

CO2Europipe
Project results
Brussels, September 13

Technical challenges



CO₂ transport experience

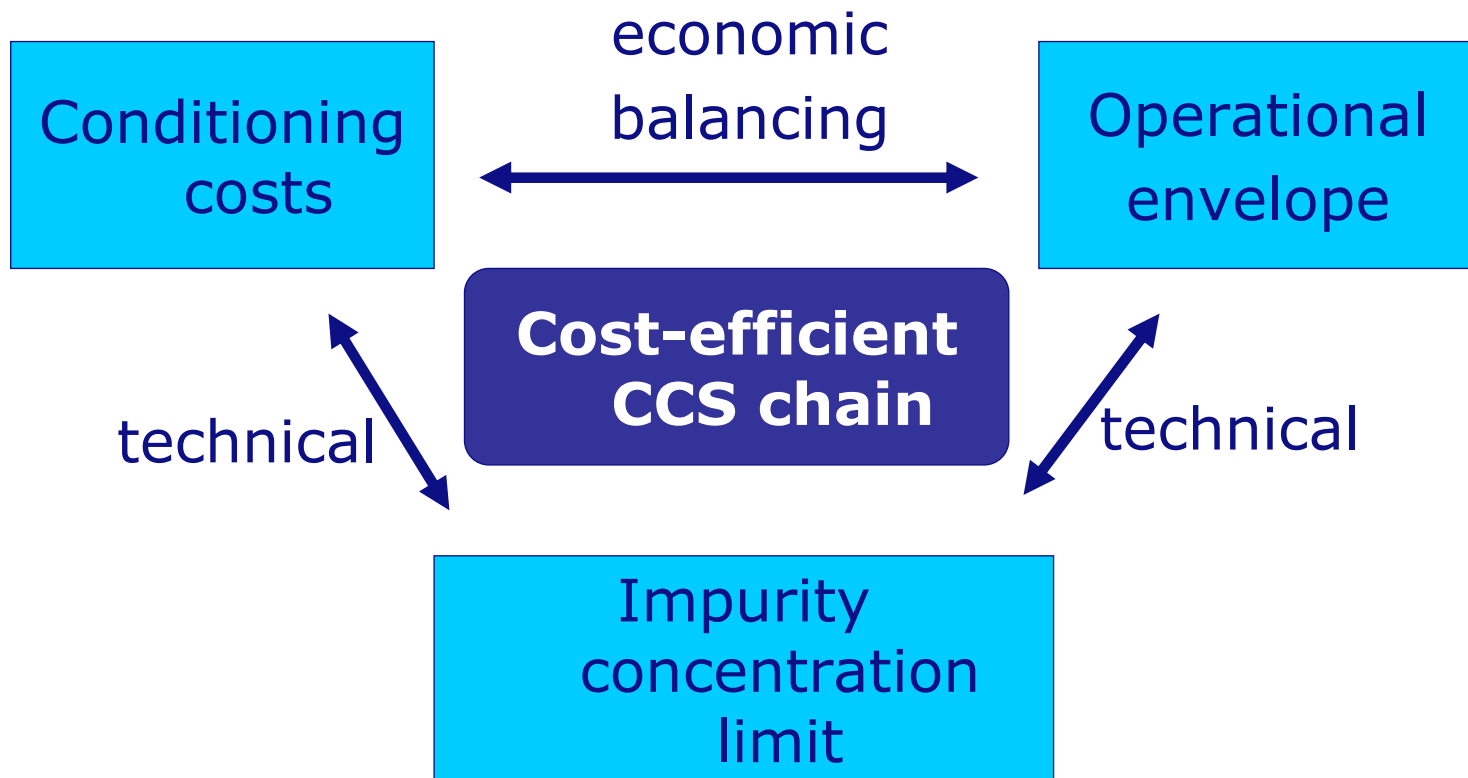
- Experience in CO₂ transport:
 - In the United States, > 6000 km of pipelines transporting 40 Mt/yr CO₂ for enhanced oil recovery
 - Onshore CO₂ transport for more than 30 years
 - Offshore CO₂ transport since 2007
(Snøhvit Snøhvit CO₂ removal in LNG plant, Norway)
 - Extensive pipeline network required for transportation of captured CO₂, but manageable

CO₂ composition

- Important: water concentration limit to prevent corrosion
 - Pipeline integrity issues (corrosion)
 - Cost (stainless steel not an option)
- Understand impact of impurities, but maintain flexible specification:
 - Thermodynamics (increase in compression requirements, impact on fracture toughness)
 - External safety (HSE exposure for some contaminants, e.g. H₂S)
 - Cost for additional treatment of CO₂ stream are significant
 - Minimize effect on storage injectivity
- (Cross) effects of impurities to be studied

Impurity concentrations

→ Technical **and** economic considerations



CO₂ release from pipeline

- Models for CO₂ releases require refinement
 - Validation of existing models required
 - Experiments ongoing, more are being planned
- Validated CO₂ release models **essential** for planning of major CO₂ transmission network, as required for CCS in Europe!

Other issues

- Leak detection
 - Sensitivity of leak detection should be increased (challenging)
- Many elastomers and other soft materials deteriorate in contact with high-pressure CO₂
 - Standards for CO₂-resistant materials should be developed
- Excessive noise generation during blow-down requires mitigation
 - Extensive safety zone, slow blow-down or silencer
- Offshore transmission lines do not have block valves , therefore the Blow down of an offshore pipeline could take weeks
- Mechanisms and risk related to propagating fractures need to be better understood
- Internal pipeline inspection tool to be confirmed suitable for long-distance CO₂ pipelines

Reuse of existing infrastructure?

- In principle, reuse of existing pipelines and installations is possible, but:
 - Most (natural gas) pipelines will remain in use and unavailable for CO₂ transport for decades to come
 - Onshore pipelines (and some offshore pipelines) not designed for pressure regime used in large-scale CO₂ transport
- Conclusion: in general, new pipelines have to be built

Shipping

- CO₂ shipping is an existing business
- Transported volumes are typically small
 - Example: 3 Mton/yr for 200 km transport distance, cost of shipping is equal to pipeline transport.
- Injection of CO₂ from a vessel into the reservoir: promising option, robust solutions to be developed
- Reuse of (LPG or ethylene) tankers for shipping CO₂ possible
 - Number of suitable CO₂ vessels (\pm 30 tankers currently) insufficient
- Dedicated CO₂ vessels will have to be built

Conclusion

- CO₂ transport technically feasible
- Reuse of existing pipelines or ships probably limited
- Research needed on specific topics (especially CO₂ release), but no real barriers to large-scale CO₂ transport
- Demo projects and R&D will help solve remaining operational issues:
 - Safety zones for CO₂ transport operations
 - Injection from ships into reservoir
 - Injection in depleted gas fields
 - Management of multi-user networks
 - Mixing rules and quality guidelines (new FP7 project planned)