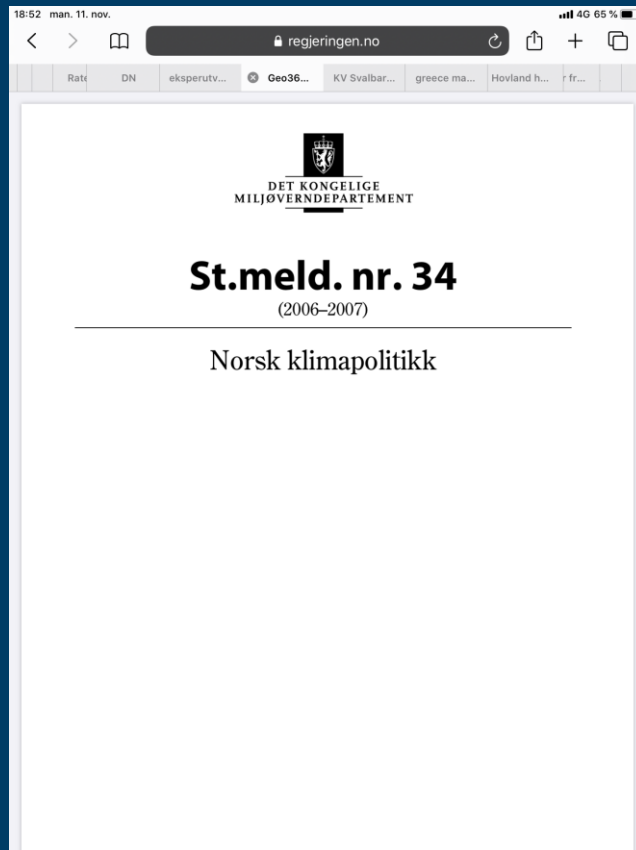


RAPPORT
VERDISKAPINGSPOTENSIALET KNYTTET TIL UTVIKLINGEN AV EN
NORSKBASERT INDUSTRI INNEN FLYTENDE HAVVIND



MENON-PUBLIKASJON NR. 69/2019
Av Even Winje, Sigrid Hernes, Gjermund Grimsby og Erik W. Jakobsen

Call for a "Norwegian Green Deal"? ...R&D key enabler





Teknologi for et bedre samfunn