Feasibility study – CO_2 transport and storage

Key findings

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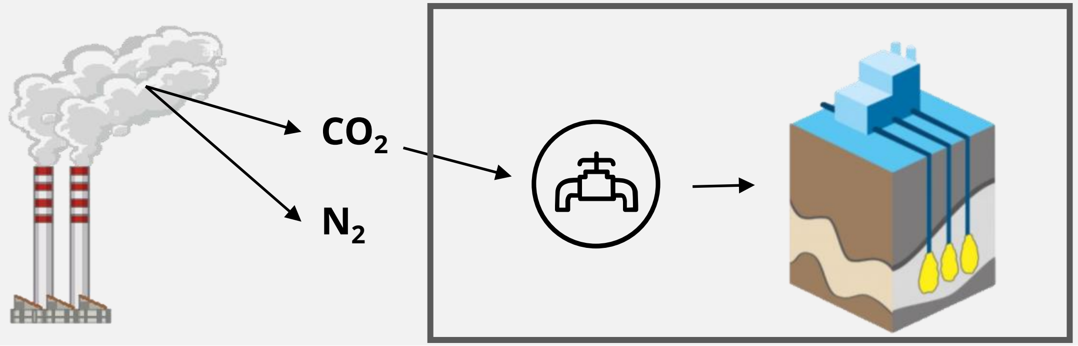
Deloitte provided a feasibility study for transport and long-term storage of carbon to help Salonit Anhovo reach carbon neutrality involving CC(U)S

Scope



Key parameters

Time frame: 2030 (beginning of industrial-scale CC(U)S) – 2035 (full scale CC(U)S)

Quantity to be captured and stored: around 0,7 MT.

Geography: Slovenia and neighbouring countries

Goals

The goal of the project was to **recommend the most viable options for transport and storage of CO_2**, to **assess economic costs and benefits**, and **discuss all other relevant impacts of CC(U)S**.

The project is conducted in **three phases:**

1. Overview of internal factors, regulation, and public acceptance
2. **Development of CO_2 transport and storage scenarios**
3. Financial and economic analysis; risk analysis

Deloitte prepared a feasibility study for the CC(U)S project, putting special focus on priority scenarios

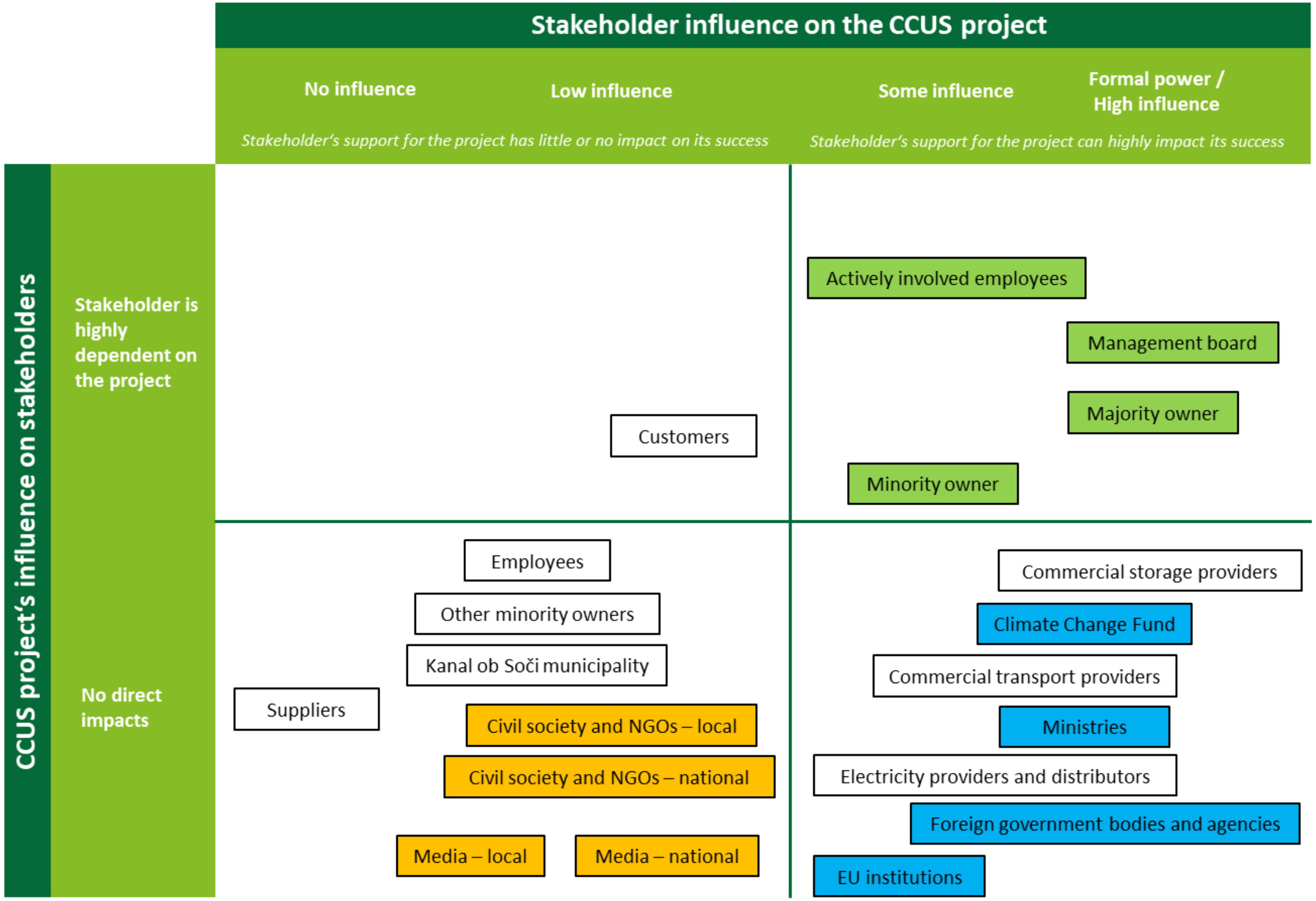
Feasibility study structure:

1. Description of the project	Introduction, project goals, structure of the study, project timeline.
2. Description of the context	Overview of Salonit Anhovo's environmental vison and planned CC(U)S project, GAP analysis, reported best practices, benchmarking against competition, and stakeholder analysis and mapping.
3. Socio-political context of CC(U)S	Review of the socio-political context for CC(U)S in Slovenia, Croatia, Hungary, and Italy.
4. Regulatory framework for CC(U)S	Review of the regulatory framework for CC(U)S in the European Union, Slovenia, Hungary, Croatia, and Italy. The chapter concludes with recommendations.
5. Scenarios for transport and storage	Mapping of storage sinks, mapping of transport routes, assessment of networking opportunities, construction of scenarios, cost projections, comparison of scenarios, and presentation of priority scenarios.
6. Financial analysis	Description of assumptions and limitations, revenues, expenses and forecasts, CAPEX, NPV calculation, WACC, and sensitivity analysis.
7. Economic and environmental analysis	Evaluation of externality costs, calculation of the eNPV, assessment of emission potential of transport options, and discussion of other environmental risks and mitigation measures.
8. Risk assessment	Qualitative risk analysis and presentation of proposed risk mitigation measures.

In the process of the feasibility study preparation, **Deloitte worked closely** with Salonit Anhovo to identify the most optimal priority scenario for CC(U)S.

The success of the CC(U)S can be influenced by policy-makers and public opinion – strategic communication is necessary to ensure buy-in and support

Activities: Using desk research we identified key stakeholder groups and placed in the standard **stakeholder matrix**, then grouped them based on indications of common interest.



There are obstacles to public acceptance of CC(U)S in Slovenia and a lack of awareness among policy-makers, resulting in a lack of financial support for CC(U)S projects

Activities: We reviewed recent reports and articles which featured the results of interviews and focus groups from the CCS4CEE project in which members of our team were involved.

Why is it important?

The socio-political context refers in general to the interactions of social, economic, political and cultural situations that (can) impact the development of a technology such as CC(U)S. In other words, the policies (priorities), historical practices and experiences, governance and/or trust between stakeholders determine the overall environment and thereby the extent to which a technology is developed.

Our interest

- Policy support
- Public awareness
- Financial support

Key findings

Due to little experience, both awareness and know-how are missing

- A major barrier for CC(U)S development in Slovenia is therefore a lack of awareness and understanding between policy-makers of its potential, use, and role.

Policy support is lacking

- Currently, there are no tangible policy incentives for the deployment of CC(U)S.
- Nevertheless, CC(U)S is mentioned, albeit to a limited extent, in three Slovenian national documents: the National Energy and Climate Plan (NECP), the Long-Term Climate Strategy (LTS), and the Slovenian industrial strategy.
- Currently, there are no tangible plans for financing, although the Climate Fund could support CC(U)S projects in the future.

Evidence of mistrust and opposition to CC(U)S in Slovenia

- Past experiences such as TEŠ have over the last decade created a level of scepticism or mistrust in government policies and/or projects when it comes to the continuation of the use of fossil fuels.
- NGOs which hold a negative view of CC(U)S in general and in the context of its development in Slovenia.

The legal and regulatory framework could act as a barrier to development of CC(U)S projects in Slovenia; the situation seems better in neighbouring countries

Activities: We reviewed current regulation and relevant reports to gain a clear understanding of the current regulatory environment impacting CC(U)S in Slovenia, Croatia, Hungary, and Italy.

Slovenia

General:

- As in most EU member states provisions of the EU‘s CCS Directive were applied directly in Slovenia, meaning no specific regulation or legislation was developed to address components of the CCS process

Storage:

- The Environmental Protection act prohibits geological storage of carbon in Slovenia – due to the social climate, this is not likely to change

Transport:

- The Energy Act only explicitly allows pipeline transport
- Since Slovenia or Italy have not yet ratified changes to international regulation prohibiting cross-border shipping of carbon, a bilateral agreement would likely be necessary for transporting CO_2 over the sea
- Current TEN-E revision proposal only addresses pipeline transport. If it eventually will recognize CO_2 transport by ship and trucks, this will have to be reflected in the Energy Act, which currently allows for transport of captured CO_2 via pipeline networks only

Croatia

Storage:

- The existing legislative framework poses no legal obstacles for geological CO_2 storage

Transport:

- CO_2 capture, transport, and utilization are unaffected by present legal acts – status is unclear

Hungary

Storage:

- There seem to be no impendiments to geological storage; previous experience with EOR
- Legislation outlines rules and procedures for storage site operators

Transport:

- No specific regulation on transport
- By law, storage sites must also enable access to transportation routes

Italy

Storage:

- Geological storage is allowed and regulated

Transport:

- Amendments to London Protocol not yet ratified, thus prohibiting cross-border shipping of CO_2

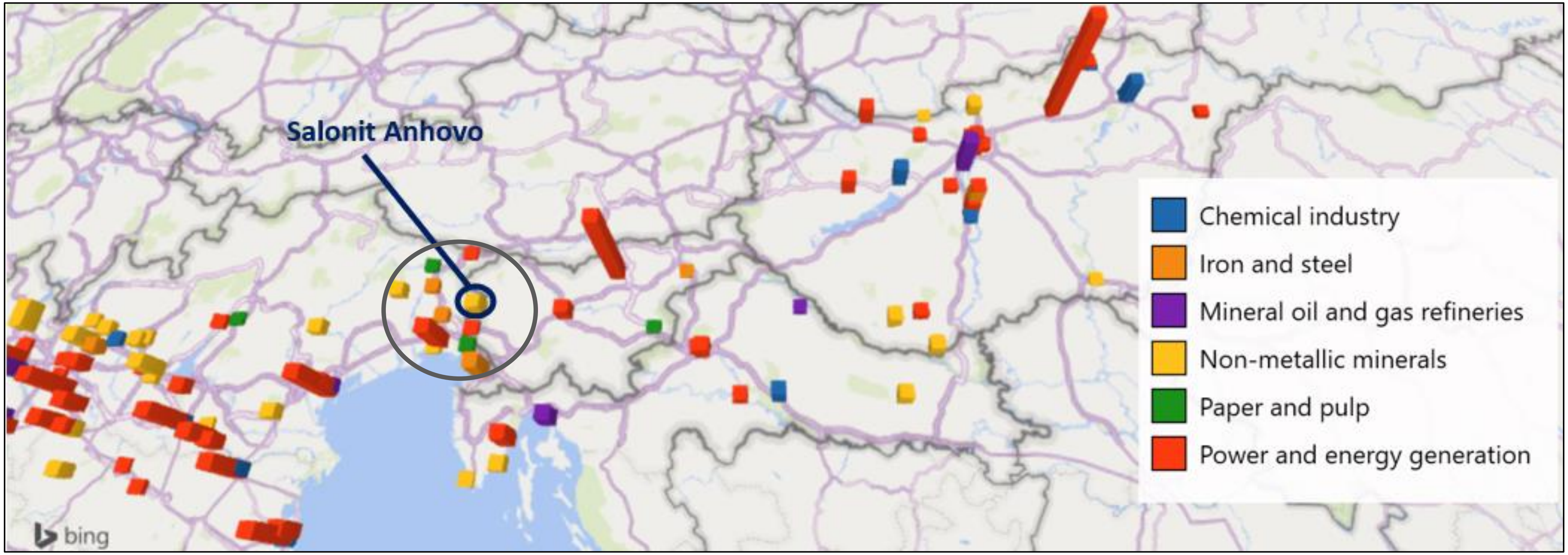
Since storage of CO_2 in not allowed in Slovenia, Deloitte identified four groups of storage sinks in Croatia, Hungary, and Italy with potential for future development; aquifers hold much more theoretical capacity, but empty oil and gas fields are more easily developed due to legacy infrastructure

Criteria:

- Scientifically confirmed
- Type of sink: UOGF; on/offshore
- Proximity
- Capacity
- Connectivity
- Lack of regulatory barriers
- Commercial opportunity
- Presence of emission clusters

Results:

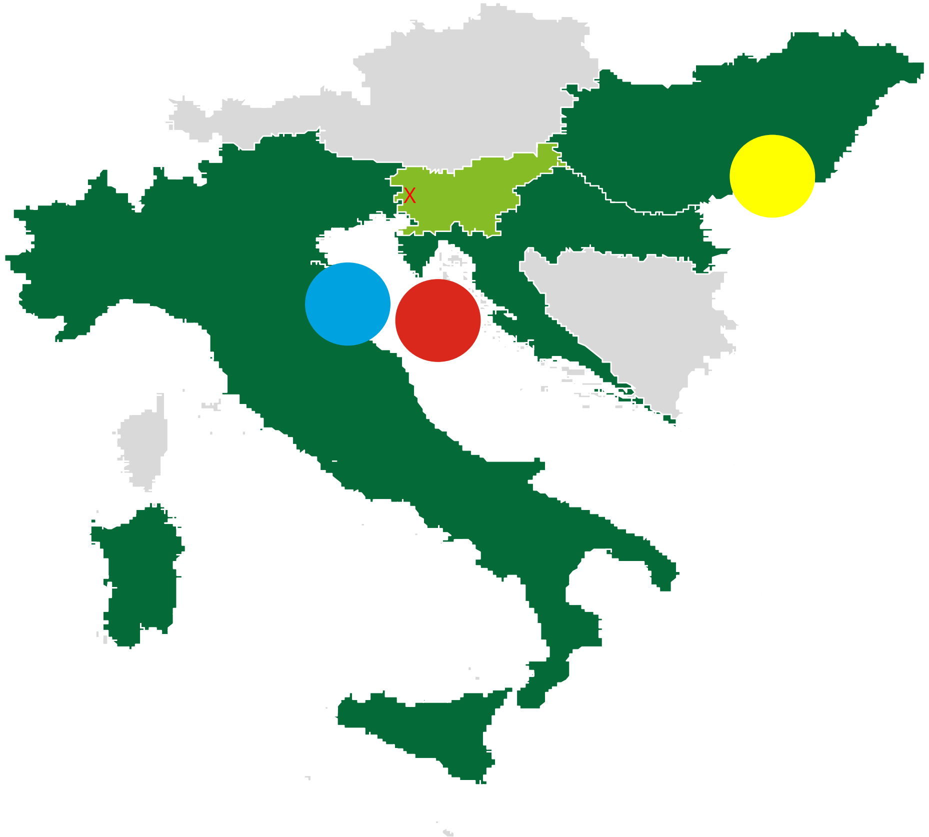
Mapping major emitters in the region highlights the potential for networking along transport corridors leading to storage sinks



Source: European Environmental Agency, 2021

Storage sinks with high capacities and potential for development are present in Italy, Croatia, and Hungary

Activities: Using scientific studies and credible reports we mapped key storage sites and estimated total storage capacities in Italy, Croatia, and Hungary, based on type of storage



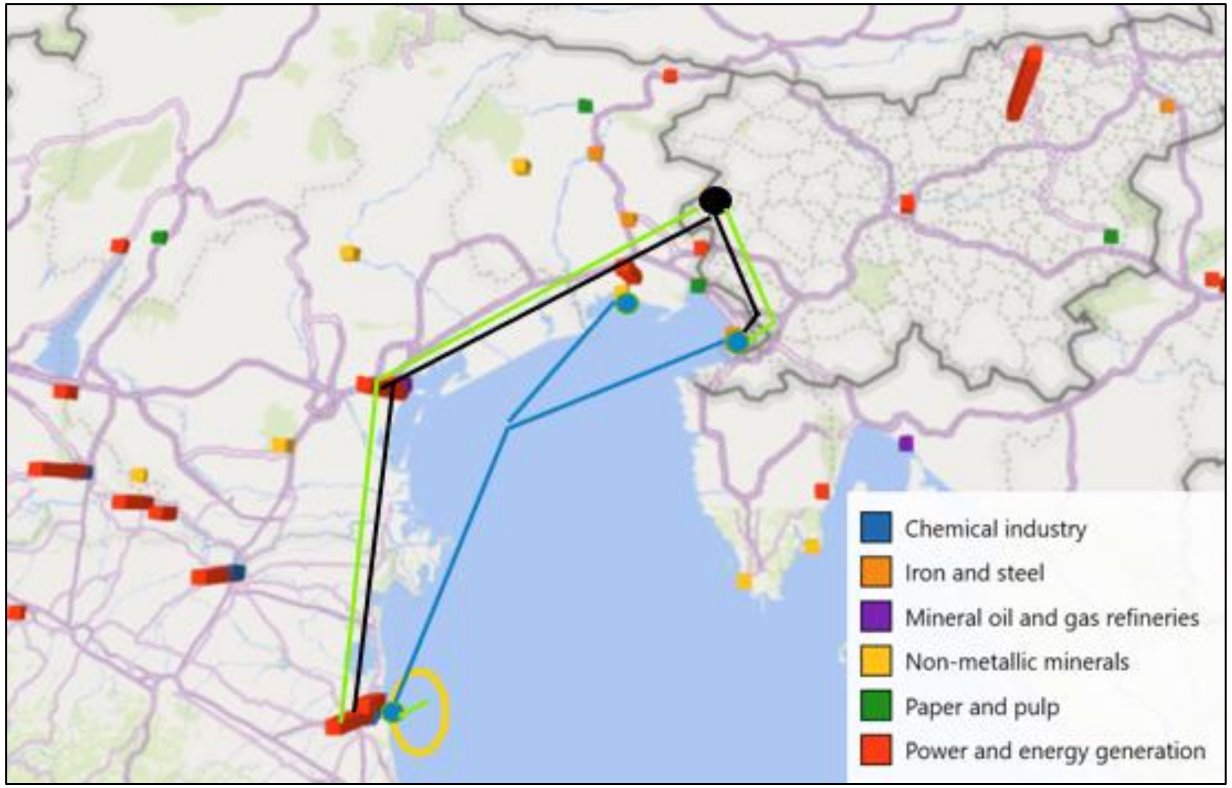
		Italy	Croatia	Hungary
Type of storage:		Offshore	Offshore	Onshore
Oil and gas fields	***Locations***	Coast of Ravenna (North Adriatic)	Below Istrian peninsula (North Adriatic)	Central and South-central Hungary
	Theoretical capacity	300 – 500 Mt	30 Mt	100 - 150 Mt
	Development prospects	High	Mid	High
Saline aquifers	***Locations***	/	/	Western Hungary, South central Hungary
	Theoretical capacity	/	/	750 – 2500 Mt
	Development prospects	Low	Low	Low

Scenario 1: Italy - offshore

Key features:

Type of storage	Offshore UOGF; permanent injection
Location	North Adriatic (Ravenna coastline)
Distance	≈ 300 km (Ravenna)
Transport options	• Railway • Ship • Pipeline corridors
Theoretical capacity	300 – 500 Mt
Capacity in development	• 4 MTpa (2026) • 10 Mtpa (2030)
Current state	In development

Proposed transport routes:



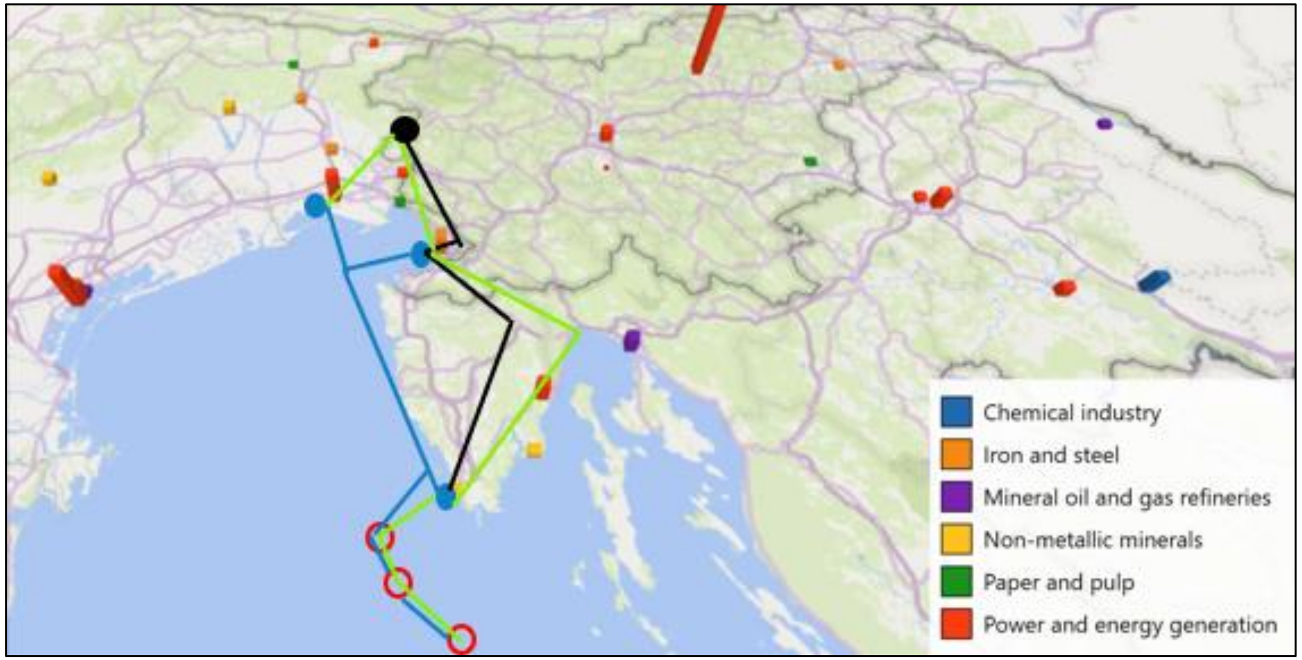
Source: Deloitte

Scenario 2: Croatia - offshore

Key features:

Type of storage	Offshore UOGF; permanent injection
Location	North Adriatic
Distance	≈ 250 km
Transport options	• Railway • Ship • Pipeline corridors
Theoretical capacity	≈ 30 MT
Capacity in development	/
Current state	Exploratory

Proposed transport routes:



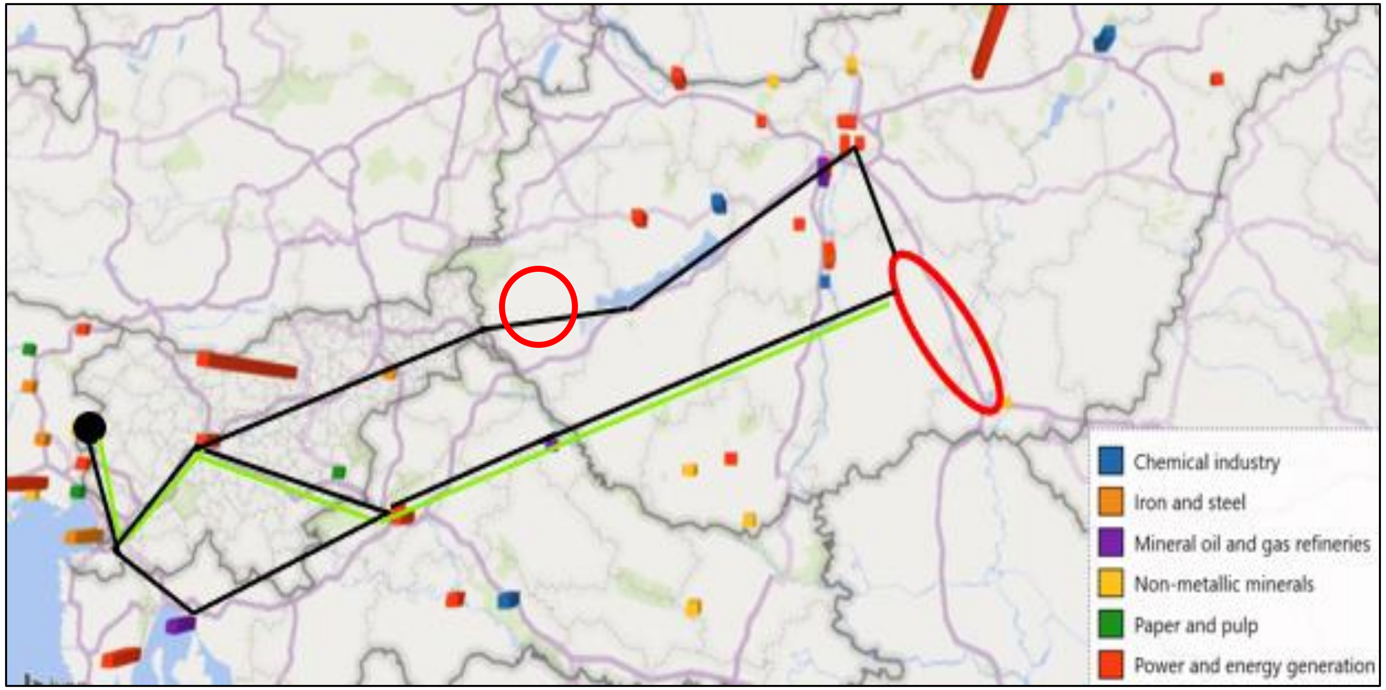
Source: Deloitte

Scenario 3: Hungary - onshore

Key features:

Type of storage	Onshore UOGF; permanent injection
Location	South-East Hungary, South-West Hungary
Distance	≈ 500 – 700 km
Transport options	• Railway • Pipeline corridors
Theoretical capacity	≈ 100 - 150 MT
Capacity in development	/
Current state	Exploratory

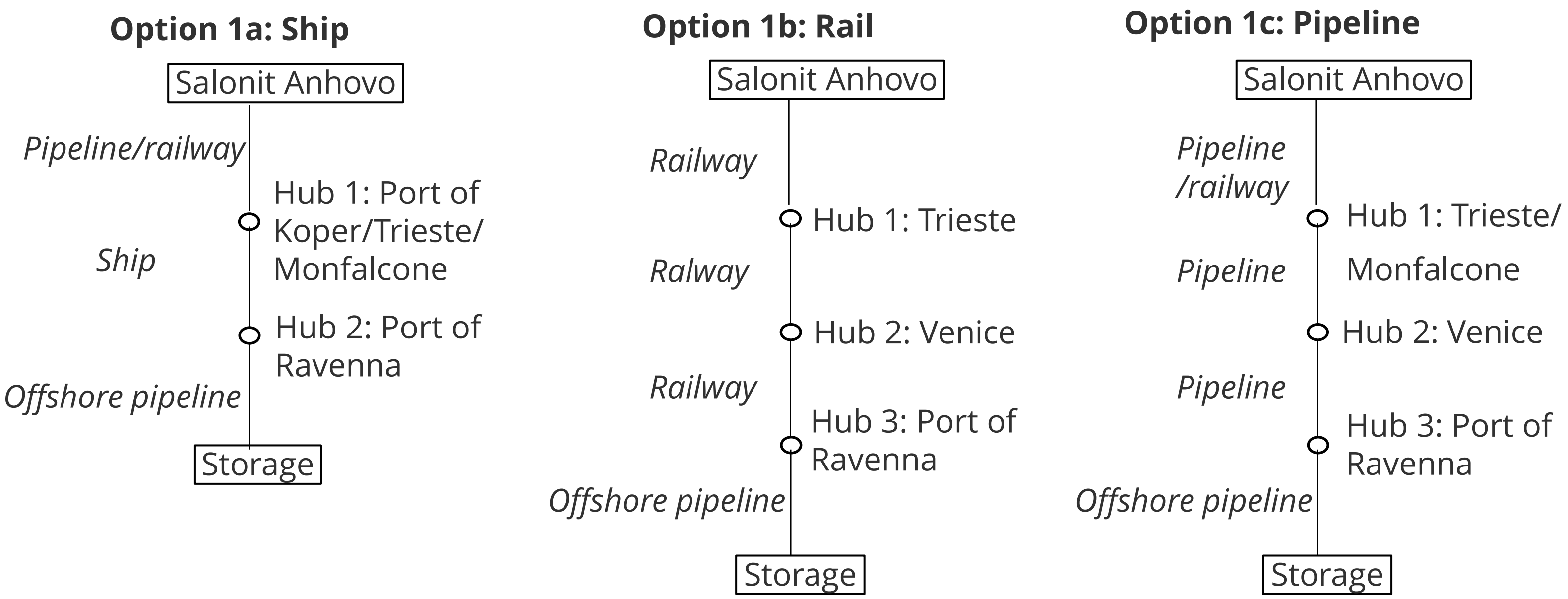
Proposed transport routes:



Source: Deloitte

Scenario „offshore Italy“ envisions joining the Ravenna CCS project and store in offshore hydrocarbon fields in the Adriatic; the key advantage are transport connections; transport would require establishing shipping routes or long-distance rail or pipe connections; presence of emitter clusters could ease operations

Transport options:



Clustering opportunity	Pooling emissions from Gorizia/ Trieste/Rijeka/Pula via ports	Pooling emissions cluster in Trieste, Venice and potentially Bologna	Pooling emissions cluster in Trieste, Venice and potentially Bologna

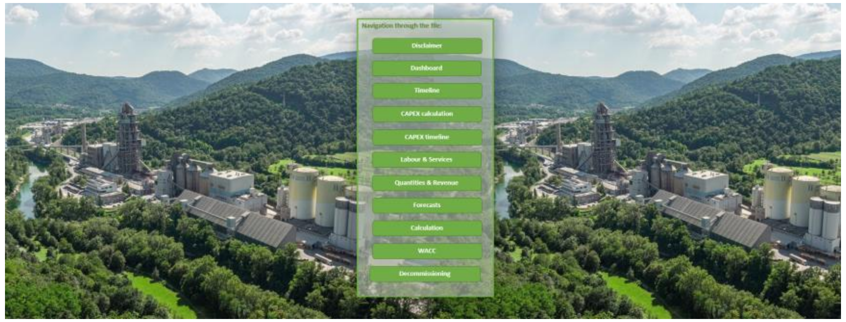
Deloitte‘s Financial Services team developed a bespoke investment model to estimate the costs and benefits of a CC(U)S initiative at Salonit Anhovo

Our approach:

- Based on European Commission‘s methodology for Feasibility Studies
- Modelling was done using a standard DCF model

What we did:

- Cost estimation (storage fees, transport fees, CAPEX, and OPEX for own investments in infrastructure)
- Discount rate estimation
- Calculation of NPV and IRR for each scenario
- Comparison of scenarios based on costs and benefits



Recommendations to support the next steps in CC(U)S pilot development in Slovenia and nearby

Shape public debate and build alliances

- In Slovenia, public opinion towards CC(U)S is largely negative.
- To ensure success, develop pro-CC(U)S arguments and finds companies/stakeholders who will support the journey.

Development of a long-term CC(U)S strategy

- There is high uncertainty over future developments and the economic environment.
- To manage risks and maximize preparation, evaluate the scenarios and prepare next steps.

Active engagement with the government

- Knowledge on CC(U)S among policymakers is on a low level.
- To provide regulatory and financial support, establish contact with the new government early in the term.

Development of a CC(U)S cluster in SI/region

- Identifying emitters interested in using CC(U)S as a solution in their decarbonisation journey.
- Developing a cluster to reduce cost, increase positive public perception, and encourage international cooperation.

Interested in cooperation?

Find out more about Deloitte's decarbonisation offering!

Get in touch:

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