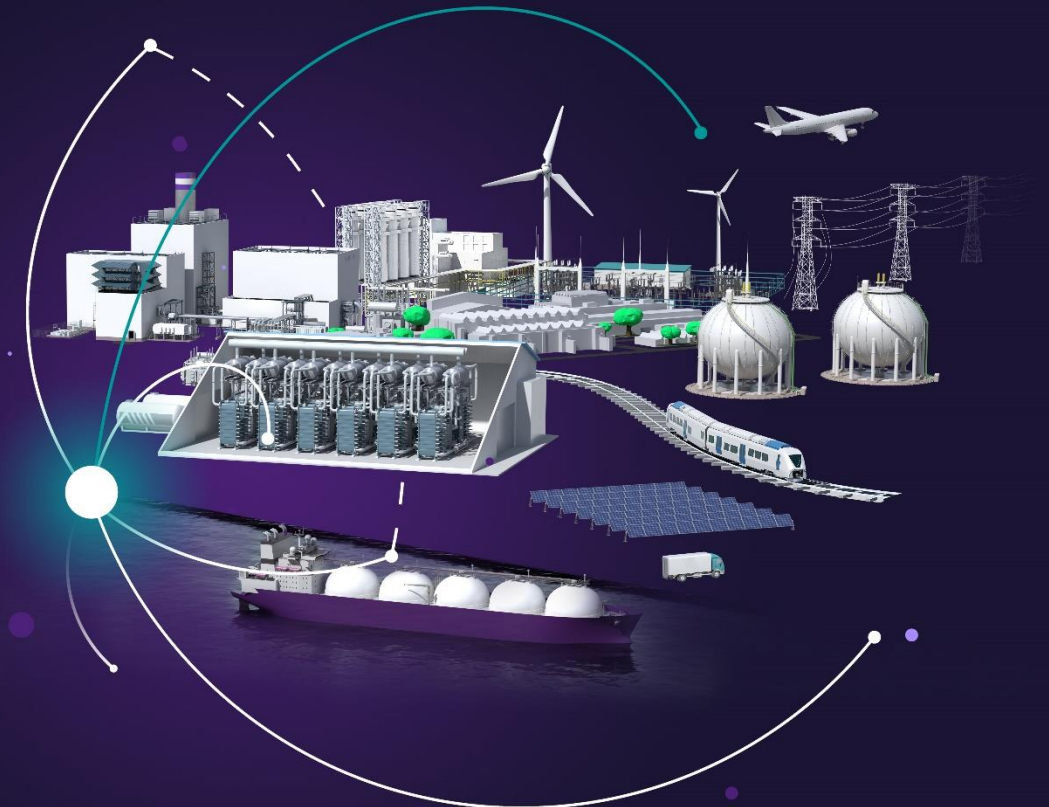


Hydrogen @ Siemens Energy

Tobias Hang – Siemens Energy Investor Relations Manager
AlsterResearch Wasserstoff Pop-up Konferenz
March 5, 2024



Siemens Energy

The right partner to lead green hydrogen solutions

Proven industrial-grade large-scale electrolyzer systems

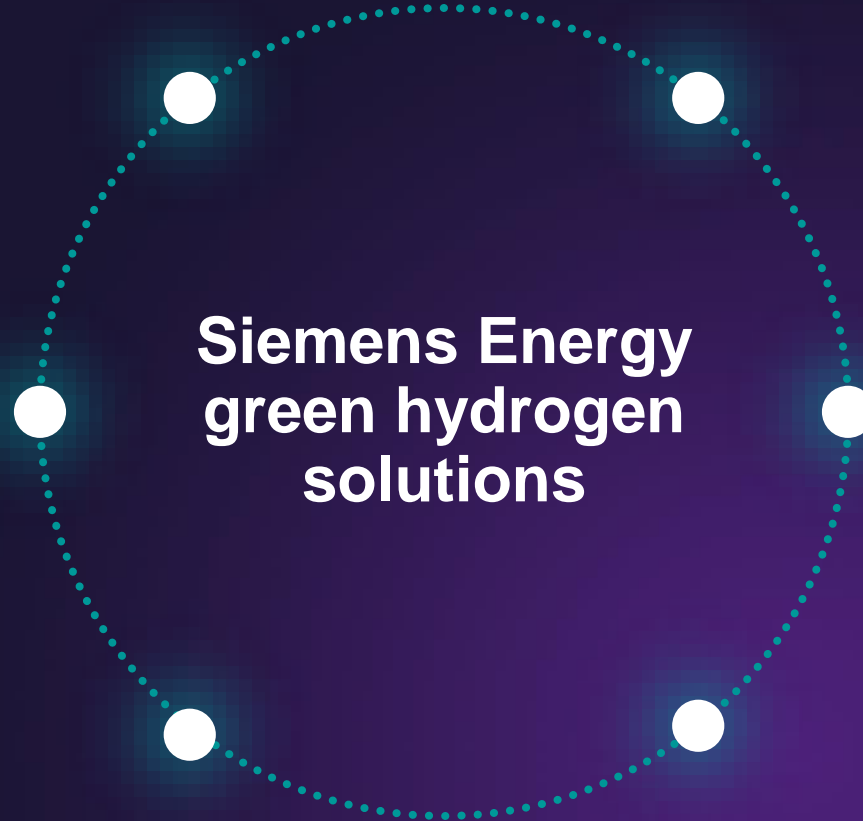
>200,000 operating h in MW range

Scalable solutions

Pre-fabricated and pre-engineered packages

Energy Consulting & Digital Services

H₂ value chain design and optimization



Fully integrated solutions

from green electrons to green molecules with our strong partner ecosystem

Global G2M setup and customer domain know-how

configuration of industry-specific solutions

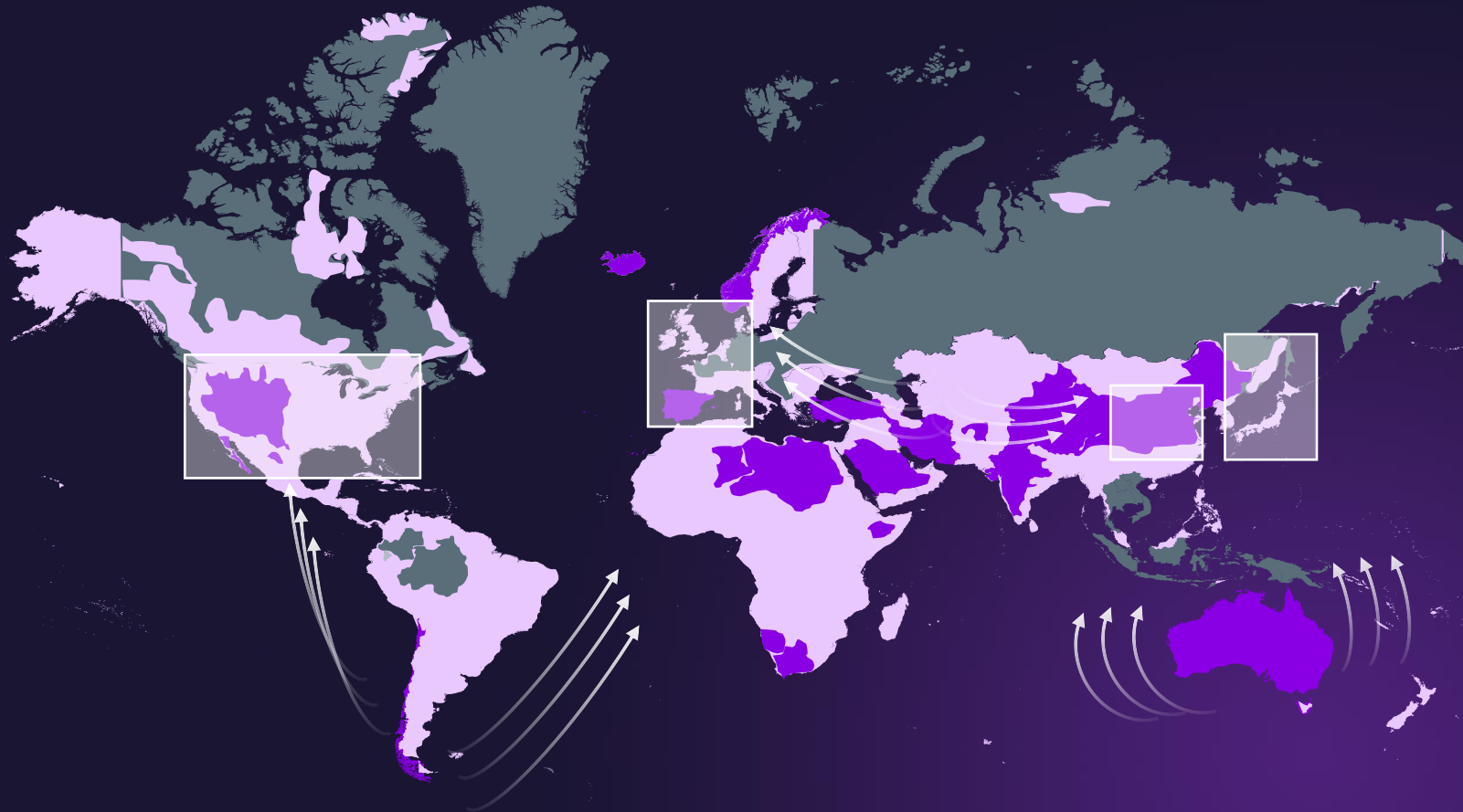
Reliable technology and reliable partner

with highest standards in safety and project excellence


Today's challenge – Green energy needs to travel from lowest cost regions to decarbonize demand centers

36 giga tons
Total energy-related
emissions in 2019

-  **10.2** Giga tons
-  **5.3** Giga tons
-  **2.6** Giga tons
-  **1.7** Giga tons
-  **1.1** Giga tons
-  **0.7** Giga tons



X.X – CO₂ emissions

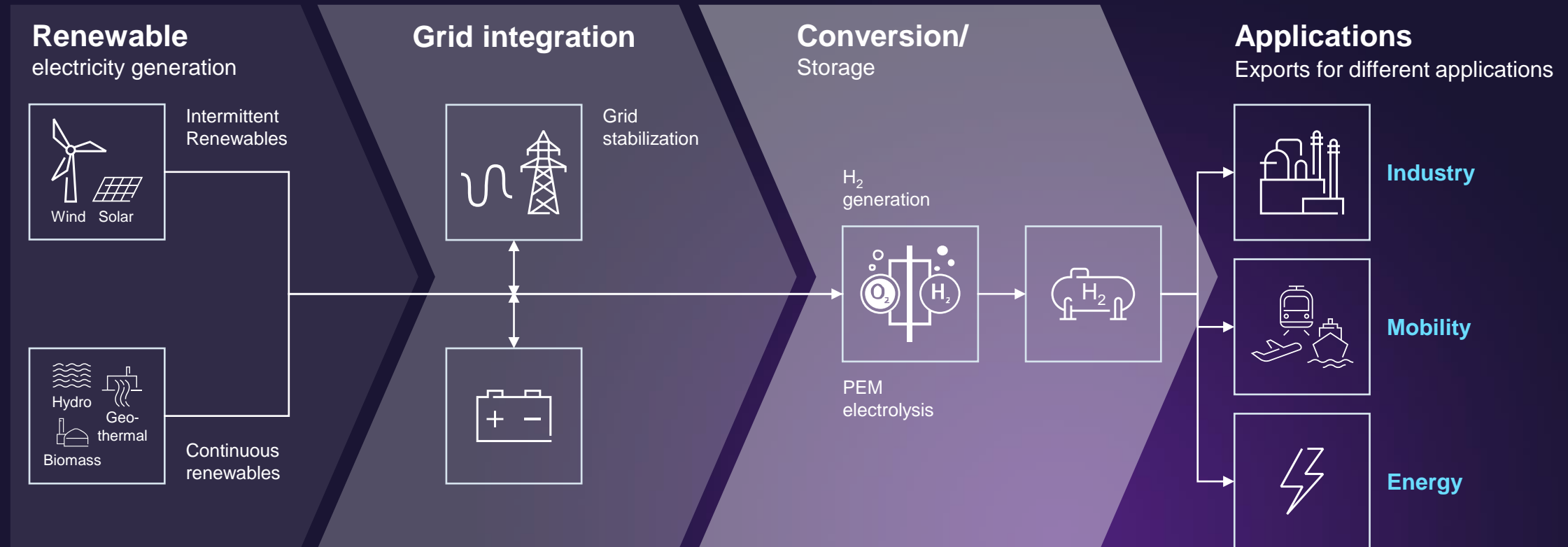
 Demand centers with high CO₂ emissions

Least    Most

PV/wind resources for renewable hydrogen production

Source: Hydrogen Council, McKinsey "Hydrogen insights report 2021", Global Carbon Atlas

Hydrogen from renewables enables large scale, long term storage and sector coupling



Focus on Proton Exchange Membrane (PEM) electrolyzer system technology

Operational performance



- **Fast start-up** and shut-down
- Highest **operational flexibility**
- **Cold start capability**

Clean by nature



- Highest **hydrogen purity >99.9%**
- **No aggressive chemical electrolyte**
- **No contaminants** – only water, hydrogen and oxygen in the system

Competitiveness



- **Small footprint** compared to alkaline systems
- **Lower OPEX** compared to alkaline systems due to maintenance free stack
- **Competitive hydrogen price** per kg at green electricity prices below 3 ct/kWh

Technology expertise in electrolysis

Our electrolyzer portfolio scales up by factor 10 every 4 – 5 years

0.1 MW

1 MW

10 MW

100+ MW

1,000+ MW

2011

Silyzer 100
Lab-scale demo

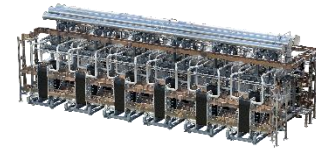
2015

Silyzer 200



2018

Silyzer 300



2023

Silyzer 300 plant



Next step

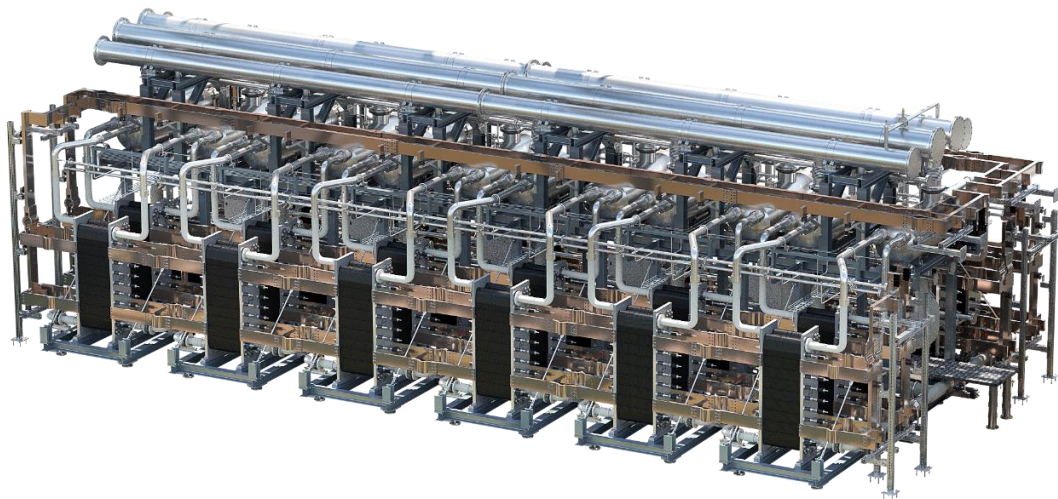
Co-Development with partners in **verticals**



Silyzer 300 – full stack array

The next paradigm in PEM electrolysis

Silyzer 300 – full stack array (24 stacks)



17.5 MW
plant power demand

>75.5 %
plant efficiency

24 stacks
to build a full stack
array

335 kg
hydrogen per hour



Starting production in the **gigawatt factory** for electrolyzers



Industrial-scale series production of electrolyzer stacks

2,000

square meters in Berlin Huttenstraße

€30m

investment in new production line

1GW

production capacity in 2023

3GW

production capacity in 2025 with a potential for more



Projects completed or in implementation based on Silyzer 300

Scale-up is already happening

6 MW

8.5 MW

up to 20 MW

50 MW

50 MW

70 MW

200 MW



H2Future Linz

- Green hydrogen for the steel making process
- Our partners: VERBUND, voestalpine, Austrian Power Grid (APG), TNO, K1-MET



Wunsiedel

- Green hydrogen for industry, grid services and mobility
- Our partners: Siemens AG, WUNH2, SWW Wunsiedel GmbH



Oberhausen

- Green hydrogen for Air Liquide pipeline infrastructure
- Our partner: Air Liquide



e-Methanol Kassø

- Green hydrogen for CO₂-neutral shipping at large-scale
- Our partner: European Energy



Hy4Chem-El Ludwigshafen

- Hydrogen as raw material for chemical plant
- Our partner: BASF



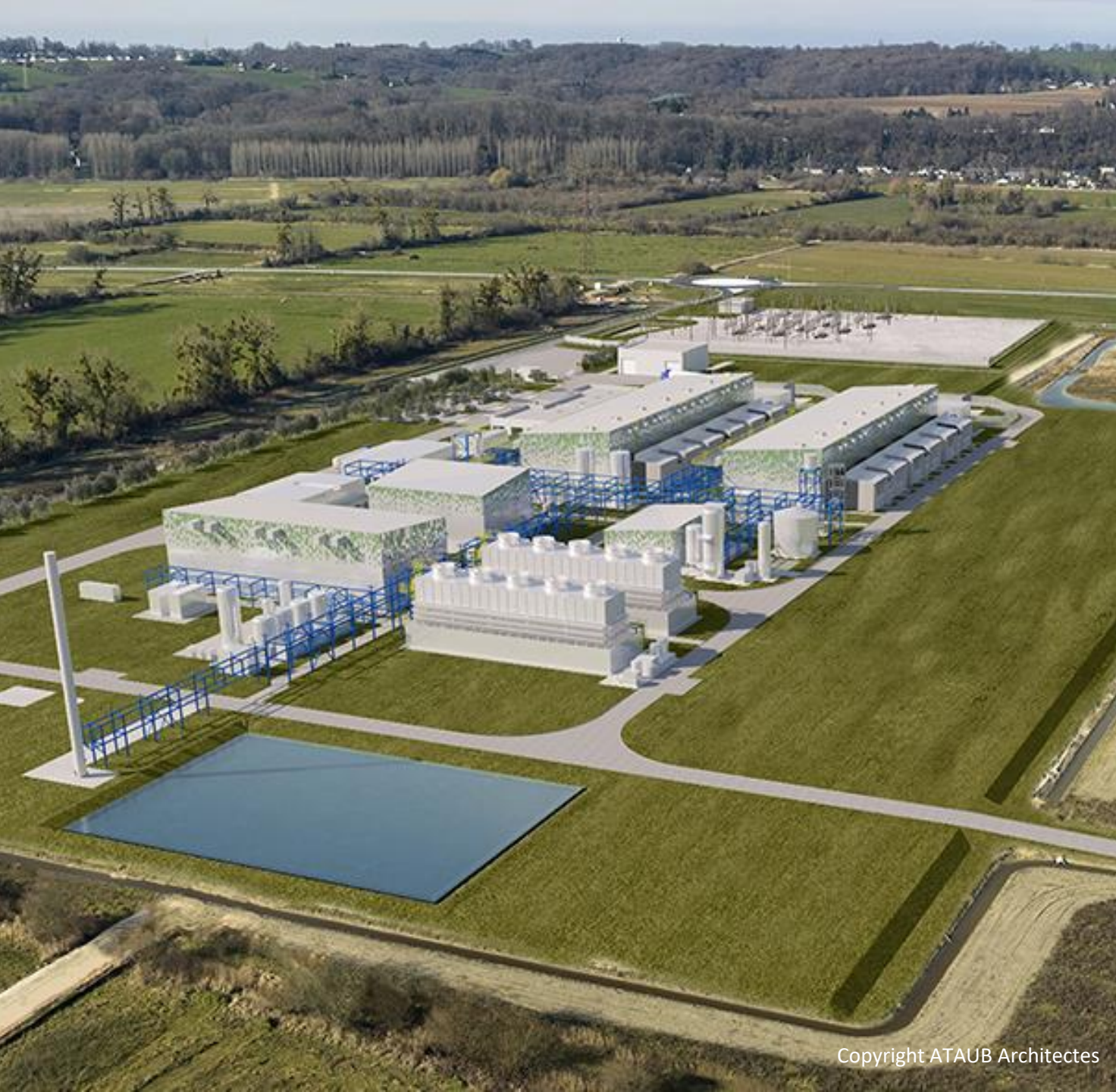
FlagshipONE

- Green hydrogen for CO₂-neutral shipping at large-scale
- Our partner: Ørsted



NormandHy

- Renewable electricity
- Engineering and Long Lead Started
- Our Partner: Air Liquide



Air Liquide Normand'Hy

Industrial-scale hydrogen electrolyzer plant to decarbonize industry and mobility

200 MW

Power demand based on Silyzer 300

4 tons

of green hydrogen per hour

250 000 tons

of carbon dioxide emissions will be avoided

FlagshipONE

Largest Power-to-X plant for e-Methanol for shipping with our partner Ørsted

70 MW

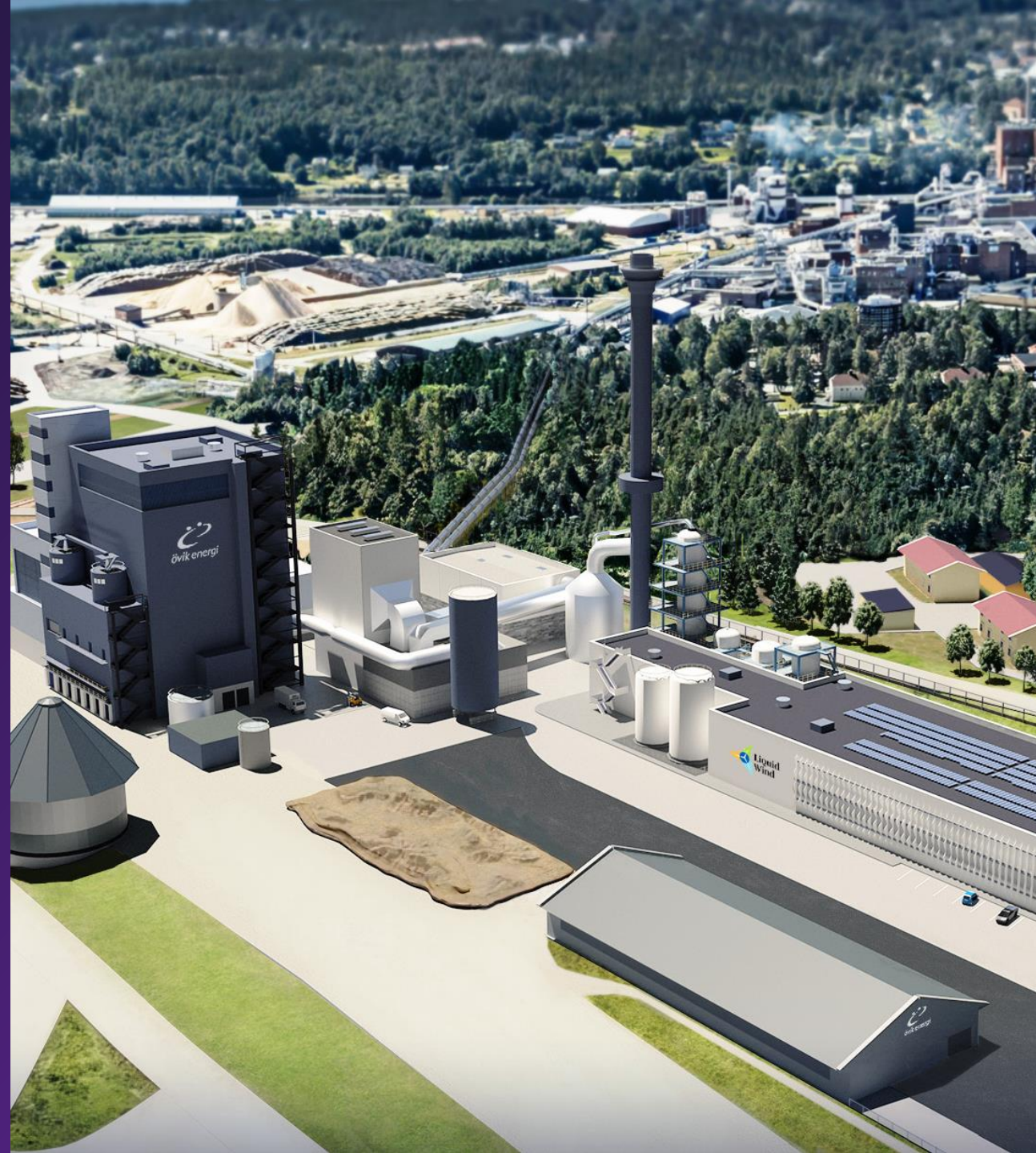
power demand based on Silyzer 300

50.000 tons

of e-Methanol per year from 2025

Blueprint: 10 more

plants by 2030



Wasserelektrolyse (Hy4Chem-EI)
Übergabe des Förderbescheids
Ludwigshafen – 23. November 2023

BASF
We create chemistry



BASF Hy4Chem-EI

Industrial-scale electrolyzer to supply hydrogen as raw material to chemical plant

54 MW

Power demand based on Silyzer 300

Capacity to produce

8,000 tons

of green hydrogen per year from 2025

up to **72 000 tons**

of carbon dioxide emissions will be avoided per year at BASF site Ludwigshafen



HARU ONI PILOT PROJECT

First integrated plant for climate-neutral e-fuel production from wind and water



750,000 liters

of e-methanol per year from 2023
(130,000 liters of e-gasoline)

>55 m liters

e-fuel per year planned from 2025

>550 m liters

e-fuel per year
planned from 2027



Project

Customer: HIF (Highly Innovative Fuels)
Off-taker: Porsche AG
Country: Chile, Patagonia
Installation: 2022
Product: Power-to-methanol solution based on SE Electrolyzer

Challenge

- Huge wind energy potential in Magallanes
 - Existing industry and port infrastructure
- Perfect conditions to export green energy from Chile to the world

Use cases



E-Fuel for Porsche cars

Potential for adding Kerosene or Diesel production in future phases

Methanol for ship motors

Solutions

- Production of e-gasoline and e-methanol at one of the best spots worldwide for wind energy
- Co-developer Siemens Energy realizing the system integration from wind energy to e-fuel production
- International Partners like Porsche and AME