

Energy resilience and energy transition Two sides of the same coin

Stefano Innocenzi
SVP and CEO Sustainable Energy Systems at Siemens Energy

Groningen, October 06, 2022



The Energy Outlook 2022¹

Change



Carbon budget is running out



Governments push decarbonization

Transition



Low carbon hydrogen increases



Modern bioenergy grows



Fossil fuels decline over next 3 decades



Global energy markets restructure



CO₂ removals and CCUS are used



Use and investment in O&G continues

¹ Based on BP Energy Outlook 2022 and SE TI SES own adjustments/visualization

How does the Energy Outlook look like after start of the war in Ukraine?

Push for Change



Carbon budget is running out



REPowerEU & Fit-for-55



US Inflation Reduction Act

Government ambitions increase

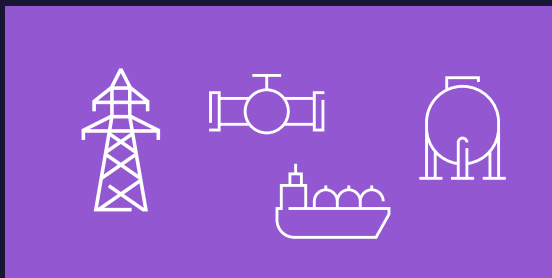
Accelerated Transition



Renewables expand even faster



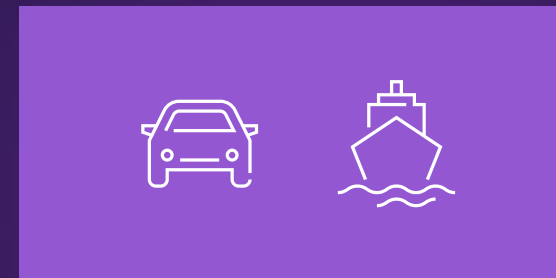
Green hydrogen cost competitive with grey



Energy security becomes priority



Countries develop bilateral collaborations

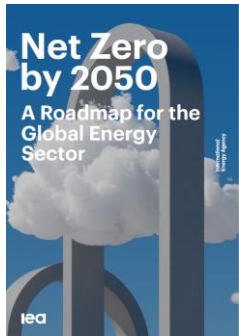


First movers implement e-fuels



Investment in import LNG terminals

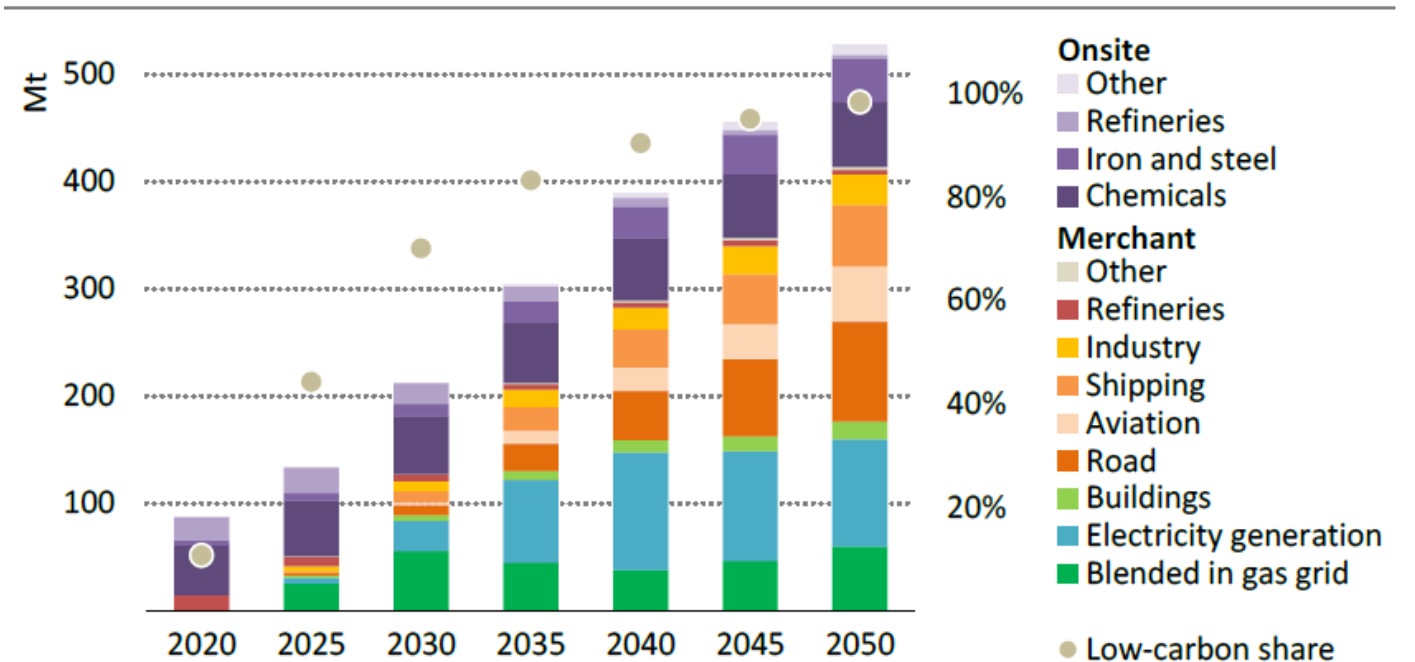
Offshore Wind farms with a modular set-up can deliver the electrolyzer standardization needed



“Global electrolyser capacity reaches 850 gigawatts (GW) by 2030 and 3 600 GW by 2050, up from around 0.3 GW today...

...Scaling up deployment of technologies and related manufacturing capacity will be critical to reducing costs.”

Figure 2.19 ▶ Global hydrogen and hydrogen-based fuel use in the NZE



IEA. All rights reserved.

Sources: IEA, Net Zero By 2050, 2021, Text page 109, graph p. 75

Renewable power and P2X create major benefits

Shift to **renewable power** leads to:

- Greater energy security
- Stabilization of energy prices
- Accelerated pathway for low-carbon energy system
- Green economy-driven growth
- A long-term sustainable energy market

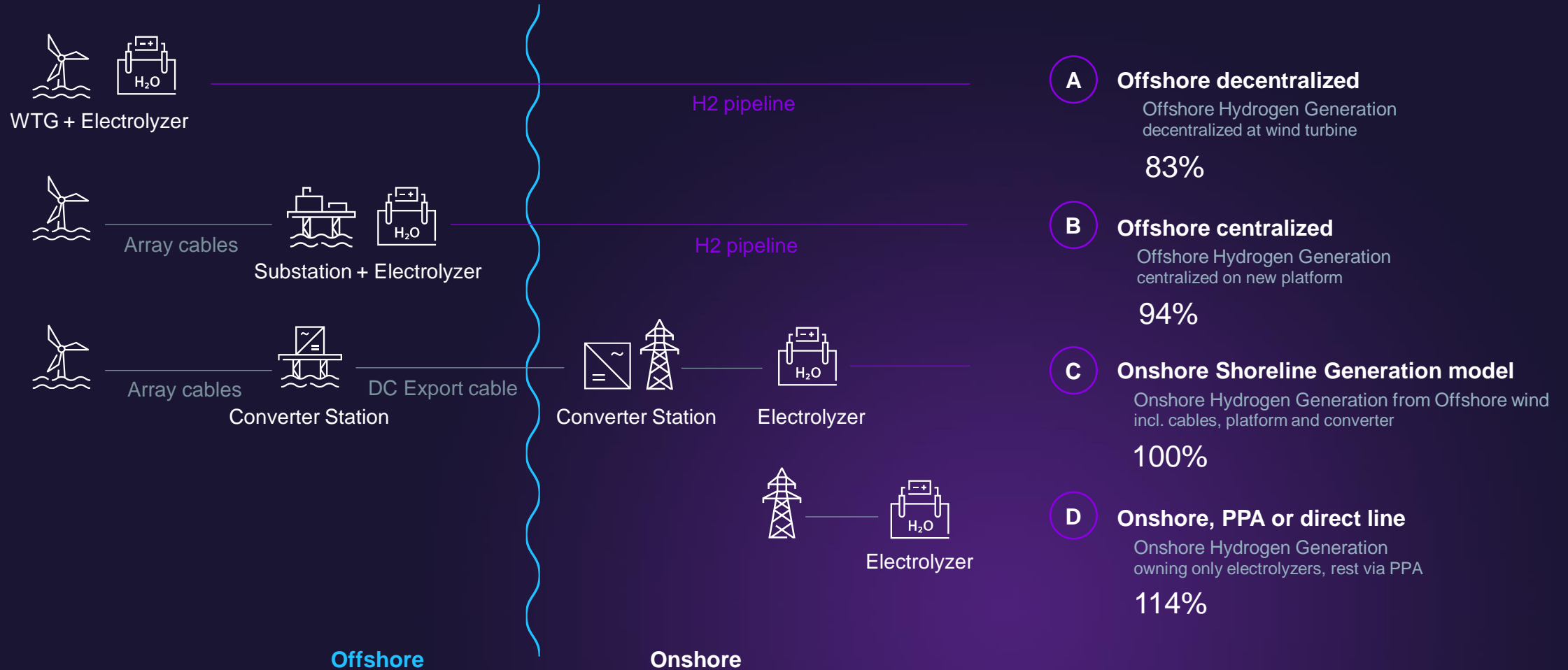


Shift to **P2X** based on renewables facilitates:

- **Domestic production of green molecules** to decarbonize industry, mobility and energy sector
- **Long-term Storage of green energy**
- **Production of green molecules** in renewable rich regions **and transport** to demand centers



Wind to Hydrogen topologies, an LCoH comparison



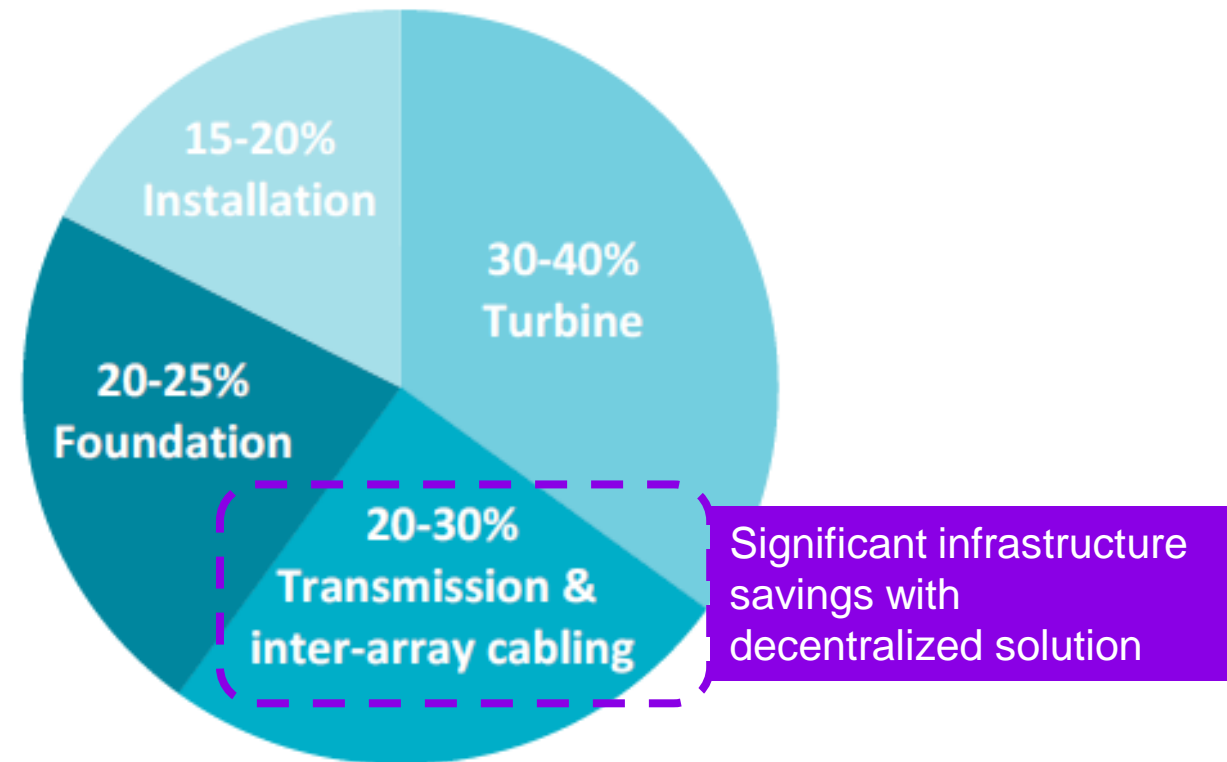
Reference value: 100% = 1GW Wind Farm, onshore hydrogen generation from offshore wind, Comparison based on pre-war values

Offshore wind farms would have a significant cost-out potential when moving to molecules



“Offshore wind projects dedicated to produce local, renewable-based hydrogen could offer significant cost advantages over projects using electricity direct from the grid. In part this is because dedicated offshore wind farms would benefit from cost reductions by avoiding the need for transmission.

Indicative shares of capital cost by component



Sources: IEA, Offshore Wind Outlook, 2019, p. 24 (graph) and p. 55 (text). Graph is part of a group of charts.

Decentralized Offshore Hydrogen Generation



“Plug and Play”
containerized
electrolyzer solution

Modified and adapted offshore wind turbine



CAPEX reduction by replacing high-cost high voltage infrastructure with pipes network

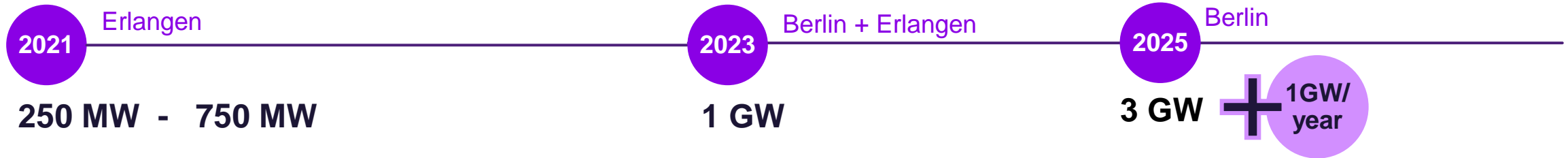


Increase of system efficiency due to lower electrical losses



Increase of plant load factor as electrolyzer load more flexible than electrical network requirements

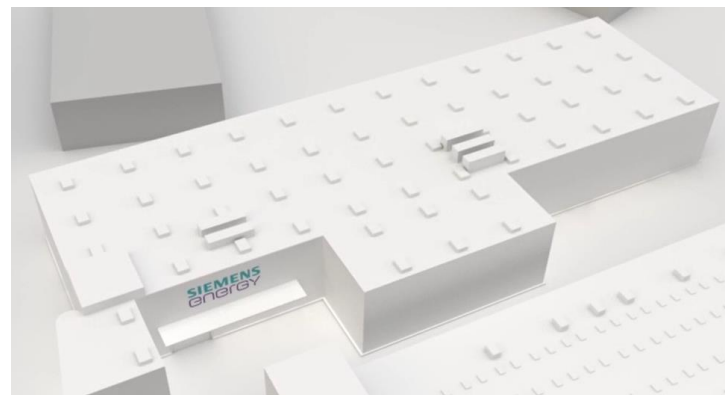
Ready to deliver large-scale electrolysis systems + capacity increase in Germany is locked and loaded



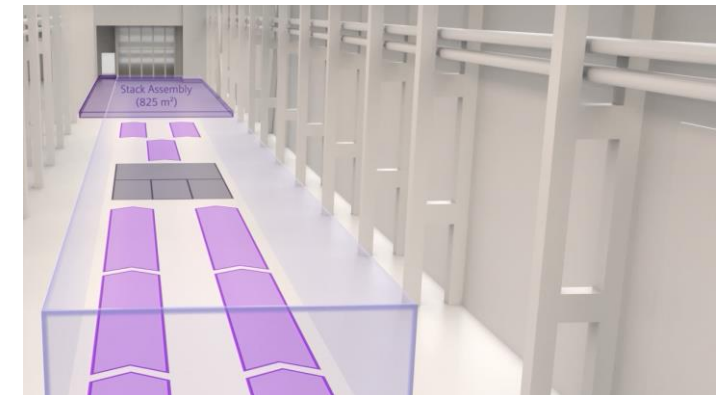
- Implementation of **modern robots**
- **Fully automated** production line
- **Industry 4.0 Digitalization** implemented



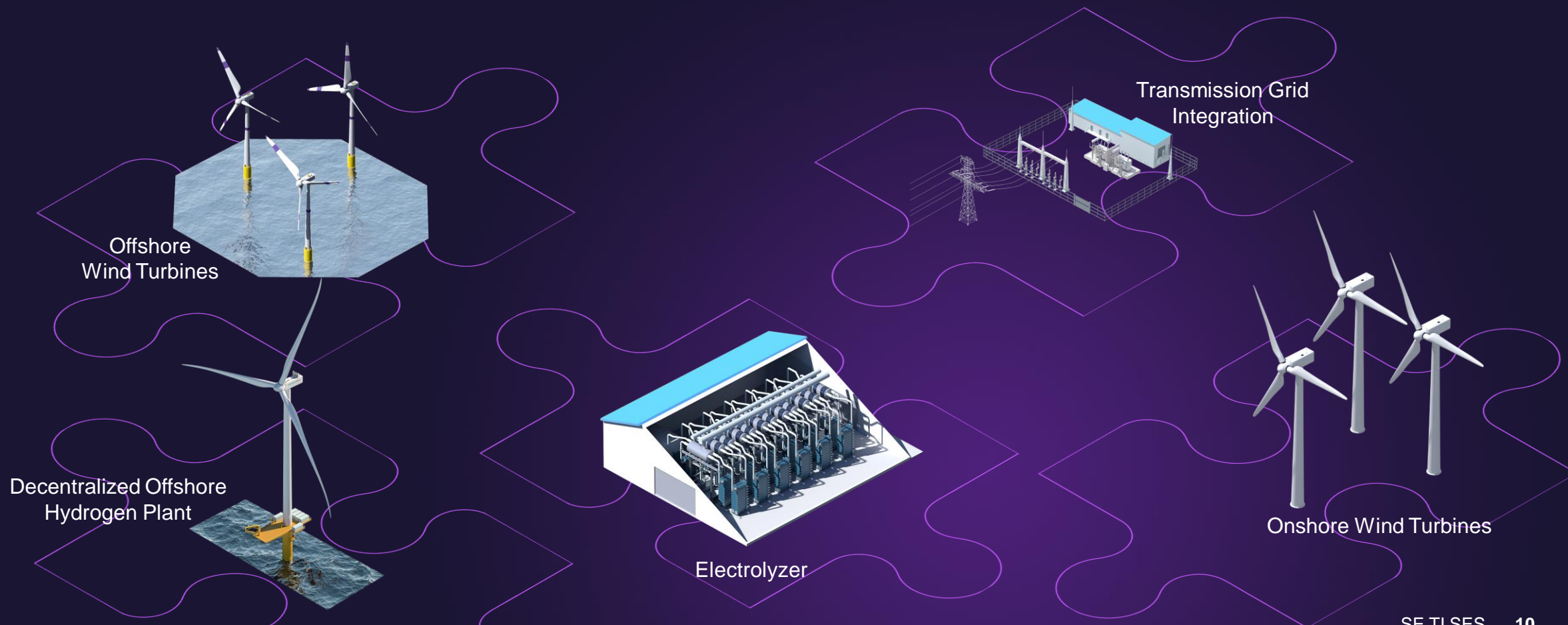
- **Inhouse design** allows for internal and external local packaging
- **Packaging** scaled with qualified third parties **worldwide**



- **Capacity growth plan locked-in** and layouts finalized
- **Additional 1 GW per year** depending on demand



Siemens Energy Group has every piece of the puzzle to deliver green hydrogen from renewables sources



Thank you!

