Developing, Implementing and Expanding Decarbonisation in Industry Clusters

A Toolkit for Action

European emission targets for 2030 and 2050 require the fundamental transformation of primary industries like cement, chemicals and steel through the integration of CCS, CCU and hydrogen. The infrastructural, technological, commercial and societal conditions of these technologies mean their respective implementation will differ depending on industry sector, region, and policy framework. As industrial regions decide to act, these conditions need to be thoroughly considered.

Addressing Three Key Dimensions for Industrial Decarbonisation Projects

Develop a Strategic Rationale

Rooting the transformative and capital intensive decisions in sound motivation and understanding is imperative to withstand commercial and political scrutiny and changes in the socio-economic and technological environment.

Overcome Investment Barriers

Developing a new, zero-emission industry entails the restructuring of entire supply chains and the creation of new ones. Physical and financial barriers need to be prioritised and addressed through policy and public - private partnerships.

Create a Business Case

For a first of a kind project, we need to develop a business model to organise the relevant elements of investment, market development and asset operation that can deliver the combined objectives of the public and private sector.

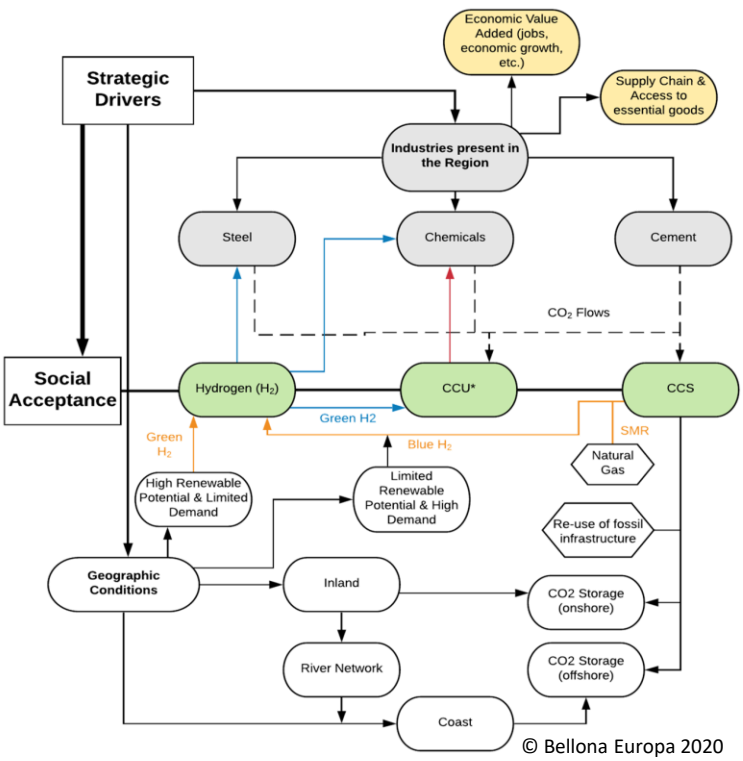
Identifying and implementing the best climate path for industry clusters

CCS, hydrogen and CCU (for minor shares of total available industrial CO_2 emissions) will be crucial for the three key process industries of steel, chemicals and cement – yet to varying degrees.

The **makeup of industry clusters** and the availability and access to resources dictate which role respective technologies can and need to play. The location affects access to options and their commerciality.

The **economic value** of industry in the region is one of the main strategic drivers for action and needs to be sufficiently understood and established.

Making decisions to create sustainable low-carbon industrial clusters requires an understanding of the **interconnections and interactions with other regions**, technologies and sectors of the economy.



WP5 INDUSTRIAL CLUSTERS

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https://www.alignccus.eu/

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A whole-system approach

Climate solutions for industry clusters need to be considerate of the overall needs of a net-zero economy. New energy carriers, such as hydrogen, and an increased demand for renewables are also needed in other sectors, including heat and transport.

Competition and cooperation are both essential to identify synergies and priorities to use scarce low-carbon resources and ensure the principles of optionality and low regret are integrated into the business case. Clusters must select sectors for decarbonisation taking into account essential drivers (market development, complexity, system) beyond technical feasibility and cost.

Overcoming barriers

Industry clusters face similar and common investment barriers. The objective of this exemplary review is to support an industrial cluster with the prioritisation of their business and policy development activities, and to determine a preliminary allocation of the responsibilities for barrier removal between the principal actors.

		Principal Collaborations for Barrier Removal		
Common Investment Barriers	**YES/NO**	**Government & Public Authorities**	**Developers & Operators**	**Finance & Insurance**
Missing System Perspective/Business Case Strategic Rationale	YES	✔	✔	✔
Missing long term markets for low carbon products (and/or H_2) to justify cost of large-scale deployment of technology	NO	✔	✔	✔
Missing H_2 and CO_2 transport and storage infrastructure	YES	✔	✔	✔
Limitations on scalability: single facility, single industrial sector, risk of competition from alternative technologies	YES	✔	✔	
Storage financial security requirements and leakage liability	YES	✔	✔	
Unacceptable full chain risk (intra-chain counterparty performance)	YES	✔	✔	✔
Missing funding model for large scale deployment	YES	✔	✔	✔
Missing societal acceptance and unacceptable moral hazard of fossil fuels use	YES	✔		✔

What about Social Acceptance?

Political and public support can alleviate investment risks and secure a project, while vocal opposition can topple it.
Social acceptance, or rather its lack, has become the crux of climate action. The goal of generating social acceptance is not necessarily to overcome all public resistance, but to generate a deeper understanding of the rationale of such projects and thereby sufficient political will and public support to carry the project.

A degree of tacit acceptance and explicit support of technologies, infrastructures and products can be achieved by

- Supporting and implementing frameworks that avoid fossil lock-ins and create market dynamics to phase out fossil-based energy carriers as green alternatives become available.
- Communicating information in a clear, truthful and comprehensible way.
- Addressing concerns and including local communities in the project to develop greater understanding and a sense of local ownership.

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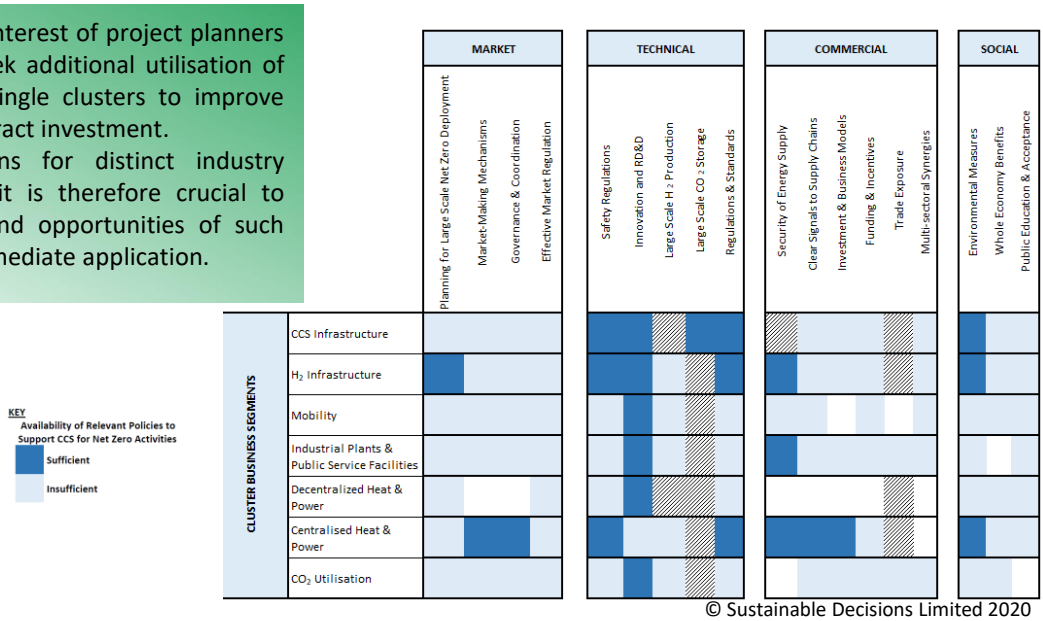
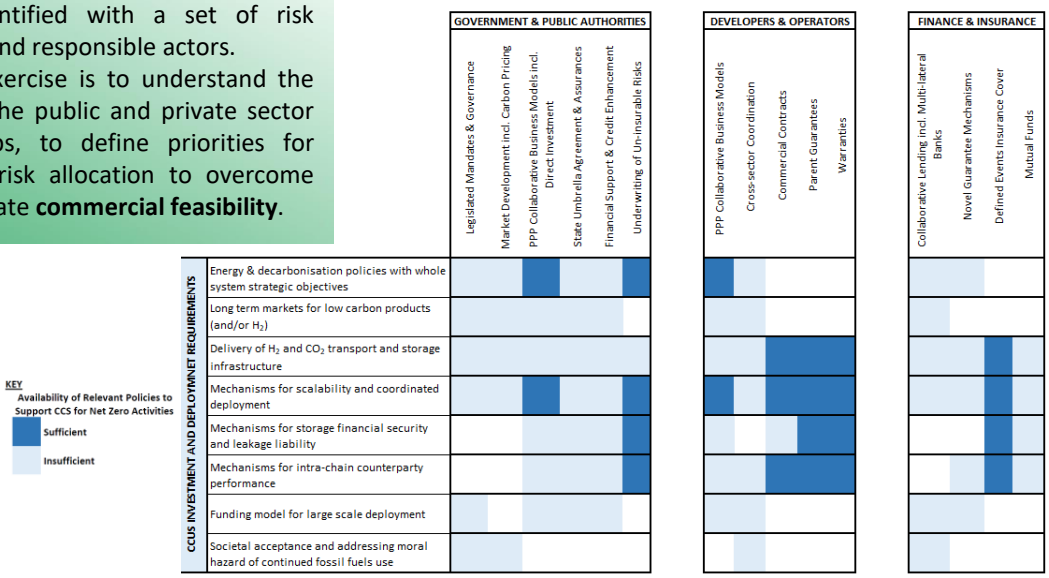
Developing the Frameworks we need for the entire economy

A detailed **policy gap analysis** through a heat map tool helps to identify and visualise the areas where policies are insufficient to support the deployment of CCS, CCU and H_2 for each of the relevant business sectors of an industrial cluster. To identify the needed policy it is important to again consider the entire system. Interactions and opportunities for cooperation exist between separate industry clusters that require similar climate technologies and infrastructures. Each may have different pre-conditions and timelines of implementation.

It is in the fundamental interest of project planners and policy makers to seek additional utilisation of infrastructures beyond single clusters to improve the business case and attract investment.
As decarbonisation plans for distinct industry clusters are developed it is therefore crucial to understand the reach and opportunities of such projects beyond their immediate application.



A **capability assessment** using this matrix combines the requirements to remove the major investment barriers previously identified with a set of risk mitigation instruments and responsible actors.
The objective of this exercise is to understand the existing capabilities of the public and private sector actors, to identify gaps, to define priorities for intervention, to guide risk allocation to overcome those barriers and facilitate **commercial feasibility**.



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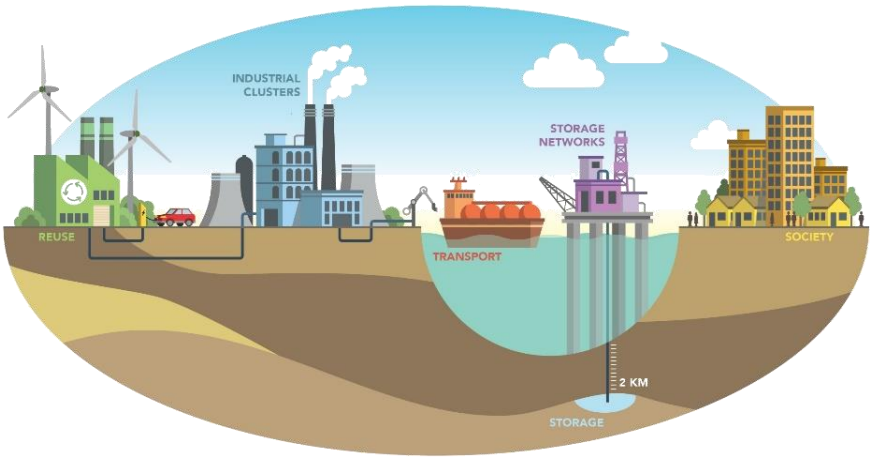
The Four Steps of Business Model Development & the Business Case

To make a business case for an investment proposition there needs to be a business model that describes how the outcome will be achieved and what mechanisms will mitigate risks and support delivery actions. The business model selection process therefore has a link to the metrics that will define its corresponding business case.



Step 1: ***Definition of the scope of the particular infrastructure for the relevant case study***

The process commences with an initial focus on the specific case study or project technical sub-components, business segments, and associated market sectors of main interest, the geographical extent (including industrial hubs, production facilities, storage areas, end-users, cross-border inter-actions), and market potential.

Step 2: ***Focussed market background review and gap analysis***

The purpose of this second step is to guide an overall assessment of the market background for any case study or project in preparation for the third step of understanding the investability and handling of major business risks.

The major barriers and business risks have been identified to be non-technical, and robust economic scrutiny is essential for any large-scale infrastructure investment. Technology components within the infrastructure chain and end markets exist and have proven functionality.

Step 3: ***Business and investment risk identification and mitigation***

Investing in, and delivering, low-carbon products using CCS at scale requires an understanding of the risks associated with government policy, market development, and regulatory frameworks.

Identify and quantify the major business risks that impact the level of investment potential for each of the market sectors and business opportunities from both a public and a private sector perspective.

Step 4: ***The Business model***

Focus on how to remove the investment barriers and mitigate business risks, and to select appropriate business models for any given case study. The outcome will be the development of a number of viable commercial structures and business models, investigation of the potential investor mix and the allocation of risks between those investors for each of the market opportunities, the de-risking mechanisms required from the financial and carbon markets and from the EU and national governments. Ultimately, the business case is the culmination of all dimensions:

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This work is part of WP5 of the ALIGN CCUS project. For more details and information around this toolkit, please refer to the final report at https://www.alignccus.eu/

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