Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

Transport: CO_2 conditions during transport

Risks of transport by trains, ships, and pipelines

Stephan Kurth

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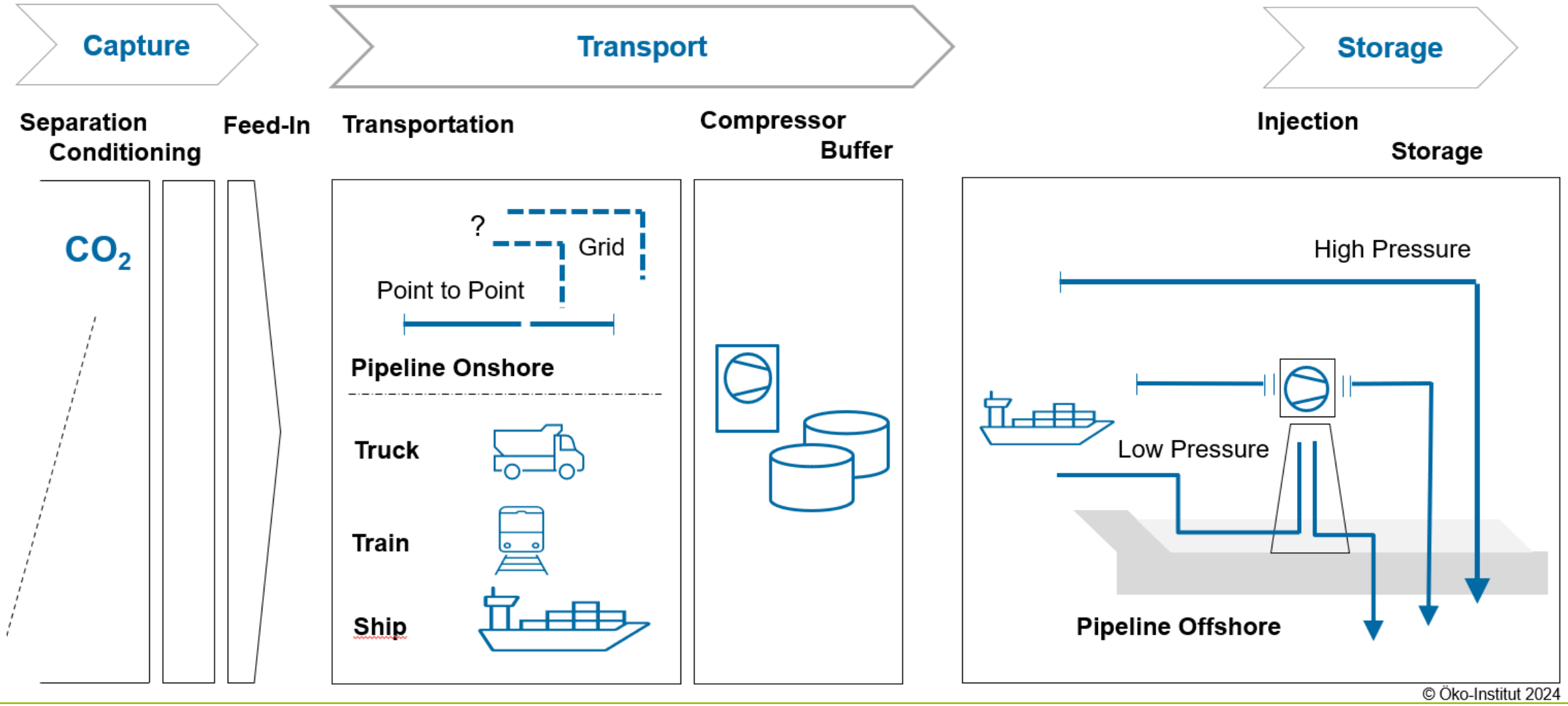
CO_2 Transport System Configuration

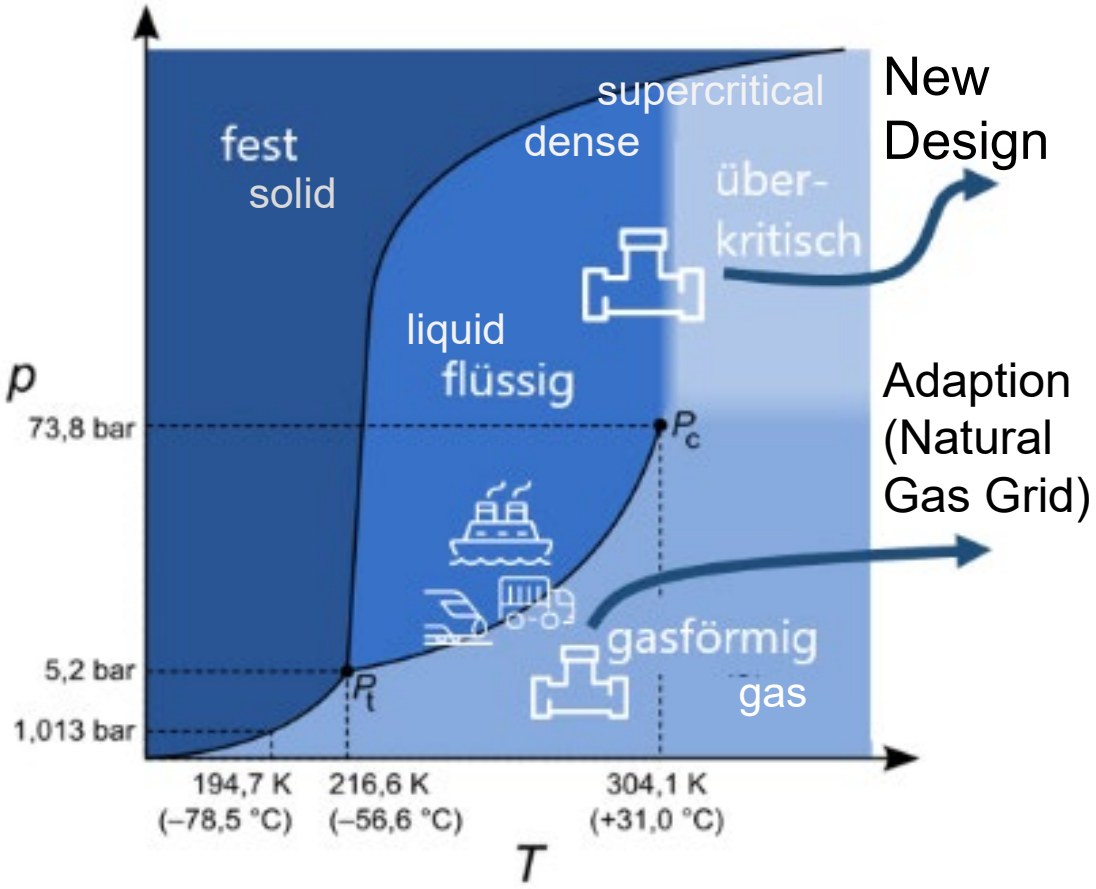


Considerations

Priority: safe and efficient transport, continous and under constant conditions

- Transport Route
  - Distance
  - Site
  - Transportation Infrastructure
- CO_2 Stream
  - Quantity and Quality (Impurities)
  - Conditions, Mode
- Technical Reliability, Design Features
- Legal Requirements
- Risks, Uncertainties
- Costs

Transport Modes and Capacities



Pressure at seabed well head: 10,5 MPaG

Transport	Mode	Conditions		Capacity
Roadway	liquid	1,7 – 2 MPa 243 – 253 K		18 t (car)
Railway	liquid	0,65 – 2,6 MPa 223 – 253 K		62 t (car)
Marine Ships	liquid	0,65 – 4,5 MPa 221 – 283 K		20 (40) Mt (ship)
Pipeline	vapor / dense	4,8 – 20 MPa 283 – 307 K		

Characteristics of Transportation Systems

Technical Risks

Challenges

- development of a new and significantly enhanced CO_2 transport infrastructure
- change of CO_2 transport mode and conditions (transport in subcritical/dense phase)
- conversion of existing infrastructure (natural gas) for the transport of CO_2 (as possible)
- adverse effects of impurities in the CO_2 stream
- implementation of adapted design specifications and standards

Risks and Fault Mechanisms → Cracks, Rupture → Leakage, Sudden Release

- corrosion, degradation, chemical reaction
- technical failures followed by loss of function, system breakdown, energy constraints
- human failures
- external hazards

Significance of Impurities

Impurities in the CO_2 stream can influence ...

- transport conditions
- transport grid
- corrosion mechanisms
- material properties
- explosion / fire risks
- hazards to human health and the environment
- controle, surveillance

Table 2
Impurity Tolerance and Effects in post-combustion CO_2 Capture Processes (Razak et al., 2023).

Component	Maximum allowable concentration (Mol %)	Effects
H2S	3.25	Decreased solvent efficiency, promoted corrosion, catalyst poisoning
SO2	2.5	Increased corrosion, adverse environmental effects
O2	1.75	Solvent degradation, diminished CO_2 capture efficiency
H2	1.65	Heightened flammability, potential explosion risk
CO	0.2	Solvent regeneration processes disruption

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Thank you for your attention!

Questions