Technical Concepts and Costs of CCS (in the German North Sea)

Dr. Sven Hoog, Fichtner GmbH & Co. KG

Erste Beiratssitzung

GEOSTOR

Status of current activities at Fichtner

GEOSTOR

GEOMAR

BGR Bundesanstalt für Geowissenschaften und Rohstoffe

CAU Kiel University Christian-Albrechts-Universität zu Kiel

Deutsches Meeresmuseum Stralsund

UHH Universität Hamburg DER FORSCHUNG | DER LEHRE | DER BILDUNG

KUM

FICHTNER

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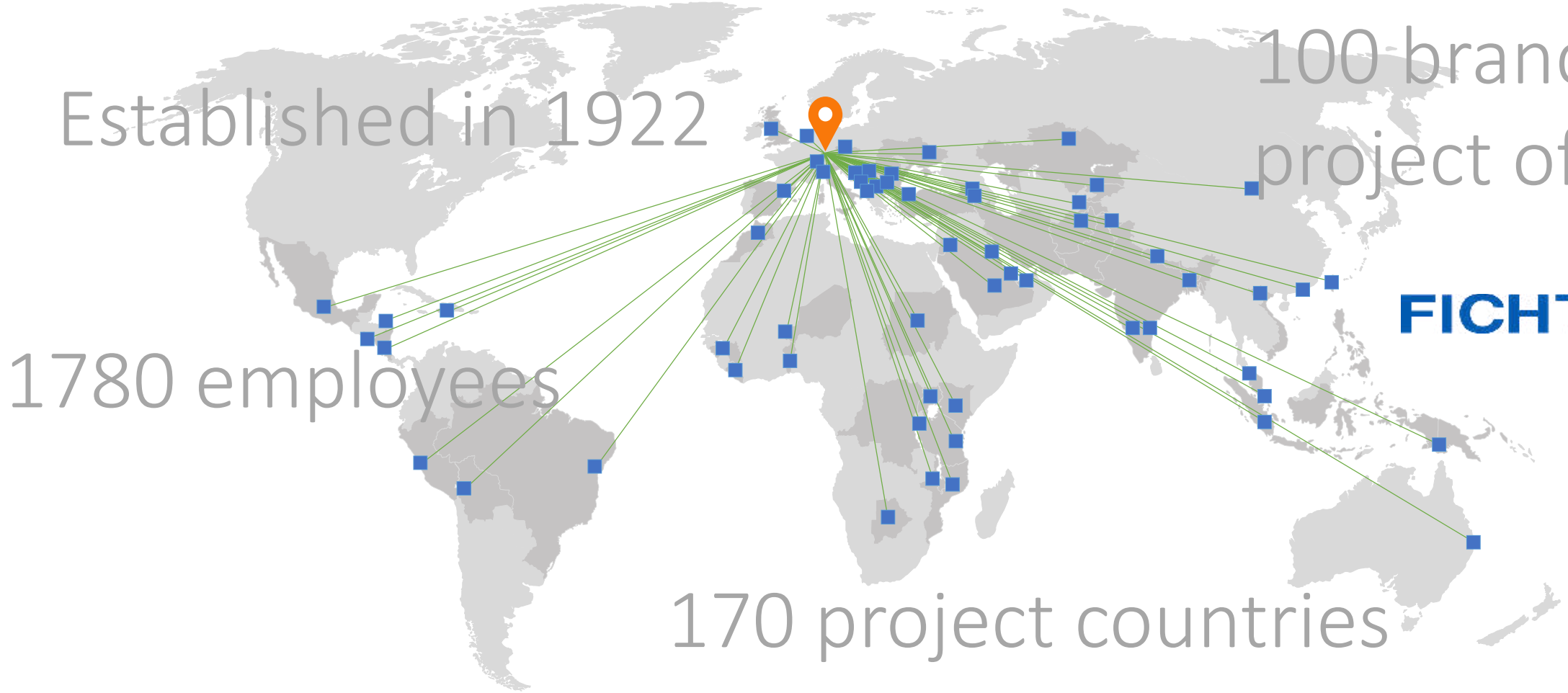
Fichtner – an Engineering Consultant with Global Reach



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Please visit https://www.fichtner.de/en/ for Details

GEOSTOR – in what is FIS involved in?

Logistics Chain Basics and Constraints

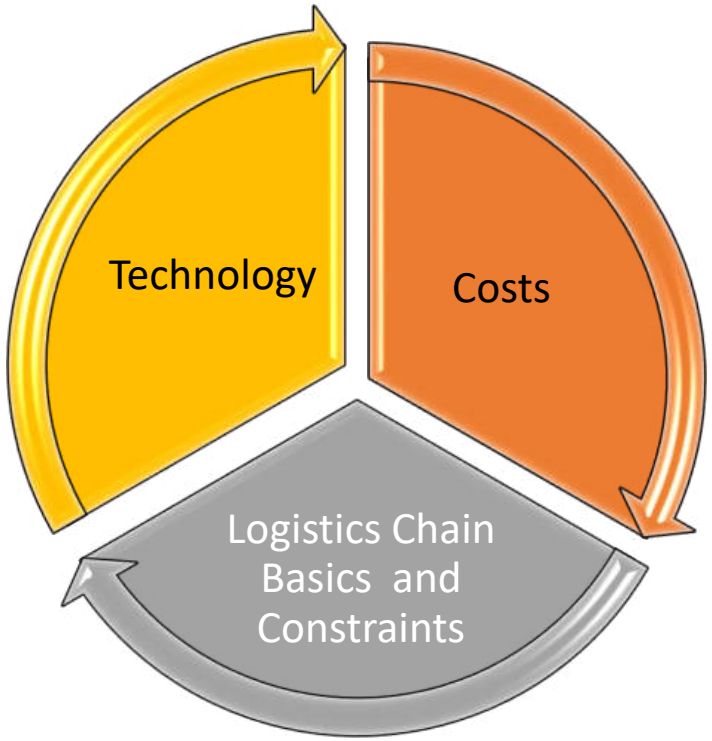
- Review of literature
- Market analysis, participation at events on CCS / CCU
- Determination / compilation of design fundamentals in coordination with GEOSTOR partners

Technology

- Determination of feasible technical options for transport and storage of CO_2 on an industrial scale to selected sites A1 and B1
- Use of the method "morphological matrix“ to combine feasible modules of a logistics chain

Costs

- Determination of costs per ton of CO_2 stored for the relevant solution options



Goal – to prevent CO_2 from entering the Atmosphere

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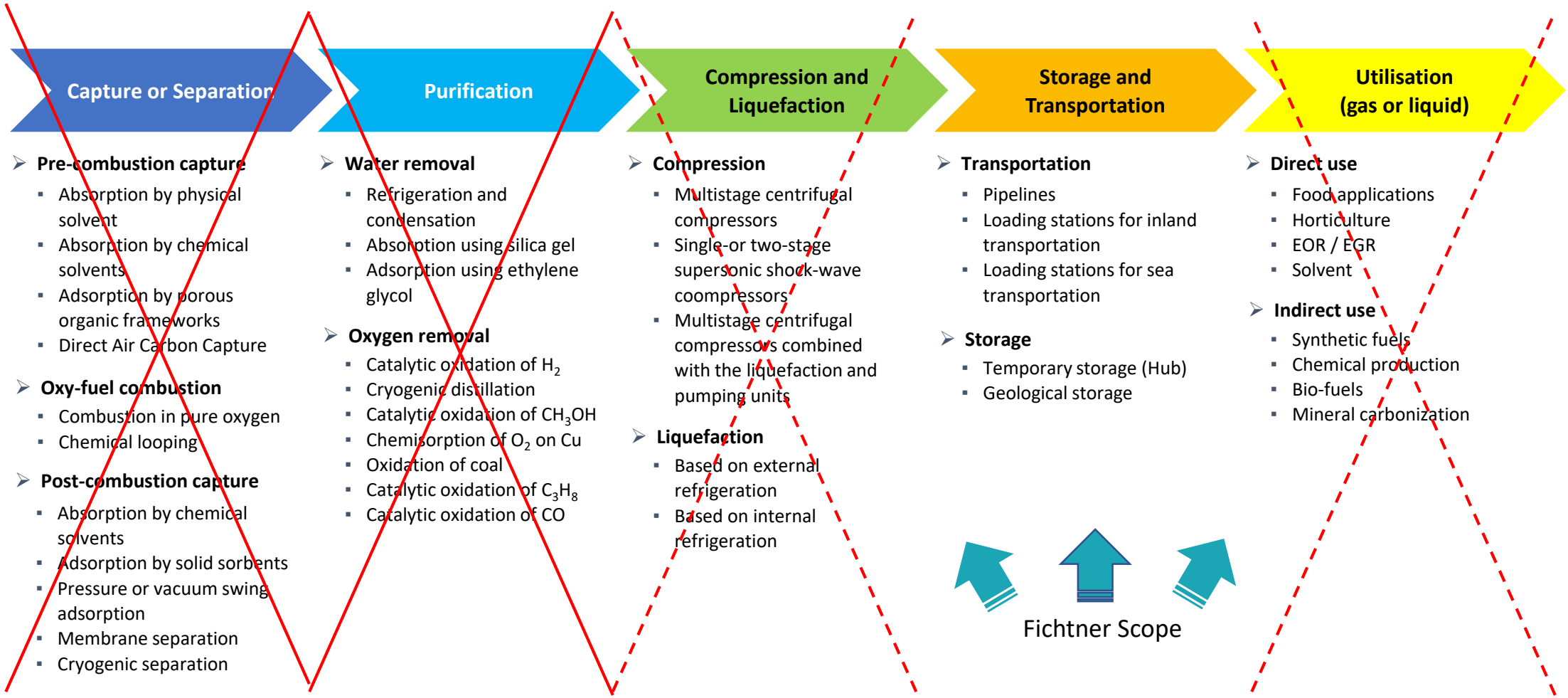
CO_2 Treatment Steps / Value Chain (Source: KNCC, KNCC (kn-cc.com))

CO_2 – from Source to Storage / Utilisation

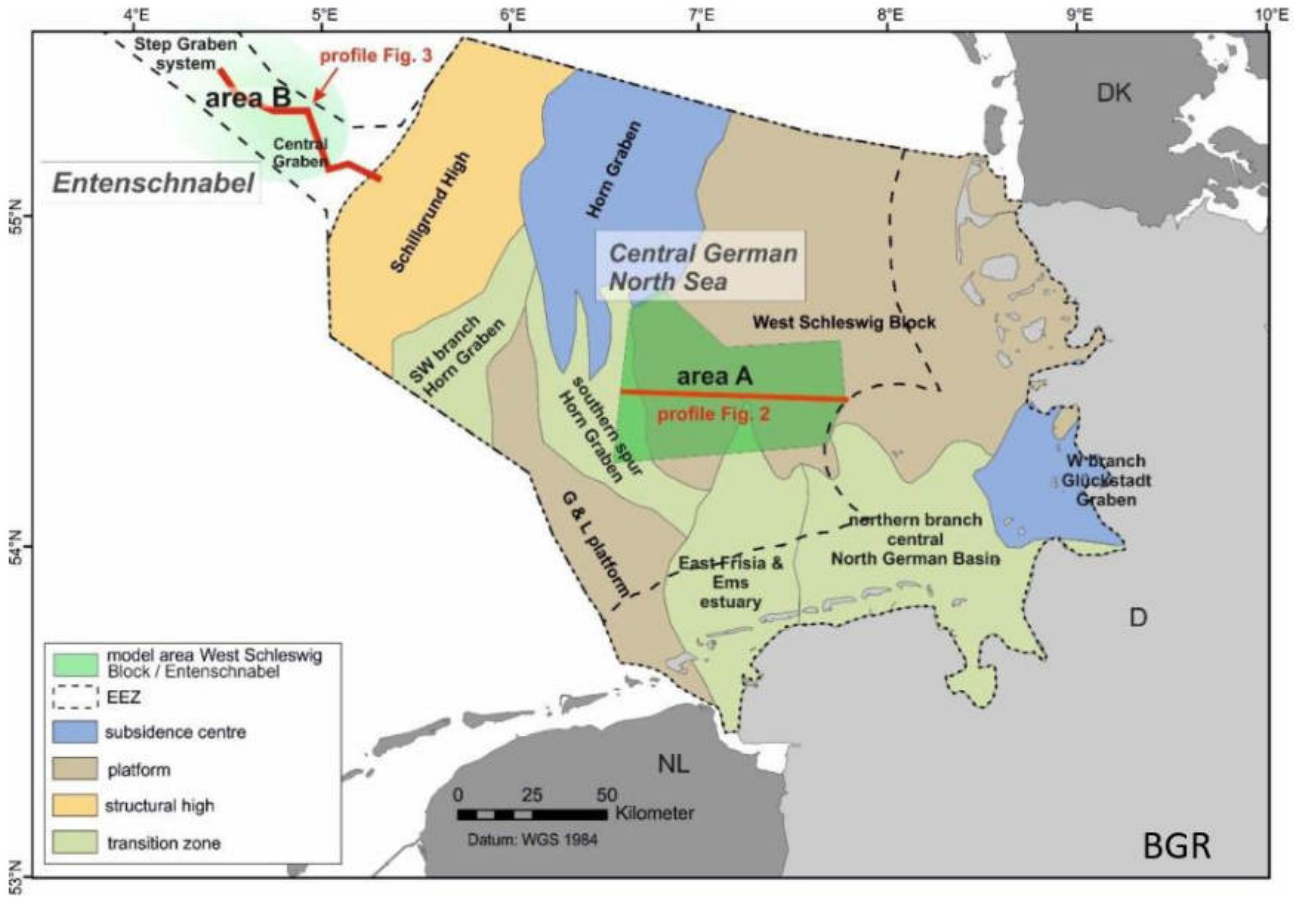


CO_2 Treatment Steps / Value Chain (Source: Bilfinger (adapted))

GEOSTOR – finding a feasible Solution to store CO_2 effectively in the German North Sea

Governing aspects for designing CCS Logistics Chains:

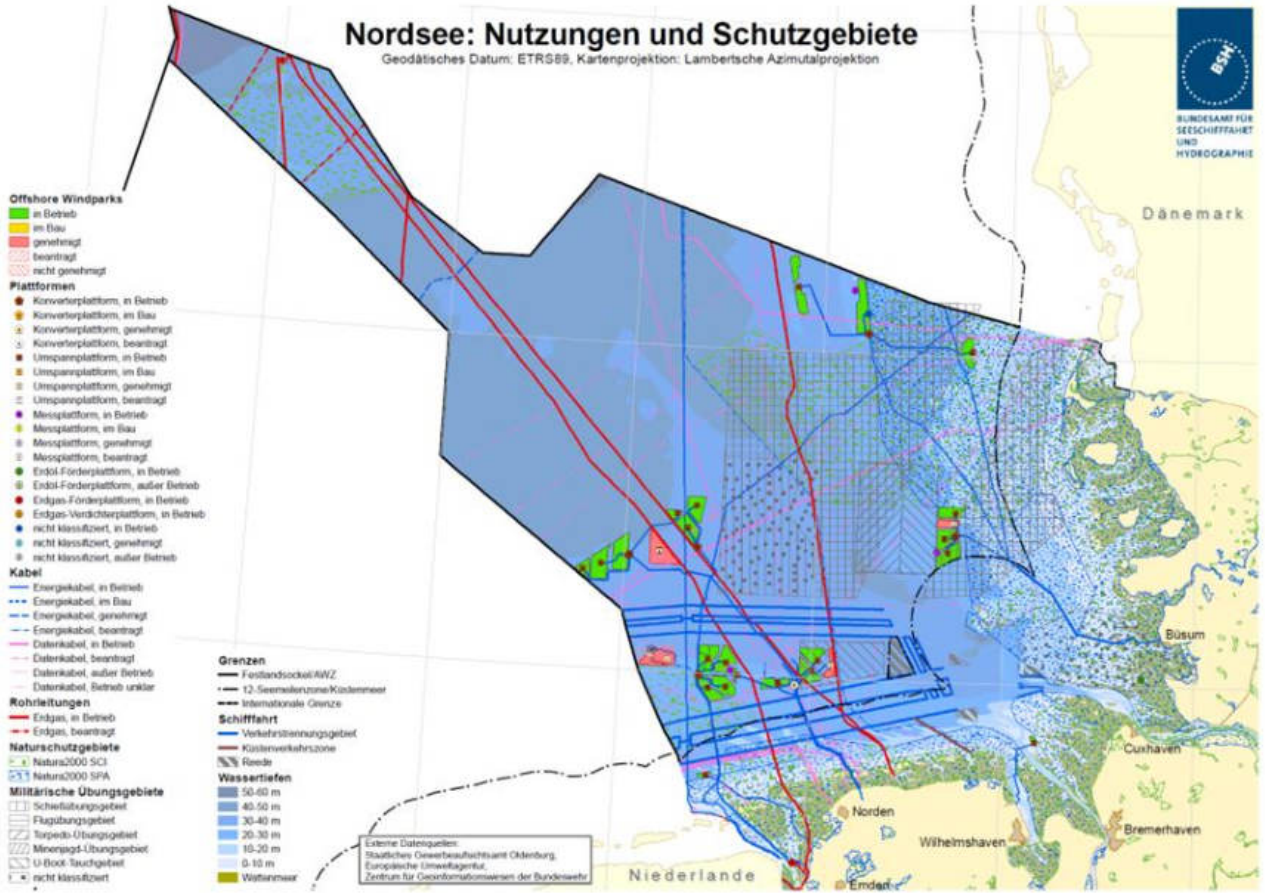
- Storage Site location(s) - Hub location
- Storage capacity / storage volume per year
- Distances (Sources->Hub, Hub->Offshore Site)
- Transport means (low/no GHG emissions?!)
- Metocean data (water depth at site, bathymetry, wind, waves, current, soil condition)
- Sources of CO_2 (physical, chemical, process implications)
- Materials / components selection and availability
- Legal aspects, Contracts, HSE
- Costs (UXO, drilling, transportation, platforms, processing, temp. storage, main components, monitoring)
- Risks for all links of the Logistics Chain
- Note: CCU is also gaining Momentum (syn. Methanol, Diesel, Kerosene, LPG, LNG)



German Offshore CCS Sites under investigation in GEOSTOR

Obstacles – Current/planned utilisation of German EEZ

- Current utilization of the German EEZ is significant
- Active and planned installations, activities and protected zones (marine spatial planning) occupy large areas – from sea surface to seafloor (and underground?!)
- It must be expected that installations for CO_2 Storage require extensive authority engineering and time for approval



Current maritime spatial planning for the German North Sea (BSH)

CO_2 Sources – Investigations for Norway and Scotland

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CO_2 Sources considered for Norway, (NORDICCS, Sintef)

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CO_2 Sources considered for Scotland, (www.sccs.org.uk)

CO_2 Sources – Investigations for EU and Germany

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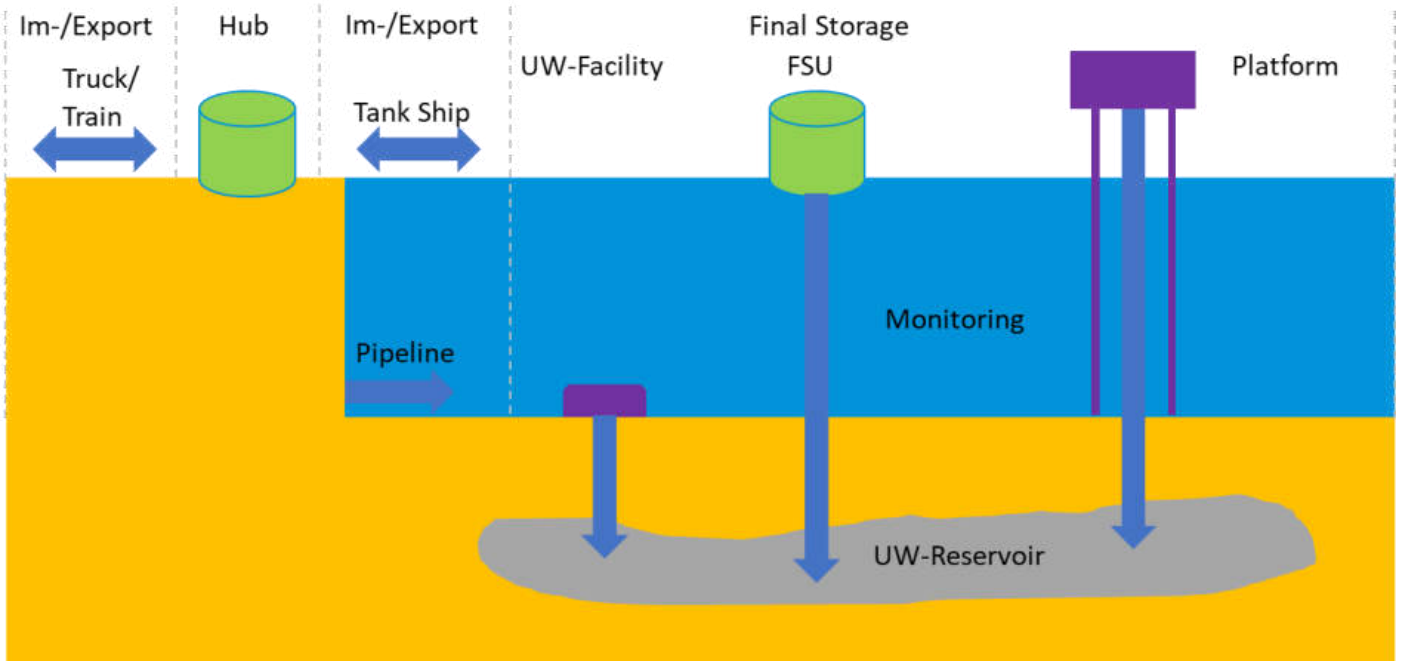
Approch – divide the Challenge into Modules

Options

- CCS - CO_2 is permanently stored underground GEOSTOR: Utilisation of the German North Sea EEZ: up to 90% relevance
- CCU - CO_2 used as feedstock (e.g. syn. fuels, food ind., EOR/EGR/ECBM*, chem. ind.) : 5-10% relevance

Impact on the Logistics Chain Design

- Creation of a hub for intermediate storage of LCO_2
- Delivery (import) of LCO_2 in different ways from different sources
- Export of LCO_2 either for multiple billable CCU(S) purposes or to a billable underground storage



Modular approach for the logistics chain

*Enhanced Coal Bed Methane Recovery

Modules – Assessment of technical Building Blocks

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Transportation, temp. Storage

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Hub and Ship

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Processing

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Installation

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Pipeline

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Subsea Manifold

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Subsea XTree

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FSU, subsea Riser and Pipelines

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Fixed Platform

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Monitoring, Survey, Maintenance and Decommissioning

Logistics Chain – Morphologic Matrix

- The different Logistics Chain Links will be structured in a Morphologic Matrix
- The Matrix will be developed in Excel
- The design constraints can be interactively modified, Chain Links will be dimensioned accordingly and can be selected to achieve a feasible technology

Dimension/ Merkmal Feature	Ausprägung Specifics			
Vorgehen	• Vollerhebung	• Stichprobe		
Erhebung der Tätigkeiten	• Einzelinterviews	• Workshops	• Fragebogen	
Erhebung der Zeiten	• Selbstaufschreibung mit begleitender Multimomentaufnahme	• Analytisches Schätzen	• Zeitaufnahme	• Laufzettel
Ausführende	• interne Beschäftigte	• externe Berater	• gemischtes Team	

Method Principle

Cost estimation

- Chain Links dimensioned and selected in the Morphologic Matrix will be evaluated regarding the related Levelized Costs of Carbon Storage (LCOCS)
- Costs will comprise CAPEX and OPEX values as far as available and suitable

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Monitoring, Survey, Maintenance and Decommissioning

Many thanks for your attention!

Contact: Sven.Hoog@fichtner.de;
Achim.Stuible@fichtner.de

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