The Research Council of Norway

Technology to provide Norwegian energy to Europe during the energy transition

SUBPRO Symposium, 27 November 2023

Gunnar H. Lille, MD, OG21

OG21

The Economist

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Business | Swap teams

Electric two-wheelers are creating a buzz in Asia

Cross-border tie-ups hope to make battery-swapping mainstream

Driver of innovation IMAGE: GETTY IMAGES

Sep 14th 2023

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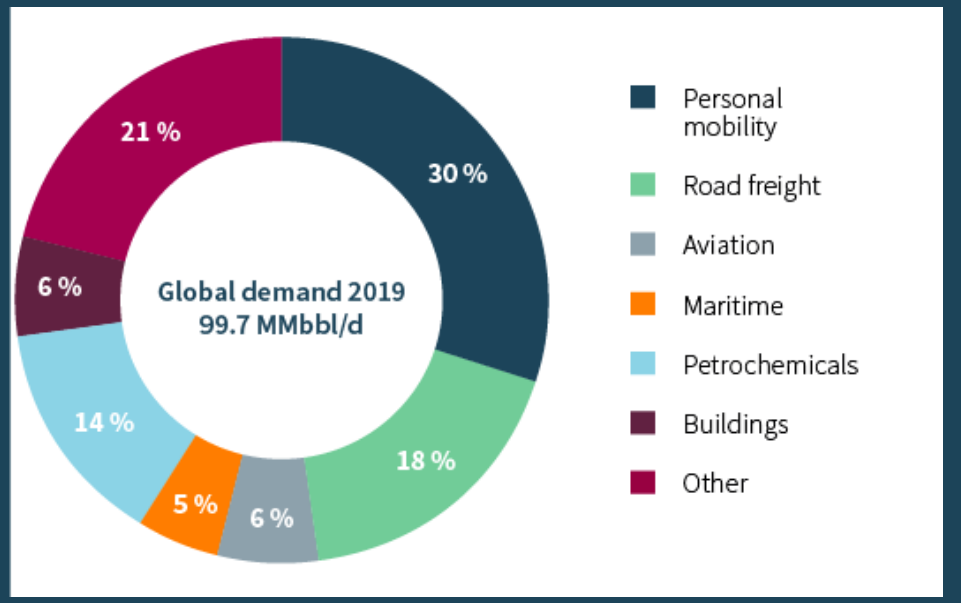
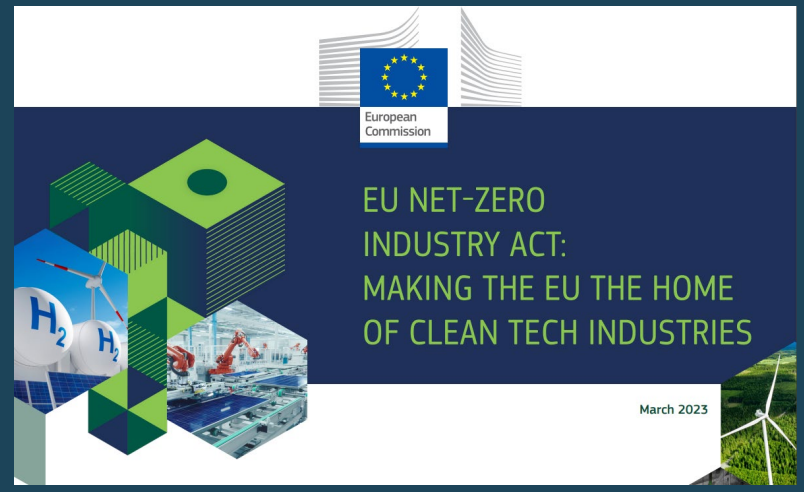


What oil is used for (OG21, 2021)

Technology development and scaling drives decarbonization

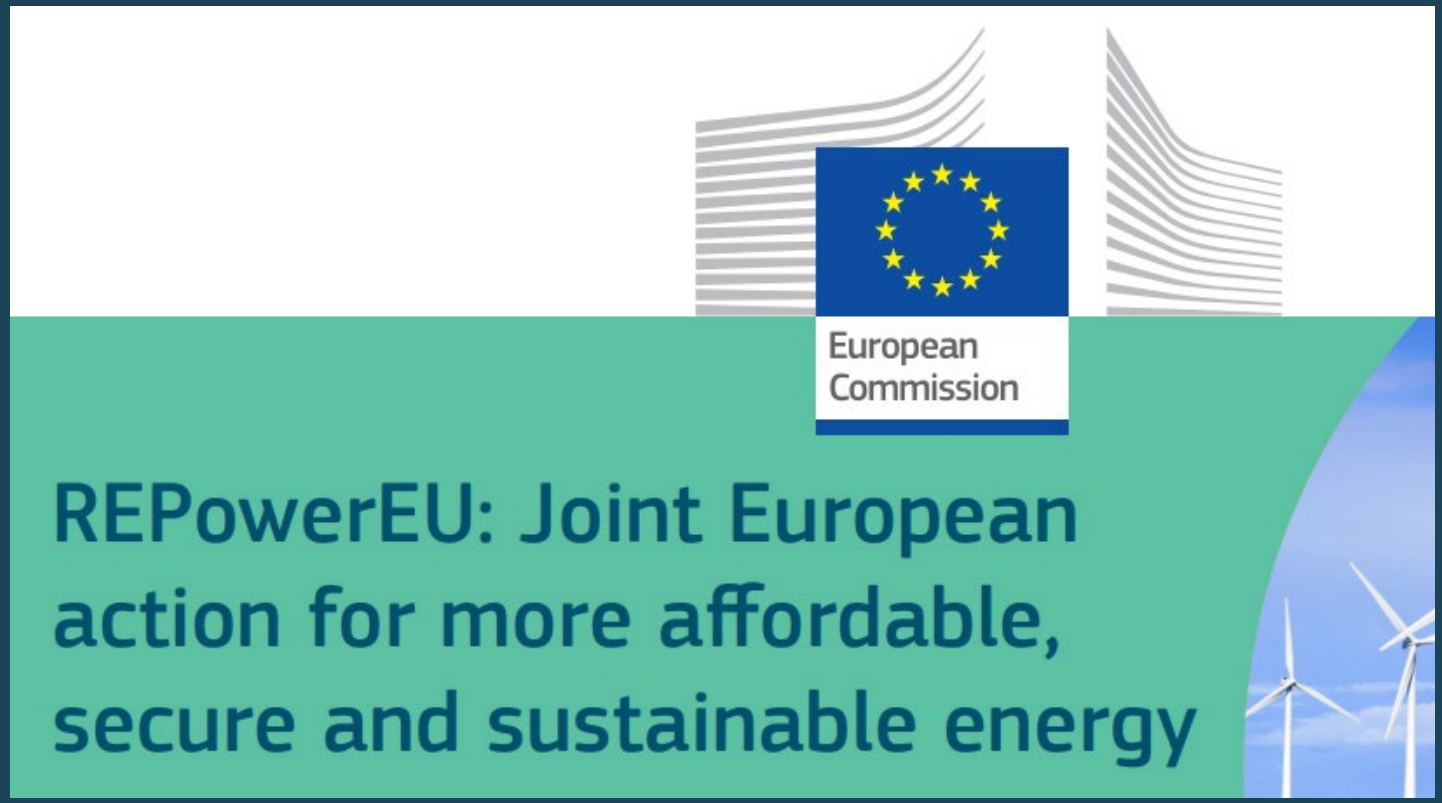
Al Dhafra Solar Photovoltaic (PV) 2GW project, Abu Dhabi (Photo: Karim SAHIB / AFP)

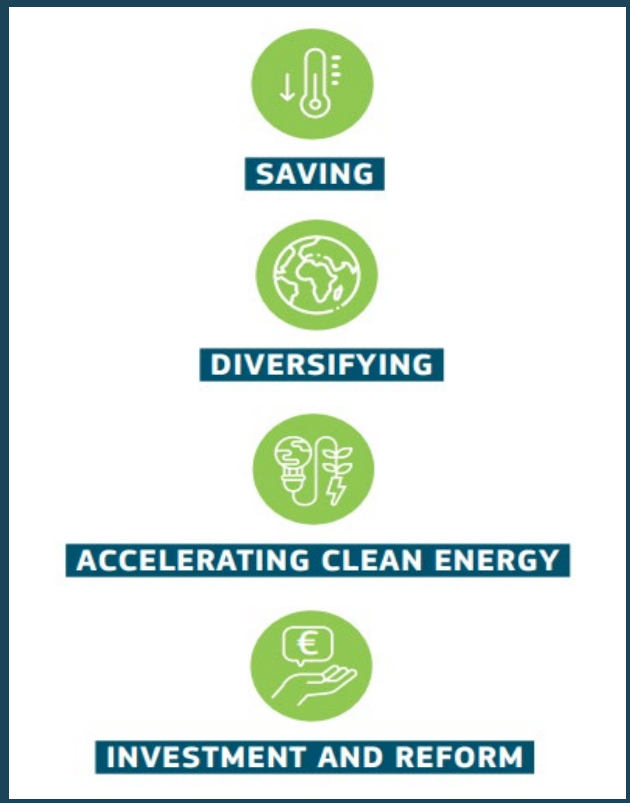


“Trust takes years to build, seconds to break, and forever to repair!”

Photo: Shutterstock

Reducing GHG emissions is at the core of European energy security strategy – NCS is part of the larger energy transition





The Economist

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Graphic detail | Out in the cold

Expensive energy may have killed more Europeans than covid-19 last winter

Our modelling estimates that high energy prices claimed 68,000 lives

May 10th 2023

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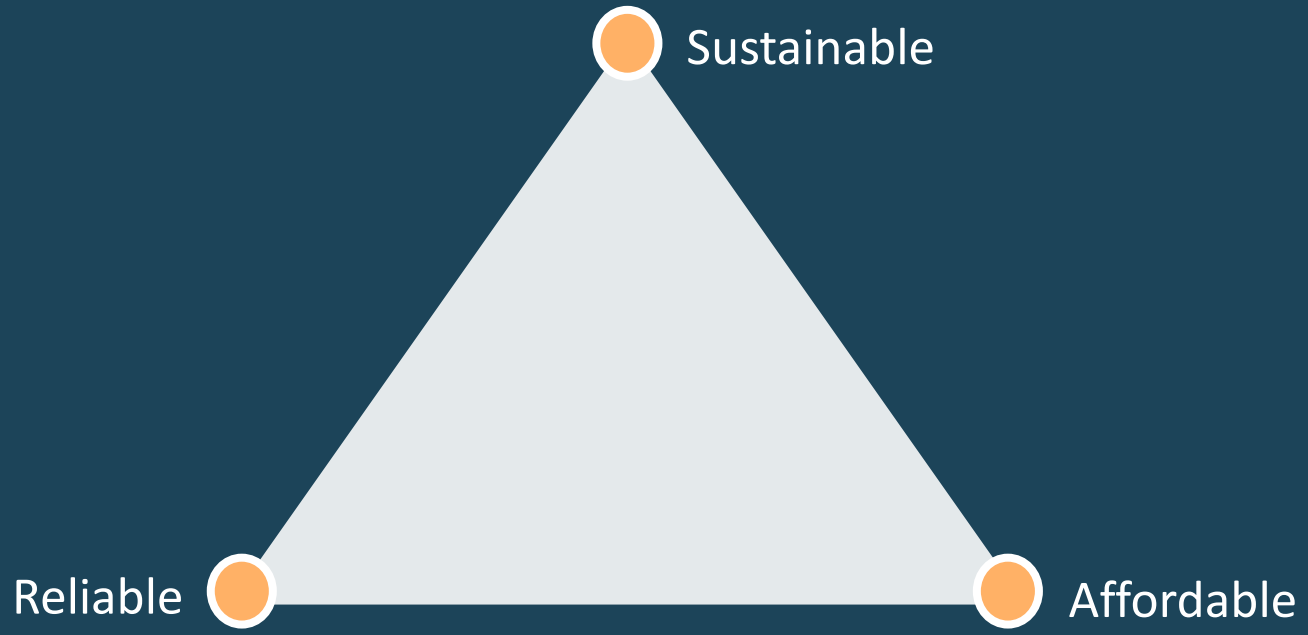
EUROPE

Heat waves in Europe killed more than 61,600 people last summer, a study estimates

July 12, 2023 · 11:39 AM ET

By Rachel Treisman

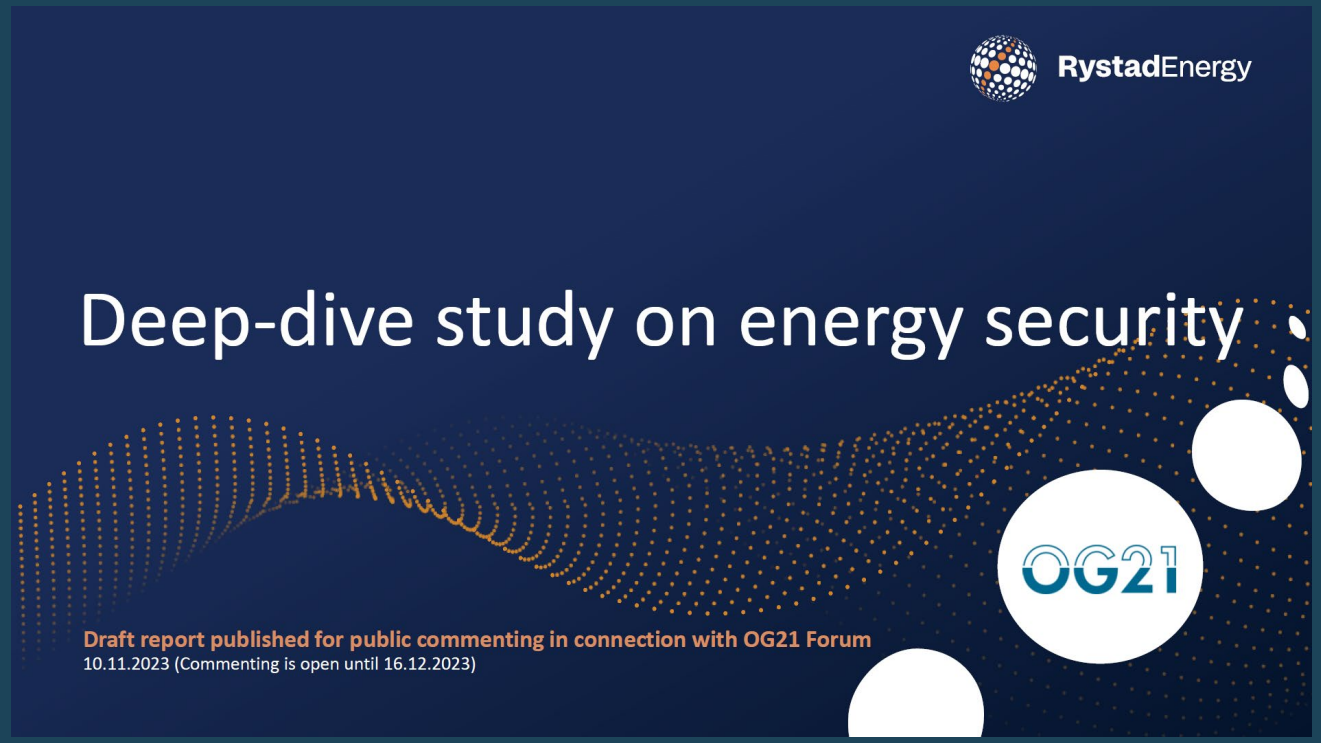
A girl refills her bottle with water from the "Fontana della Barcaccia" fountain in Rome in during the heat wave of July 2022.
Andreas Solaro/AFP via Getty Images



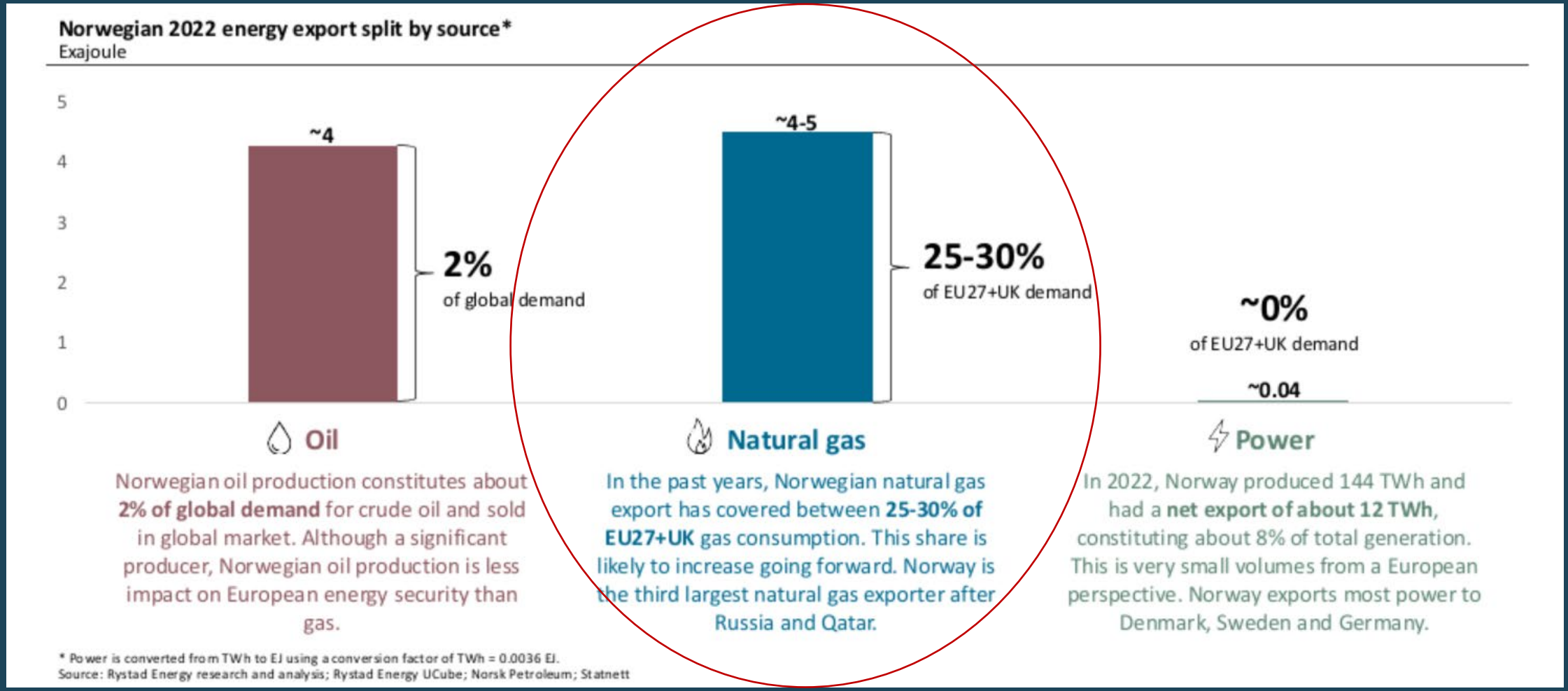
OG21

New deep-dive study on energy security: Two key questions

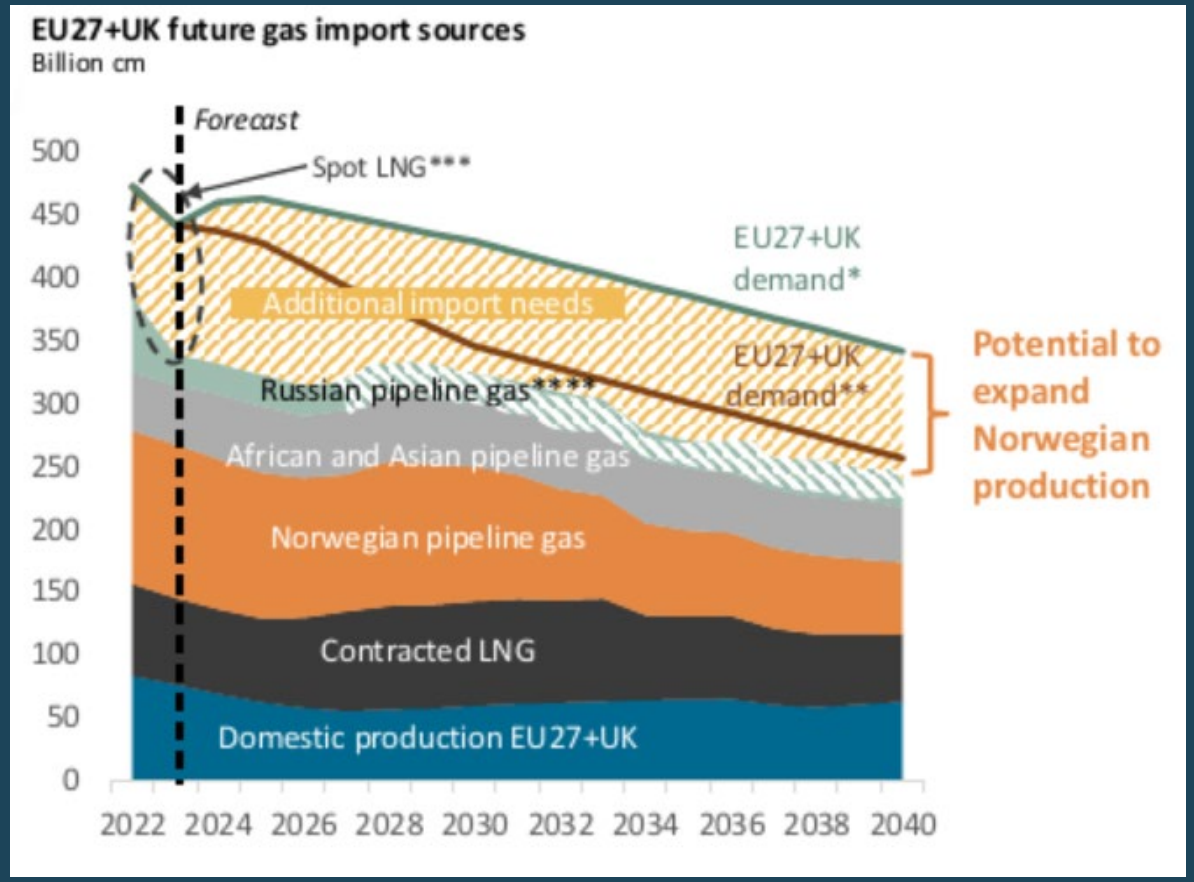
1. How important is Norwegian energy supply for the European energy security?
2. How important is technology for reliable energy supply from Norway?

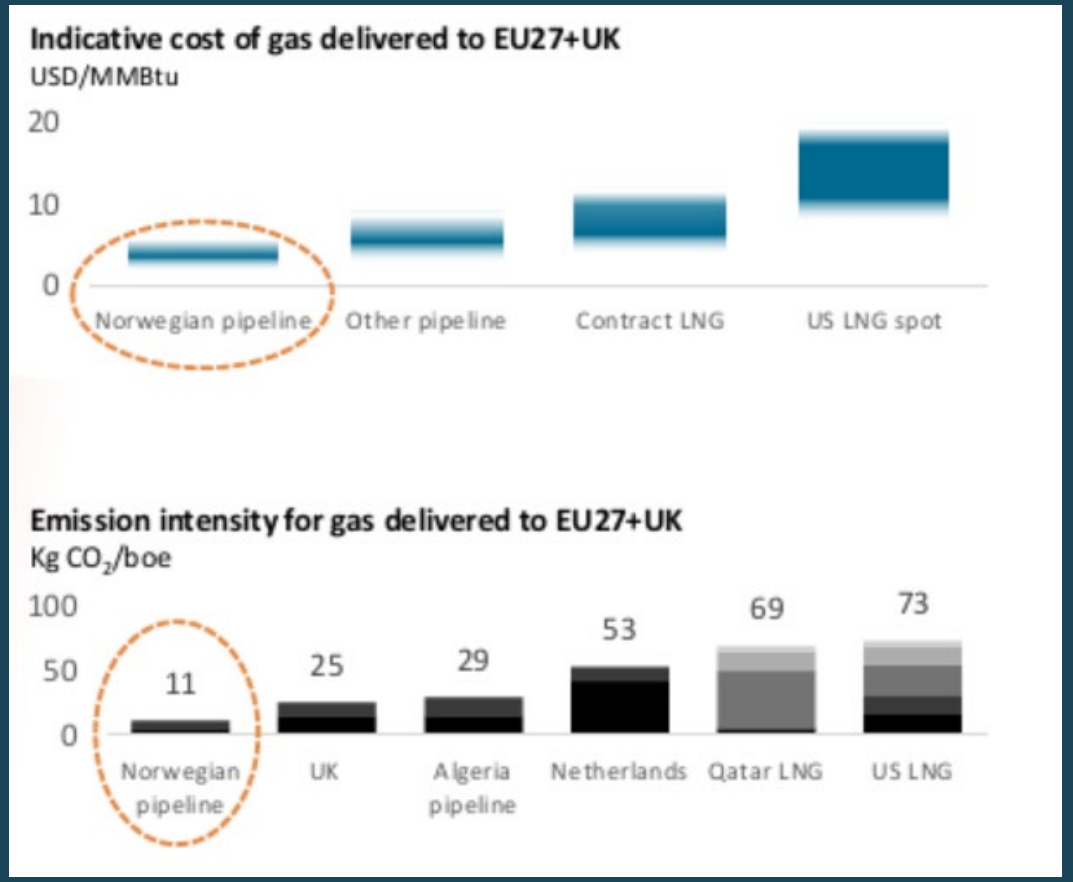


How important is Norwegian energy supply for the European energy security?



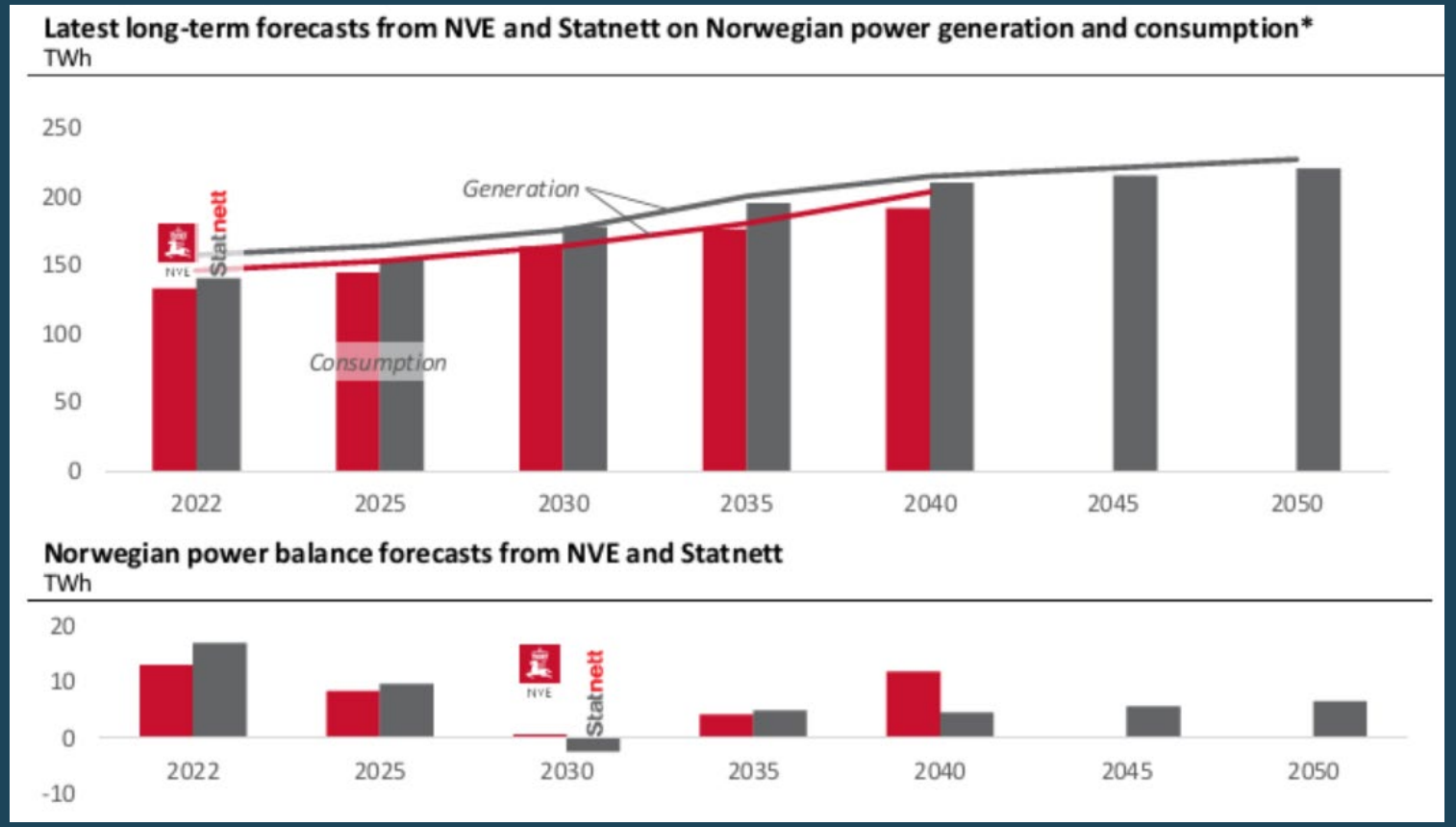
The call for Norwegian gas will be strong for a long time – lowest cost, lowest emissions, reliable provider





How do we provide gas to Europe whilst curbing domestic GHG emissions?

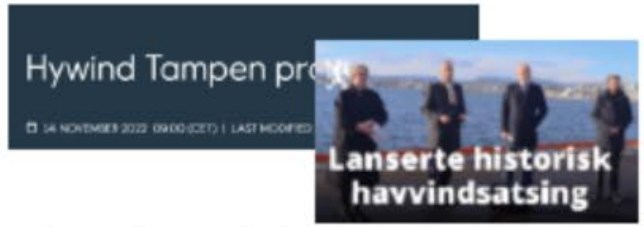
- Electrification key to curbing O&G production emissions
- Tight power market expected in Norway towards 2030
- Possible solutions:
  - Offshore wind
  - Gas power w/CCS
  - Other?



Delivering on offshore wind targets could give 100 TWh green power export

Norwegian power balance in 2050 given various offshore wind scenarios*

TWh



Hywind Tampen, Sørlige Nordsjø II and Utsira Nord

Statnett

Statnett's base-case power deficit if no offshore wind is built

-34

+ 4.6 GW

Additional yet-to-be awarded volumes required to reach Statnett base-case

19

+ 4.4 GW

Additional yet-to-be awarded volumes beyond Statnett base-case required to reach Government target

92

+ 21 GW

97

= 30 GW

Export potential of roughly 100 TWh if Government offshore wind targets are met

120 100 80 60 40 20 0 -20 -40 -60

No offshore wind | Known projects (4.6 GW) | Statnett base case (9 GW) | Government target (30 GW) | Total export potential

* Assuming 50% capacity factor

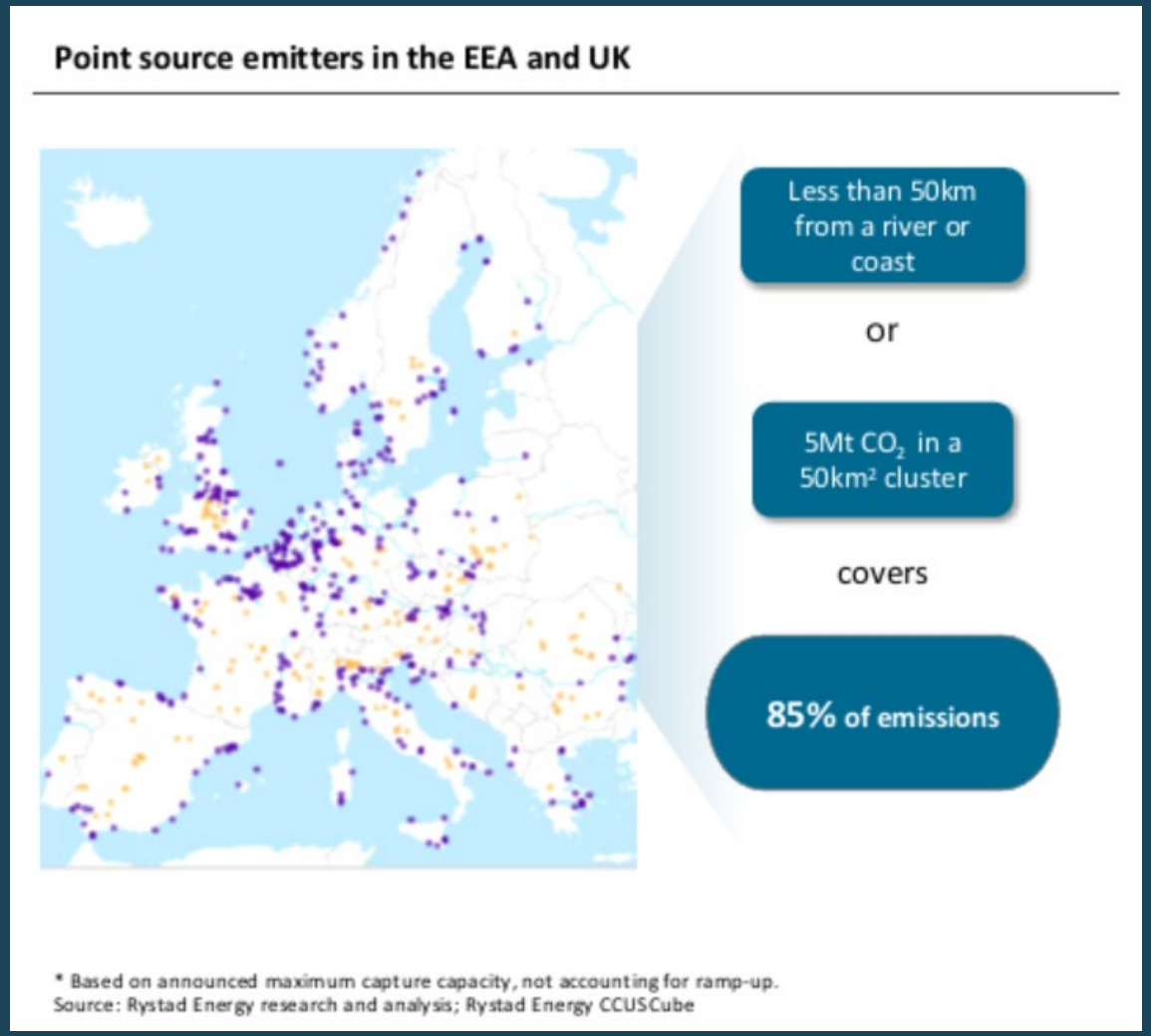
Source: Rystad Energy research and analysis; Statnett; Regjeringen.no

Norway has an important role within CCS, enabling a pathway to reach European emission targets

1. Increased CCS demand in Europe if renewables and hydrogen develop too slowly

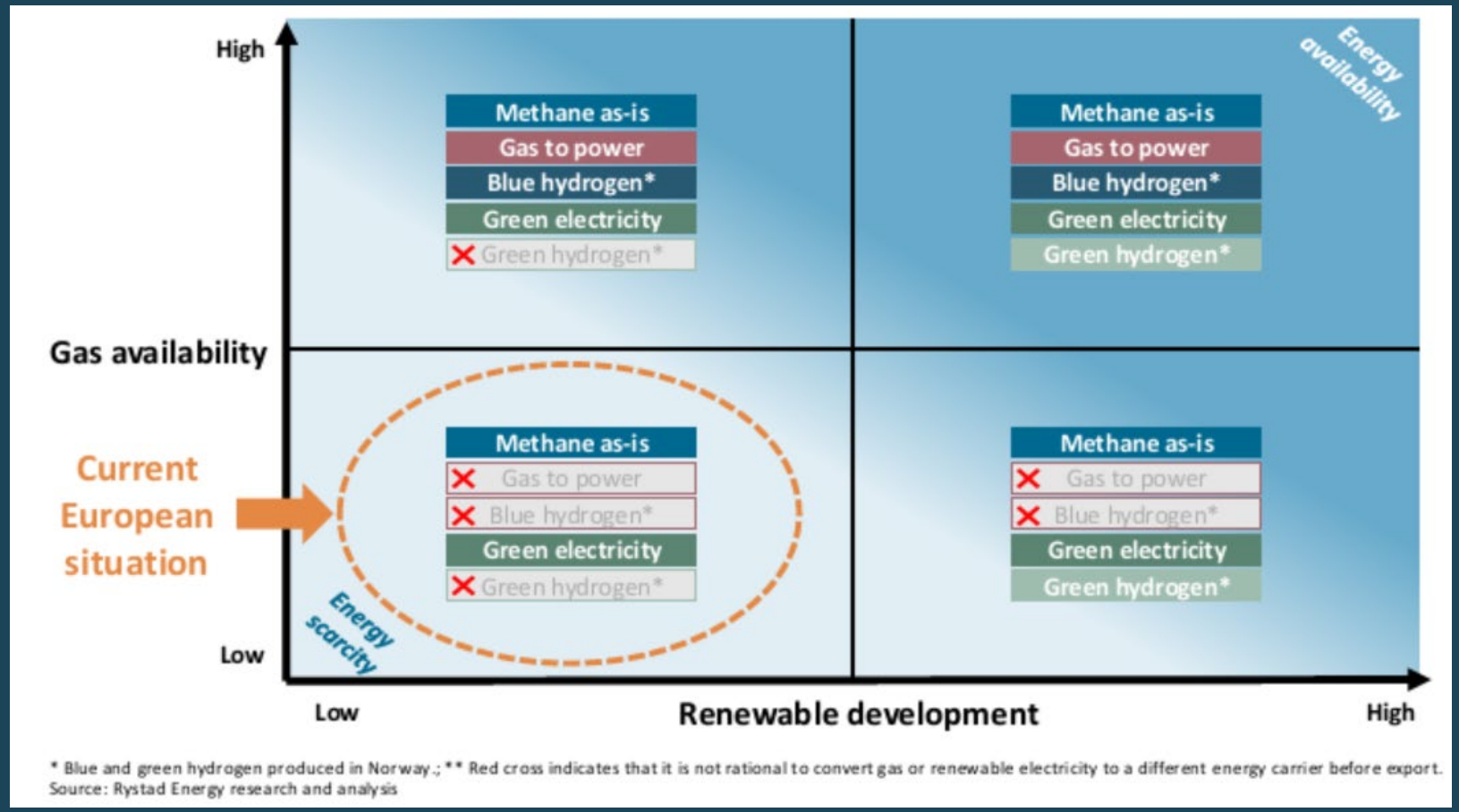
2. A possible Scope 3 responsibility could require an integrated natural gas and CCS approach

3. CCS is needed to decarbonize European industry -> an industrial opportunity for Norway



What about blue hydrogen production in Norway?

- High costs and high energy losses in hydrogen value chains
- Energy scarcity favor traditional value chains
- OG21 still believe Norway should continue hydrogen-innovation:
  - Scope 3 responsibility
  - Customers may want the energy delivered as H2 or NH3
  - Hard-to-abate sectors
  - Gas demand uncertainties



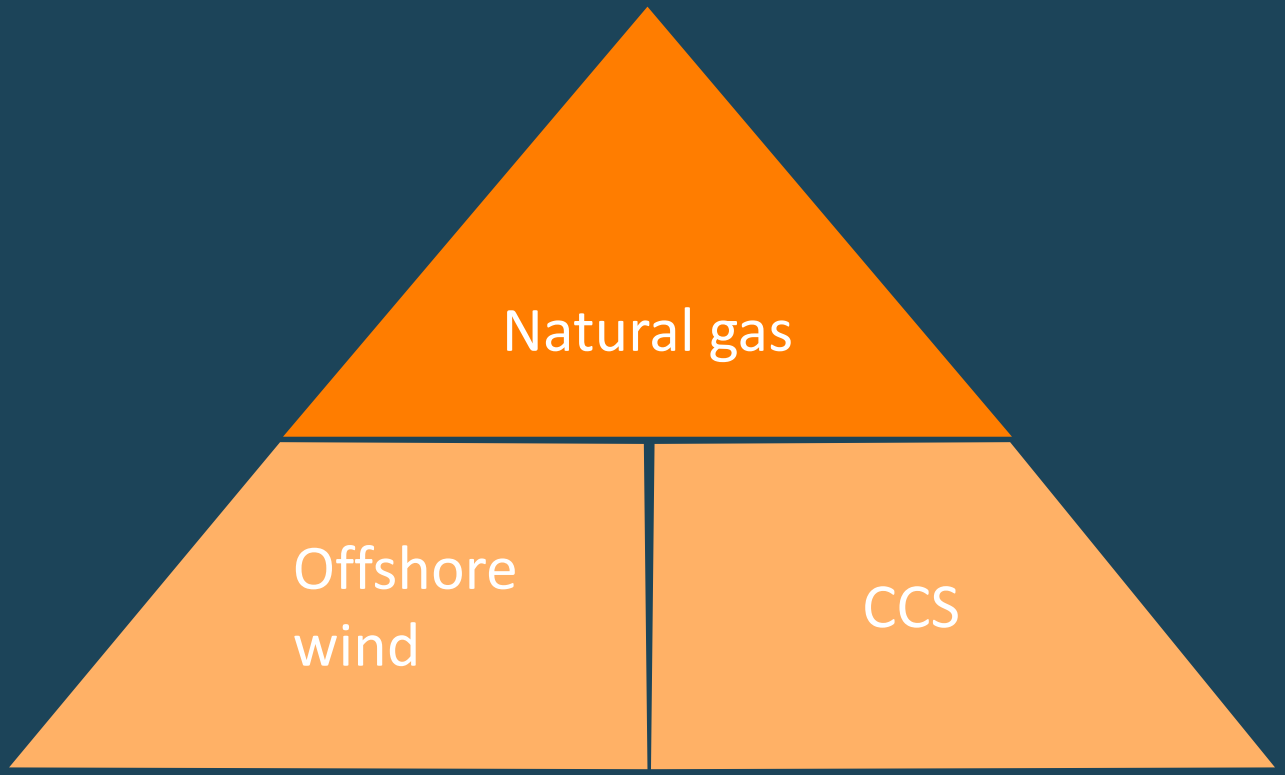
* Blue and green hydrogen produced in Norway.; ** Red cross indicates that it is not rational to convert gas or renewable electricity to a different energy carrier before export.
Source: Rystad Energy research and analysis

Wide range of threats to Norwegian energy supply to Europe

Theme	Threat	Evaluation
Regulatory and social license to operate	Skewed understanding of energy security consequences in the public energy transition discourse	Lack of fact-based energy transition discourse today can have a large impact on Norwegian energy exports in the long term.
	Increasing emission intensity of a maturing NCS	Increasing emission intensity may challenge the social license to operate, potentially impacting future Norwegian energy exports.
	Uncertainties in regulatory framework for the future of O&G	Slows down investment decisions both on new projects and emission reduction measures, with potential large impact.
	Uncertainties in regulatory framework for new industries	Regulatory uncertainty slows down renewables development, which has low export impact, but affects electrification of O&G.
	Major accidents related to maturing NCS	A major accident would potentially impact the social license to operate, but the likelihood is still considered very low.
Financials	Financials and innovation support affecting the development of new industries	Potentially large impact on development of offshore wind and CCS in Norway, which also affects e.g. O&G electrification.
	Access to external capital in the O&G industry	Restrictions to O&G financing mainly impacts smaller companies, but can have large impact on exploration activity.
Security	Lack of protection against cyber attacks	Likelihood of high-impact attack is relatively small, but potential volume effect and HSE risk can be significant.
	Lack of protection against physical attacks	The likelihood of such an event is considered very low, but with potential fatal consequences to export volumes.
Access to competence	Challenges related to recruitment of STEM professionals	O&G already struggles to attract STEM professionals in competition with other industries, limiting future O&G activity.
	Challenges related to recruitment to STEM studies at the universities	Already observing less interest and capacity for STEM education, which can impact long term energy volumes.
Supply chain	Bottlenecks in supply chain caused by geopolitical dependencies	High concentration and geopolitical tension increases likelihood, with a moderate potential effect on energy volumes.

Source: Rystad Energy research and analysis

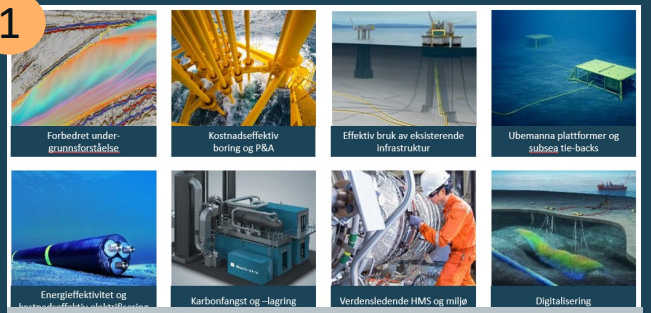
New deep-dive study on energy security – key take-aways



1. Holistic energy plan
2. Infrastructure and production security
3. Competence
4. Collaboration across energy sectors

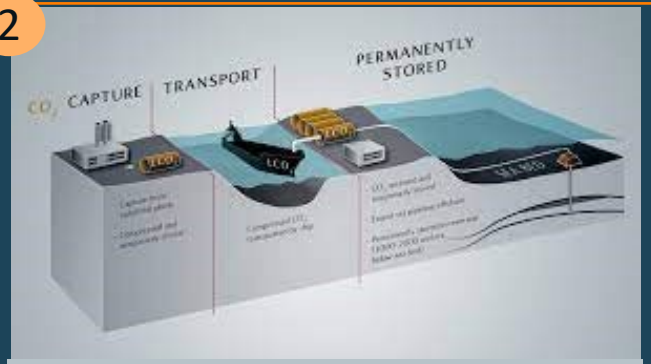
All elements of the OG21 strategy still relevant

1



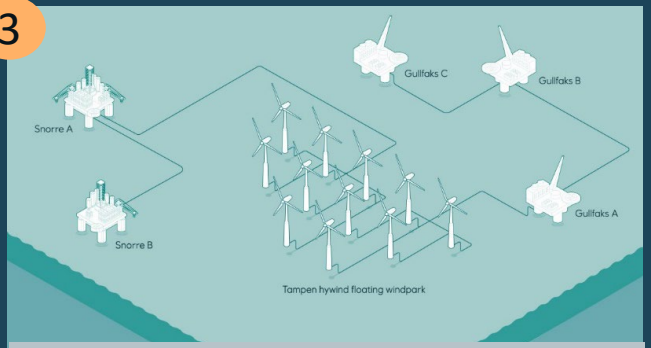
Compete for O&G market shares

2

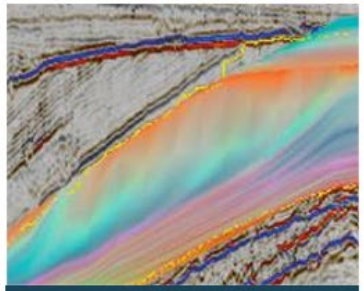


De-carbonize value chains

3



Contribute to new industries



Improved subsurface understanding

Cost-efficient drilling and P&A

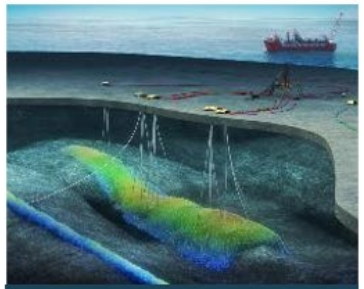
Efficient use of infrastructure

Unmanned installations and subsea tie-backs

Energy efficiency and cost-efficient electrification

Carbon capture and storage

World leading HSE and environment



Digitalization

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