Northern Lights CCS

A European CO_2 transport and storage network

Market development
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09 June 2020

https://northernlightsccs.com

Northern Lights CCS FID – a major milestone

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Important milestone in the CO2 storage project

Press release | Date: 15/05/2020
| No: 027/20

The Ministry of Petroleum and Energy has received and started our assessment of the development plan for the Northern Lights CO2-storage project.

Ministry of Petroleum and Energy

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=> We are getting closer to being able to take delivery of 3rd party CO_2

The energy transition – the role of CCS

- <u>Aggregate level</u>: How do we de-carbonize the economy while at the same time maintaining industrial activities, value creation, jobs?
- <u>Company level</u>: What's our role? What will our shareholders want us to do? What can we afford?

Source: https://markets.businessinsider.com/commodities/co2-european-emission-allowances

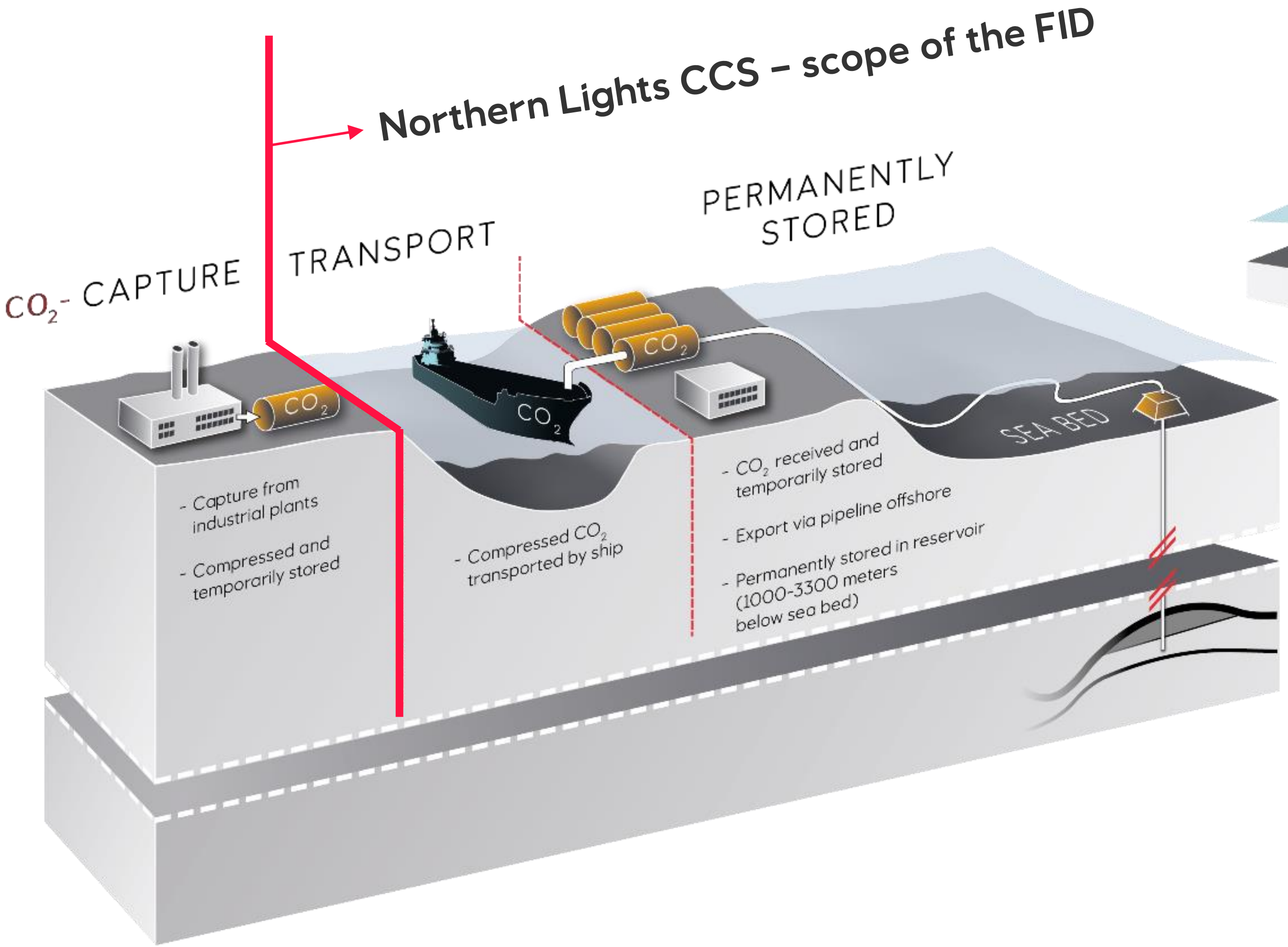
- What will the ETS price do in the future?

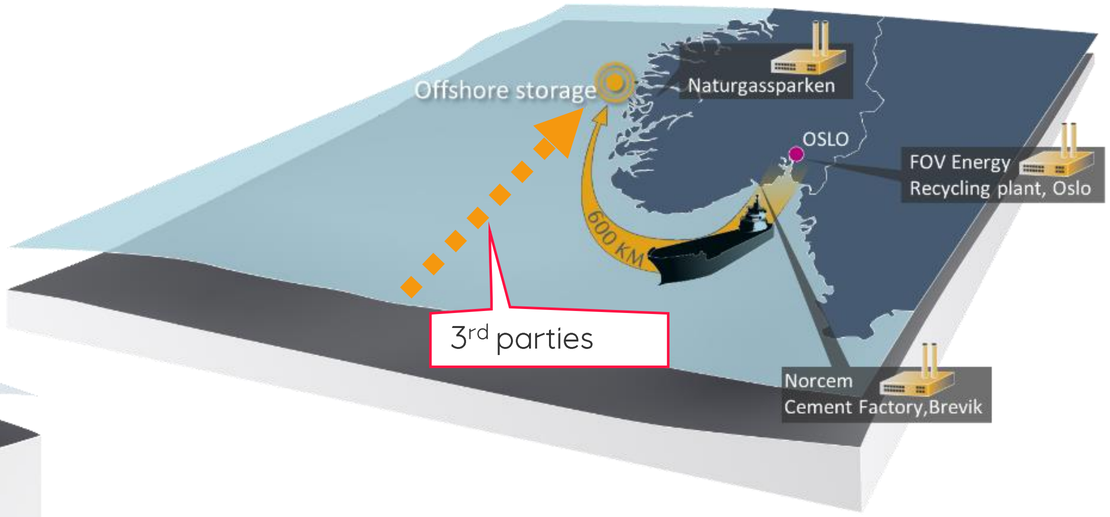
- Availability of subsidies?

- Is there a market for decarbonized end products?

- Covid-19 economic impact?

The Norwegian full scale CCS demonstration project





Northern Lights CCS concept overview

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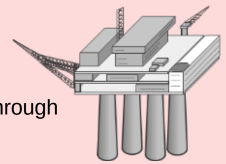
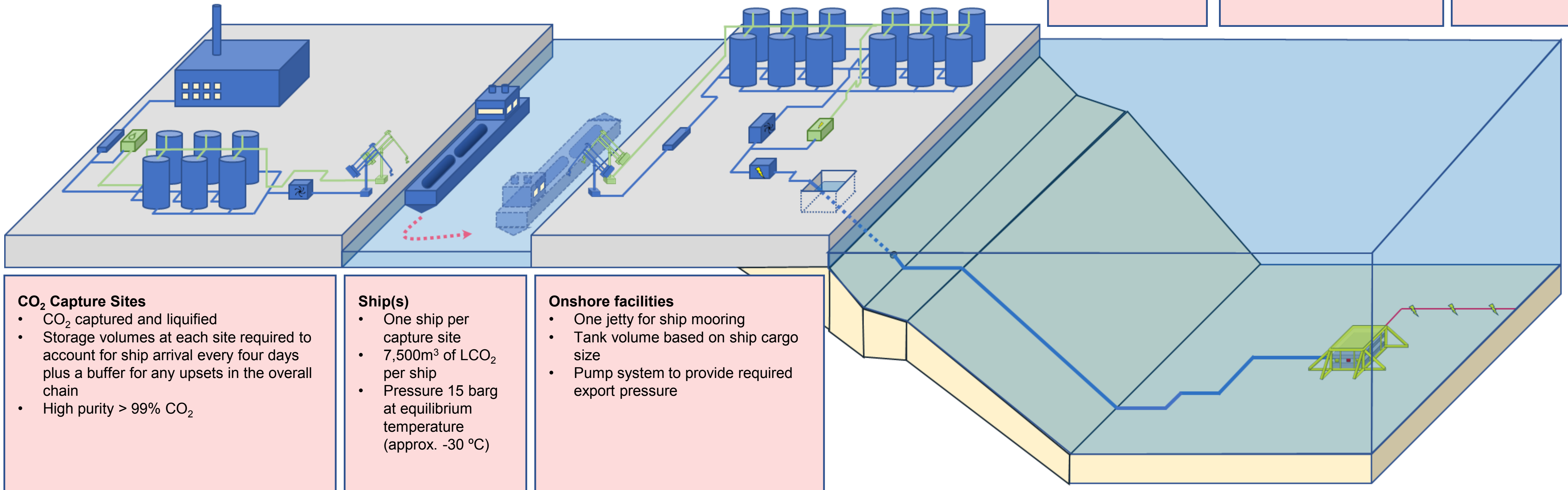
Pipeline
- 110km un-insulated pipeline
- 12 ¼ inch
- Single phase (liquid) CO_2

Subsea facilities
- Connecting pipeline, umbilical and well(s)
- Water depth ~300m
- Connection for future step-out

Umbilical to Oseberg
Connection from Oseberg-field providing power and signal from DC/FO and fluids through umbilical system



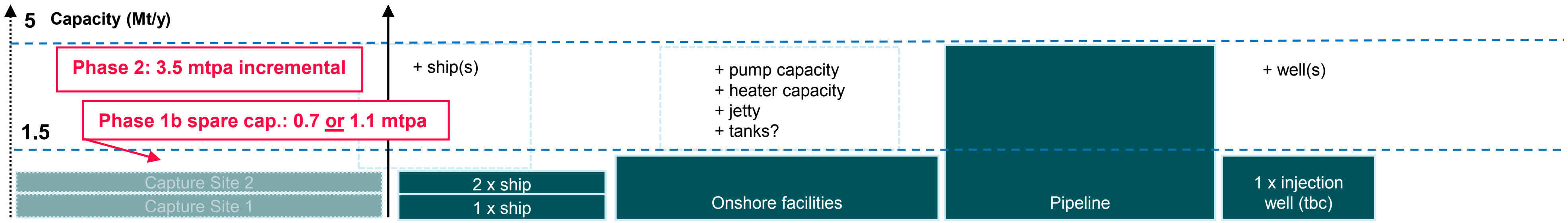
Subsea injection well
- Injection of CO_2 into reservoir at ~2-3000m depth
- Pressure in reservoir ~2-300bar
- Temperature in reservoir ~100 ºC



CO_2 Capture Sites
- CO_2 captured and liquified
- Storage volumes at each site required to account for ship arrival every four days plus a buffer for any upsets in the overall chain
- High purity > 99% CO_2

Ship(s)
- One ship per capture site
- 7,500m³ of LCO_2 per ship
- Pressure 15 barg at equilibrium temperature (approx. -30 ºC)

Onshore facilities
- One jetty for ship mooring
- Tank volume based on ship cargo size
- Pump system to provide required export pressure

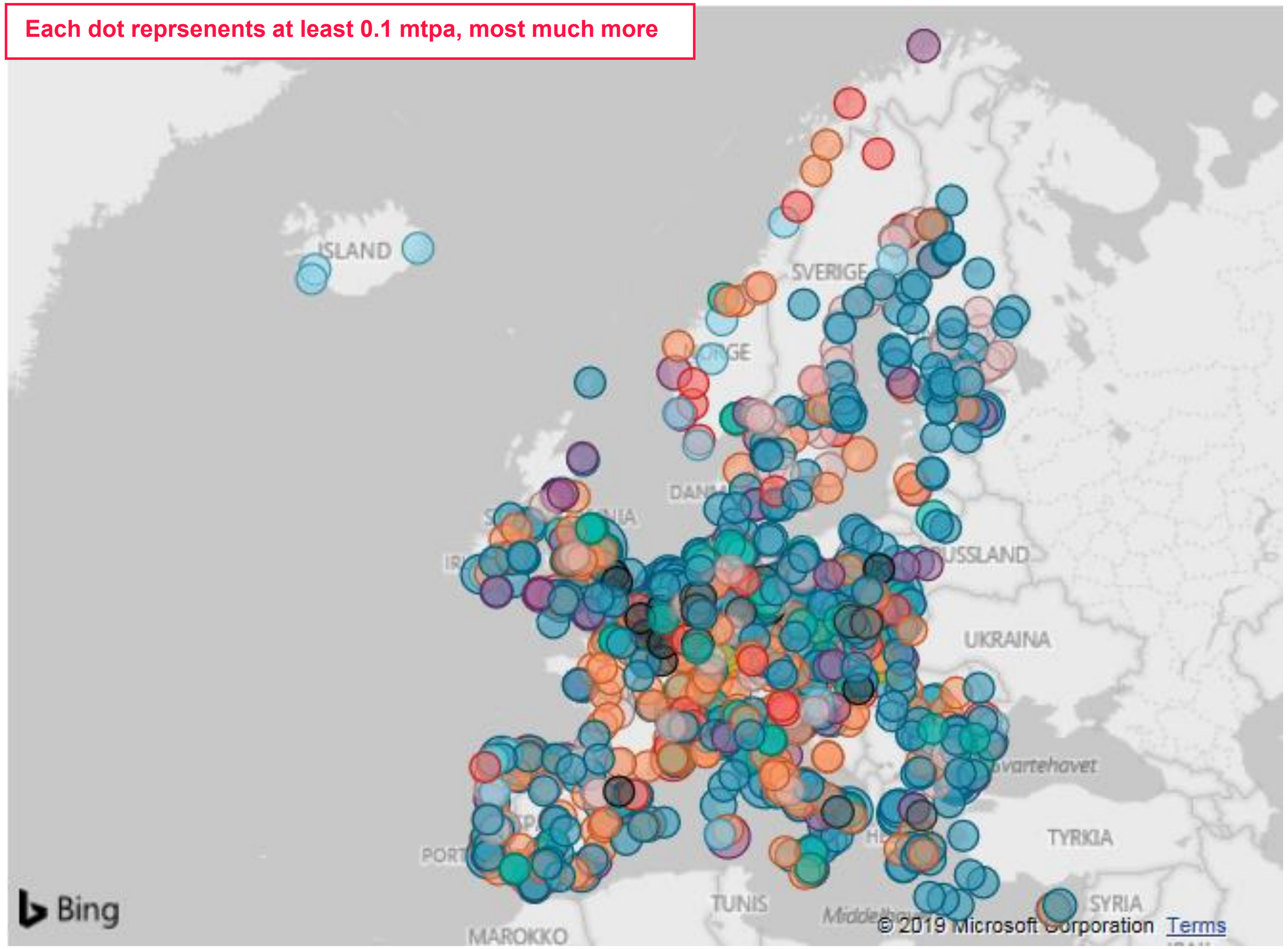


Storage complex
- Saline aquifer (Johansen formation) south of Troll ("Aurora")

Is there a business opportunity?

- There is no lack of CO2 in Europe
- The ship based solution means access for CO_2 emitters across Europe

Each dot reprsenents at least 0.1 mtpa, most much more



endrava CARBON LIMITS

Sectors with the largest potential

- Waste incineration / WtE
- Cement
- Biomass and biofuel
- Refineries
- Steel
- Natural gas
  - Hydrogen
  - Electricity

Is there a business opportunity?

- There is no lack of CO2 in Europe

- The ship based solution means access for CO_2 emitters across Europe

For the entire Europe map:

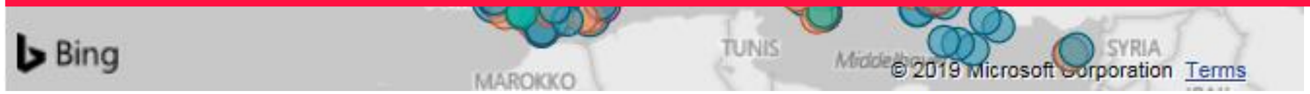
- Waste incineration – 261 facilities, 75 MTPA
- Cement and lime production – 277 facilities, 141 MTPA
- Biomass/fuel (pulp and paper) – 121 facilities, 73 MTPA
- Refineries – 94 facilities, 130 MTPA
- Steel and iron – 70 facilities, 134 MTPA
- Hydrogen – 10 facilities, 3 MTPA
- Natural gas – Very hard to estimate, as this is part of the "Heat and Electricity", which is a combination of several fuel sources (coal, gas etc). Total for Heat and Electricity is: 753 facilities, 962 MTPA

Grand total: Approx. 1 500 MTPA

For Northern Lights CCS (Direct distance to Naturgassparken less than 1500 km, closest port within 25 km):

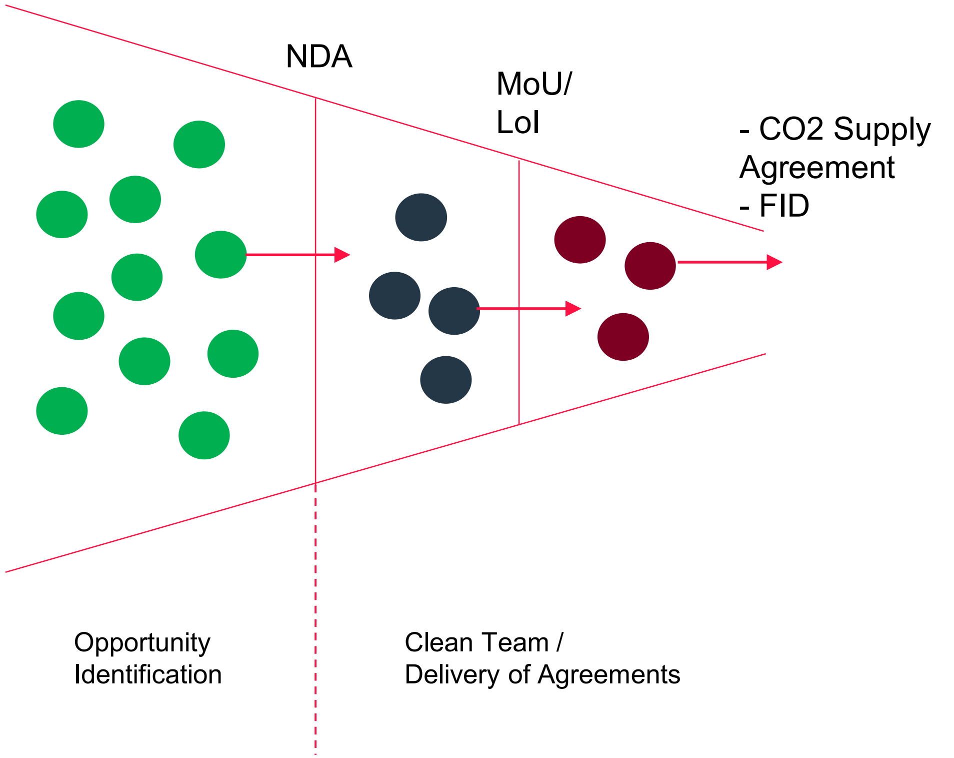
- Waste incineration – 108 facilities, 40 MTPA
- Cement and lime production – 40 facilities, 24 MTPA
- Biomass/fuel (pulp and paper) – 55 facilities, 40 MTPA
- Refineries – 45 facilities, 65 MTPA
- Steel and iron – 30 facilities, 75 MTPA
- Hydrogen – 4 facilities, 2 MTPA
- Natural gas – Very hard to estimate, as this is part of the "Heat and Electricity", which is a combination of several fuel sources (coal, gas etc). Total for Heat and Electricity is: 253 facilities, 335 MTPA

Grand total: Approx. 580 MTPA



How do we organize Business Development?

- **Advocacy**
  - EU
  - National capitals
  - Other important stakeholders
- **Opportunity Identification**
  - Responsibility of everyone, across the project team and in the NL companies
- **Clean Team / Delivery of Agreements**
  - Commercially sensitive information
  - Personal Confidentiality agreements
  - Reports to the Project Director, Mandates from the Project Steering Committee



Commercial maturation process

1) Non-Disclosure Agreement

- To enable sharing of commercially sensitive material

2) Joint Workshops & Discussions on *inter alia*

- Volumes & rates
- Timeline
- CO_2 specification
- Logistics
- Need for subsidies / Availability of external funding
- Credit Risk
- Risks and Opportunities (synergies/econ.s of scale)
- Key challenges
- Tariffs and tariff structure
- *Etc.*

3) MoU / LoI / HoT

4) Detailed Agreement

1) Working cooperatively on all relevant topics together means
2) decreasing uncertainty over time means
3) long-term and sustainable agreements

NDA

MoU / LoI / HoT

- CO_2 Supply Agreement
- FID

Seven MoUs signed
– EU/Norway CCS Summit 5 September 2019

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COMPANIES

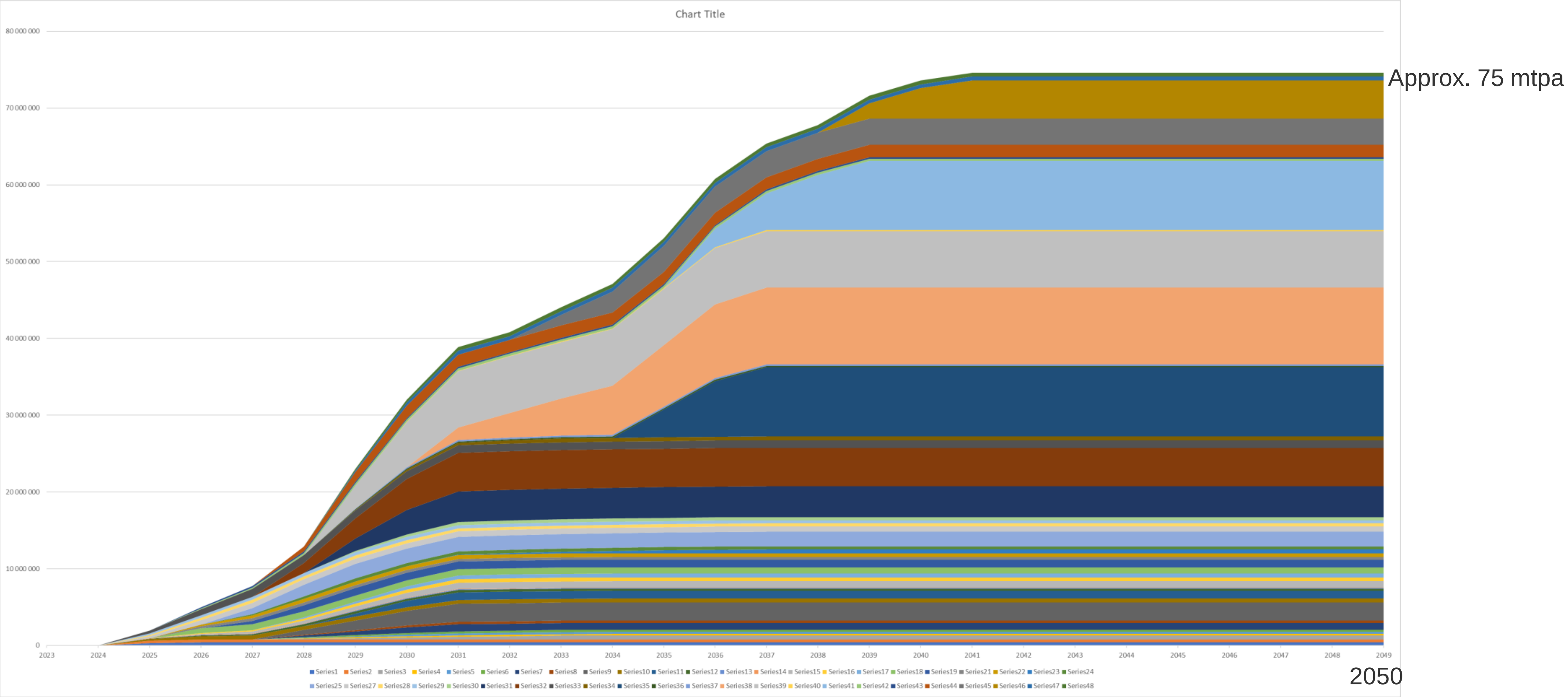
1. Fortum Group; Finland
2. Ervia, Ireland
3. Air Liquide, Belgium/France
4. Stockholm Exergi, Sweden
5. ArcelorMittal, Luxembourg/Belgium
6. Preem, Sweden
7. Heidelberg Group, Germany

TYPICAL CONTENT

- Logistics studies
- CO_2 specifications optimized across value chain
- Roadmap towards potential start of operations, including key activities
- Joint advocacy for CCS and its importance for the successful decarbonization of European industry
- Initiate dialogue with National Government and dialogue with Norwegian government

NW Europe based companies NL CCS have a positive dialogue with, MoU-partners ++

- *This is a dynamic picture, subject to change*
- *Will not be realized, but provides an impression of the scope/size of the prize*



Allocation of Capacity

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Process Alternatives	Pro.s	Con.s
'First come, first serve'		
Parallel negotiations - with all interested parties		
Parallel negotiations - with selected subset		
Auction		

To be populated

- We are in constructive conversations with a handful of companies, aiming to move towards HOT
- Virtually all of those companies will rely on EU and/or national subsidies for capture, liquefaction, transportation to shore, intermediate storage, offloading facilities
- There will have to be some form of process in order to allocate the capacity we have

Creation of a European CCS ecosystem and a virtuous circle

- Northern Lights CCS are being contacted by a number of companies that would like to play a role in the value chain
  - Capture
  - Transportation
  - Storage
  - Non-technical disciplines
- We believe this will stimulate
  - Innovation
  - Cost reductions
  - Jobs creation

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- A ship based solution means access for CO2 emitters across Europe