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The Value of Negative Emissions: How Bioenergy Carbon Capture and Storage (BECCS) could realize the Paris Agreement targets

Biomass PowerON 2023

Implement Consulting Group • 11-12 October

TODAY'S SPEAKERS

Ulrik Jacobsen

Partner with 20+ years of experience. Specialized in sustainability strategies & development of greens energy assets.

Kristoffer Jensen

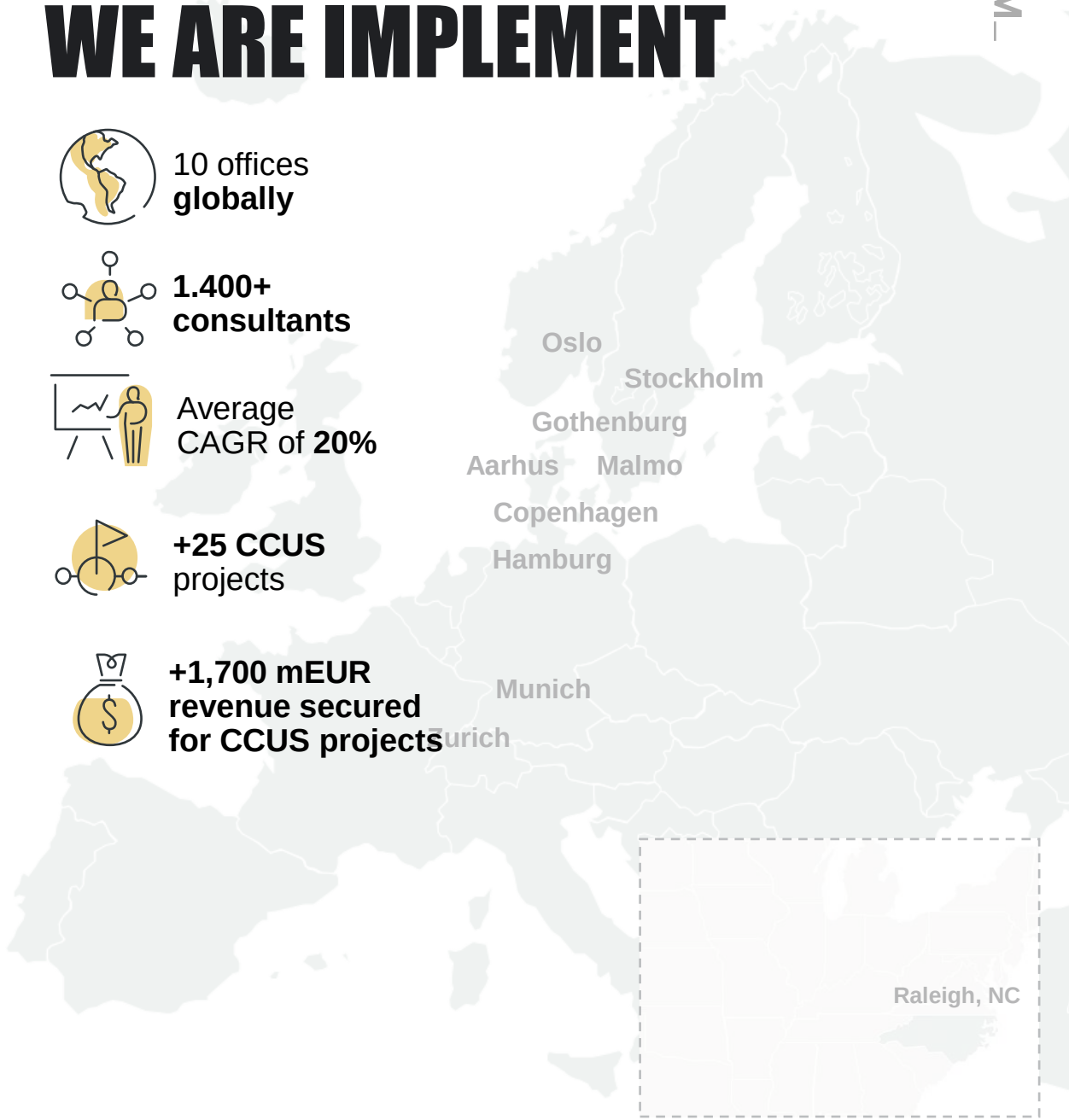
Senior consultant with 10+ years of experience. Specialized in BC modelling, regulation, standards and trading of negative emissions credits.

FOCUS IN OUR SESSION

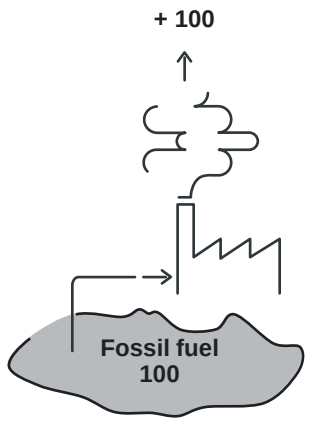
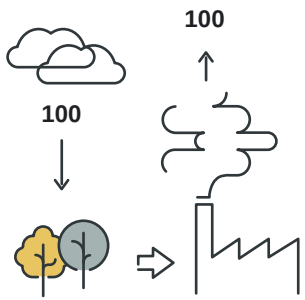
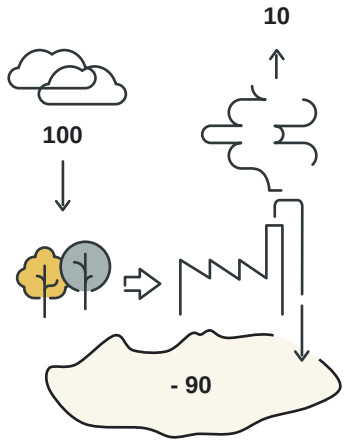
- Why the world needs BECCS to reach our **climate ambitions**?
- What are the large emitters **incentives for BECCS** incl. sales of negative emissions?
- What are the **Value of Negative Emissions** - status, trends, and projections for the voluntary carbon market?

WE ARE IMPLEMENT

- 10 offices **globally**
- **1.400+ consultants**
- Average CAGR of **20%**
- **+25 CCUS** projects
- **+1,700 mEUR revenue secured for CCUS projects**



Negative emissions happen when CO_2 from the atmosphere is captured and stored permanently

Carbon positive	Carbon neutral	Carbon negative
		
Fossil fuel without CCS	Biomass without CCS	Biomass with CCS

Definition

> Carbon dioxide removal (CDR) refers to the process of removing CO_2 from the atmosphere. Since this is the opposite of emissions, practices or technologies that remove CO_2 are often described as achieving "**negative emissions**".
>
> **IPCC**

Examples of negative emissions

Forestation

Enhanced weathering

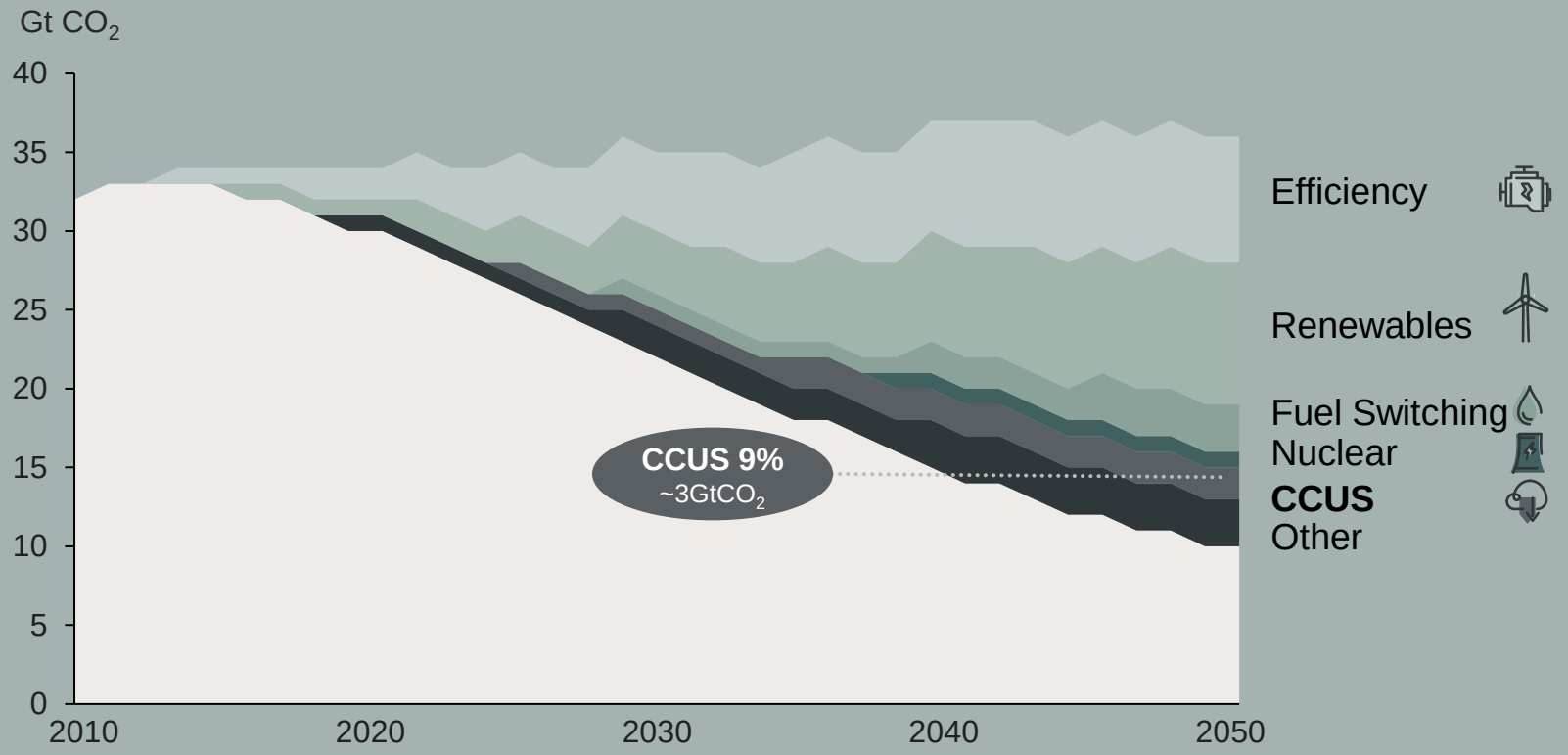
Biochar

Bio-energy carbon capture and storage (BECCS)

Direct air carbon capture and storage (DACCS)

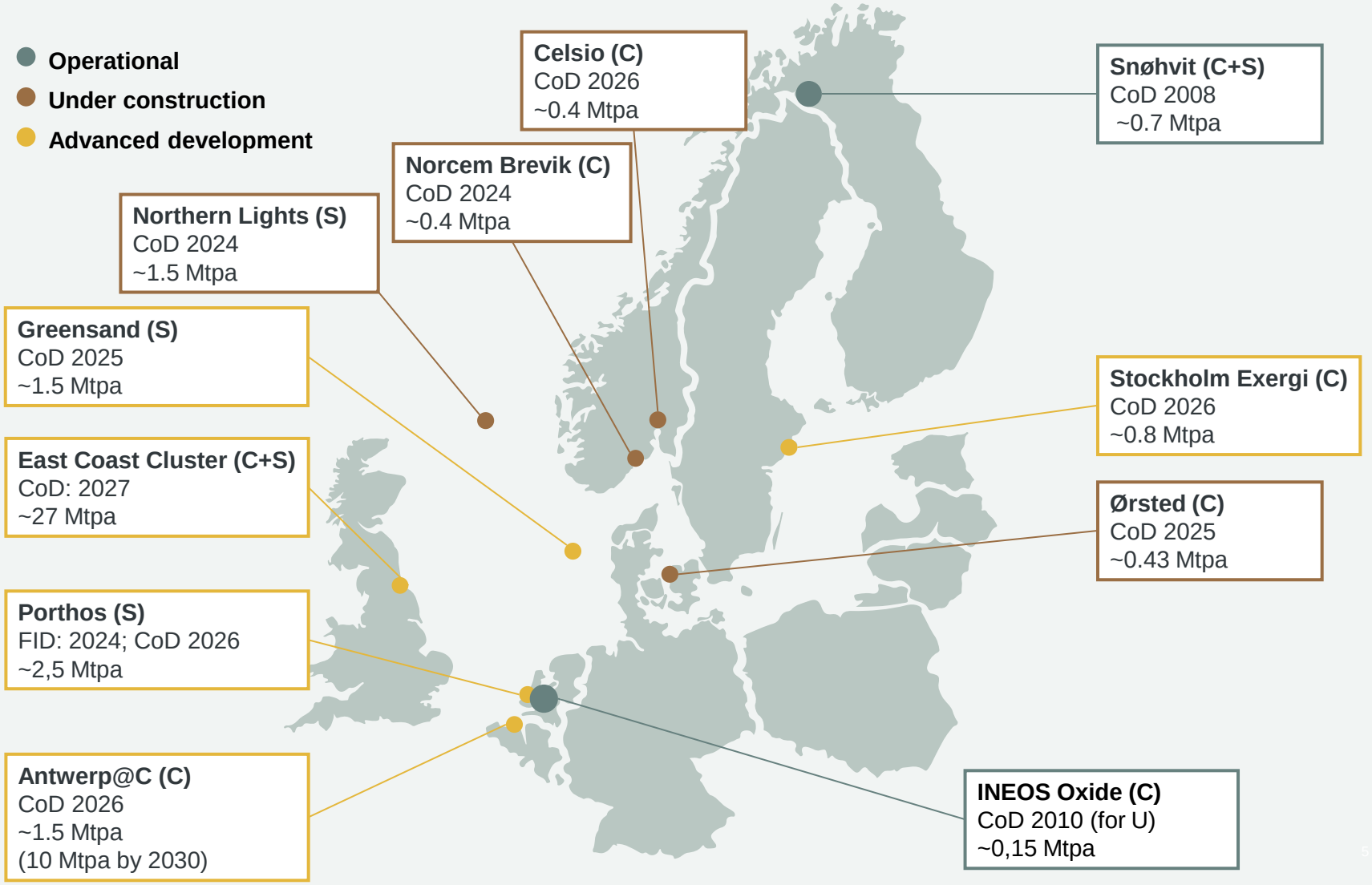
Carbon capture is indispensable for reaching the Paris Agreement's 1.5°C target

According to the IEA 9% of all CO_2 reductions to reach the Paris Agreement target are expected to come from CCUS



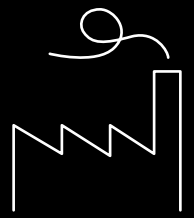
CCS is already proven…

In Northern Europe alone several projects are operational or have CoD in next years

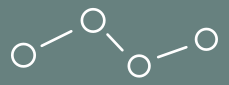


Revenue streams for CCUS can be grouped into four overall categories

Fossil Share



Biogenic Share



EU ETS AND OTHER CO_2 PRICES

- Incentive to reduce fossil-based carbon emissions, e.g. through CCS.
- National CO_2 taxes will supplement or add to the incentives created by the ETS.

PUBLIC FUNDING

- The EU Innovation Fund's key source of public funding to CCS projects (provided funding for 6 CCS projects the past two rounds – 11 projects with CC).
- National schemes under way, e.g. in Sweden (reverse auction) and Denmark (direct subsidy).

VOLUNTARY CARBON MARKET

- A marketplace for voluntary trades in climate projects.

SALE OF PHYSICAL CO_2

- Developers of e.g. e-methanol or other applications are willing to pay for the physical CO_2 as a feedstock in their production.

The voluntary carbon market is a bilateral market, where intermediaries typically facilitate transactions of carbon certificates

Buy-side ⟶ **Sales-side** ⟵ **Supply-side**

Corporates

Organisations or individuals wanting to offset their carbon footprint by buying carbon credits.

Key players include:

- Microsoft
- Google
- Unilever
- JP Morgan
- Stripe

Intermediaries & brokers

Intermediaries facilitating transactions of carbon credits between project developers and end buyers.

Key players include:

- Southpole
- Klimate.Co
- Puro.earth
- 3Degreesinc
- Carbonfund
- Climatepartner
- MyClimate

Exchanges

They enable the trading of carbon credits by providing online platforms, matchmaking services, and financial transaction management.

Key players include:

- TVCM
- Carbon trade exchange

Governance

Provide guidance through principal frameworks and endorse compliant standards or corporates with quality labels.

Key players include:

- VCMI
- ICROA

Standards & registries

Third party organisations that certify carbon offsets to ensure credibility and standardisation of carbon credits.

Key players include:

- Verified Carbon Standard (Verra)
- The Gold Standard
- Puro.earth

Project developers & aggregators

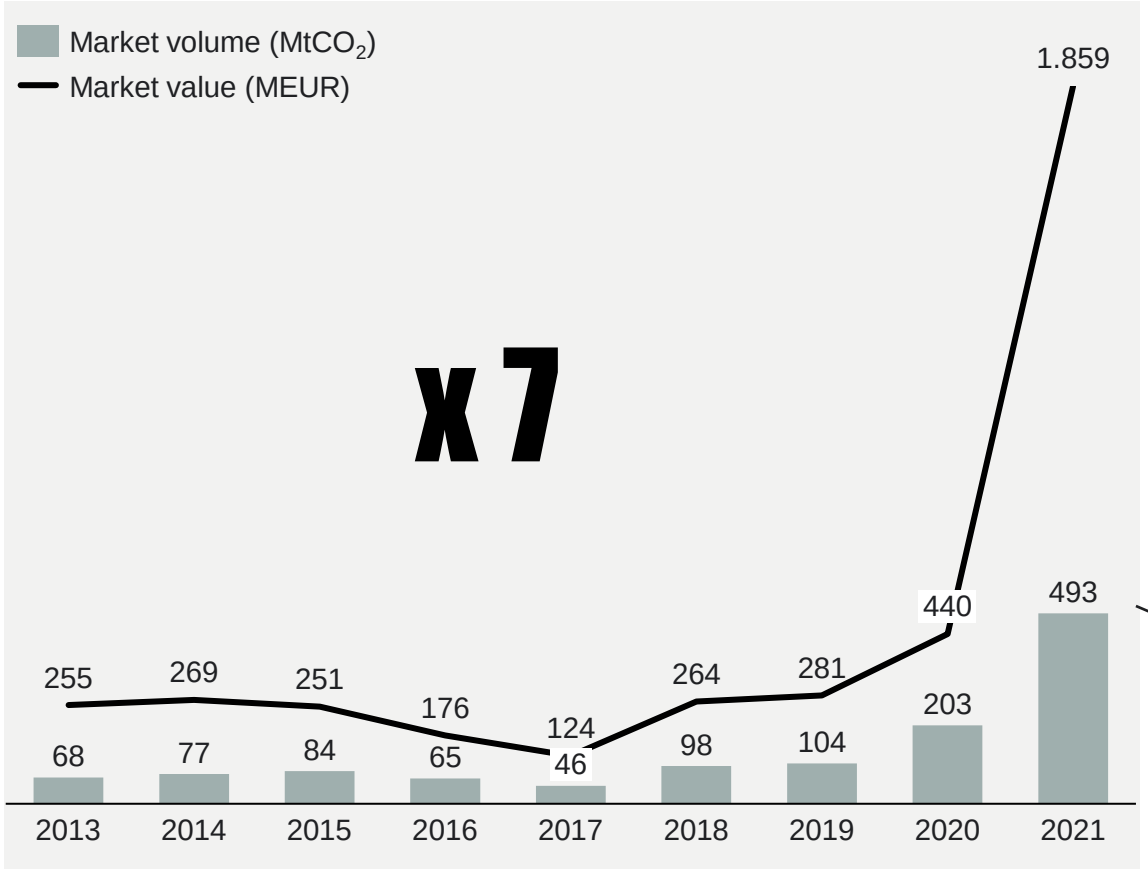
Project developers execute carbon offset projects, to create carbon credits that can be sold to another party.

Project types examples:

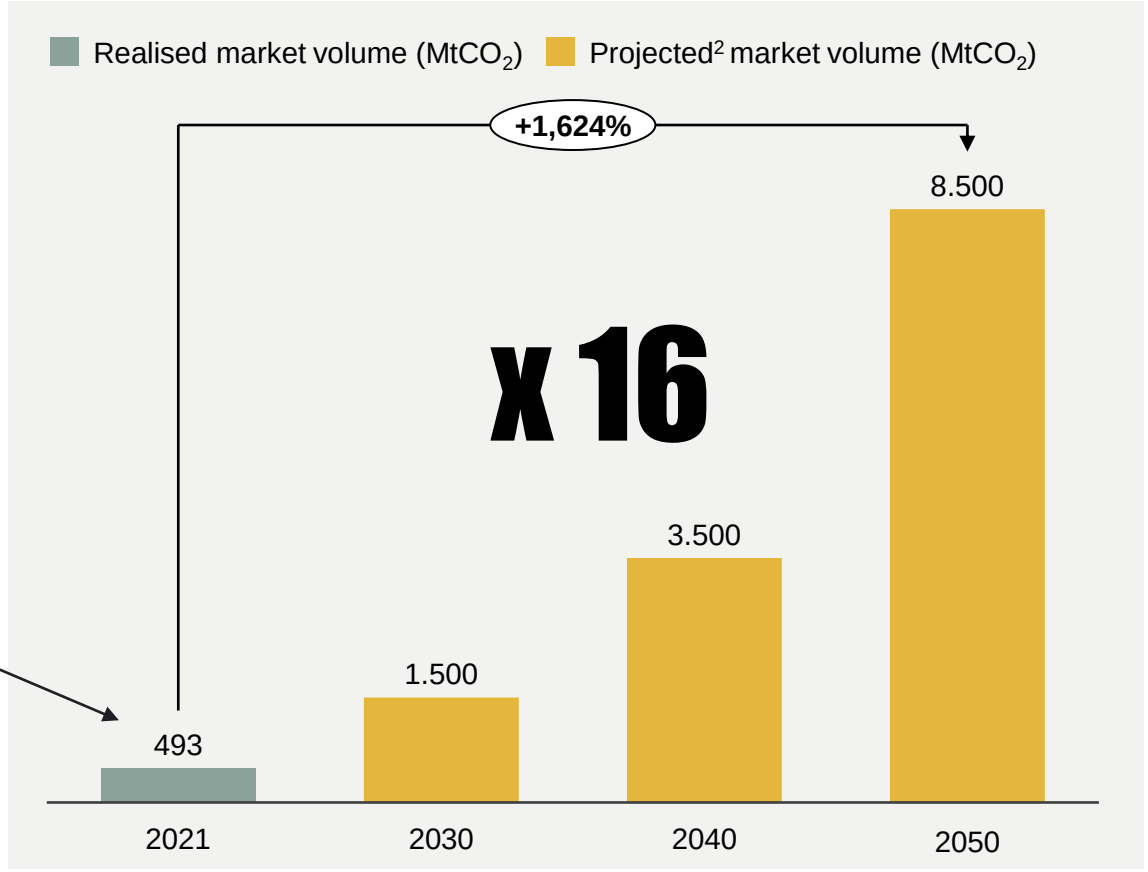
- Forestation
- Renewable energy
- Direct air capture and storage
- Bioenergy carbon capture storage

The volume of the voluntary carbon market is expected to continue to grow at an exponential rate towards 2050 with increased price and quality of credits

Historical Value and volume of the global voluntary carbon market[1]
(MEUR & $MtCO_2$)



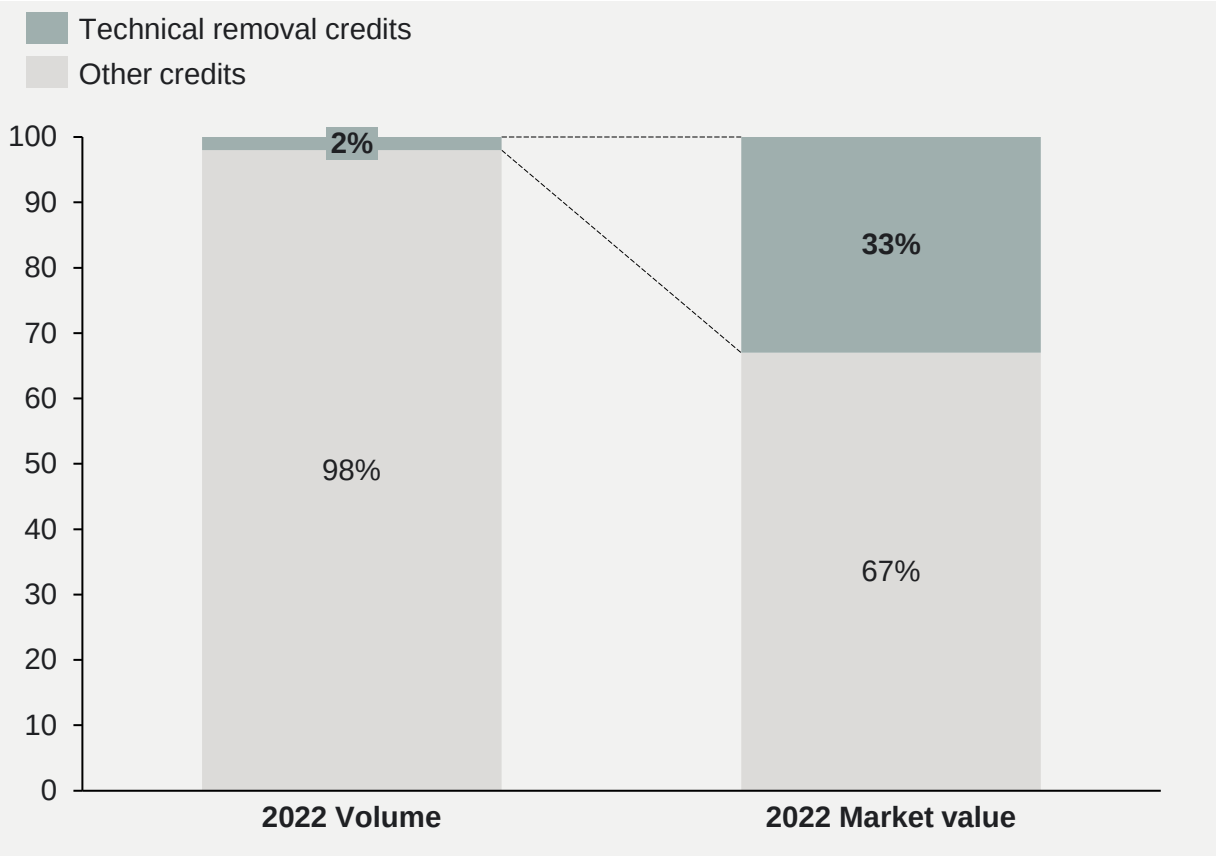
Future demand scenarios for global voluntary carbon market
($MtCO_2$)



Sources: 1) State of the Voluntary Carbon Markets 2022 Q3, Ecosystem Marketplace; 2) Based on TSVCM Survey, NGFS Scenarios and Implement Analysis

The current 2% volume market share of technical credits is likely to hide a much larger market share of ~33% by value due to the higher price of technical credits

Volume and value of retired credits in the global voluntary offsetting market[1]
% of total market value, 2022



Volumes are rising

High demand for technical removals, accounting for **~2%** of retired credits in 2022.

Current prices are high

Currently, the high-quality technical removal credits are sold at prices of up to **250-500 EUR**.

33 % share of market value

Using a conservative average price of 100 EUR for all technical credits, we estimate a **33% market share by value**.

Sources: 1) The Voluntary Carbon Market | 2022–2023, South Pole; State of the Voluntary Carbon Markets 2022 Q3, Ecosystem Marketplace

Two major trends will impact the demand for advanced technical carbon removals such as BECCS and DACCS

Trend 1: Growth in companies' demand for offsets

An estimated 80% of global emissions are now covered by pledges that commit to reaching net-zero emissions.

Source: Reuters

More than 18,700 companies have been assessed by CDP.

Source: CDP

More than 5,200 companies have committed to the Science-based target initiative.

Source: SBTi

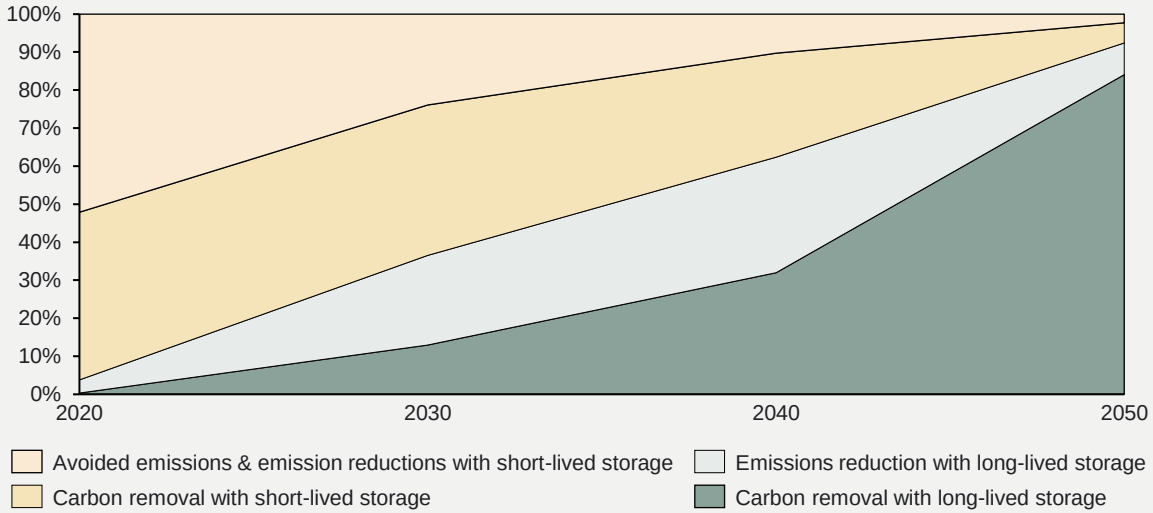
Trend 2: Shift to higher-quality products

Countries' climate pledges rely on more land for carbon removals by 2050 than the total size of the United States (Land Gap Report 2022).

Novel solutions are much easier to verify in terms of additionality and impact.

Example of a net-zero-aligned offsetting trajectory[2]

Share of voluntary carbon offsetting market, 2020-2050



Source: 1) The Oxford Principles for Net Zero Aligned Carbon Offsetting; 2) The Oxford Principles for Net Zero Aligned Carbon Offsetting, Figure 2

A number of large engineered carbon removals deals have been struck indicating appetite across a number of buyers for relatively large commitments

Five of the largest agreements in the voluntary carbon market have been signed during the spring of 2023. It is especially negative emission technologies such as DACS, **BECCS** and bio-oil that are in **demand due to their high-integrity quality stamp**.

	AGREEMENT	TOTAL VOLUME (tCO_2)	YEARLY VOLUME (tCO_2pa)	CONTRACT DURATION (years)	PRICE (EUR/t)	CONTRACT SIZE (MEUR)	REMOVAL TECHNOLOGY
1	Microsoft, Ørsted	**2,760,000**	**250,909**	**11**	**Not public**	**(estimated) +250**	**BECCS**
2	JPMorgan Chase & Co., Frontier	-	-	-	135	68	Not specified
	JPMorgan Chase & Co., CO280	450,000	30,000	15		Not public	Not specified
	JPMorgan Chase & Co., climeworks	25,000	2,778	9		Not public	DACS
	JPMorgan Chase & Co., CHARM	28,500	5,700	5		Not public	Bio-oil CDR
3	Frontier, CHARM	112,000	18,667	6	473	53	Bio-oil CDR
4	CarbonCapture™	40,000	8,000	5	Not public	Not public	DACS
5	drax, RESPIRA	2,000,000	400,000	5	Not public	Not public	BECCS
6	amazon.com, 1POINTFIVE	250,000	25,000	10	Not public	Not public	DACS
7	Microsoft, Heirloom	315.000	31.500	10	Not public	(estimated) 200	DACS

Large investments during the spring of 2023 has underlined what large potential is ahead of the VCM if uncertainty is reduced

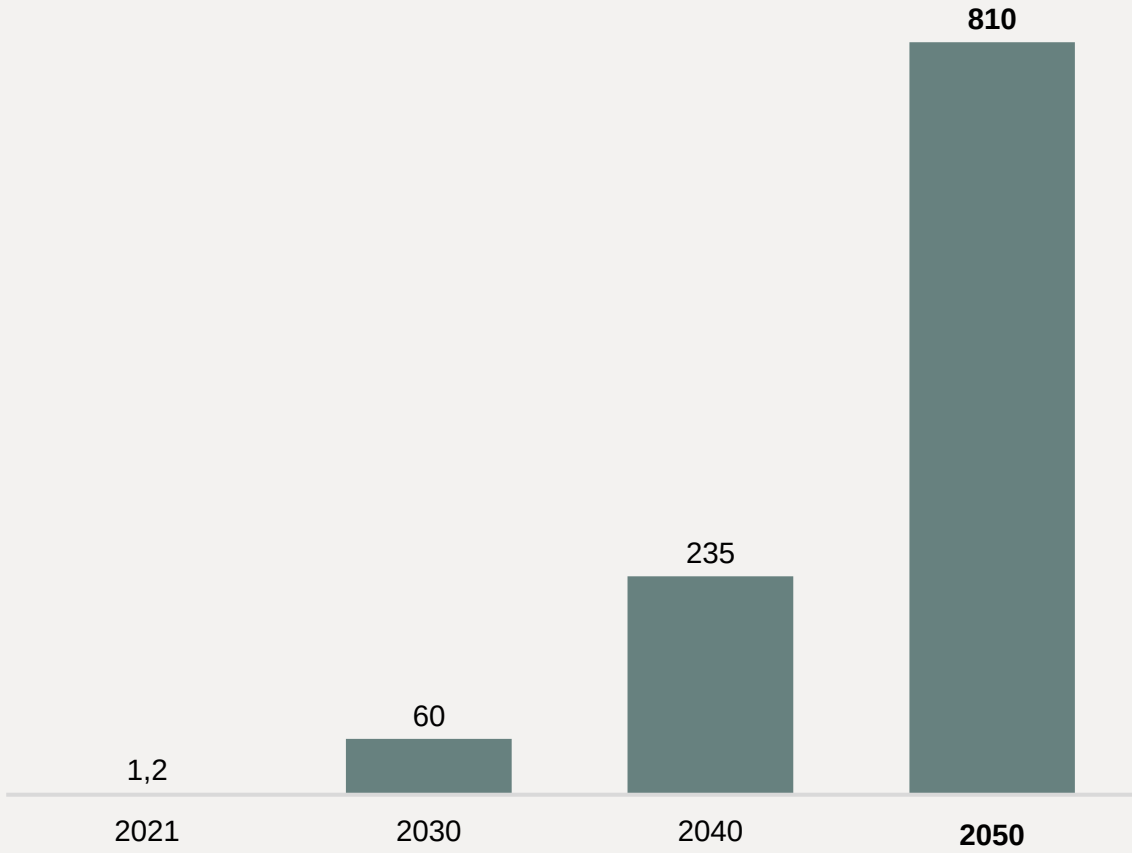
1) Ørsted (2023) 2) JP Morgan Chase with Frontier, CO280 Solutions, Climeworks, Charm Industrial (2023), 3) Frontier (2023), 4) BCG (2023), 5) Drax (2023), 6) Amazon (2023)

As high-quality technical credits gains dominance in a VCM following volume forecasts, the value could reach **810 bn EUR globally by 2050**

Key take-aways

- **Carbon capture is indispensable** for reaching the Paris Agreement's 1.5-degree target and the technology is proven
- **Voluntary carbon market can provide key revenue** to close the business case for negative emissions projects
- The volume of the voluntary carbon market is expected to continue to grow at an exponential rate towards **8,500 $MtCO_2$ per year in 2050**
- For high-quality technical credits current **prices are as high as 250-500 EUR per ton** and they likely already form 33% of the market by value
- High-quality technical credits are expected to gain **dominance in the market towards 2050**
- As high-quality technical credits gains dominance in a VCM following volume forecasts, the value could reach **810 bn EUR globally by 2050**

Global market value of technical removal credits (Bn €)

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QUESTIONS?
Implement Consulting Group

CONTACT DETAILS

ULRIK JACOBSEN

+45 2533 3669

ulja@implement.dk

KRISTOFFER JENSEN

+45 2464 0497

krje@implement.dk