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BILBAO · 4 NOVEMBER 2026

Beyond Capture

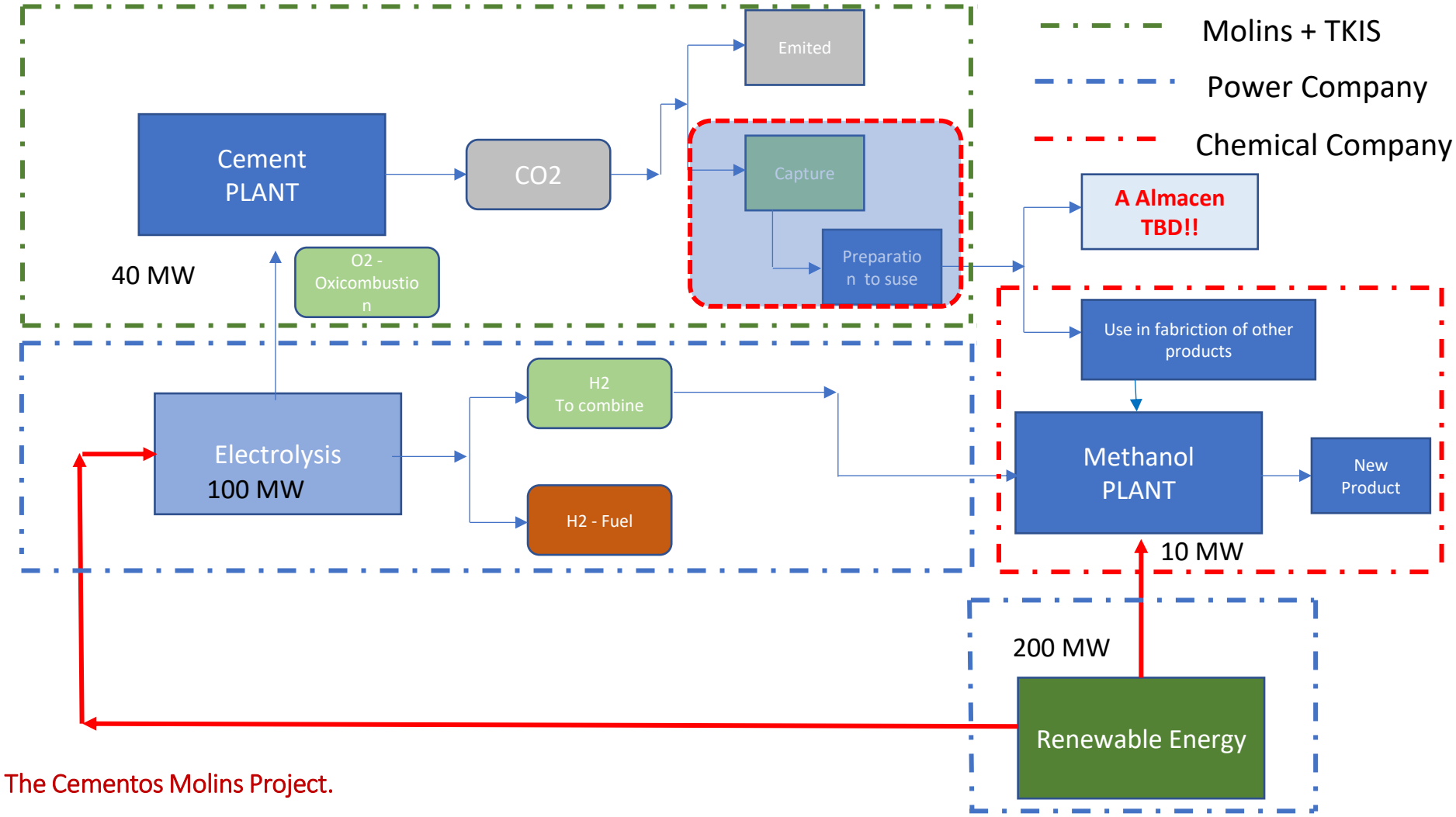
Aligning the CCS Value Chain for Cement Decarbonization

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Where we started in -2020/21 – Capture & use

BARCELONA GREEN: 10% capture And use to produce methanol



Cost of power
Power availability
RED III Directive

No off taker for methanol
No advantage in ETS

No solution for our decarbonization problem

The Cementos Molins Project.

Capture: the challenge we end with

MOSUSOL Net CO2 : A Joint project with ENAGAS & LINDE – 3RD ATTEMPT TO INNOVATION FUND

Advanced oxyfuel retrofit: ~97% capture at €133–141 per t CO_2 avoided (capture + transport)

Advanced oxyfuel ("1.5")

Polysius & VDZ

Oxyfuel kiln and burner
Bypass
Clinker cooler

SENER

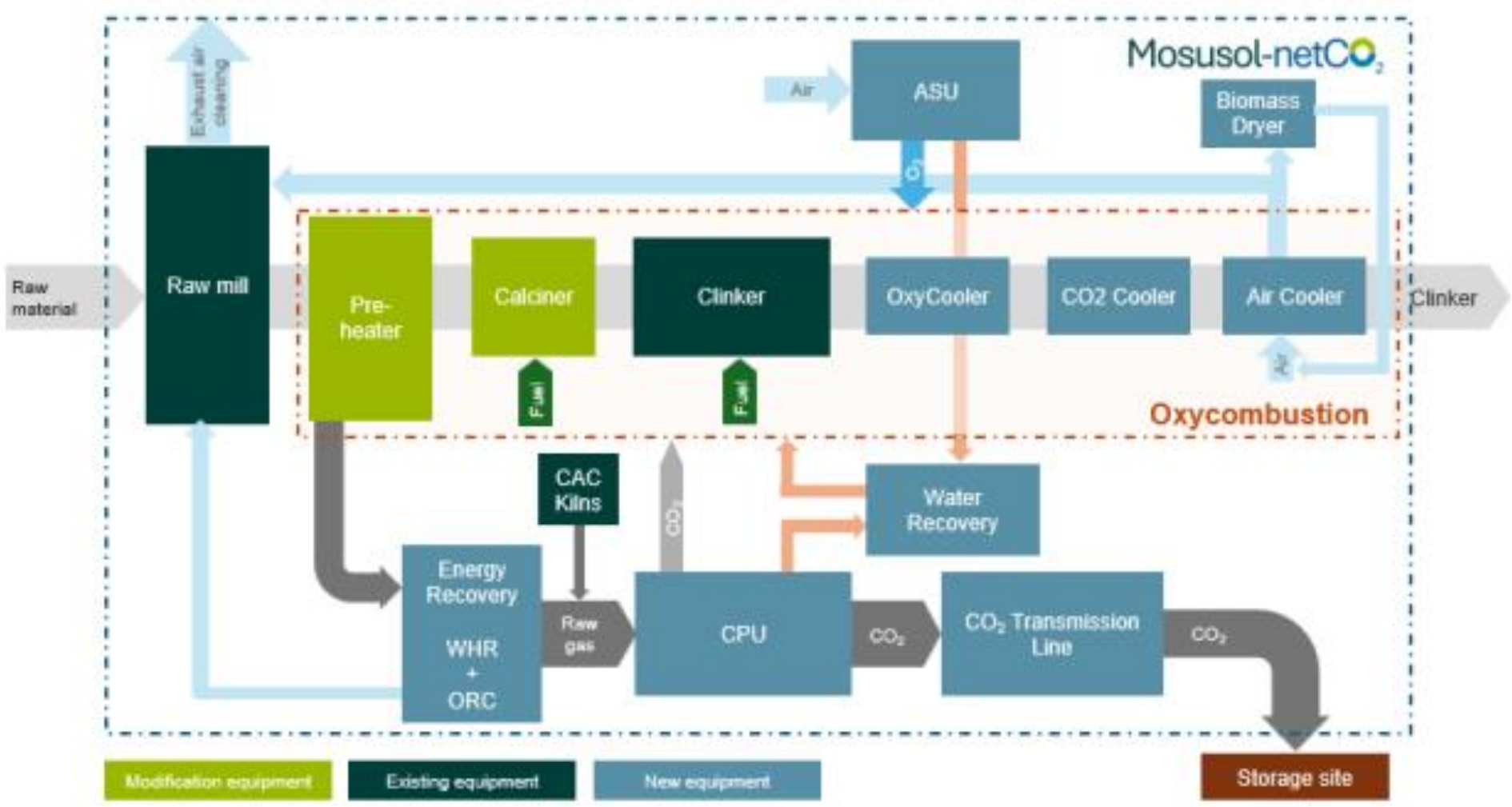
Water treatment plant
Waste heat recovery (ORC)
Biomass drying

Linde

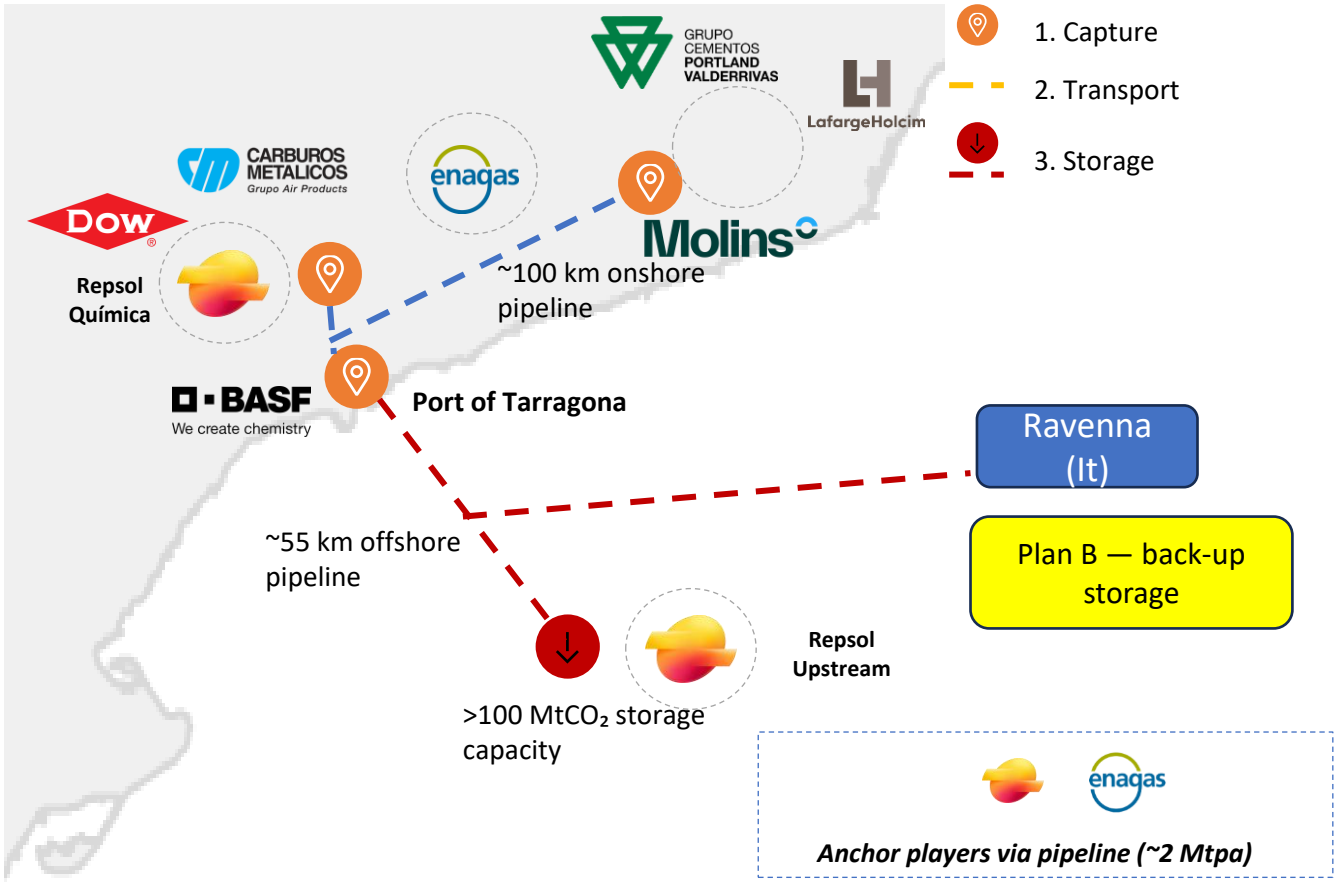
ASU (O_2): build-own-operate
CPU (99% CO_2): EPC + O&M

Enagás

Pipeline to TARRACO2



Transport and storage: the full chain



Capture of ~1.1 Mtpa at Molins Sant Vicenç dels Horts (Barcelona).

Transport infrastructure sized for up to ~4 Mtpa from chemical and cement emitters

CO_2 transport through a ~100 km dedicated pipeline to the Port of Tarragona (Enagás)

It can collect CO_2 from the petrochemical hub, joining the line over the last 15 km

Open-access, telescopic design ready for new emitters

From the Port, a ~55 km offshore pipeline to the TarraCO_2 saline aquifer (Repsol) for permanent storage

Net-zero cement: is there a premium?

Capture enables a new product — but the market will not pay for CCS

Captured and stored CO_2 turns our clinker into a net-zero product.

With >90% alternative fuels and ~23% biogenic CO_2, the plant becomes net-negative: 120% relative GHG avoidance.

A real differentiator for public works, flagship buildings and customers' Scope 3 targets.

The premium we assume

Conservative and declining

10% premium on ~28% of volume at start-up (2032).

Down to 5% by 2041 and zero by 2052, as competitors decarbonise.

Impact on the final building: only ~1–3% of its cost.

The reality check

Only ~5% of revenues

Green premium: ~€235 M over 20 years.

Versus €3.7 bn of avoided ETS costs and €1.2 bn of removal credits.

Lead markets and green public procurement would make the premium bankable.

Where the revenues come from

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Over 20 years, ~95% of revenues depend on carbon markets — not on the cement market

€3.7 bn

Avoided ETS costs

16.3 Mt fossil CO_2 stored; EUA from €150/t (2032) to €270/t (2052). ~72% of revenues

€1.2 bn

Biogenic CO_2 removals

4.9 Mt biogenic CO_2 stored and sold as removal credits at ~€240/t. ~23% of revenues

€0.24 bn

Green premium

Low-carbon clinker, cement and CAC. ~5% of revenues, fading to zero by 2052

Our main revenue is a cost we avoid. Its value is set by policy — which is why a stable, realistic CCfD is the cornerstone of bankability.

The uncertainty stack

Every price that decides the business case is still moving

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Viable only with public support *(indicative figures)*

Project IRR: 6% without grant vs. 9% WACC → 9.5% with the Innovation Fund grant; 7.5% in the low case. Most sensitive to ETS price, clinker output and CAPEX.

Key variables and their range (Business Plan, IF25)

CO_2 price (ETS)

€145/t in 2032 → €265/t in 2052 (base case). Cap, MSR and removals integration under review

Biogenic removals

~€240/t expected in 2032

No compliance market yet: depends on CRCF and ETS integration

Power

~0.42 MWh per t CO_2 captured; PPA offers between €45 and €95/MWh

CAPEX & OPEX

€780 M first-of-a-kind CAPEX; €3.3 bn OPEX over 20 years

Internal ToP for CAPEX

Storage fee

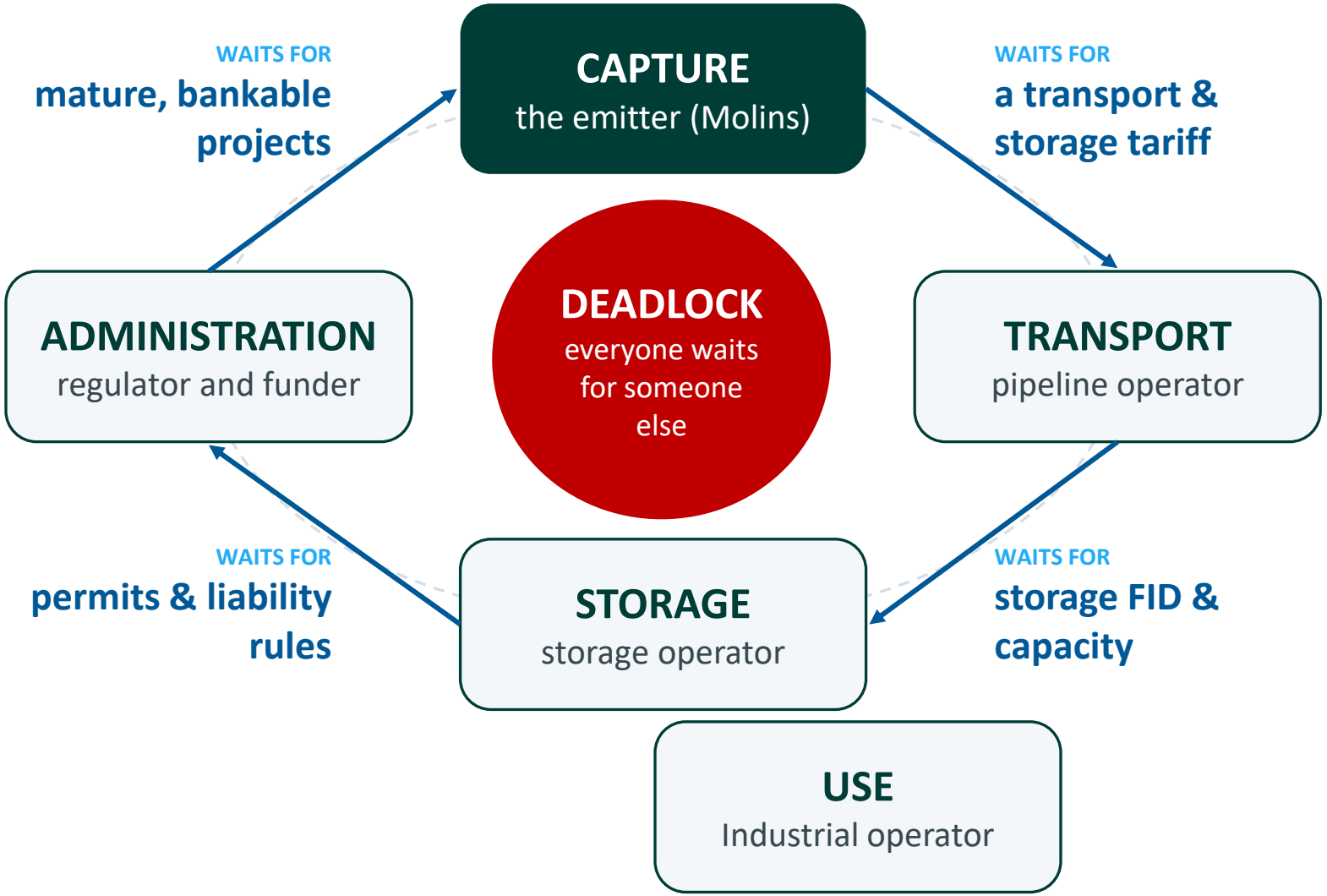
Whatever we assume now it can/will vary significantly in 4-5 years
We assume 49.5% of lifetime OPEX

Around 95% of revenues depend on carbon markets. A CCfD does not remove these uncertainties — it allocates them. That is why its design matters.

And the storage price — our largest operating cost — is still unknown at the moment we must commit to engineering.

MISSION IMPOSSIBLE?

Every link waits for another — and the loop never closes by itself



The deadlock

Everybody is rational — and everybody is waiting for somebody else.

No single company can break the loop alone.

…and CO_2 use adds a second loop

E-fuel producers need firm biogenic CO_2 and rules still being written. We learned it with methanol.

Who carries the risk?

Aligning the chain means sharing risk, not only signing MoUs

The real barrier is organisational

Capture technology is no longer the bottleneck.

Each link has its own business model, timeline and risk appetite — and none can reach FID alone.

Today the emitter carries most of the pre-FID risk: development costs are lost if any other link fails.

Sequencing investments and sharing risks along the chain is now the critical path.

Roles and risk exposure along the chain

EMITTER	Capture investment, exposure to ETS and markets, take-or-pay commitments. ***Carries the industrial and market risk***
TRANSPORT	Pipeline as infrastructure, remunerated by tariff. *Needs committed volumes*
STORAGE	Permanent storage and long-term liability. *Needs volumes and a stable fee*
OFFTAKERS & USERS	Low-carbon cement buyers, removal credit buyers, CCU (e-fuels). *Need firm supply — commit late*

The engineering trap

The logical chain that forces us to invest early — before any certainty

1

Revenues depend on the CCfD

The project's viability is tied to its strike price.

2

CCfDs are awarded by auction

To compete, operating costs must be known precisely.

3

That requires detailed engineering

Each technical option needs its own design to find the most competitive one.

4

…and all of it before FID

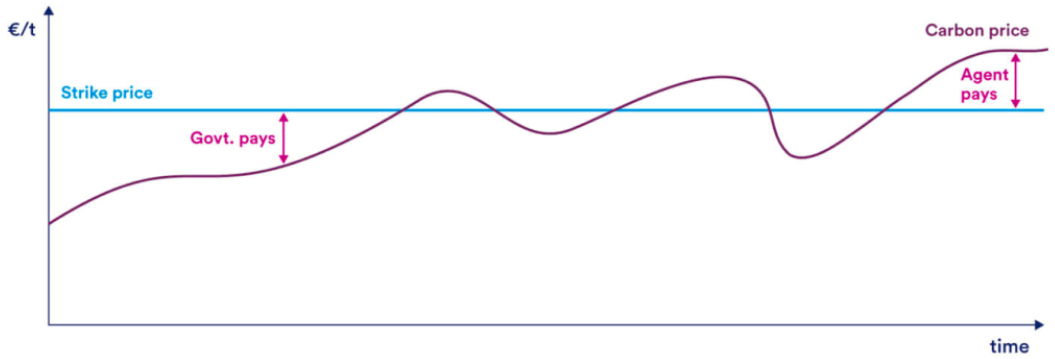
Large engineering costs incurred with no regulatory clarity yet.

The financing gap: the Innovation Fund alone cannot carry these early phases.

Pre-FEED and FEED concentrate ~€100 M of development spending (WP1 + WP2) when uncertainty is highest and revenues are not secured.

This is where public support makes the difference between a project that moves and one that stays on paper.

Under a CCfD the promoter bids a strike price covering OPEX and CAPEX; a public counterparty pays the gap to the ETS price each year — and the project pays back when the market is above it.
Setting that strike price requires knowing the cost of the whole value chain — storage included.



What the public administration must provide

Five conditions to turn a first project into a regional CCS hub

1. Early support for engineering

Co-finance pre-FEED and FEED — the phase before FID where viability is decided and where each public euro is most efficient. Compatible with the Innovation Fund under CISAF.

2. A stable and realistic CCfD

- Revenue certainty that banks accept:
  - Strike price reflecting full-chain costs, storage included.
  - Long enough duration and indexation to power and CAPEX.
  - Rules for biogenic removals and CO_2 use.

3–5. Infrastructure and territory

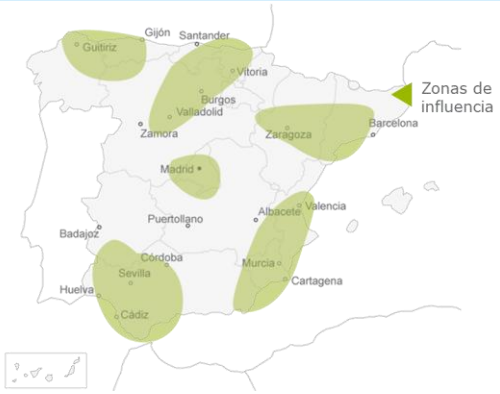
- 3. Transport & storage planning: open-access, regulated tariffs.
- 4. Faster permitting: NZIA strategic status.
- 5. Territorial support for a regional hub.

- Public co-investment where it cuts risk:
  - Shared CO_2 network
  - Gas conditioning
  - Grid & renewable power

A regional CCS hub Mission Possible… together

From a single project to shared infrastructure

Where emissions concentrate



37 empresas interesadas en **captura CO_2**

53 empresas interesadas en **infraestructura**

10,4 Mt/a Cantidad CO_2 a capturar

Enagás' 2023 call for interest showed:

- Catalonia represents ~20% of the interest in CO_2 infrastructure in Spain.
- Catalonia is Spain's second CO_2 cluster: ~8 Mtpa, of which ~5 Mtpa are hard to abate.

Enagás is developing CO_2 transport in several hubs — Bilbao with EVE, Asturias — plus a PCI for the northern hubs.

Models that already work

United Kingdom: succeeded because the State sequenced clusters, awarding capture plants and networks together.

Bilbao hub: EVE (Basque Energy Agency) takes part in the CO_2 transport network.

Storage: Plan A and Plan B

Plan A — Offshore Tarragona (TarraCO₂): storage close to the emitters cuts cost and secures the chain.

Plan B — Ship the CO_2 from a hub in Tarragona to storage in Ravenna (Italy), Prinos (Greece) or the North Sea.

A back-up, not an alternative: storing abroad adds +100–120% to transport and storage costs.

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THANK YOU

Mission possible — together

