The Technopolitics of Environmental Market Making: The Case of Hydrogen Markets in the EU

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Introduction: Environmental Market Making

To reach environmental policy objectives, one increasingly turns to *market making* as a policy instrument.

- e.g. EU Emissions Trading Scheme, Biofuel policy

Case in point: EU Environmental Market Making for Hydrogen: EU Hydrogen Strategy (2020):

- Renewable hydrogen as solution to decarbonize hard-to-abate sectors
- Target: 10 Mt. renewable hydrogen production and 40 GW electorlyser capacity by 2030
- *Market making* as instrument: 'The policy focus will be on laying down the regulatory framework for a liquid and wellfunctioning hydrogen market and on incentivising both supply and demand in lead markets, including through bridging the cost gap between conventional solutions and renewable and low-carbon hydrogen and through appropriate State aid rules. (European Commission, 2020, p. 6, emphasis added)

Environmental Markets?: (How) Does it matter that environmental policy is conducted through market making?

- What types of technopolitical issues accompany environmental market making?
- Does it introduce novel types of (neoliberal) policy making?

What key areas of (techno-)political contestation emerge in environmental market making?

Hydrogen 101

Hydrogen (H_2): high caloric, clear and clean burning fuel (only produces water when burning)

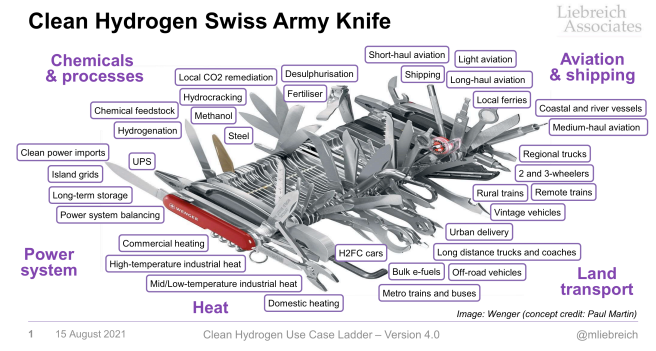
Hydrogen is an *energy carrier*, <u>not</u> a source of energy (like electricity)

Energy vector with multiple production, storage, distribution, and application pathways:

- Production pathways: Hydrogen color spectrum
- Applications: Hydrogen Swiss army knife

Some technopolitical concerns:

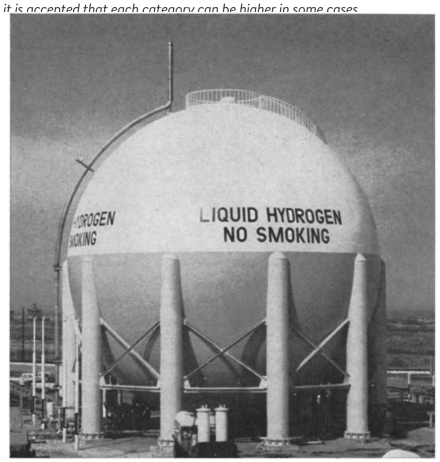
- Which pathways to promote?
- Energy conversion efficiency of hydrogen is relatively low
  - To power a hydrogen vehicle from production to use 72% of energy is lost (as opposed to 20% for EV) (Baxter 2020)
- Safety



	Terminology	Technology	Feedstock/ Electricity source	GHG footprint*
PRODUCTION VIA ELECTRICITY	Green Hydrogen	Electrolysis	Wind, Solar, Hydro, Geothermal, Tidal	Minimal
	Purple/Pink Hydrogen		Nuclear	
	Yellow Hydrogen		Mixed-origin grid energy	Medium
PRODUCTION VIA FOSSIL FUELS	Blue Hydrogen	Natural gas reforming + CCUS gasification + CCUS	Natural gas, coal	Low
	Turquoise Hydrogen	Pyrolysis	Natural gas	Solid carbon (by-product)
	Grey Hydrogen	Natural gas reforming		Medium
	Brown Hydrogen	Gasification	Brown coal (lignite)	High
	Black Hydrogen		Black coal	

*GCG footprint given as a general guide but it is accepted that each category can be higher in some cases

Source: Global Energy Infrastructure (GEI),



A European Market for Hydrogen?

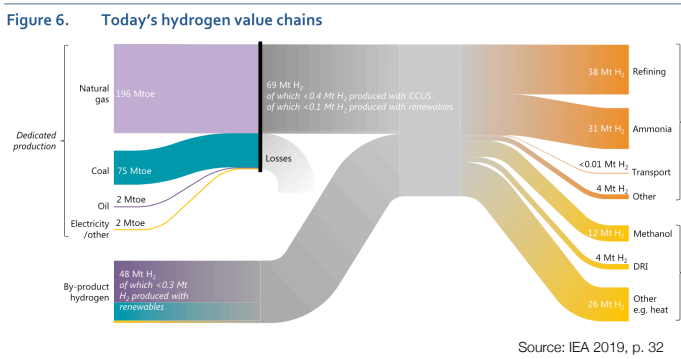
Current production and use of Hydrogen in EU? (Source: European Hydrogen Observatory)

- Demand: 7.2 Mt (EU-27, 2023): nearly exclusively feedstock in industry (Germany, Netherlands, Poland)
- Production Capacity: 10.3 Mt (EU-27, 2023): nearly exclusively gas-reforming (Germany, Netherlands, Poland)
- Trade: negligible: EU imports: 170 t (EU-27, 2023)
- Virtually no renewable hydrogen production; limited electrolyser capacity
- Hydrogen market is captive market: hydrogen production capacity dedicated to on-site consumption

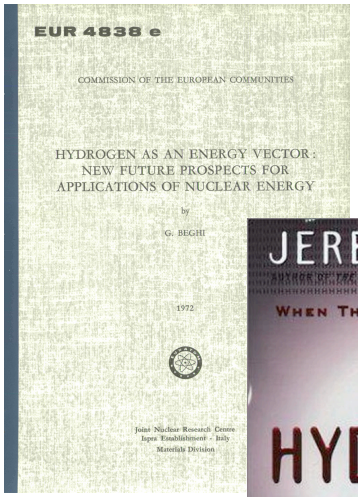
Idea of Hydrogen as energy solution not new:

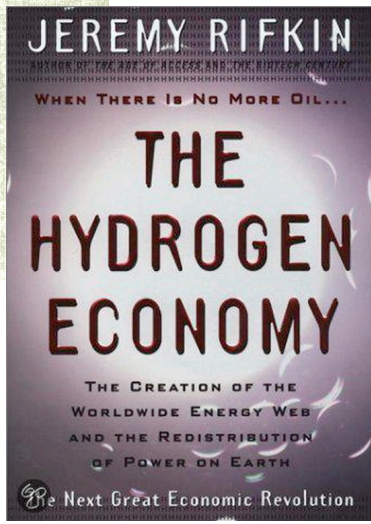
- *Hydrogen Economy*: socio-technical imaginary with history dating back to 1960s (General Motors 1966; Bockris 1972; Rifkin 2002)
- Also European involvement with hydrogen from 1960s: Joint Nuclear Research Centre Ispra, Italy (Beghi 1972); since 1986 Framework programs on Fuel Cells

How to 'Make' a Market for Clean Hydrogen?



Source: IEA 2019, p. 32





Marketization (Callon and Caliskan 2009 and 2010; Callon 2022)

Actor-Network Approach (STS): Markets as emergent phenomena

Five framings within marketization / market making process:

1. Making goods marketable
2. Making market actors
3. Making market encounters
4. Price-setting
5. Market design and maintenance

Each understood as networks of agents and technical devices (technopolitical arrangements)

Technopolitics?: political contestation that concerns, involves (or is embodied in) technological designs, devices, practices, and knowledges (Barry 2001)



Analyze technopolitics of EU hydrogen market making using five frames

Timeline of EU Hydrogen Policy Initiatives

July 2020 - EU Strategy on Hydrogen

Market for Hydrogen

Target of 1 x 10 m. tons and 40 GW capacity of renewable H2 by 2030

2020 - European Clean Hydrogen Alliance

July 2021 – Fit for 55

EU target for emissions reductions

Hydrogen Refueling infrastructure

November 2021 - Clean Hydrogen Partnership / Clean Hydrogen Joint Undertaking

€1 billion euro for the period 2021-2027 (matched)

Support research and innovation: production, storage, distribution, uses, Hydrogen Valleys

May 2022 – RePowerEU

Accelerate Hydrogen

Doubles targets to 2 x 10 m. tons of renewable H2 by 2030

Support for technology

March 2023 - European Hydrogen Bank

Auction of fixed price premiums for domestic and international producers

Hydrogen Mechanism (market information)

November 2023 - Renewable Energy Directive III

Binding Target for renewable hydrogen (RFNBO):

Industry – 42% of hydrogen renewable

Transport – 1% RFNBO

Definition of renewable hydrogen: emission savings of 70%

November 2023 Two Delegated Acts

Additionality + temporal and geographical correlation

Lifecylce emissions

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Infrastructure and Internal Market rules for Hydrogen

5. Designing a Hydrogen Market: Mission Politics

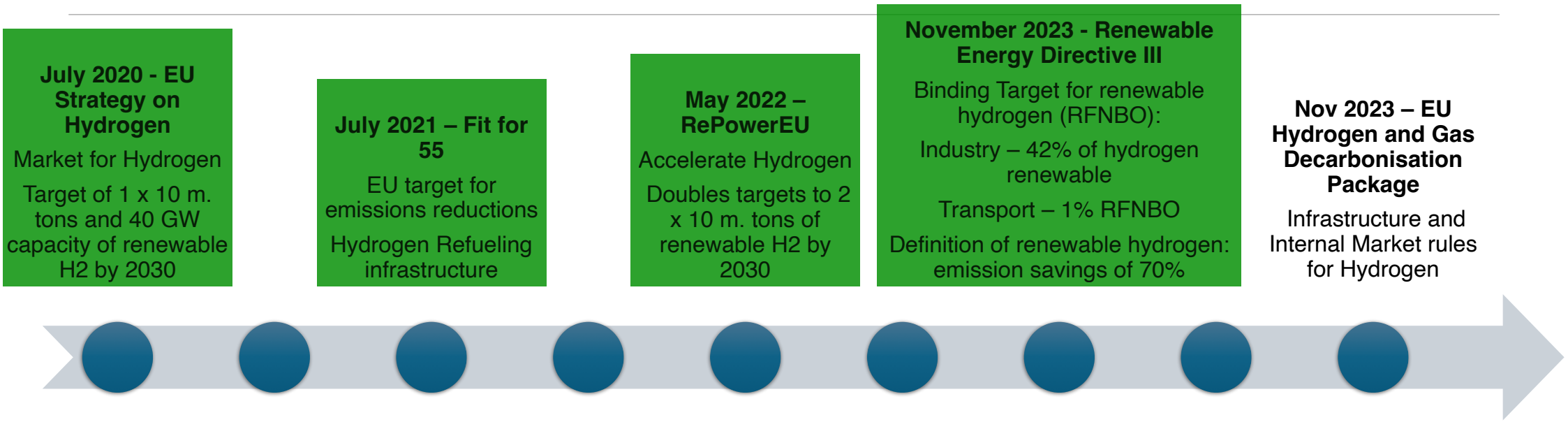
Challenge: Virtually no market in hydrogen; no market in renewable hydrogen: How to build a market from scratch?:

- exceptional case of environmental market making (only comparable to EU ETS)

EU Instrument: Mission Politics:

- Mission of Hydrogen Strategy: 1 x 10 m. tons and 40 GW capacity of renewable hydrogen by 2030
- Adjusted, notably RePowerEU and RED III

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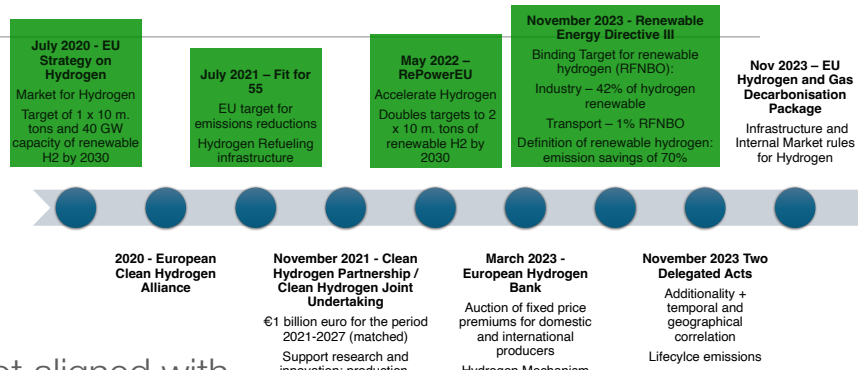
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5. Designing a Hydrogen Market: Mission Politics

Technopolitics of Designing a Hydrogen Market: Mission Politics

- Politics *over* the mission: how is mission decided?
  - No clear rationale
  - Suggested by Hydrogen Europe
  - Adjusted and expanded over time: with sectoral requirements
  - Ambiguous targets: but multiple and contradictory ambitions, and not aligned with Member States strategies (EC Auditors)
- Politics *of* the mission: mission hides political choices
  - Ambiguous regarding sources: renewable, low-carbon, any hydrogen? (EP, EC Auditors)
  - No preference for applications: hard-to-decarbonize or all applications? (EP)
- A politics of the future: missions are techniques of futuring
  - Uncertain technology: Market as futuring device
  - No evident scientific basis for mission: IPCC anticipates a limited share of 3% of hydrogen in 2050

Technopolitics of the hydrogen mission: is a strong catalyst, but skews towards interests of hydrogen sector





1. Making Hydrogen Marketable: Taxonomic Politics

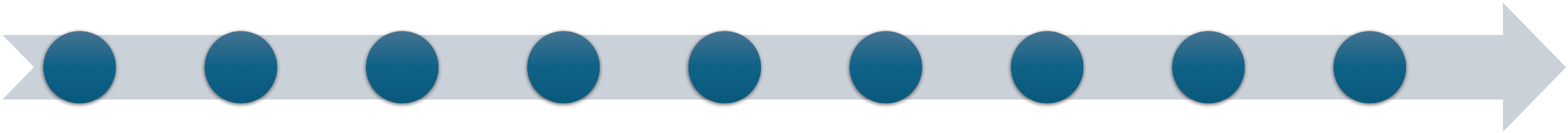
Challenge: Making Hydrogen a Marketable and Renewable Good:

- No market for (renewable) hydrogen (yet)
- Disentangle (renewable) hydrogen from local regulation and turn it into European object (Laurent 2023)
- No international standards for (renewable) hydrogen

EU Instrument: Taxonomic Politics

- Revised Energy Directive III (2023): targets and criteria for renewable hydrogen
- Two Delegated Acts (2023) with additional criteria: I - additionality + Temporal and Geographic Correlation ; II - Measurement of Emissions Intensity: Lifecycle

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Technopolitics of Making Hydrogen Marketable and Renewable: Taxonomic Politics

1. Standardization: Disentangle hydrogen from current entanglement as captive resource and re-entangle as market good / global commodity:
    - Roadmap on Hydrogen Standardization (2023, European Clean Hydrogen Alliance): identify gaps and priorities in standardization
        - Reinforces ‘technical neutrality’: strong focus on non-renewable applications and retrofitting of gas networks
2. Classification: What counts as renewable hydrogen
    - Cleanness of hydrogen does not follow unequivocally from color scheme
    - EU stipulates ambivalent criteria (Court of Auditors)
        - Delegated Acts strict on safeguarding renewability of hydrogen produced from electricity - but includes exceptions for nuclear energy
        - RED III more lenient in defining low-carbon thresholds (as 70% less emissions than fossil comparator)
3. Certification:
    - European Certification: CertifHy
    - Global Certification efforts

Technopolitics of hydrogen taxonomies: strengthens norms for renewability, but leaves substantial room for less renewable applications

2. Making Hydrogen Market Actors: Politics of Technology Support

Challenge:

- Currently no functioning market actors: supply, demand, distribution, intermediaries, global link-up
- How to align actors and to form a market agencement (humans and non-human devices)
- EU / Member States cannot support business, but can support technology

EU Instrument: Technology Support

- Alliance forming: European Clean Hydrogen Alliance (2020 - today): stakeholders alliance
- Direct support (together with Member States): 18.8 bn. Excluding IPCEIs
  - Recovery and Resilience Facility and REPowerEU (2022): 13.6 bn. in national plans for capital and operating costs of clean technologies: demonstration, flagship and national agendas (Auditors)
  - Fuel Cells and Clean Hydrogen Joint Undertaking (2021) / Clean Hydrogen Partnership (2021-2027): joint public-private partnership: 1.2 bn. from EU for R&I
  - Important Projects of Common European Interest (IPCEIs) on hydrogen: Hy2Tech (2022), Hy2Use (2022), Hy2Infra (2024), Hy2Move (2024): instrument for Member States to provide state aid.
- Regulatory: EU Directive on Gas and Hydrogen Networks (proposal 2021; 2024 adopted): rules for internal market in hydrogen

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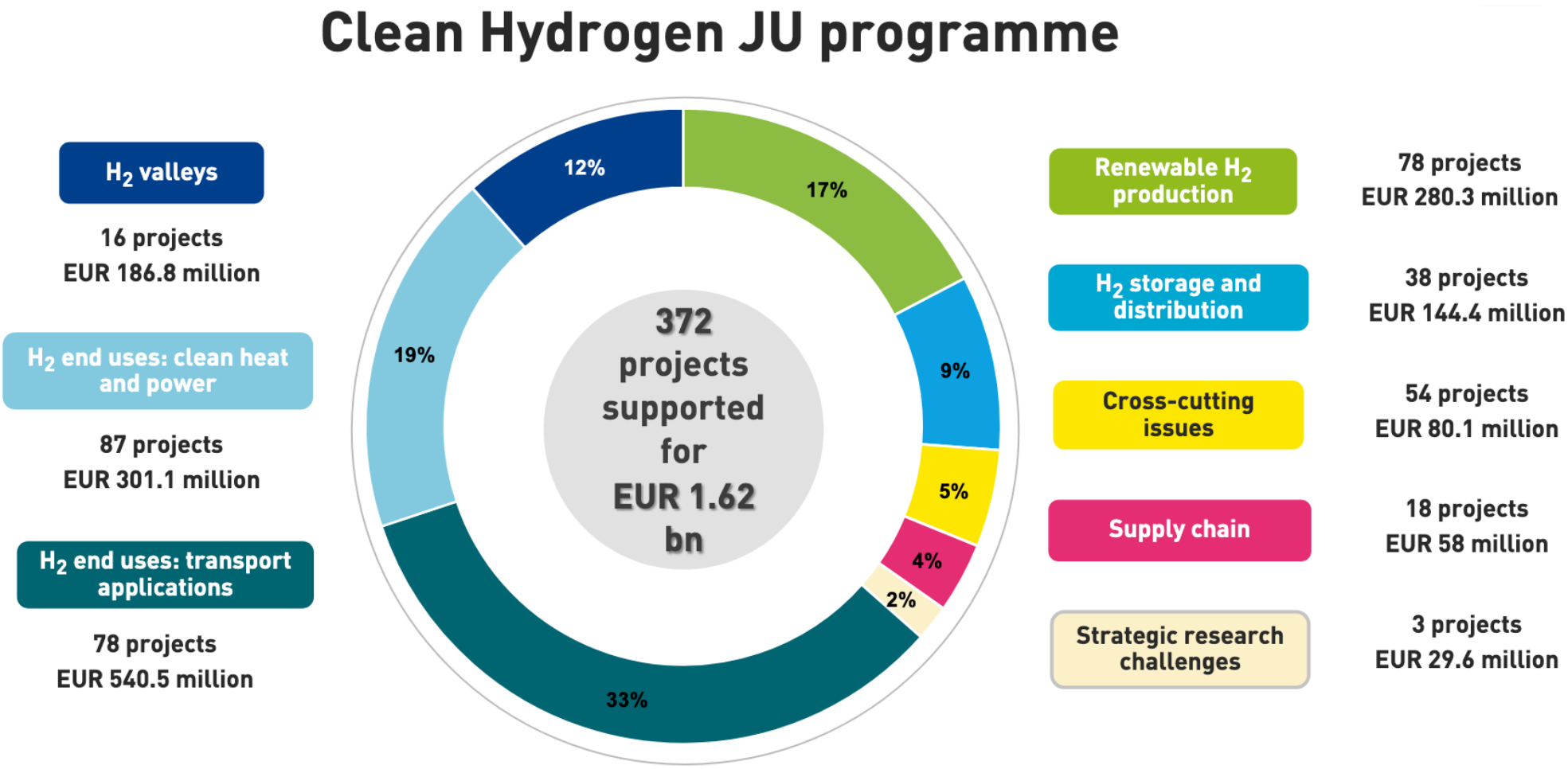
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Figure 2: Projects supported by the Clean Hydrogen JU per pillar and annual financial contribution (2008-2023)



Source: Clean Hydrogen JU.

2. Making Hydrogen Market Actors: Politics of Technology Support

Technopolitics of Marketizing Agencies through Technology Support

1. Pilots: experimentation and demonstration
2. Incentives to develop technology and uses
3. Market regulation: provide reliable framework
4. Long-term Signals (mission; taxonomy)
5. Reduce value chain complexity: Clusters (Valleys); Public-Private-Partnerships

Technopolitics of Technology Support: Comprehensive, Substantial, Involvement of Member States, but diffuse: how to pick the technological pathways to support?

- Diffuse set of instruments
- Diffuse set of actors (supply, demand, distribution, intermediaries, Member States) and technologies
- Diffuse set of hydrogen uses
- Diffuse support for both renewable and non-renewable hydrogen technologies: how to make sure support goes to renewable hydrogen?
- Diffuse support between Member States, and EU

3. Making Market Encounters: Value Chain Politics

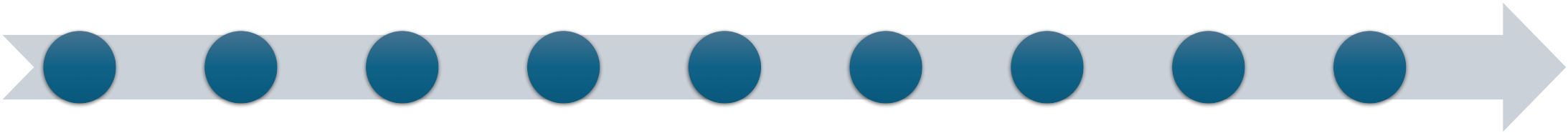
Challenge:

- Where will the market meet? Hydrogen not traded on commodities markets; hardly traded elsewhere: how will supply and demand meet?

EU Interventions: Value Chain Politics

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- Direct support to create value chains: Hydrogen Valleys; hydrogen corridors:
  - Hydrogen Europe and European Commission (2023): Joint Declaration on Hydrogen Valleys: Moving the hydrogen economy from niche to scale: ‘regional hydrogen economies’
  - European Clean Hydrogen Alliance (2024): Learnbook Implementation of Supply Corridors: 6 corridors to form pan-European network

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Technopolitics of Value Chains:

- Hydrogen and Decarbonised Gas Market Package: modeled after gas market; too early and too little flexibility given developmental state of hydrogen market?
- Who sets the agenda and determines the priorities on Hydrogen Valleys and Corridors? How committed to renewable hydrogen?

4. Price-setting: Politics of Price Support

Challenge:

- Untangling from a captive market: where and how are prices are ‘set’?
- Competitive prices: can (clean) hydrogen compete with other hydrogen / energy vectors?

EU Interventions: Politics of Price Support

- Regulatory: EU Directive on Gas and Hydrogen Networks (proposal 2021; 2024 adopted): rules for internal market in hydrogen
- European Hydrogen Bank (2023):
  - Cover and lower the cost gap between renewable hydrogen and fossil fuels for early projects [price support]
  - De-risk hydrogen projects [investment support]
  - Increase transparency on hydrogen flows, transactions and prices, gather demand and supply information, provide transparent, price information, and develop price benchmarks [market transparency]
  - Support and increase cooperation and trade with third countries

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4. Price-setting: Politics of Price Support

Modern version of Price-supports: Auction (800 mln.)

- Pay-as-Bid or Discriminatory Price Auction: a market to efficiently allocate price-support for the hydrogen market
- Producers place a bid for a fixed price payment (premium) per kg of hydrogen produced for a period of 10 years
- Compete with US support schemes ($3 per kilo of hydrogen)

Technopolitics of Price Support:

- Contrast Internal Market regulation and Price Support
- Exclusive support for renewable hydrogen (in EU's RFNBO definition)
- Market design of auction: does it subsidize where decarbonization effect is largest, or where price gap is smallest?
- Who will benefit?: Sectors, Member States?

Conclusion

Not your usual EU market liberalization project, but attempt to create a Hydrogen Economy

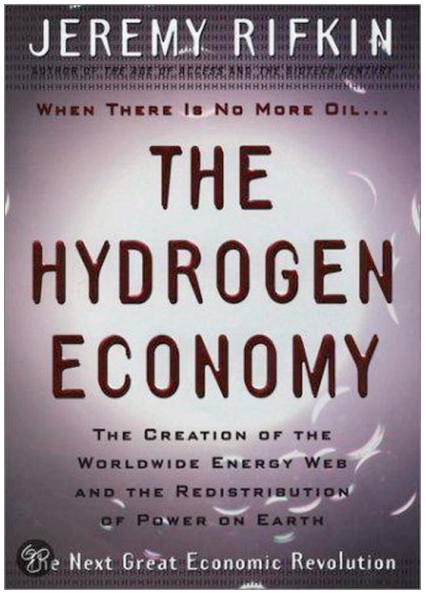
- Preview of future EU politics: Green Industrial Policy

EU Hydrogen Market Making is a multidimensional technopolitical project comprising:

- Mission Politics
- Taxonomic Politics
- Politics of Technology Support
- Value Chain Politics
- Politics of Price Support

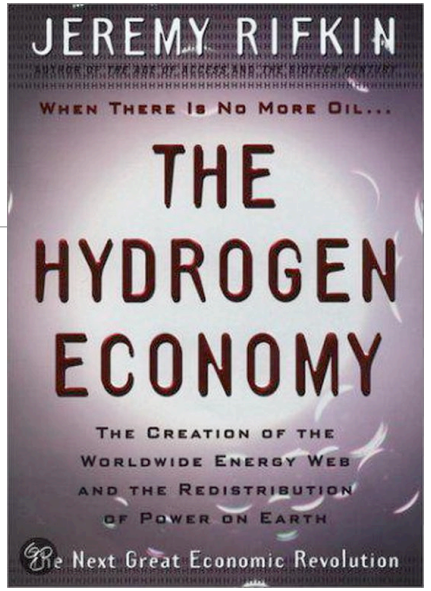
(How) Does the technopolitical nature of environmental market making matter?

- Politics happens at multiple sites (target setting; standard setting; value chains; pricing) and involves multiple actors (political, and business, science, consultancy)
- Market forms technopolitical buffer-zone between politics and policy outcomes
- Risk that policy objectives and outcomes become diffused, diluted and delayed



Environmental market caught between dream of Hydrogen Economy and tool to promote renewable hydrogen

Conclusion (cont.)



Distinctive type of (neoliberal) policy making:

- Mission Politics: defines public purposes of market making
- Taxonomic Politics: provides norms for environmental market
- Politics of Technology, Value Chain and Price Support: Unparalleled forms of direct government involvement to support hydrogen economy making
- Co-opted market: Powerful existing (fossil) market actors are setting the agenda

Combination of Market Making and Technopolitics: mix of economic interests, state ambitions, and technological knowledge lends itself to Hy-ghly idealistic narrative (in need of reality check?):

- Hy-Pipe Dreams: clean promises of hydrogen tend to be overstated
- Iron-Hy: many players driving the agenda and receiving support are established fossil (related) actors

Do environmental markets foster dreams, or provide a reality check?