

Business model analysis: Waste-to-Energy

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Overview of deep dive into business models for CCS at waste-to-energy (WtE) plants

Content

- WtE is a key sector to scale BECCS in Switzerland and Europe
- High-level overview: current business models and future direction
- Workshop designs for initial business model discussions and in-depth financial modelling

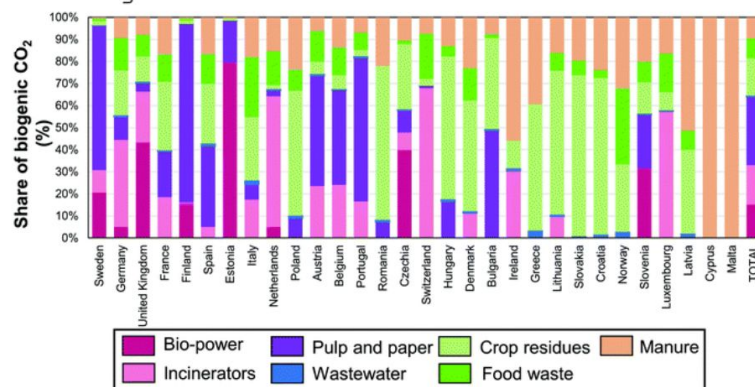
Data sources

- Airfix mandate with a Swedish waste-to-energy plant within Net Zero Cities programme and similar mandates (2025, anonymized)
- Airfix mandate with a Swiss waste-to-energy plant about business model
- “Finanzierungslösungen CCS by KVA” by Ramboll within mandate for Cargo Sous Terrain, in which Airfix had a significant role (2025)
- WWF proposal on advanced disposal and recycling fee (2023)
- [Scienceindustries report by DENA and BAK](#) (2025)

WtE as a key sector to scale BECCS

WtE is a key sector required to scale BECCS in CH and Europe

- Due to its significant role among potential BECCS (Bioenergy with Carbon Capture and Storage) carbon dioxide removal (CDR) pathways in both Switzerland and Europe, this sector was selected for an in-depth analysis to illustrate existing business models and explore potential future solutions.
- A frequently cited ETH Zurich study* estimates that approximately **7.5 billion tonnes of CO₂** must be sequestered through BECCS in Europe by 2050 to meet climate targets. This corresponds to about **5% of Europe's 2018 greenhouse gas (GHG) emissions, or roughly 200 million tons of CO₂ per year.**
- While the contribution of waste-related BECCS varies across countries (see graph), Switzerland's potential is particularly concentrated in **waste incineration**.
- In May 2022, the **Swiss Federal Office for the Environment (FOEN)** published a baseline study on CCS and CDR*, outlining a long-term plan to achieve **12 million tonnes (Mt) of CO₂ reductions or removals through CCS and NETs (Negative Emission Technologies)**. Of this total, 7 Mt are expected to occur within Switzerland, including **2 Mt of negative emissions**. These 2 Mt correspond to the biogenic share of emissions from waste-to-energy plants, which collectively emit about **4.5 Mt of CO₂ annually**, including both fossil and biogenic sources.



*Sources: [Assessment of carbon dioxide removal potential via BECCS in a carbon-neutral Europe](#) by Lorenzo Rosa, Daniel L. Sanchez and Marco Mazotti, 2021; [Carbon capture and storage \(CCS\) and negative emission technologies](#) by BAFU, 2022

Current business models and future direction

Reflections on current BECCS business models in Switzerland:

Compliance market view

- Similar to other European countries, there are currently **no viable business models for large-scale BECCS deployment** in WtE plants. Existing projects – mainly in Denmark and Sweden – rely heavily on **public subsidies**, highlighting the absence of market-based solutions.
- Switzerland shows **growing openness** toward BECCS implementation, but key **regulatory and financial mechanisms** are still under development. In 2024, the **Federal Council** confirmed that a **nationwide increase in waste disposal fees** aligned with the **polluter-pays principle** would be possible under the **Environmental Protection Act (USG, SR 814.01)**.
- Additionally, the **Climate and Innovation Law foresees annual subsidies of CHF 200 million to support new technologies** and processes, including CCS. However, **WtE plants are excluded from this program**, as they are already covered by an agreement between the WtE association and the Federal Office for the Environment (FOEN). This agreement exempts them from the Emissions Trading Scheme (ETS) but **requires the construction of at least one CCS plant by 2030**.
- **CCS projects may also qualify as compensation projects** within the current offset obligations for fossil fuel importers, offering another potential – though limited – funding avenue.
- While discussions about **nationwide disposal fee increases** remain at a conceptual level, some cantons and regions are moving ahead with more concrete measures. Basel, Hinwil, and Innerschwyz (Linth) are actively exploring local solutions; the latter has already announced a **disposal fee increase from 2027**, referencing the **planned CCS pilot plant at KVA Linth as one justification**.
- Despite progress, **key challenges remain**. The existing subsidy scheme covering 50% of CAPEX and OPEX does not apply to WtE plants, and for large-scale projects, **the remaining financing gap is unresolved**. Moreover, **carbon credit prices from compensation projects are currently below the cost of CCS**, limiting economic feasibility and slowing progress toward scalable deployment.

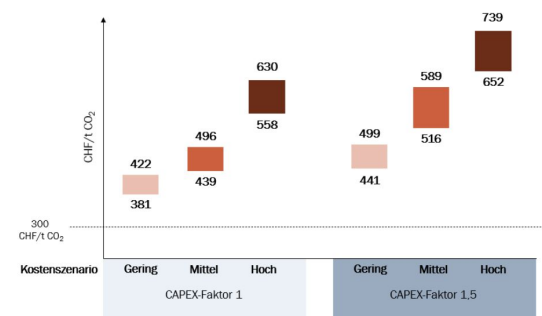
*Sources: [Solidarische Finanzierung von Carbon Capture auf Kehrrichtverbrennungsanlagen](#), Das Schweizer Parlament, 2024; [Innerschwyzer Güselsäcke werden ab 2027 massiv teurer, bote.ch](#), June 2025; [Förderungsprozess – innovative CO2-Reduktions-Technologien](#), Infrawatt, March 2025;

Reflections on current BECCS business models in Switzerland:

Voluntary market view

- Beyond urgently needed compliance mechanisms, the **voluntary carbon market (VCM)** can also play a role in enabling **viable business models for CCS**. Although some projects in Switzerland have received financing from corporate buyers or Stiftung Klimarappen, there are currently **no examples of voluntary CDR certificate sales from Swiss WtE operators**.
- **This contrasts with developments in other European countries**, where large-scale CDR certificate sales have already taken place. According to cdr.fyi*, major transactions include:
 - **Stockholm Exergi (Sweden)** – over 5 Mt CO₂ removals sold to Microsoft for delivery in 2024/25; project capacity: ~800 Kt CO₂/year.
 - **Gaia ProjectCo (Denmark)** – around 3 Mt CO₂ removals sold to Microsoft; project capacity: ~500 Kt CO₂/year.
- **Both projects receive substantial government subsidies** in addition to revenue from voluntary market buyers. While exact prices are undisclosed, estimates suggest ~EUR 200 per ton of CO₂ removed.
- By comparison, Swiss WtE plants have smaller CO₂ capture potential (~100–400 Kt CO₂/year), but **significantly higher cost estimates**. According to a recent DENA and BAK study, the cost of capturing and storing CO₂ from Swiss WtE plants ranges between CHF 381 and 739 per ton. These figures do not include subsidies, as **WtE plants are excluded from current federal support programmes under the existing FOEN–WtE association agreement**.

Abbildung 4: Kostenszenarien für Vermeidungskosten 2030



Quelle: Eigene Darstellung von BAK und dena

*Sources: cdr.fyi/leaderboards; Stockholm Exergi wins auction for government support for BECCS, [beccs.se](https://www.beccs.se), Jan 2025; [10 companies selected to compete for Denmark's CCS Fund with DKK 28.7 billion for Carbon Capture and Storage](https://www.energi.dk/da/Energisystemet/Planlægning/Carbon%20capture%20and%20storage), Energysterelsen, May 2025.

Towards a collective solution for CCS in Swiss WtE plants

Several companies and organizations have explored **potential pathways for implementing CCS in Swiss waste-to-energy (WtE) plants**, and **all favor a collective approach**. Such a model would prevent **early movers** from bearing **disproportionate costs**, which would otherwise need to be passed on to customers in their respective regions.

Given that WtE plants in Switzerland are **well-coordinated through a strong national association**, this organization – or a dedicated entity acting on its behalf—could effectively **coordinate collective planning, financing and implementation** of CCS and permanent storage.

This **coordinated approach** could also serve as a **blueprint for other countries**, where similar organisational structures exist.

The following slides present **two conceptual models** developed by **Ramboll** and **WWF**, both of which have been publicly discussed in Swiss CCS forums, including **Airfix**.

Solution 1: Solidarity-based financing model

As part of the **CCS Taskforce of VBSA**, Ramboll proposed a **solidarity-based financing mechanism** for implementing CCS across Swiss waste-to-energy (WtE) plants. The key objective is to **remove CCS deployment from competitive market pressures** within the waste sector.

Core concept:

- All Swiss WtE plants (**KVA**) contribute to a **Carbon Capture Fund**.
- The fund finances both:
 1. The **first demonstration project**, and
 2. The **gradual retrofitting** of all WtE plants with CCS.

Key design principles:

- **Market neutrality:** Installation and operation of CCS facilities must not distort competition in the waste management sector.
- **Cost-covering fee:** The CCS operator receives a **per-tonne CO₂ fee** that fully covers costs
 - High enough to ensure investment and operation,
 - Low enough to avoid competitive advantage.
- **Central governance:**
 - **All rights and obligations** related to the captured CO₂ are transferred to a **designated foundation**, including ownership of **NET certificates** and any avoided emissions.

Summary:

A **simple and collective financing model** enabling sector-wide CCS deployment—balancing fairness, cost-efficiency and environmental integrity.

Solution 2: Advanced disposal and recycling fee

WWF proposed an **advanced disposal and recycling fee** to support CCS implementation at Swiss waste-to-energy (WtE) plants, addressing the **financial disadvantage of early movers** who would otherwise face higher disposal fees compared to non-CCS operators.

Core idea:

A **nationwide fee**, similar to the existing **vRG (advance recycling fee)** applied to electronic devices, would finance CCS at WtE plants.

- The fee would apply to **all plastic products** (full or partial) **imported to or produced in Switzerland**.
- The rationale: **up to 100% of fossil emissions** from WtE plants originate from **plastic waste**.

Two variants proposed:

1. **Full CCS coverage:**
 - The fee covers CCS costs for both **fossil and biogenic emissions**,
 - Revenue from selling **emission certificates** is deducted.
2. **Fossil-only coverage:**
 - The fee covers CCS for **fossil emissions only**,
 - CCS costs for **biogenic emissions** are financed through **emission certificate sales**.

Advantages:

- **Simple and quick** mechanism to finance CCS deployment.
- **Minimal price impact** on plastic products, with a potential **steering effect** toward lower-emission materials.
- **Prevents competitive distortion** — early movers and their customers **are not penalized** for leading on climate action.

Source: “Die hohen CO₂ Emissionen der KVA klimafreundlich entsorgen: Eine vorgezogene Entsorgungs- und Recyclinggebühr für Kunststoffe macht es möglich”, WWF, Feb 2023

Key enabler: A robust regulatory framework for CDR financing

A **clear and stable regulatory framework** is essential for scaling and financing carbon dioxide removal (CDR) solutions, including BECCS.

According to a **BCG study for the German Association for Negative Emissions**, leading CDR countries share several defining features:

-  **Measurable CDR targets** anchored in national climate strategies.
-  **Accounting standards** and **regulatory infrastructure** for monitoring and certification.
-  **Subsidy programs** supporting both **land-based** and **technical CDR methods**.
-  **Integration into carbon pricing systems** or **emissions trading schemes (ETS)**.
-  **Additional policy levers**, such as **clean fuel standards** or innovation credits.

International examples:

-  **Denmark:** €3.8 billion CDR subsidy fund + clear BECCS/DACCS roadmap.
-  **United Kingdom:** Layered approach with **Carbon Contracts for Difference (CCfD)**.
-  **Australia:** **Carbon Credit Units** and **Emissions Reduction Fund**.
-  **United States:** **Tax credits (e.g. 45Q)** supporting CCS/CDR investments.
-  **Canada:** Combined **natural and technical removal focus**, with **tax incentives** and evolving certification systems.

Emerging Development:

-  Integration of **carbon removals into the EU Emissions Trading Scheme (ETS)** – currently under active evaluation for the coming years.

Source: "Investitionsbedarf und Unterstützungsmechanismen für die Skalierung von CDR", BCG x DVNE, Jun 2025

Workshop design

Workshop design for an initial business model reflection

Workshop structure
for a holistic reflection

For waste-to-energy (WtE) operators, **the largest barrier to CCS deployment is establishing a viable business model**. To address this, **Airfix conducted workshops** with clients to examine business models holistically, with typical goals including:

The WtE operator should:

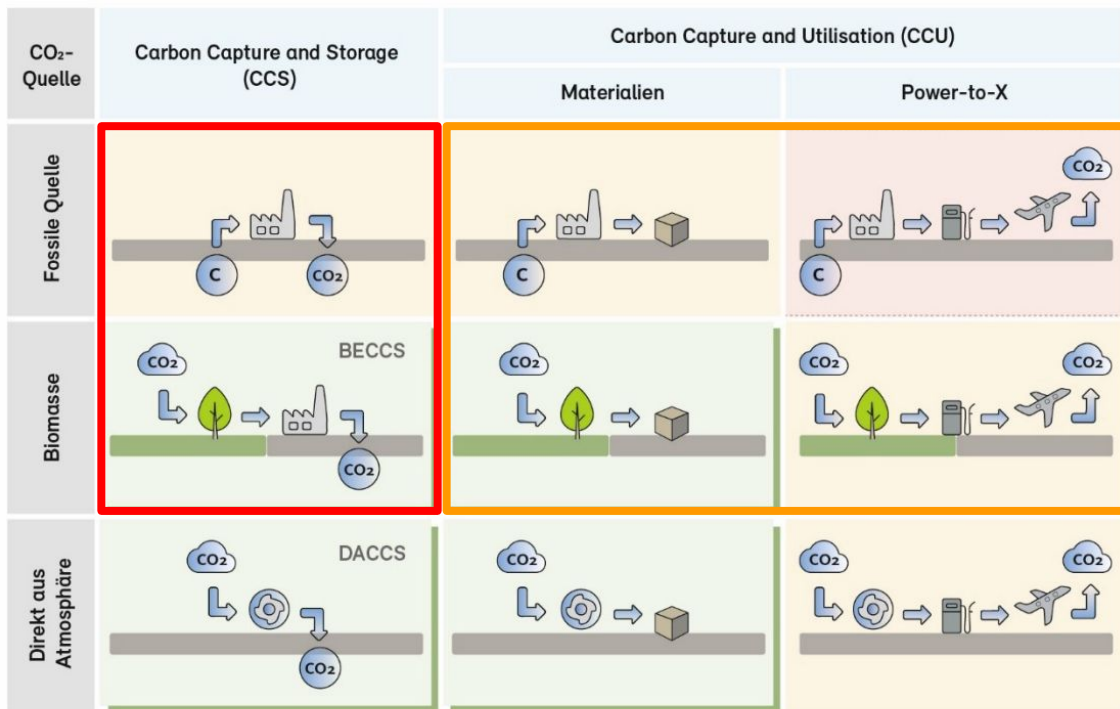
- Understand **various business model options** for **biogenic and fossil CO₂**.
- Know the **requirements for accounting captured CO₂** as a **negative emission**.
- Gain an overview of the **current voluntary market** and anticipated developments.
- Be aware of **key pending or open regulatory decisions** affecting voluntary and mandatory markets and related business models.

As **only the first goal** directly concerns the **BECCS business model at WtE plants** (“understand various business model options for biogenic and fossil CO₂”), the following section focuses on this topic. The **other goals provide supporting context** for decision-making and planning.



CCS - CCU - CDR at WtE plants

Example for an overview of options to set up a business model. This can be helpful that the WtE operator team is aware of the various business model options there are currently out there.



Quelle: Angepasst von [BAFU 2020 \(p.11\)](#)

Es wird davon ausgegangen, dass die verwendete Energie klimafreundlich gewonnen wurde.

Negative Emissionen
(CDR-Zertifikate)

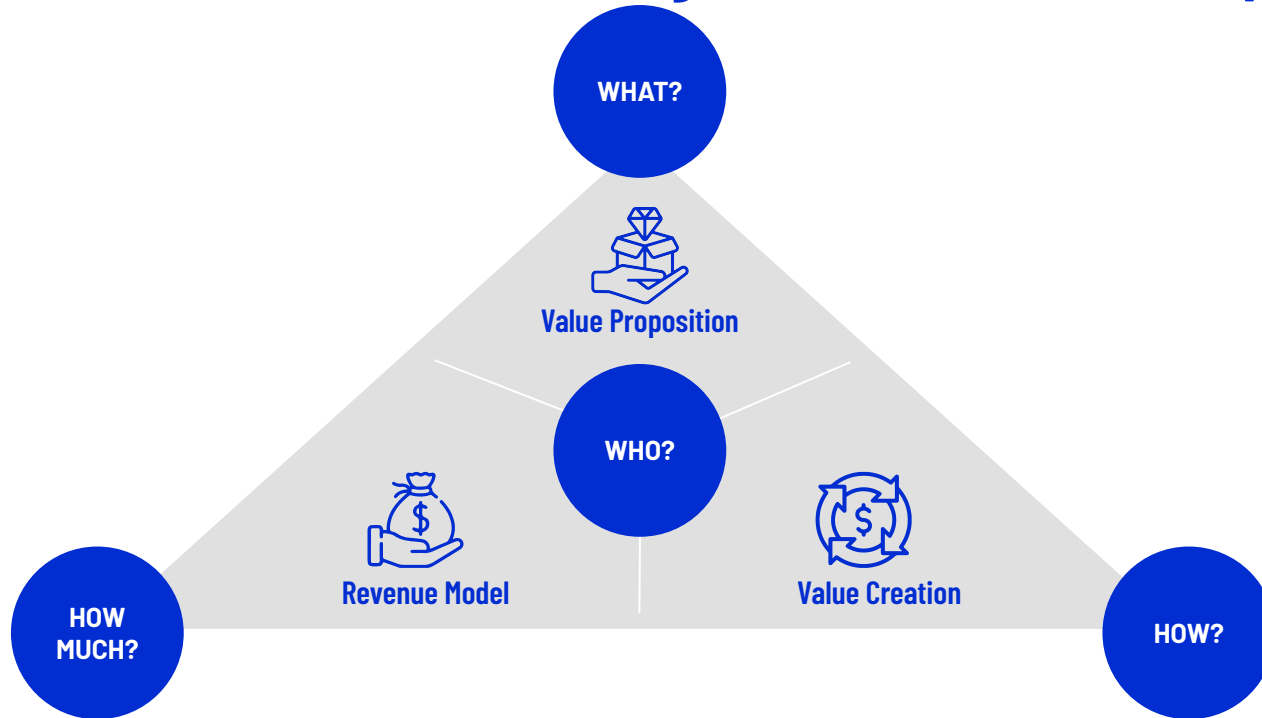
Klimaneutralität
(im besten Fall)

CO₂-Emissionen

CC bei KVA mit Speicherung

CC bei KVA mit "Utilisation"

A model called “magic triangle” helps to structure the business model together in the workshop

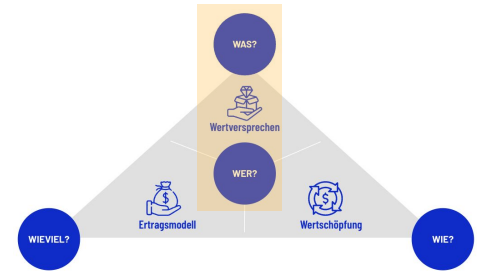


Source: „Geschäftsmodelle entwickeln, 55 innovative Konzepte mit dem St. Galler Business Model Navigator“, 2013

WHAT is the goal? WHAT are success factors? WHO is the target group?

- As a first step, in an open brainstorming session, goals are collected with all participants. These are typically more focused, if various target groups are taken into account.
- Therefore, it can be helpful to first determine who the target groups to address are.
- Finally, these goals are structured into various logic groups.

The first goal is to have a **collection of goals** structured into groups, in order to create a value proposition. The second goal is to align on a **common value proposition**, which typically is 2-3 sentences at maximum and includes all items that seem important to the WtE operator.



Goal:
WtE plant needs to
comply with national
standard
Target group:
WtE industry

Goal:
...
Target group:
...

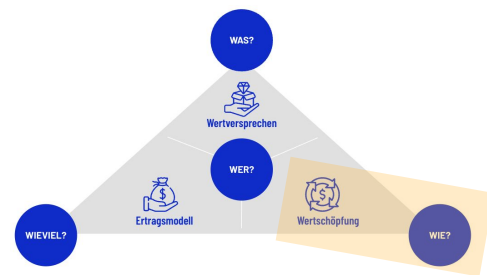
Goal:
Contribute to climate goal
of country
Target group:
Government and public

Goal:
...
Target group:
...

HOW do we create value with the captured CO2?

- In the HOW, a groups looks closer at specific use cases. The first step is to collect ideas which use cases are relevant for the WtE operator - in line with the WHAT.
- After these cases are collected, a prioritization is made.

The goal is to have a **clear idea of the use cases** that will be taken forward, including clarity on the **buyer** in each of these use cases.



Use case:

CO2 is sold to gas trader
at market price

Buyer:

Gas trader

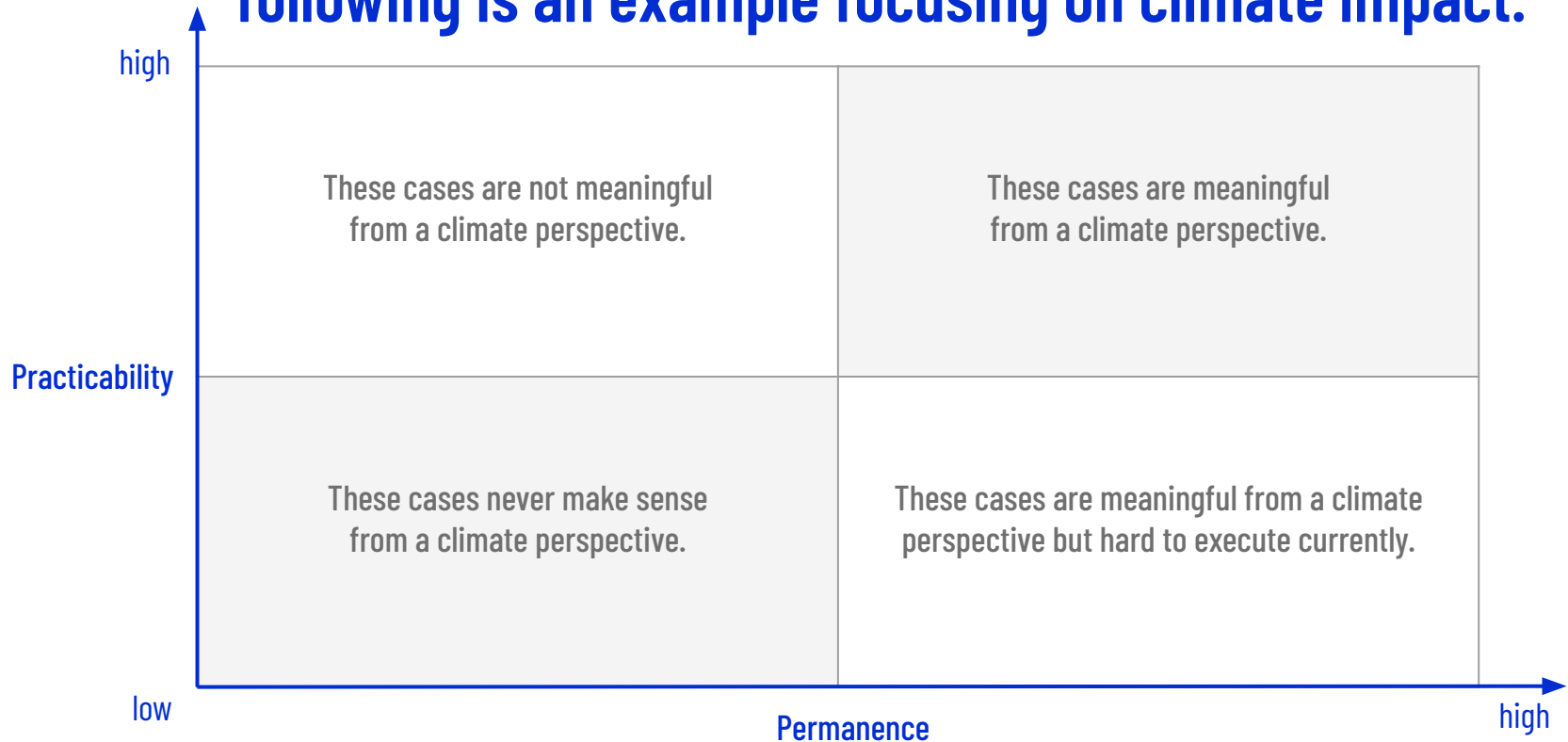
Use case:

...

Buyer:

...

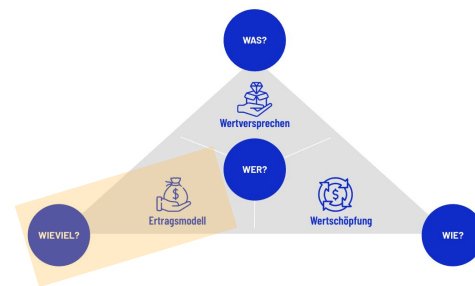
The use cases can be structured according to a 2x2 matrix - the following is an example focusing on climate impact.



HOW MUCH: What are our expected revenues?

- This session during a workshop typically goes into more detail of specific use cases. The following slide provides an example of a table with information that the participants gather together during and after the workshop.

The goal is to understand the **contribution of each use case**, and be able to **determine next steps** where to focus on.



Use case:

CO2 is sold to gas trader
at market price

Buyer:

Gas trader

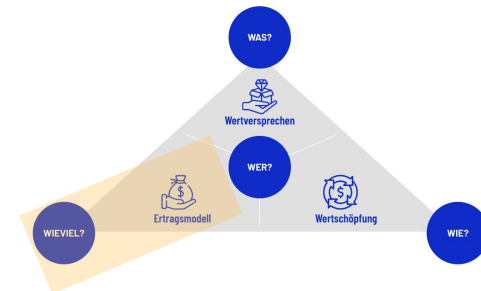
Use case:

...

Buyer:

...

HOW MUCH: What are our expected revenues?



Examples:

Option for monetization	Specifics for mixed CO2 sources (biogenic and fossil CO2)	Potential revenues	Market size	Complexity	Climate impact	Notes and thoughts of workshop participants
Permanent Storage (Carbon Capture & Storage - CCS)						
Sale of biogenic emission removal to public institutions with a net zero target	Potentially options to sell CO2 reduction (fossil CO2) as reduction certificates	High	Small but growing	High	Very positive	- Revenues: usually cost+ - Certification: via standard/methodology of the voluntary market (no double-counting) - Examples: City of Zürich (Werdhölzli), Denmark
Non-permanent Storage (Carbon Capture & Utilization - CCU)						
Usage in commercial products (CCU): sale to gas traders, greenhouses	Fossil & biogenic	Medium	Stable	High	Low to medium	- Not permanent - Revenues: - Without project on the Swiss compliance market: ca. CHF 50/ tCO2 - With project on the Swiss compliance market: CHF 50/ tCO2 plus ca. CHF 160.- / tCO2 - Demand in Swiss market is limited - export is difficult due to high cost for Swiss CO2

Workshop design for a deep session on project finance

Workshop structure
for a holistic reflection

Many WtE operators are already **advanced in conceptualizing business models** for CCS but **lack detailed financial insight**. While uncertainties remain, several **benchmark figures** can provide guidance on potential financial implications.

Typical objectives of a financial-focused mandate or workshop:

- Develop all **assumptions** needed to build a comprehensive **financial model**.
- Create a **clear revenue plan** for CCS operations.
- Develop an **in-depth understanding of expenses**, including **OPEX and CAPEX**.
- Build a **profitability model** to assess the **current quality and viability** of the business model.



Outcome of deep session on project finance

After a comprehensive session on project finance, the client gains:

- **Detailed understanding of CAPEX and OPEX** for a potential BECCS project, including key cost drivers and scenario-building with different assumptions.
- **Insight into CDR pricing** required to achieve project profitability.
- **Clarity on subsidies**, their critical role, and which programs apply to the specific project.
- **Benchmark data** to further refine the financial model.
- **Awareness of model gaps**, highlighting positions that still require further detail.

Value:

Provides a **solid foundation for discussions with financial decision-makers** and serves as a **base for subsidy applications**.