

Update Full Scale CCU Plant at Twence

Together ... making Carbon Capture happen now

CATO | 26 september 2023

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AKER CARBON CAPTURE

Twence®



Climate Change Latest News

Sources from The Guardian | World Meteorological Organization (WMO) | NASA | EuroNews



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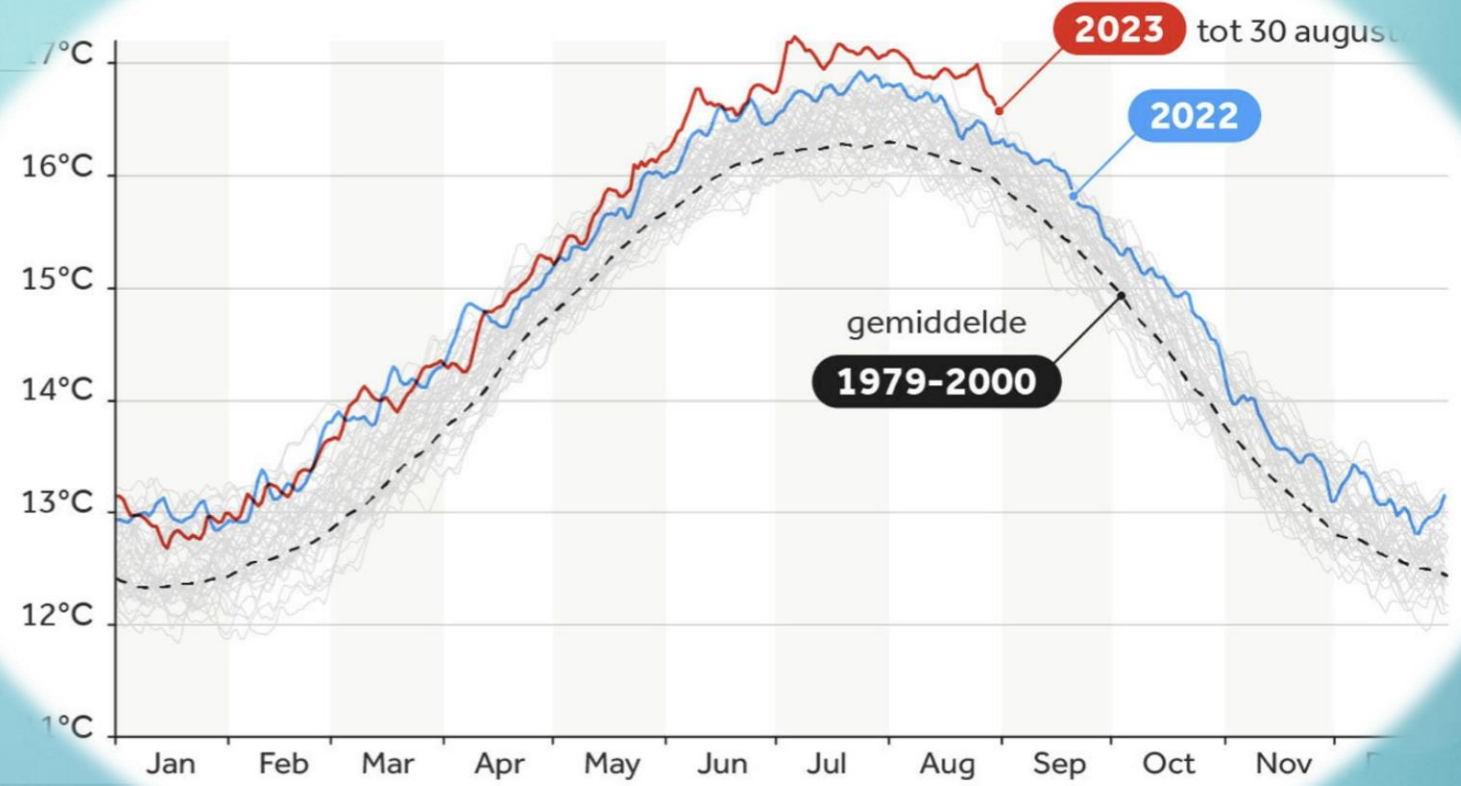
Zomer 2023 wereldwijd met afstand de warmste ooit gemeten

Afgelopen zomer was wereldwijd "met afstand" de warmste ooit gemeten, melden de Wereld Meteorologische Organisatie en Copernicus, het klimaatbureau van de Europese Unie. De temperatuur op aarde was in de maanden juni, juli en augustus gemiddeld 16,77 graden en dat is 0,66 graden hoger dan het gemiddeld in de jaren 1991 tot en met 2020 was.

Wereldwijd noemen wetenschappers de verbranding van onder meer steenkool, olie en aardgas en El Niño, een tijdelijke opwarming van delen van de Stille Oceaan, als belangrijkste oorzaken van de temperatuurstijging.

CONTINUED CLIMATE WARMING

temperatures From 1991 to 2020



2000

Source: Global Carbon Budget 2022 / Climate Change Institute / University of Maine

CLIMATE CENTRAL

al. (2022). Global Carbon Budget 2022.

Full Scale CCU at Twence

CCUS Roadmap towards 2030

First Full Scale CCU(S) Project

Lessons Learned from EZK & EU

Preconditions for being Net Zero

CO₂ Footprint Twence in scope 1/2/3

Updated CCUS Roadmap => Net Zero in 2030

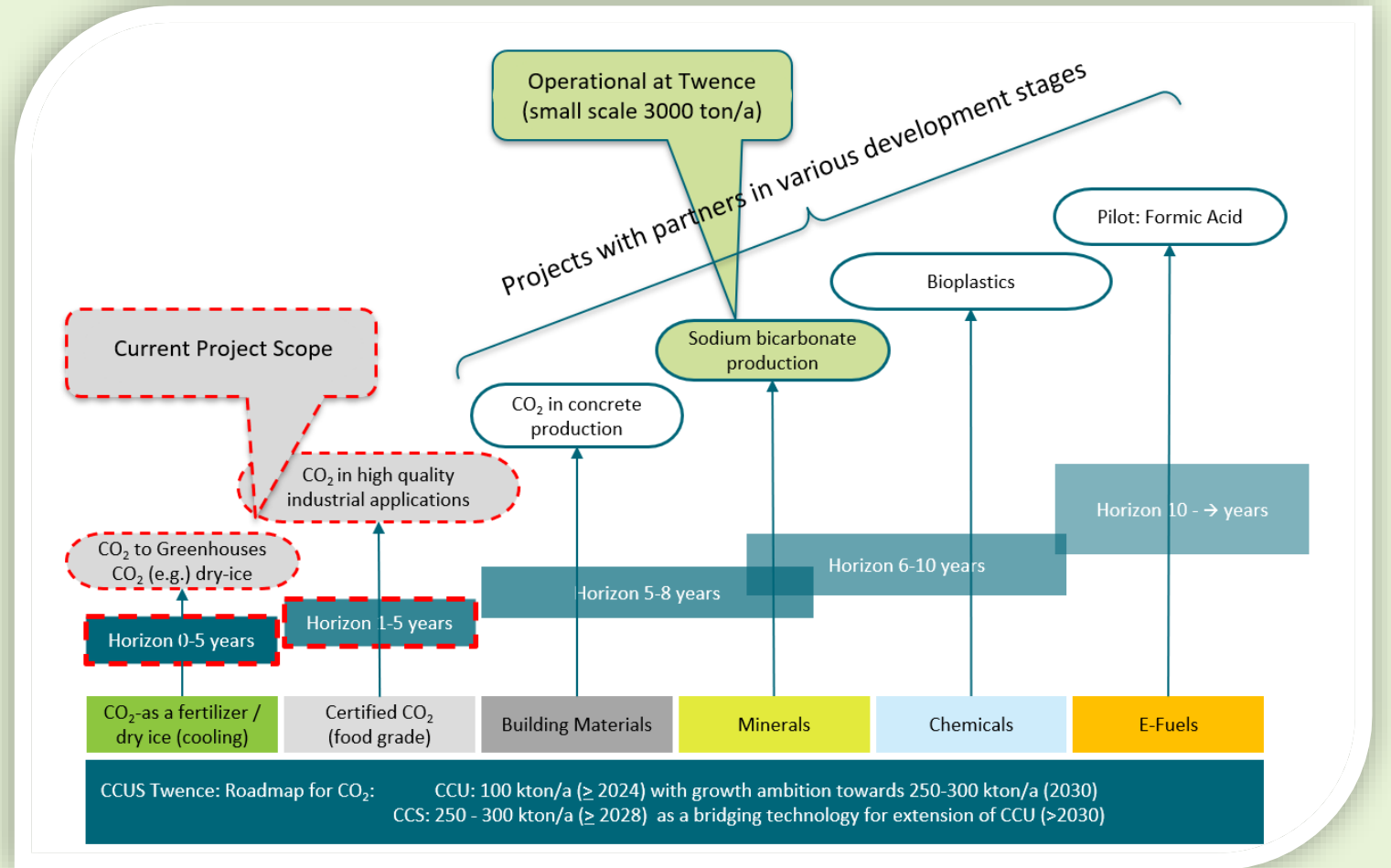
CCU routes:

- CO₂ to Greenhouses
- CO₂ to industry for dry ice and food grade applications
- CO₂ to minerals

In 2030: goal to achieve net zero CO₂ footprint

CCS routes:

- Required before 2030
- New CCUS Projects





Full Scale CCU Project at Twence

- *Lessons Learned*
- *Challenges*

Lessons Learned from Full Scale Project Development



- EIA | Permit | LCA | EoW Statement – Key Success Factors
- CO₂ Off Take Contracts depend on Funding Challenge
- Funding Challenge depends on subsidy schemes
- Specific subsidy schemes depend on:
 - National level (Min. EZK)
 - Scalability and innovative character
 - EU/EC regulations
 - Eligibility with applicable State Aid legislation
 - Compliance with Art.107 of the TFEU



Preconditions for having received EU approval for state aid

Criteria assessed by DG Competition

- Environmental protection
- Market and re-use CO2 produced by Twence
- Change of greenhouses by avoidance of 'summer heating' and switch to renewables
- Impact of national policy instruments

Conclusions

- Reduction fossil CO2
- Sustainability
- State Aid granted is proportionate
- Low share in national volume of CO2 captured and acting in restricted geographical market
- Limited and positive impact on competition

The Commission has made the overall conclusion that any possible distortion of competition or adverse effect on trade between Member States resulting from the envisaged measure would be limited, whereas the environmental benefits are clearly established and could not result from other types of competing initiatives, so that the **overall balance with regard to the objective of common interest of environmental protection is positive**

Preconditions for becoming net zero producer

Strategische Projecten - 2023 - 2030 Circulaire Economie	Q3 2023	Q4 2023	Q1 2024	Q2 2024	Q3 2024	Q4 2024	Q1 2025	Q2 2025	Q3 2025	Q4 2025	Q1 2026	Q2 2026	Q3 2026	Q4 2026	Q1 2027	Q2 2027	Q3 2027	Q4 2027	Q1 2028	Q2 2028	Q3 2028	Q4 2028	Q1 2029	Q2 2029	Q3 2029	Q4 2029
CO2-afvang AEC lijn 3 (CCUS)	█	█																								
CO2-afvang AEC lijn 1 en 2 (CCS)															★											
CO2-afvang op BEC (CCUS)																										
CCU mineralisatie met ETS partner (Full Scale)																										

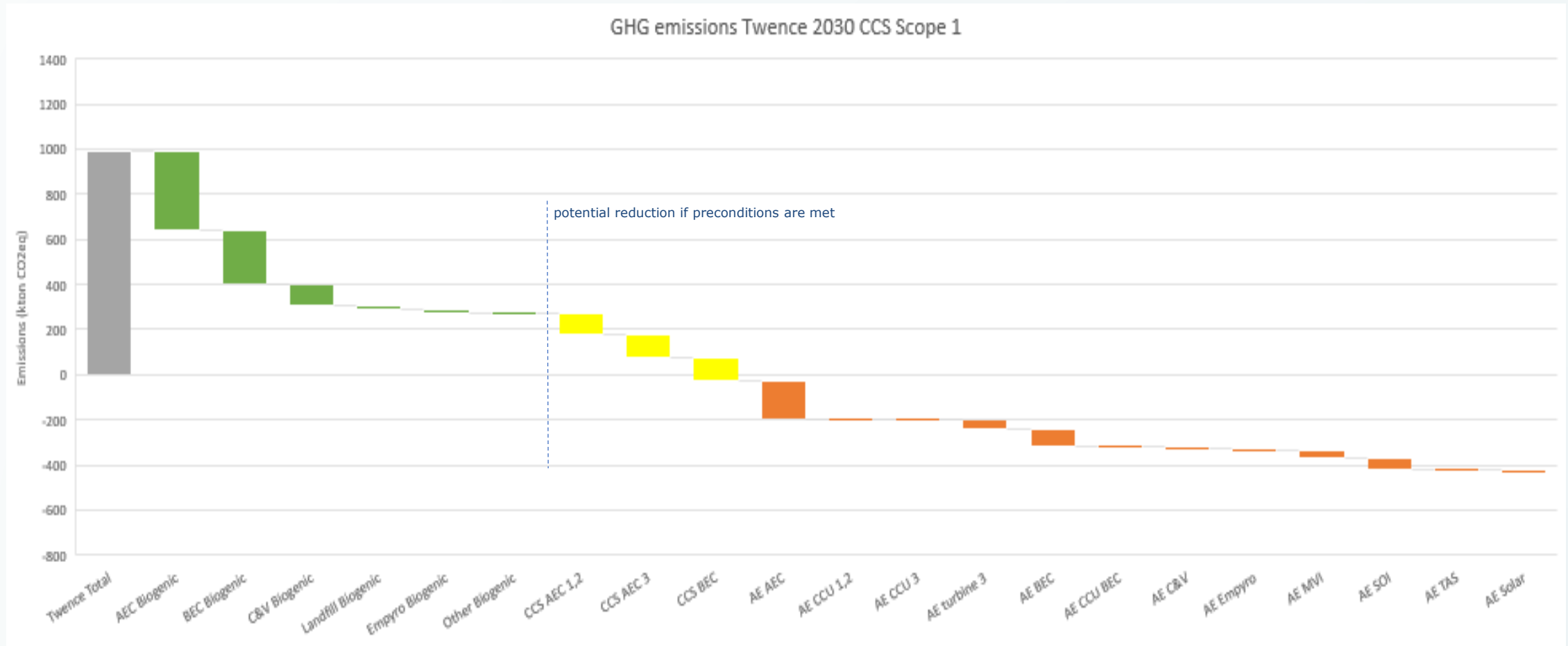
- CCUS projects require 5 – 7 years of development / engineering / realisation
- CCS routes need to be accelerated because CCU route require more time
- Financing new CCUS projects is key: to capture all fossil CO₂ before 2030

Policy instruments for scaling up CCUS to a minimum of 250 kton/year

- Administratively allocate fossil and biogenic captured CO₂
- CCS support frameworks (SDE++) for 'off the CCS grid' companies
- CCS policy across national borders with international CO₂ transport infrastructure



CO₂ Footprint Twence – forecast 2030



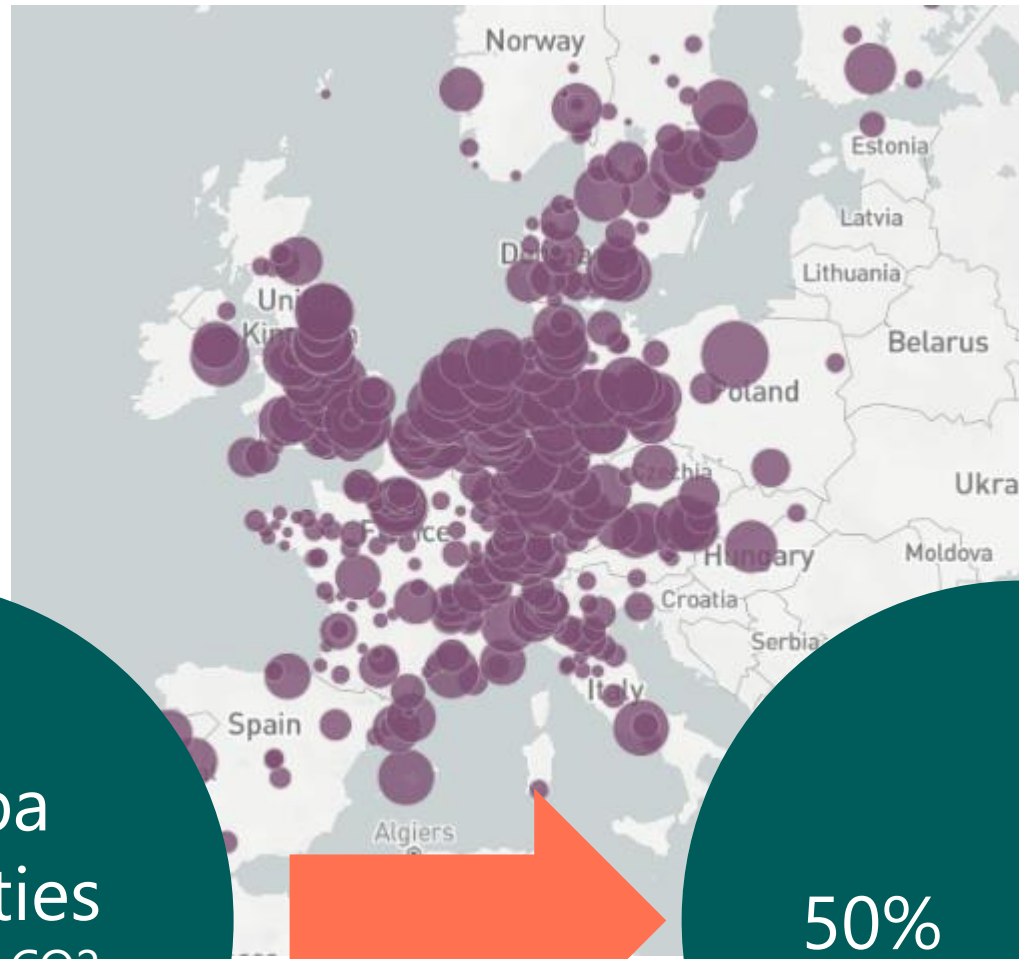


Visit Ministry of Economic Affairs and Climate 11 September 2023

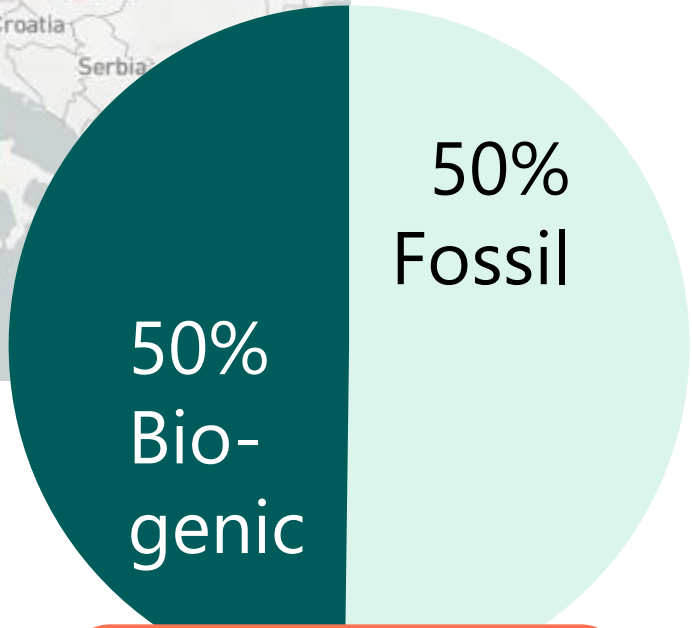
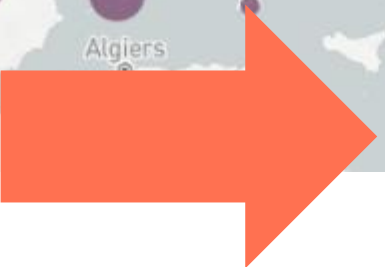
Movie on next slide prepared and shared by Ministry of EZK

https://www.linkedin.com/feed/update/urn:li:activity:7107373980541427712/?lipi=urn%3Ali%3Apage%3Acompanies_company_posts_index%3Bf2503a5b-740a-45f2-aac9-f88226453167

WtE industry Europe



104 Mtpa
491 Facilities
10 – 2300 ktpa CO₂



100% Hard to abate

How do you build 491 plants?



Just Catch™ Modular

Just Catch™

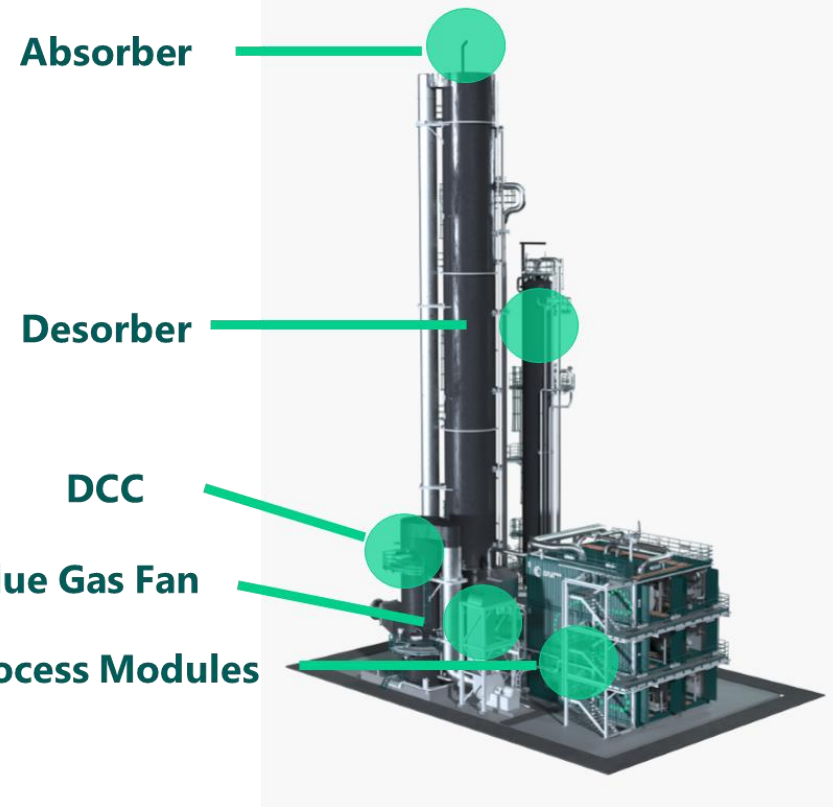
Capacity: 40, 100 & 400 kilotons/year

- Modularized and cost efficient
- ~15 - 24 months delivery time
- Easy transport and installation
- Compact design – 25m x 19m
- 100% automated

Big Catch™

Capacity: > 500 kilotons/year

- Made to order
- ~30-36 months delivery time
- Larger footprint
- Using bulk materials – cost efficient
- Retrofit potential





Twence®

WASTE TO ENERGY

Hengelo in the Netherlands

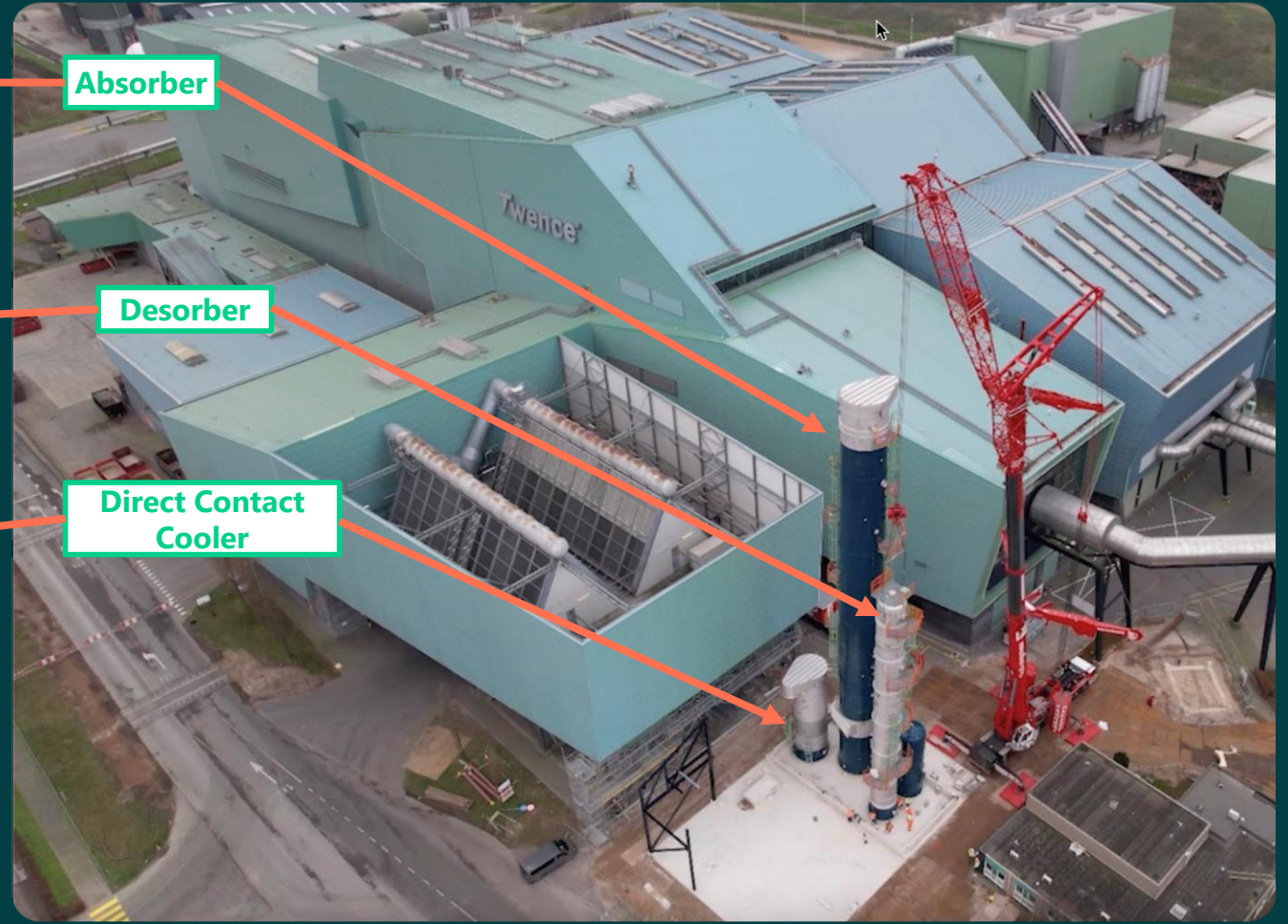
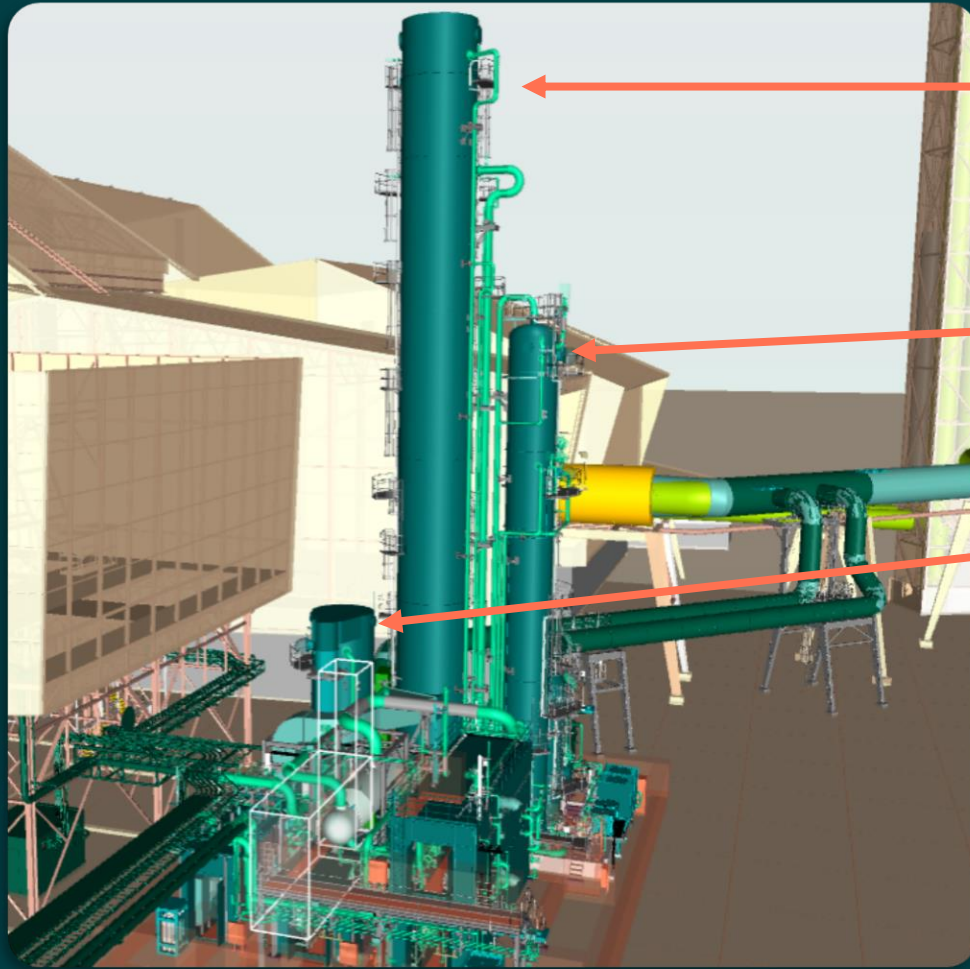
- 100,000 TPA
- CCU local greenhouses
- Planned operation in 2023



Twence project



Just Catch 100 Model and in Real Life Installation



Absorber

Desorber

Direct Contact Cooler

Process Containers



Connecting duct



What can be achieved in a year?





Lessons learned - 3rd generation Just Catch™ 100

- More energy efficient
- Small footprint, ~18 x 25 m, ~45 m high
- Taking operating space to the next level
- The ACC Energy Saver™ – now as standard
- Fewer modules

Key features optimized

- Modularized core process modules - transportable on road
- Pre-fabricated
- Easy to install
- Short delivery time

Enabled **by mass production principles**

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Thank you for your attention

Questions?

