The Coda Terminal and the Future of Geologic CO_2 Storage via Rapid Mineralization

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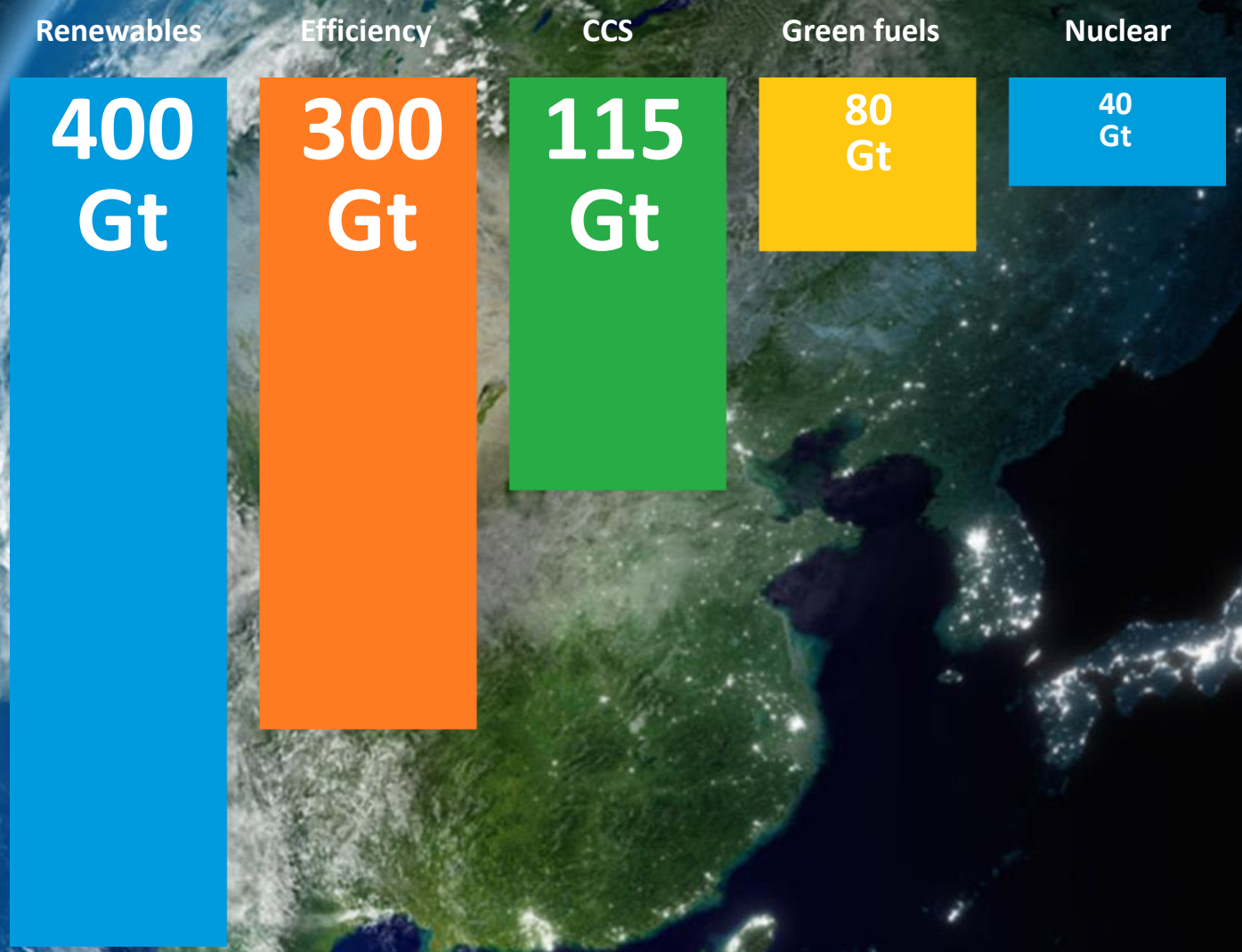
BALTIC CARBON FORUM 2021

Carbfix

Climate goals will not be met without widespread carbon capture and storage



Emission reductions required by 2060
IEA: Exploring Clean Energy pathways: The role of CO_2 storage 2019

Basalts and other reactive rock formations

CO_2 dissolved in water

Solid carbonates

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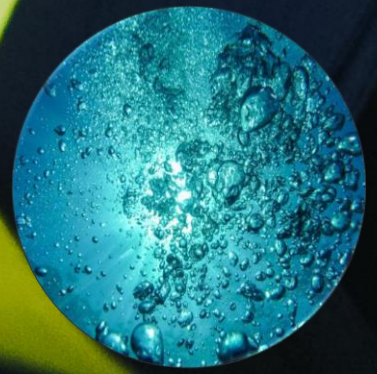


=

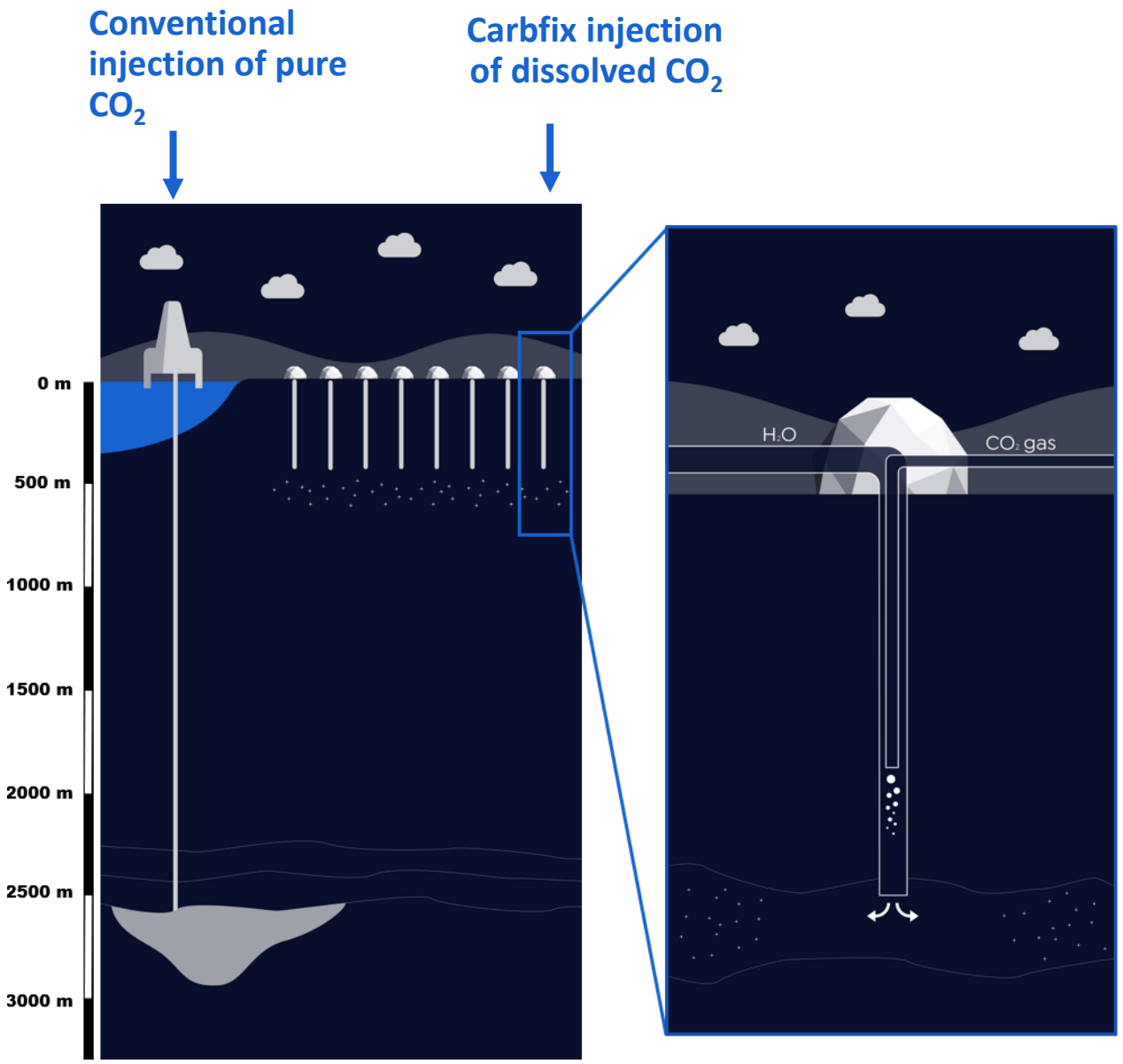
$CaCO_{3\,(s)}$
$MgCO_{3\,(s)}$
$FeCO_{3\,(s)}$

$Ca^{2+}, Mg^{2+}, Fe^{2+}{}_{(aq)}$

$CO_3{}^{2-}{}_{(aq)}$

Carbfix

Carbfix captures CO_2 and turns it into stone underground in under two years through proprietary technology that imitates and accelerates natural processes, providing a permanent and safe carbon storage solution.

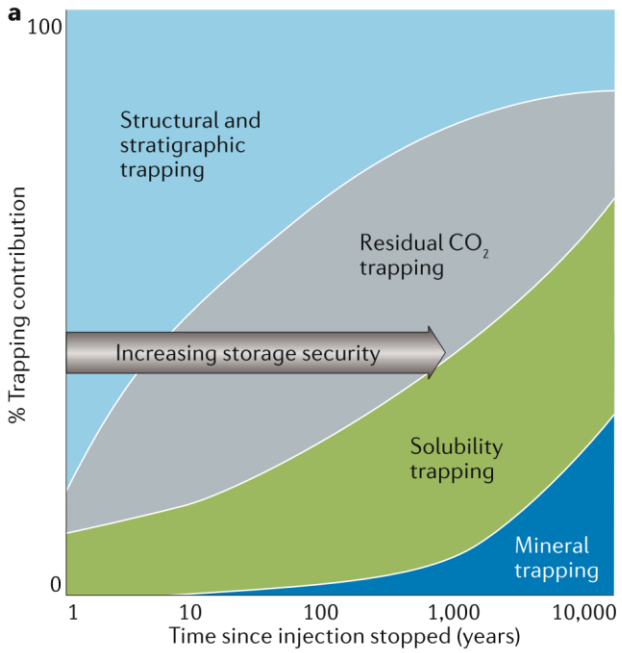


Unique about mineral storage

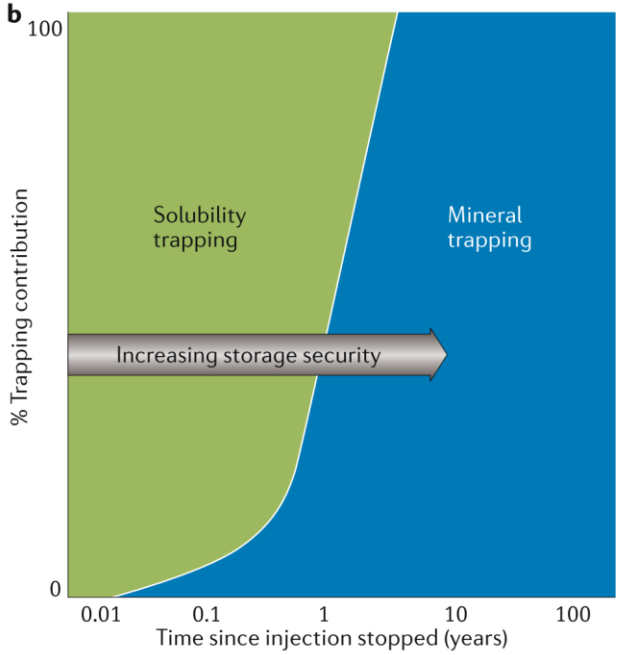
- **Safe:** risk of leakage is fully eliminated by dissolving CO_2 in water
- **Cheaper** than alternative solutions, lower up-front capital costs and risk
- **Environmentally friendly:** imitates and accelerates nature's way of storing CO_2 in rocks
- **Permanent:** minerals are stable for thousands of years limiting the need for long-term monitoring
- Built on firm **scientific foundation** and robust monitoring campaigns
- **Highly flexible** and modular with respect to capture technology, injection strategy and up-scaling
- High level of **public acceptance**

Unique about mineral storage

Conventional injection of pure CO_2



Carbfix injection of dissolved CO_2



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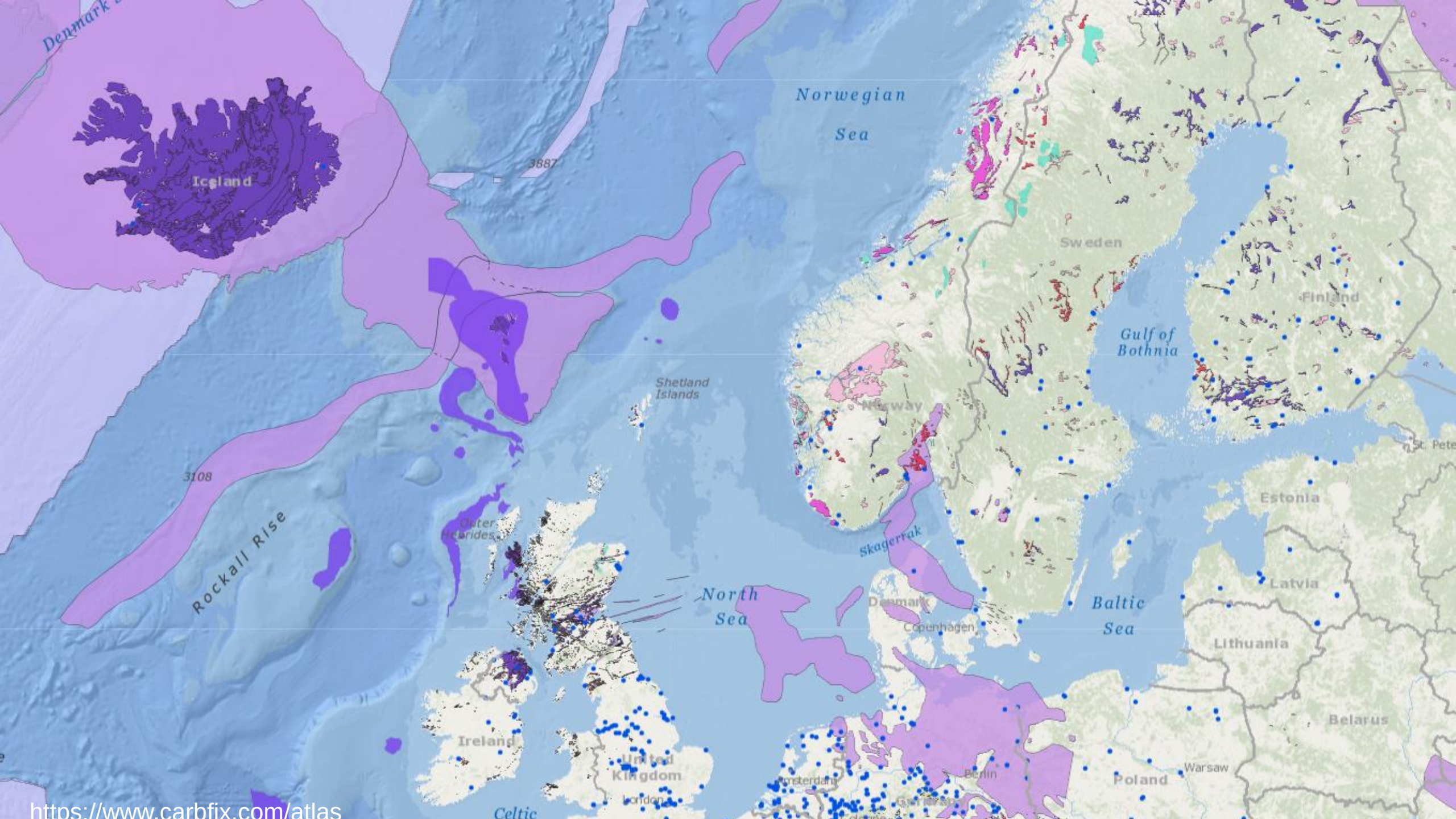
Unlocks large regions where CCS has not been considered possible

https://www.carbfix.com/atlas



https://www.carbfix.com/atlas

Carbfix

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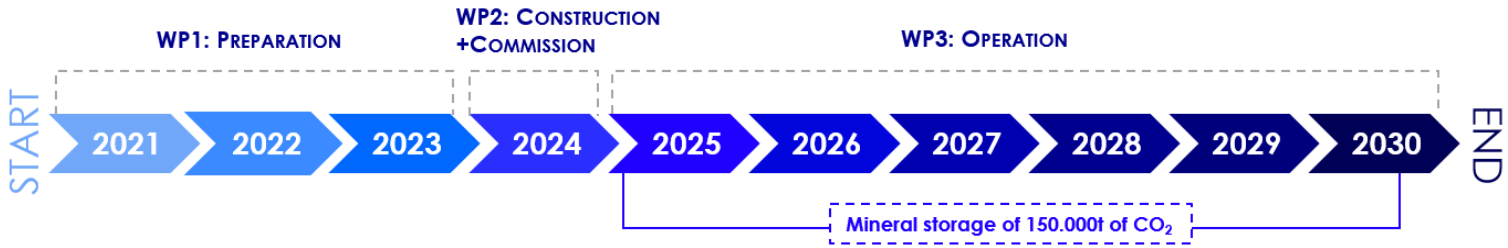
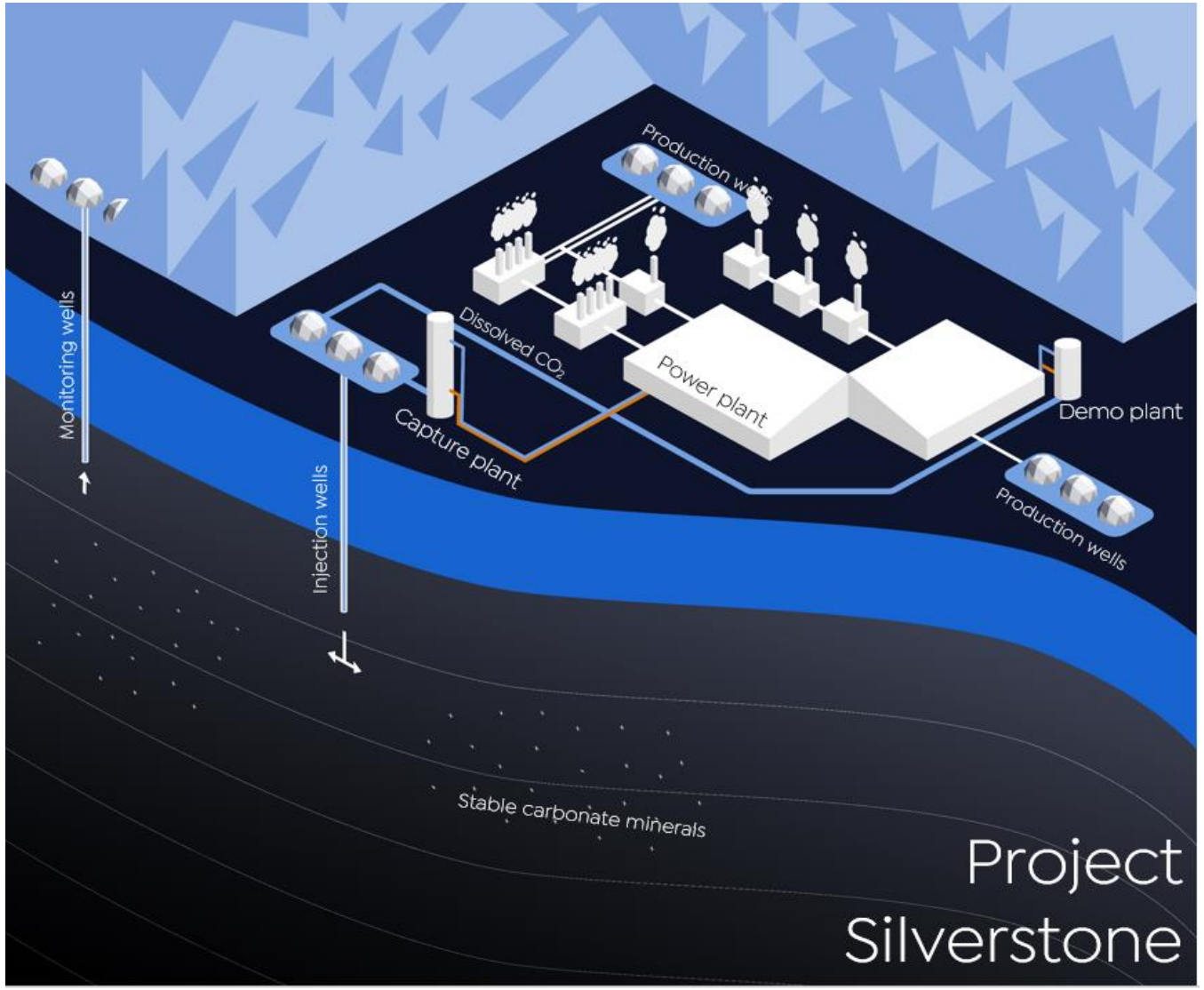


Project Silverstone

- Already injected >70 ktCO_2 since 2014
- Full scale (95%) capture and storage planned in 2025
- Selected as Innovation Fund small-scale project
- Design and construction of new CO_2 optimized capture plant
- Total cost 8 million EUR
- Expected to run the entire CCS chain at 27 EUR/tonne



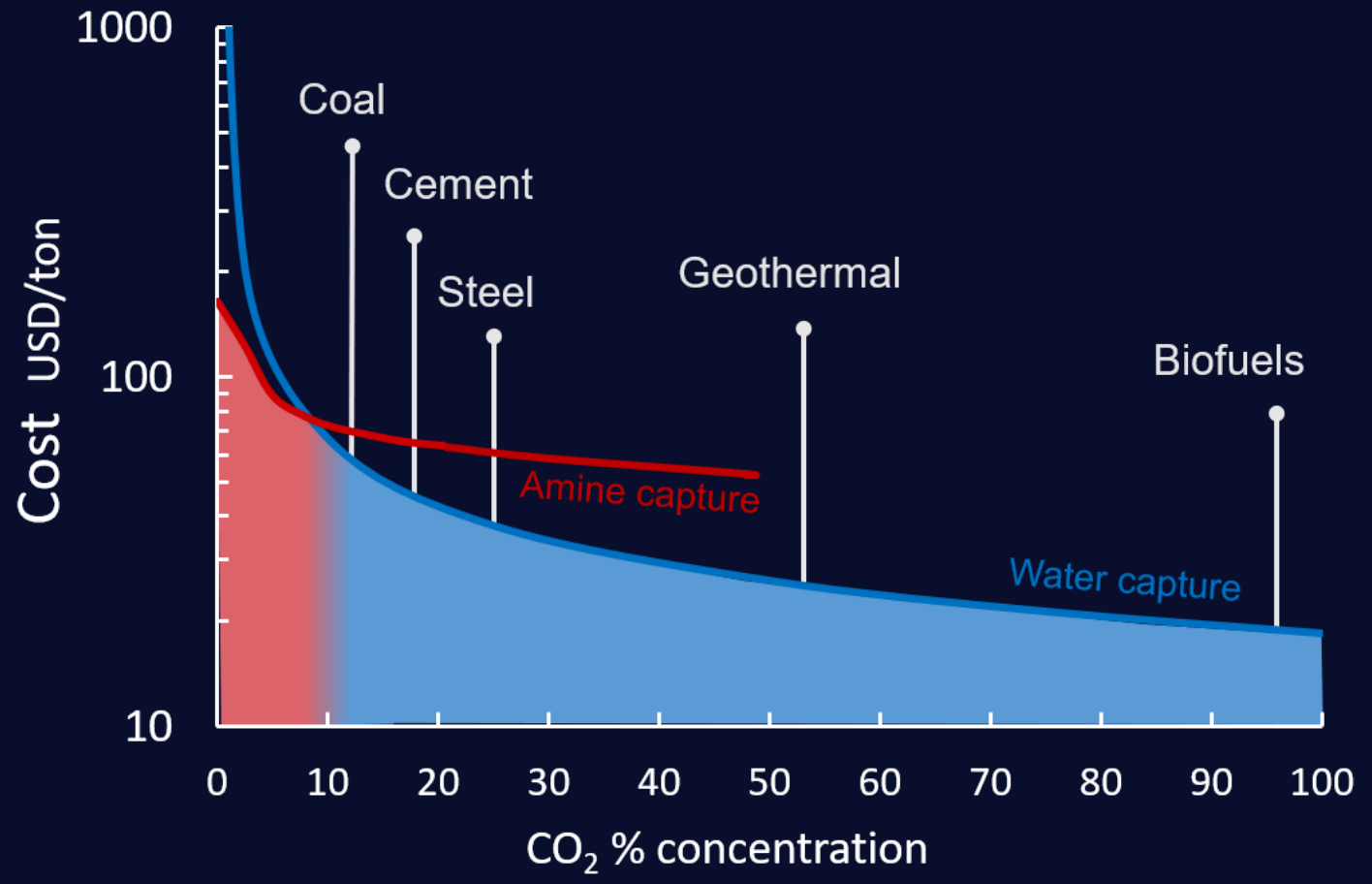
INNOVATION FUND

Carbfix

ON POWER

Carbfix

On-site capture and storage at industrial facilities



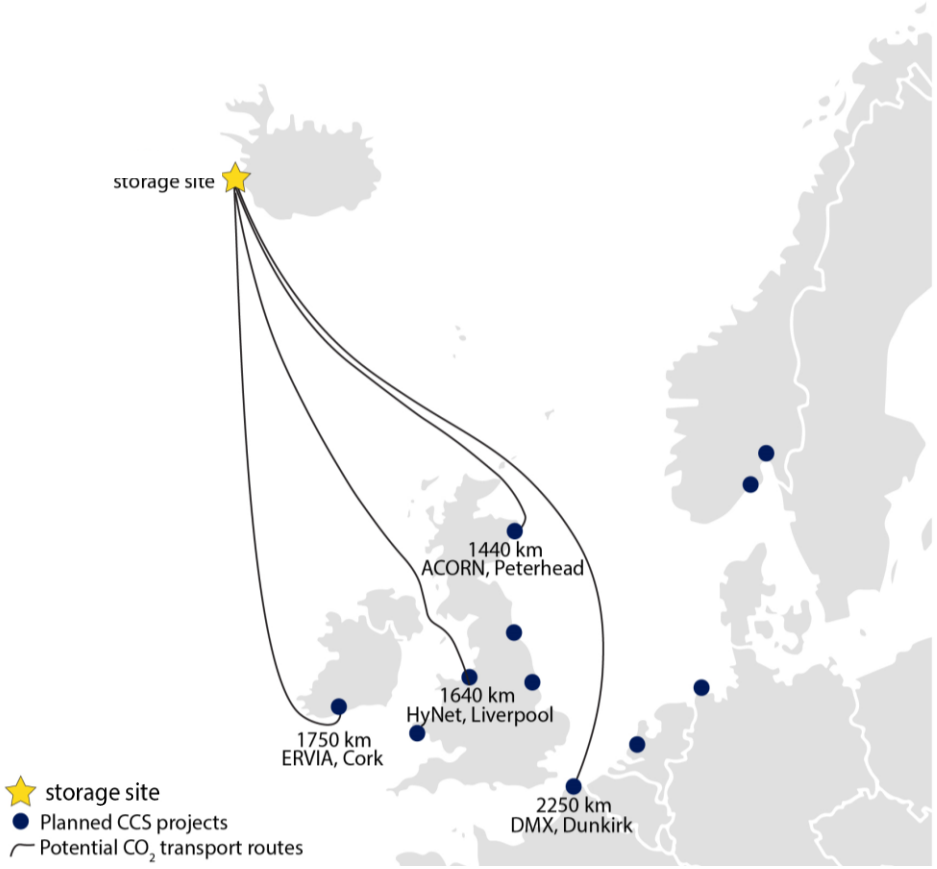
First commercial direct air capture and storage chain

Carbfix

4000 tCO_2/yr capacity
Injected to 400-2000m depth
Mineralization verified using chemical tracers

CODA TERMINAL

A highly scalable, cost effective, CO_2 mineral storage hub

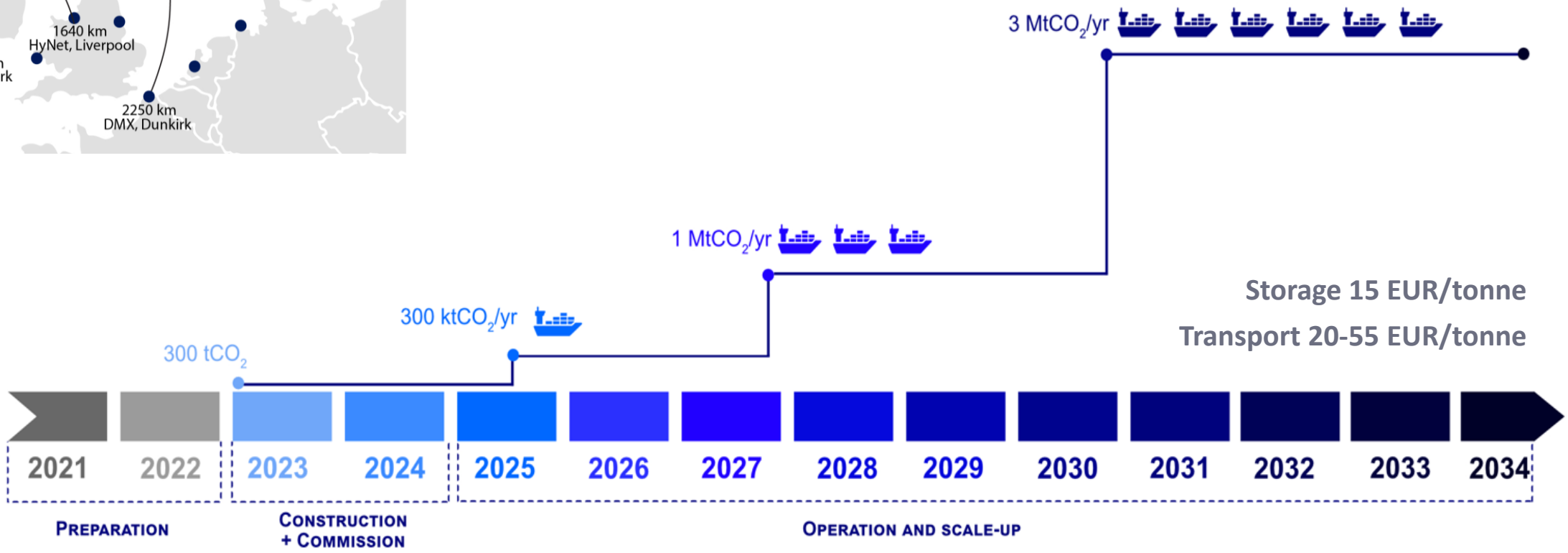


Low-cost storage makes longer transport leg feasible

Low energy requirements

Onshore multi-well operations lowers risks

ETS-deductible under the EU CCS directive adopted by the Icelandic parliament



Storage 15 EUR/tonne

Transport 20-55 EUR/tonne

Carbfix

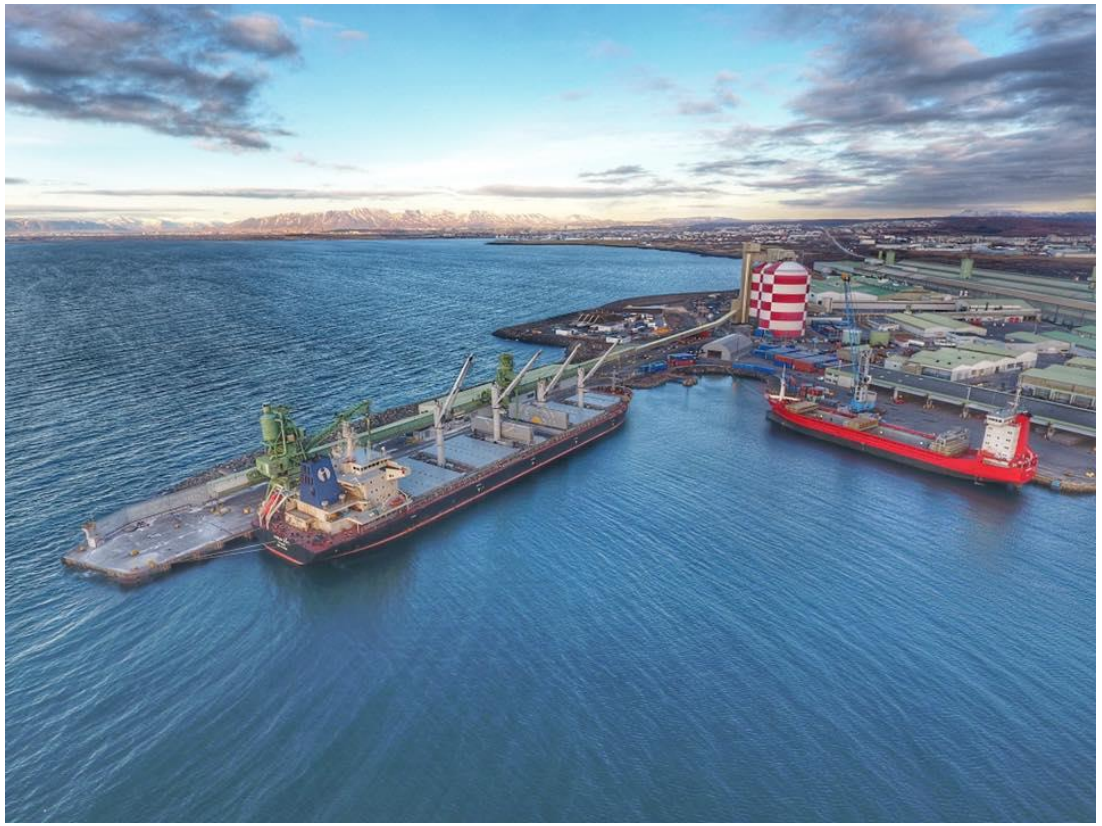
Storage site

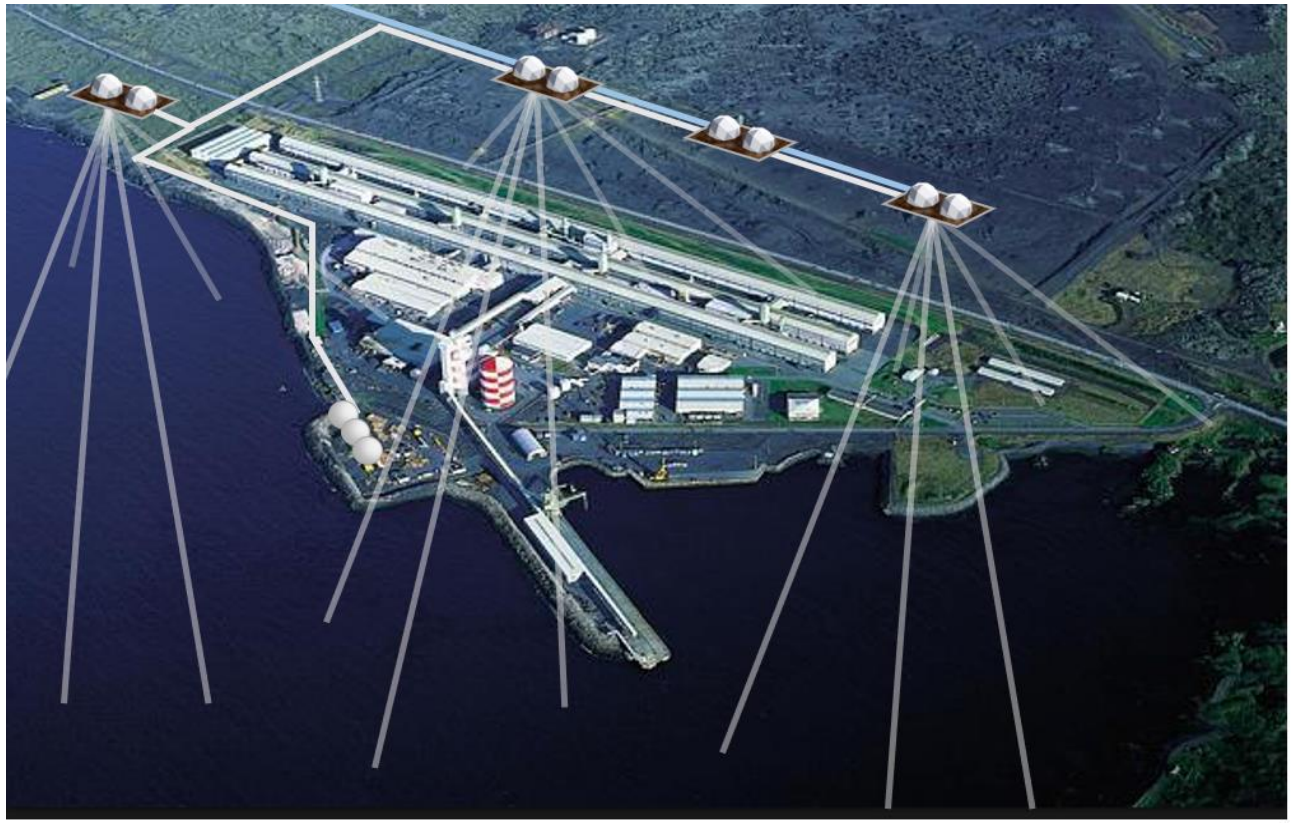
EIA process started

Currently in FEED

Drilling starting in 2022

Full local support





Shipping partner is DanUnityCO_2 will commission and operate CO_2 carriers

Low emission - methanol-fuelled

DAN-UNITY CO_2

Iceland storage capacity: ~2500 Gt

Iceland is almost entirely made out of volcanic basalt.

The youngest formations lie along the rift zone from SW to NE

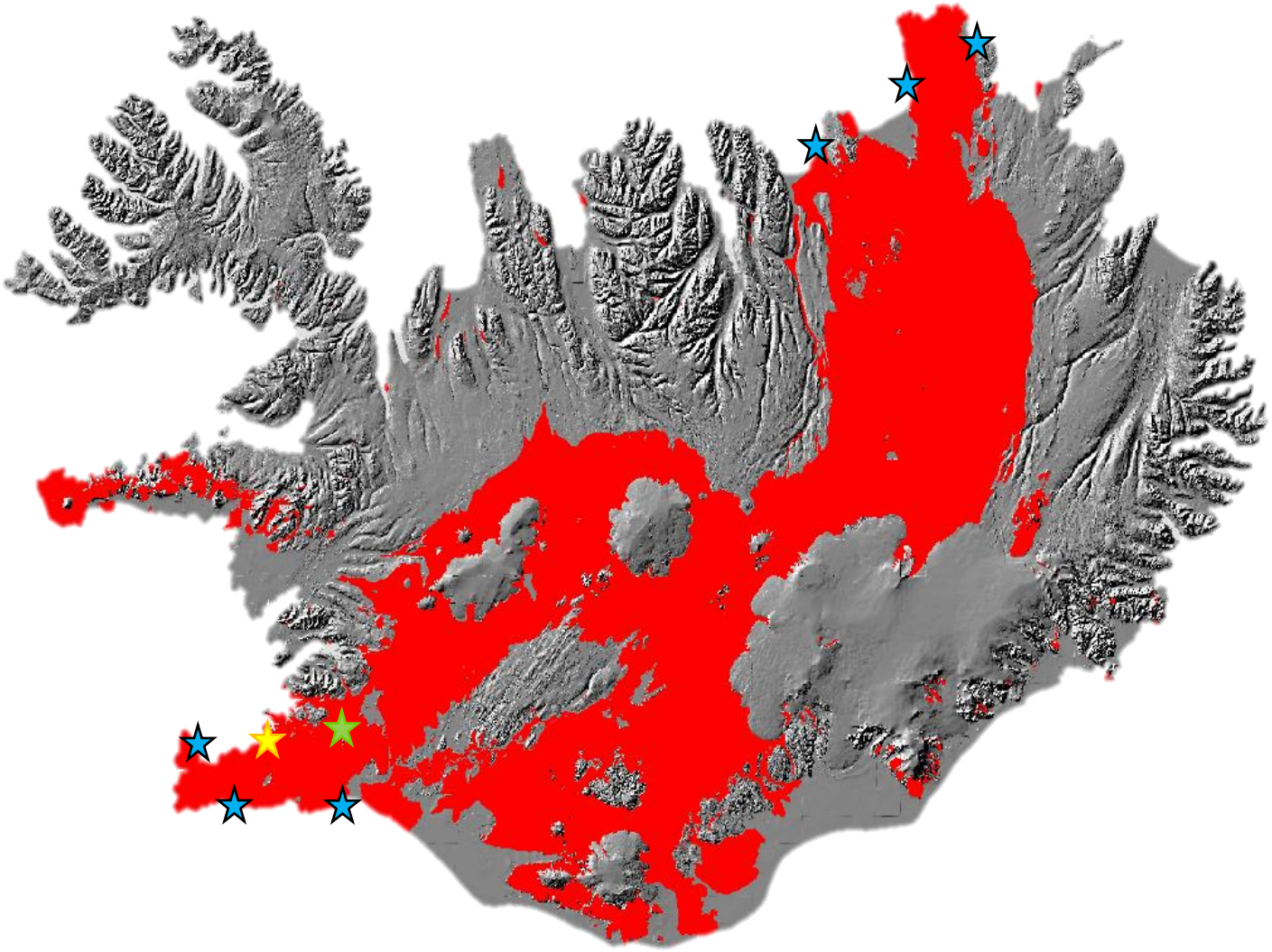
These are the most permeable and chemically favourable

Young basaltic formations

Existing harbor facilities

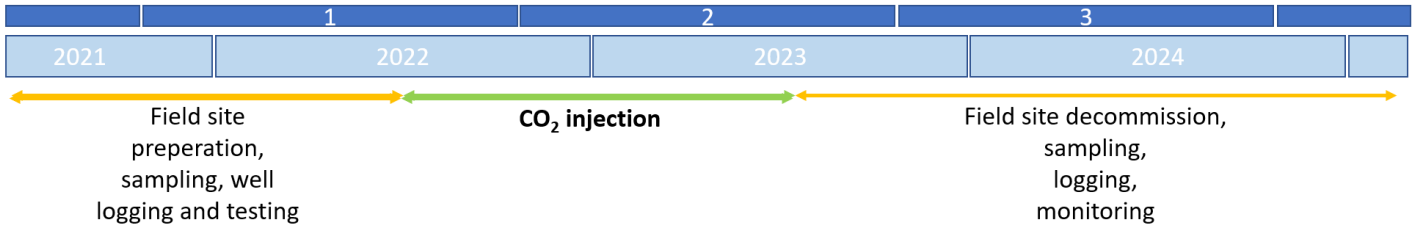
The Coda Terminal

Hellisheidi geothermal power plant & Carbfix demonstration site



Setting the stage for offshore mineralization

- The validation of using seawater instead of fresh water will unlock large regions in the world where water is a scarce resources
- Field scale injection of seawater-dissolved CO_2 in 2022
- CO_2 will be captured and transported from Switzerland.



An experimental study of basalt–seawater–CO_2 interaction at 130 °C

Martin Voigt [a,*], Chiara Marieni [b], Andre Baldermann [c], Iwona M. Galeczka [a,d], Domenik Wolff-Boenisch [e], Eric H. Oelkers [a,b], Sigurdur R. Gislason [a]

Mineralization potential of water-dissolved CO_2 and H_2S injected into basalts as function of temperature: Freshwater versus Seawater

Chiara Marieni [a,*], Martin Voigt [b], Deirdre E. Clark [c], Sigurður R. Gíslason [b], Eric H. Oelkers [a,b]

Carbfix lab experiments validate effective CO_2 mineralization in seawater

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Turning CO_2 into stone

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