ÖGEW/DGMK Herbsttagung ‘24

Direct Air Capture - modulare Anlagenkonzepte zur Kohlenstoffentfernung als Beitrag zu Netto-Null

Kraftanlagen ENERGIES & SERVICES

ECM

PHLAIR™

COMPANY INTRO

We're a young and hungry team working our a** off to scale up fast

2022

Founded in 2022, Headquartered in Munich

Young and hungry team of 20 FTEs all on-site in Munich

2023

Frontier pre-purchase and POC of Hydrolyzer

We would not be here today without the pre-purchase

Frontier shopify stripe

Q2 2024

€14.5M Seed round + EtE process

+ Rebranding from Carbon Atlantis to Phlair
+ including €2.5M grant from European Union

extantia planet A VENTURES VERVE VENTURES
ATLANTIC LABS covestro CIRCULAR CARBON CHEMISTRY European Innovation Council
WACKER PAUL SCHERRER INSTITUT PSI counteract

Q4 2024

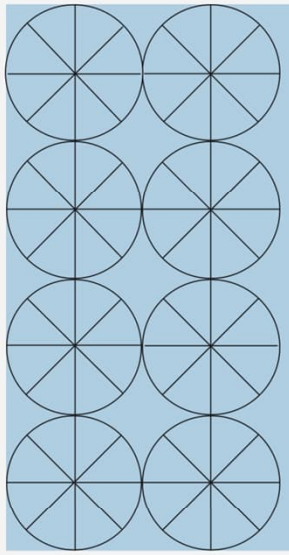
Electra 00 comissioning + Offtake volumes available for Dawn

We develop a purely electric DAC approach that has the potential of getting to ultra-low energies and costs

HOW IT WORKS

Every DAC technology has a frontend and a backend

CO_2 rich air **CO_2 lean air**



Frontend: Absorption or Adsorption

Liquid or solid

+

Backend: Sorbent or solvent regeneration

Thermal or electrochemical regeneration

Water generation OR consumption

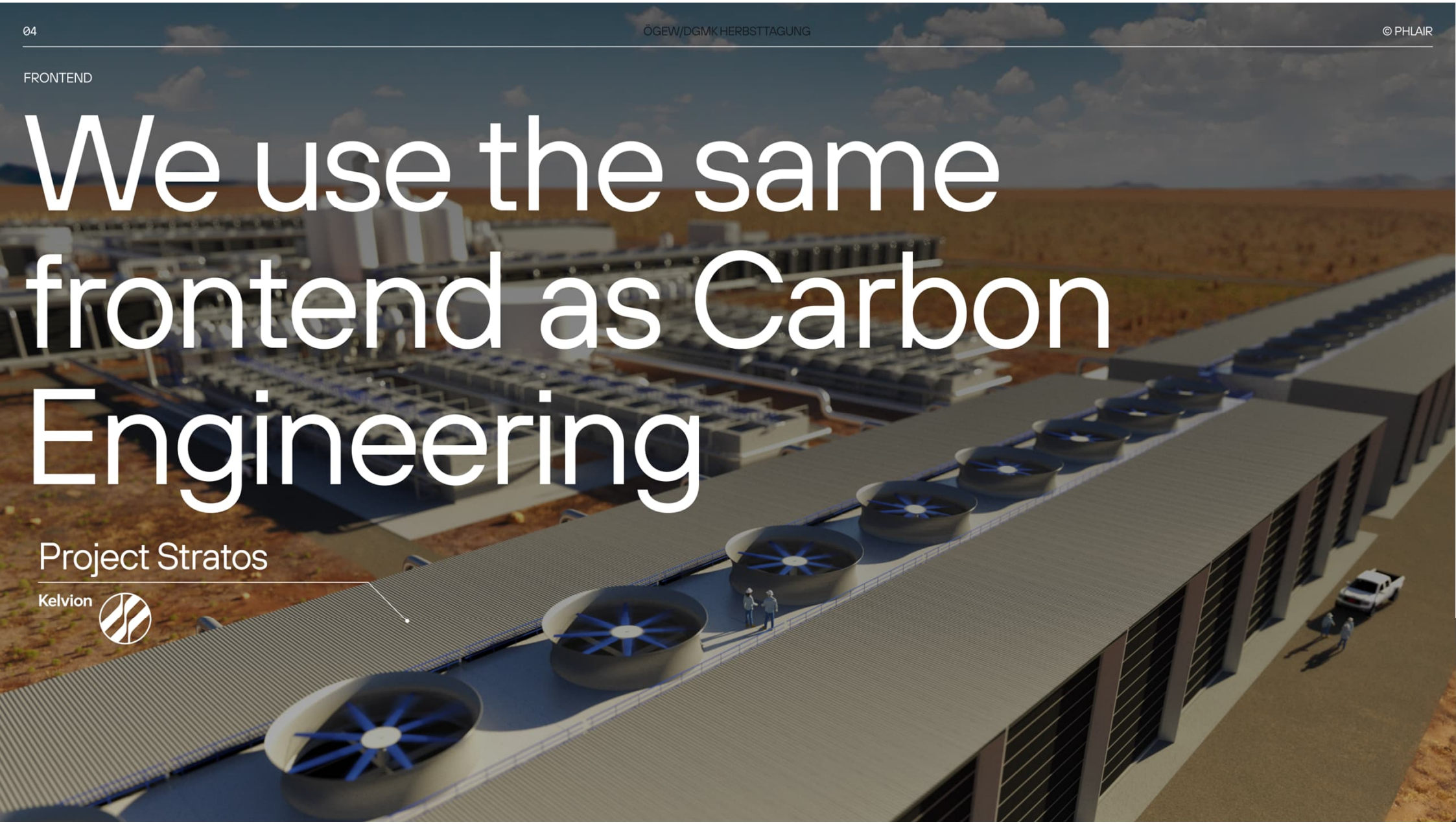
Electricity OR Heat **CO2**

FRONTEND

We use the same frontend as Carbon Engineering

Project Stratos

Kelvion



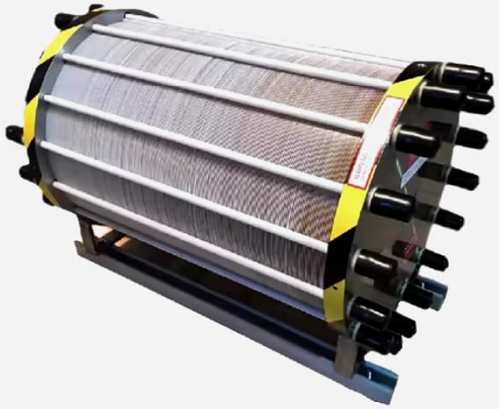
BACKEND

But have reinvented the backend with our Hydrolyzer by combining existing and scaled components into a new cell design

Proton Exchange Membrane (PEM) Fuel Cell

+

Alkaline Electrolyzer



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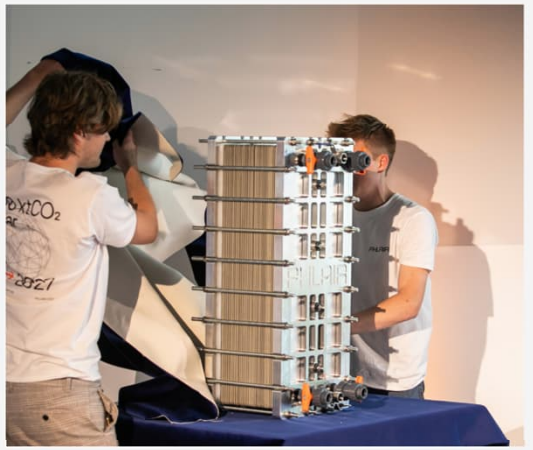
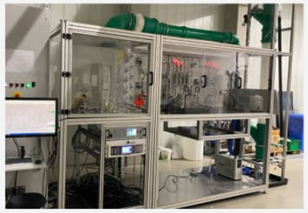
Phlair Hydrolyzer



COMMERCIALIZATION & SCALING

The modular nature of our hardware and well-established supply chains will facilitate our rapid scale up

Today:
EtE demonstrator
1 tCO2/y.



SEED

September 2024:
Prototype stack

SEED

September 2024:
Electra 00 (Pilot)
10 tCO2/y

SEED

Q2 2025:
Electra 01 & 02 (FOAKs)
260 tCO2/y each

Frontier shopify stripe
Milkywire Klarna. WRLD Foundation
DEEP SKY

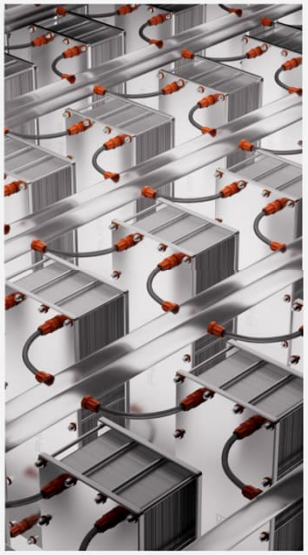
SERIES A

2026:
Project Dawn
(commercial plant)
20 ktCO2/y

2027:
Extend Project Dawn to
200 ktCO2/y

SERIES B

2029 onwards:
Hydrolyzer plant
producing 20 kt
modules for **> 500 Mt plant capacity**

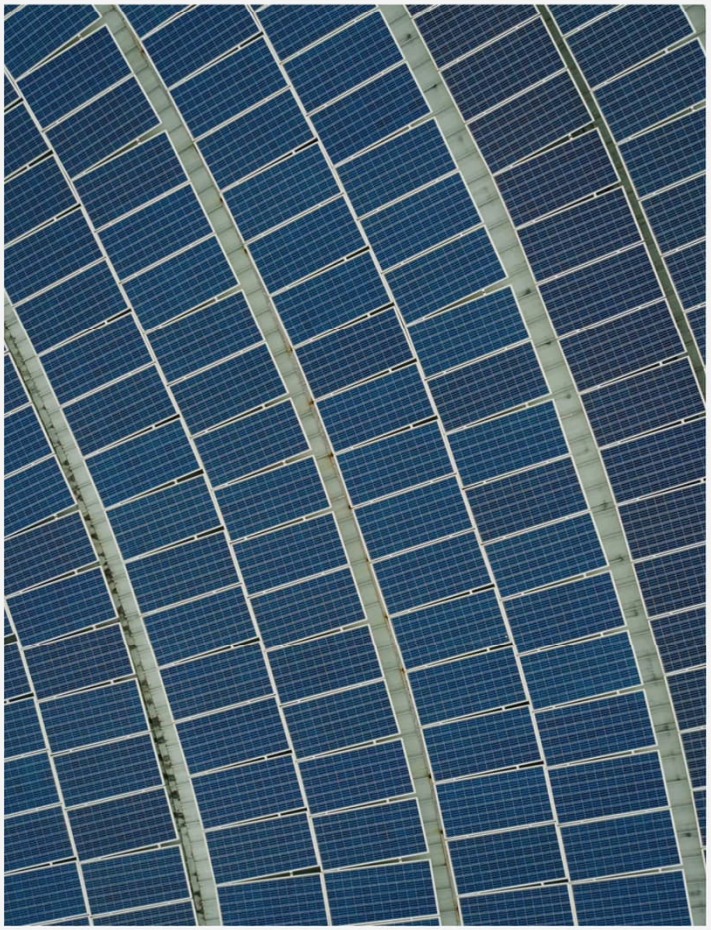


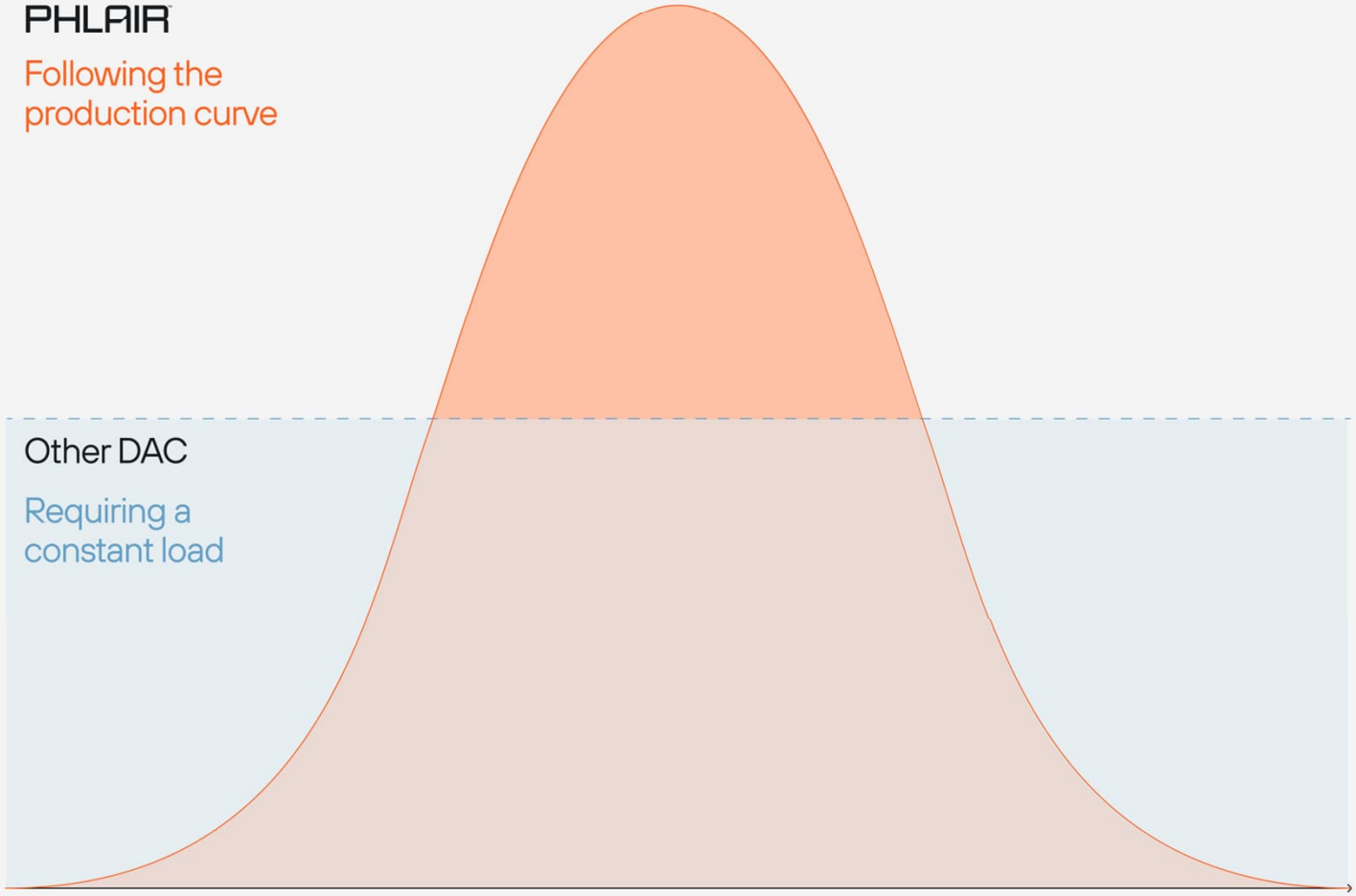
Electra 00

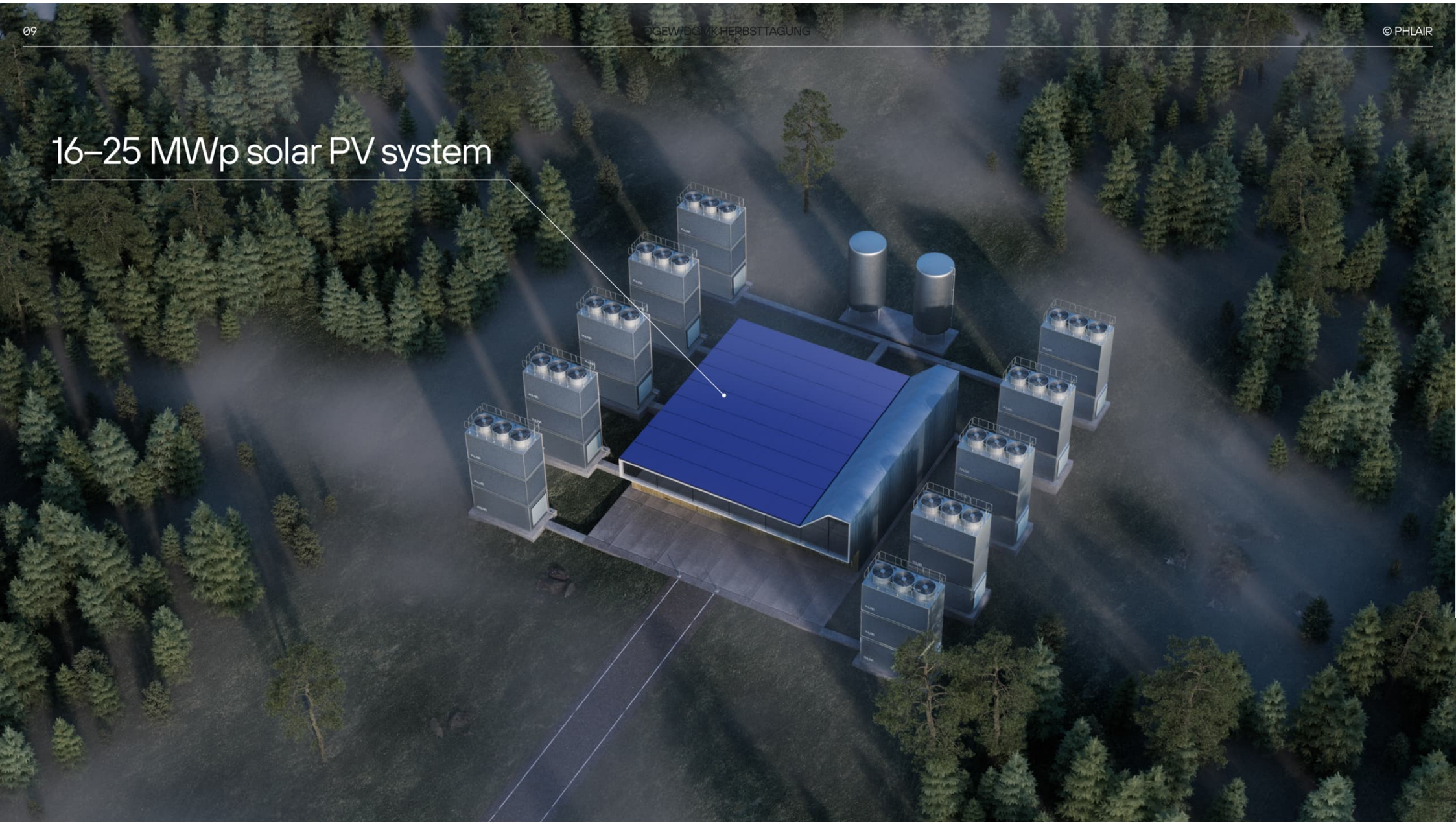
© PHLAIR

THE NEW STATUS QUO

We're the first DAC company that can follow a solar energy supply curve through our internal acid/base storage






16–25 MWp solar PV system

SUMMARY TECHNOLOGY

Why we will win

01 Cost effective

Low energy requirements at high current density translates to low capex and overall low removal costs of < $90/tCO2[1] at scale

02 Scalable

Our technology leverages mass produced, TRL 9+ components (e.g. membranes) from fuel cells and alkaline electrolysis (>60,000 h lifetime)

03 Fully compatible with solar

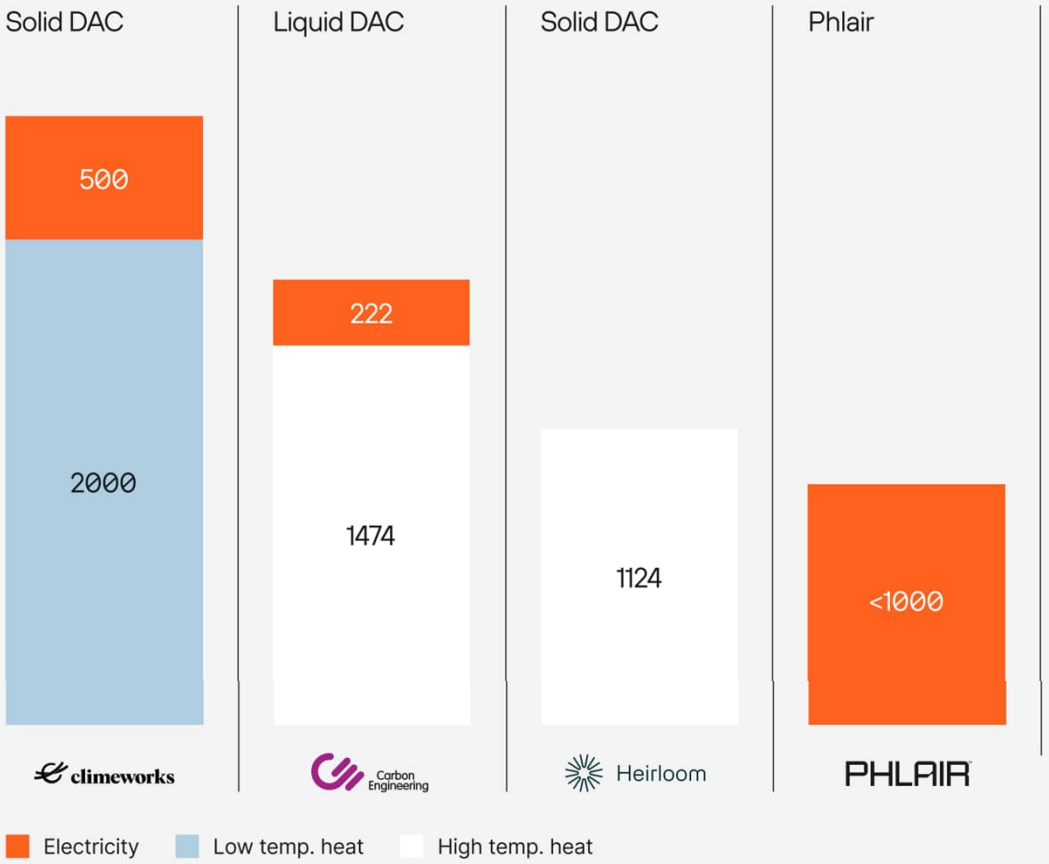
Our technology can directly connect to a fluctuating source of energy (solar), withouth the need for additional battery storage while still achieving 24/7 capture rate. The result is access to ultra low-electricity prices

04 Clear focus on project execution

Our team and advisors (i.e., former Climeworks CTO) have a strong track record of execution projects on time and in budget. Our scale-up to date is progressing without delays

[1]Assuming electricity prices of $40/MWh, capital costs of 6 %, 20 years plant lifetime and NOAK plant at 1 MtCO2/year capacity.

Other DAC systems require up to 3x more energy (in kWh/tCO2)



Sources: Climeworks and Carbon Engineering, Heirloom (thermodynamic limit), Phlair (thermodynamic limit)

TEAM

We combine scientific and engineering experience with an unwavering focus on execution

Team

Malte Feucht
Founder / CEO

MSc Robotics // experience in construction Robotics // previously bootstrapped profitable startup

Paul Teufel
Founder / CTO

MSc Robotics and Engineering Science // hands on with extensive engineering experience

Steffen Garbe
Founder / CSO

PhD in PEM electrolysis // industry experience at Merck and Apricum

+ 16 FTEs including:

Mark Daniel
Mechanical Engineer

Mark has 15+ years of experience in designing and developing electrochemical cell stacks.

Sean Ashton
Lead Stack Engineer

With a PhD in electrocatalysis, Sean brings extensive experience in flow battery, fuel cells and electrolysis application.

Joan Weststrate
Lead Plant Engineer

Joan's expertise includes process engineering, operational knowledge in electrolytic chemical processes and OEM product development.

Our core team has honed their craft at

TUM · Harvard University · ETH zürich · RWTH Aachen University · TUM Carbon Removal Initiative · BMW · Merck · voltstorage · EADS Defence & Security · Apricum

Advisors

Birgit Heraeus Roggendorf
Board Member Heraeus

Dr. Carlos Härtel
Ex-CTO Climeworks

Dr. Rudolf Staudigl
Former CEO Wacker Chemie

Sebastian Herler
COO Hirschmann Automotive

Dr. Markus Steilemann
CEO Covestro

Dr. Lorenz Gubler
ETH / PSI

SUMMARY

In summary this means we are...

01
Trusted

by leading and scientifically rigorous buyers.

Frontier, shopify, stripe, Milkywire, WRLD Foundation, Klarna., RioTinto, Hydro

02
Supported

by world class investors and co-funded by the EU. We have secured €14.5+ million in dilutive and non-dilutive funding.

extantia, planet A ventures, VERVE ventures, ATLANTIC LABS, covestro, Circular Carbon Chemistry, European Innovation Council, WACKER, Paul Scherrer Institut PSI, counteract

03
Verified

by one of the leading registries.

ISOMETRIC

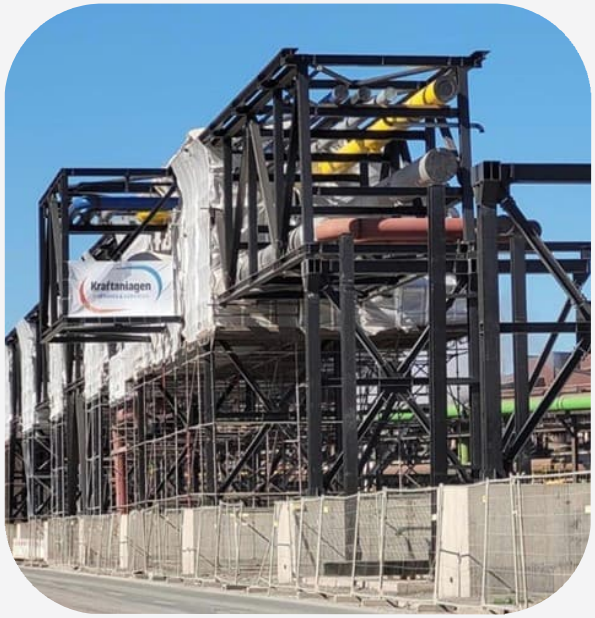
04
Ready

for the scale-up of our technology.

Modularisierung

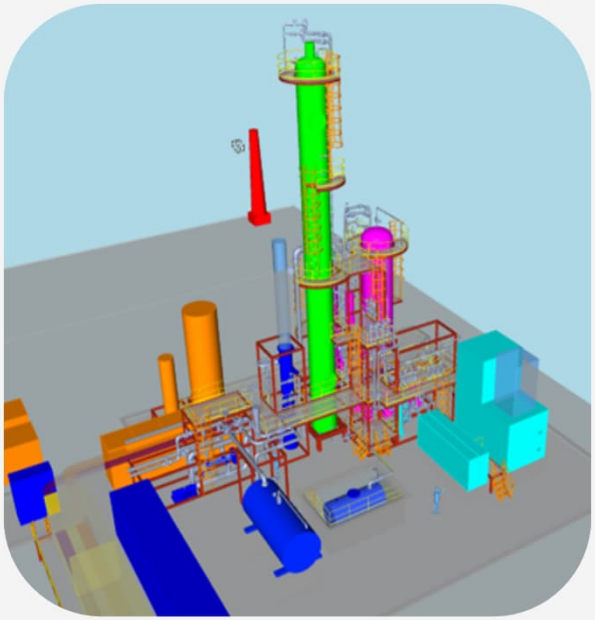
Modularisierungskonzepte

Modular Construction



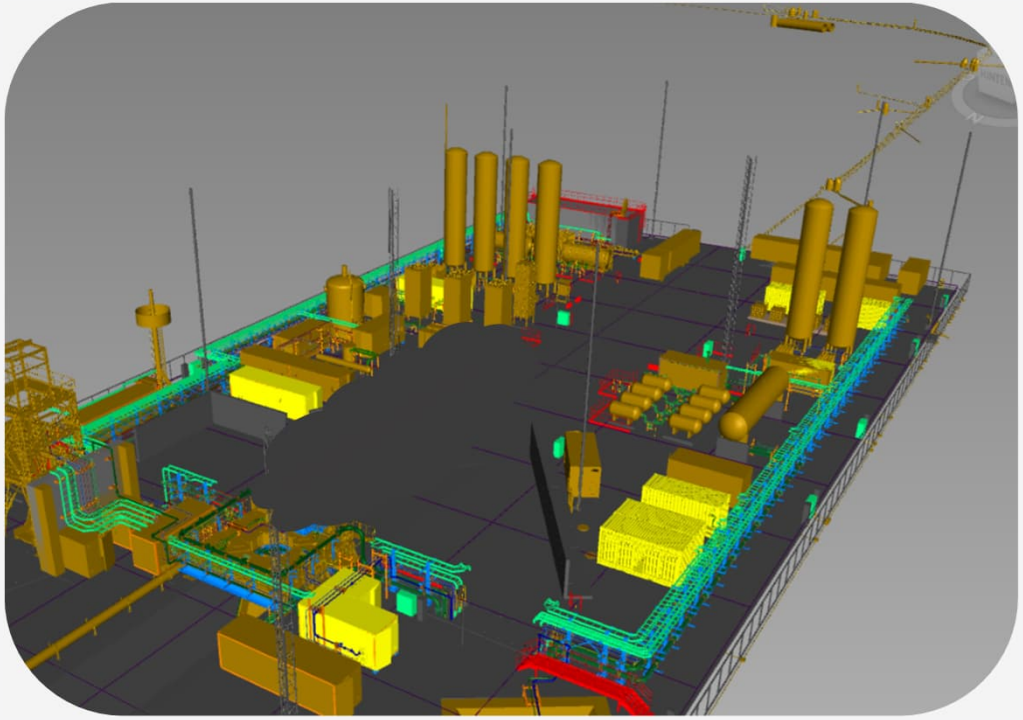
Modularisierungskonzepte

Multiple Trains



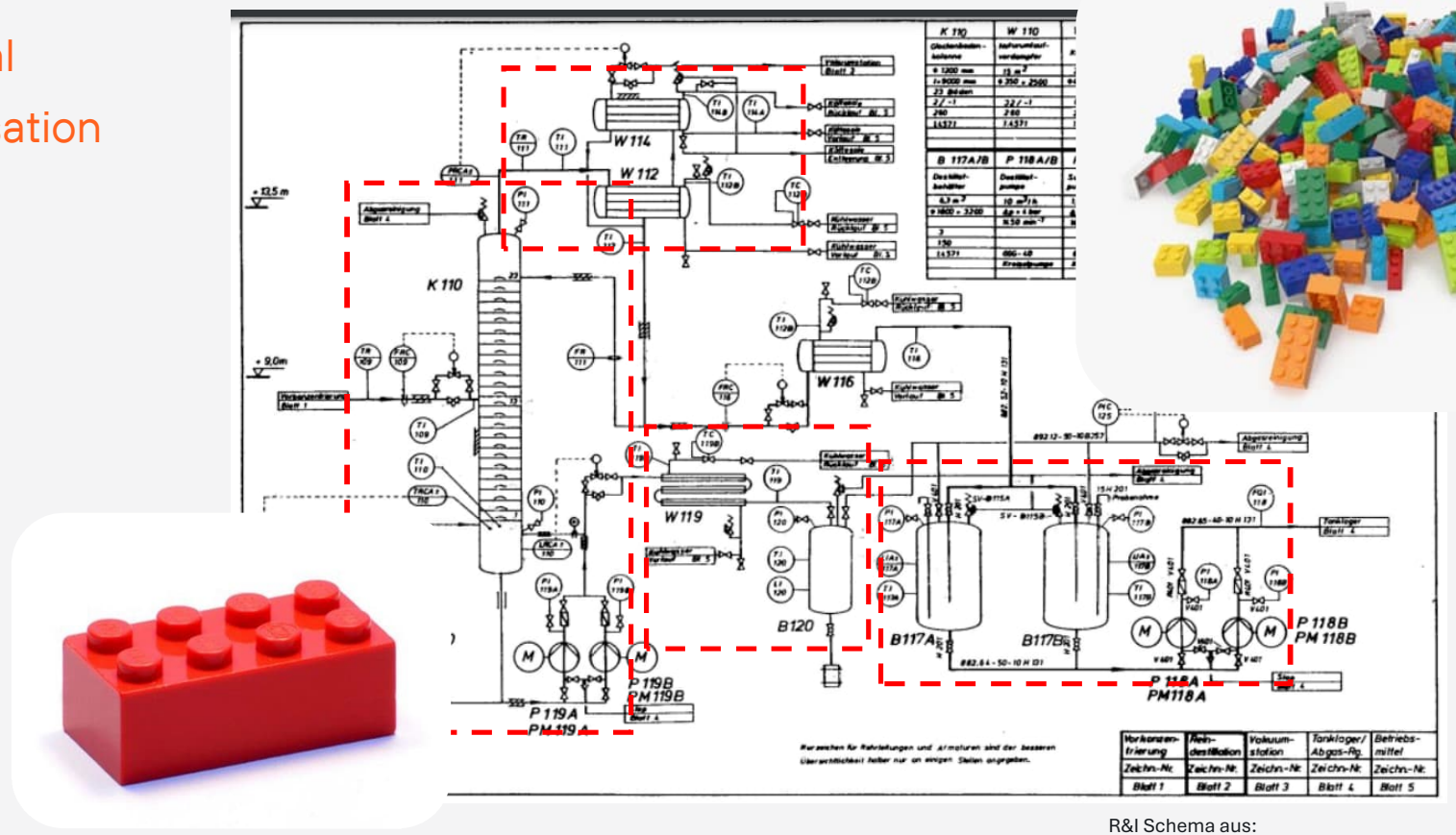
Modularisierungskonzepte

Containerization (& Modular Construction)



Modularisierungskonzepte

Functional Modularisation



R&I Schema aus:
Einführung in die Technische Chemie I
Darstellung chemischer Verfahren und Anlagen durch Fließschemata
https://uol.de/f/5/inst/chemie/ag/tcgme/Vorlesung_WS_09/Fliessbilder.pdf

Modularisierung als Boost der Einführung von Direct Air Capture

Vorteile

Einsatz Integrierter Planungstools
Hohes Maß an Standardisierung bei gleichzeitig notwendiger Flexibilität
Scale up ist vereinfacht

Kürzere Projektzeiten
Fertigung einzelner Module bevor für andere Module das Engineering abgeschlossen ist
Fertigung parallel zu Tiefbauarbeiten

Geringere Kosten

Verbesserte Arbeitssicherheit (Fertigung in der Halle)
Kürzere Zeit „On Site“