Hydrogen Projects: Practical perspective

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Hydrogen Europe

European Hydrogen Week 2025

Conference

SAVE THE DATE

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The Square

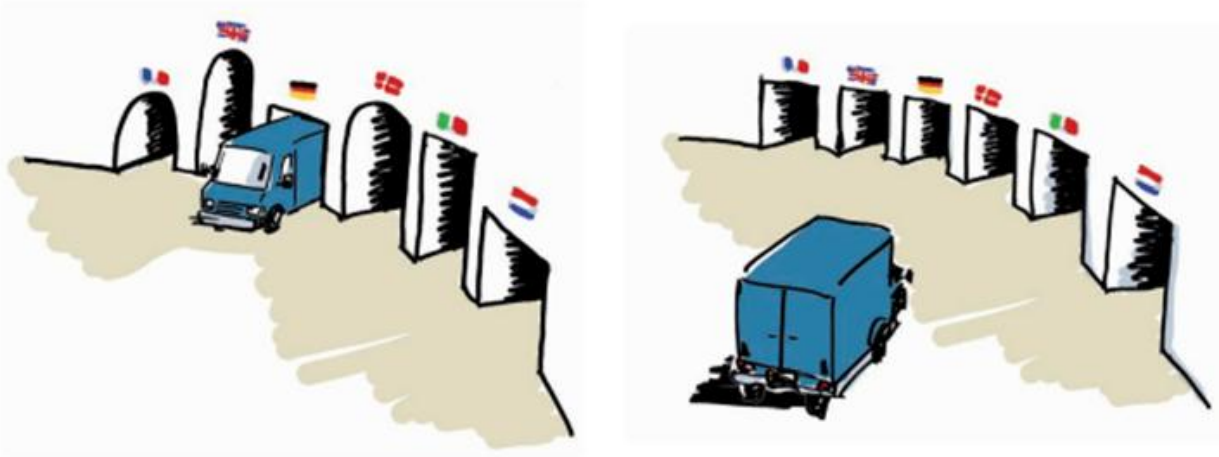
Brussels, Belgium

euhydrogenweek.eu

Standards in Everyday life

Standardization for hydrogen scale up

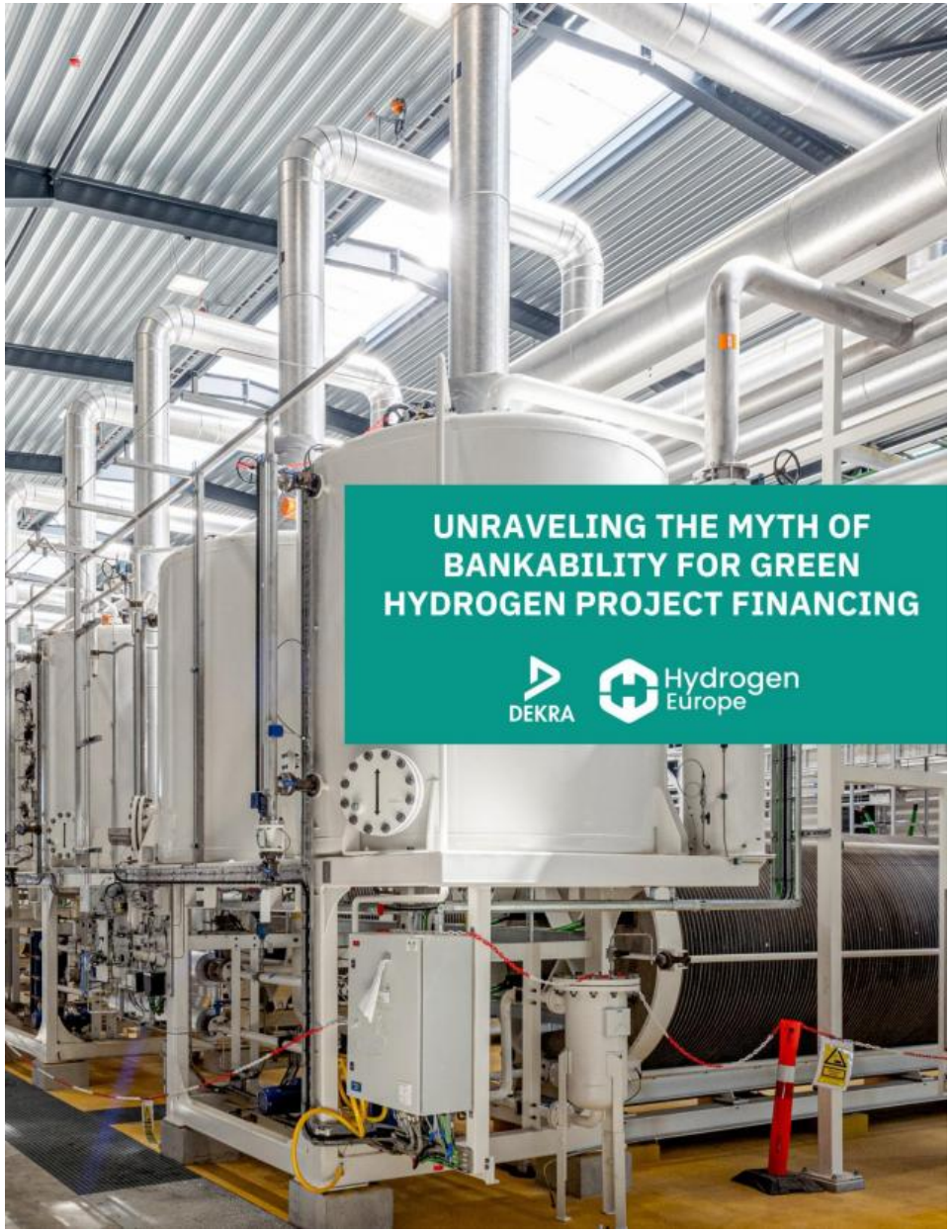
- Why RCS is so important for H2 scale up?
  - ➢ Fast template style roll out
  - ➢ Economics of scale & mass production
  - ➢ Product Compliance
  - ➢ Safety and risk
  - ➢ Liability



Hydrogen market needs certification: Irena

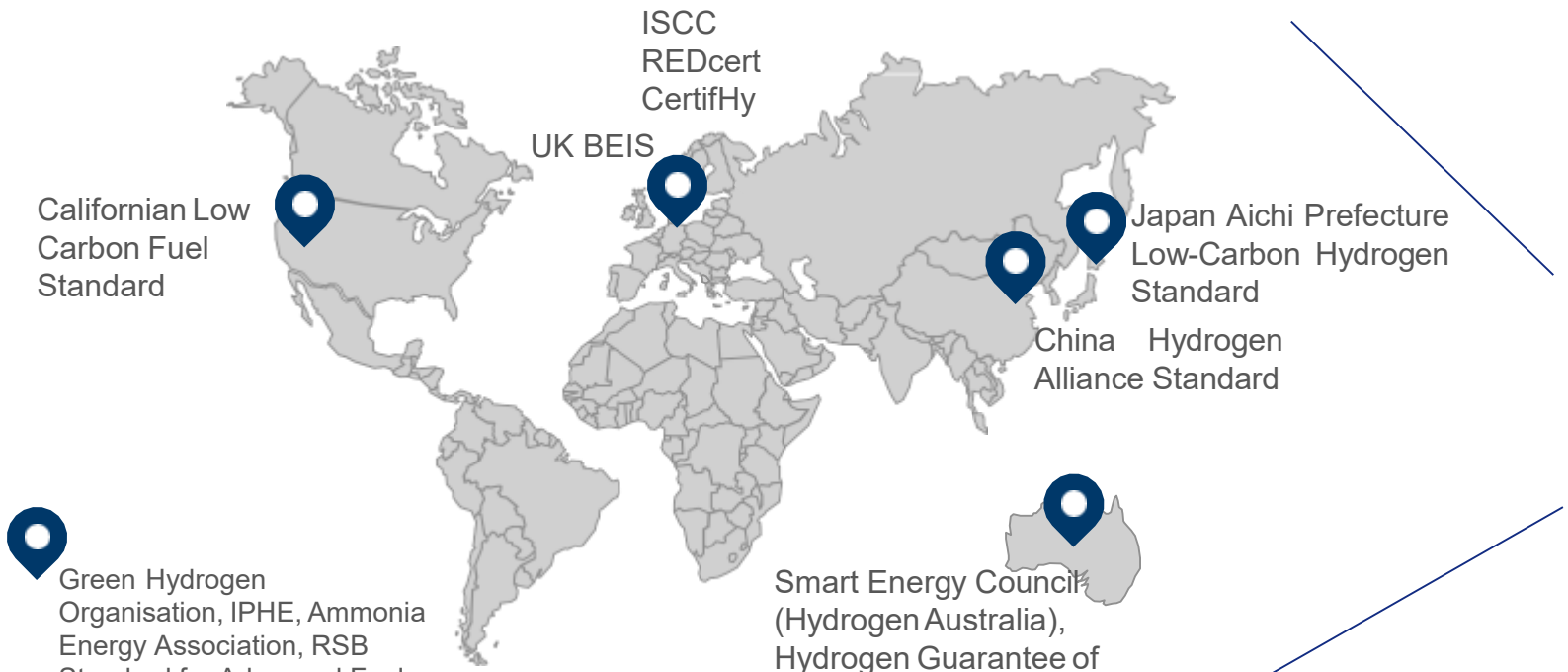
A standardized system would facilitate trading across jurisdictions and prevent market fragmentation, and certification must not noticeably increase the price of low-carbon hydrogen where costs are already a key barrier to uptake, Irena said.

Hydrogen Europe



Current Standards and Criteria for Hydrogen

Certifying green hydrogen isn't straightforward. The global landscape is dotted with numerous standards, making it a challenging endeavor.



General Criteria

- Energy Source
- Production Process
- Carbon Intensity

Advanced Criteria

- Environmental
- Social & Ethics
- Governance

Numerous standards exist, each either confined to a particular region or tailored to the specific local context.

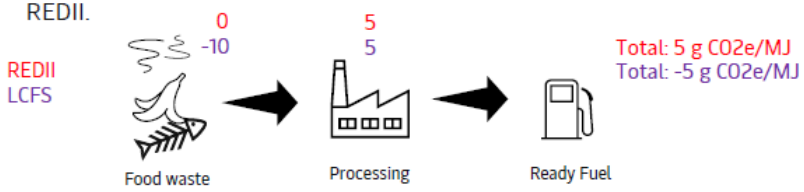
Sustainability requirements are only partially covered by some standards

Source: TUEV Nord

Problems with harmonization

Challenges and needs

- International shipping is global and shipping emissions fall outside the national greenhouse gas emissions inventories (UNCCC), outside of local trading schemes e.g. California Low Carbon Fuel Standard (LCFS) .
- Existing standards do greenhouse gas accounting differently.
- A biofuel certified to e.g. the LCFS Standard is likely to have a very different GHG footprint than the same fuel certified to the REDII.

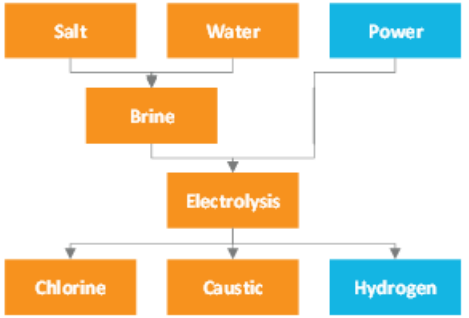


- Shipping needs consistency in grade naming and GHG allocation for new renewable/circular fuel plants for residual and intermediate streams.
- The EU's pending a delegated act for e-fuels*, RFNBOs (Renewable Fuels of Non-Biological Origin) is causing major uncertainty for fuel suppliers and off-takers
- Existing rules on mass-balance bookkeeping are not aligned with the realities of marine fuel logistics, e.g. floating storage, bunker barge last point before consumption.
  - Fuel production is often far from ports

* It is finally out!

Shipping needs **globally recognised** standards and **robust** greenhouse gas accounting across continents, regions and countries (and preferably also across transport modes like trucking and aviation) that emphasize **consistency**.

Problems with allocation



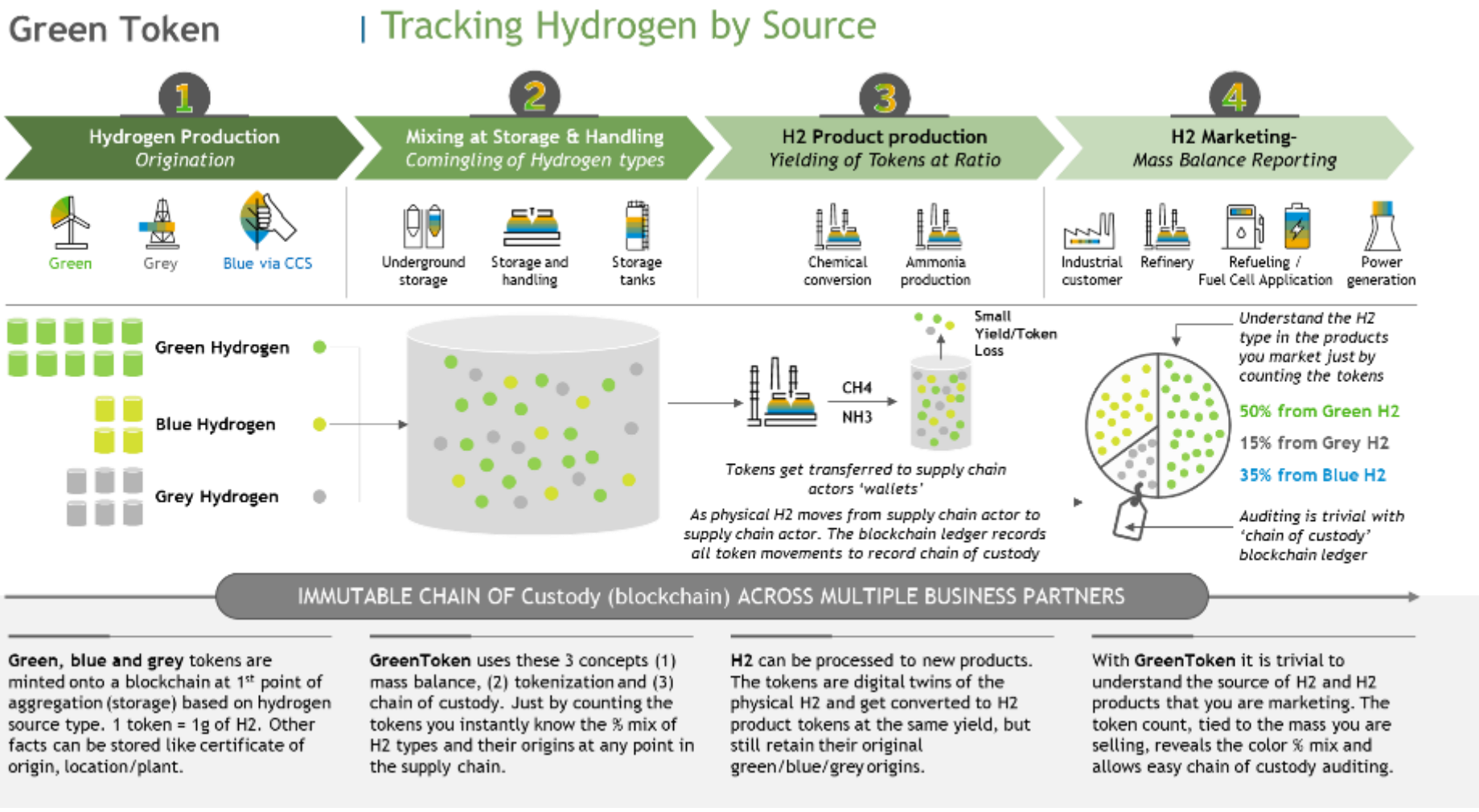
Allocation Method	H_2 Emissions Share	H_2 Emissions ($g\ CO_{2e}/MJ_{LHV}\ H_2$)
Energy-Based	N/A	N/A
Mass-Based	1%	7
Market Value-Based	9-11%	34-59
Molar-Based	25%	134
Enthalpy-based	53%	282
Benchmark-Based (ODC process)	21%	134

Figure 17: Allocation principle in the chloralkali case

Table 3: Carbon footprint calculation methodologies used across different standards, international frameworks and policy instruments

	ISO 14044:2006/ AMD 2:2020	ISO 14067: 2018	GHG Protocol	RED II – adopted Delegated Act (10 Feb 2023)	IPHE (2021)
Type	International Standard	International Standard	Corporate Reporting Standard	Regulation	Working Paper
Approach	Attributional approach and consequential approach	Attributional or consequential	Attributional	Includes elements of attributional and consequential	Attributional
Scope	System boundaries are defined based on goal and scope	Allows for well-to-grave and well-to-gate	Allows for well-to-grave and well-to-gate	Well-to-grave CFP of reference fuel minus CFP of hydrogen[9]	Well-to-gate
Allocation	Should be avoided through system expansion, if not possible, physical relationships (mass or energy) should be used to partition inputs. When physical relationship cannot be established other relationships can be used (e.g. economic value)	Adopts ISO 14044	Adopts ISO 14044	Allocation based on energy content in general, exceptions when co-products include non-energy products	Building on ISO 14044; where allocation cannot be avoided, coproducts should be allocated in the following order; based on 1. Energy content System expansion Economic value

Overcoming challenges of tradable certificates from the commodity



Source: SAP

DPP - demanded by politics... (Intention Green Deal)

- **December 2019: European Green Deal**

"[...] for example, an electronic product passport could provide information on a product's origin, composition, repair and disassembly options, and end-of-life handling."

- **March 2020: European Circular Economy Action Plan (CEAP).**
- **December 2020: European Regulation on Batteries and Waste Batteries.**

"Each battery shall receive its own battery passport with an individual identifier. The battery passport shall be linked to the information on the basic characteristics of each battery type and model [...]."

- **December 2021: German coalition agreement**
- **Circular economy *"We introduce digital product passports, support companies in the implementation [...]."***

March 2022: Draft ESPR (Ecodesign Requirement for Sustainable Products). statement on DPPs:

"The proposal also includes the creation of a digital product passport to register electronically, process and share product-related information amongst supply chain businesses, authorities, and consumers. This is expected to increase transparency, both for supply chain businesses and for the general public and increase efficiencies in terms of information transfer. In particular, it is likely to help facilitate and streamline the monitoring and enforcement of the regulation carried out by EU and Member State authorities. It is also likely to provide a market-intelligence tool that may be used for revising and refining obligations in the future" (European Parliament and European Union Council, 2022).

- **RED III (13)**

(...) *Furthermore, to provide access to appropriate supporting evidence for persons concluding renewable power purchase agreements, it should be ensured that any associated guarantees of origin can be transferred to the buyer. In the context of a more flexible energy system and growing consumer demands, there is a call for a more innovative, digital, technologically advanced and reliable tool to support and document the increasing production of renewable energy. To facilitate digital innovation in this field, Member States should enable issuing guarantees of origin in fractions and with a closer to real time timestamp.*

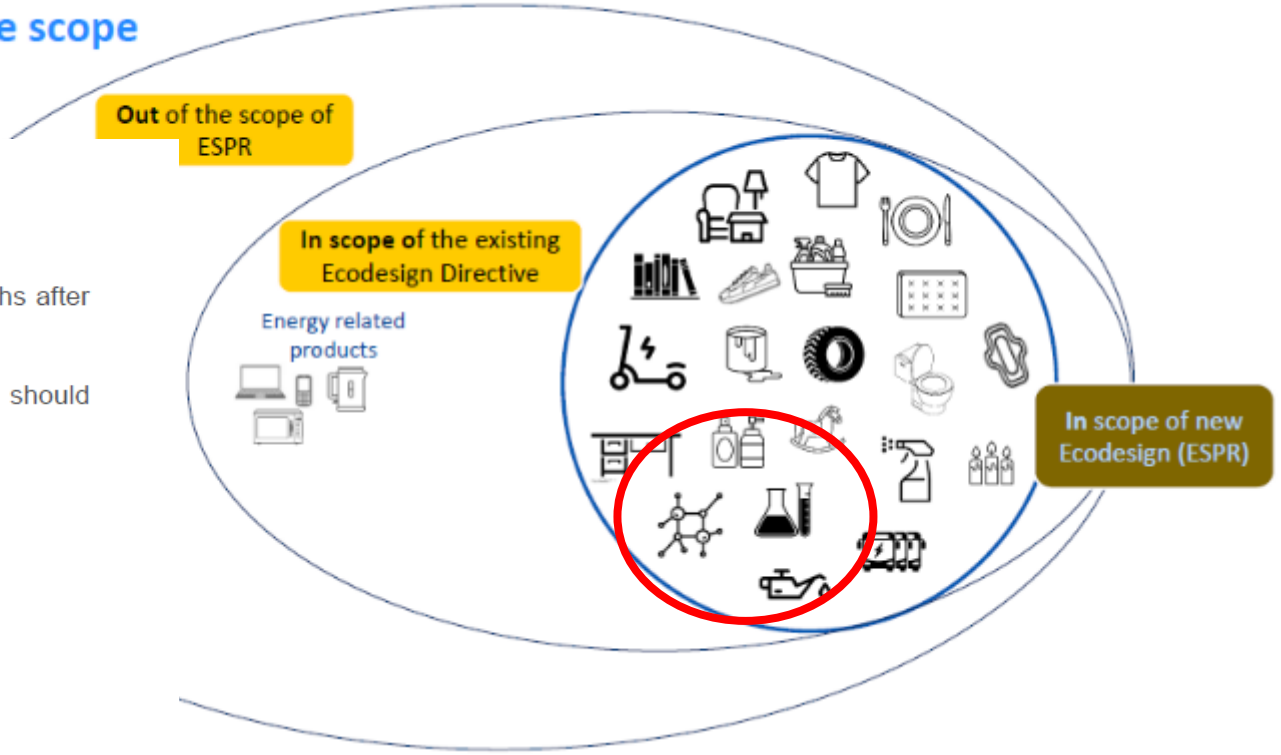
- **New Legislative Framework**
- **96% of manufacture goods today use resources ferived from chemical processess (Either H2 or carbon containing).**

Scope of ESPR

Implementation work ahead

- The Commission will adopt an **ESPR Working Plan**. Adoption is expected within 9 months after the entry into force of ESPR (i.e., around Q1-Q2 2025).
- The co-legislators have pre-identified a number of product groups the Commission should prioritise:
  - Iron & steel
  - Aluminium
  - Textile, notably garments and footwear
  - Furniture, including mattresses
  - Tyres
  - Detergents
  - Paints
  - Lubricants
  - Chemicals
  - Energy related products
  - ICT products and other electronics
- The Commission retains the right to add or remove product groups from the ESPR working plan, but it should provide a justification for each decision.

The scope



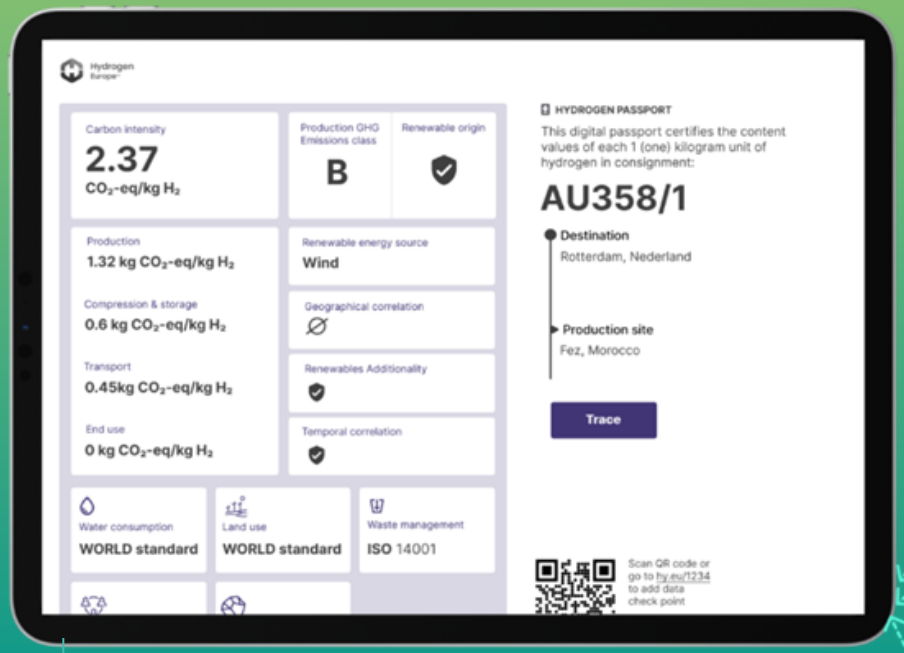
Proposed solutions for fragmented international regulatory framework

Strategy	Key Concept	Positive Aspects	Negative Aspects
Convergence fueled by market demand	Alignment driven by market forces and demand	Market solutions arise from client preferences and industry choosing criteria; specific certification schemes with specific LCA methodology	Time-consuming, relies on customer knowledge and willingness to pay; may go sideways, creating more fragmentation, market distortion, and incoherent certification schemes
Mutual recognition agreements (MRA)	Multilateral agreements that acknowledge compatibility between certification schemes or standards	Market access facilitation, cross-border recognition, cost reduction, and multiple market entry; promotes global hydrogen trade by enabling mutual recognition	Complex process due to politics/self-interest, need for regulation and oversight, audits, and quality assurance to ensure MRA adherence; **may require harmonization of national energy policies, which could be challenging**
Internationally recognized standard	Creation of collective understanding and unified approach to certification, ensuring consistency and comparability of results [e.g. ISO TS 19870]	Consumer confidence, transparency, comparability rise, cost reduction, and market access boosts	May restrict adaptability and hinder innovation; complex and time-consuming development process; significant time and resource investment; regulatory compliance challenges
Type III declarations	Create a structured framework to compare and assess environmental impacts of products, presenting data and relevant details in the form of a report	Environmental quantification reports, product comparison simplification, sustainability enhancement	Lack of case solutions, time-consuming process, complex collaborations, and challenges in aligning with market demands
Digital Product Passport (DPP) as Comparability factors	Use of comparability factors and digital technology to establish harmonization, traceability, and comparability in certification protocols	Practical implementation, reliability, and consistency enhancement; enhanced traceability, improved transparency, and greater compliance ease; supports harmonization and international recognition	Requires digital infrastructure, cybersecurity risks, and data privacy concerns; potential for additional compliance burdens; resource-intensive due to technology implementation

DPP is a key tool proposed by the EC to create the **digital landscape, data-exchange mechanisms, and transparency** needed to **close information gaps** in value chains which enables **better sourcing decisions** and **closed-loop activities** in order to **tackle major environmental issues** and tap into the **$4.5tn opportunity** of the circular economy

Digital Product Passport for Hydrogen: Seizing Global Leadership

A passport for hydrogen's future – A leap towards technological, economic, and environmental excellence



EU Borders:
CBAM

Point of use:
RFNBO Certificate issuance

Intra EU:
Union Database /
mass balance

Import terminal

Point of Use

Production

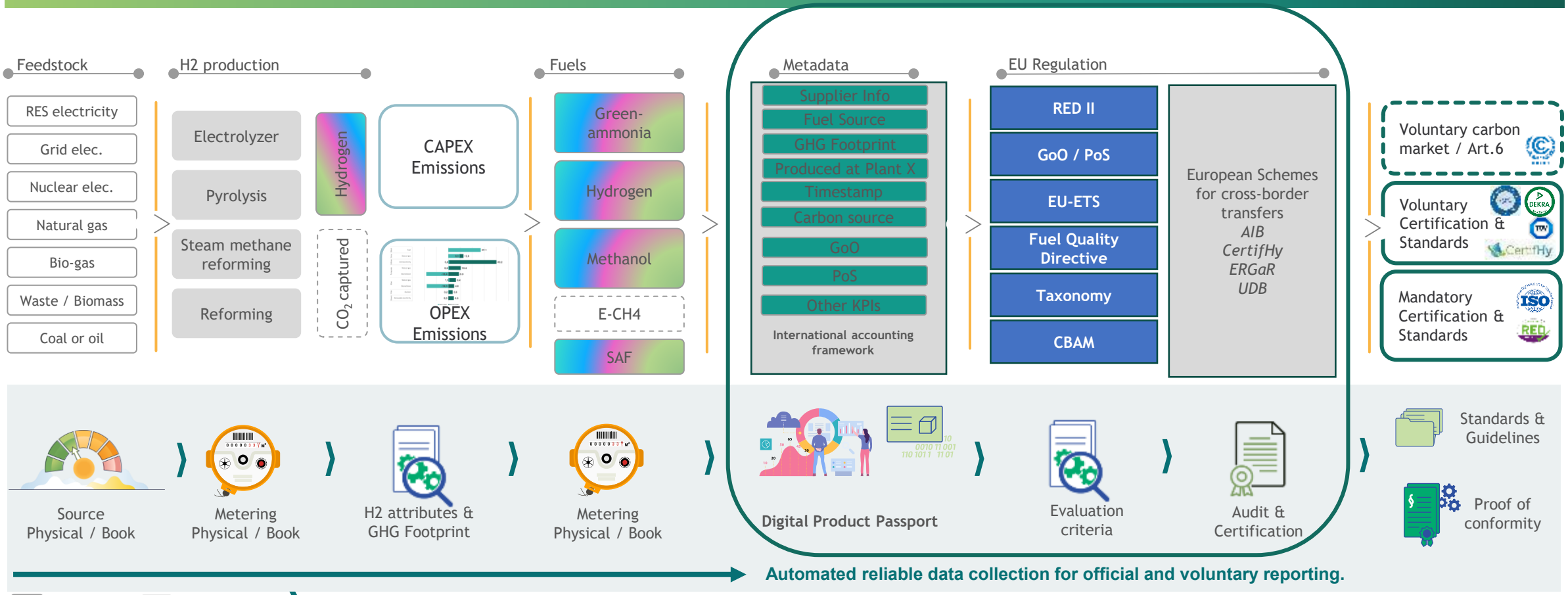
Transportation

Data flows

Physical flows

Source: Hydrogen Europe, ATMEN, Standards United

Harmonization & automated validation



Source: HyStandards

Validation of the E-SAF value chain

Compliance data via Digital Product Passport (DPP) for Hydrogen and derivatives

Hydrogen Europe

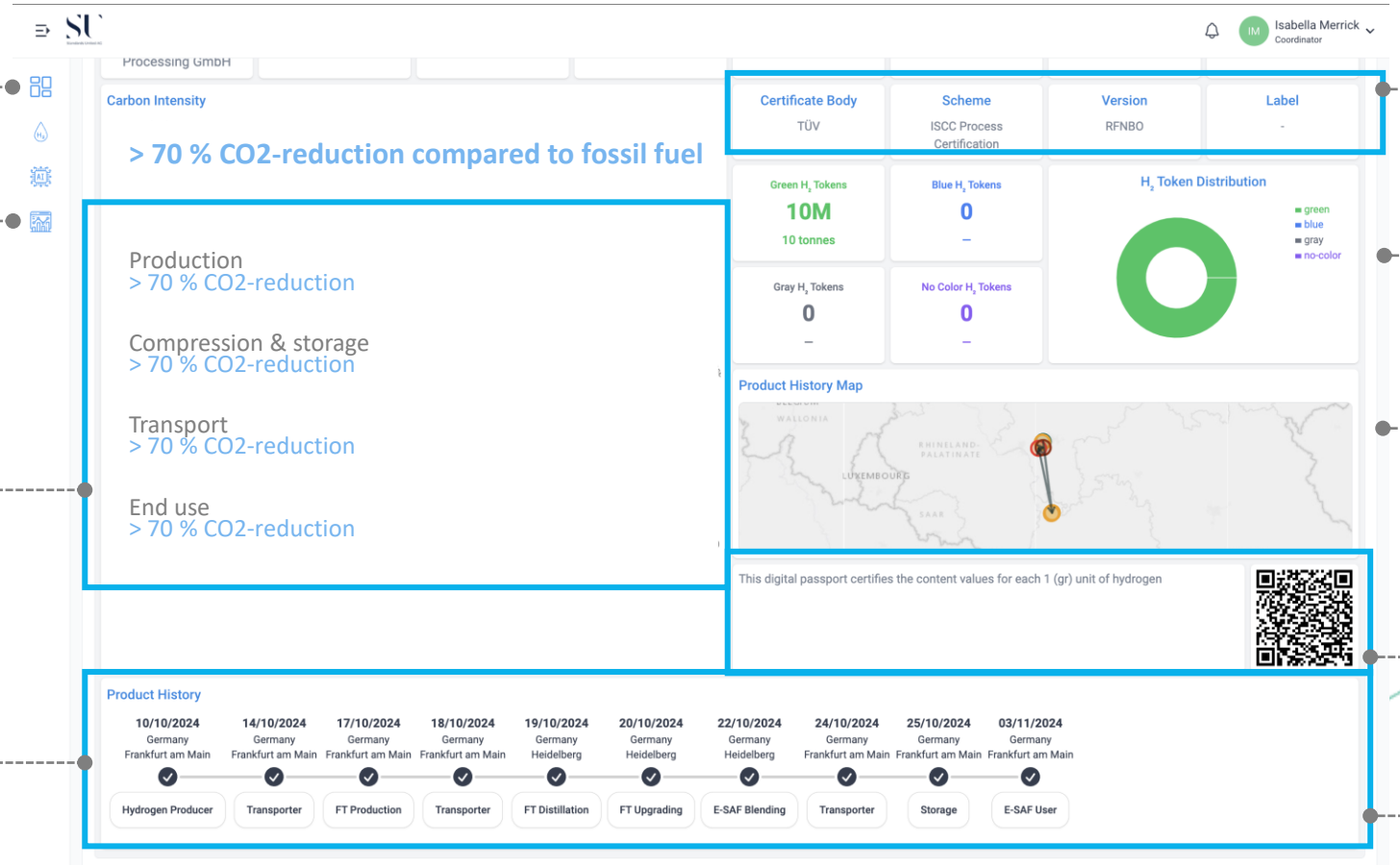
Data Analytics
& **Digital Facility Profile**

Conformity Assessment: Compliance Check

CLAIMS: Scope 1, 2, 3 Emissions

WHO: Registered Entity ID & facility data

ORIGIN: Chain of custody



AUDIT: Voluntary & mandatory certifications

ESG: ESG metrics value & tokenization (Quota allocation ID)

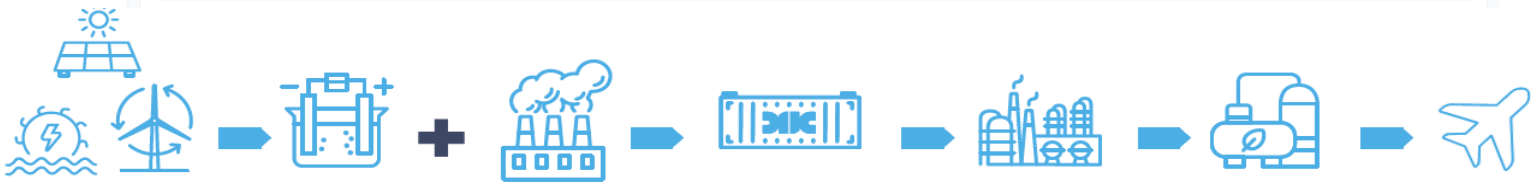
HISTROY: Product history visualization & location ID

TRACE: Unique Identifier for Digital Product Passport

Verifiable Credentials
Batch/ Serial/ Shipping ID

ITEM: Individual serial or batch

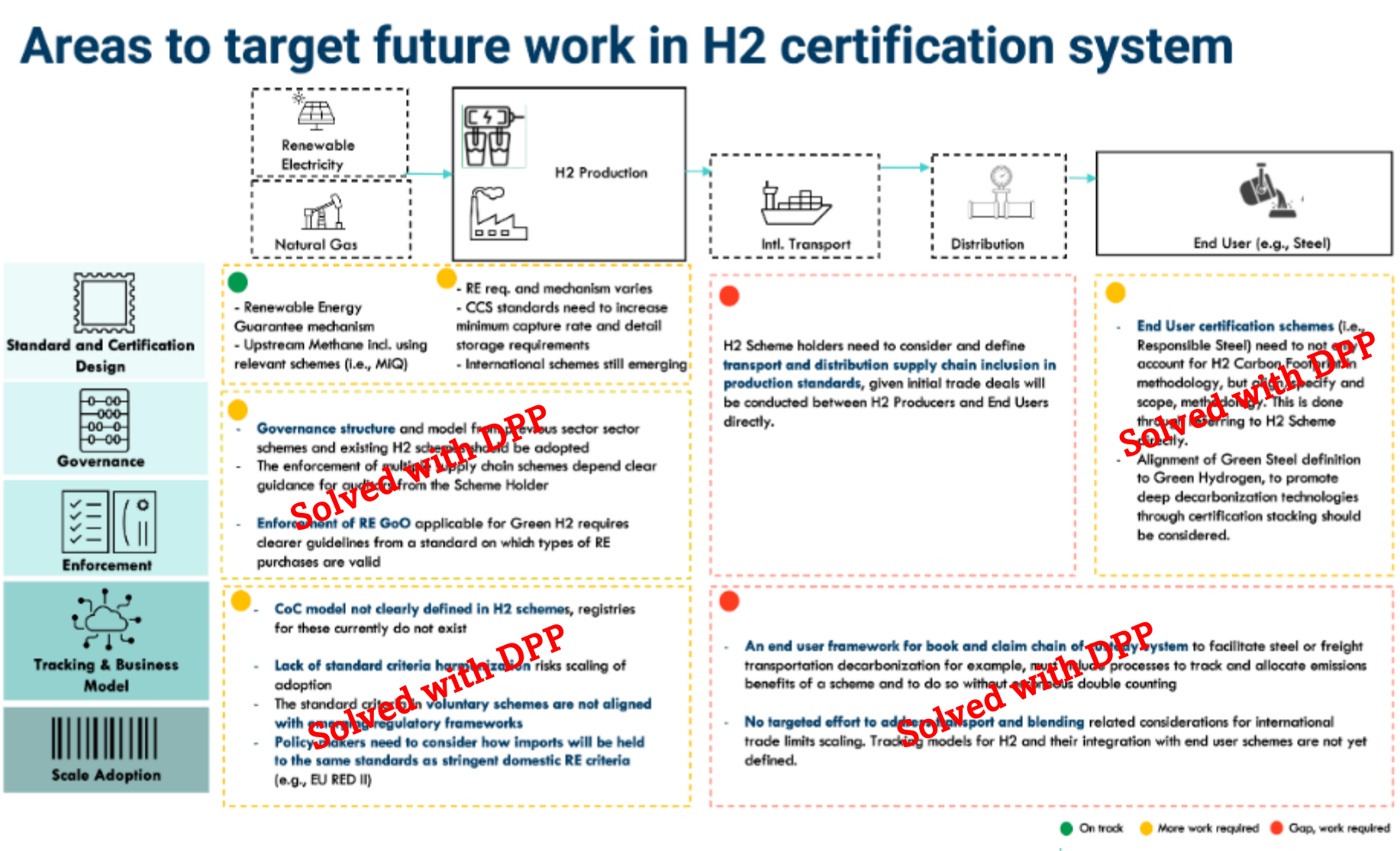
INERATEC



Source: Hydrogen Europe, INERATEC, Standards United

The displayed data has been compiled for test purposes and does not represent the final numbers for e-SAF produced by INERATEC.

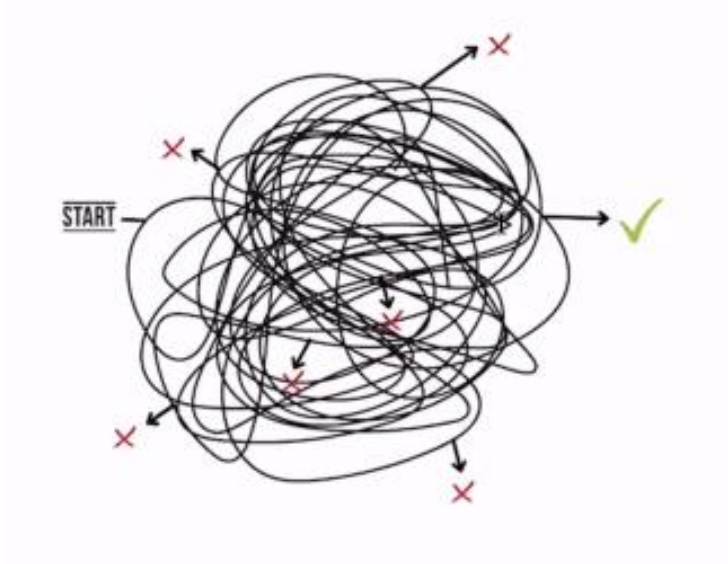
Areas where a DPP can help



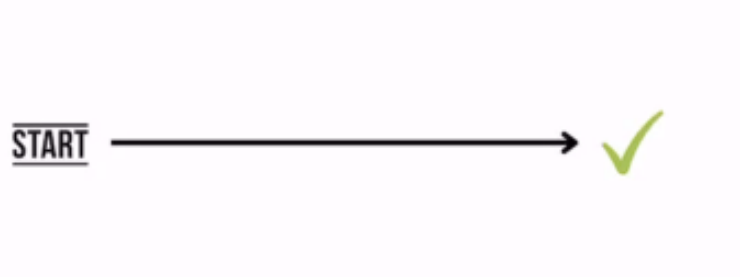
Source: IRENA

Why DPP is needed

Without DPP project



With DPP project



State aid: Why control it?

Art. 107(1) TFEU: notion of aid and general prohibition of State aid

"… any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, insofar as it affects trade between Member States, be incompatible with the internal market".

Reasons for State aid control, amongst others:

- Avoid undue market distortions
- Internal market safeguard, level playing field
- Avoid subsidy races
- Avoid crowding out private investments

Source: Florence School of Regulation; DG COMP

Basic Principles of Compatibility

General goal: positive effects of aid should outweigh negative effects

Aid is compatible under Article 107(3)(c) TFEU if **two conditions** are met:

- **Positive**: the aid facilitates the development of an economic activity;
  - The aid must have an incentive effect
  - Contribution to EU policies can be taken into account (but no requirement)
  - The aid must comply with relevant EU laws
- **Negative**: the aid does not adversely affect the trading conditions to an extent contrary to the common interest
  - The Commission must balance the positive effects of the aid against its negative effects on the internal market

Source: Florence School of Regulation; DG COMP

CEEAG options for hydrogen

SECTORAL RULES	• Support limited to:
	  • Hydrogen produced in line with the RFNBO DAs under RED II.
	  • Low-carbon hydrogen (once defined) will enjoy equal treatment with RFNBOs
	  • Support for extra costs of CCS for blue hydrogen remains possible.

ELIGIBILITY	• Measures should in general be open to competing technologies that can contribute to the identified objective, and selected through competitive bidding processes, • More limited measures can be justified, including to meet EU targets or support technologies with long term potential. • Special route for projects emerging from the IPCEI process.
COMPETITION DISTORTIONS	• Aid mainly covering operating costs can only be used where this results in more environmentally-friendly operating decisions. • Projects may not support coal generation, and must not lock-in gas.

Source: Florence School of Regulation; DG COMP

Proposal: Clean Industrial Deal State Aid Framework

State of play

- Part of the Clean Industrial Deal, published 26 February 2025
- Aims to accelerate the roll-out of renewable energy, including production of renewable fuels
- Open to public consultation from 11 March 2025 to **25 April 2025**

Facilitates granting of State aid

- Allow separate **support schemes for specific technologies** such as wind and solar.
- Allow for a wider use of **simplified methods to set aid amounts** instead of complex individual assessments
- **Creates minimum shares of RFNBO hydrogen** in industrial decarbonisation measures
- Further **align funding criteria** for the Innovation Fund and national financing to accelerate State aid approval for Member States wanting to support projects with a STEP seal
- Enable support for investments in **clean tech manufacturing**, including electrolysers
- Stimulate demand for **clean tech equipment** by allowing the use of **accelerated tax depreciation** to incentivise its acquisition

Source: Florence School of Regulation; DG COMP

Case study: Production of PtX in DK

Key features

Budget: €170 million scheme (DKK 1.25 billion)

Allocation: Pay-as-bid competitive bidding

Eligibility: All firms planning to construct new electrolysers in DK and produce RFNBOs

Form of aid: Fixed premium for 10 years

Award criteria: Subsidy requested per unit of renewable hydrogen produced only

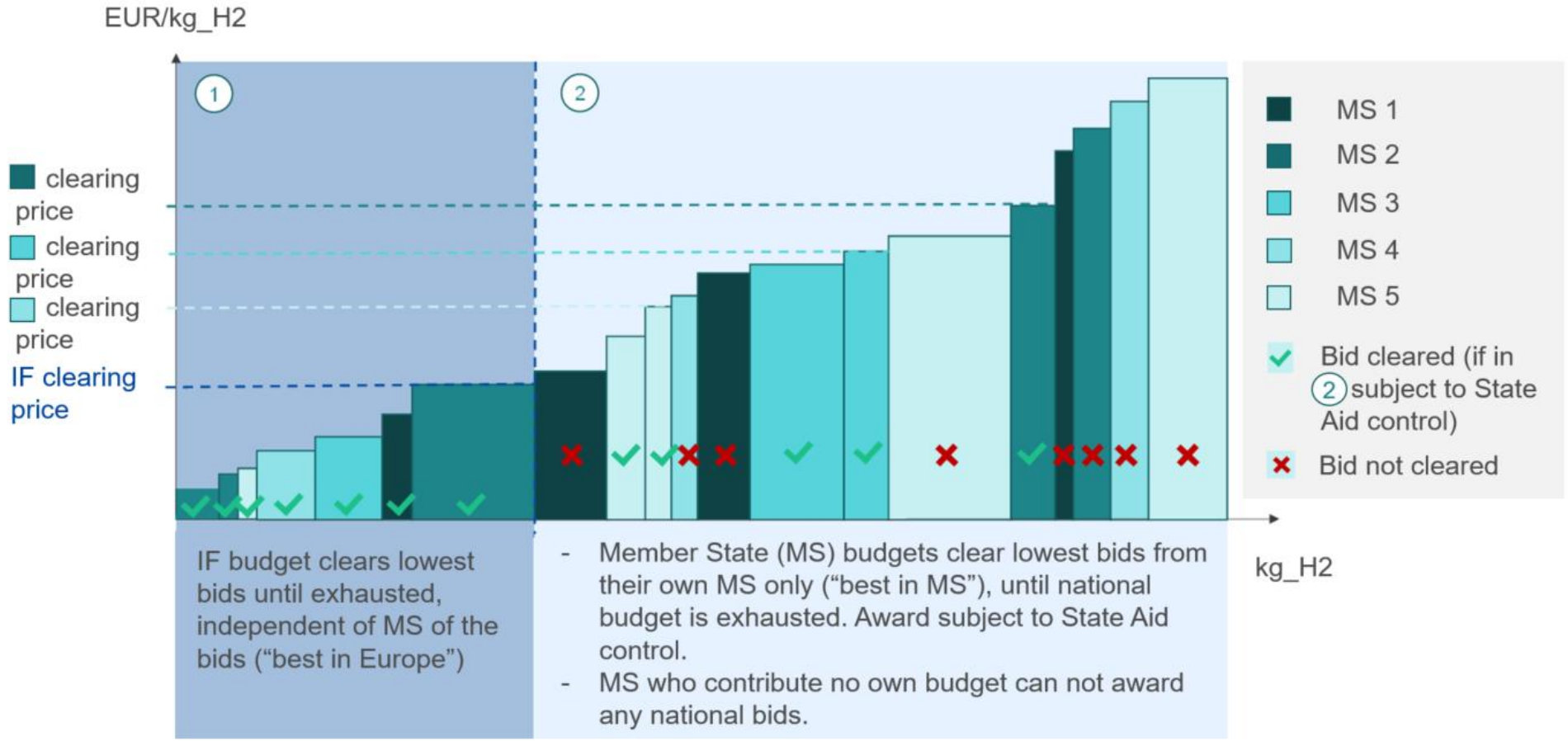
Cumulation: None

Auction results

Price	Company/project	Localisation	Total subsidy	Capacity of plant
0.157 EUR/KG	Plug Power Idomlund Denmark	Holstebro	107 673 447 DKK	100 MW
0.676 EUR/KG	European Energy/ Vindtestcenter Måde K/S	Esbjerg	43 994 973 DKK	9 MW
0.777 EUR/KG	European Energy/ Padborg PtX ApS	Padborg	910 800 000 DKK	150 MW
1.014 EUR/KG	Electrochaea/Biocat Roslev	Rybjerg	71 279 762 DKK	10 MW
1.132 EUR/KG	European Energy/ Kassø PtX Expansion ApS	Rødekro	81 879 549 DKK	10 MW
1.141 EUR/KG	HyproDenmark/Everfuel (Marginal bidder)	Fredericia	The rest of the budget	

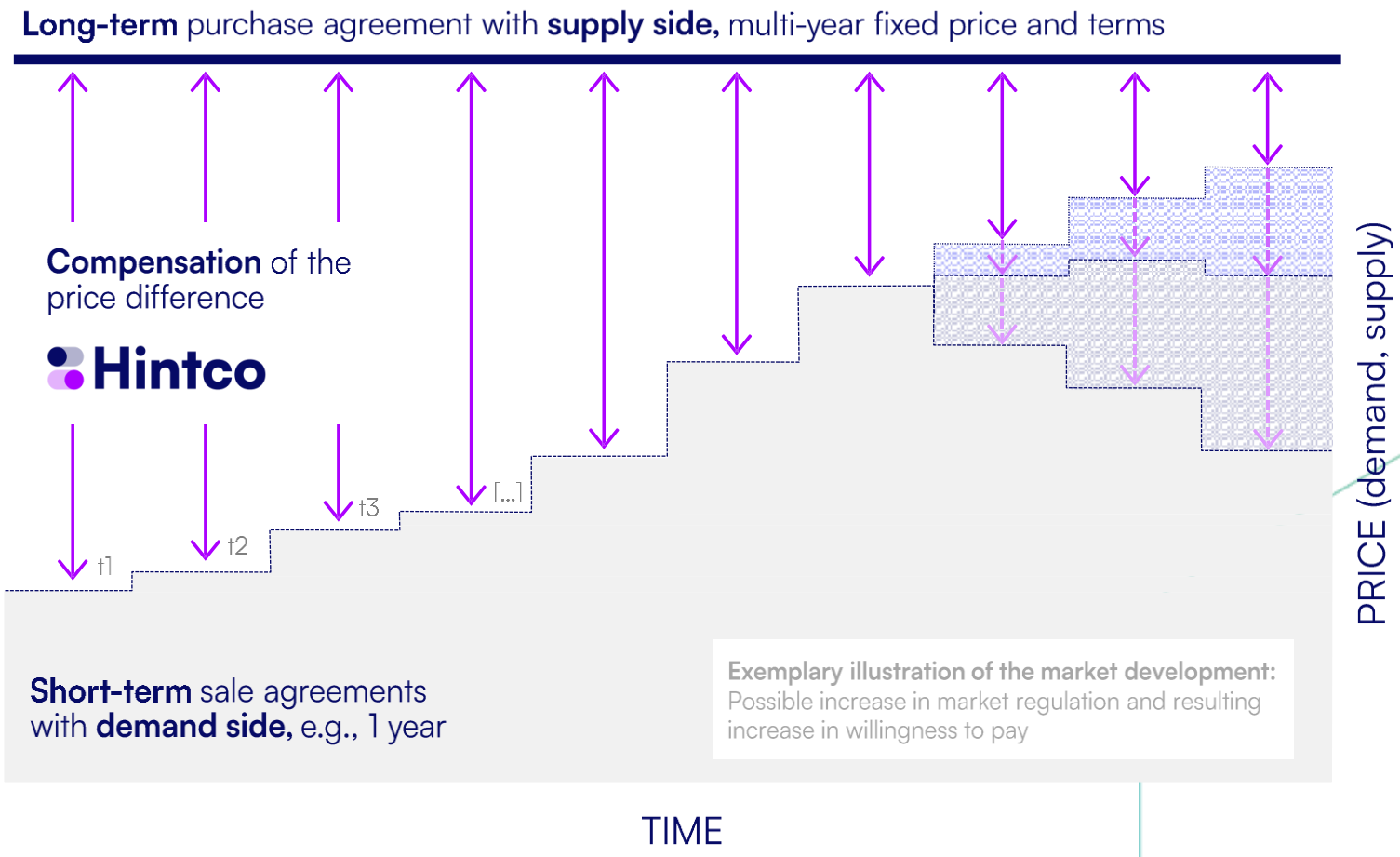
Source: Florence School of Regulation; DG COMP

Case study: Hydrogen Bank Auctions-as-a-Service



Source: Florence School of Regulation; DG COMP

Case study: H2Global



IPCEIs

Eligibility

- Research & Development and / or First industrial Deployment Projects going beyond global state of the art
- Infrastructure Projects of great importance for the EU

Requirements

- Important contribution to Union objective(s) and significant impact on competitiveness, innovation, sustainable growth, or value creation across the EU
- Positive spillover effects beyond the participating undertakings, sectors and Member States, need to demonstrate wider relevance and application to the European economy or society
- Funding from several Member States and important co-funding by beneficiaries
- IPCEI must respect the principle of “Do no significant harm”
- Positive indicators (e.g. openness to all Member States, EC involvement, co-financing by EU funds, public tenders/calls)
- Necessity, proportionality, no undue distortions of competition, balancing test, transparency

Case study: IPCEI Hydrogen Technology (Hy2Tech)

15 countries participating

35 companies, including SMEs

41 research, development and first industrial deployment projects

Collaborations with **+300 indirect partners** across Europe

Up to **€5.4 billion** public funding, which will unlock **€8.8 billion** in private investments

Hydrogen Generation Technology	Fuel Cells Technology	Storage, Transportation and Distribution Technology	End User Technology
1s1 Energy*	1s1 Energy*	Arkema	Alstom FR
Advent*	Advent*	B&T Composites*	Alstom IT
Ansaldo	Alstom	Daimler Truck	Bosch AT
AVL	Ansaldo	Enel	Daimler Truck
Christof Industries	Arkema	Faurecia	Fincantieri
De Nora	Bosch DE	NAFTA	HYVIA
Elcogen*	Daimler Truck	Neste	Iveco CZ
Elogen	De Nora	Ørsted	Iveco ES
Enel	EKPO	Plastic Omnium FR	Iveco IT
Genvia	Elcogen*		Neste
H2B2*	Fincantieri		Ørsted
Cummins	Genvia		Plastic Omnium AT
John Cockerill	HYVIA		Plastic Omnium FR
John Cockerill	Iveco		
McPhy*	Nedstack*		
Nordex	Plastic Omnium AT		
Ørsted	Symbio		
Sener			
Stargate			

Source: Florence School of Regulation; DG COMP

Thank You

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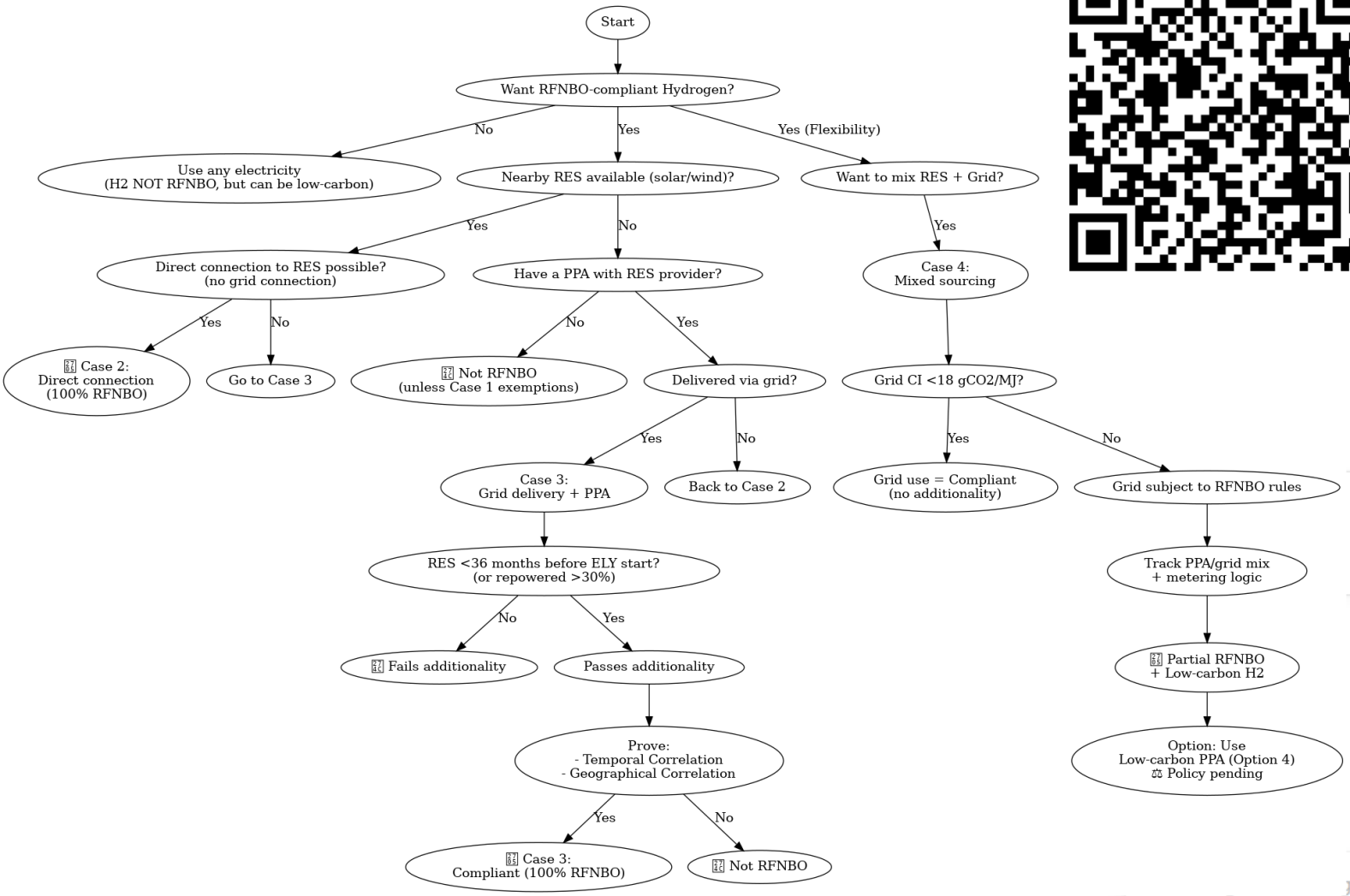
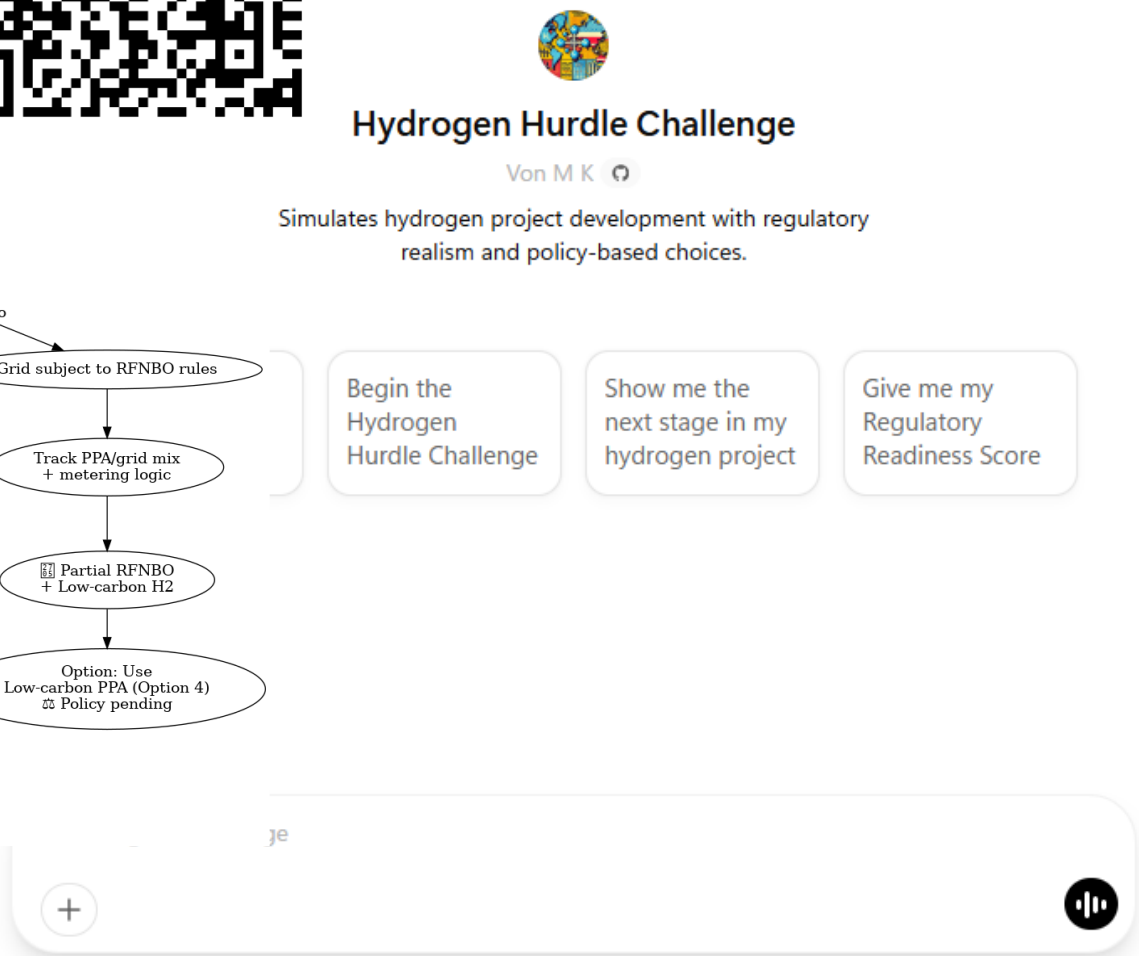
GPT Hydrogen Hurdle Challange





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