

## S-LCA indicator framework for CO<sub>2</sub> marine transport.

34 indicators across 7 stakeholder categories and 19 subcategories.

Grounded in ISO 14075:2024 and UNEP S-LCA Guidelines (2020).

Covers all value chain participants:

- workers (seafarers, port and terminal workers),
- local communities,
- consumers,
- society,
- value chain actors,
- vulnerable groups,
- future generations.

Key social impacts:

- occupational safety,
- noise,
- emergency preparedness,
- governance transparency,
- intergenerational equity.

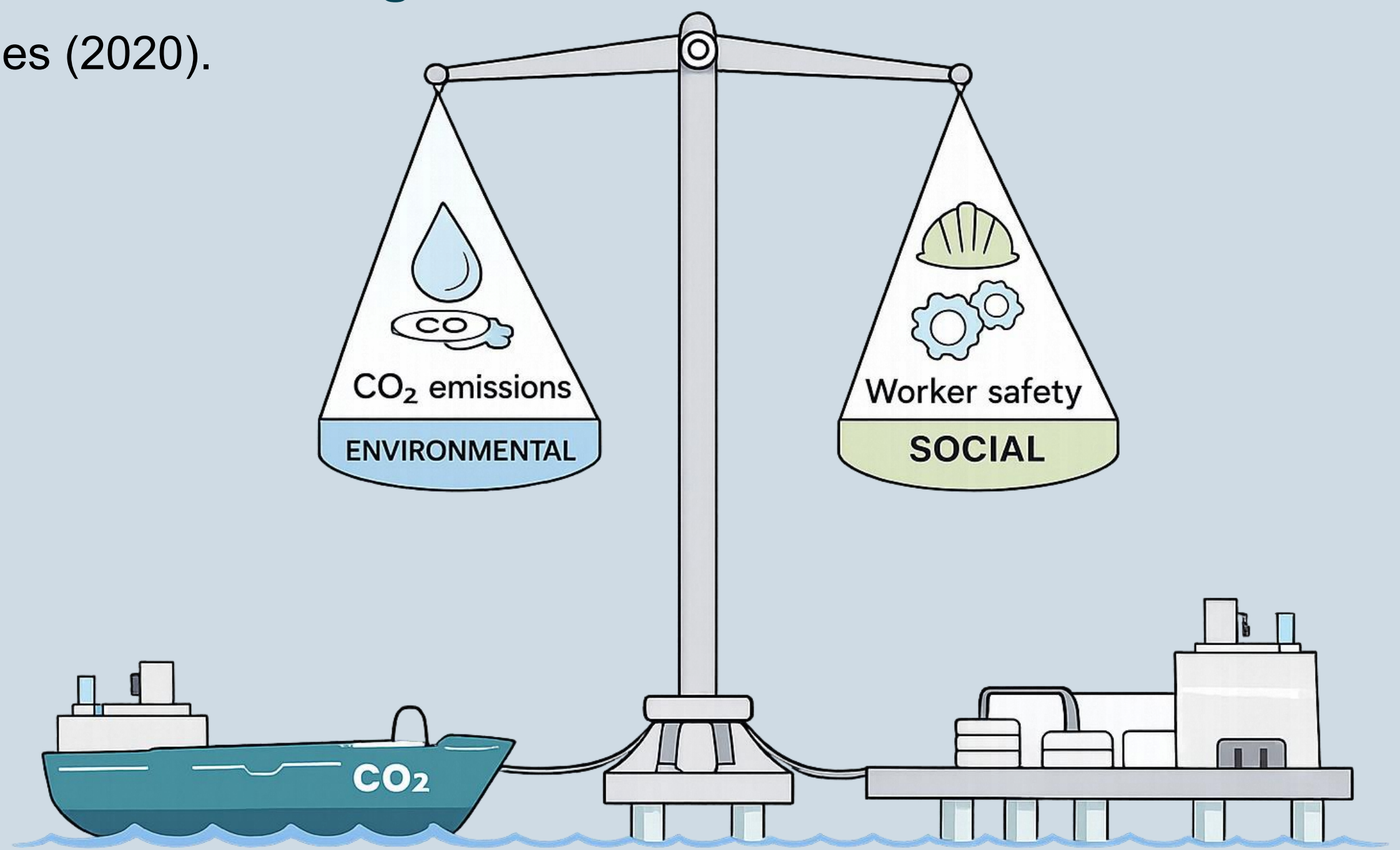


Figure 1. Conceptual illustration of the relationship between environmental performance and social aspects in offshore CO<sub>2</sub> transport and storage activities.

### Introduction

- Carbon Capture, Utilisation and Storage (CCUS) is a key decarbonisation pathway for industries where decarbonisation options are limited.
- Marine transport of CO<sub>2</sub> is gaining attention as a flexible, scalable solution within CCUS value chains.
- Research gap: existing studies focus on technical and economic aspects of CO<sub>2</sub> marine transport, with limited attention to structured social sustainability assessment.
- No systematic S-LCA indicator set exists for this context.
- S-LCA provides a structured approach for assessing social impacts across stakeholder groups throughout the value chain.

### Methodology

#### Literature search

Scopus & Web of Science

Screening - inclusion/exclusion criteria

#### CO<sub>2</sub> transport chain

Mapped across 8 stages

capture → transport → geological storage

#### Indicators

E – event-based

D – dimensionless

A framework was developed to assess the sustainability of marine CO<sub>2</sub> transport.

### Results

#### Workers (9)

- Accident rate
- Work schedule
- Grievance access
- Wage equity
- PPE availability
- Burnout index
- CO<sub>2</sub> exposure
- Child labour compliance
- Gender diversity share

#### Consumers (4)

- Risk information access
- CCUS safety information
- Price effects
- Volume of public information

#### Society (4)

- Incident reporting
- Anti-corruption
- Climate policy alignment
- Infrastructure investment

#### Local communities (6)

- Local employment
- Safety complaints
- Noise & vibration
- Air quality
- Evacuation awareness
- Cultural heritage

#### Vulnerable groups (3)

- Migrant worker rights
- Disability accessibility
- Low-income household exposure

#### Value chain actors (4)

- Supplier ethics
- Risk-sharing contracts
- Supply chain resilience
- Joint R&D

#### Future generations (3)

- Post-closure monitoring
- Decommissioning plans
- Intergenerational equity

### Conclusions

An indicator-based S-LCA framework for CO<sub>2</sub> marine transport was developed, covering 34 indicators across 7 stakeholder categories, to support social sustainability assessment across CCUS value chains.

**Next steps:** Identify and engage companies operating across the 8 CO<sub>2</sub> marine transport value chain stages for structured interviews. The interview findings will form the empirical basis for the next publication, focusing on indicator validation and social performance assessment.

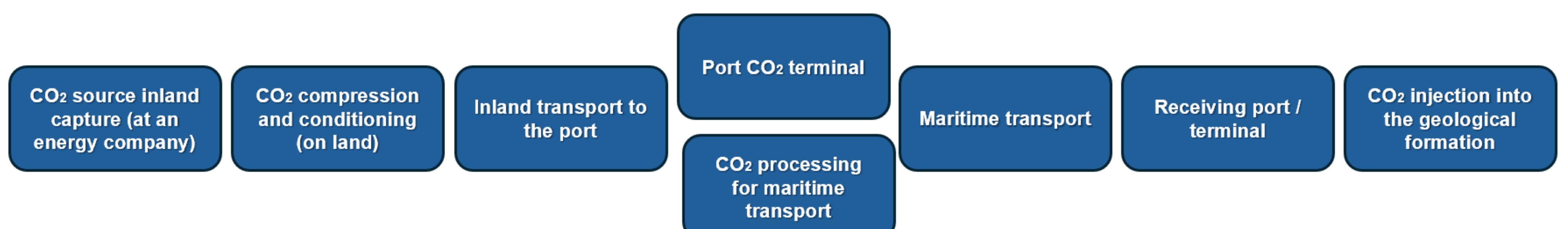


Figure 2. Stages of the CO<sub>2</sub> marine transport value chain, from inland capture through maritime shipping to geological injection.