

Accelerating hydrogen market development through pricing clarity



10 - 12 JUNE
2024

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- Cost, price and carbon intensity
- Market evolution

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Market-based & Cost-based prices



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RFNBO definition;
EU Delegated Act
C/2023/1087 compliant

Emission In order of
priority: avoided, removed,
offset

Premium of carbon-neutral
attribute

Germany: H2 Mobility
Deutschland
Japan: Iwatani

**Regulation Compliant
Hydrogen Assessments**

**Carbon Neutral
Hydrogen (CNH)
Assessments**

**Implied Hydrogen Origin
Certificate (h-OC)**

Hydrogen Pump Prices

Hydrogen Production Cost Valuations

SMR with CCS
SMR w/o CCS

ATR with CCS

Coal gasification with CCS
Lignite gasification with CCS

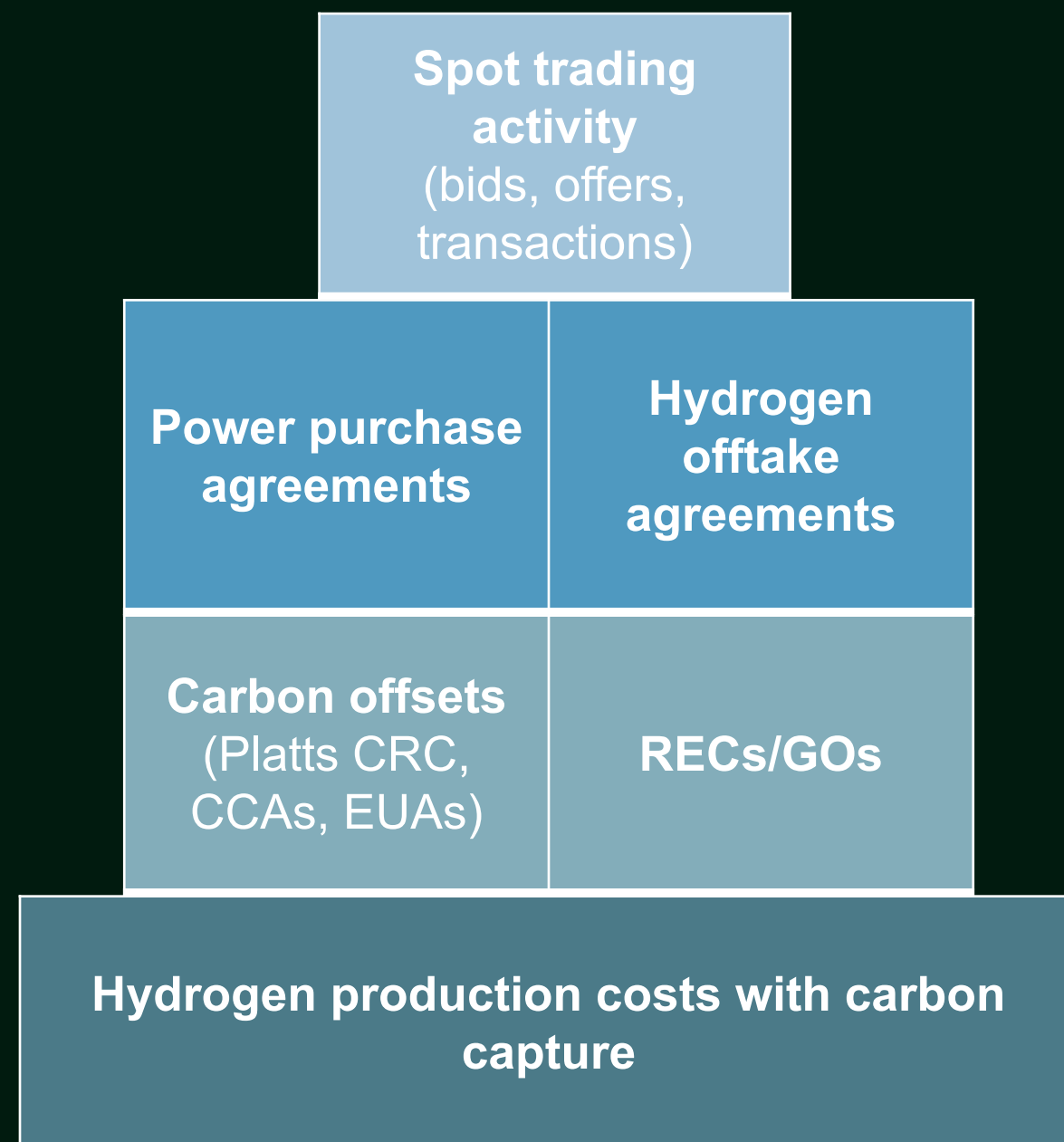
PEM electrolysis
Alkaline electrolysis

Market-based carbon-neutral H2 assessments covering six potential hubs



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Market-based hydrogen assessments taking account of a range of inputs, including source data, market activity, and cost of production factors

Covering six potential hydrogen trading hubs:

- USGC (Texas/Louisiana)
- California
- Far East Asia (Japan)
- Australia
- Middle East (Saudi Arabia)
- NW Europe (Netherlands)

Daily publication in /kg and /MMBtu

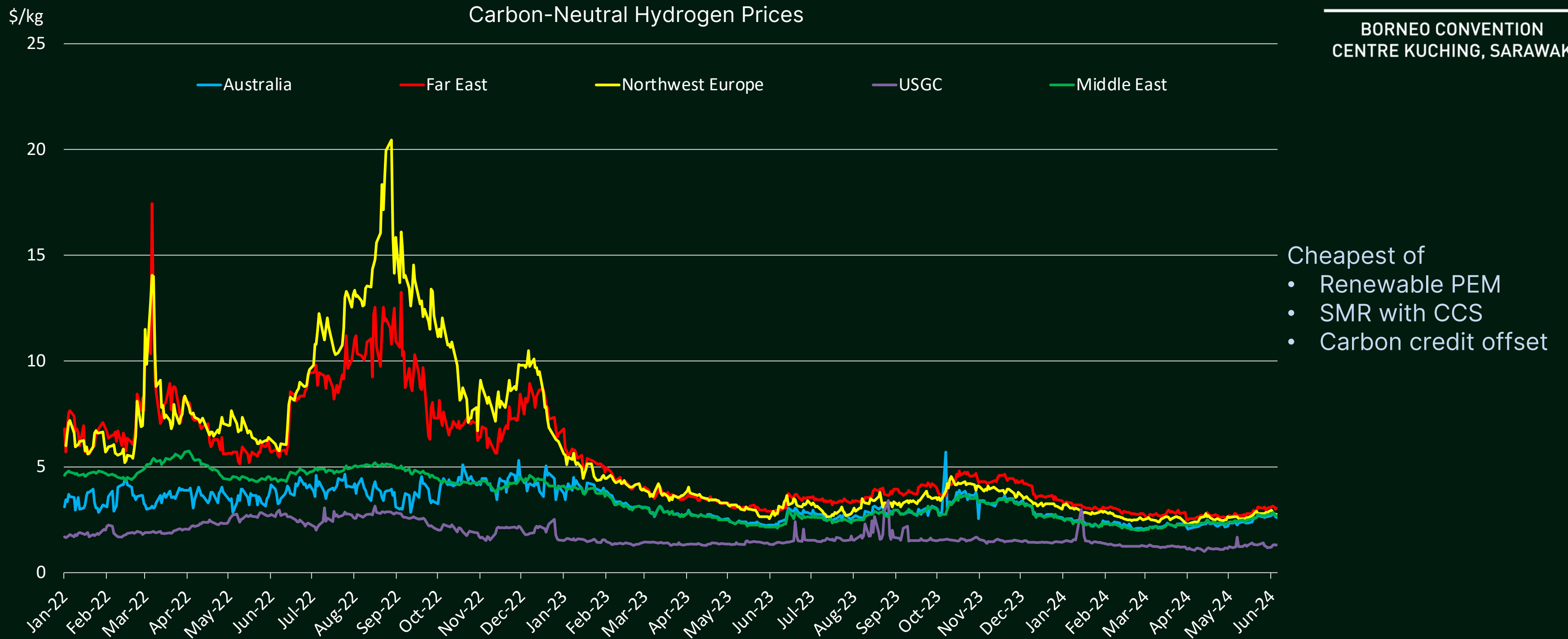
Subscriber note: [S&P Global Platts launches new carbon-neutral hydrogen assessments](#)

Multiple pathways lead to carbon-neutrality; Far East more than double cost in USGC



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h-OC represents the implied premium for hydrogen from PEM electrolysis over SMR

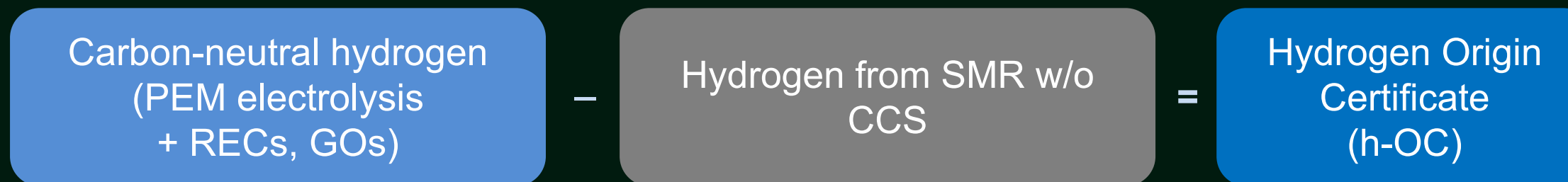


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Fast-evolving attributes market can play a key role in the development of hydrogen market, by giving clear indication on the premium of carbon-neutrality

Certificates have extensive trading and market depth in renewable power markets globally (Guarantee of Origin, Renewable Energy Certificate), and in low-carbon natural gas in the US (Methane Performance Certificates)



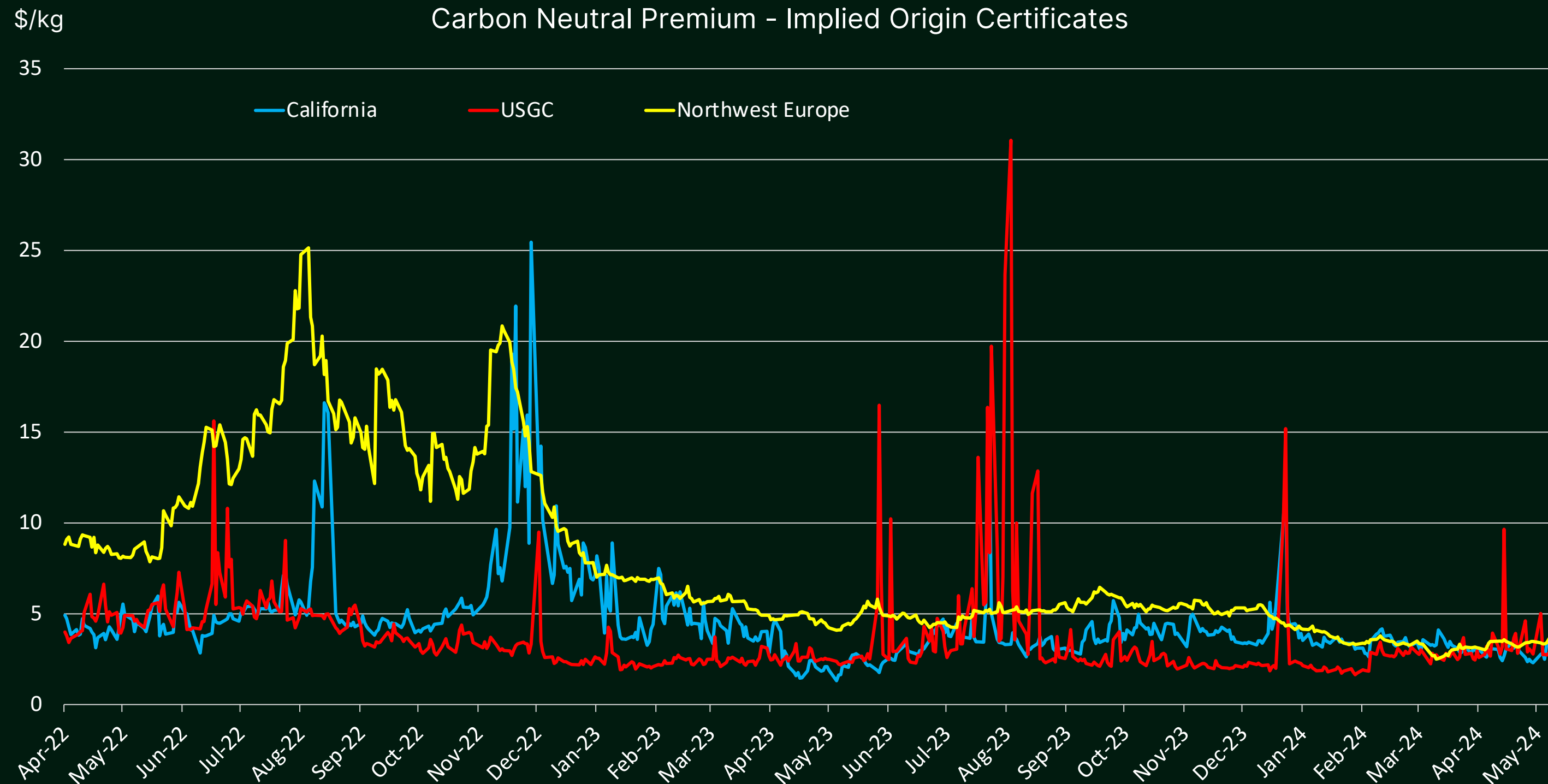
- NW Europe (Rotterdam) – €/MWh and \$/kg
- US Gulf Coast (Texas and Louisiana) - \$/MWh and \$/kg
- California - \$/MWh and \$/kg

Carbon intensity attribute – origin certificate



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Renewable PEM - SMR

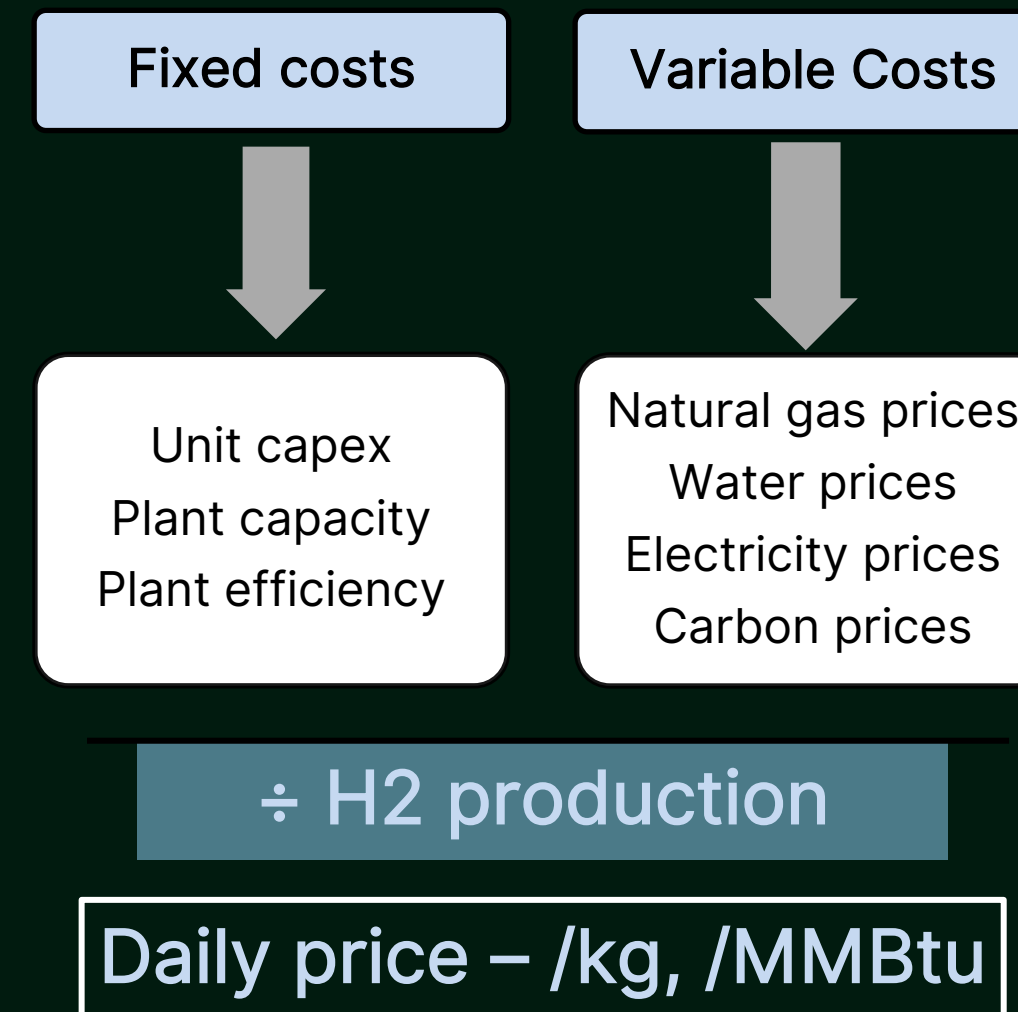
Cost of production values illuminates opaque hydrogen valuation



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- > First launched in December 2019; expanded to cover relevant technologies in likely hubs
- > Valuations include production by SMR, ATR, gasification and electrolysis across global locations
- > Assessments consider fixed and variable costs
- > Market participants can more effectively evaluate the use of hydrogen as a fuel; and begin to make investment decisions to build a hydrogen economy

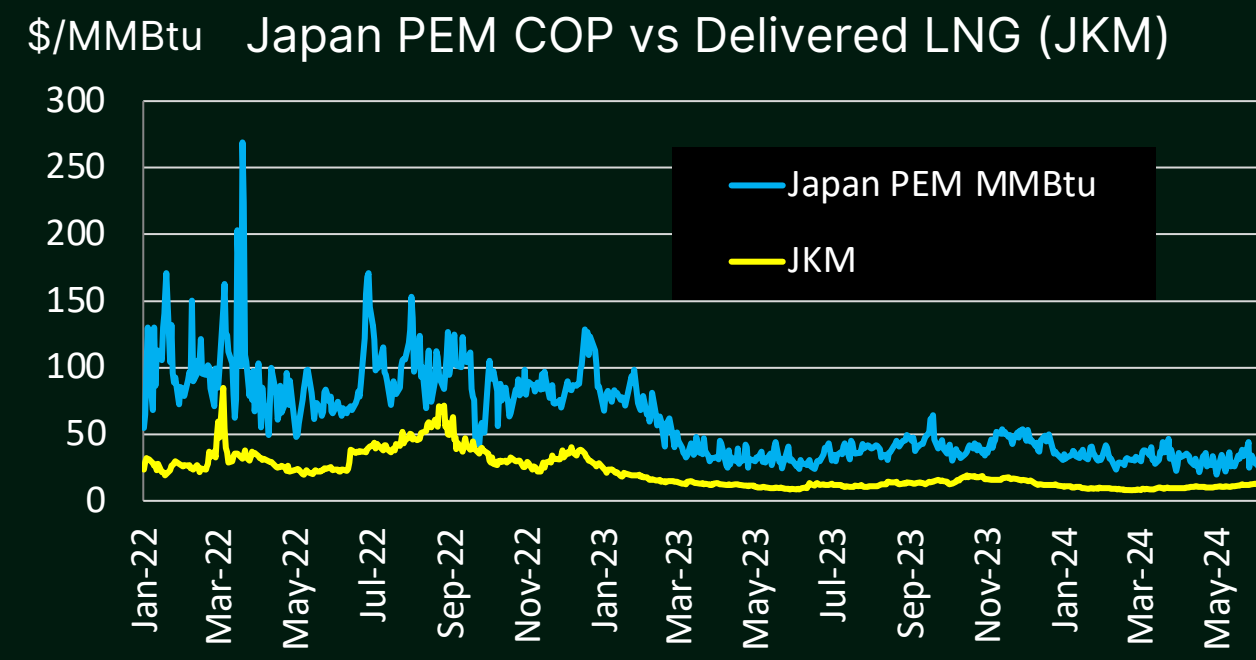
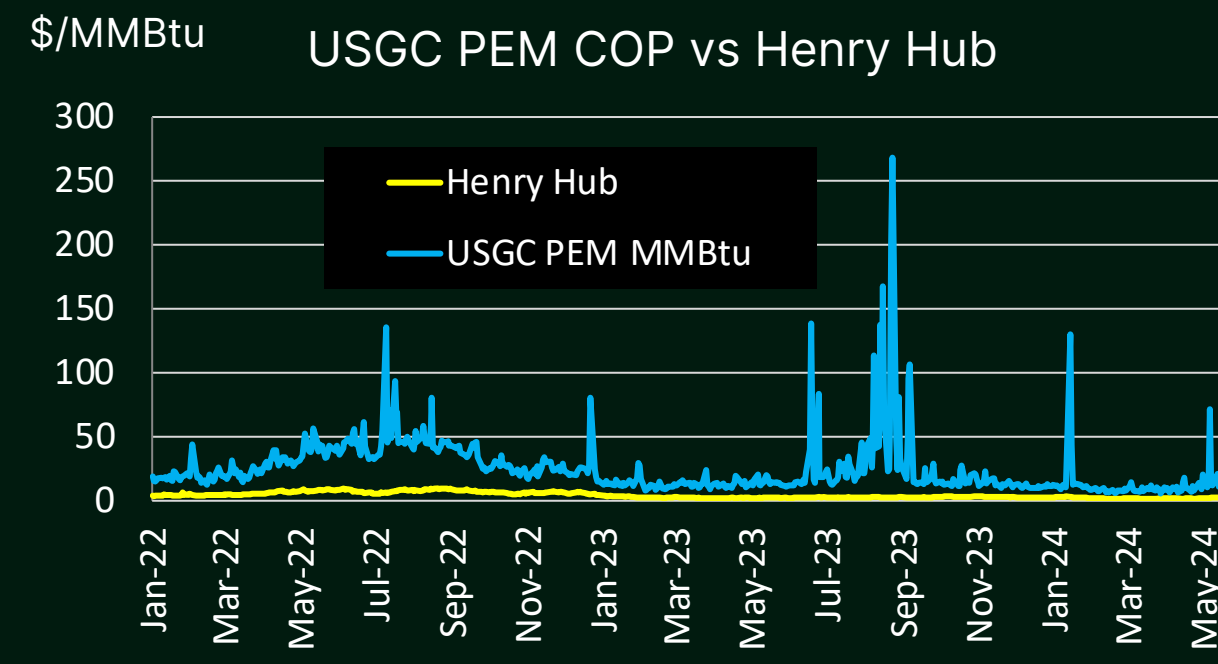
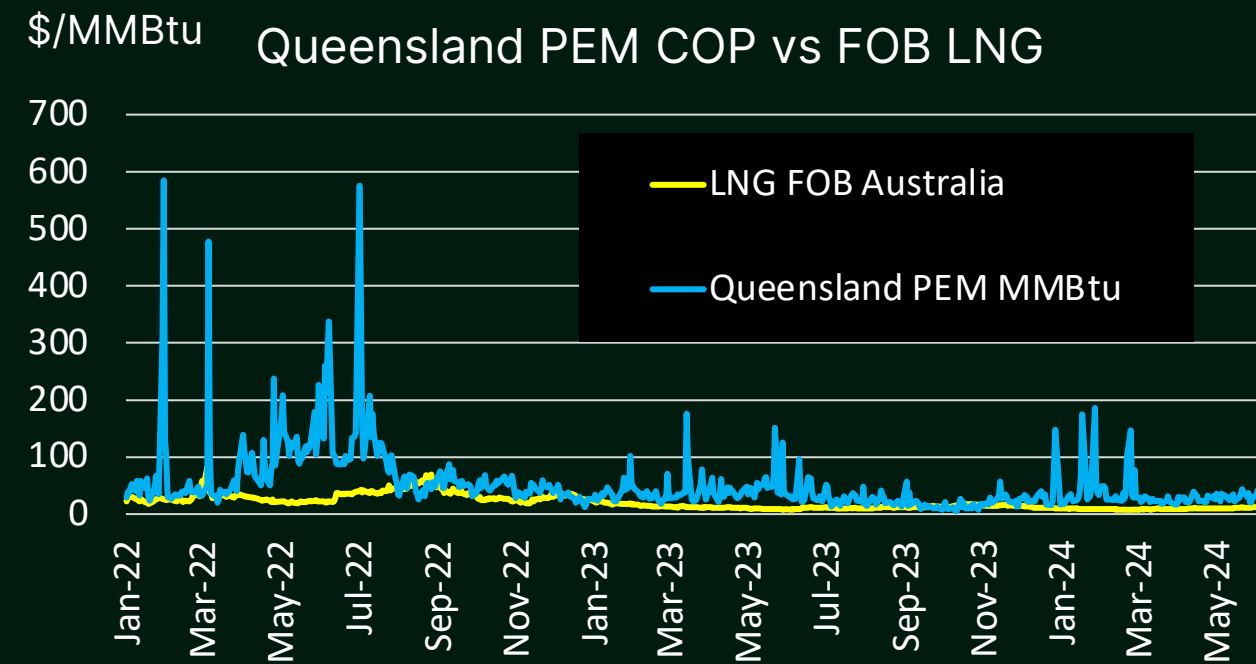


If natural gas is primary fuel to replace, hydrogen needs to be much, much cheaper



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PEM Premium over Natural Gas

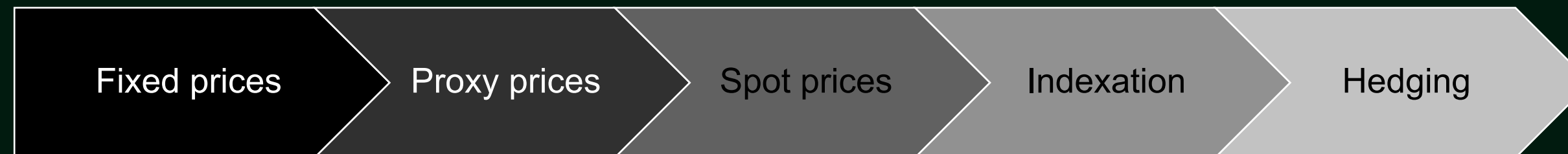
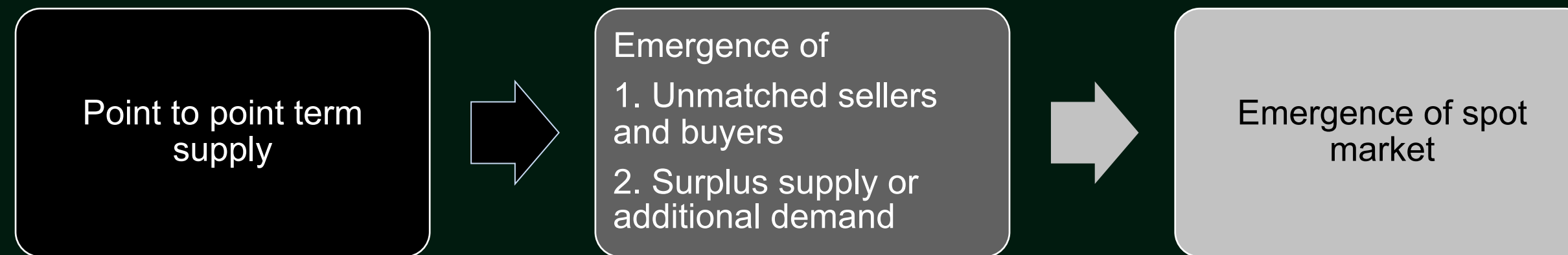
\$/MMBtu	Japan	USGC	Queensland
2022	59.20	26.13	46.01
2023	29.81	18.87	19.93
2024 YTD	22.37	11.26	24.94

Development of hydrogen market and prices – possibility of following LNG



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LNG example:	“\$10/MMBtu”	“15% of Brent”	“Platts JKM”	“5 Year contract on JKM”	“JKM Futures”
Potential Hydrogen example:	“\$40/MMBtu”	“50% of Brent”	“Platts NWE”	“5 Year contract on Platts NWE”	“NWE Futures”

Platts hydrogen price wall



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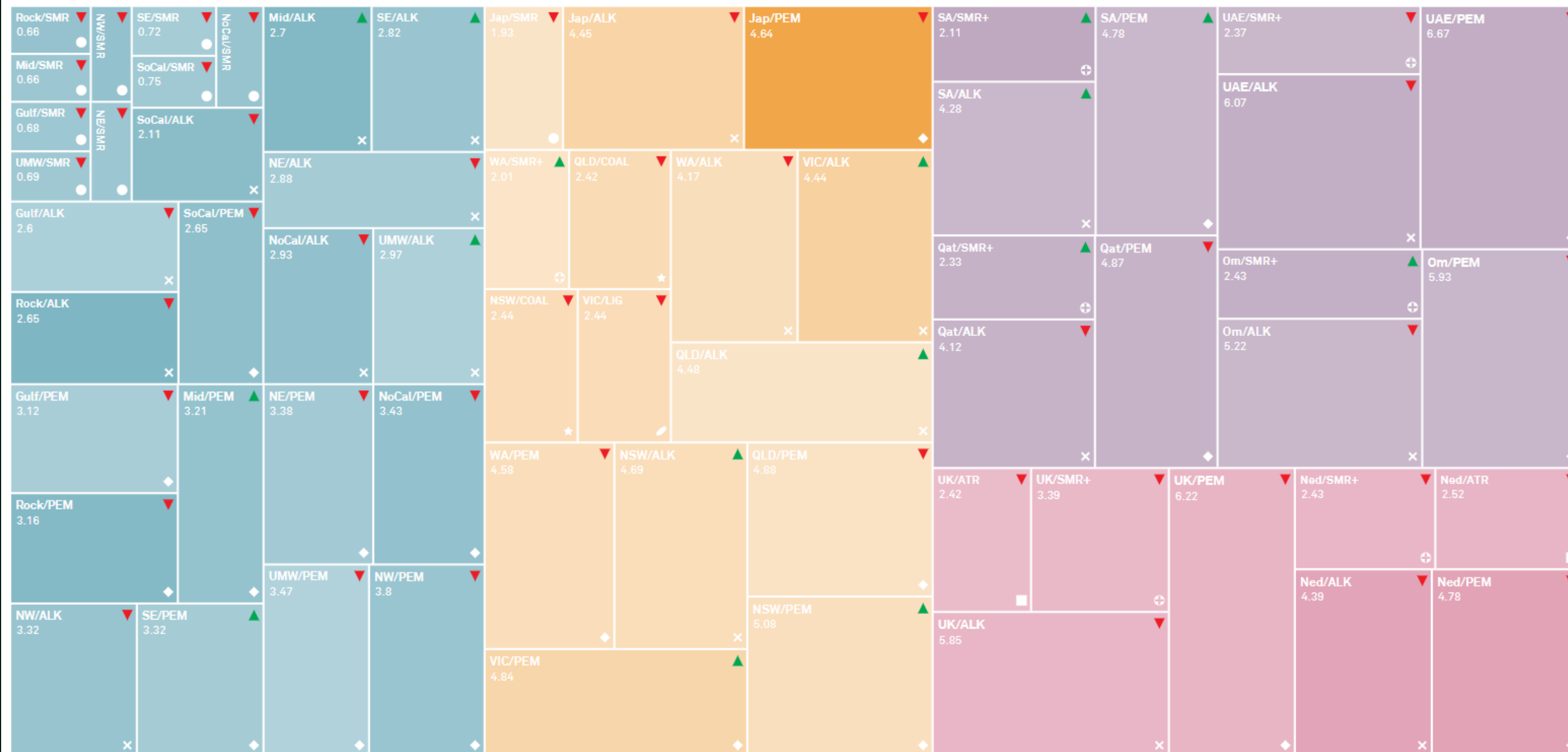
https://www.spglobal.com/commodityinsights/PlattsContent/_assets/_files/en/specialreports/energy-transition/platts-hydrogen-price-wall/index.html

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Platts hydrogen price wall

Hover over the panels below to explore: larger panels represent higher prices. Prices in \$/kg.

Below is a selection of S&P Global Platts hydrogen assessments showing regional price differences and month-on-month changes. Early trade potential is emerging as technologies and regions compete to produce the cheapest low-carbon hydrogen through water electrolysis powered by renewables or from fossil fuels with carbon capture and storage.

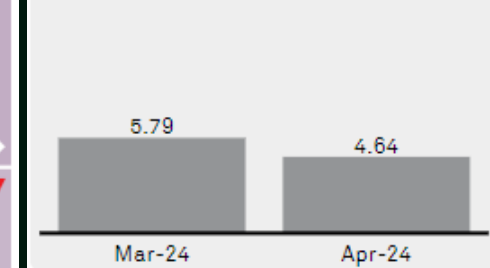


Prices are month average cost-of-production assessments, including capex. European prices include carbon costs for SMR and ATR assessments. Prices for the Netherlands and UK are converted to \$/kg from assessments in Eur/kg and GBP/kg. Rank: 1 = lowest price. As of Marenber 2023, the Queensland PEM assessment includes capex. This includes the month-on-month change from November. Developed by James Burgess and Henry Edwardes-Evans. Designed by CI Content Design.

Jap/PEM 19.8% M/M ↓

Japan
PEM electrolysis

Monthly average prices (\$/kg)
Symbol: IGYFY00
Rank: 49 of 62



Filter by production pathway

- PEM electrolysis
- Alkaline electrolysis
- ATR + CCS
- SMR + CCS
- SMR without CCS
- Coal gasification + CCS
- Lignite gasification + CCS

Filter by producing region

- Darkers shade = greater M/M price move
← less change more change →
- United States
 - Asia-Pacific
 - Europe
 - Middle East