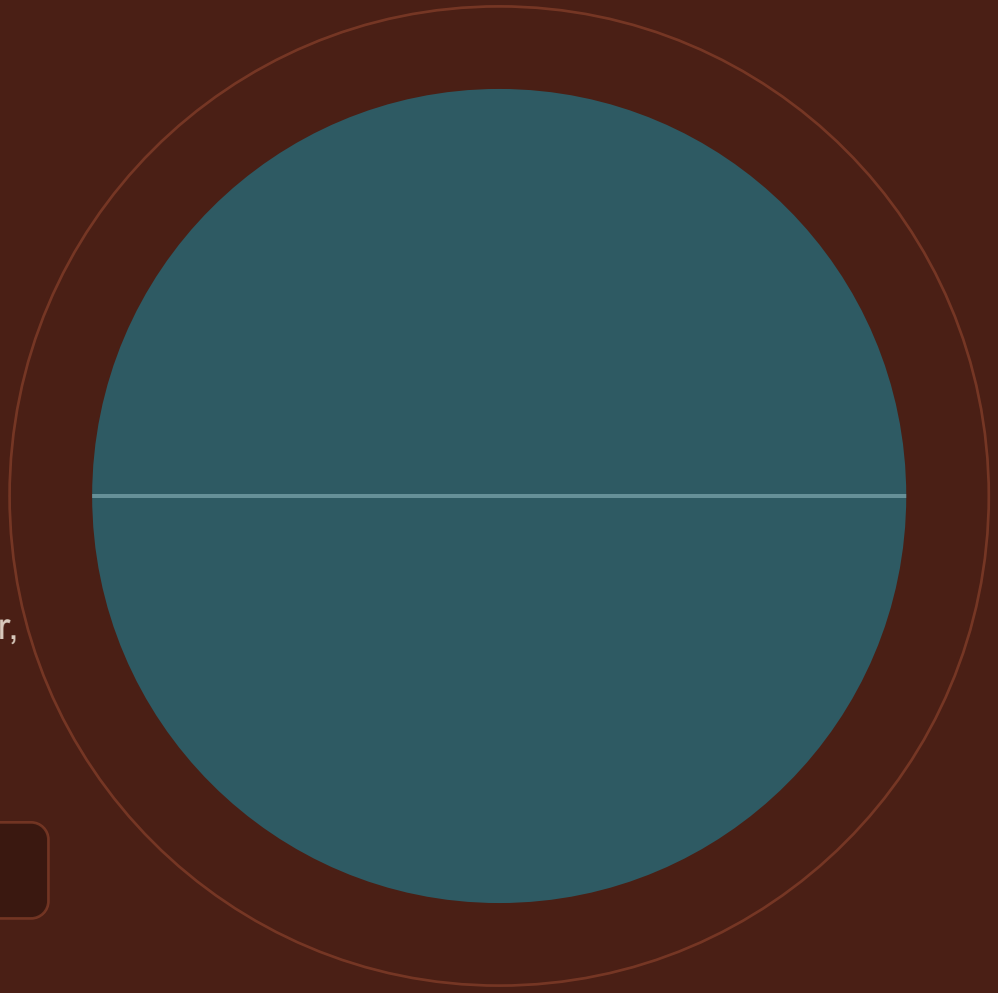
DIOXINK

CARBON STORAGE SOLUTIONS

Brussels, Belgium

A geopolymer answer to permanent CO_2 storage



Engineered subsea capsules that hold liquid CO_2 at 400–6,000 m depth: a modular, geology-independent path to gigatonne-scale storage.

- 400–6,000 m depth
- Self-sealing
- Impurity-tolerant
- Patented

Robert Masse · Speaker

Presented at Geopolymer Camp · dioxink.com · hello@dioxink.com

Who we are, and the gap we're closing.

DIOXINK · BRUSSELS

DIOXInk is a deep-tech company engineering subsea capsules that lock CO_2 away permanently. We started in Brussels in 2024, filed our first patents, and now coordinate a European research effort advancing the technology toward pilot readiness.

2024
Founded in Brussels

3
Patents filed

TRL 2
Advancing to TRL 4

THE PROBLEM WE'RE SOLVING

Permanent CO_2 storage has to scale enormously this decade, yet every established method depends on rare, specific geology and can't accept impure CO_2.

Most emitters are simply in the wrong place, with no good option nearby. DIOXInk makes storage you build to specification and deploy in any deep basin, close to where the CO_2 is captured.

Storage is the bottleneck.

Permanent CO_2 storage must scale roughly one hundred-fold by 2050. Subsurface injection cannot reach that scale alone, the geology required is rarely located where emitters operate.

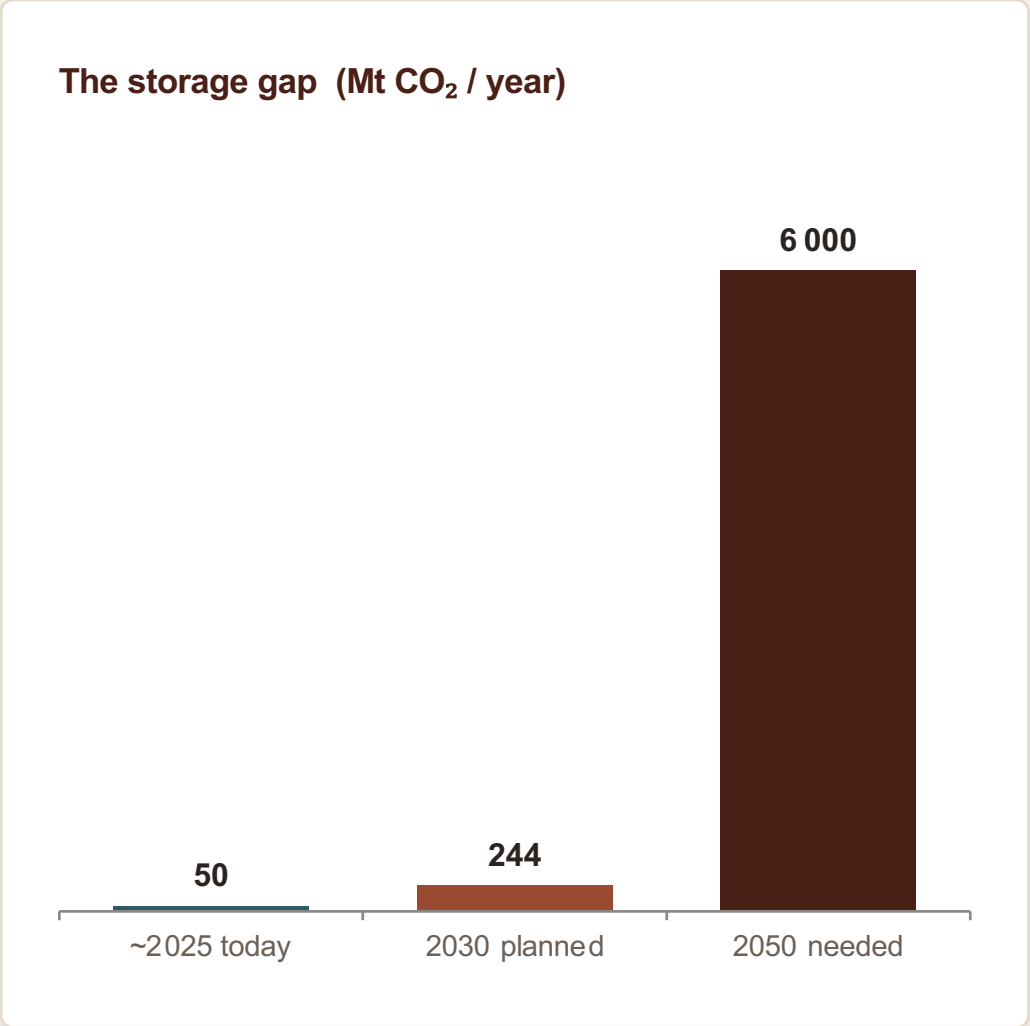
244 Mt planned for 2030

vs

6,000 Mt needed by 2050

Today's operating capacity (~50 Mt/yr) covers under 5% of 2030 targets. Suitable formations cluster in the North Sea and Norwegian shelf, stranding inland emitters, islands and DAC sites.

The alternative: build storage objects to specification, instead of searching for the right geology in the right place



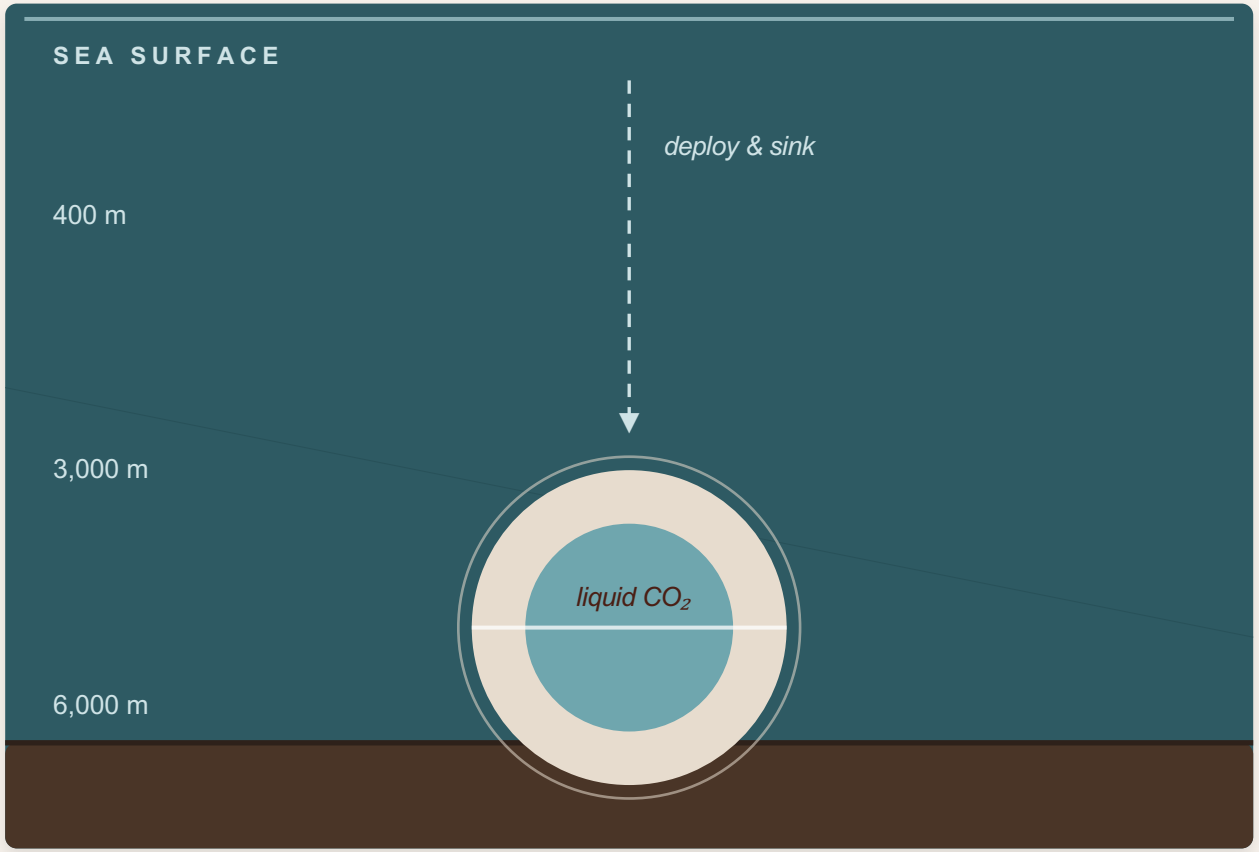
Every route today has a catch

Four established storage methods, and the constraint each one runs into.

Approach	The core issue today	Geology-free	Impurity-tolerant
Depleted oil & gas wells	Ageing well plugs, corroded by acidic brine	✗	✗
Deep saline aquifers	Injection can trigger earthquakes (Groningen, Pohang)	✗	✗
Sub-seabed injection	Precise placement; unproven beyond pilot scale	✗	✗
In-situ mineralisation	~25 t water per tonne CO_2; reactive basalt only	✗	–
DIOXInk capsule	Built to spec: manufacturing is the open frontier	✓	✓

Our solution, in place.

A sealed geopolymer capsule, filled with liquid CO_2 and set on the deep seabed: no reservoir, no pipeline, no purification.



1. **Geopolymer shell**

   A low-permeability, saltwater-resistant container that holds the CO_2.

2. **Pressure keeps it liquid**

   At 4–60 MPa the CO_2 stays dense and liquid: no buoyant gas pushing up.

3. **Self-sealing barrier**

   Any breach meets seawater and forms hydrates that re-seal from within.

4. **Geology-independent**

   Deployed in any deep marine or freshwater basin, close to the emitter.

Three principles, combined for the first time

Each principle has been studied independently in the literature. Integrating all three into a single deployable system has not been done before, and geopolymer chemistry is what makes it possible.

01

Geopolymer envelope

An aluminosilicate cement with recycled aggregates, engineered for low permeability and saltwater resistance. Compressive strength target above 40 MPa across the operating pressure regime.

02

Hydrate self-sealing

At depth CO_2 stays liquid. Any breach brings it into contact with seawater, forming clathrate hydrates that passively re-seal from within: a second barrier engineered in, not bolted on.

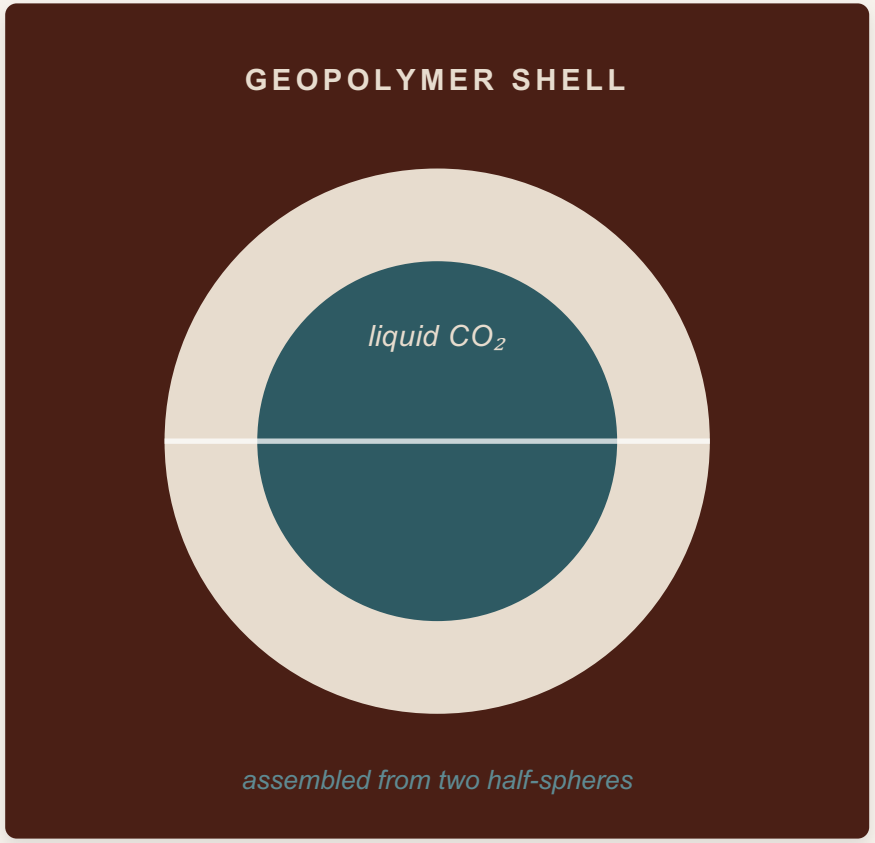
03

Impurity tolerance

Mechanically isolated from any pipeline or reservoir, the capsule stores post-combustion, DAC or biogenic CO_2 streams with no expensive purification step.

Built to specification

Two geopolymer half-spheres, assembled and filled with liquid CO_2 before deployment. Hydrostatic pressure keeps the contents liquid. Every parameter is set in advance.



Depth envelope	**400 – 6,000 m**
Pressure range	**4 – 60 MPa**
Operating temperature	**1 – 5 °C**
Shell material	**Aluminosilicate geopolymer + recycled aggregates**
Compressive strength	**Target > 40 MPa**
Form factor	**Assembled from geopolymer half-spheres**
Secondary barrier	**In-situ clathrate hydrate self-sealing**

A four-year path to TRL 4.

DIOXInk is developing the geopolymer capsule from Brussels, working with research collaborators across Europe on high-pressure validation, structural modelling and life-cycle assessment.

Currently at TRL 2, advancing to TRL 4 by 2030.

2024

TRL 1

Incorporated in Brussels. First 3 patents filed. Lab-scale tube prototypes tested.

2026

TRL 2 · now

Development programme underway. Research consortium forming.

2028

TRL 3

Reference geopolymer formulation locked. Proof of concept at lab scale.

2030

TRL 4

Container validated. Self-sealing demonstrated across the envelope. Full LCA.

2032

TRL 6

Demonstrator deployed at intermediate depth. First CO_2 batch stored under test.

The science is proven. The making is the frontier.

The formulation and physics are ours to solve. The open frontier is manufacturing: turning the geopolymer into large hollow half-spheres, reproducibly and at scale.

Moulding hollow half-spheres

Casting large-diameter, thick-section geopolymer half-shells with controlled curing and no through-porosity.

Seam & dimensional tolerance

Repeatable geometry so two half-spheres mate into a pressure-tight seam under deep-sea load.

Durable to spec

Low permeability, saltwater resistance and >40 MPa compressive strength held across every unit produced.

A route to scale

Scaling from one-off lab prototypes to the high-volume, repeatable production that gigatonne-scale storage will require.

This is exactly the kind of problem the geopolymer community is built to solve.

From validated capsule to storage at scale.

What's in place today

3 patents filed (PCT extending)

Covering the capsule shape and operating principle — a protected foundation to build on.

Development programme & consortium

A four-year roadmap to a validated capsule, with research collaborators across Europe.

Formulation & application lead

The geopolymer mix design, thermodynamics and end-application feasibility are ours.

The piece that turns it into product

A manufacturing route for the geopolymer spheres. We're keen to learn from, and eventually work with, teams who can bring:

- Geopolymer moulding and curing of large hollow forms
- Precision forming and unit-to-unit quality control
- A credible path from prototype to series production

If that sounds like your world, we'd love to talk while we're here.

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Let's talk geopolymer

We're always glad to compare notes with anyone working on geopolymers, moulding and long-term durability. Come find us at the Camp.

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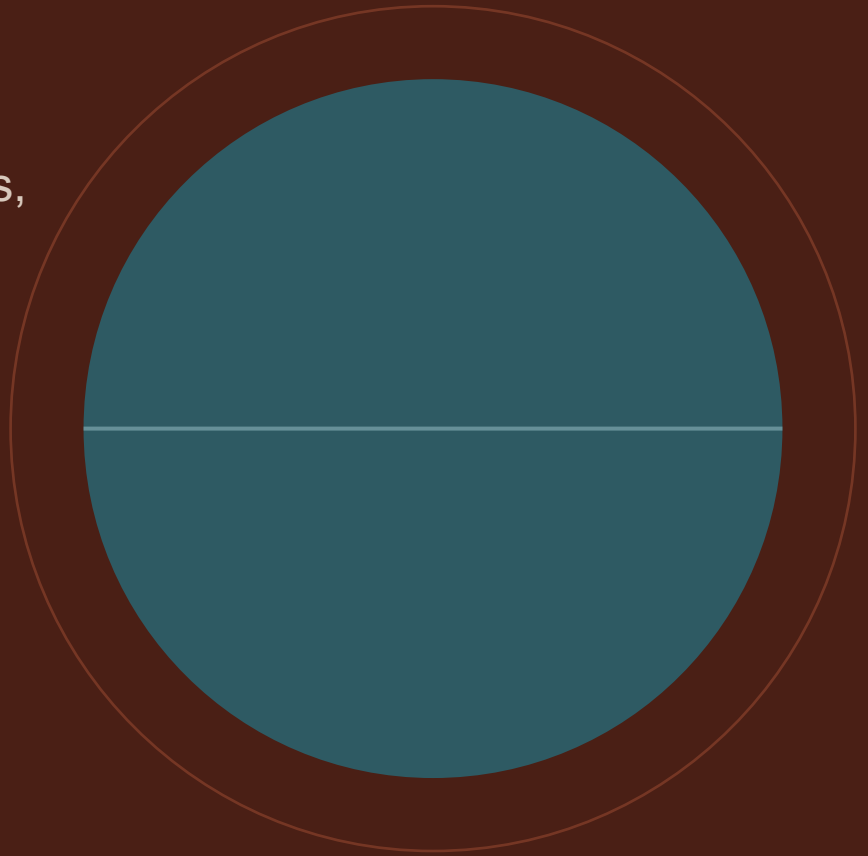

Permanent CO_2 storage · Brussels · toward TRL 4