Welcome to the Workshop!

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In order to ensure a smooth meeting we would kindly ask you to respect the following "house-keeping" rules:

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4. For each session, we will poll two short questions via slido. Please open the slido details in the corner.

The meeting will start at 9:00.

European Commission

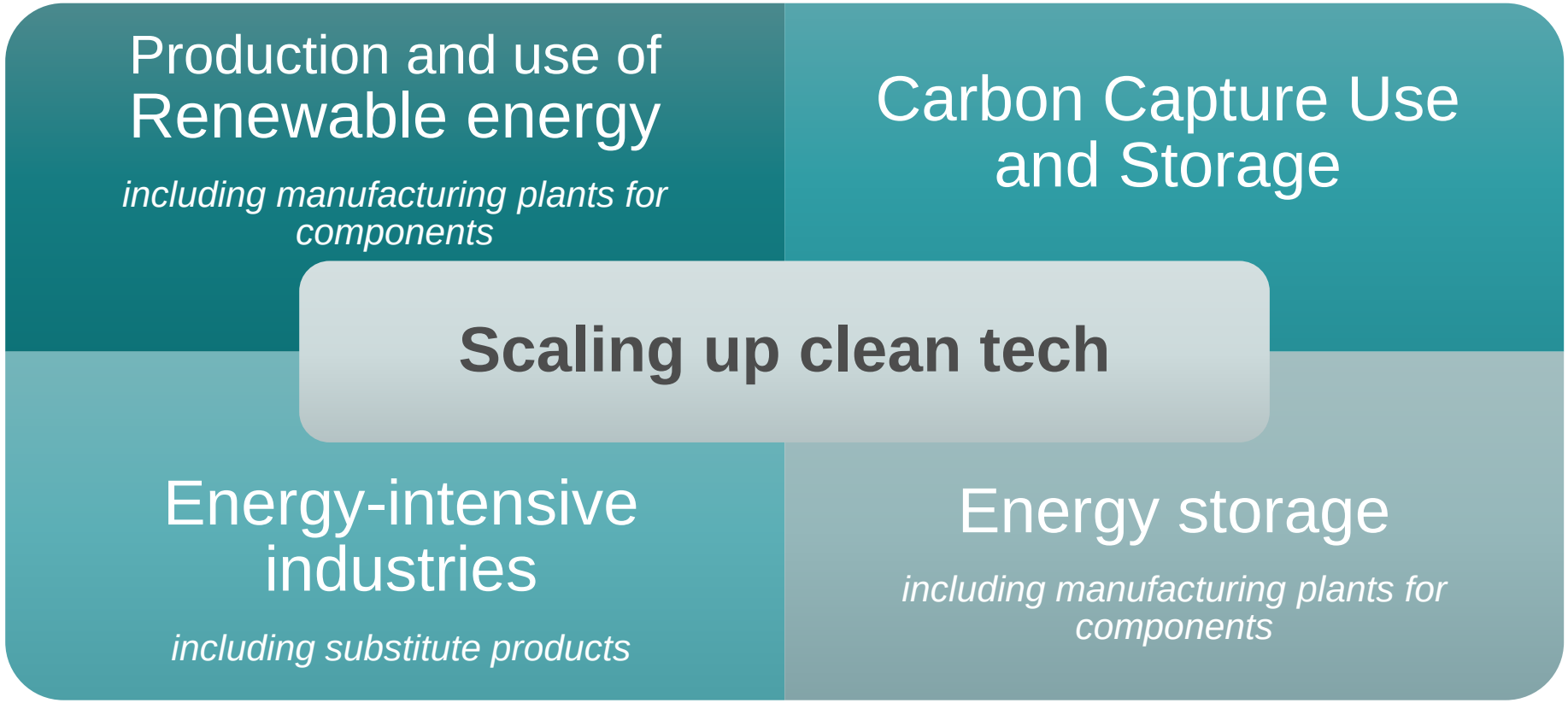
Designing competitive bidding mechanisms under the Innovation Fund

Stakeholder consultation 21 November 2022

Ewelina Daniel and Johanna Schiele, Innovation Fund team, DG CLIMA

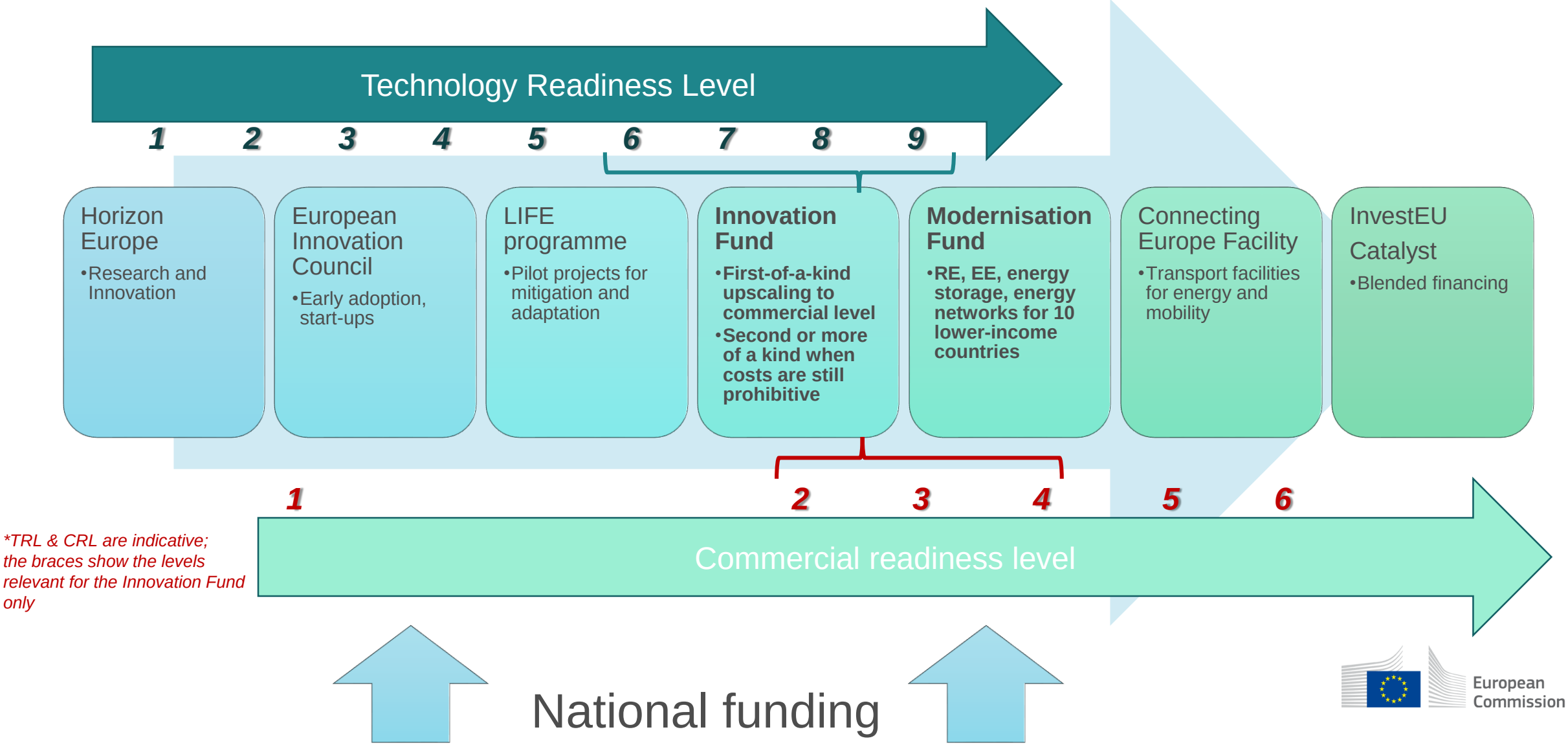
Contents

1. Introduction: Innovation Fund sectors



For complete information see Innovation Fund website

1. Introduction: Innovation Fund and other funding programmes



*TRL & CRL are indicative; the braces show the levels relevant for the Innovation Fund only

European Commission

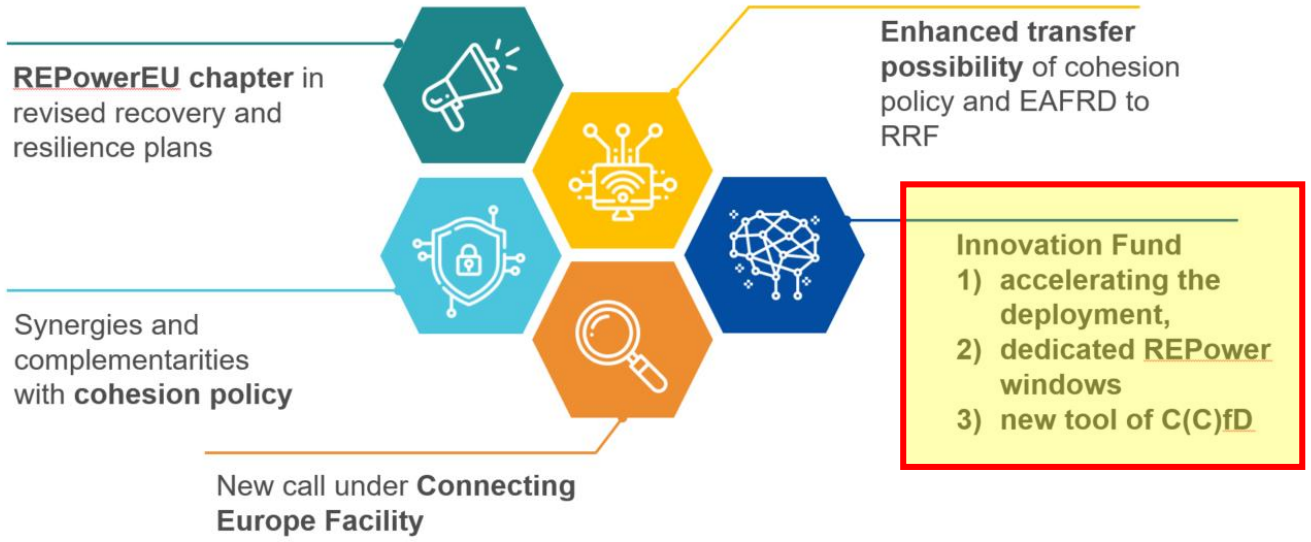
2. Legal Basis

- Introduction of a Competitive Bidding Mechanism (CBM) as a new tool for the IF was proposed under proposal for **ETS Directive revision ("Fit for 55")**
- First analysis of the operation in the IA, focus on CCfD
- "Competitive bidding mechanism" could cover "up to 100% of relevant cost"
- CBM is **largely supported by co-legislators**
- Once ETS revision is adopted, the Innovation Fund **Delegated Regulation has to be revised** to operationalise CBM
  - CBM will still provide "grants" but with new features compared to the current programme
  - New processes will have to be established:
    - prequalification
    - auction clearing
    - provisioning, deposits, reflows
  - Many processes will be similar (knowledge sharing, monitoring)

3. RePowerEU and choice of first pilot auctions

REPowerEU Plan:

To support hydrogen uptake and electrification in industrial sectors, the Commission will roll out carbon contracts for difference and dedicated REPowerEU windows under the Innovation Fund to support a full switch of the existing hydrogen production in industrial processes from ***natural gas to renewables*** *and the transition to* ***hydrogen-based production*** *processes in new industrial sectors, such as steel production*



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4. Support contract and study by DG CLIMA

Technologies

- Which technologies could be sensibly called through an auction?
- Technology-neutral or -specific?
- Which technology baskets?

Auction Design

- Evaluation of different auction *types* and *features*
- From long-list of options to 2 fully fleshed out auction designs
- Auction procedure, clearing mechanism, winner remuneration etc.

Contract Design

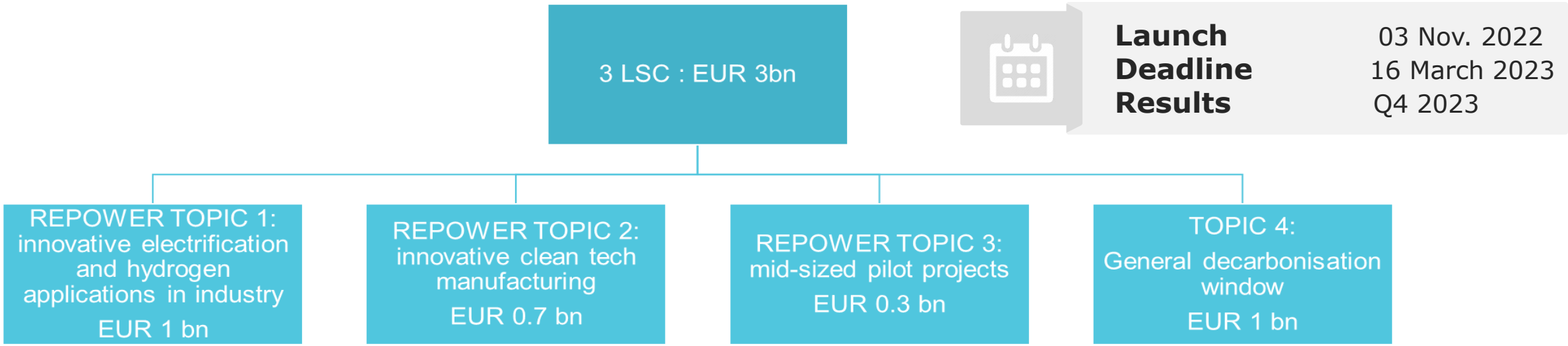
- Getting from an economic auction design to legally fixing those features in the IF Delegated Acts and contracts between the auction winners and the EC

Governance & Implementation

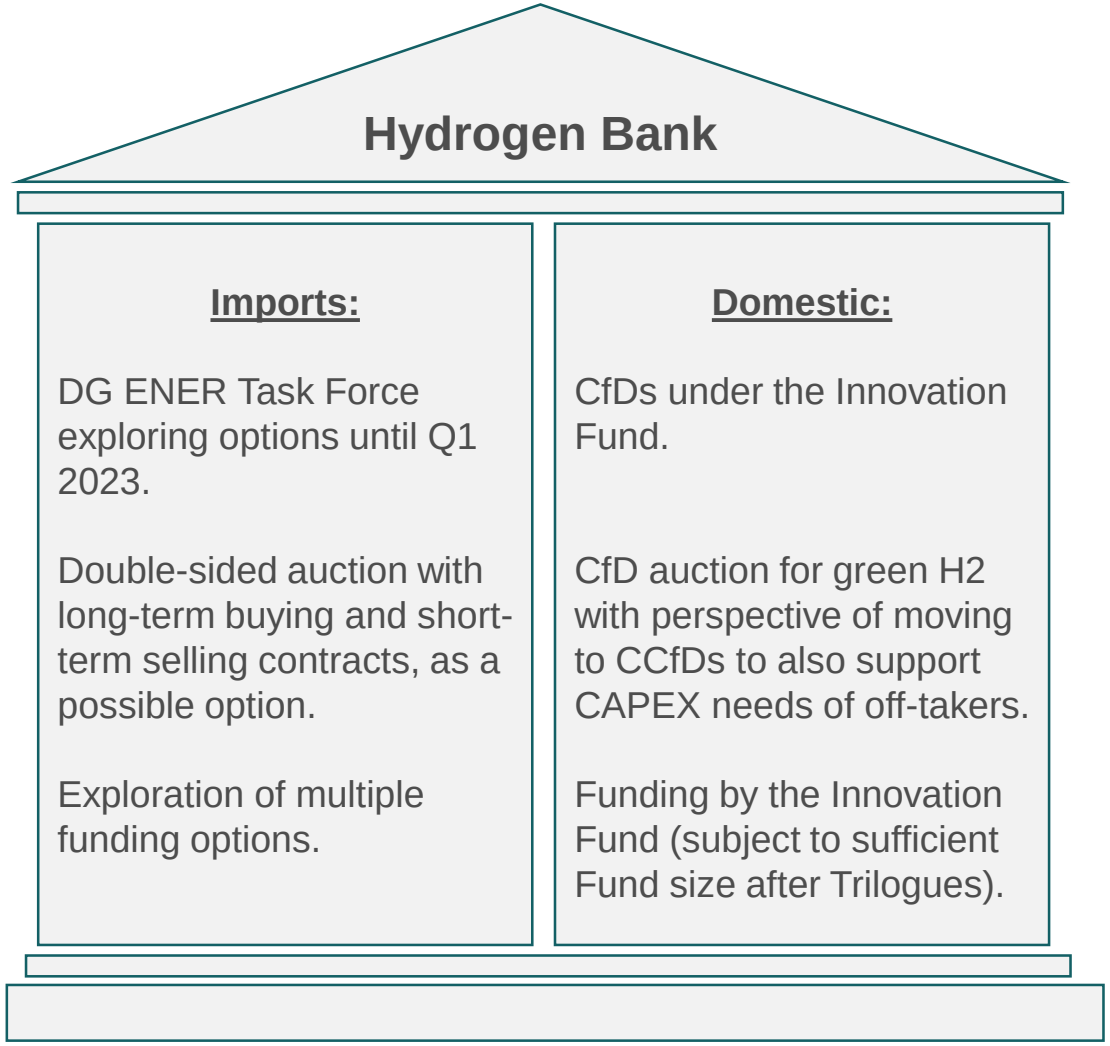
- From auction and contract design to implementation
- Governance, procuring auction clearing software, staff planning…
- Budget and risk forecasting tools

5. Links with the 3rd LSC

- The 2022 3rd Large Scale Call (“LSC”) under the IF ***is not*** the Hydrogen Bank
- Budget made available for **3LSC: 3bn** + 20% flexibility reserve
- Info days will be held on 30 November [link to Info Days registration]



6. Links with the European Hydrogen Bank



- CfDs for Hydrogen production under the Innovation Fund at this point the most likely implementation option for the domestic leg of the H2 Bank.
- Creating a domestic market and price discovery has other requirements than securing diversified imports of H2 (derivatives) from abroad.

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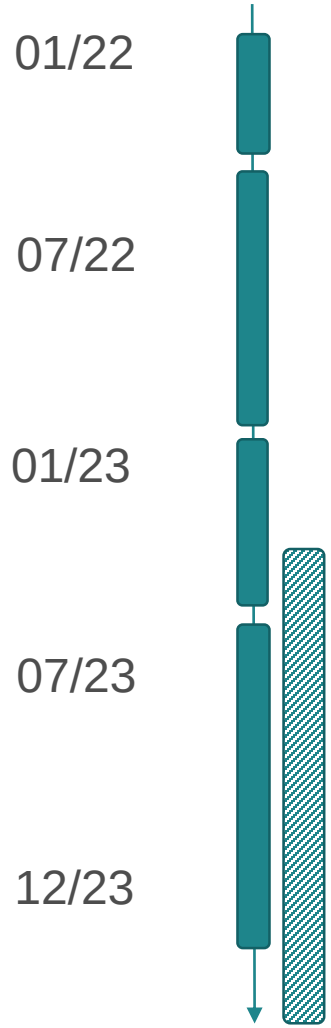
7. Implementation timeline and dependencies



March 22: Tender of Support Contract

July – December 22: Auction Design & Budget/Auction Modelling

- July-September: EC internal Task on budget and legal, resulting in CfD legal text for *ETS Trilogues*
- Q4 2022: Stakeholder workshops -> feedback into final auction design

Q1&Q2 2023: Legal drafting of Terms and Conditions, *IF Delegated Act Revision*

Q2/Q3 2023: Draft Terms and Conditions out for Public Consultation

2023: Implementation preparation at CINEA, procurement of auction clearing IT

First Pilot Auction (*subject of entry into force of ETS Directive and IF DA*)

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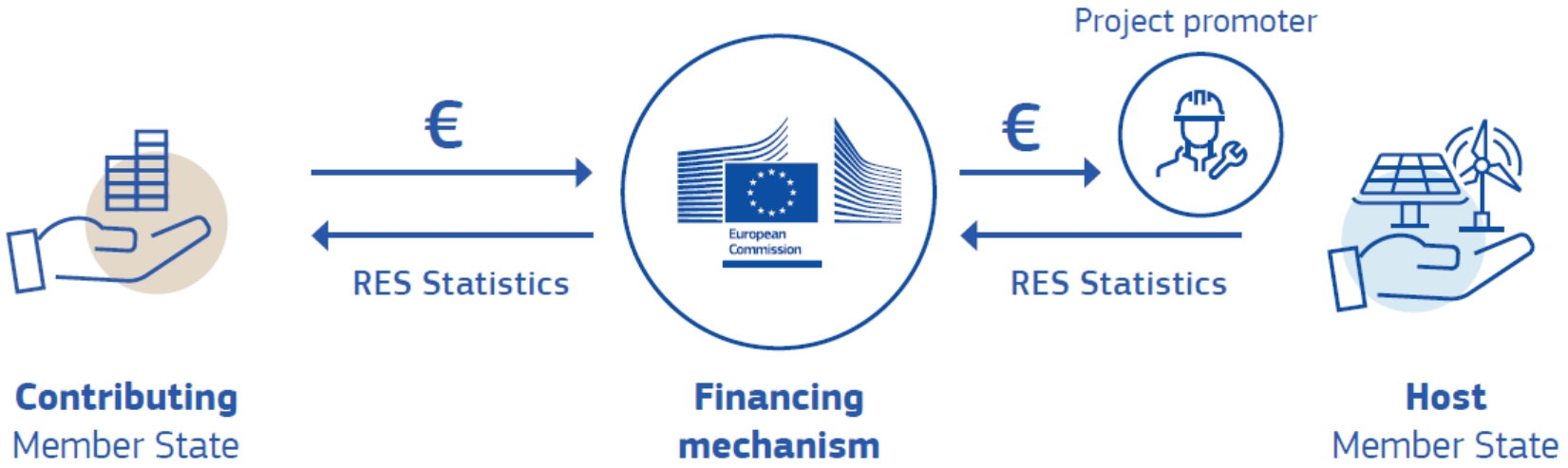
Back-up

BACK-UP Precedent of RES financial mechanism

Functioning of the mechanism



- Mechanism developed by DG ENER
- Established by the Governance Regulation from 2018
- Delegated Regulation adopted in 2020

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BACK-UP: Supporting service/study contract

Objectives:

- **(in Part 1)** to assist in the **economic assessment** and of different competitive bidding mechanisms and mechanism design features, to be implemented under the IF.
  - Assessment the design features options
  - Preparation of DR revision, budget planning
  - Organisation workshop with Member States and stakeholders
- **(in Part 2)** to assist in **setting up a selected competitive bidding mechanism** by developing full legal terms and conditions for a pilot tender and in defining other aspects of governance and practical implementation.
  - preparation of the first auction(s),
  - preparation of legal Terms & Conditions for the calls,

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ICF

BBH BECKER BÜTTNER HELD

Competitive Bidding under the Innovation Fund

Stakeholder Consultation

Brussels, 21/11/2022

Content

1) Competitive bidding mechanisms under the IF: design possibilities and options currently considered
   - Overarching Issues
   - Auction design configurations
   - Dedicated hydrogen auctions
   - Emission reduction auctions
   - Electricity auctions
2) Potential design of a hydrogen supply -side auction for a Contract - for - Difference (CfD)
   - Remuneration form
   - Reference price
   - Indexation
3) Potential implementation of a demand -side hydrogen auction for a Carbon Contract -for -Difference (CCfD)
   - Choice of sectors
   - Indexation
   - Criteria beyond price

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Session 1

Competitive bidding mechanisms under the IF: Design possibilities and options currently considered

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Content

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There will be Competitive Bidding under the Innovation Fund, complementary to existing grants programs

Objectives for using a Competitive Bidding mechanism

1. Accelerate the deployment of innovative low-carbon technologies, next auction rounds will focus on hydrogen
2. Ensure efficiency of distributing support and price-discovery for new technologies
3. Complement the existing distribution mechanism of grants using a multi-criteria selection procedure
4. Practical experiences from the renewables sector have shown considerable cost reductions

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What needs to be considered when supporting hydrogen based on Competitive Bidding at EU level?

1. Supply-side versus demand-side support
2. Infrastructure
3. Level playing field and cumulation

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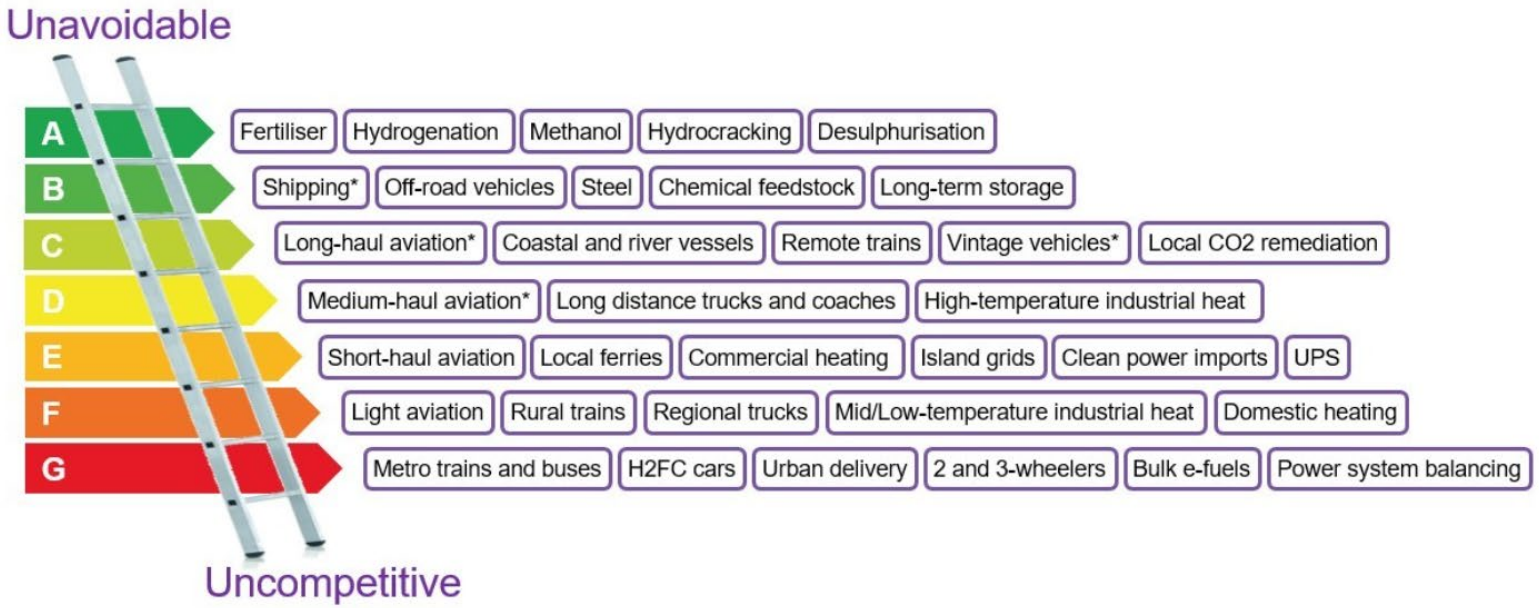
1. Hydrogen should be prioritised for hard-to-abate sectors

- Hydrogen is scarce and expensive at least in the short to medium term
- It should therefore be used in sectors where other climate -neutral options are not available
- EU hydrogen strategy foresees use of hydrogen primarily in industry and transport sector



** Via ammonia or e-fuel rather than H2 gas or liquid*

Source: Liebreich Associates (concept credit: Adrian Hiel/Energy Cities)

The Clean Hydrogen Ladder, Version 4.0 Source: Liebreich Associates (concept credit: Adrien Hiel/Energy Cities)

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1. Supply and demand side support schemes need to ensure efficient hydrogen usage

Supply	Demand
• Sales can be restricted to desired sectors • Higher level of competition • Smaller projects and broader geographical spread • Hydrogen is produced within the EU	• Demand sectors can be targeted directly • Necessary investments on the demand side can be included in the support (e.g. DRI) • Fewer projects and sites and potentially lower competition • Hydrogen can also be imported

Differences of the support systems become more pronounced once hydrogen transport infrastucture is available!

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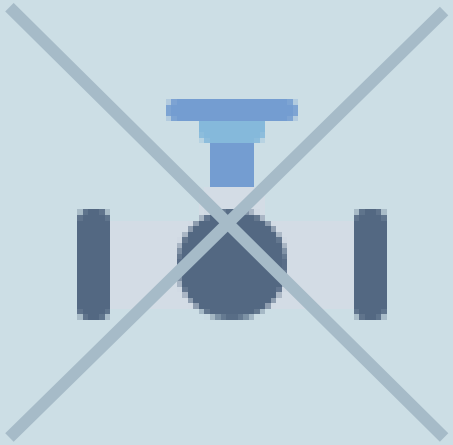
2. Infrastructure availability determines project types



Short to medium term:

Available transport infrastructure for hydrogen is very limited

- Pilot auctions are expected to favour co-located projects in industry clusters

Medium to long term:

Infrastructure availability increases and hydrogen transport costs decrease

- A liquid hydrogen market can develop
- Demand and supply projects can be geographically distant

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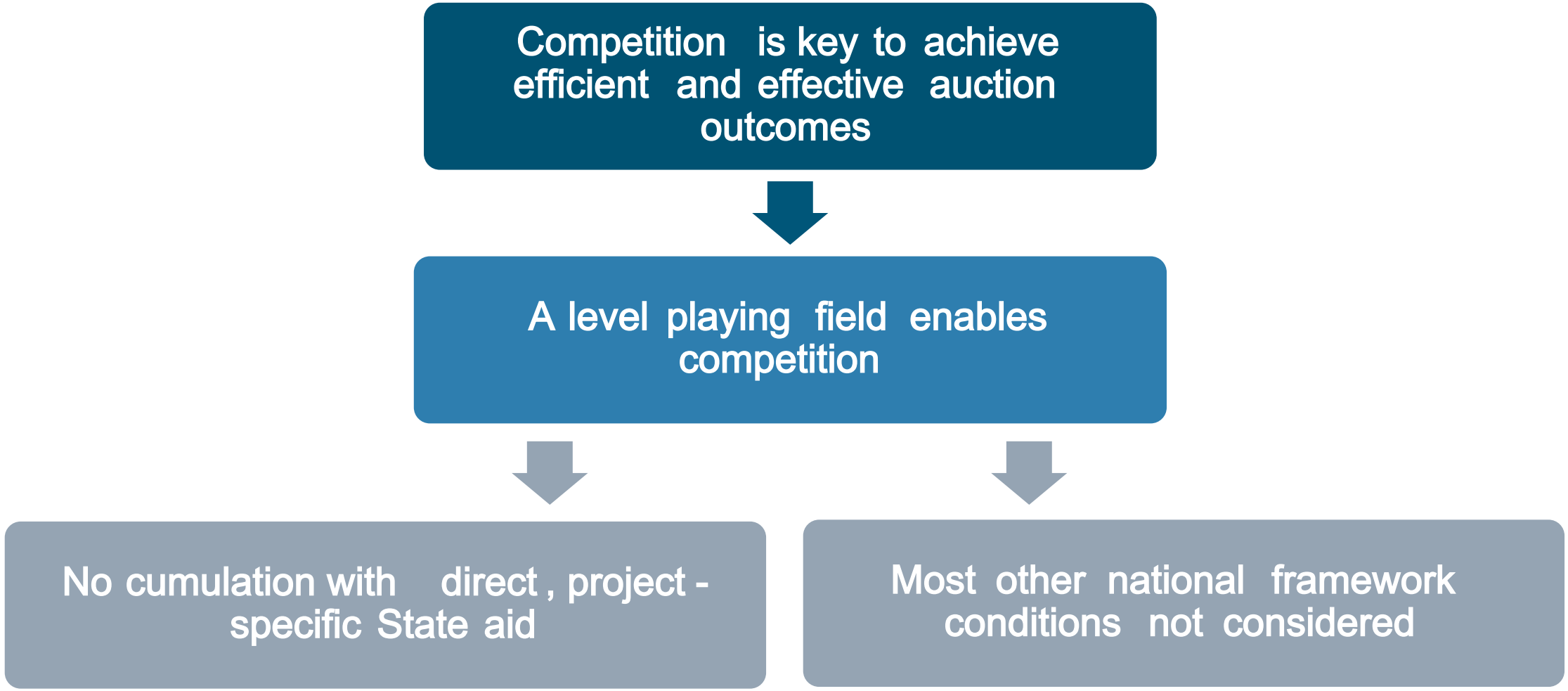
Pipeline icon by Icons8:

https://icons8.com/icon/upUyd29lcuhw/pipeline

3. A level playing field enables competition



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Content

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There are many options for implementing competitive bidding for hydrogen

H_2 Dedicated hydrogen auctions

1.Hydrogen **supply** side auction (fixed premium or CfD)

2.Hydrogen **demand** side auction (fixed premium or CfD)

3.Joint hydrogen demand and supply auction for **industry clusters** (fixed premium or CfD)

4.Double -sided auction for hydrogen **supply and demand**

CO_2 Emission reduction auctions

5.Demand -side auction using Carbon Contracts for Difference

6.Supply -side auction using Carbon Contracts for Difference

Electricity input auctions

7.Supply-side auction for **electricity using a CfD**

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Auction design involves various specific design elements

- Many design elements need to be defined when designing an auction
  - **General auction design elements** , e.g. auctioned good, remuneration form, indexation etc.
  - **Auction procedure** , e.g. pricing rules, static vs. dynamic auction etc.
  - **Qualification requirements** („eligibility criteria"), e.g. necessary licenses, technical restrictions etc.
  - **Legal obligations** , deadlines and penalties, e.g. realization period
  - **Auction framework conditions** , e.g. scheduling, implementing agency

- Discussion today focuses only on possible **high level auction configurations** (this session) and goes more in detail on some specific design elements for **two preferred options**
- Objective is to keep most elements as simple as possible since these are **pilot auctions**
- **At a later stage we will focus on legal conditions** (liabilities and other issues) there will be another opportunity to bring in your opinions on legal design elements
- We are happy to receive recommendations already now

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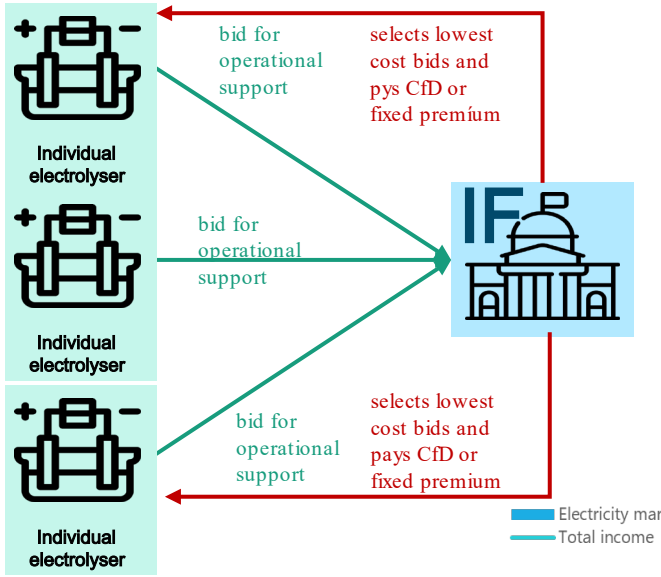
1. Hydrogen Supply Side Auction (Fixed Premium or CfD) (I)

Mechanism and objectives

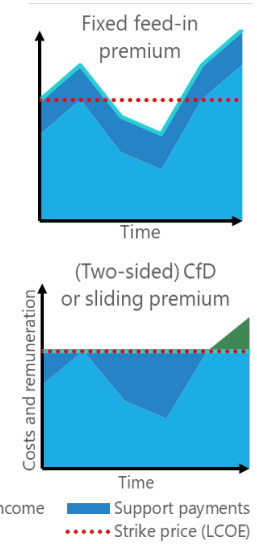
Mechanism

- Supply-side auction addresses **green hydrogen producers** , receiving (upon award) operational support for each unit of hydrogen produced (as fixed premium or CfD).
- Producers are responsible for **negotiating** offtake contracts & procuring electricity for hydrogen production.
- Producers that require the lowest amount of support to fulfil a supply contract are selected in the **auction** .
- Different support schemes are feasible:
  - Support may be in the form of a **fixed premium** on top of hydrogen offtake prices.
  - Alternatively, support scheme may cover price risks, either regarding the **offtake price (CfD)** (or adequate reference market price is required), and/or
  - the price of the electricity (**indexation of strike price**)

Auction Model



Support Forms



Objectives

- ✓ **Close the gap** between the production of renewable hydrogen and the willingness to pay of demand sectors
- ✓ **Scale up electrolyser capacities** & increase the competitiveness of green hydrogen production

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1. Hydrogen Supply Side Auction (Fixed Premium or CfD) (II)

Advantages and disadvantages

Advantages

- Clear **focus on hydrogen capacity ramp -up** and in line with electrolyser capacity targets in the EU hydrogen strategy and domestic production target in the RePowerEU plan.
- Relatively **simple to implement**, in particular if compared to a demand -side carbon -contract -for difference (CCfD), as the instrument addresses very similar technologies.
- Potentially **higher competition level** compared to demand -side auction.
- Electrolysers can in principle be built in **all EU MS** .

Disadvantages

- Non -existing market for renewable hydrogen implies risk for investor: **how to establish a reference price** (in case of CfDs)
- Possibly **inefficient allocation to demand side sectors** (e.g. use of hydrogen in applications for which direct electrification is an option); but this can be addressed by steering demand towards eligible sectors (e.g. with prequalification criteria)
- **Specific approach for hydrogen**, widening to other sectors requires adaptation / is challenging.

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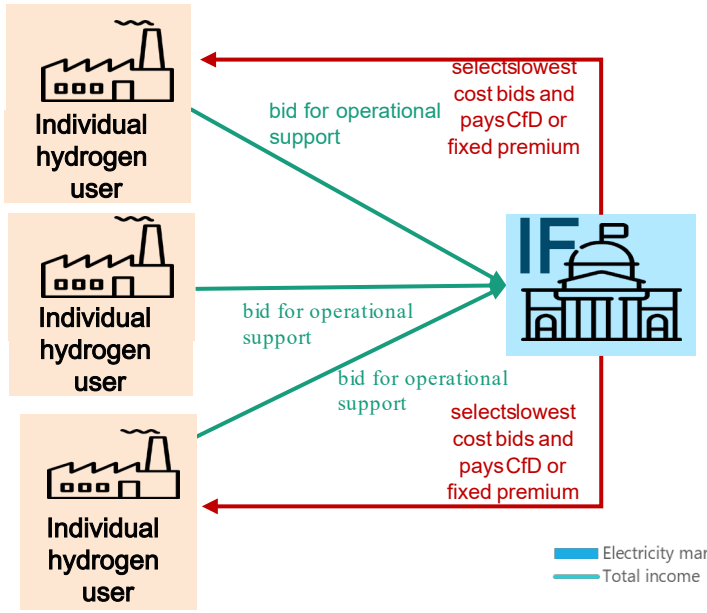
2. Hydrogen Demand Side Auction (Fixed Premium or CfD) (I)

Mechanism and objectives

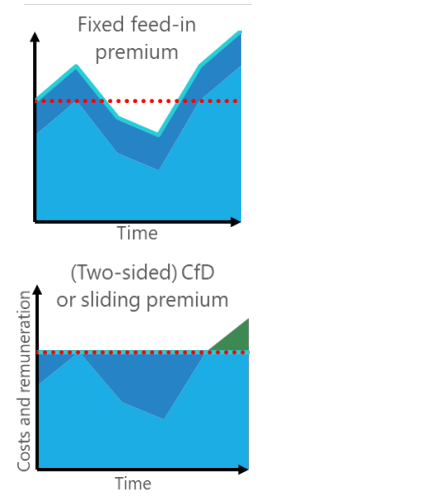
Mechanism

- Demand-side auctions determine the support level required to **bridge the cost gap** between using renewable hydrogen and fossil-based alternatives (either CfDs or fixed premiums)
- Based on **offtake agreement with supplier(s)**, (industry) offtaker determine their bid based on:
  - the cost of renewable hydrogen
  - the cost of incorporating renewable hydrogen into production processes
  - hydrogen infrastructure/transport costs
  - prices of current energy carriers
- Key consideration for a demand side CfD approach will be developing an **adequate reference market value** (e.g., hydrogen price or proxy thereof)

Auction Model



Support Forms



Objectives

- ✓ **Cover the cost gap** between the use of green hydrogen compared to fossil-based alternatives, thus ensuring green hydrogen is used by industrial sectors to decarbonize
- ✓ Incentivize building out hydrogen **production capacities**

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2. Hydrogen Demand Side Auction (Fixed Premium or CfD) (II)

Advantages and disadvantages

Advantages

- Targets sectors where renewable green hydrogen will be needed and is most probably the lowest cost option for emission reduction, thus can **incentivize cost efficient allocation of low -carbon** , hydrogen -based technologies in relevant industry sectors.
- Relatively **straightforward / easy implementation** (at least when implemented as fixed premiums)
- Provides **incentives for expanding electrolysis capacities**

Disadvantages

- **Limited risk reduction potential with CfD** approach given lack of liquid hydrogen market (i.e., bilateral offtake agreements with relatively stable prices can be assumed)
- Relatively **low level of competition** in auctions may arise (e.g., few industry actors), which could lead to lower support cost efficiency compared to e.g. supply -side auctions.
- **Hydrogen price as reference price** instead of the carbon price implies a lower incentive for emission reductions compared to ETS price.

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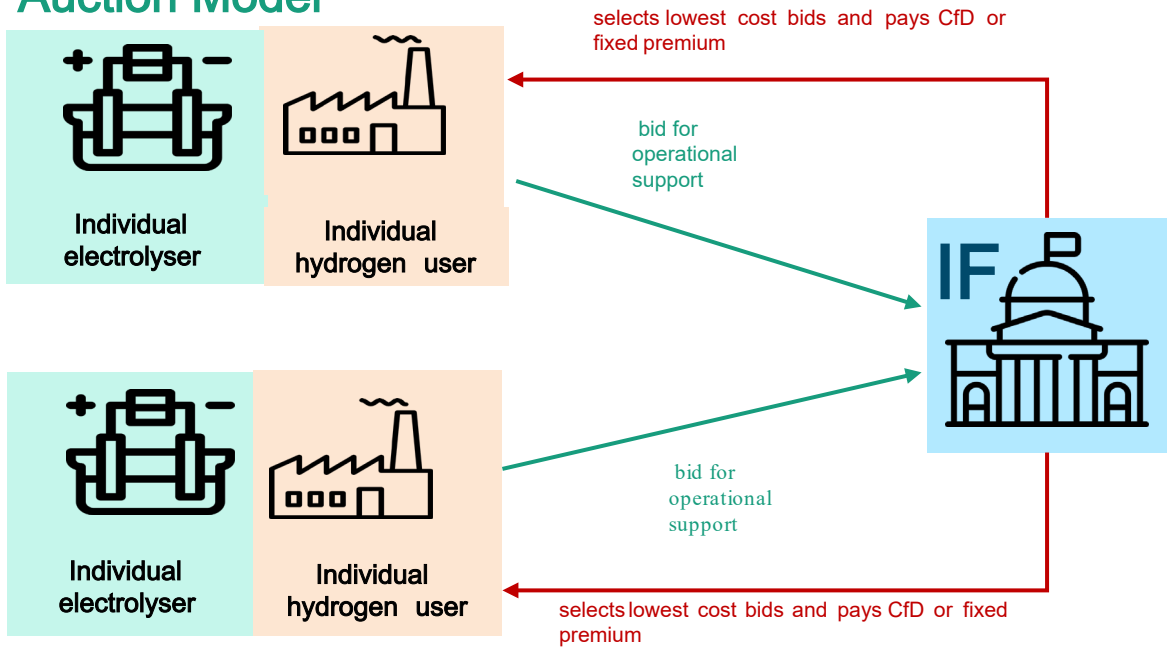
3. Joint hydrogen demand and supply auction for industry clusters (I)

Mechanism and objectives

Mechanism

- Here, the electrolyser and offtaker, such as a steel plant (together: industry cluster) **bid together**.
- In the current absence of transport infrastructure, this option would likely lead to **similar results as the supply-side or demand-side auction:**
  - bilateral offtake agreements between offtaker and electrolyser in proximity is required in both cases in advance of the auction
  - transport costs not included in the bid, thus industry clusters have cost advantages

Auction Model



Objective

✓ Could serve as a **pilot option** to address lack of transport infrastructure (similar to IPCEI, but with auction-based project selection)

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3. Joint hydrogen demand and supply auction for industry clusters (II)

Advantages and disadvantages

Advantages

- Potential **pilot option** to address lack of transport infrastructure
- Makes explicit that **industry clusters (co -location of electrolyser and offtaker)** are expected to be successful initially, even in supply -side or demand -side auctions that do not explicitly limit participation to such clusters.
- May bring **stronger commitment from offtakers** that would be part of the support contract

Disadvantages

Once infrastructure is available, this option entails major problems:

- **Low competition levels** given that projects will have to occur where hydrogen production and offtake are in a proximity
- Option **neglects optimization potential** from a system's perspective
- **Geographical distribution** of awarded projects / clusters depends on location of industrial sites

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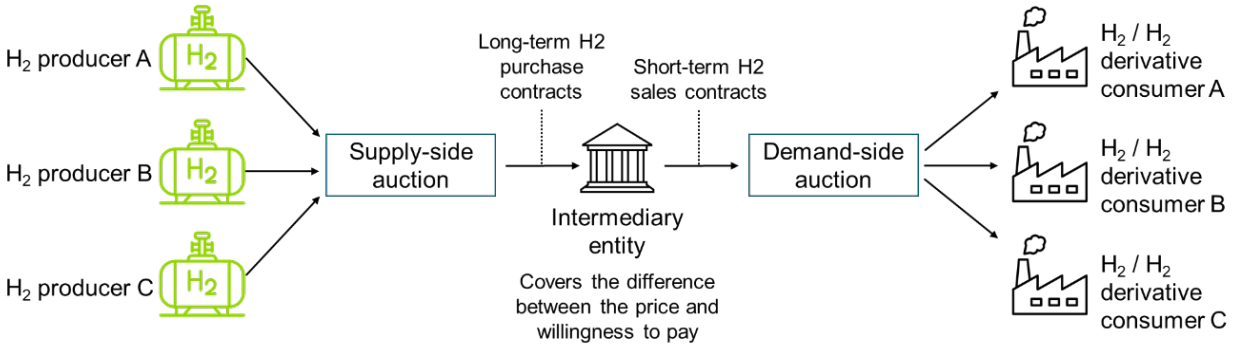
4. Double-sided auction for hydrogen supply and demand (I)

Mechanism and objectives

Mechanism

- Mechanism to **buy** hydrogen or its derivatives from producers and **sell** it to end users via (double-sided) auction mechanism
- **Price gap:** Difference of lowest RE H_2 offtake prices and the highest willingness to pay for RE H_2, which is covered by IF subsidy.
- Publicly installed **intermediary**
  - **covers price gap** via subsidy
  - **purchases** H2 or H2-based derivative volumes via long-term contracts (e.g., 10 years) in a supply-side auction
  - **re-sells** H2 or H2-based derivative volumes via short-term contracts in a demand-side auction
- Potential to function as a platform for **matchmaking** between demand and supply-side

Auction Model



Source: Guidehouse

Objectives

- ✓ Security for **renewable H_2 / derivative producers** to invest in new electrolyser capacity
- ✓ Enable eligible **offtakers** to procure renewable H2 for their decarbonisation efforts, e.g., to switch industrial production processes to renewable H2.

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4. Double-sided auction for hydrogen supply and demand (II)

Advantages and disadvantages

Advantages

- Simultaneously **incentivises electrolyser ramp -up** and **investments in green hydrogen applications** (reducing supply & offtake risk and closing funding gap)
- **Competitive price -discovery** for hydrogen and hydrogen -based derivatives demand and supply in the absence of a liquid hydrogen market (support cost efficiency)
- Allows for **matchmaking** between supply and demand, supporting the development of the green hydrogen market and new supply routes for green derivatives.
- Instrument is flexible to **adapt to shrinking price gap** between the offtakers' willingness to pay and production cost over time

Disadvantages

- **High risks and liabilities** for the intermediary due to the role of hydrogen trader
- High **implementation complexity** & administrative effort
- **High funding requirements**, at least initially, to reach sufficient scale due to coverage of price risks for demand and supply and large funding gaps.
- Double -sided auctions are **relevant primarily for H2 derivatives** that can be transported more easily over longer distances without pipeline infrastructure.
- Challenge to **reconcile diverging priorities** between creating efficient results through aggregation of volumes and ensuring national priorities are met

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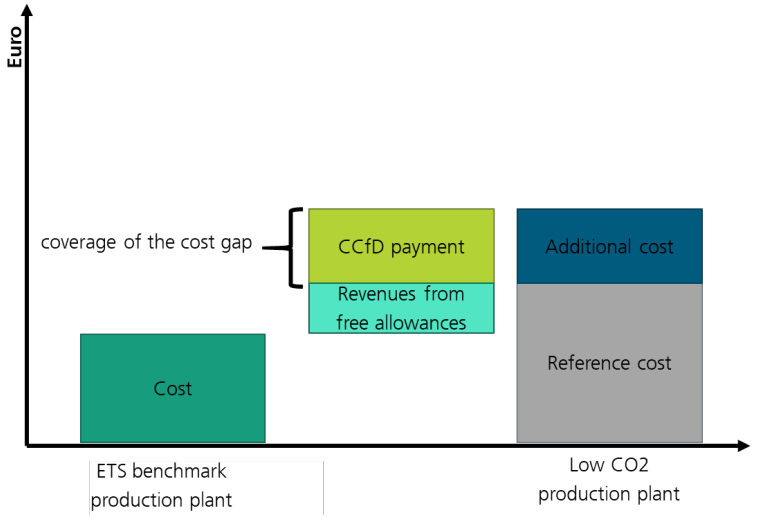
5. Demand Side auction using Carbon Contracts for Difference (CCfD) (I)

Mechanism and objectives

Mechanism

- CCfDscompensate the difference between mitigation costs of a CO_2-efficient breakthrough technology & the effective CO_2 price.
- **Users of low -carbon hydrogen technologies** are supported in their efforts to diminish carbon emissions.
  - The CO_2 mitigation costs (€/t CO_2) of the low carbon technology are set as the **strike price** .
  - The **CCfD premium** is the difference between the strike price and the effective CO_2 price.
  - The **CCfD payment** (€) results from multiplication of the CCfD premium with the verified CO_2 reduction
- The strike price can be **dynamized / indexed** to shield investors against additional market risks over time (e.g., H2 offtake price)

Illustration of CCfD Payment



Objectives

- Supports **hydrogen uptake in industry sectors** that require low-carbon hydrogen (e.g. steel)
- Incentivizes emissions reductions in industrial sector
- Beyond hydrogen uptake, industries could also use CCfDs to **finance other investments** necessary to decarbonize.

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5. Demand Side auction using Carbon Contracts for Difference (CCfD) (II)

Advantages and disadvantages

Advantages

- **Targets sectors (i.e., industry)** where renewable hydrogen is needed for certain decarbonization applications and is most probably the lowest cost option for emission reduction
- **Investments in industry applications / equipment** to use hydrogen (e.g., DRI steek) can be covered by the IF support, if CAPEX is not excluded.
- **Extending to other sectors relatively simple** (even though providing a level playing field given different CO2 abatement costs and project cost structures is still challenging)

Disadvantages

- **Less targeted to support ramp -up of hydrogen** , if participation is not restricted to applications that require (green) hydrogen as a feedstock (e.g., if cement projects can participate).
- **CO2 price is not the main source of uncertainty** for many industrial decarbonisation options including hydrogen.
  - Hence, covering the difference between the ETS and the required carbon price might not take away sufficient risks, e.g., due to volatility in the (electricity or gas) market.
  - However, additional risk hedging instruments (e.g., indexation) involve higher complexity.

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6. Supply Side auction using Carbon Contracts for Difference (CCfD)

Mechanism, objectives & advantages and disadvantages

Mechanism

- **Support hydrogen production based on CCfD support :** Levels the difference between the CO_2 abatement cost for a specific hydrogen supply facility and the carbon price.
- This requires the definition of a **calculation method for carbon abated per unit of hydrogen** (e.g., based on ETS benchmarks)

Objectives

- ✓ Maximize emission reduction from supported hydrogen

Advantages and disadvantages

Advantages	Disadvantages
Direct link to emissions reductions and to the emissions trading system (EU-ETS)	Theoretically feasible, but complex compared to supply-side hydrogen auction, e.g. requires a calculation methodology to define the emissions reductions from renewable hydrogen production
	Hedges against CO2 price fluctuations while the CO2 price risk is not the main risk faced by hydrogen producers. Additional risk hedging can be introduced but increases complexity.

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7. Supply-side auction for electricity using a CfD

Mechanism, objectives & advantages and disadvantages

Mechanism

- The hydrogen producer receives a **CfD payment for each unit of electricity purchased** (main input cost)
- **Reference price** : Support payments are adjusted to fluctuating electricity costs based on e.g., an EU-wide pre-defined index
- Hydrogen producers that require the lowest strike price are selected in the **auction** .

Advantages and disadvantages

Advantages	Disadvantages
Implementation based on existing liquid electricity market prices	With EU reference price, differences between national electricity price developments would not be addressed MS specific reference prices very difficult to implement
Accounts for electricity price risk, which is the main input cost factors for renewable hydrogen production	PPAs are existing solution for electricity price hedging. New tool potentially reduces demand for fixed price PPAs.
	Substantial budget uncertainty since support is adjusted to power prices

Objectives

- ✓ Reduce electricity price risks for hydrogen producers as the main input cost for renewable hydrogen production
- ✓ Increases investment certainty for green hydrogen production by stabilizing operating costs

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Design configurations selected for further elaboration

1 Hydrogen Supply Side Auction (Fixed Premium / CfD)

Objective: Scale-up of hydrogen market

- **Directly targets the ramp-up of renewable hydrogen technologies** in-line with EU hydrogen strategy and REPowerEU plan
- Enables a **more level playing field** for different types of electrolysers across different geographies
- **Higher level of competition** and high cost efficiency compared to demand-side auctions
- Leave the **negotiations of offtake contracts** to the private sector (not the case in double-sided auctions)
- **Less administratively complex** mechanism to implement compared to CCfD auctions
- More **flexible adapt** to evolving transport infrastructure compared to hydrogen auction for clusters

2 Demand-side auction using CCfD

Objective: Investment security for low carbon investments

- Directly **contributes to decarbonizing** hard-to-abate sectors
- Likely incentivizes **lowest cost option** for emissions reductions
- **Widening to other sectors** is relatively simple
- **Can be focused on ramp-up of renewable hydrogen** if participation is restricted to those sectors / application using hydrogen
- Enables bidders to factor **in low-carbon investment expenditures** into the bid (e.g. DRI steel)
- In general, **relatively complex to implement**, e.g. compared to supply-side auctions

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Do you have clarifying questions at this point?

Slido poll

Participant statements and open discussion

Questions for discussion

- In your opinion, what type of auction is most needed in the next years: A supply-side instrument, a demand-side instrument or a combination of both?
- What pipeline of projects do you expect for hydrogen production and offtake?
- What type of projects would you expect to bid in IF pilot auctions for hydrogen production (2023-25): only co-located projects or also geographically distant ones?
- In your opinion, which national factors (taxation, State Aid, investment environment…) will most influence bids? Which of those should be accounted for explicitly because they threaten a level playing field?
- Which differences present natural competitive advantage and are welcome from a system-efficiency perspective?

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Session 2

Potential design of a hydrogen supply-side auction for a Contract- for- Difference (CfD)

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Recap: What does the CfD/fixed premium demand side auction do?

Addressed sector: Supply of hydrogen / electrolyser

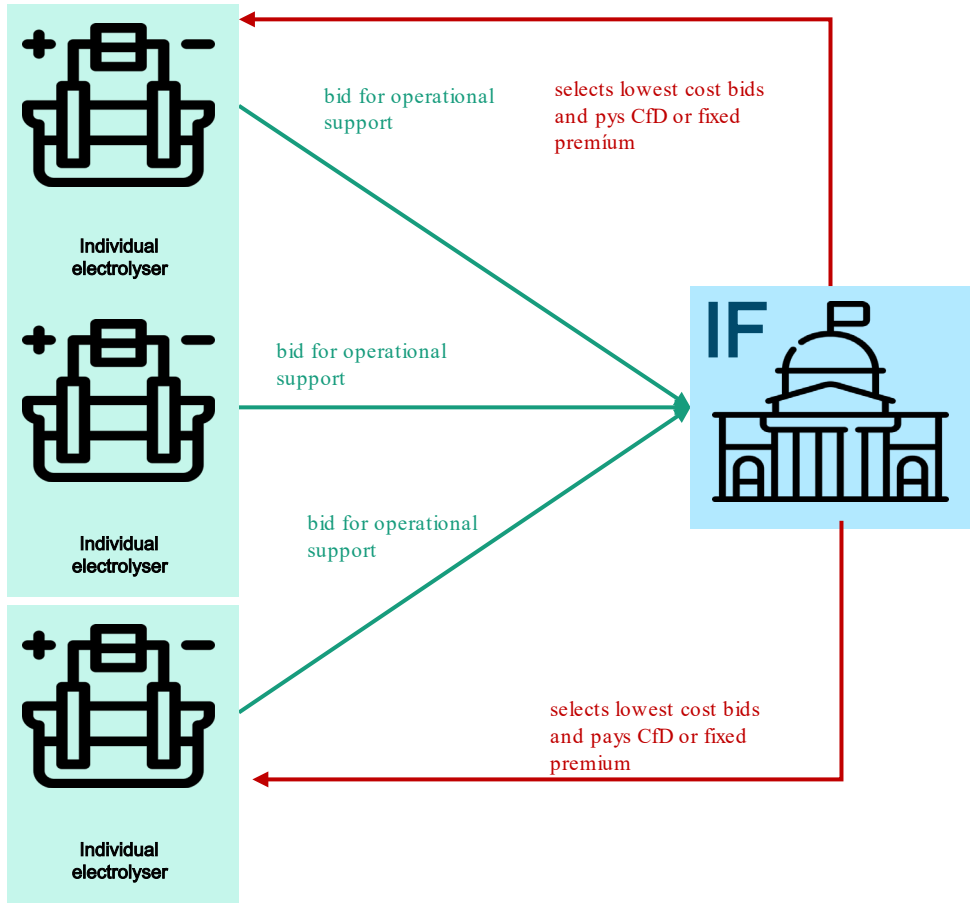
Reference market: Hydrogen

How does it work?

- Electrolyser with offtake -contracts for hydrogen bid for operational support to cover the difference between the market‘s willingness - to -pay and actual production costs
- Suppliers that require the *lowest* amount of support per unit of hydrogen produced are selected in the auction

Remuneration options

- Fixed premium
- Sliding premium / CfD to cover offtake price risks



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Risks of hydrogen producers can be addressed through remuneration form and indexation

- Financial support addresses:
  - covering a competitiveness gap
  - reducing price risks for investors
- Basic principles of risk allocation

Focus design elements for discussion

1. Remuneration form
2. Determinination of reference price
3. Options for indexation

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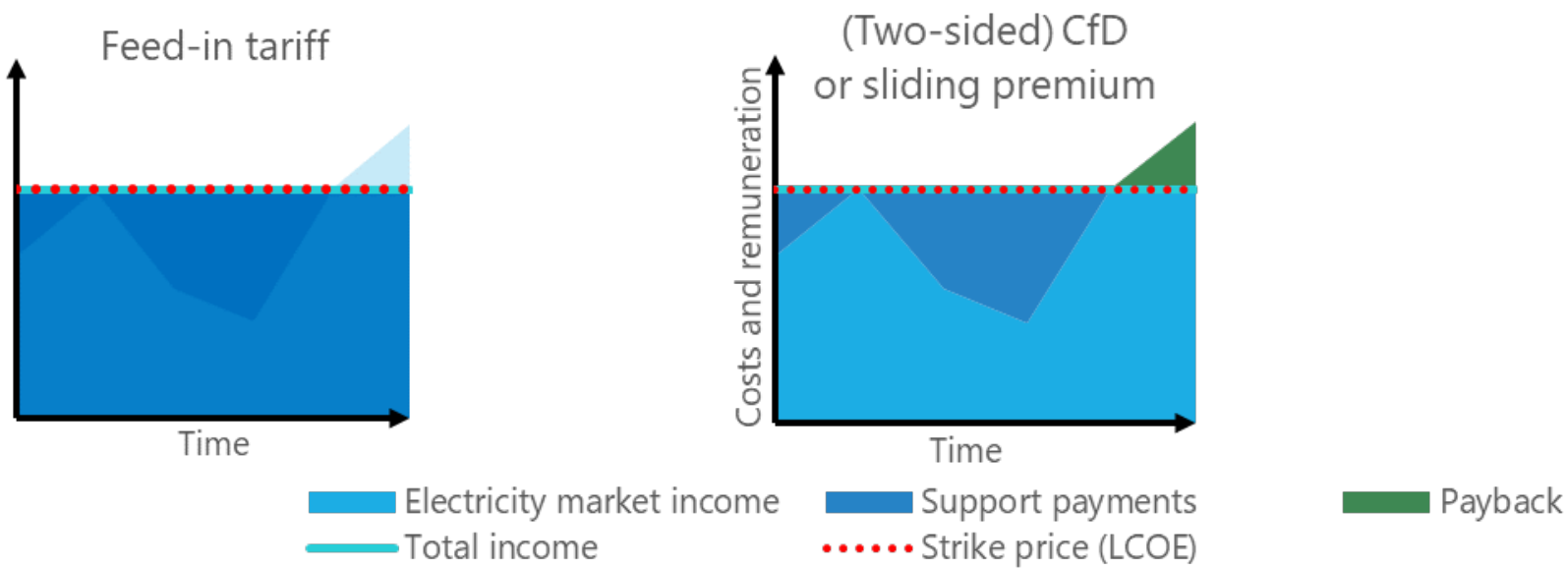
The form of remuneration impacts the distribution of risks

Experiences from renewable electricity



- Hydrogen producers receive full estimated costs
- Producers are not responsible for selling and marketing the product
- Low risk for producers, low incentive for market participation

- Sliding premium depending on the reference price
- Part of the price risk taken by producer
- Payback possible in case of two - sided premium

- Constant premium, independent of reference price
- High incentive for market participants to hedge price risks

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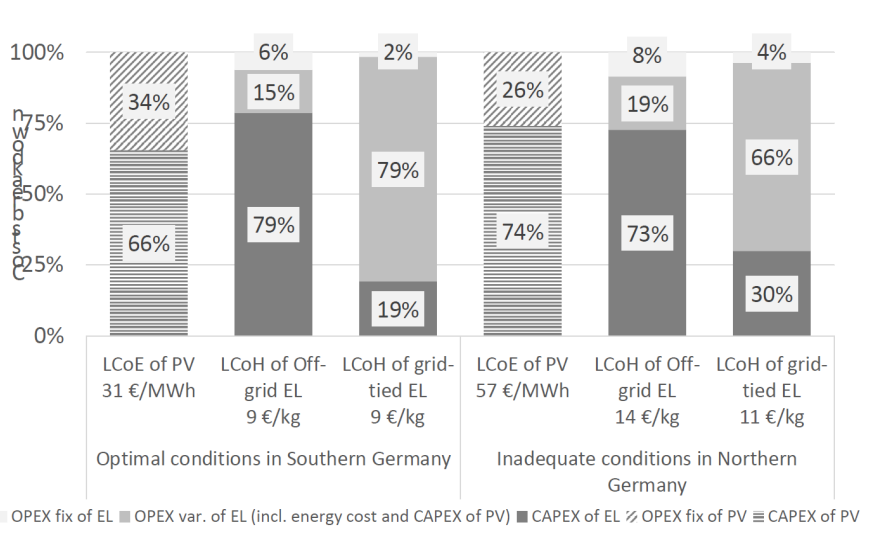
Green hydrogen production is different from renewable electricity (1), making direct comparison with power CfDs difficult

Exemplary cost structure of green hydrogen and renewables



Source: Zheng et al. 2022

- RES-E costs mainly investment-driven and well-known in the beginning
- Green hydrogen costs dominated by costs for purchasing renewable electricity
- Electricity costs may fluctuate and change over time
- Costs of green hydrogen may vary and are not known in the beginning

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Green hydrogen production is different from renewable electricity (2)

Hydrogen

- For hydrogen, no liquid market exists at the moment
  - Grey hydrogen produced in integrated projects or sold bilaterally OTC
  - Green hydrogen production still restricted to pilot plants
- Unknown price setting mechanism and behavior involve uncertainty about future hydrogen price
  - Pricesetting technology grey/blue hydrogen: correlation to natural gas prices
  - Pricesetting technology green hydrogen: correlation to electricity prices
- Absence of transport infrastructure
- Additional risk factor input factor costs
- Low economic maturity

Renewable electricity

- Availability of liquid and transparent markets
- Well-known price setting mechanisms
- Grid infrastructure available
- Constant / well -known LCoE
- Closed to competitiveness

- Challenge of defining adequate reference price limits risk reduction of sliding premium / CfD
- Price risks exist for input and output
- Payback is less relevant

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CfDs or fixed premiums can be used in a supply side scheme

Sliding premium /CfD versus fixed premium for hydrogen

Options	CfD, two -sided	Fixed premium
Description	Includes a payback if market prices higher than strike price	Fixed premium on top of the market price
Advantages	• Risk reduction for investors, but only in case of liquid hydrogen market	• Stable support requirements • Good fit with integrated projects • Incentive for long term hydrogen sales contracts
Drawbacks	• Limited risk reduction for investors due to non-liquid hydrogen market • Uncertainty regarding support requirements • Risk of inadequate support payments (too high or too low) • Uncertainty regarding support requirements	• No risk reduction for investors • Risk of inadequate support payments (too high or too low)

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Various reference prices could be used in a supply side auction for hydrogen

Real Prices	Grey hydrogen price based on current OTC trades
	Natural gas price
Synthetic reference prices	Based on natural gas price considering the efficiency of blue/grey hydrogen production
	Available commercial (synthetic) price: HYDEX
Individual off -taker price	Offtaker agreement required and needs to be disclosed. May change over time.

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Reference prices can be based on real prices

Options	Grey hydrogen price	Natural gas price
Advantages	• Real current hydrogen price • Potentially stepwise integration of green hydrogen prices	• Reflects price developments of main competing energy carrier for green hydrogen in many applications.
Drawbacks	• Only few trades and thus not representative for the real market developments	• Does not reflect the hydrogen market price. • Green hydrogen is not included.

Price risk of hydrogen production depends on the contractual arrangements (e.g. fixed or indexed)

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Reference prices can be based on synthetic prices

Options	Hydrogen price based on natural gas prices	Available commercial index (HYDEX)
Advantages	• Revenue fluctuations are covered (if linked to the price of grey hydrogen) • Existing experience with this approach through Dutch SDE++	• Might be perceived as more neutral • Potential transformation to a real price index once a liquid market exists
Drawbacks	• Cost fluctuations not covered (depending on correlation between natural gas and electricity prices) • Limited risk reduction	• Lower transparency of calculation method of synthetic index • Limited risk reduction

Price risk of hydrogen production depends on the contractual arrangements (e.g. fixed or indexed)

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Reference prices can be based on the project-specific offtake price

Options	Individual off -taker price
Advantages	• Incentivises the use of PPAs for hydrogen producers • Enables risk reduction for hydrogen offtake price • Variable premium minimises risk of overcompensation
Drawbacks	• Possibilities for strategic bidding, especially for integrated project • Limited transparency on offtake price formation • Limited relation to market H_2 price once this becomes available

Price risk of hydrogen production depends on the contractual arrangements (e.g. fixed or indexed)

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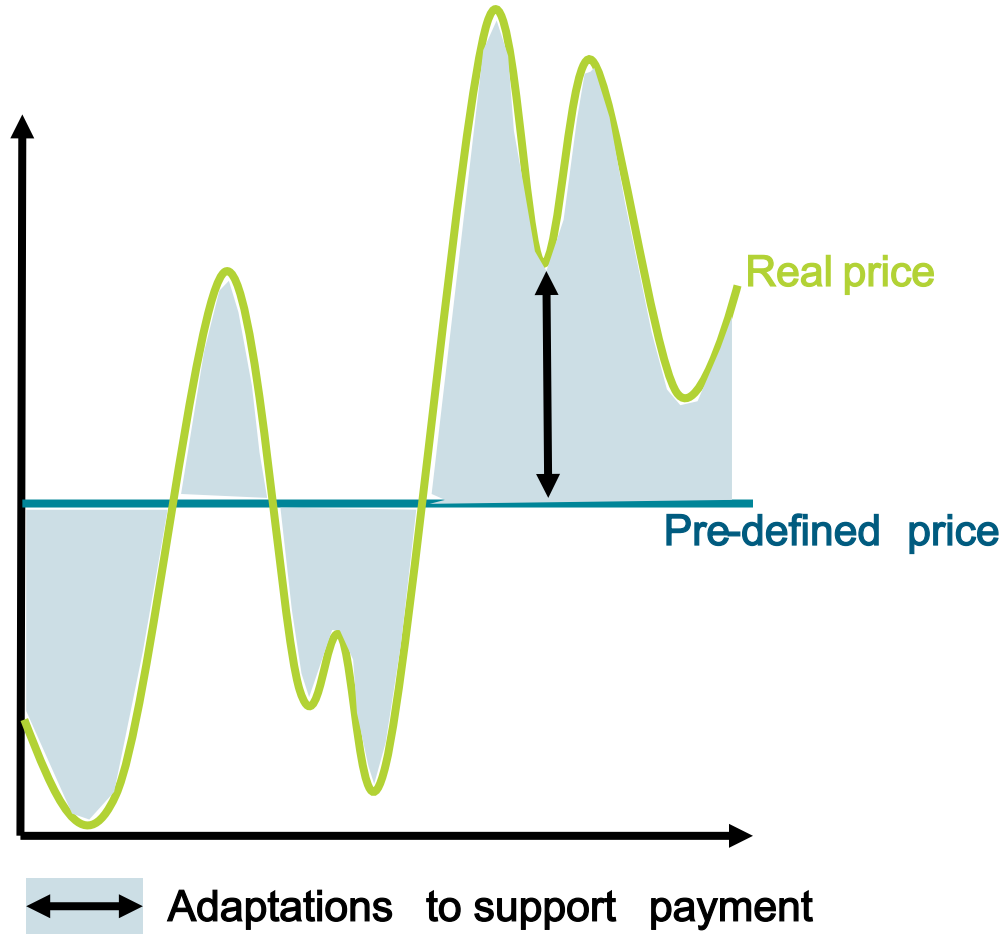
Electricity price risks can be addressed by indexation

1. Auctioneer sets fixed (artificial, e.g. futures-based) price level for each indexed input parameter
2. Bidder optimizes bid in the auction based on predefined prices and own expectations
3. Contract price resulting from the auction is adapted based on real price developments in the respective market for the indexed parameter



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Should electricity price risks be addressed through indexation?

Advantages

- Limits risks of H2 producers (and thus off-takers)
- Does not level out different starting points in electricity prices between Member States, thus it maintains competition of overall investment framework

Disadvantages

- The more electricity price risks are removed, the bigger the uncertainty around overall support cost (budget implications)
- Limiting risks fully would reserve larger budget, hence less projects supported
- Setting the right price level will be challenging (thus capturing the correct changes in electricity prices)

Whether indexing for electricity prices is needed depends on the ability of hydrogen producers to manage electricity price risks e.g. by entering into long term fixed price PPAcontracts.

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Do you have any clarifying questions at this point?

Slido poll

Participant statements and open discussion

Questions for discussion

- As a project developer, do you already hedge yourself against electricity price risks?
- As a hydrogen project developer, in what ways will you likely secure electricity supply? (PPAs, integrated RES generation or spot market)
- As a hydrogen project developer, do you fear that you won't be able to find off-takers, even for hydrogen that is "subsidised down" to the price of the fossil reference product?
- If the CfD would guarantee you a fixed off-take price (without additional indexation), would that de-risk the project sufficiently to secure commercial lending?
- As how mature do you perceive the hydrogen project pipeline? How fast could projects get from securing a CfD to reaching entry into operation?
- As a hydrogen project developer, who do you see as you most likely off-taker?

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Session 3

Potential implementation of a demand -side hydrogen auction for a Carbon Contract -for- Difference (CCfD)

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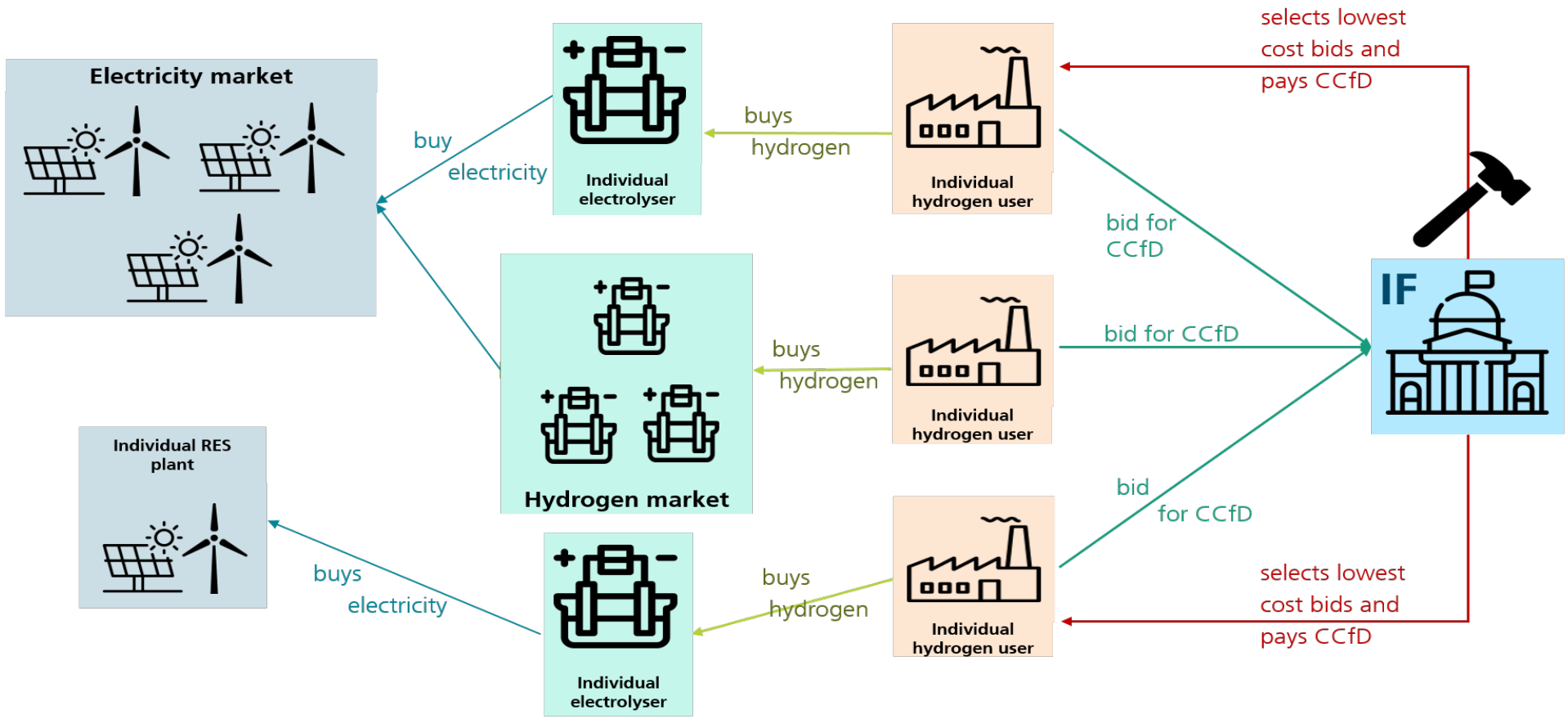
Recap: What does the CCfD demand side auction do?



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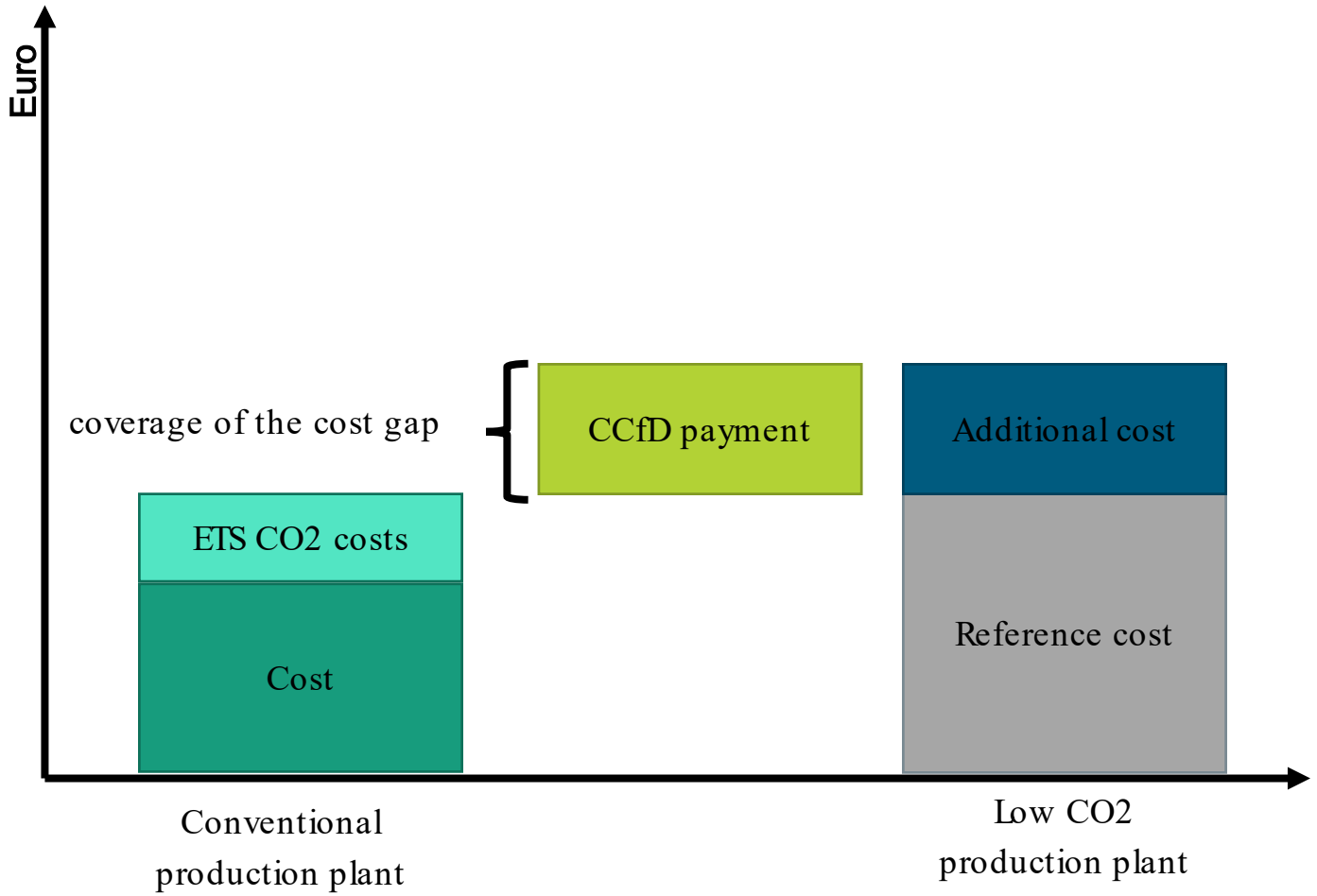
Recap: How does a CCfD work?



- CCfD payment addresses gap between current and CO2 price and CO2 price required for low CO2 technologies to be competitive
- Currently free allowances for conventional plant but not for low carbon plant → real cost gap is higher
- Revision of the ETS Directive foresees free allowances also for low carbon production plants
- If this will not be realised the support payments need to be increased accordingly

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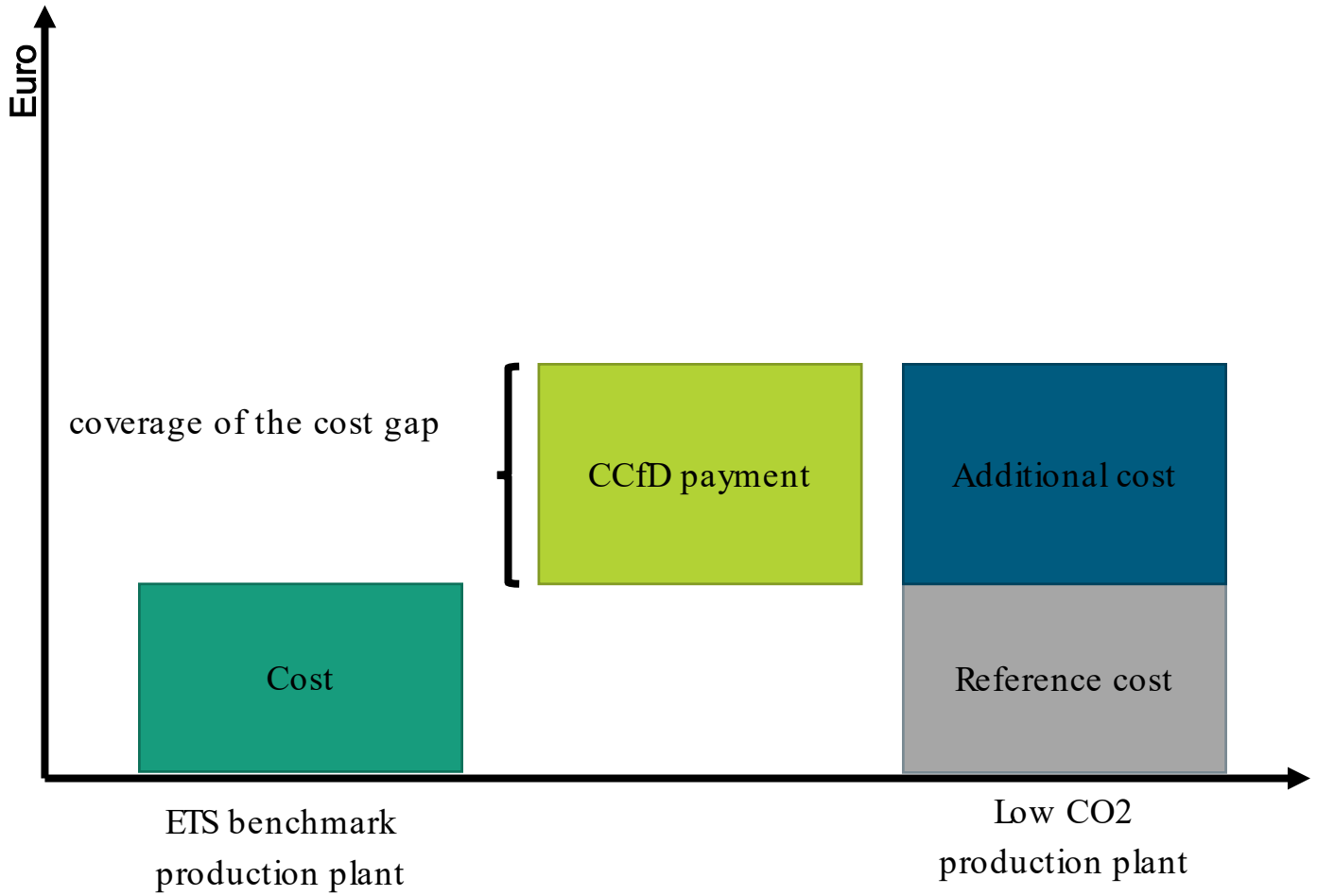

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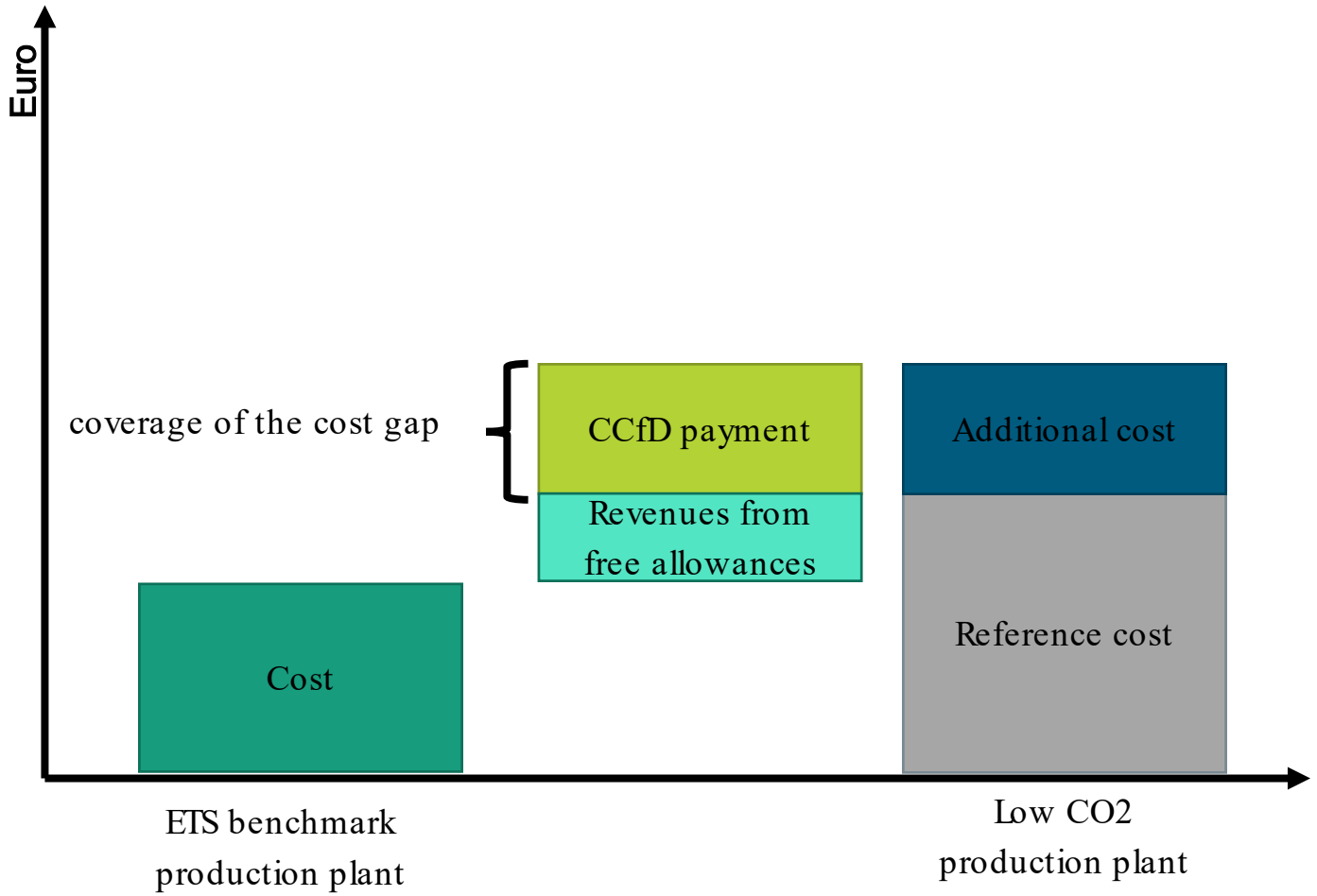

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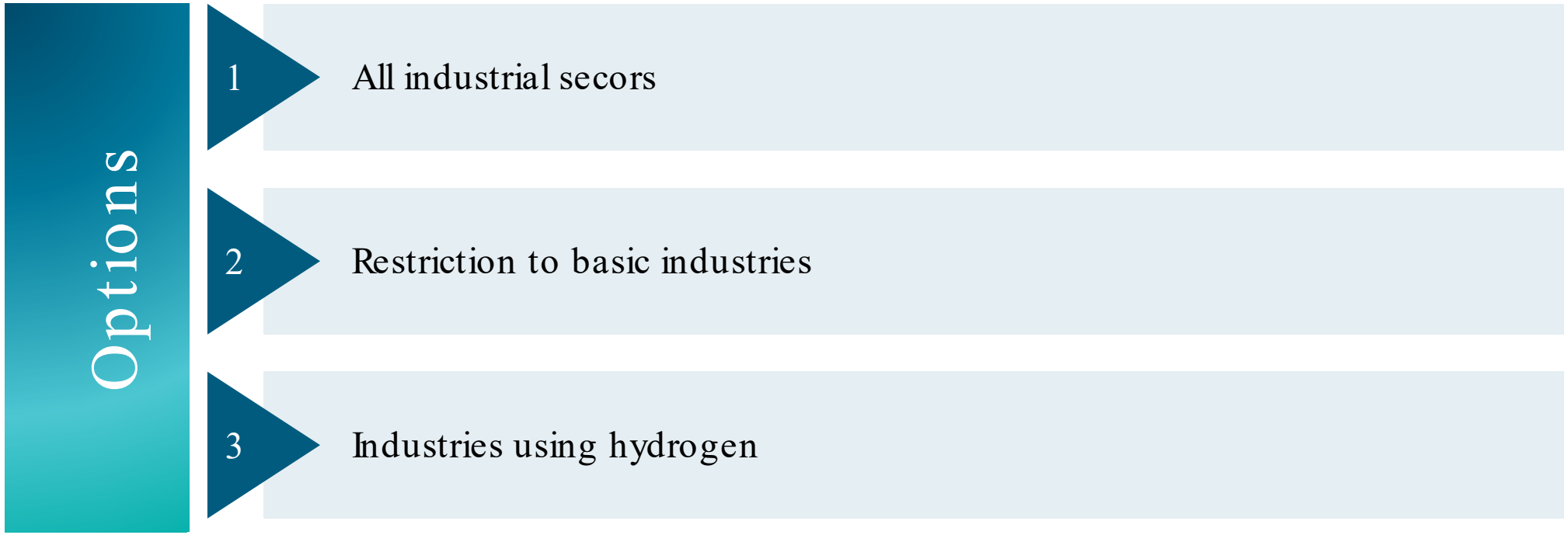
Who can participate – focus on hydrogen or broader support scheme?

- In the first auction rounds the focus will be on hydrogen technologies (and most probably a supply side auction will be implemented)
- In later rounds the focus could also be broader than hydrogen and more sectors included



Who can participate – focus on hydrogen or broader support scheme?

Options	(1) All industrial sectors	(2) Restriction to basic industries	(3) Industries using hydrogen
Advantages	• Higher degree of competition • Potentially more sites and geographical areas successful	• Focus on industries with highest emission reduction	• Clear focus on hydrogen ramp-up
Drawbacks	• Unclear effect on hydrogen • Basic industries with highest emissions might not be awarded • Potentially technologies with a higher maturity and close to competitiveness are awarded (e.g. low and mid temperature heating)	• Potentially lower degree of competition • Potentially lower geographical spread and fewer bigger projects awarded • Unclear effect on hydrogen	• Less focus on decarbonisation • Potentially lower degree of competition • Potentially lower geographical spread and fewer bigger projects awarded

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The carbon price risk is not the most relevant risk for CCfD projects

- Carbon price risk is not the most relevant risk factor for many technologies (especially hydrogen technologies)
- Indexation can be a way to limit these other risk factors in a CCfD support scheme
- Risk reduction for bidders implies a higher budget risk and thus fewer projects can be supported

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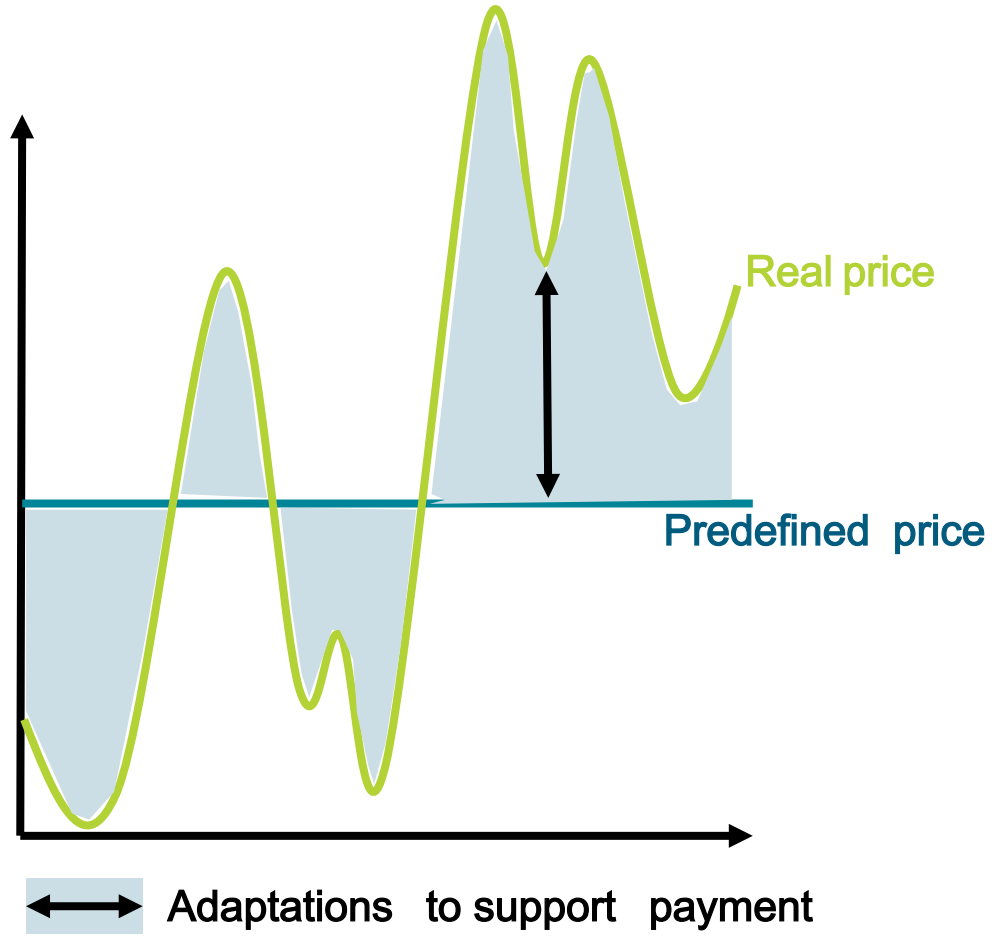
Indexation can be used to reduce additional price risks

1. Auctioneer sets fixed (artificial, e.g. futures-based) price level for each indexed input parameter
2. Bidder optimizes bid in the auction based on predefined prices and own expectations
3. Contract price resulting from the auction is adapted based on real price developments in the respective market for the indexed parameter



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Different options exist for indexation

Options

1. No indexation
2. Indexation for hydrogen only
3. Indexation for all energy carriers
4. Indexation for energy carriers and other input factors

- Combination with project-specific suppport caps reduces the risk hedging effect of indexation
- Indexation needs to minimize impact on energy carrier choices (e.g. by setting adequate predefined prices)

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Indexation for more input factors increases budget risks and complexity

Options	(1) No indexation	(2) Indexation for hydrogen only	(3) Indexation for all energy carriers	(4) Indexation for energy carriers and other input factors
Advantages	• Simple implementation • Clear contract price • Lower budget risk for auctioneer	• Highest risk factor for hydrogen technologies addressed	• Further risk reduction for bidders • Avoids potential rush for hydrogen	• Further risk reduction for bidders
Drawbacks	• Major investment risks not addressed and thus potentially no investment • Potentially higher financing costs and support expenditures	• More complex support scheme • Potentially higher fluctuations of support payments and thus lower amount of projects that can be supported (depending on necessary budget allocation) • Suitable hydrogen index difficult to define (gas-based, electricity-price based, mixed) • Potential preference for hydrogen due to lower risk	• 3 first option 2 drawbacks • Many indexes need to be defined	• Option 3 drawbacks • industry has better information about raw material markets than auctioneer and is thus able to manage better the associated risks

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Beyond price – which other criteria are suitable for awarding projects for CCfD support?

- Multi-criteria scoring systems can help exploit higher performance on multiple policy targets (apart from lowest cost only)
- Auctions perform best when kept simple
- Eligibility best for issues related to ensuring capability of bidders
- Criteria need to be transparent and objectively quantifiable

Ensure capability → **Eligibility**

E.g.
- Financial capability (balance sheet, turnover, etc.)
- Technical requirements for hydrogen

Exploit higher performance → **Award**

E.g.
- Degree of innovation
- Faster hydrogen ramp-up
- Ealier decarbonisation

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The current Innovation Fund grants programme uses five main award criteria (incl. price)

- Effectiveness of greenhouse gas emissions avoidance
- Degree of innovation
- Project maturity
- Scalability
- Cost efficiency (cost per unit of performance)

The detailed scoring and ranking methodology are set in each call for proposals.

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Potential eligibility and non-price award criteria for CCfD competitive bidding could be different and depend on political objectives

GHG emission reductions	• Absolute emission reduction: minimum as eligibility criterion • Relative emission reduction:minumum as eligibility criterion, faster reduction as award criterion
Hydrogen uptake	• Technical hydrogen readiness as eligibility criterion • Early uptake as award criterion
Contribution to circular economy	• Higher share of recycled material as award criterion
Scalability	• Minimum number of similar applications across EU as eligibility criterion

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Do you have any clarifying questions at this point?

Slido poll

Participant statements and open discussion

Questions for discussion

- Which project development risks should remain with the private sector? Which should be taken on by the auctioneer (public authority)?
- As a project developer do you already hedge yourself for CO2/electricity risk?
- Are there already industrial decarbonisation projects mature enough for a CCFD scheme at the time of IF pilot auctions (2023-25)?
- Which sectors/types of project are most in need of CCfD support?
- How could electricity price indexation work in practice?
- Which criteria for auction clearing would you consider relevant beyond price? How could these be implemented?

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Thank you for your attention!

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