Energy transition involving renewables and hydrogen towards full decarbonization

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To decarbonize the global economy by 2100 we need to take more than one measure

Politics force worldwide decarbonization

G7 summit, 2015:
Decarbonization of the global economy by 2100: Greenhouse gas emissions reductions of 40% to 70% by 2050 (baseline: 2010).

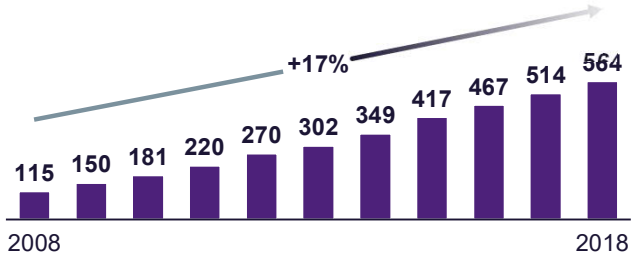
COP21, 2015:
195 countries adopt the first universal climate agreement: Keep a global temperature rise this century well below 2° C.

COP23, 2017:
The 197 Parties discussed how and how far they can implement decarbonization measures

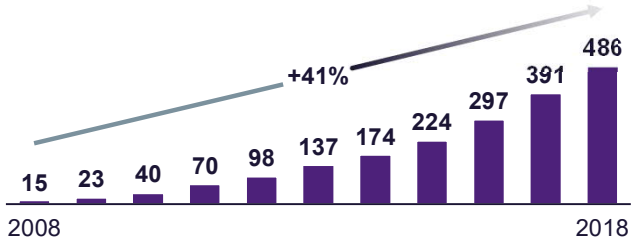
EU Hydrogen Strategy
Until 2024: Install at least 6 GW of H2 Electrolyzers
Until 2030: Install at least 40 GW of H2 Electrolyzers
Until 2050: H2 technologies deployed at large scale

Renewables installation increase

Global Wind Installations (GW)[1]

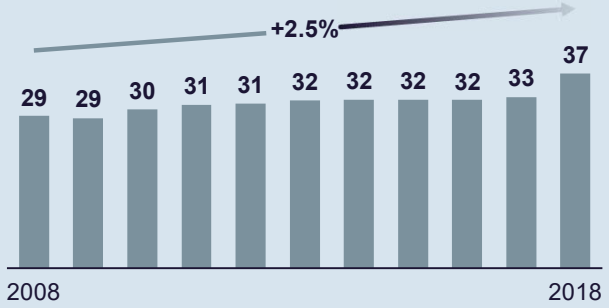


Global PV Solar installations (GW)[1]



But CO_2 grow constantly

Global CO_2 Emissions (Gt)[2]

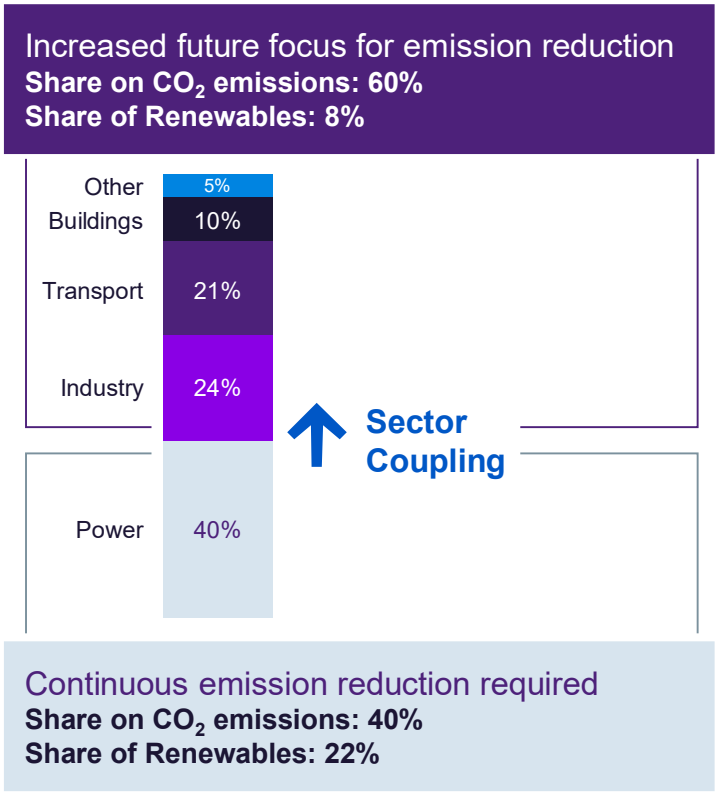


! Renewables integration; Decarbonization of every industry; Changes in legislation !

Sources: 1 IRENA, Renewable Capacity Statistics 2019 | **2** IEA

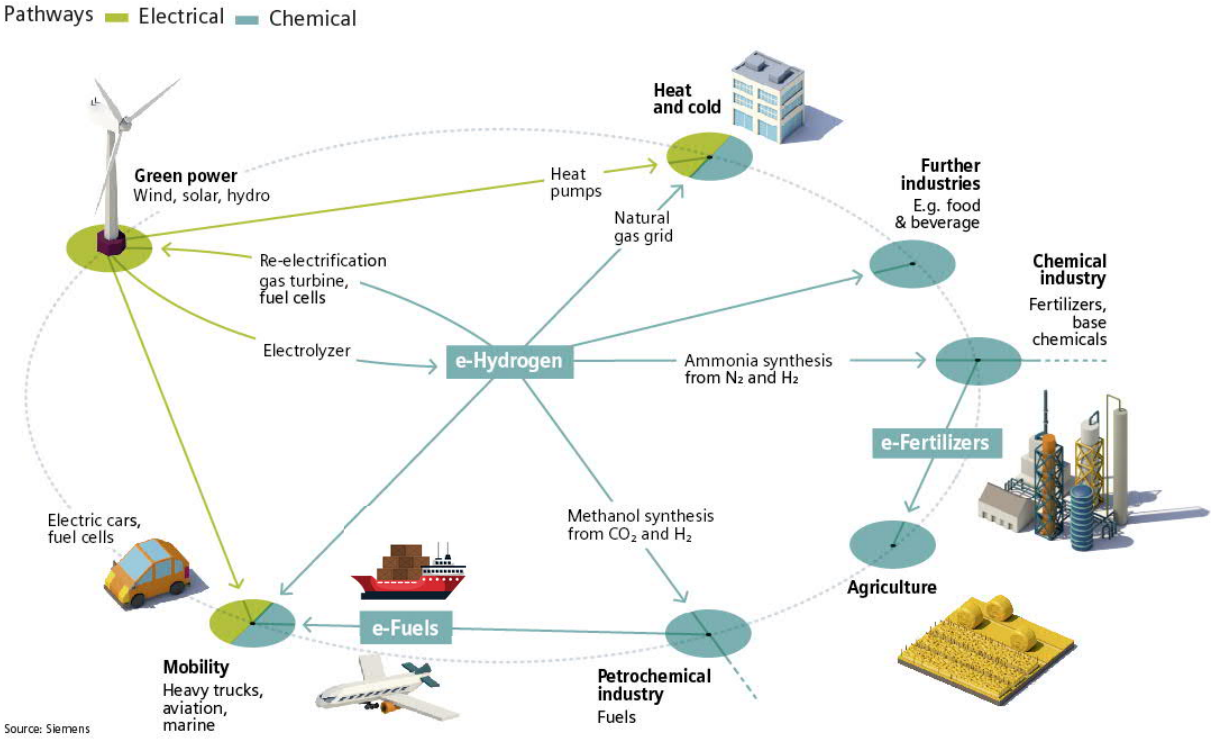
“Sector Coupling” is the key lever for decarbonization of all end-user sectors

Shares in global CO_2 emissions by sectors

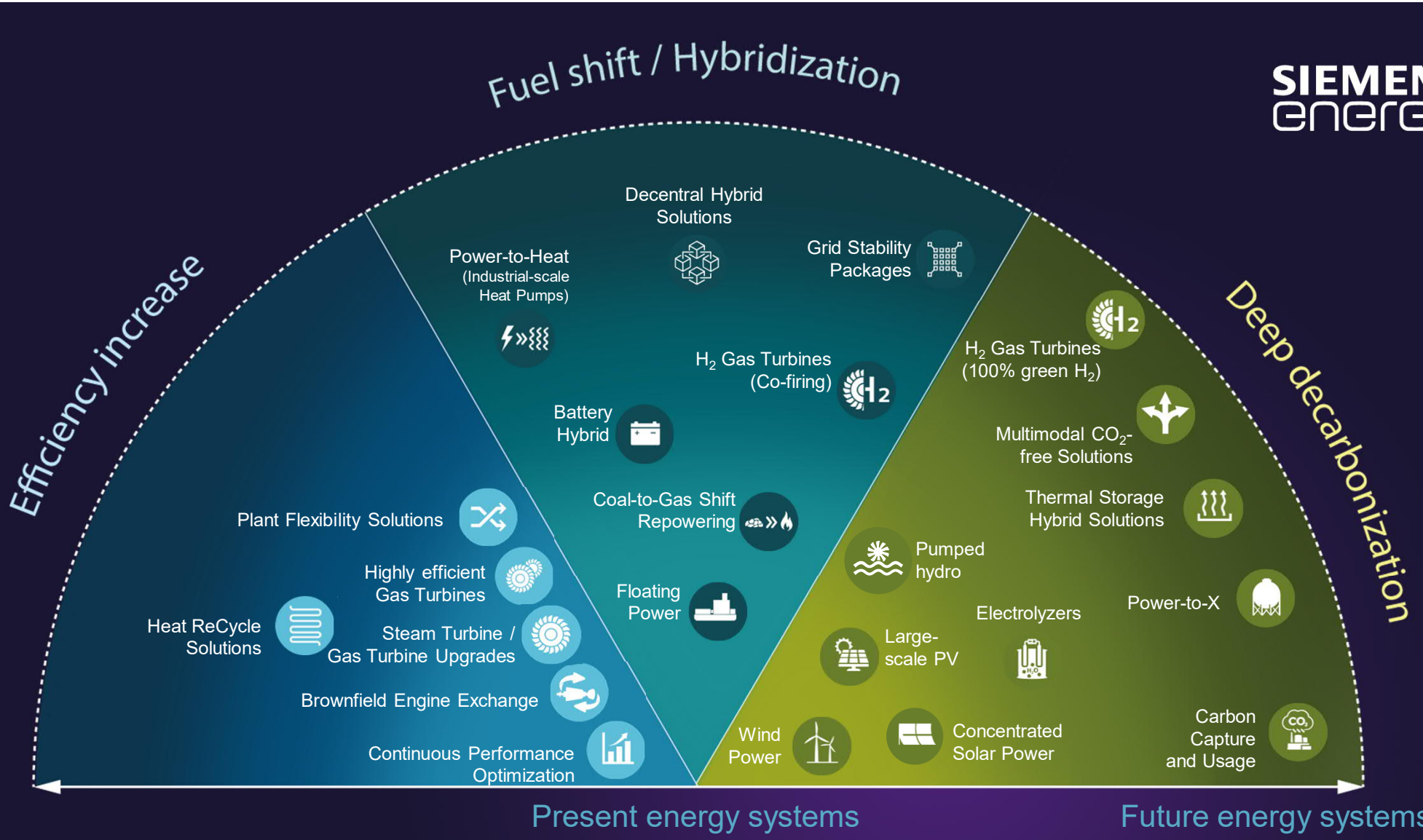


Source: World Energy Balances 2018

Sector Coupling – Links and Interactions



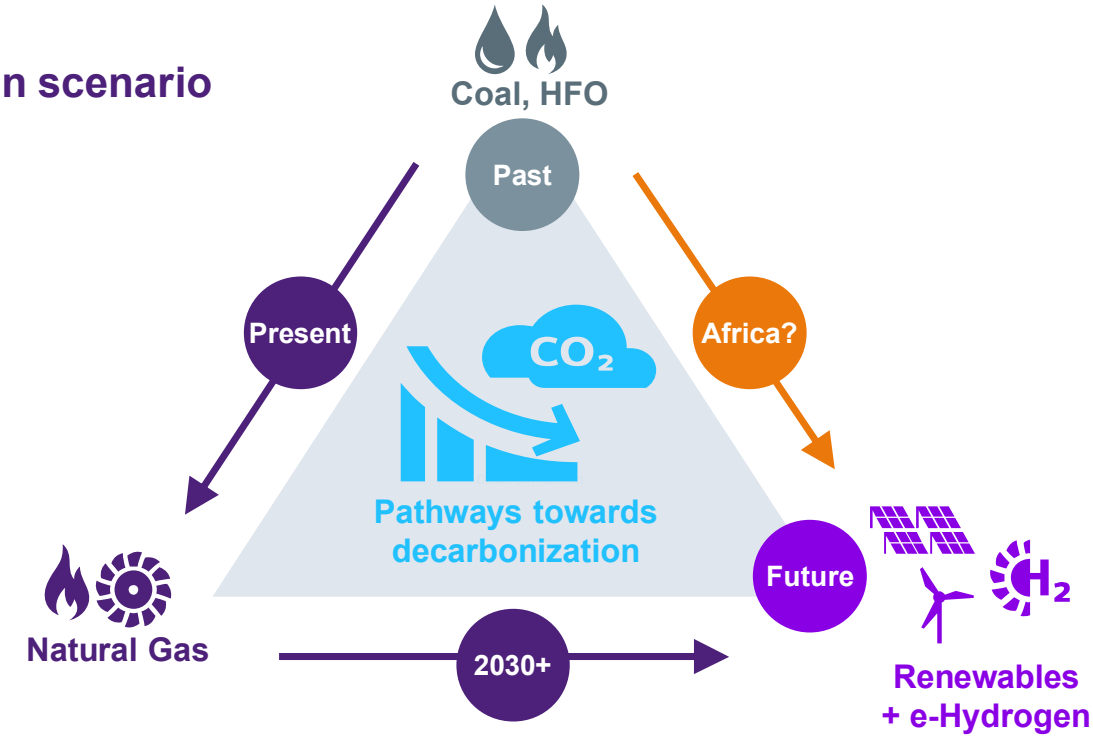
Green Hydrogen based on electrolysis. Profitability depends strongly on electricity costs and CAPEX



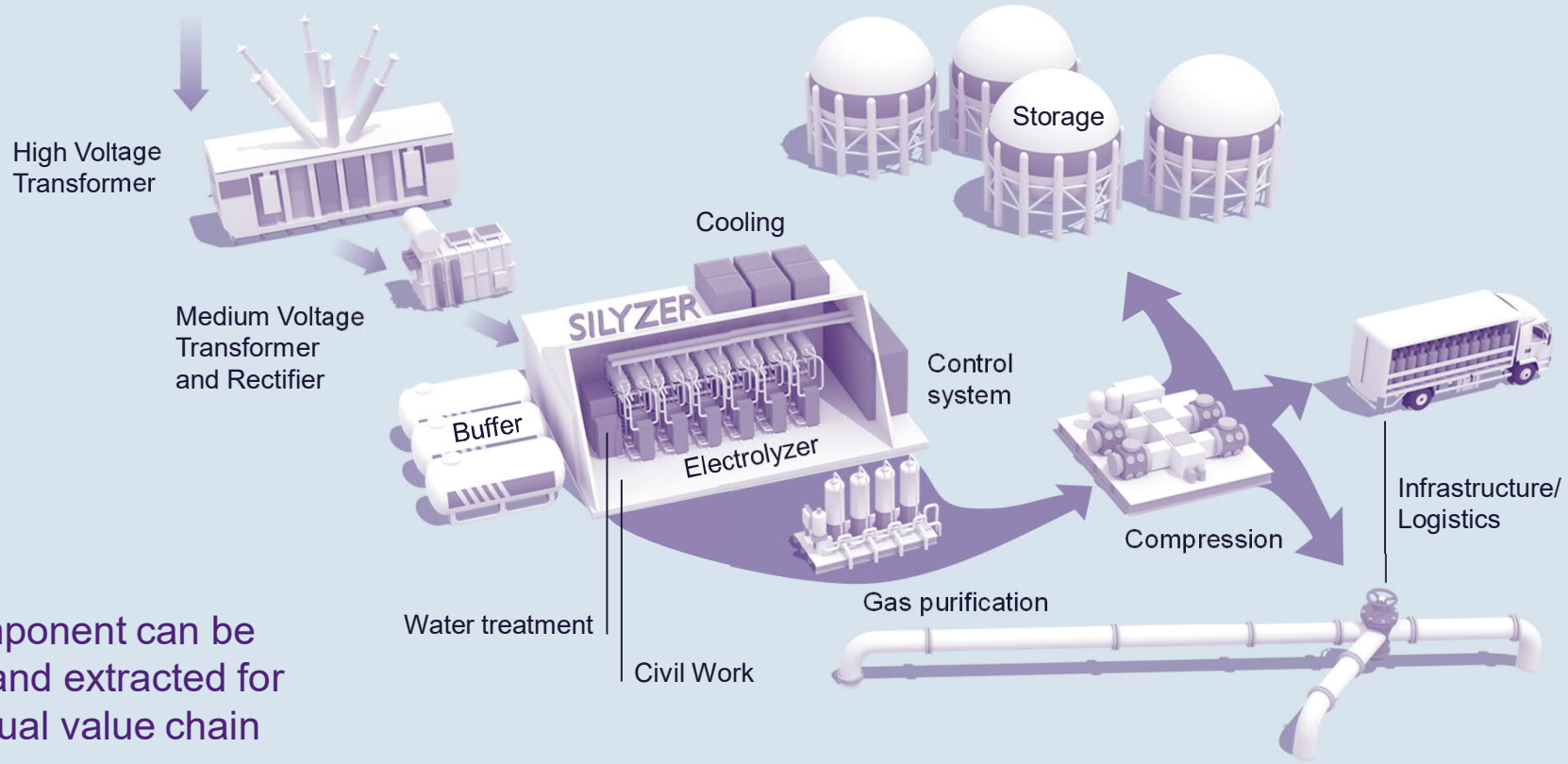
Tunisia has the potential to shortcut the energy transition, directly towards a decarbonized energy mix based on renewables and e-hydrogen

SIEMENS energy

Decarbonization scenario



Hydrogen generation
More than just an electrolyzer

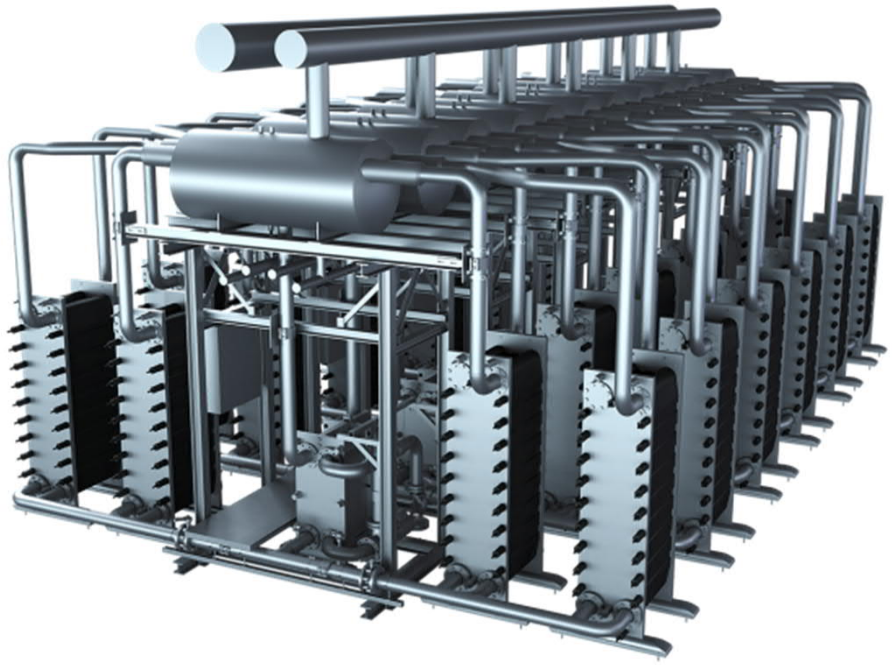


Each component can be selected and extracted for an individual value chain

Silyzer 300
Siemens' solution for industrial scale e-Hydrogen production

17.5 MW	Power demand per full Module Array (24 modules)
75%	System efficiency[1] (higher heating value)
24 modules	To build a full Module Array
340 kg	Hydrogen per hour per full Module Array (24 modules)

Silyzer 300
Module Array (24 modules)



1 Ambient temperature 15° C, air cooled

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

2011

Silyzer 100
Lab scale demo
~4,500 OH[1],
~150k Nm³ of H_2

1 MW

2015

Silyzer 200
~86,500 OH[1]
~7.3 m Nm³ of H_2

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

10 MW

2018

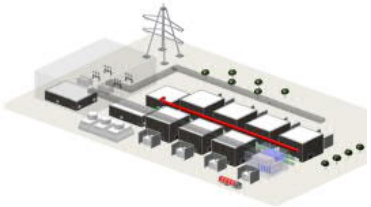
Silyzer 300

Biggest PEM cell in the world built by Siemens!

100 MW

2023+

Next generation
Under development



1,000 MW

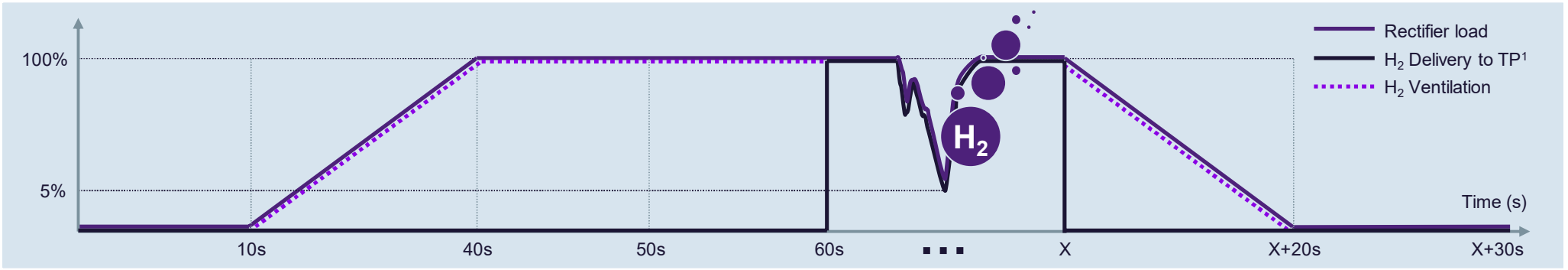
2030+

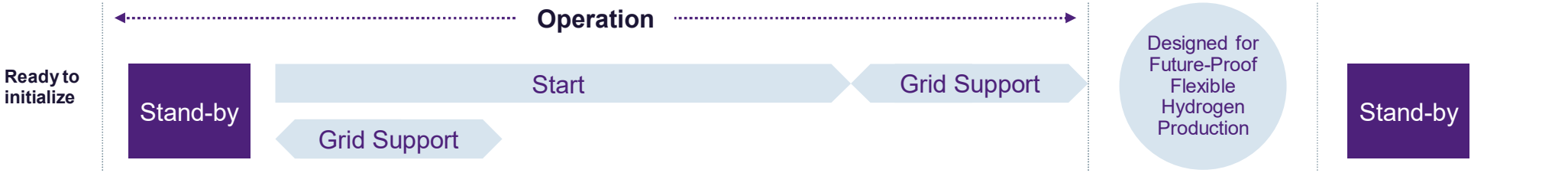
First investigations in cooperation with chemical industry

1 Operating Hours; Data OH & Nm³ as of Dec 2019

The Silyzer 300 enables grid support services with efficient hydrogen yield and maximum dynamics

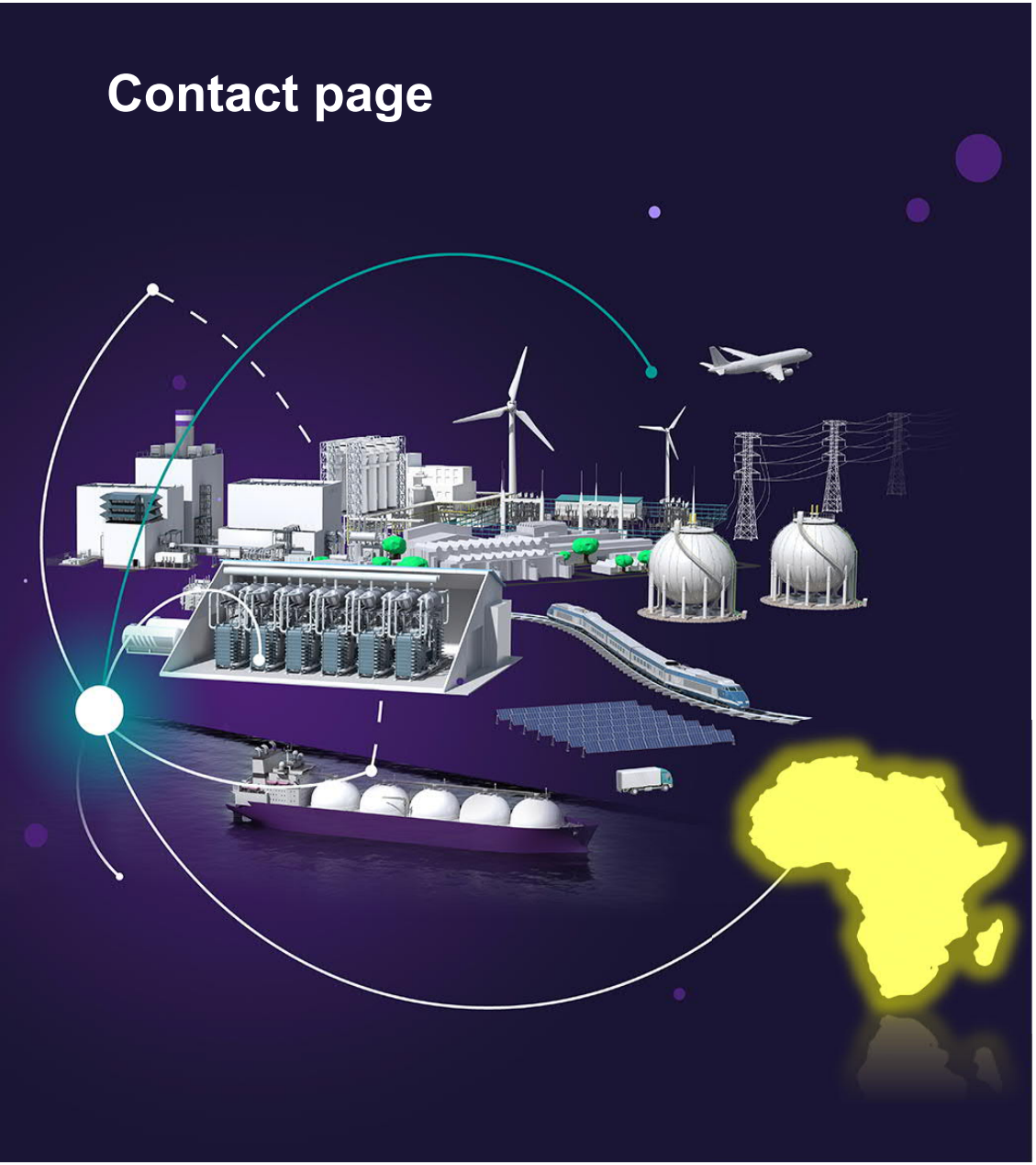
	Start 0 – 100% H_2	<1 min, enabled grid support
	Dynamics in range	10%/s in range 0 – 100%





1 Terminal Point

Contact page



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