

# Decarbonization needs in Europe

An update of the market

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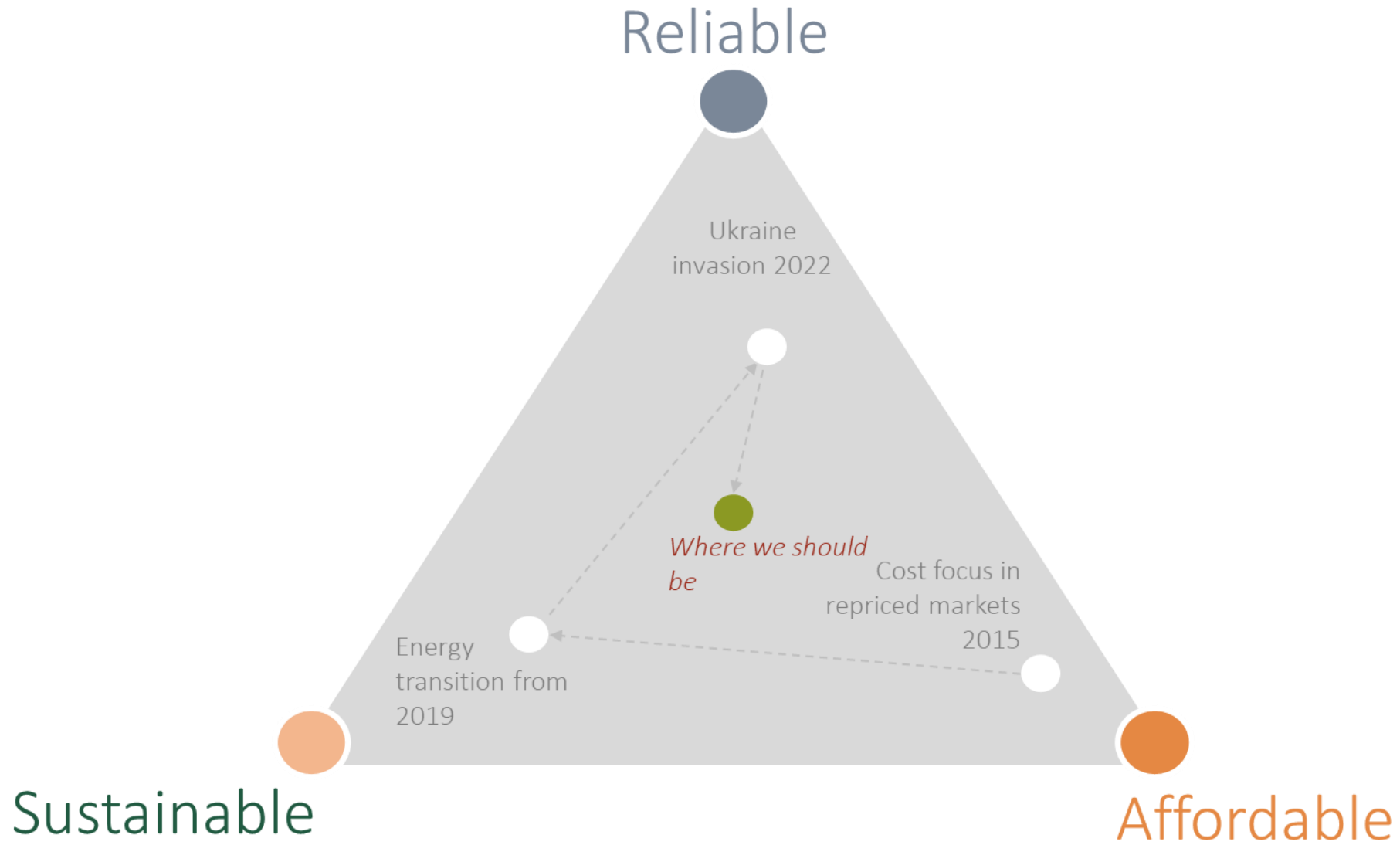
**Global Energy System**

Sep 2022

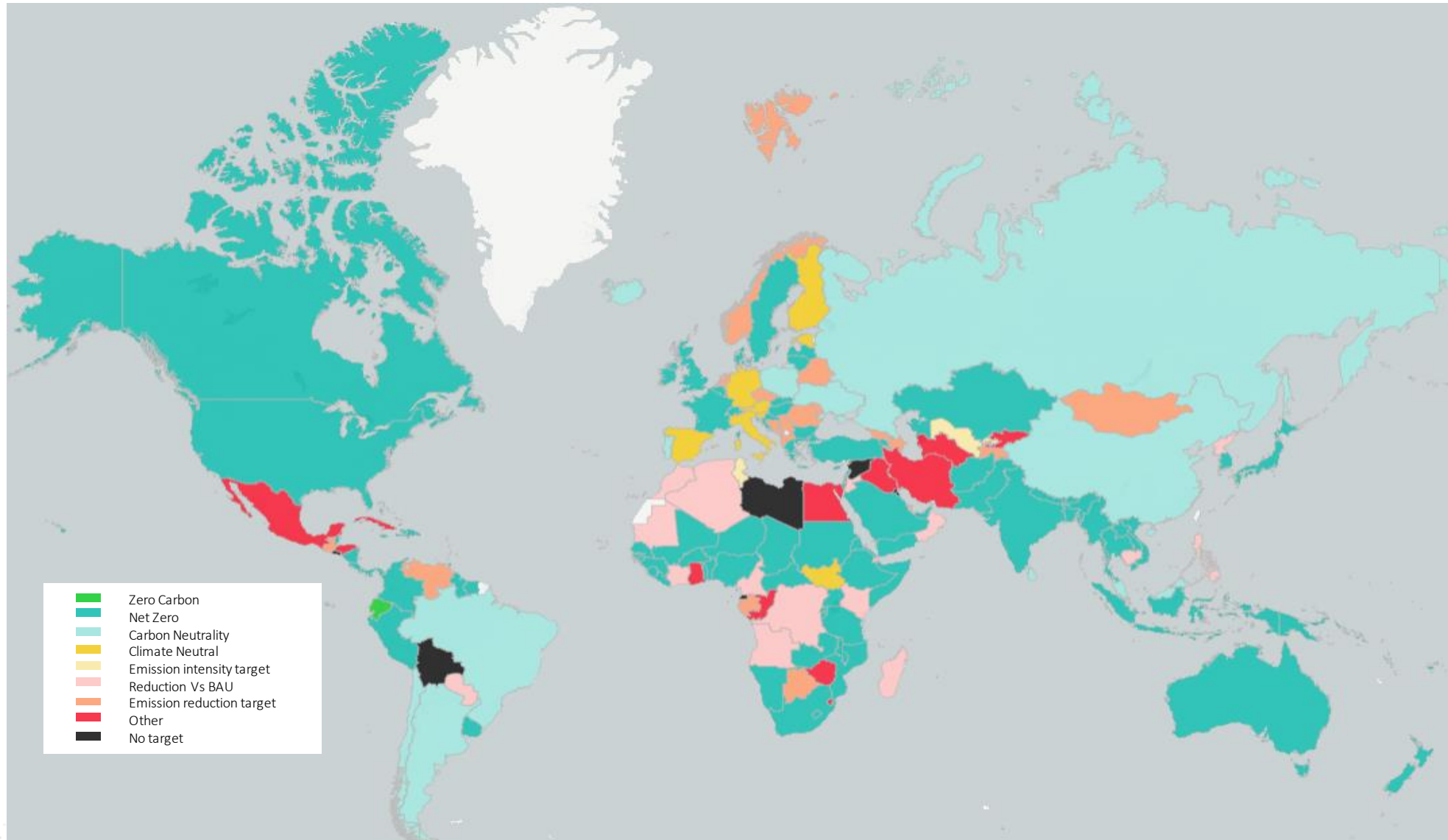
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# The balancing act of the “Energy Trilemma”



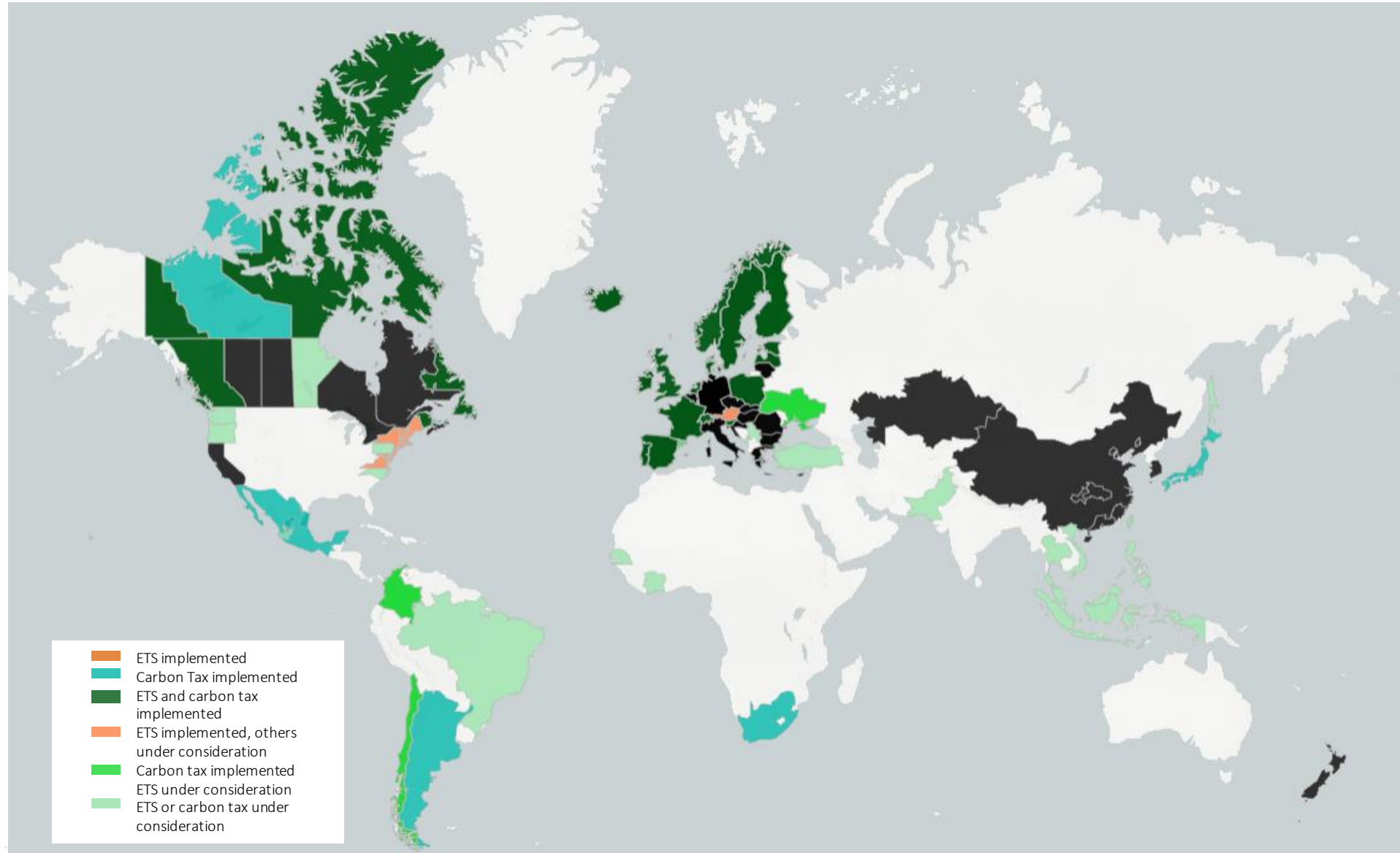
# Most countries have determined their carbon reduction targets, but varies in aggressiveness



Source: Rystad Energy CCUS Solution

Sustainable

# Many countries have implemented mandatory carbon pricing system

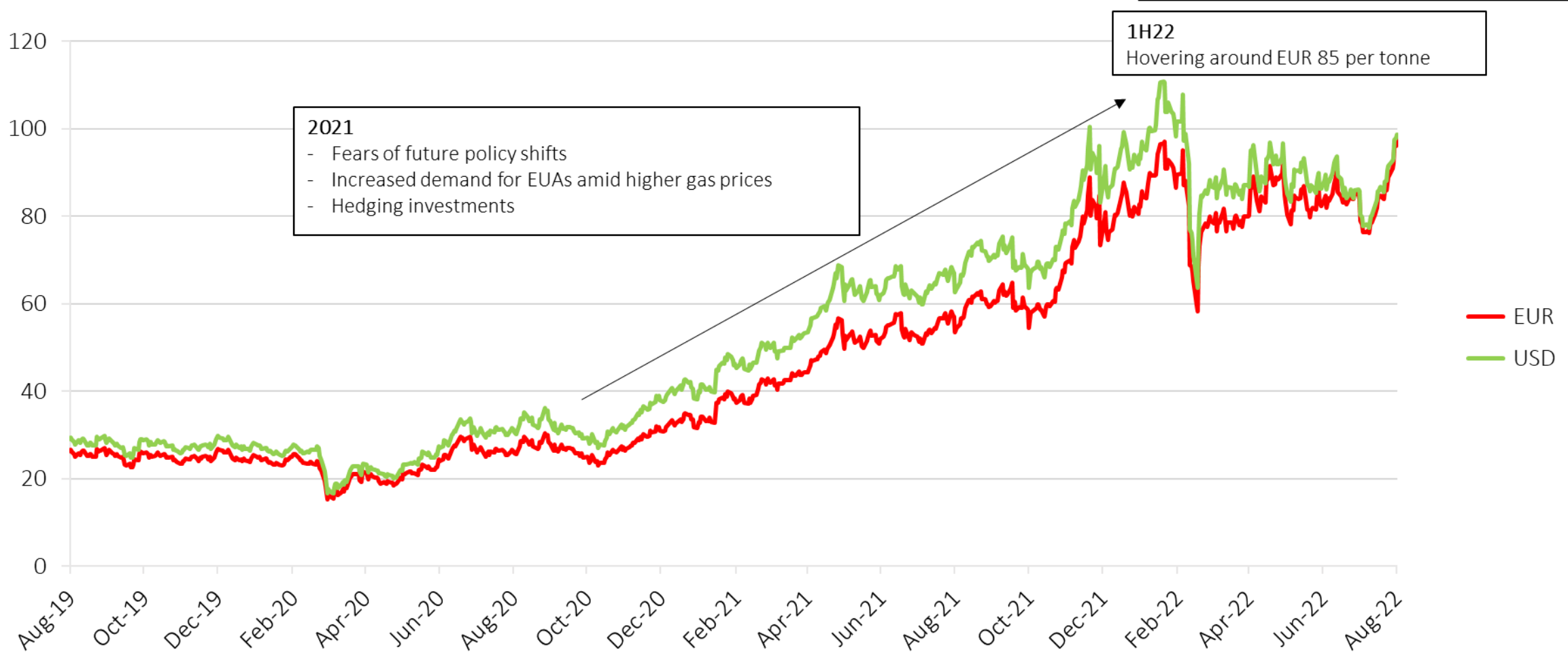


Source: Rystad Energy CCUS Solution

Sustainable

# EU carbon prices surged by ~350% throughout 2021 – February 2022

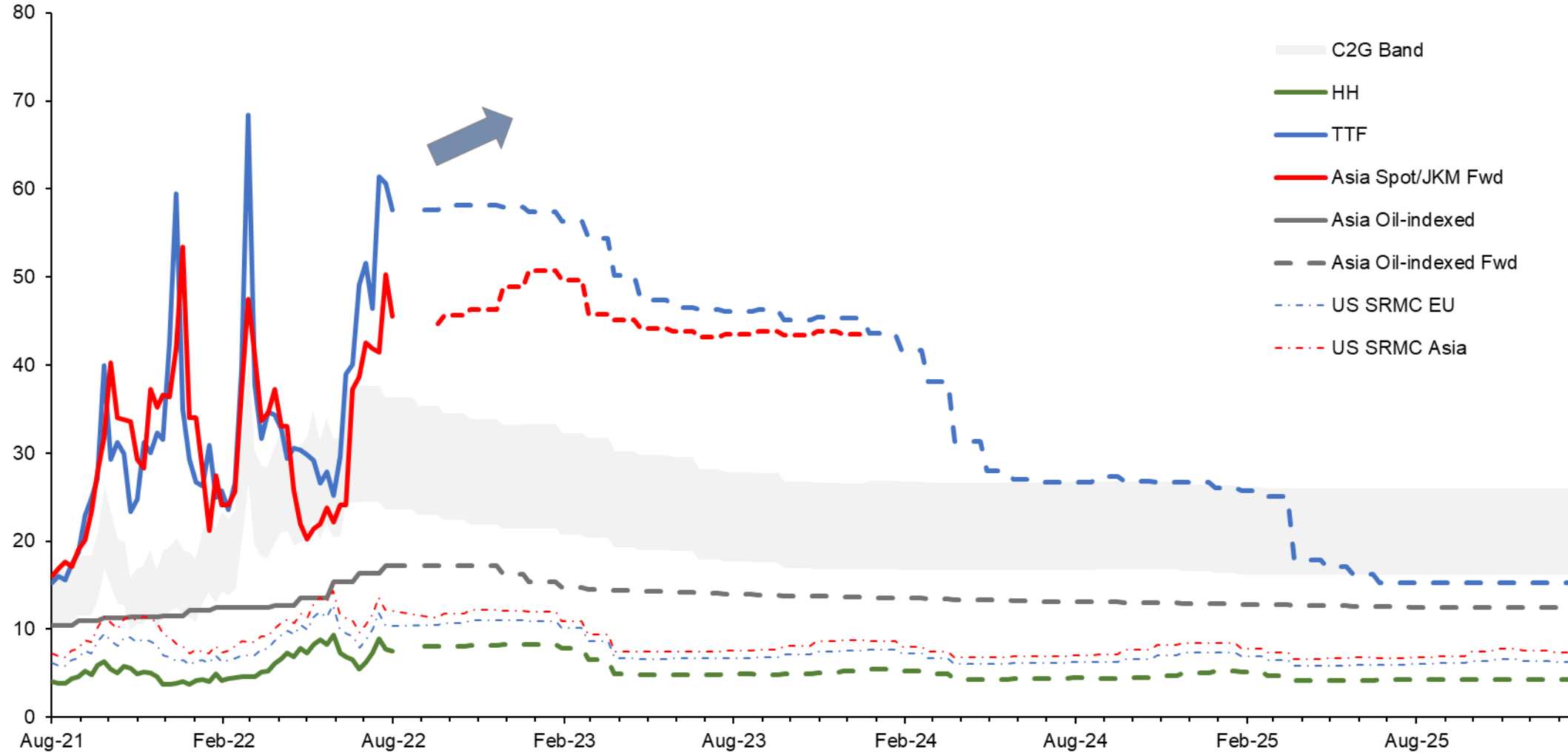
EU ETS historical price development  
EUR / USD per tonne



Source: Rystad Energy CCUS Solution

# International prices jump after a further drop in Russian pipeline exports to Europe

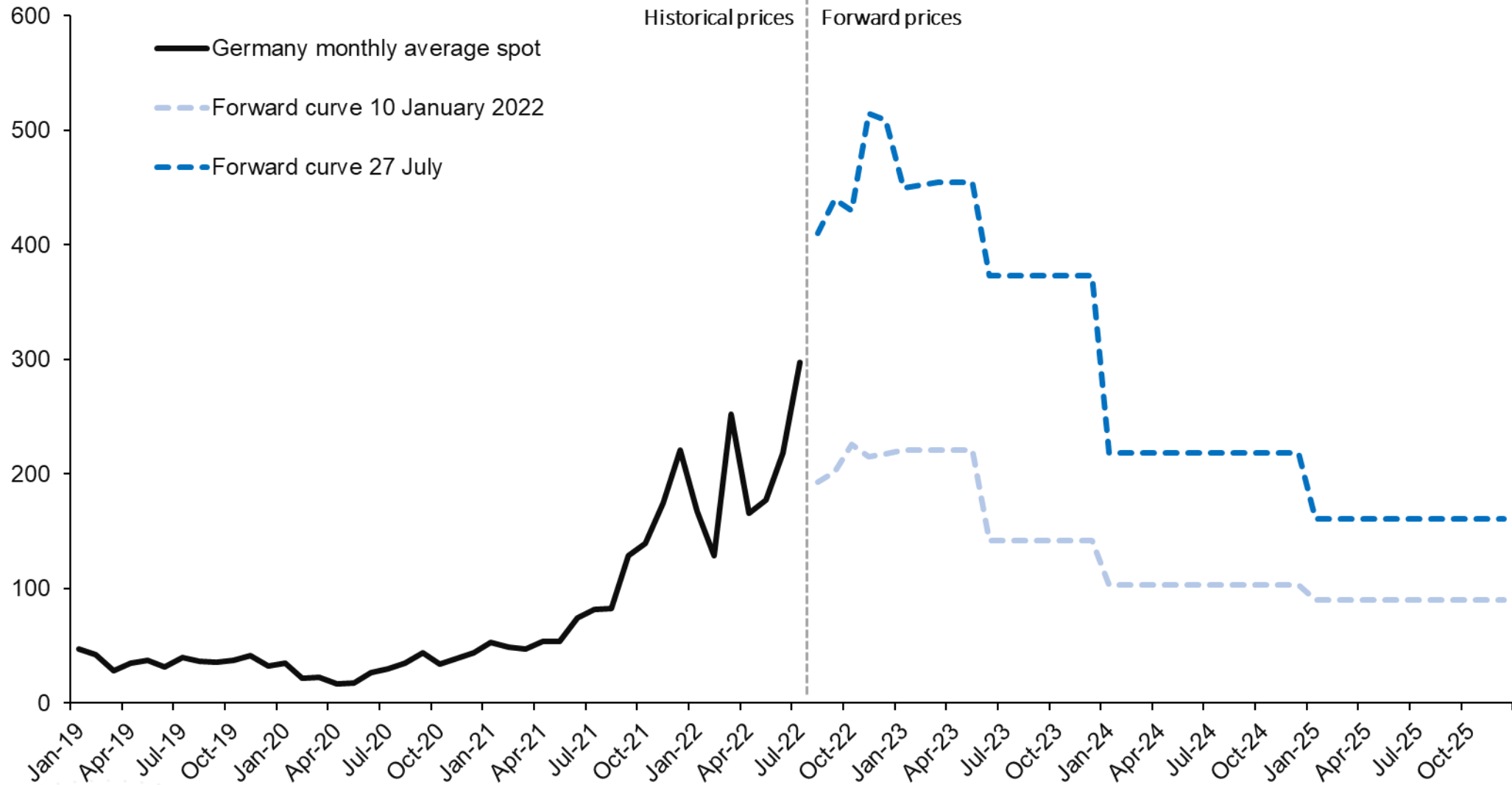
**International natural gas prices\* (historical and forward curves)**  
 USD per million British thermal units (MMBtu)



\*Historical TTF and HH prices correspond to the front month contract. Forward prices are from 09 Aug 2022. Prices are monthly average. C2G: coal to gas. \*\*SRMC: Short run marginal cost of US LNG delivered to Europe/Asia. Sources: Rystad Energy research and analysis, Rystad Energy LNG Trade Solution

# Front-year future break records

EUR per megawatt-hour

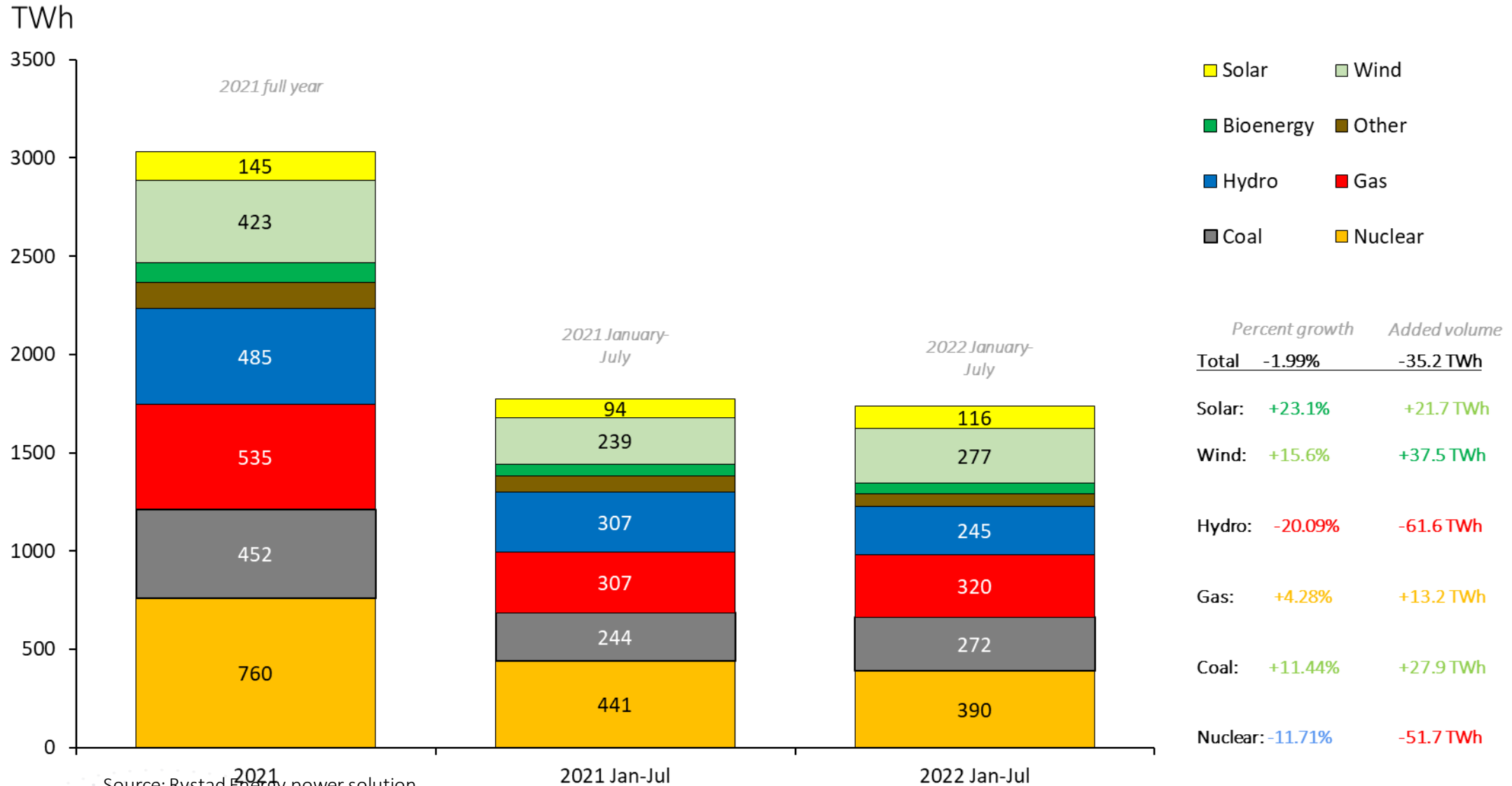


\*Forward curve as of 27 July 2022.  
Sources: Rystad Energy power solution, Refinitiv Eikon

Affordable



# YOY growth for coal and gas, despite record prices. Hydro and nuclear shortfall

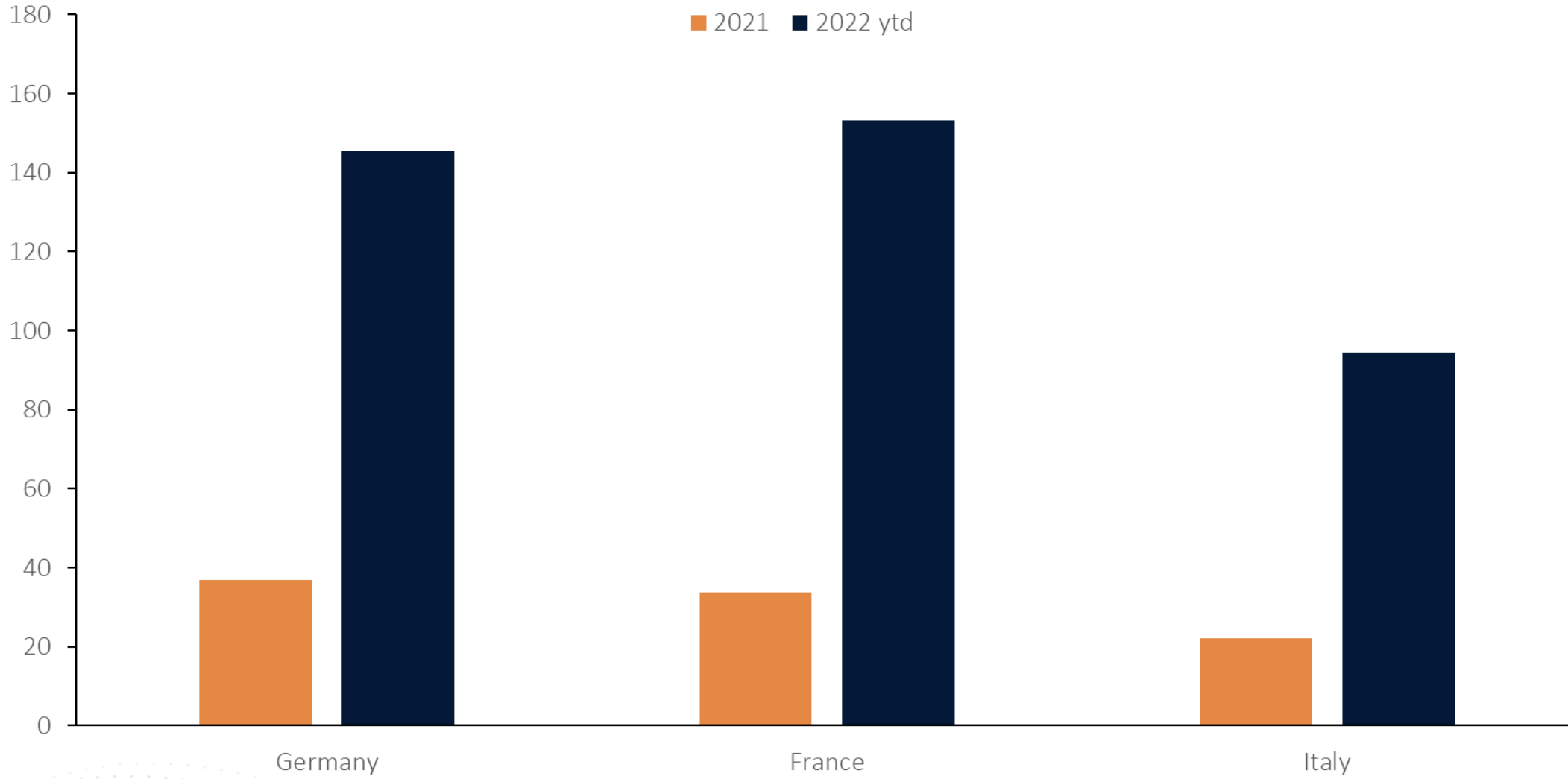


Source: Rystad Energy power solution

\*Net on-grid generation, countries included are EU-27, Norway, Switzerland and Serbia. Data included is for the first 7 months of the year

# Spending on power in 2022 (ytd)

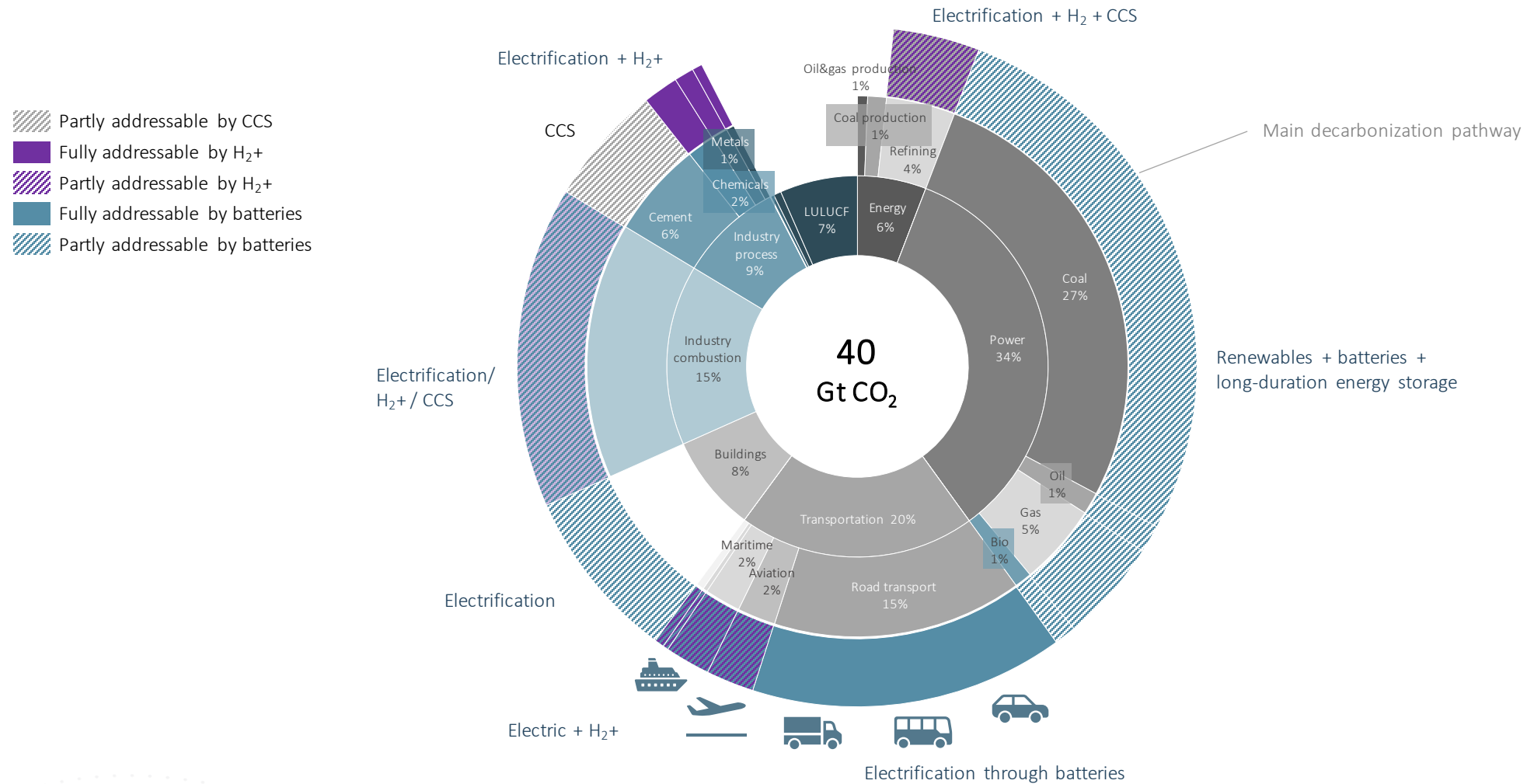
BUSD



Based on average price  
Rystad Energy Power research & analysis

Affordable

# Global CO2 emissions by sector and most likely decarbonization technology

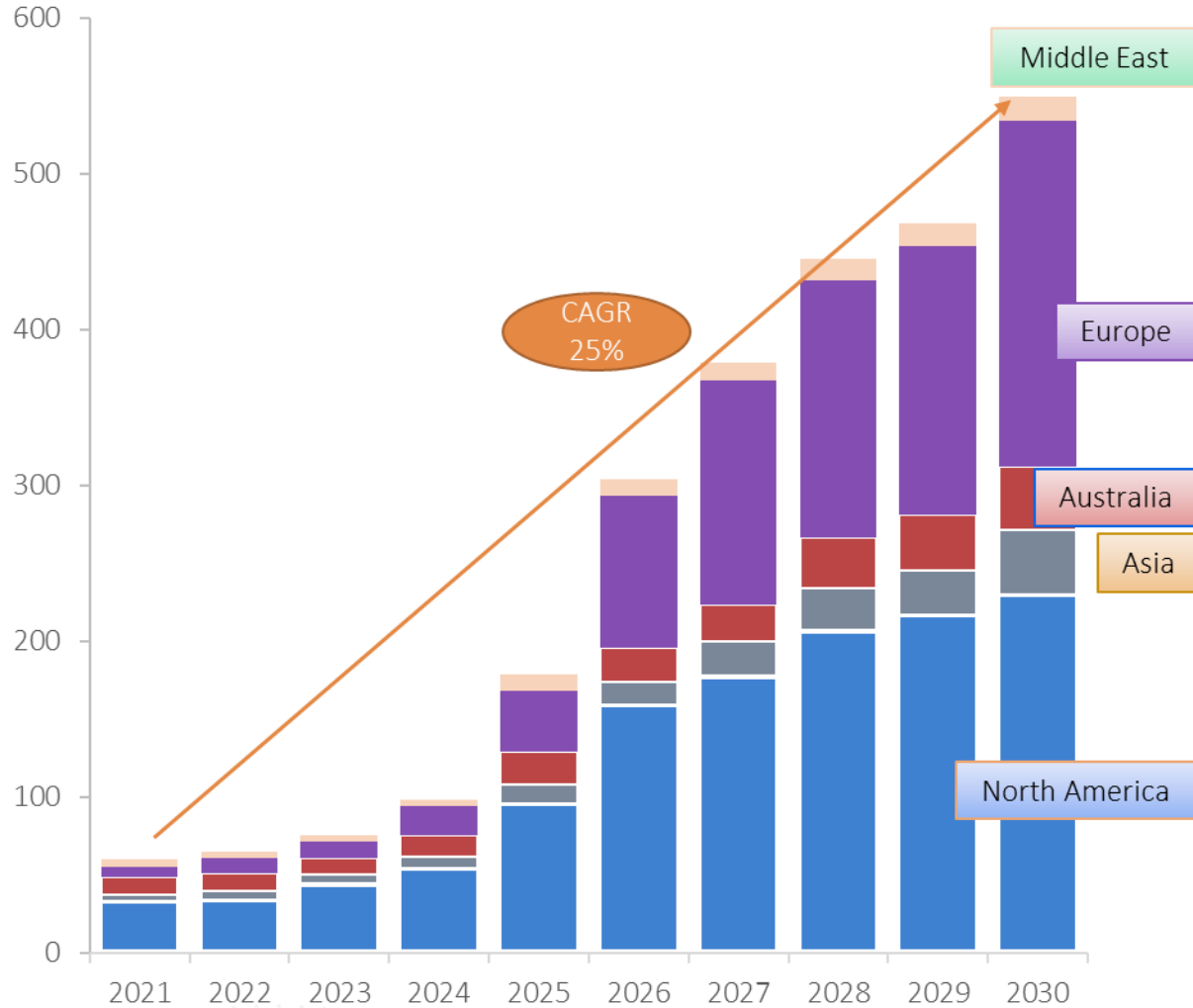


Source: Rystad Energy research and analysis

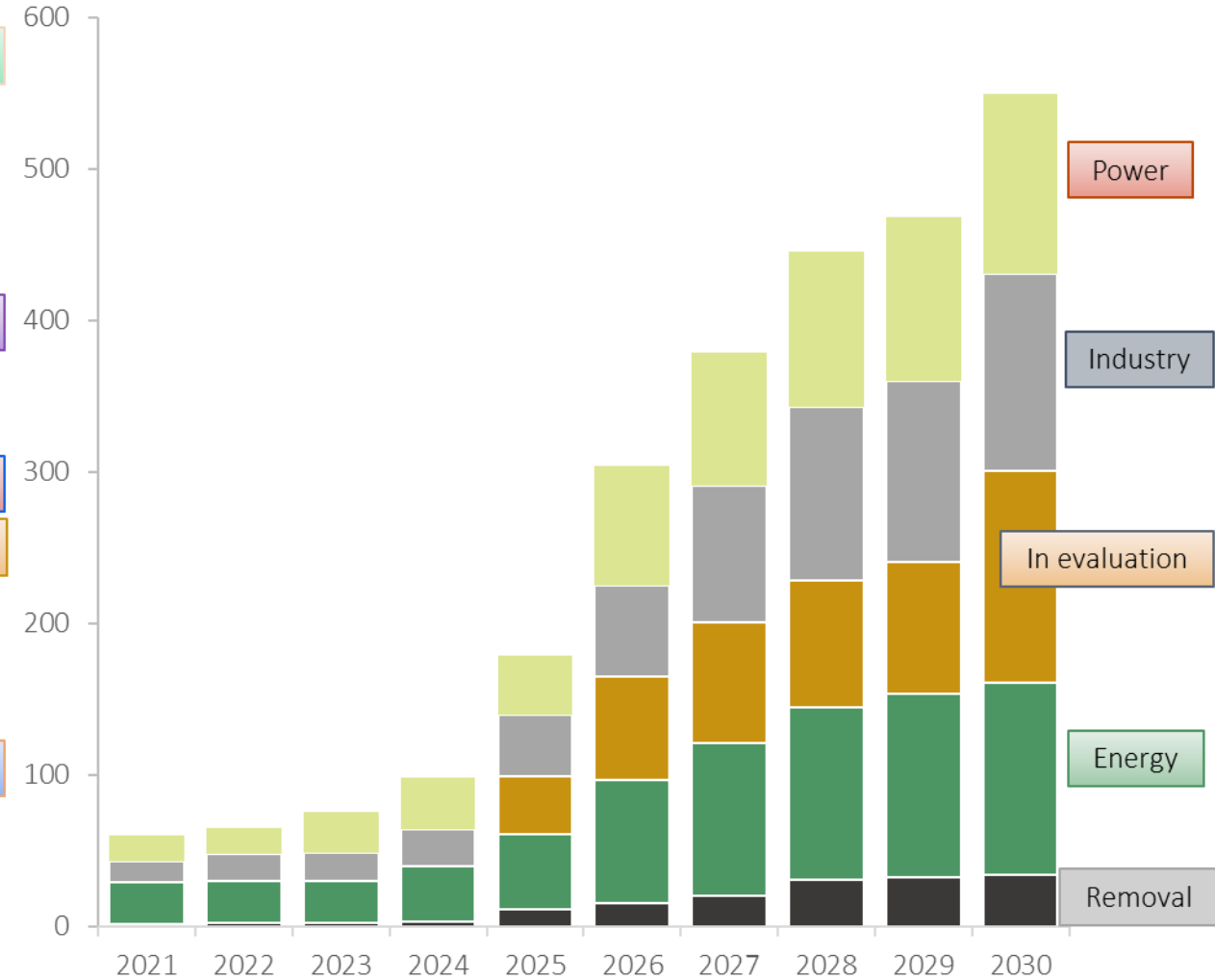


# Positive outlook for CCUS capacity growth, but are we on track to deliver on decarbonization pledges?

Global CO<sub>2</sub> capture capacity by region  
Million tonnes (Mt) of CO<sub>2</sub>



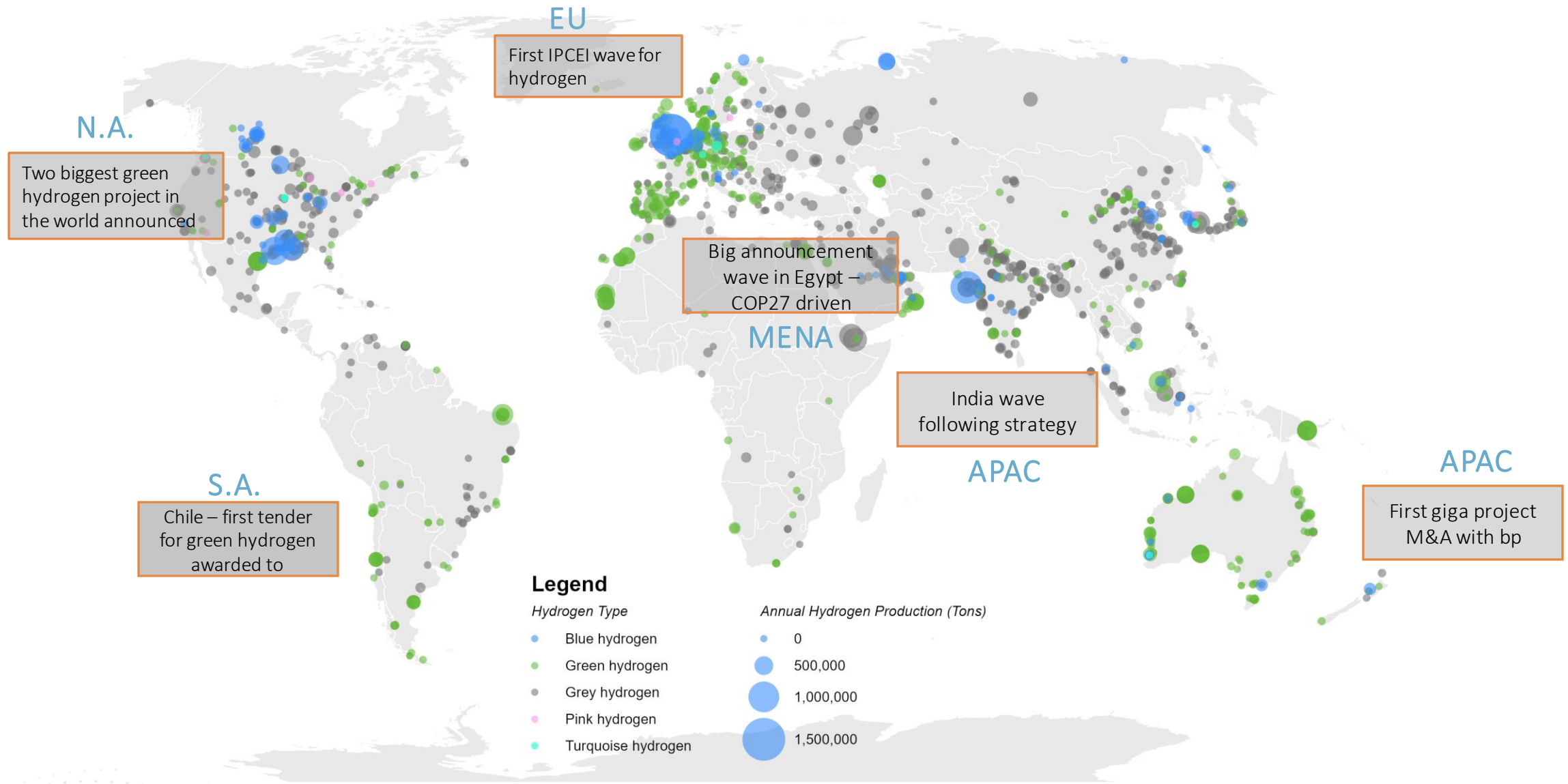
Global CO<sub>2</sub> capture capacity by CO<sub>2</sub> source  
Million tonnes (Mt) of CO<sub>2</sub>



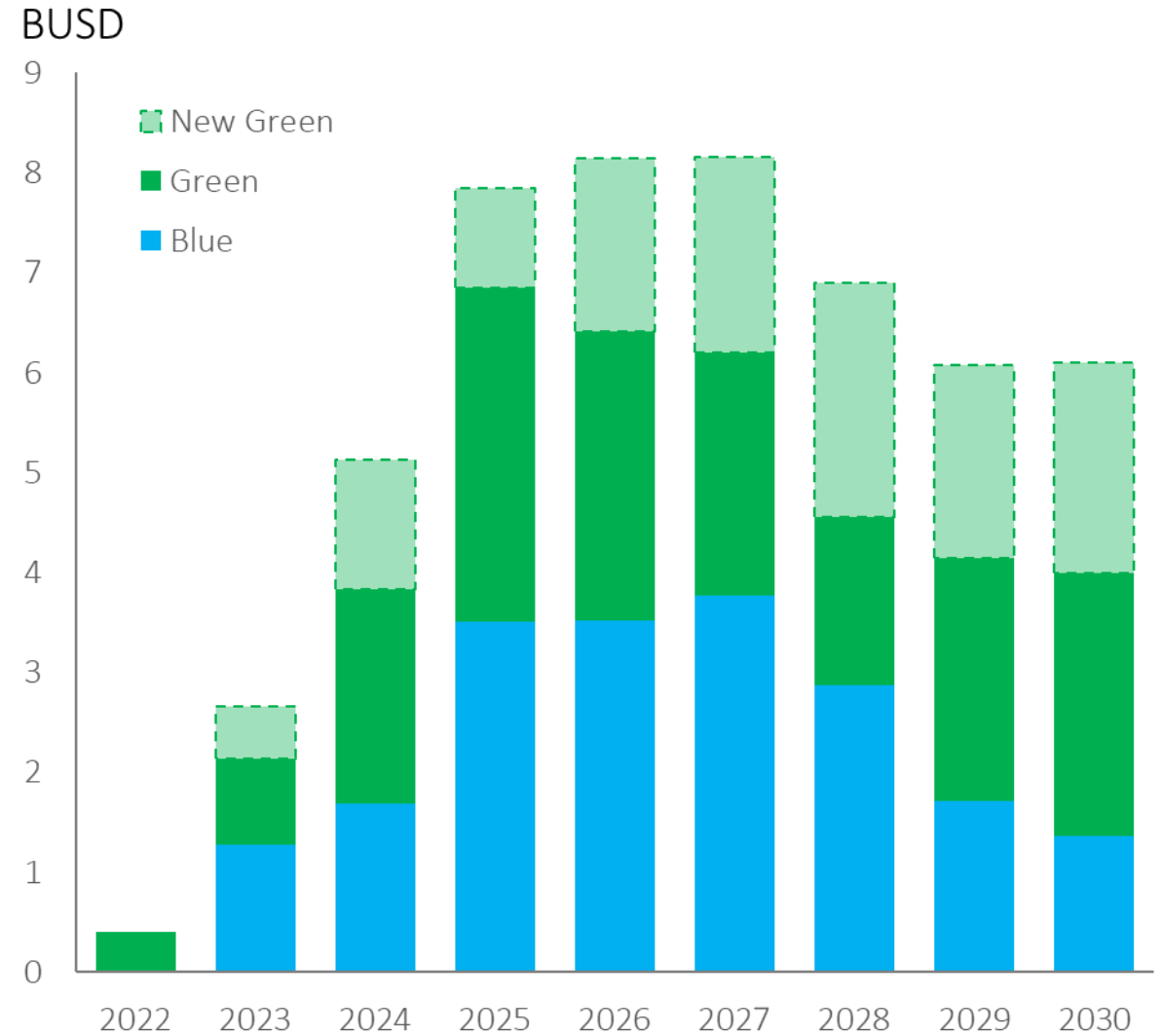
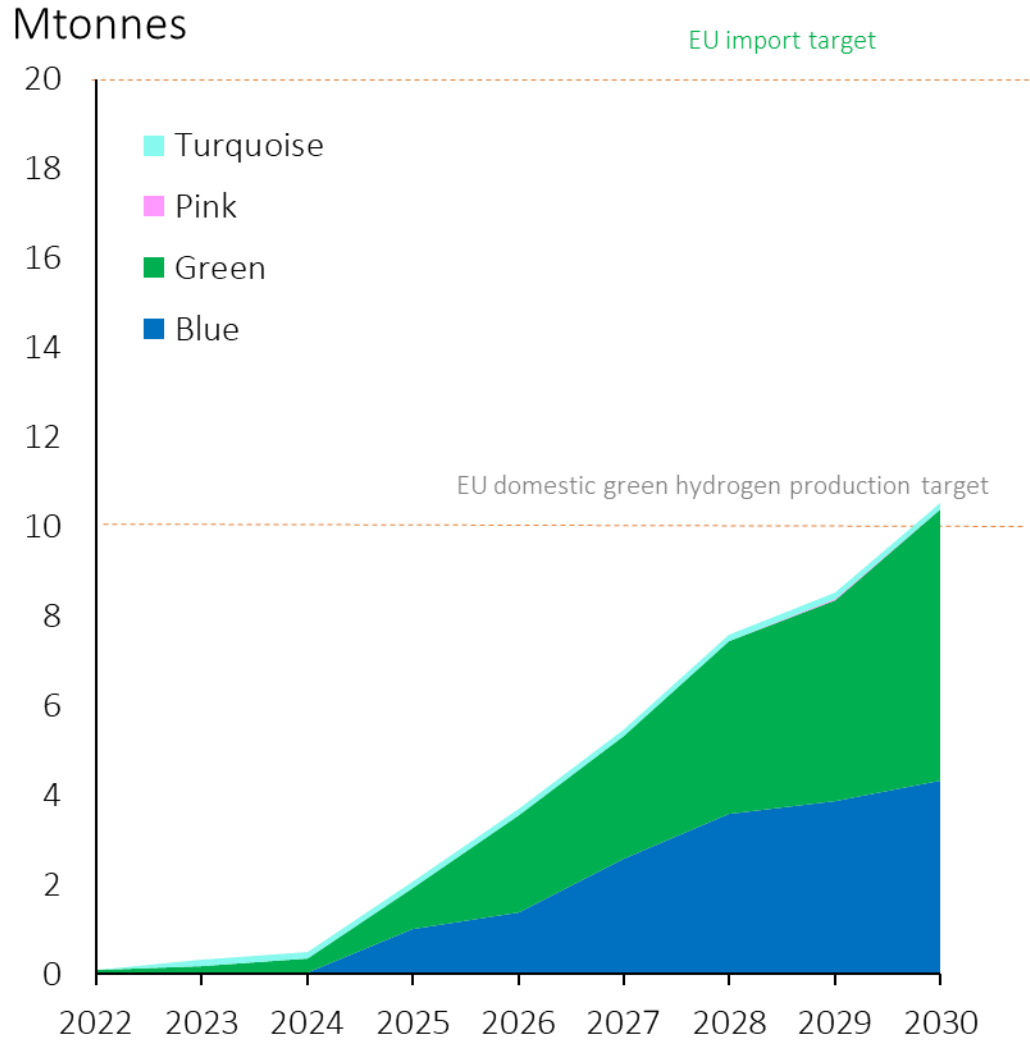
Source: Rystad Energy CCUS Solution



# 2022 continues the announcement trends and growth for hydrogen projects



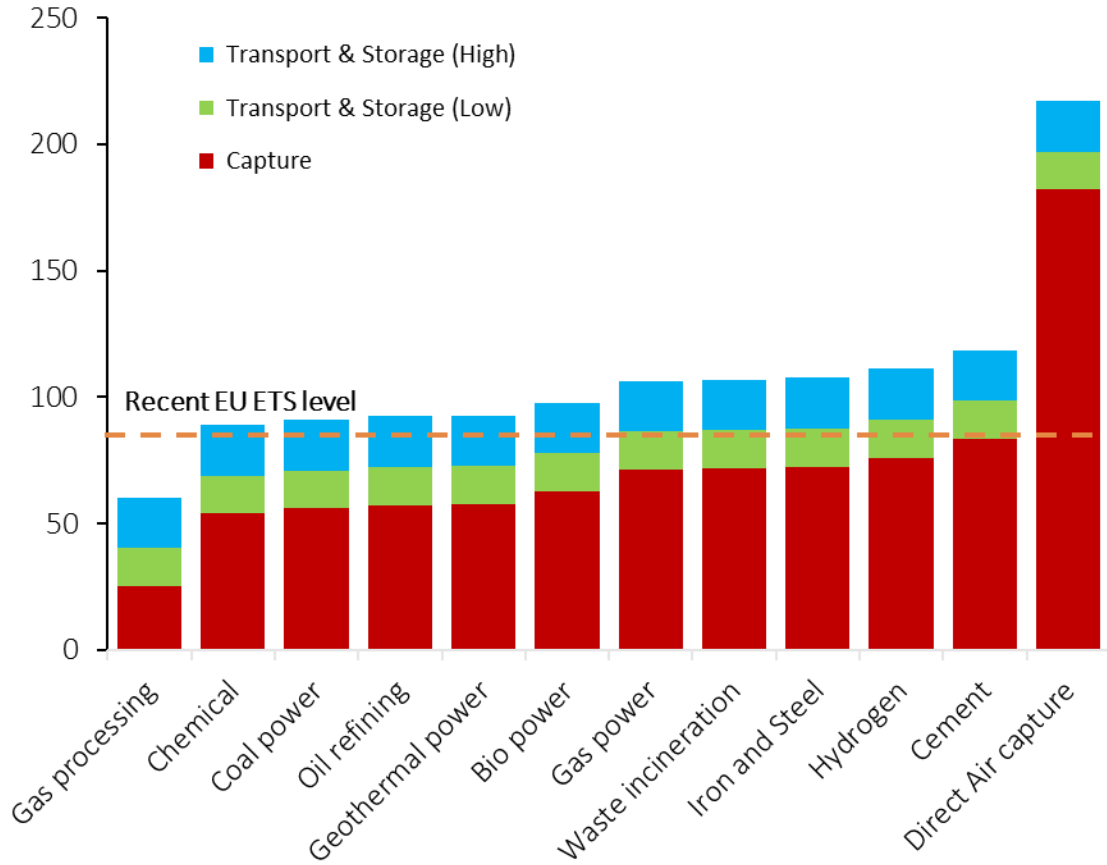
# Global pipeline of clean hydrogen of EU to 2030



# Recent prices means break-even is now closer

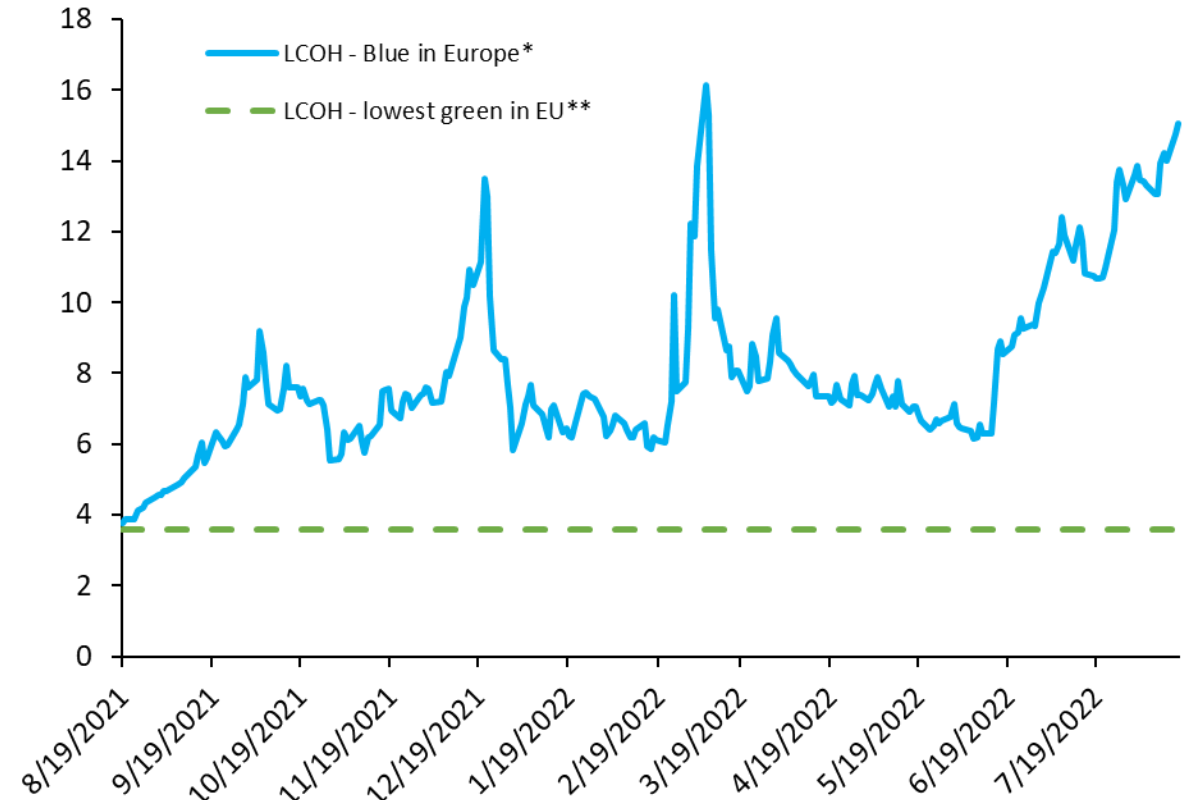
## Expected levelized cost of carbon capture based on real-world CCUS projects in 2030

USD per tonne



## Levelized cost of hydrogen in Europe in 2021/22

USD per kg hydrogen



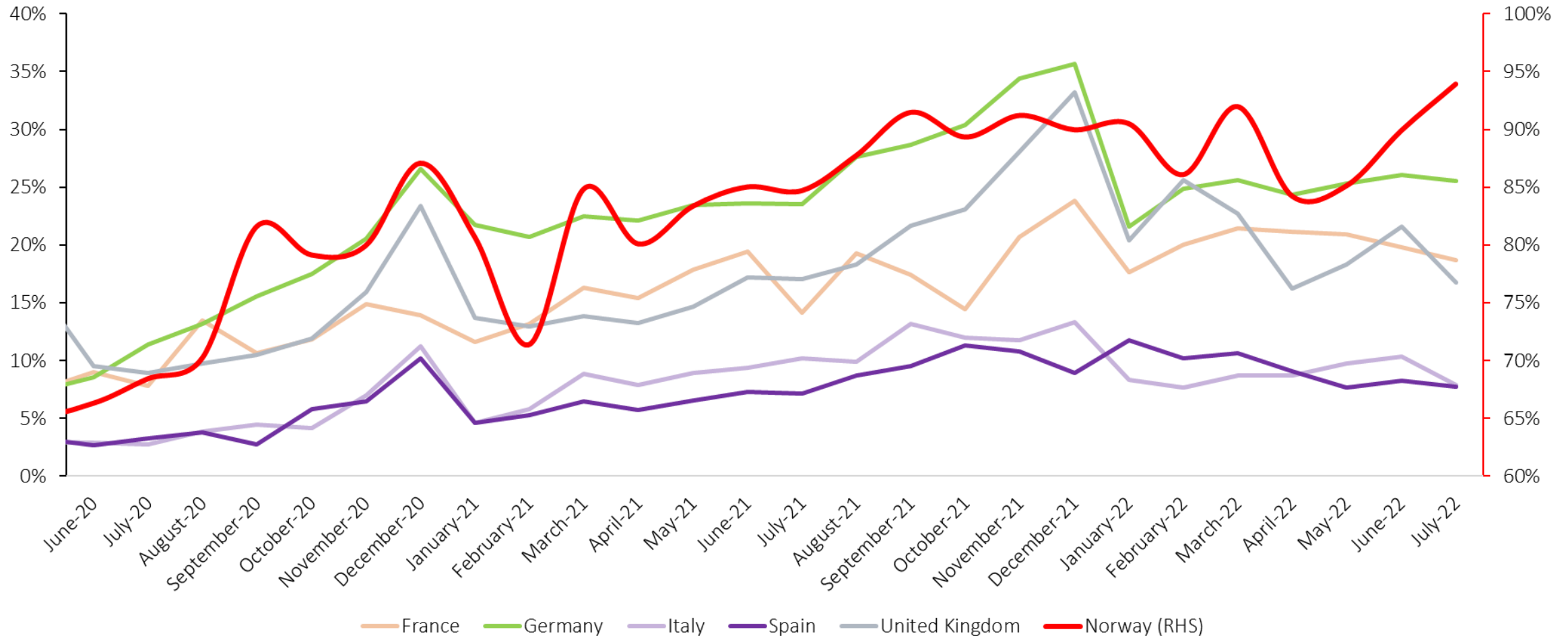
# Not all major European car markets can replicate Norway's adoption curve

Supply chain bottlenecks and limited availability of cheaper EV models slow down EV penetration in short-term - YE22 step change in adoption curves is anticipated

## Europe, EV\* market share in LDV segment for major car markets and Norway

Share of total LDV car registrations

Share of total LDV car registrations (Norway)



\*BEV and PHEV  
Source: Rystad Energy Battery Solution







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