CO2Europipe Seminar ***Addressing the challenges of a European CO_2 transportation network*** Neth-ER, Aarlenstraat 22, Brussels September 13, 2011		
Times:	**Speakers:**	**Content:**
09:00 – 09:30	*Registration, coffee*	
Opening session (Chair: Filip Neele, TNO)		
09:30 – 09:40	Peter Petrov **Project officer for CO2Europipe** *DG-Research*	Welcome and introduction
9:40 – 10:00	Filip Neele **Project coordinator, CO2Europipe** *TNO, the Netherlands*	CO_2 transport network scenarios to 2050
10:00 – 10:20	Wim Mallon **Senior researcher** *Gasunie, the Netherlands*	Technical challenges
10:20 – 10:50	Tom Mikunda **Senior researcher** *Energy research Centre of the Netherlands*	Policy, regulations, risks
10:50 – 11:30	Stijn Santen **Director** *CO2 Net BV*	Case study results: from detail to high-level analyses
Panel discussion – (Chair: Peter Petrov)		
11:30 – 12:30	Mike Haines (IEA-GHG) Barend van Engelenburg (DCMR, NL) Russel Cooper (CCSA, UK) Wim Guijt (Shell) Thomas Thielemann (RWE, GE)	Panel discussion on the results from the project, their implications and follow-on steps
12:30 – 13:30	*Lunch*	
Close		

CO2Europipe

SEVENTH FRAMEWORK PROGRAMME

CO2Europipe
Project results
Brussels, September 13

Project overview,
CO_2 transport scenarios

CO2Europipe

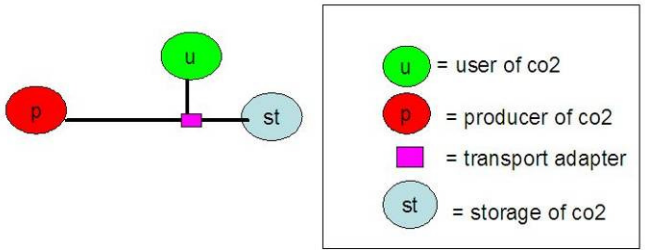
- Aim
  - Define requirements for development of future, large-scale CCS transport network in Europe
    - EU, national initiatives / regulations
    - Timeline for policies / regulatory frameworks to be put in place

- Method
  - Define future large-scale CCS transport requirements
    - CO_2 volumes: what, where, when?
    - Network lay-out ((inter)national, simple or complex)
    - CO_2 management (cross-border issues)
    - Regulations

Future (long-term) CCS infrastructure lay-outs

- Identified future infrastructures from current knowledge of timing of capture and storage
- Study architectures: technical, societal, environmental, etc impacts
  Use current situation as starting point
- Develop business models for different architectures, plus impact of upscaling for large-scale infrastructure
- Derive recommendations

"Local" 1 on 1



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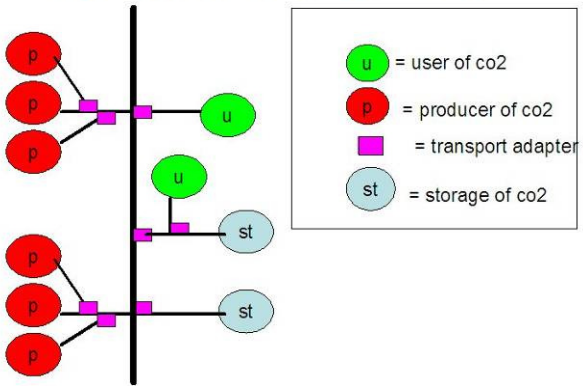
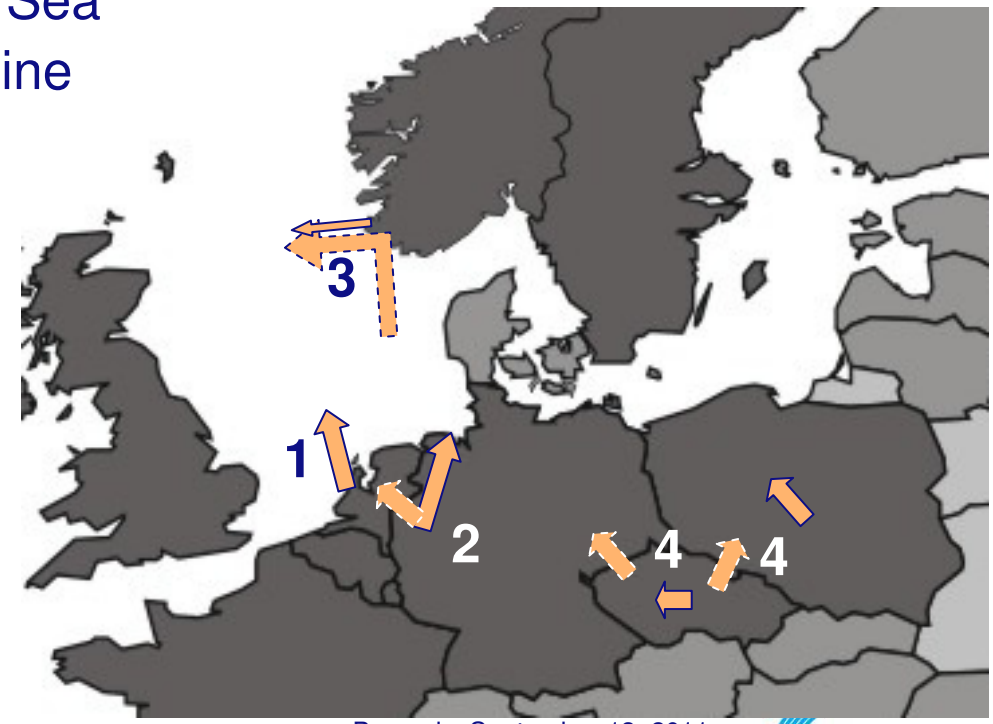
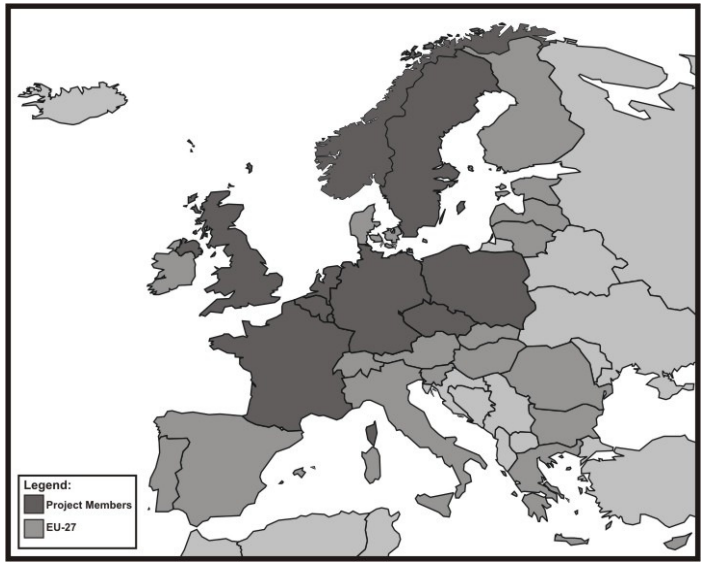


Business cases
Early projects

1. Rotterdam
   - Storage DCS
2. Rhine / Ruhr area, Northern Germany
   - Storage in North Sea, through Emden or Rotterdam
3. Norwegian mainland – North Sea
   - Kårstø offshore CO_2 pipeline
   - EU case
4. Options for CCS in central Europe
   - Poland, Czech Republic
   - National; cross-border



Consortium



CO2-Net

CCS transport and storage
Long-term requirements

Aim:

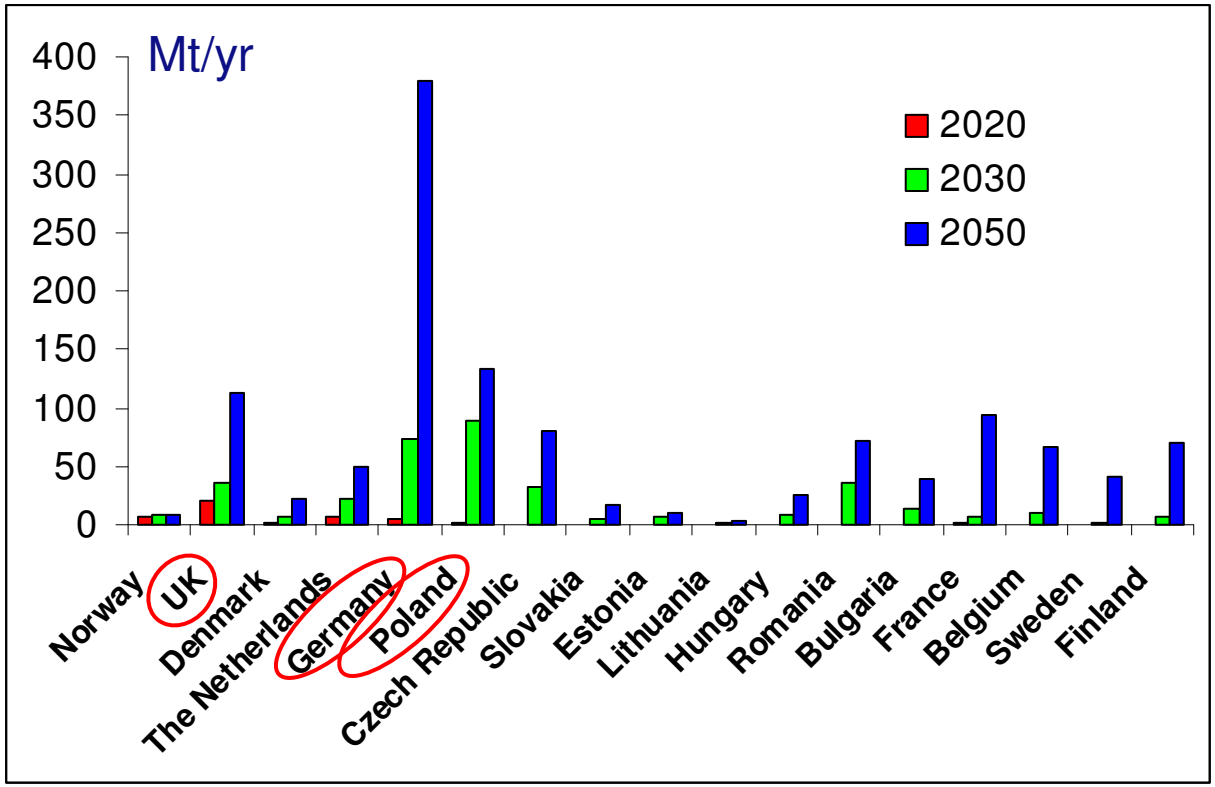
Show requirements for CCS to develop as an emission reduction measure

- NW and Central Europe
- Time line 2020 – 2030 – 2050

Methods:

- Evaluate CO_2 supply and storage
- Match CO_2 captured streams and storage capacity
- Define indicative transport corridors and volumes

CO_2 capture

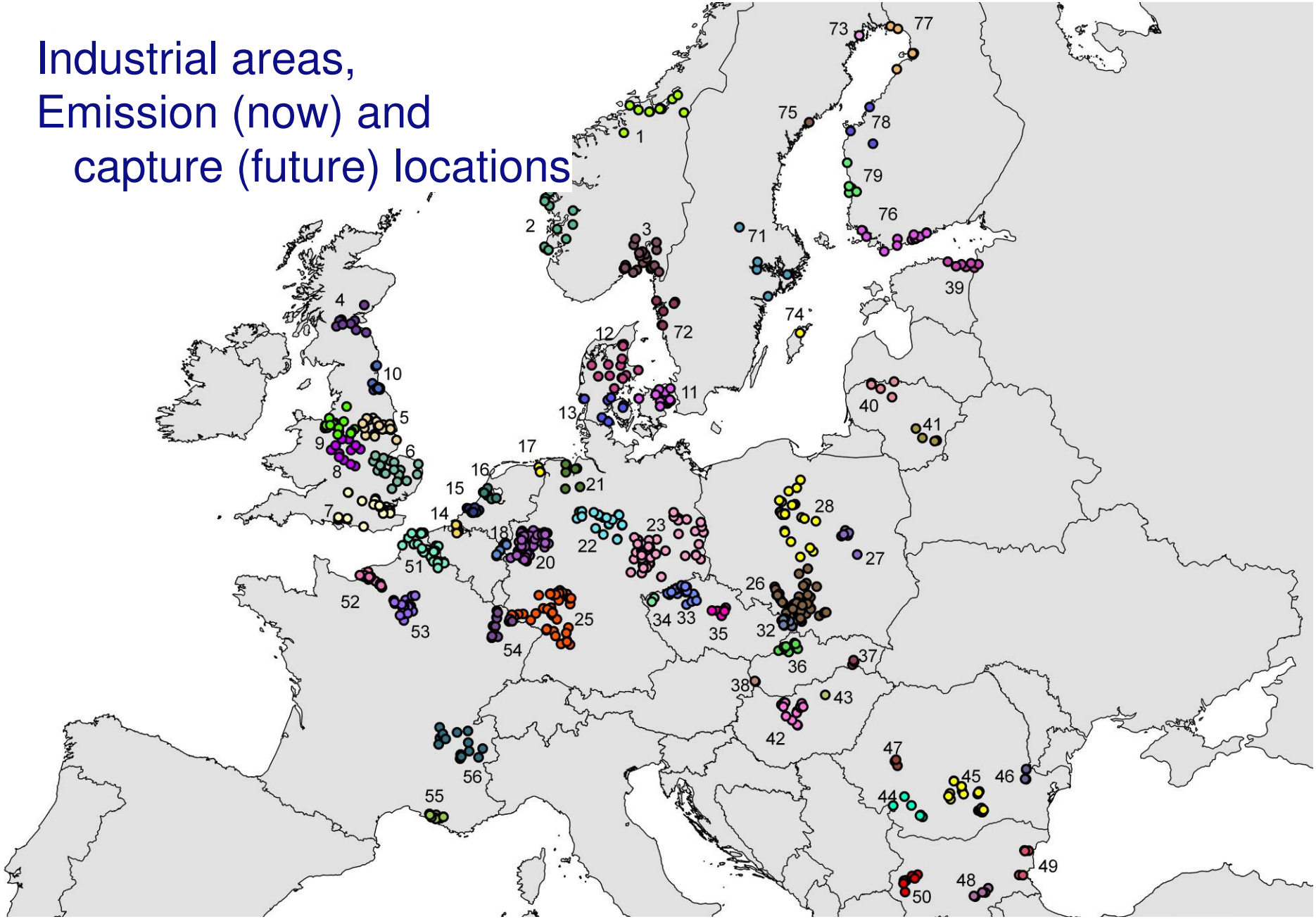


- 2020: demo projects
- 2030 and 2050:
  - Economic growth model (PRIMES)
  - Fuel mix changes

- Emission reduction targets:
  - 50% in 2030 (~ 400 Mt/yr)
  - 80% in 2050 (~1200 Mt/yr)

- CCS: ~1/3 of CO_2 emission reduction

Industrial areas, Emission (now) and capture (future) locations

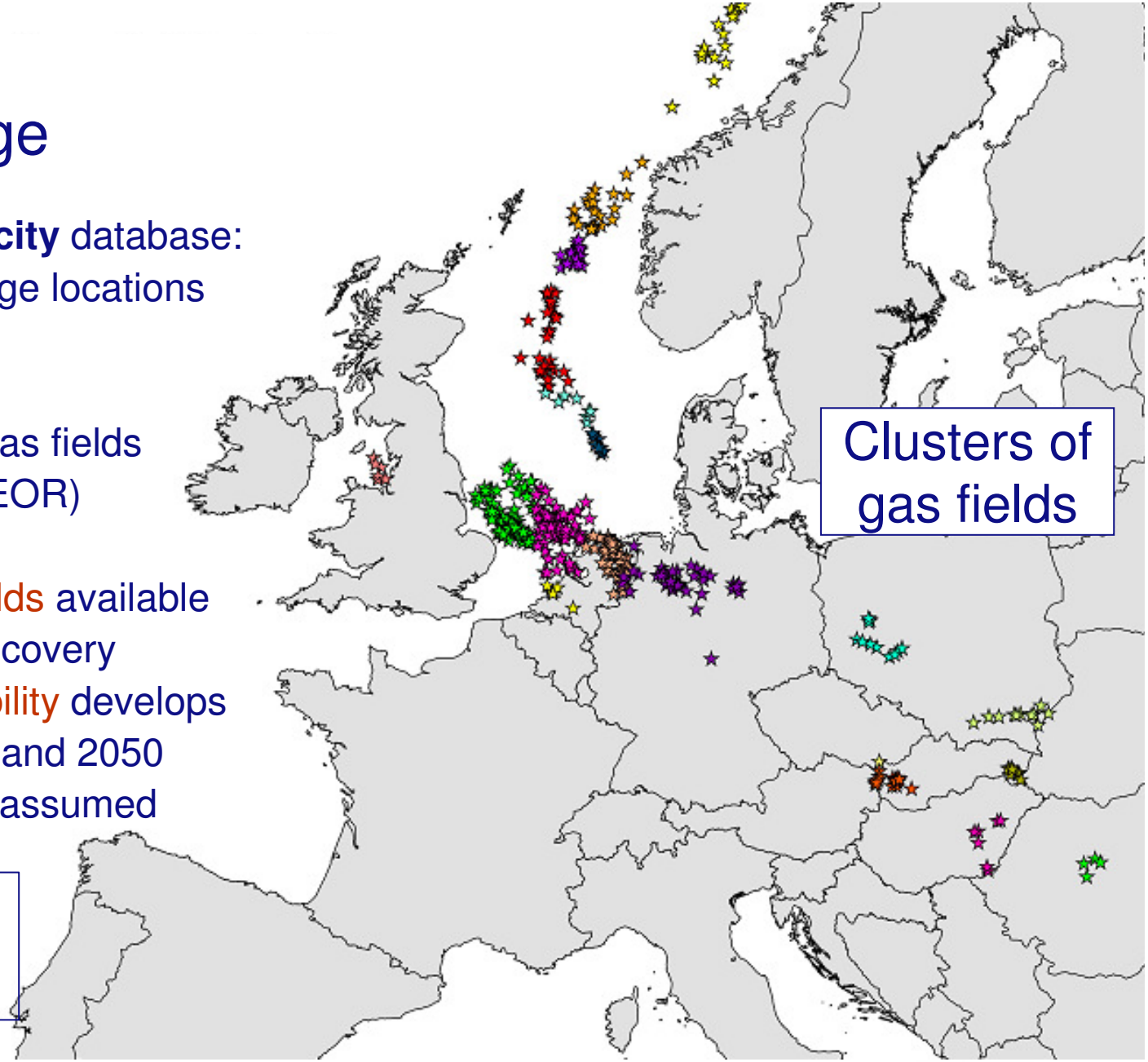


CO_2 storage

- **EU FP6 Geocapacity** database:
  Clusters of storage locations

- **Storage capacity**
  - Depleted gas fields
  - Oil fields (EOR)
  - Aquifers
  - Gas and oil fields available 50 yrs after discovery
  - Aquifer availability develops between 2025 and 2050
  - Injection rates assumed

Gas fields	**20**	**Gt**
Oil fields	**5.6**	**Gt**
Aquifers	**290**	**Gt**



Linking CO_2 capture to storage

Three scenarios

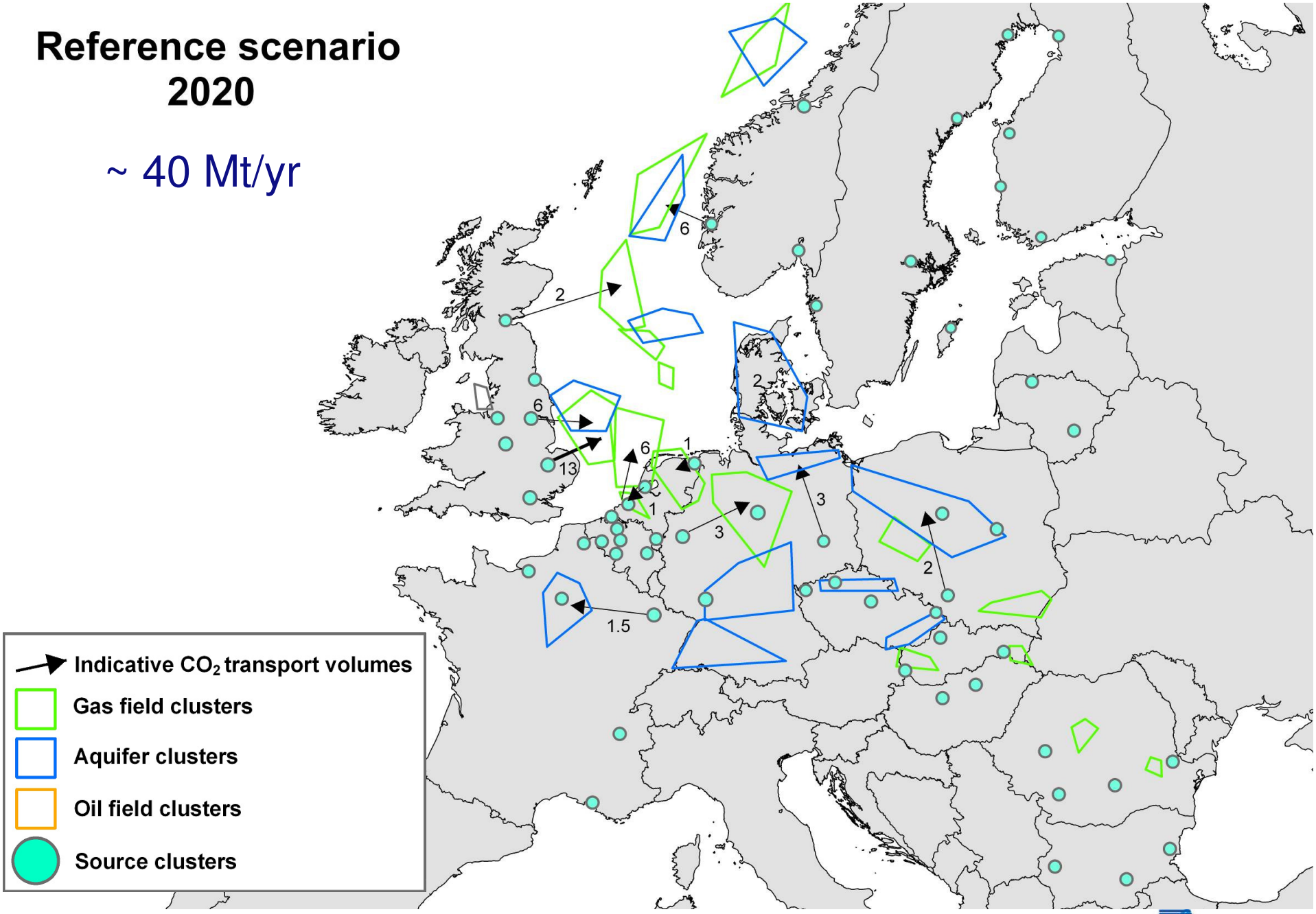
1. **Reference: Onshore + offshore storage**
   - **based on national assumptions**
2. **Offshore only**
3. **Offshore only + EOR**

General assumptions:

- **Cross border transport avoided where possible**
- **Matching at injection rate + storage capacity levels**

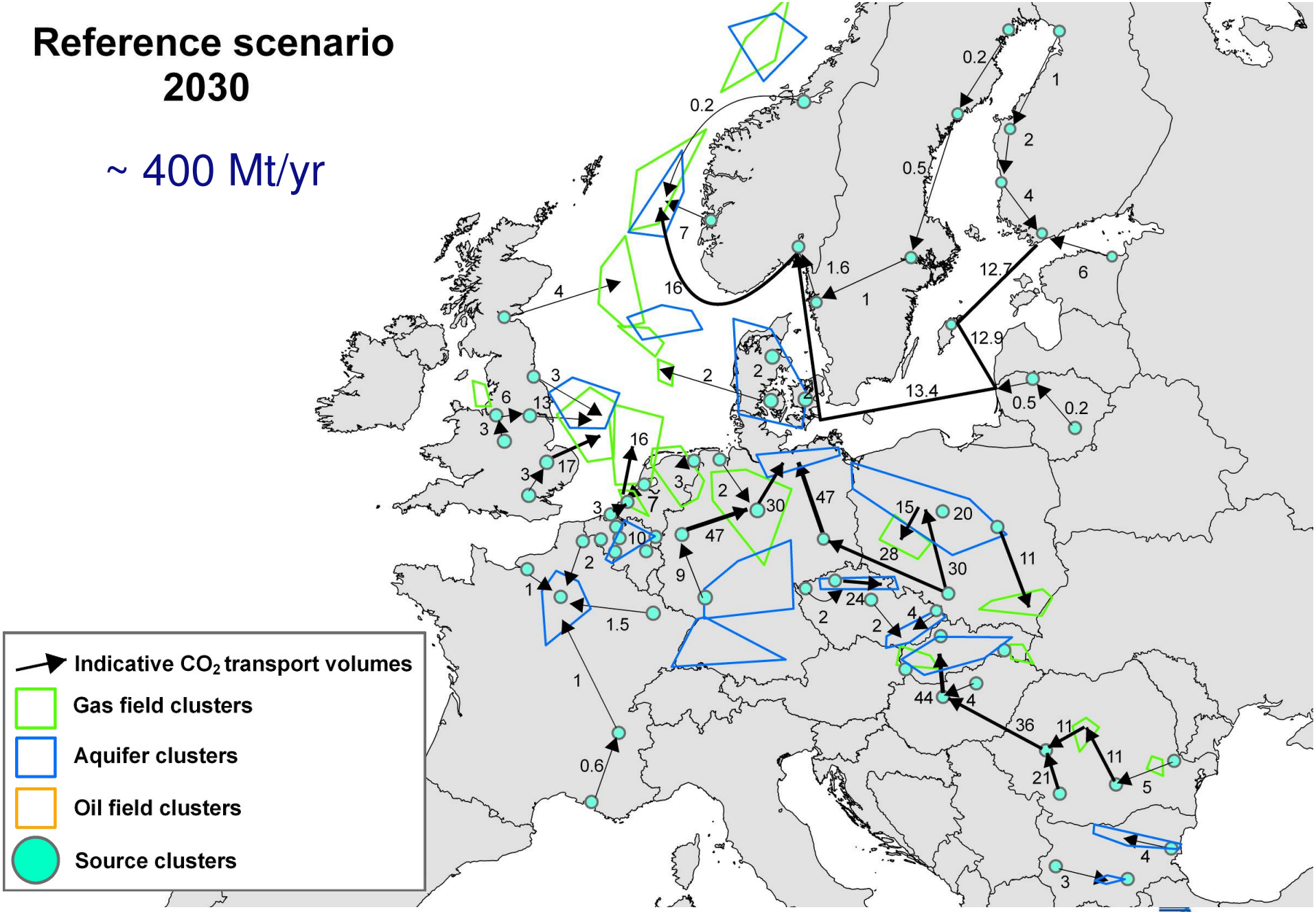
Reference scenario 2020

~ 40 Mt/yr



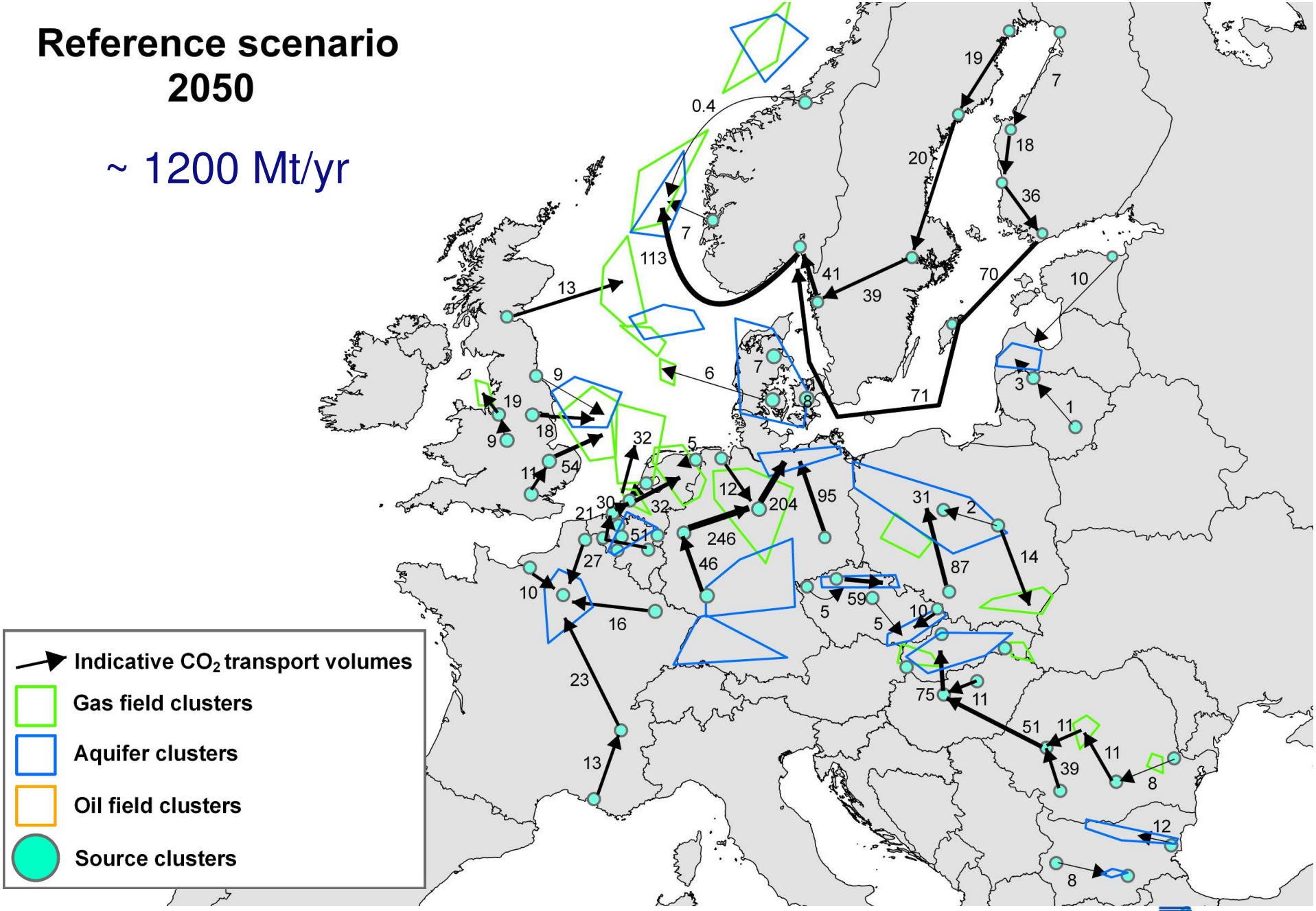
Reference scenario 2030

~ 400 Mt/yr



Reference scenario 2050

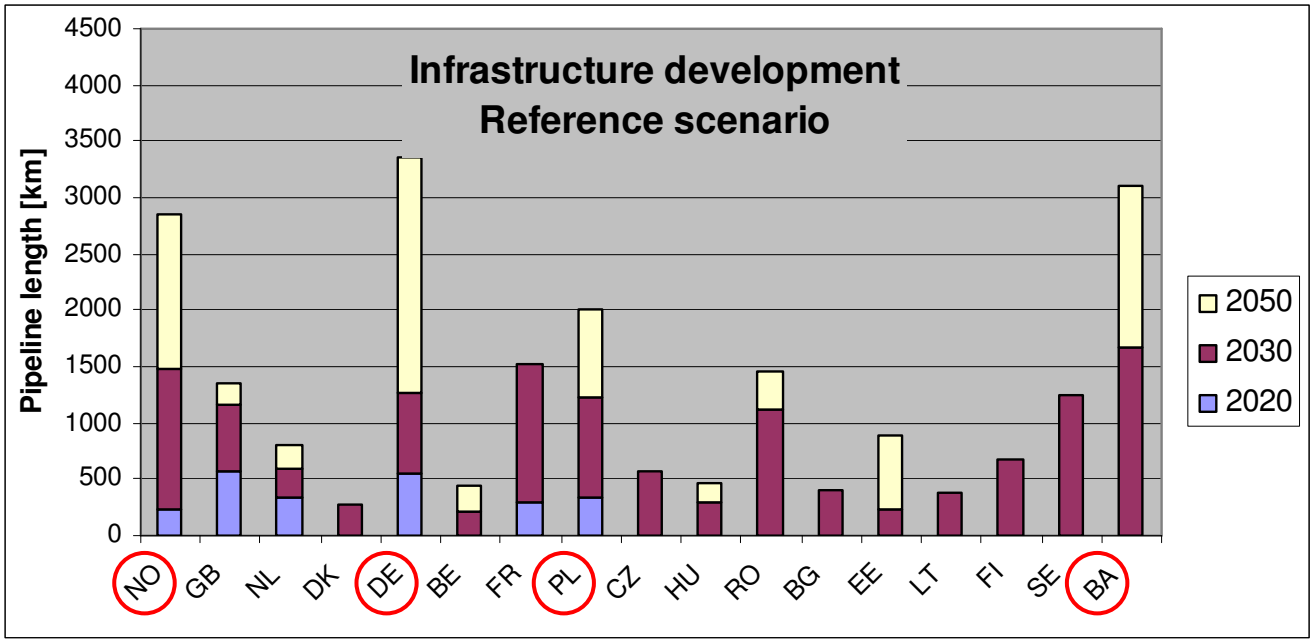
~ 1200 Mt/yr



Infrastructure development

Backbone (km)	Reference scenario	Offshore-only scenario	EOR scenario
2020	2.300	4.200	5.300
2030	14.300	20.900	20.900
2050	21.800	32.000	33.200

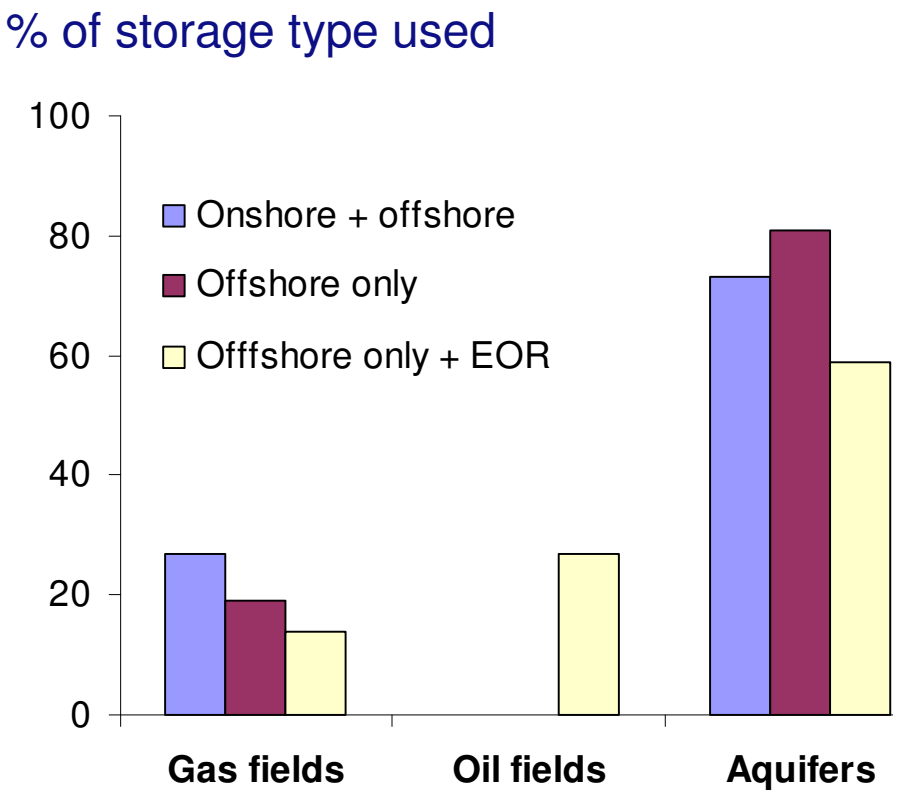
Comparison: EU oil products network ~ 35.000 km

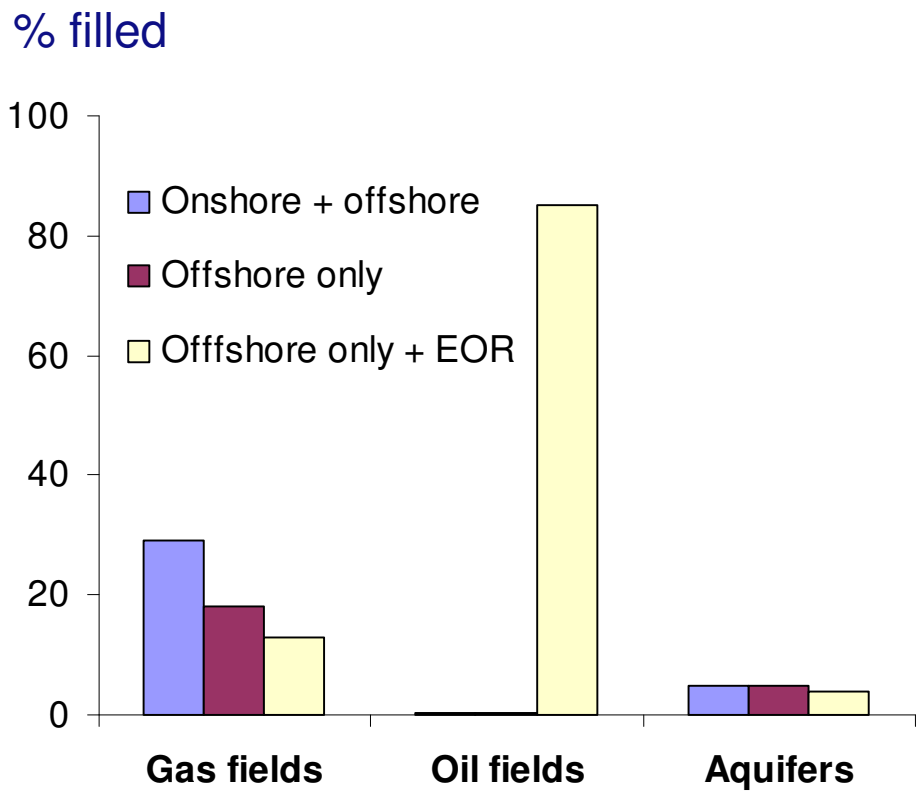


Construction ~ 50-100 km/month, continuously for 30 years

Cost: 50 – 80 billion € until 2050

Storage requirements up to 2050





Transport across borders

	Reference Scenario (Mt/yr)	% of total	Offshore-only scenario (Mt/yr)	% of total	EOR Scenario (Mt/yr)	% of total	Total (Mt/yr)
2020	-	-	3	7	9	19	40
2030	89	25	249	70	254	71	400
2050	215	18	861	70	857	70	1200

- Large % transported to other countries

→Requires coordination at EU level

Conclusions from infrastructure maps

- **Uneven distribution** of capture, transport and storage capacity

- **Key players**
  - Capture: Germany, Poland, UK
  - Transport: Germany, Poland, Norway, Baltic region
  - Storage: Germany, Poland, UK, Norway
  - Cross-border transport: North Sea region, Baltic region

- **Infrastructure types**
  - One-on-one 'networks' in early phase
  - Complex, multi-user networks throughout most of Europe from about 2030
    - Transition from simple to complex networks: 2020 - 2030
    - Mixing CO_2 flows: common design basis, quality requirements
    - Cross-border issues (liability in transport and storage)

Barriers

- **Uncertainty in storage**: where will pipelines go?
  - Member States to qualify / prove storage capacity
  - > 10 years ahead:
    - Provide certainty on location of certified storage capacity
    - Provide certainty on location infrastructure
    - Provide option to future-proof transport network
- **Transition** from one-on-one to multi-user networks
- **Key players**
  - Uneven distribution of capture, transport, storage
  - Momentum must be maintained
- **Onshore storage**
  - Results in significantly lower transport requirements

Conclusions

- Possibility to **future-proof** infrastructure
  - Optimise development using long-term strategy and goals
  - Minimise cost of construction (coordinated planning)
- **Current demonstration projects**
  - Close gaps in knowledge, regulation
- Transport technology **available today**
- **CO_2-EOR** as driver for CCS
  - Briefly explored in CO_2Europipe