

# HYDROGEN TRADING HUBS



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ANU Grand Challenge: *Zero-Carbon Energy for the Asia-Pacific*

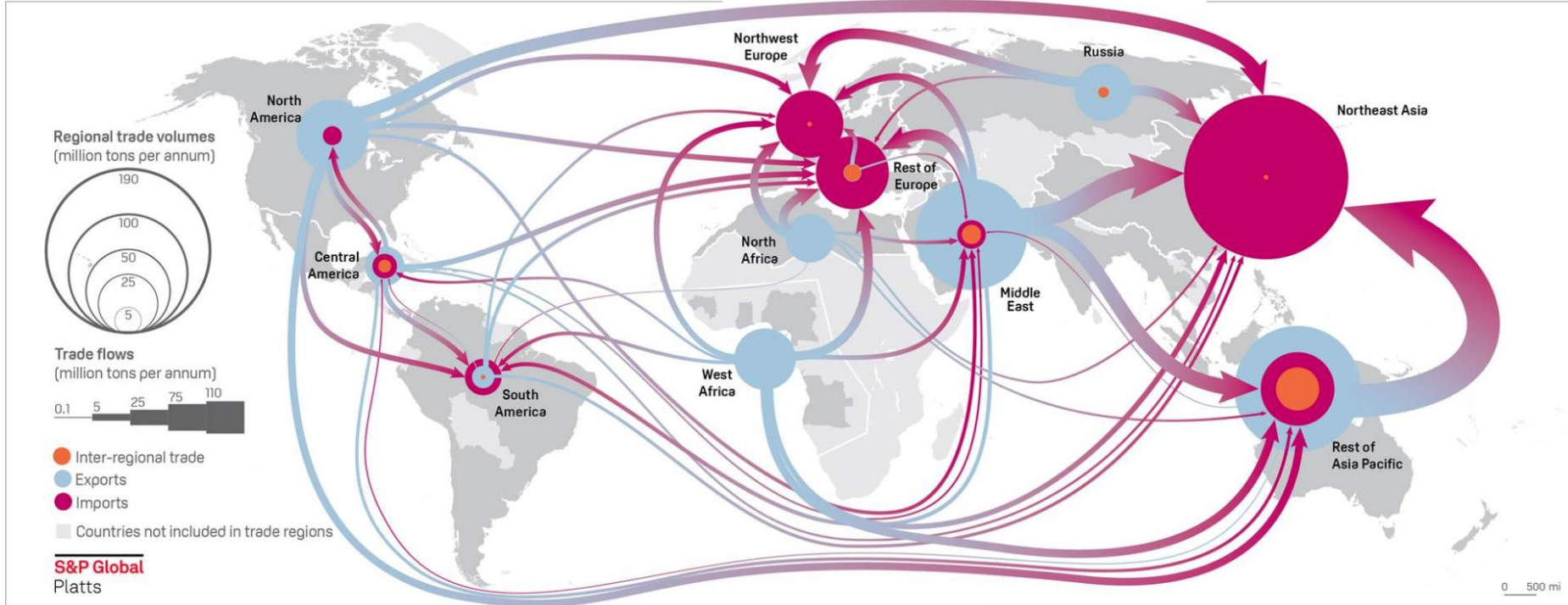
# Developing trade in hydrogen

- There is growing interest in trade in hydrogen and other low-carbon energy carriers
- Key countries have positioned themselves as potential:
  - importers (Belgium, Germany, Japan, Netherlands, South Korea, Singapore, Spain – France?)
  - exporters (Australia, Norway, Chile, Saudi Arabia, Brunei).
- Initial pilot demonstration projects on international hydrogen trade exist
  - Between Japan and Australia/Saudi Arabia/Brunei (note that these do not involve green hydrogen)
- There's uncertainty on how trading will evolve
- Technological determinants of future trade include:
  - the types of energy carriers (e.g. cryogenic H<sub>2</sub>, liquid organic hydrogen carriers (LOHC), or NH<sub>3</sub>)
  - the development of shipping/storage technologies
- But the trade of oil and gas has interesting examples



# Global LNG trade in 2019

LIQUIFIED NATURAL GAS TRADE FLOW FORECAST, 2019



# Analogy: oil and gas

🌐 Futures & Indexes	Last	Change	% Change	Last Updated
🇺🇸 WTI Crude	40.00	+0.19	+0.48%	(11 Minutes Delay)
🇬🇧 Brent Crude	41.95	+0.23	+0.55%	(11 Minutes Delay)
🇺🇸 Mars US	40.45	+0.36	+0.9%	(13 Hours Delay)
🇩🇪 Opec Basket	41.49	-1.49	-3.47%	(2 Days Delay)
🇨🇦 Canadian Crude Index	27.70	+0.17	+0.62%	(4 Days Delay)
🇸🇦 DME Oman	41.27	+0.32	+0.78%	(10 Hours Delay)
🇷🇺 Urals	42.95	+0.05	+0.12%	(1 Day Delay)
🇲🇽 Mexican Basket	37.26	-1.71	-4.39%	(2 Days Delay)
🇮🇳 Indian Basket	41.28	-1.60	-3.73%	(2 Days Delay)
🇨🇦 Western Canadian Select	31.55	+0.26	+0.83%	(6 Hours Delay)
🇦🇪 Dubai	41.41	-0.60	-1.43%	(2 Days Delay)
🇬🇧 Brent Weighted Average	41.79	-1.43	-3.31%	(2 Days Delay)
🇺🇸 Louisiana Light	40.51	-2.08	-4.88%	(2 Days Delay)
🇺🇸 Coastal Grade A	29.25	+0.25	+0.86%	(1 Day Delay)
🇺🇸 Domestic Swt. @ Cushing	36.25	+0.25	+0.69%	(1 Day Delay)
🇺🇸 Giddings	30.00	+0.25	+0.84%	(1 Day Delay)
🇺🇸 ANS West Coast	41.82	+0.04	+0.10%	(5 Days Delay)
🇺🇸 Gulf Coast HSFO	36.25	-0.68	-1.84%	(2 Days Delay)

## Oil

Varies by sulphur and hydrogen content (*intrinsic*)

Trading hubs

Spot and futures markets

## Gas

Varies by Wobbe Index (*intrinsic*)

Long term supply contracts

Trading hubs

## Hydrogen

Varies by embedded carbon content (*extrinsic*)

Long term supply contracts?

Trading hubs?



# Hydrogen certification

Energy 215 (2021) 119139



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Towards emissions certification systems for international hydrogen: The policy challenge of defining boundaries for accounting

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Schemes based on either

- Guarantee of Origin *OR*
- Technology used to produce *OR*
- Embedded CO<sub>2</sub> ( $X_i$  = emission intensity)  
- favoured

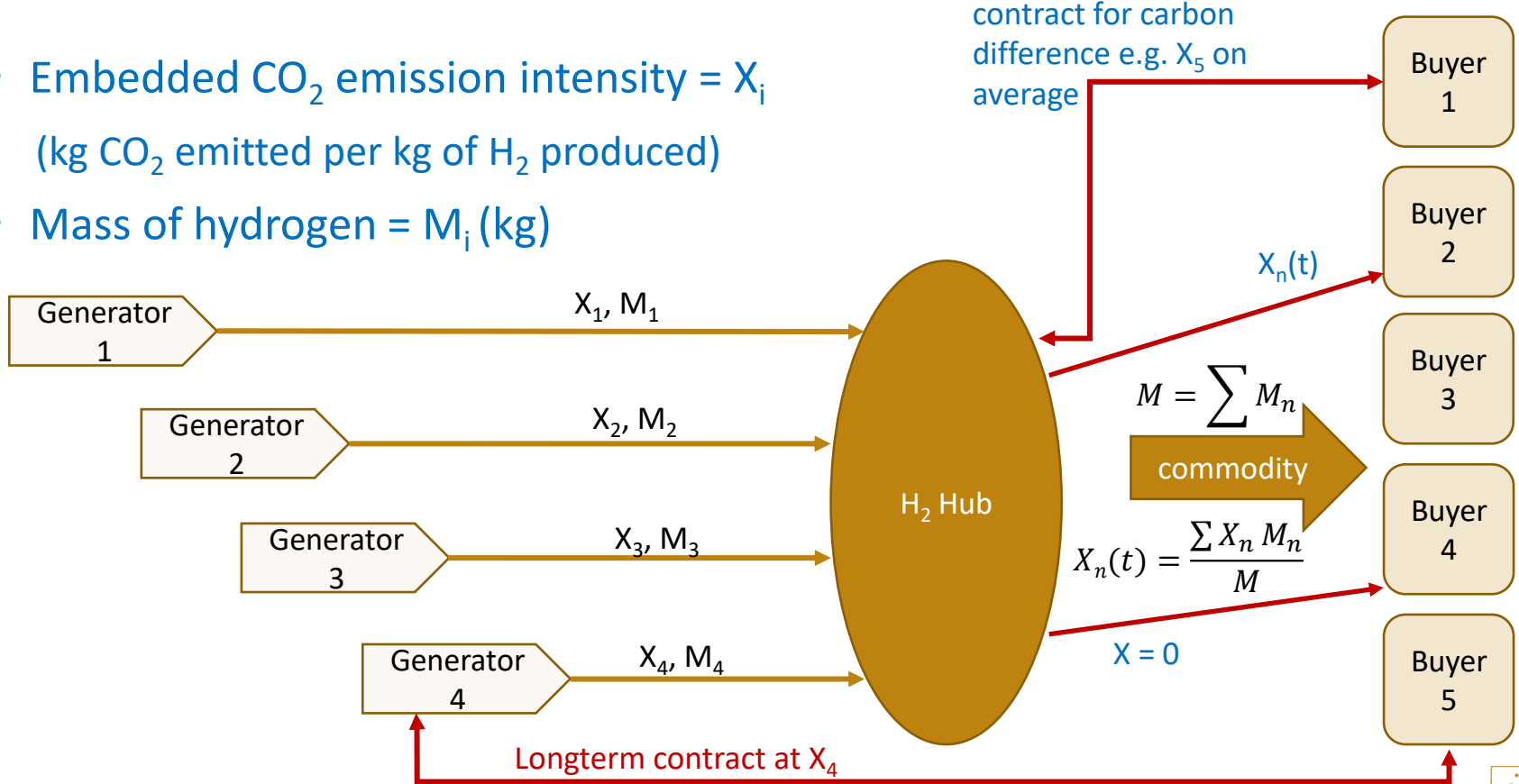
Important to use a modular approach:

- Fugitive emissions
- Feedstock emissions
- Production emissions
- Storage emissions
- Transport emissions etc.



# Hydrogen Trading Hub

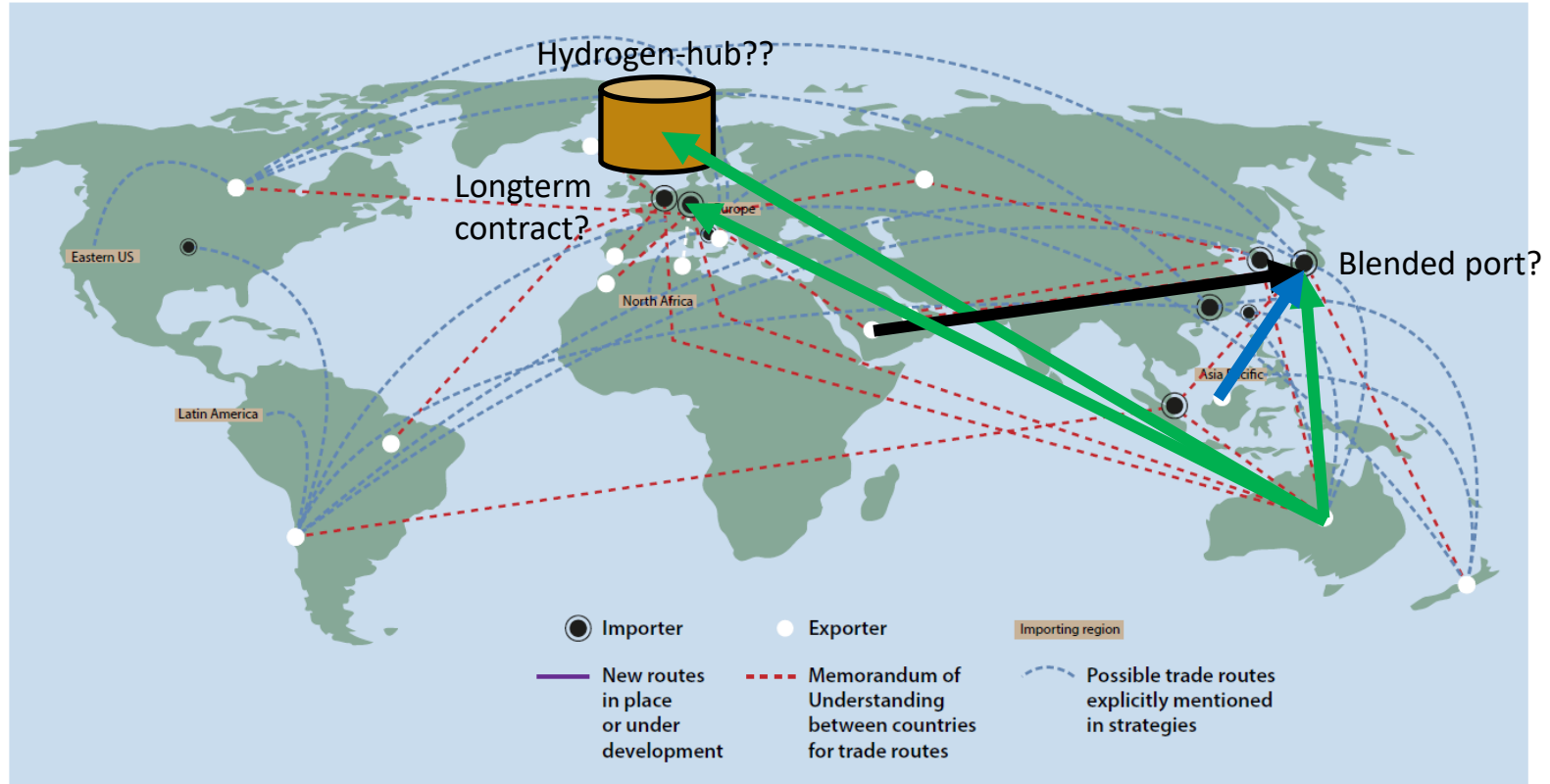
- Embedded CO<sub>2</sub> emission intensity =  $X_i$   
(kg CO<sub>2</sub> emitted per kg of H<sub>2</sub> produced)
- Mass of hydrogen =  $M_i$  (kg)



# Global hydrogen trade ?

Figure 2.7 **Envisaged trade routes for hydrogen as of 2021**

<https://irena.org/publications/2021/May/Green-Hydrogen-Supply-A-Guide-To-Policy-Making>





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