The future of auctions in the energy system

Auctions beyond renewable electricity

AURES II webinar, 15 December 2021

Hydrogen auctions

Applying RES auction expertise to renewable hydrogen support

Guidehouse and Fraunhofer ISI within AURES II

Why this paper?

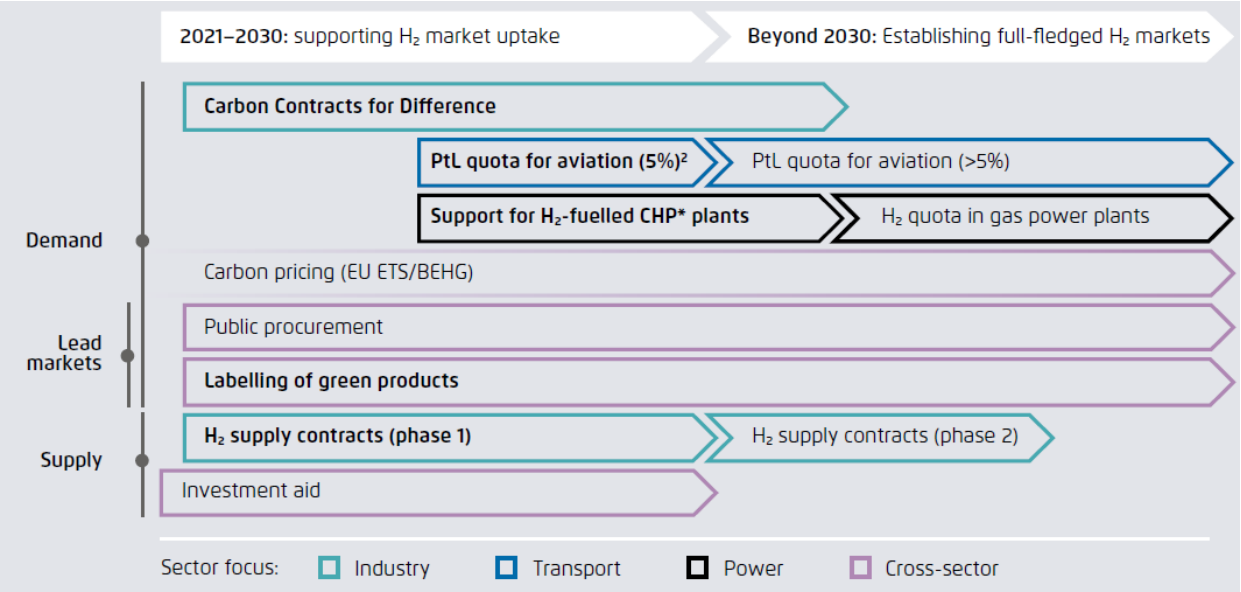
Goal of this paper: provide initial considerations on auctions for renewable hydrogen (H_2) support allocation

- Renewable H_2 is seen as a key solution to achieve climate neutrality
  - EU and national H_2 strategies include significant funding pledges
  - EC proposal for RED II revision includes H_2 sub-targets for industry & aviation
  - Missing piece: implementation

➢ Our focus: practical, near term auction-based policy options for electrolyser deployment/renewable hydrogen use

There are numerous support instruments in discussion at the moment

- In the end, it will likely be a mix of support instruments
- Some of the discussed instruments involve the use of auctions to select projects
- The auctions-approach could be highly relevant for the timeframe up to 2030
- Beyond 2030, support levels may be reduced as markets become liquid and a larger emphasis can be placed on quotas for specific demand sectors

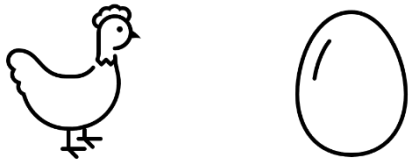


Source: Guidehouse (2021)

Policy intervention is required to ramp-up supply and demand for renewable H_2

There are two main challenges in the near term:

1



Missing market

2

- Support instruments are required for both supply and demand
- Infrastructure is a binding constraint in the near term

Auctions for renewable H_2 can work with no infrastructure and little demand/supply

- We developed four near-term options to meet specific aims
  - Option 1: Demand-side auction for H_2
    - Ramp-up H_2 demand to help achieve the proposed RFNBO target for industry (RED II revision)
  - Option 2: Double-sided auction for H_2 derivatives
    - Support the supply of derivatives and the build-up of a demand market
  - Option 3: Supply-side auction
    - Help move towards EU H_2 strategy capacity target of 40 GW
  - Option 4: Joint auction for hydrogen and renewable energy
    - Support the joint deployment of RES and electrolysers

Options take account of current key issues:

1. no demand & supply
2. no infrastructure

Options were developed for short-term implementation. With developed markets and infrastructure, options may need to be adapted.

Basic assumptions and considerations for all four options

We take certain design decisions based on the below assumptions and considerations.
In practice, all four options can be further adapted to meet other specific needs by policy-makers.

We assume that:

- there will be **enough actors** interested in the demand and supply side in the short term which leads to sufficient competition in the auctions
- policymakers take the potential number of participants and projects into account when setting the **auction volumes** to support
- the **RED II revision** will be implemented as proposed (e.g. amongst others resulting in a need for industry-focused support instruments)
- the EC's **sustainability criteria** will be considered and fulfilled

Other considerations:

- Because options are designed for the next years where there is no infrastructure, we ask in some options for **offtake agreements** to ensure that demand and supply are matched with bilateral transport arrangements
- Hydrogen and derivatives are fundamentally different with regards to transport
  - H_2 is bound to pipelines
  - Derivatives can be traded globally via ships

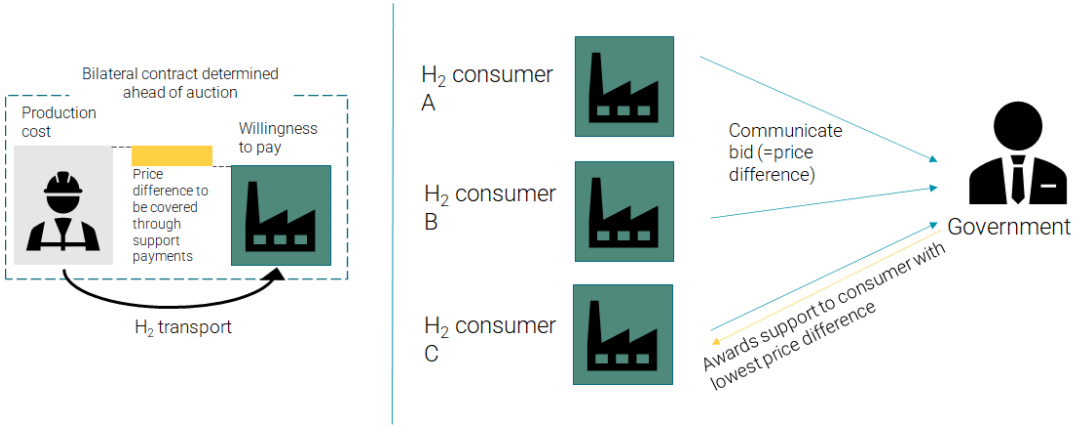
Demand-side auction: enable H_2 use as feedstock or energy carrier in industry

Option 1

- Focus on demand from industry sectors that need renewable H_2 to decarbonize
  - Selection determined by policy priorities (e.g. RED II requirements)
  - Need for separate support windows to differentiate between industries that already use H_2 and those that don't (i.e. that have additional costs from retrofitting processes)
- Incentives for industry to participate:
  - Corporate sustainability targets
  - Aim to "green" a product to appeal to a certain target group
  - Ramp-up corporate learning curve on H_2
  - Avoid rising CO_2 costs under EU ETS
- Focus on pure H_2 (not derivatives)

Demand-side auction: auction design

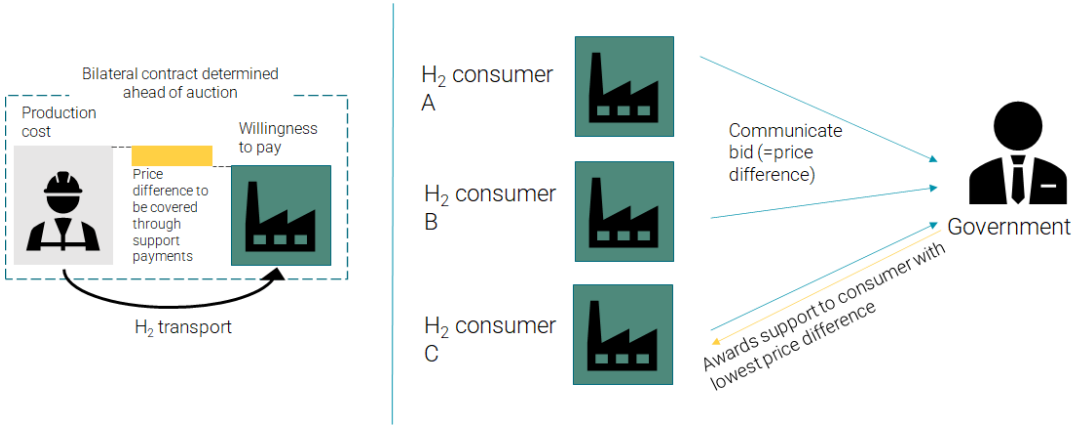
Option 1



- Industry offtaker determines a **bilateral offtake contract** with a hydrogen supplier ahead of the auction
  - It is a pre-qualification requirement to ensure that transport is considered
- Based on negotiations with supplier, the industry offtaker can determine the price difference to be covered by the support (= **bid**)
  - Bid = Costs of renewable H_2 production + H_2 infrastructure/transport costs - price of current energy carrier
- Industry-specific **ceiling prices** are necessary given differences in cost gap between H_2 and the energy carrier it replaces
  - There is currently no market price for renewable hydrogen, hence a proxy is needed to determine a feasible ceiling price: calculation is based on level of abatement costs

Demand-side auction: auction design

Option 1



Auction can award either:

- **Fixed Feed-in-Premium**
  - Advantages: relatively simple, provides high cost predictability for the government, provides high incentive for bidders to negotiate best supply contracts
  - Disadvantage: increases the risk of the winner's curse because long-term price forecasts are necessary but related to high uncertainties
  - RES-E price fluctuations must be considered in the bilateral offtake contract
- **Contract for Difference**
  - Advantages: effectively reduces risks for the bidder
  - Disadvantages: lower predictability of total support costs for government (government needs to ensure support for times of high delta between strike price and market price)
    - In case the support is levy-financed this is less an issue, in case it is state budget financed, it is a problem

Double-sided auction for derivatives: meeting industry demand for derivatives

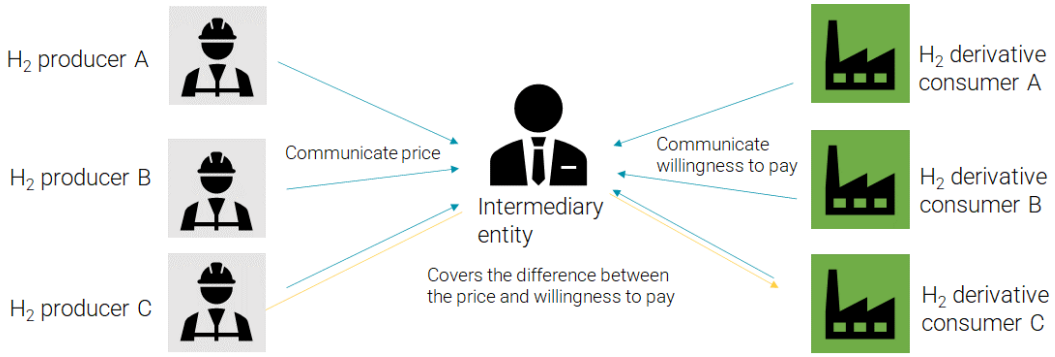
Option 2

Provide security to producers to invest in new electrolysers and industry offtakers to switch to green derivatives

- Derivatives are easier to transport
  - Location of electrolyser is not bound to location of offtaker
  - Derivatives could also be imported from outside the EU
- Double-sided auction would function as a platform for match-making
  - Markets and new supply routes for green derivatives have not established yet
  - Auction could target large groups of actors on both sides, thereby enhancing competition and lowering prices
- Design is comparable to H2Global concept in Germany

Double-sided auction for derivatives: auction design

Option 2



- Producers have high CAPEX & OPEX
  - Countries with investment support schemes have competitive advantage over others (may favor EU producers with access to the EU Innovation Fund)
- Offtakers communicate willingness to pay to intermediary
- Intermediary closes contracts with both sides
  - No bilateral offtake agreements required
- Difference between production price and willingness to pay is covered by intermediary through dedicated funds
- Many design questions remain open:
  - How does the landing of derivatives work, e.g. at a dedicated harbor or one of several industrial clusters?
  - How is the landing point determined?
  - What are feasible contract durations? Producers require long-term security which can be provided through the contracts, however offtakers may only want to be bound for e.g. 5 years to take advantage of expected price degressions.

Supply-side auction: ramp-up electrolyser capacity in parallel with demand

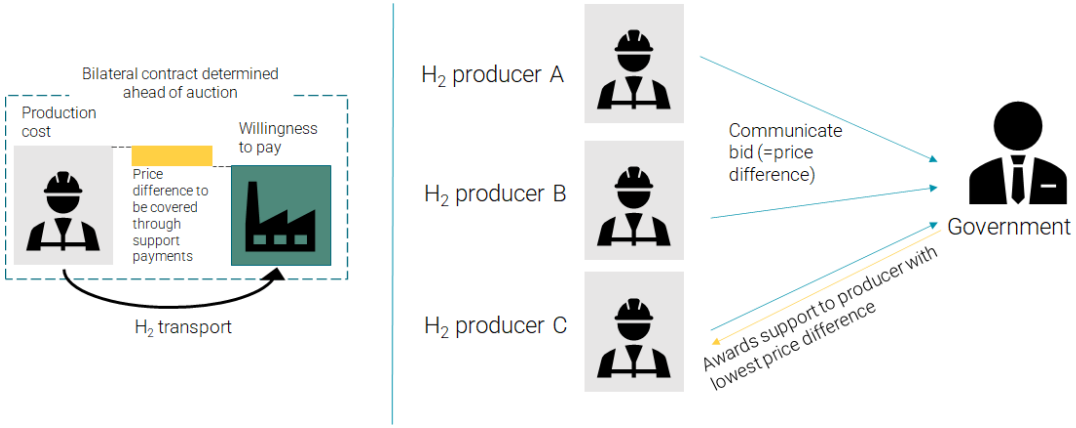
Option 3

Supply-side auction to help move towards EU H_2 strategy capacity target of 40 GW

- Demand and supply parties must negotiate a bilateral offtake contract before participating in the auction
  - It is a pre-qualification requirement
  - It ensures that transport is considered (provides certainty that the binding constraint is fulfilled)
  - It ensures that supply and demand ramp-up in parallel
- Depending on national policy priorities, end use sector can be determined as part of auction design
  - Compliance must be demonstrated through the bilateral offtake contract
- Electrolyser would likely be installed in close geographic proximity to the offtaker

Supply-side auction: auction design

Option 3



- Auction can award either investment support or operating aid
  - Investment support alone does not ensure H_2 production due to high OPEX share
  - Operating support should be considered, but electrolysers should have incentives for system friendly renewables consumption
- A ceiling price is implemented to ensure that bids are not overstated

Joint H_2 and RES auction: use integrated solution for deploying RES & electrolysers

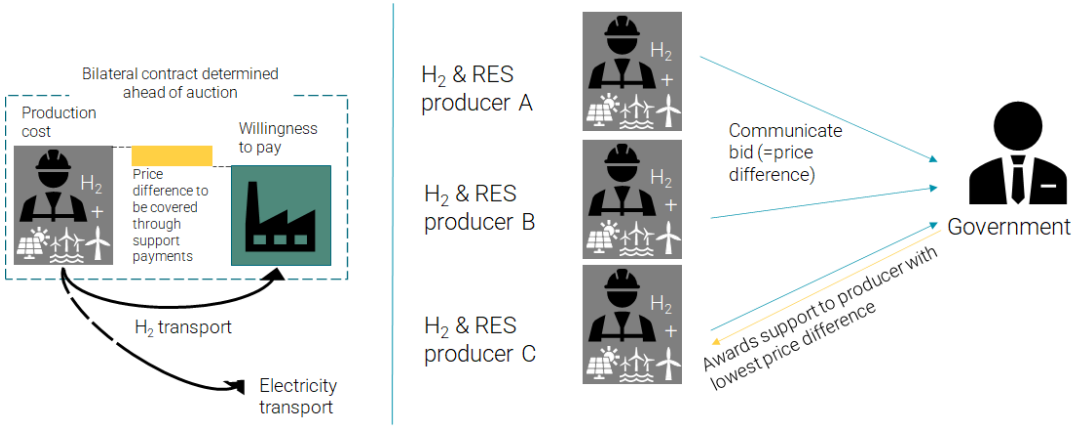
Option 4

Joint auction can support the simultaneous deployment of hydrogen and a renewable energy source

- Important choice regarding the technical set-up is the connection type of electrolyser: on-grid or off-grid
  - Off-grid: Electrolyser is restricted to the full load hours of the RES plant
  - On-grid: Can run independent of full load hours as it can source from the grid
  - Choice has strong impact on the operating hours and hence the H_2 production costs
- Auction can pre-determine project design

Joint H_2 and RES auction: auction design

Option 4



- Auction design similar to supply-side auction
- Only H_2 scope of project receives support
  - Exact criteria will be defined by Delegated Act to be published until the end of 2021

Review of design options

Each option has a different purpose:

- Option 1: Ramp up demand for H_2
- Option 2: Double-sided auction for derivatives
- Option 3: Ramp up supply of H_2
- Option 4: Increase electrolyser and RES capacity at the same time

- We took design decisions for each option that can be amended by policymakers as needed
  - E.g. regarding the form of support, the pre-qualification requirements, etc.
- All options respect the fact that hydrogen markets are currently in their infancy and that there is limited infrastructure
  - This poses challenges with a view to demand and supply matching and the level of competition
- The options are designed for the short-term and need adaptation once markets have established and infrastructure is available

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