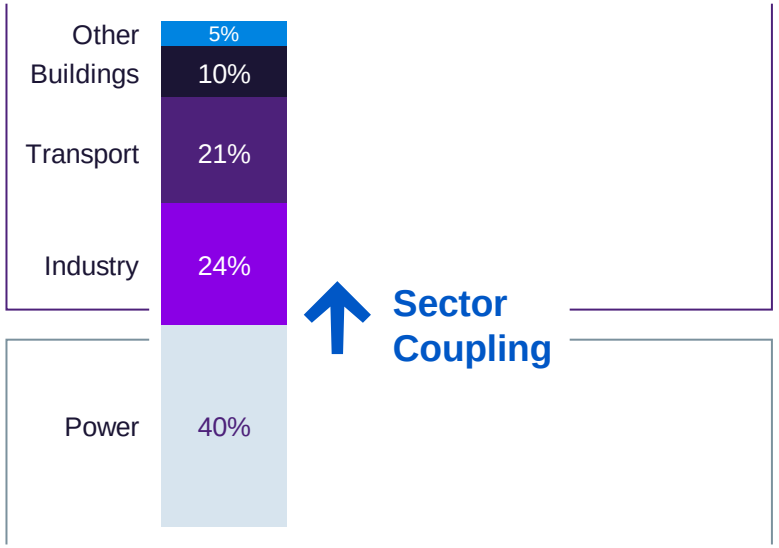
Workshop PtG/ PtL

Large Scale PEM Electrolysis and Sector Coupling
8th of March, 2021; Ilona Dickschas

“Sector Coupling” is the key lever for decarbonization of all end-user sectors

Shares in global CO_2 emissions by sectors

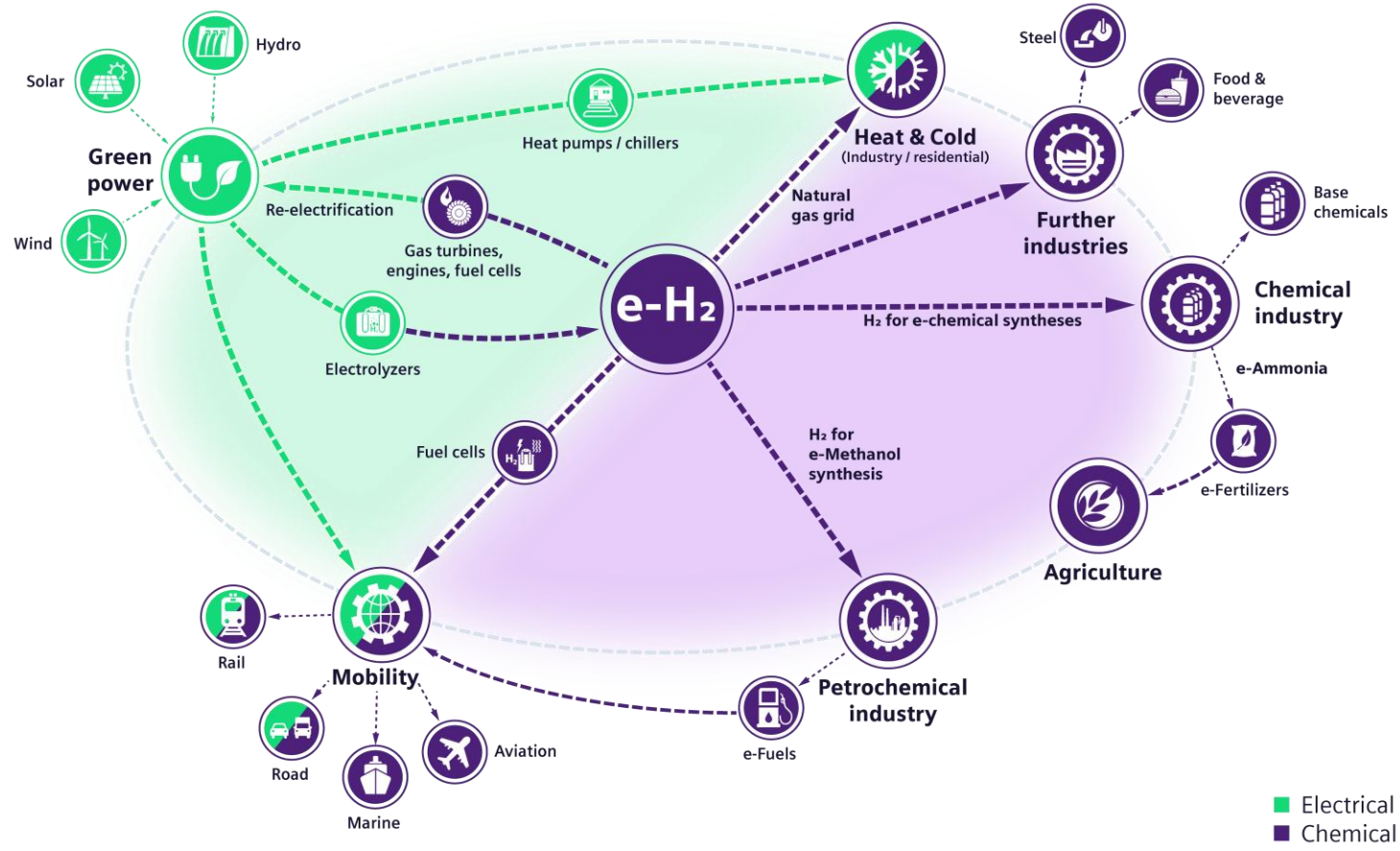
Increased future focus for emission reduction
Share on CO_2 emissions: 60%
Share of Renewables: 8%



Continuous emission reduction required
Share on CO_2 emissions: 40%
Share of Renewables: 22%

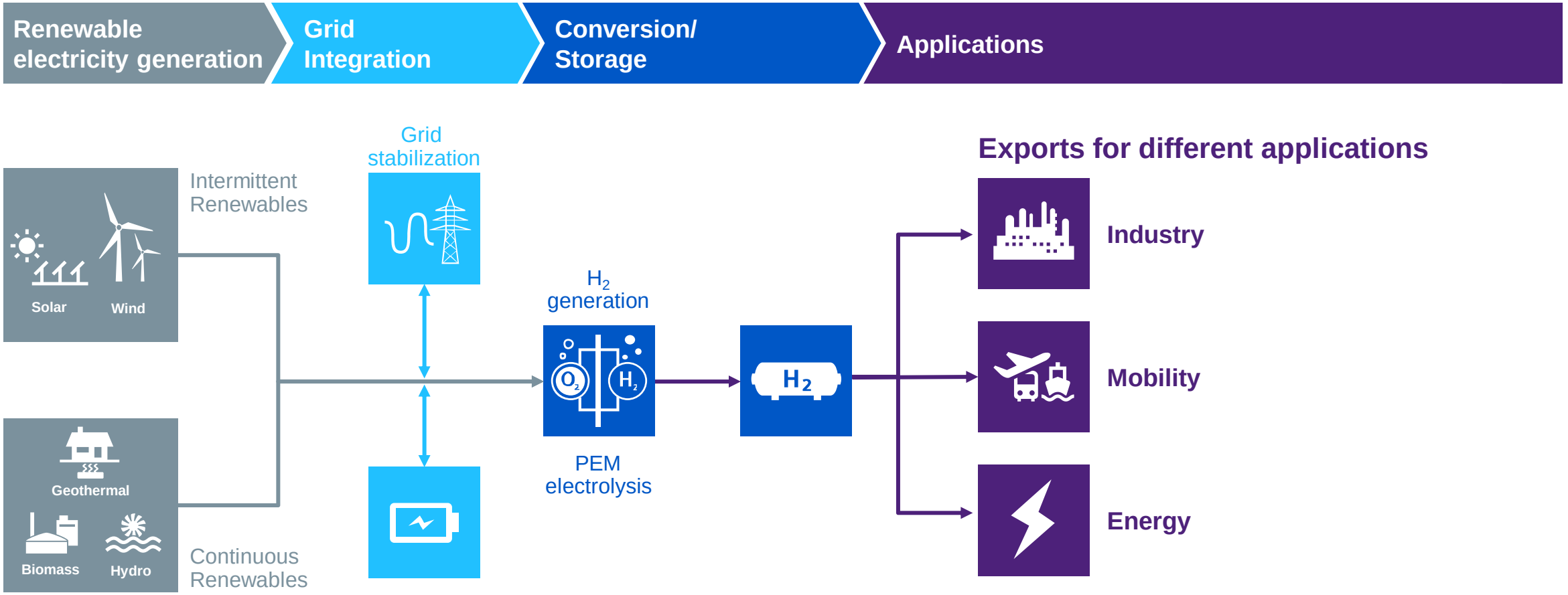
Source: World Energy Balances 2018

Sector Coupling – Links and Interactions



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

SIEMENS energy



Silyzer portfolio scales up by factor 10 every 4 – 5 years driven by market demand and co-developed with our customers

Silyzer portfolio roadmap

0.1 MW → 1 MW → 10 MW → 100 MW → 1,000 MW

2011

Silyzer 100
Lab scale demo
~20 kOH[1],
~30 t of H_2

2015

Silyzer 200
~130 kOH[1]
~1700 t of H_2

World's largest Power-to-Gas plants with PEM electrolyzers in 2015 and 2017 built by Siemens Energy!

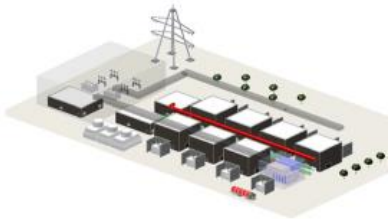
2018

Silyzer 300

Biggest PEM cell in the world built by Siemens Energy!

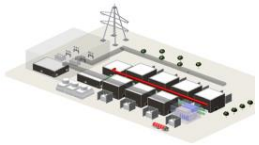
2023+

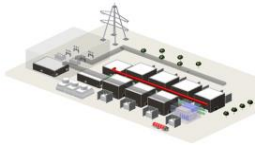
Next generation
Under development

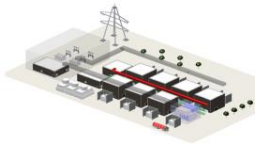


2028+

First investigations in cooperation with chemical industry







1 1000 accumulated Operating Hours; Data OH & tons as of Oct 2020

Silyzer 300 – Full Module Array
The next paradigm in PEM electrolysis

Silyzer 300 – full module array (24 modules)

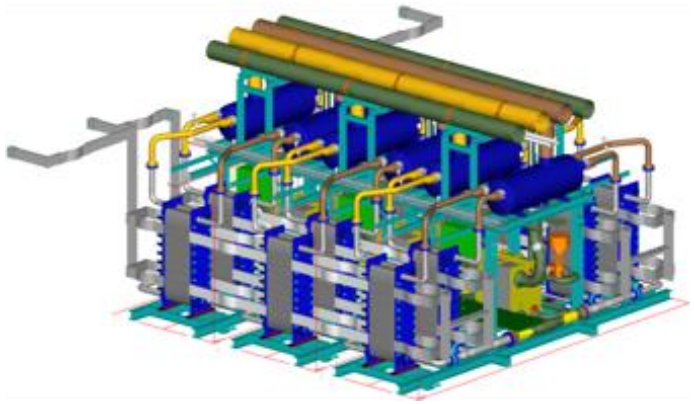
17.5 MW
plant power demand

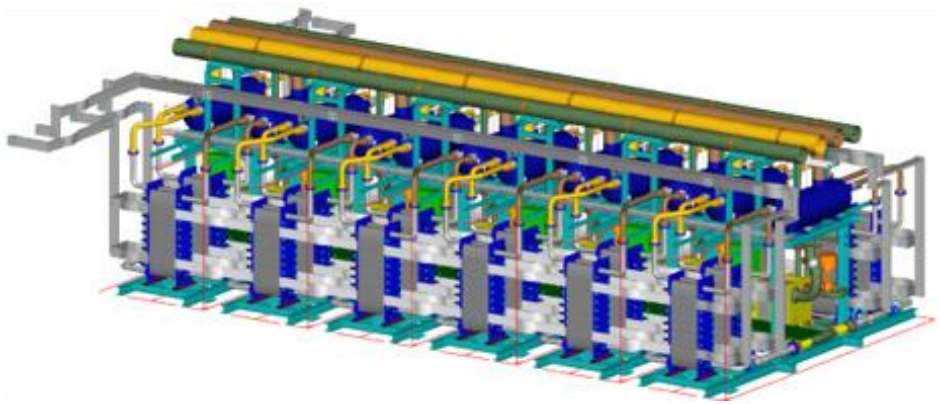
> 75.5 %
plant efficiency

24 modules
to build a full module array

330 kg
hydrogen per hour

Cost-optimized and pre-engineered solutions for Silyzer 300 – can be multiplied up to Gigawatt-scale solutions





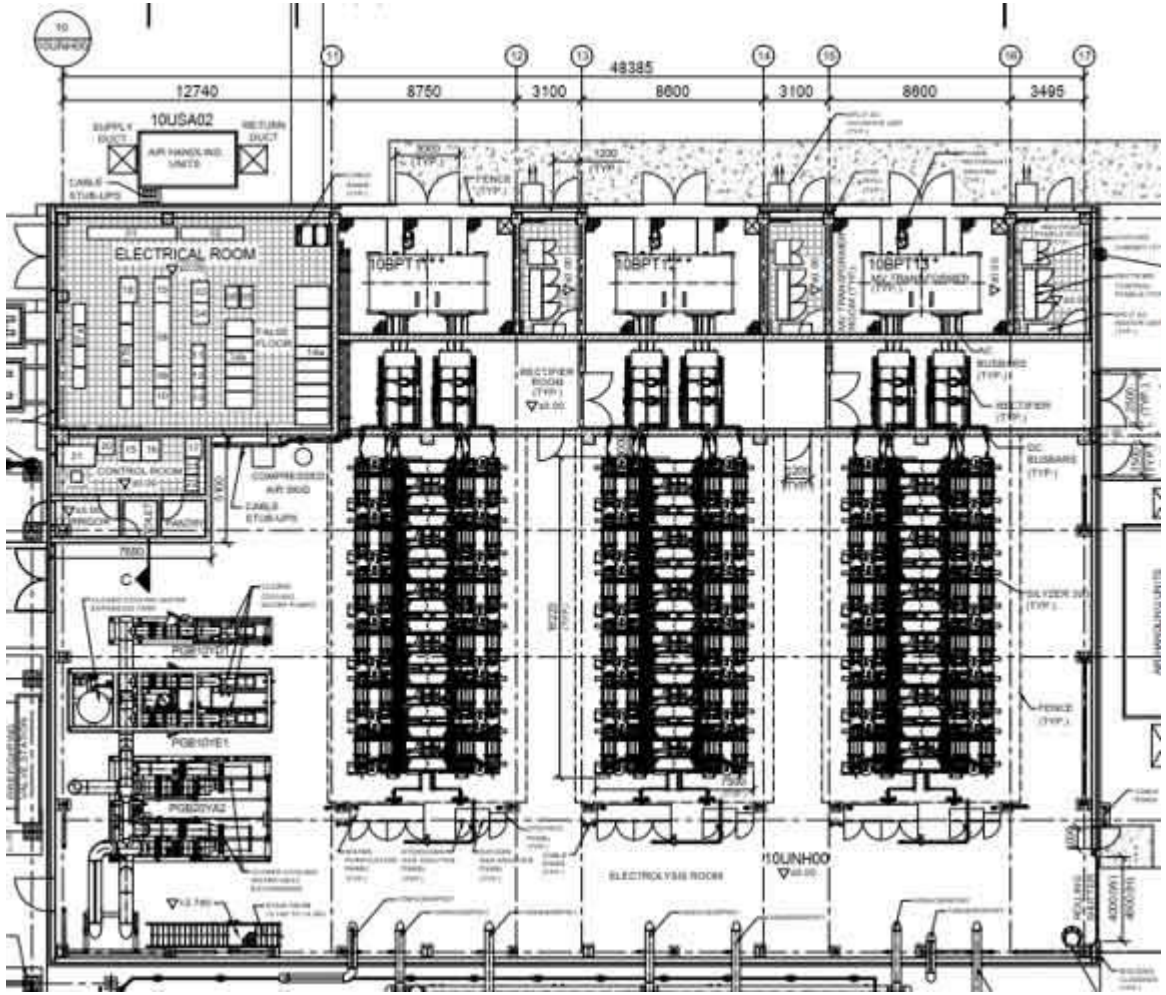
	Half Array – 12 Modules	Full Array – 24 Modules
Rated H_2 production	165 kg/h at rated power	330 kg/h at rated power
Rated Silyzer 300 plant power[1]	8.7 MW	17.5 MW
Plant efficiency Silyzer 300[1]	>75.5%	>75.5%
Dimension array	8.0 x 7.5 x 3.7 m	15.0 x 7.5 x 3.7 m
Output pressure	Array: 100 mbar(g); Plant: project specific	
Hazard concept	Standard industrial building, only water no additional chemicals	

1 Power demand and efficiency calculated for the air-cooled plant, new and clean, T_{amb} = 15°C, HHV = 39.45 kWh/kg

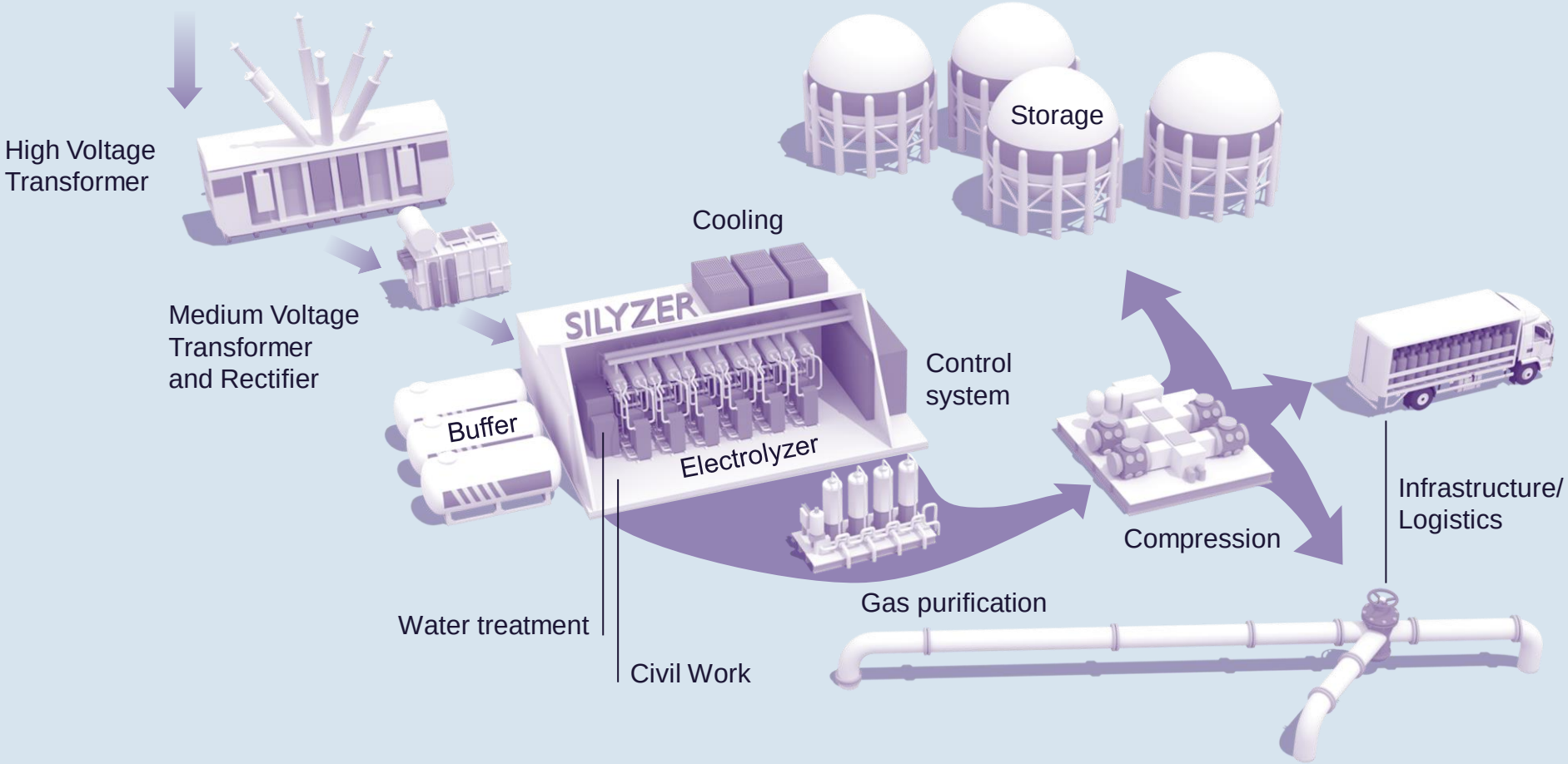
Optimized plant design for fast installation, low cost and maintenance friendliness

Plant layout

- Pre-fabricated and pre-tested module groups for reduced onsite effort
- Compact footprint
- Standard industrial building
- No indoor crane necessary
- Separate rooms for power electronics
- Future upgrades compatible



Hydrogen generation
More than just an electrolyzer



H2FUTURE
A European Flagship project for generation and use of green hydrogen

6 MW

Power demand based on Silyzer 300

1,200 Nm^3

of green hydrogen per hour

January 2021

Project

- Partner: VERBUND (coordination), voestalpine, Austrian Power Grid (APG), TNO, K1-MET
- Country: Austria
- Installed: 2019
- Product: Silyzer 300

Use cases

- Hydrogen for the steel making process
- Supply grid services

Challenge

- Potential for “breakthrough” steelmaking technologies which replace carbon by green hydrogen as basis for further upscaling to industrial dimensions
- Installation and integration into an existing coke oven gas pipeline at the steel plant
- High electrolysis system efficiency of 80%

Solutions

- Operation of a 12-module array Silyzer 300
- Highly dynamic power consumption – enabling grid services
- State-of-the-art process control technology based on SIMATIC PCS 7

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 735503. This Joint Undertaking receives support from the European Union’s Horizon 2020 research and innovative programme and Hydrogen Europe and NERGHY

Future of energy in Europe is about decarbonization through “Sector Coupling” and a new market design

Cornerstones of a future energy system

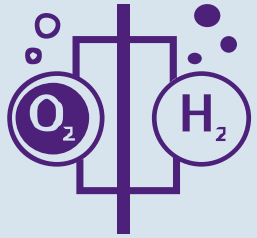
Decarbonization of energy

Transforming the conventional generation capacity into low-carbon assets

Sector coupling

Leveraging renewables in power sector to decarbonize heat, mobility, industry

Electrolysis



Key technology for P2X/sector coupling

§ **Regulatory framework:** Has to value CO_2 reduction and needs to be technology open – necessary now!

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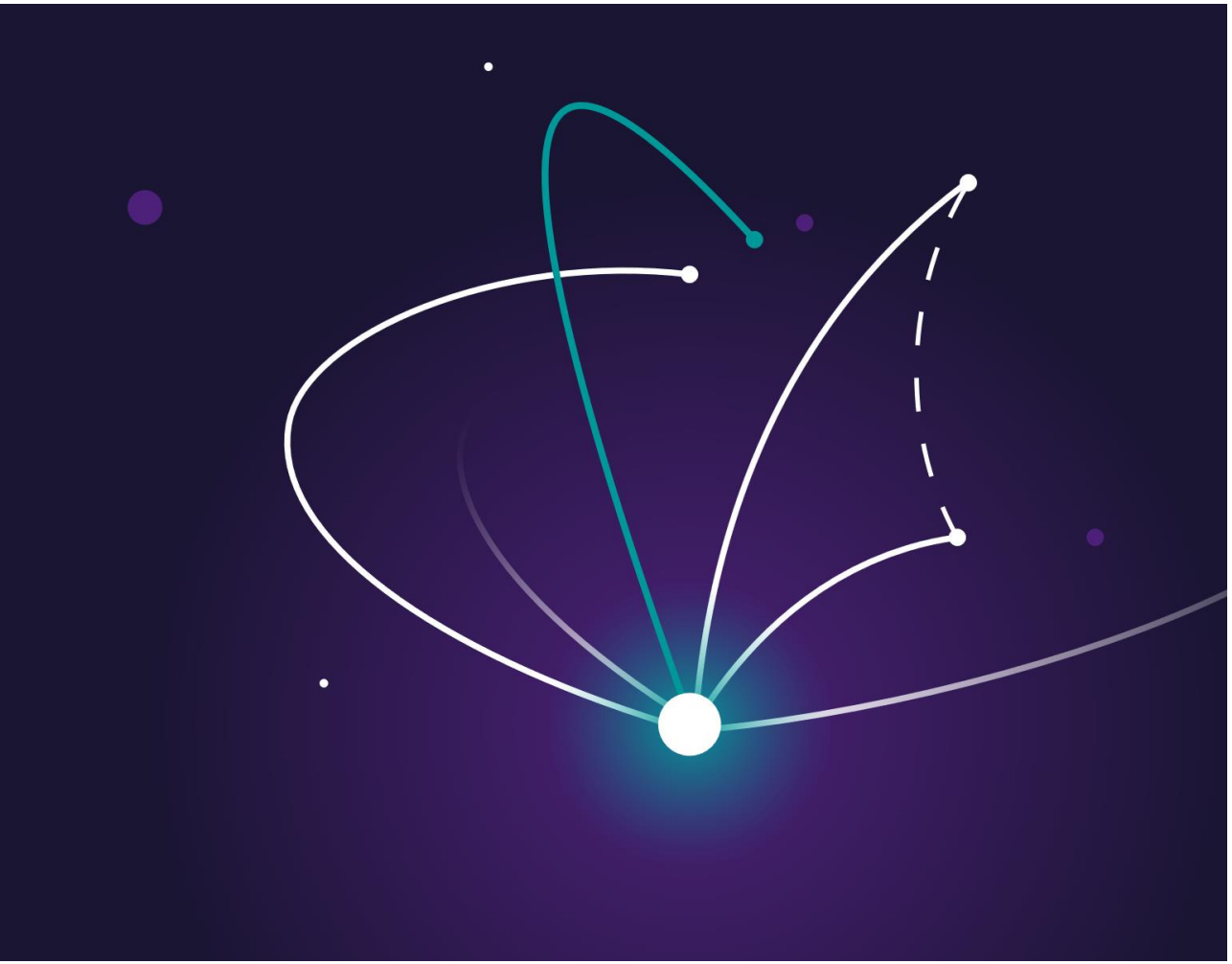

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