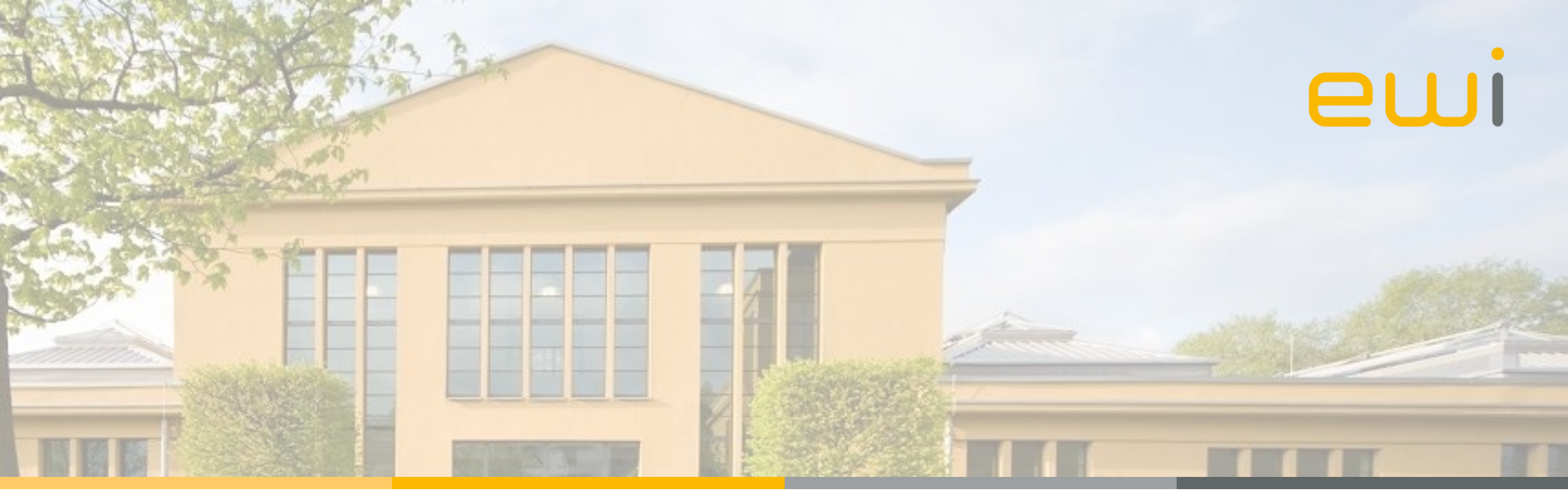


REGULIERUNGSFRAGEN FÜR EINE NACHHALTIGE WASSERSTOFFINDUSTRIE

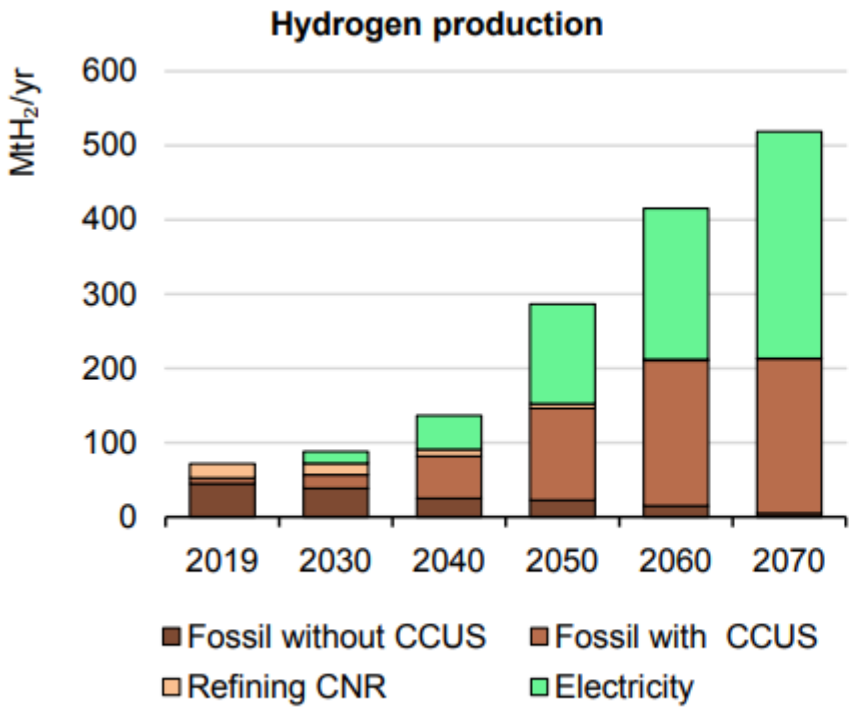
IN4Climate.NRW – Wissenschaft trifft Wirtschaft

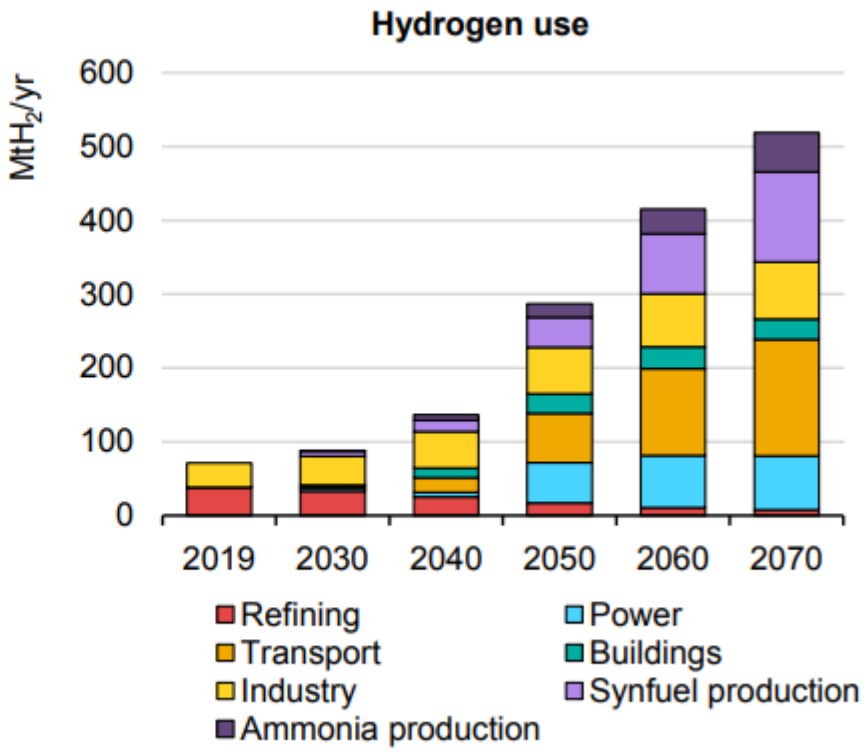
Samir Jeddi

Energiewirtschaftliches Institut an der Universität zu Köln (EWI) gGmbH | 4. Dezember 2020

WHAT ARE WE TALKING ABOUT?

The evolution of a hydrogen economy requires investments on both market sides – Supply and Demand





Source: IEA (2020) – Energy Technology Persepctives

WHAT ARE INVESTMENT INCENTIVES FOR A FIRM?

The profitability of the abatement is subject to multiple uncertainties

vs.

$$\begin{aligned}\pi =& (c_{conv} + \mathbb{E}[p_{CO_2}])q - (c_{conv} + \mathbb{E}[\Delta c])q - c_{INV} \\ =& (\mathbb{E}[p_{CO_2}] - \mathbb{E}[\Delta c])q - c_{INV}\end{aligned}$$

Abatement costs are a function of
Coal price
Iron ore (incl. freight rates)
CAPEX for investment
Carbon price (p_{CO2})
Hydrogen supply
Electricity supply

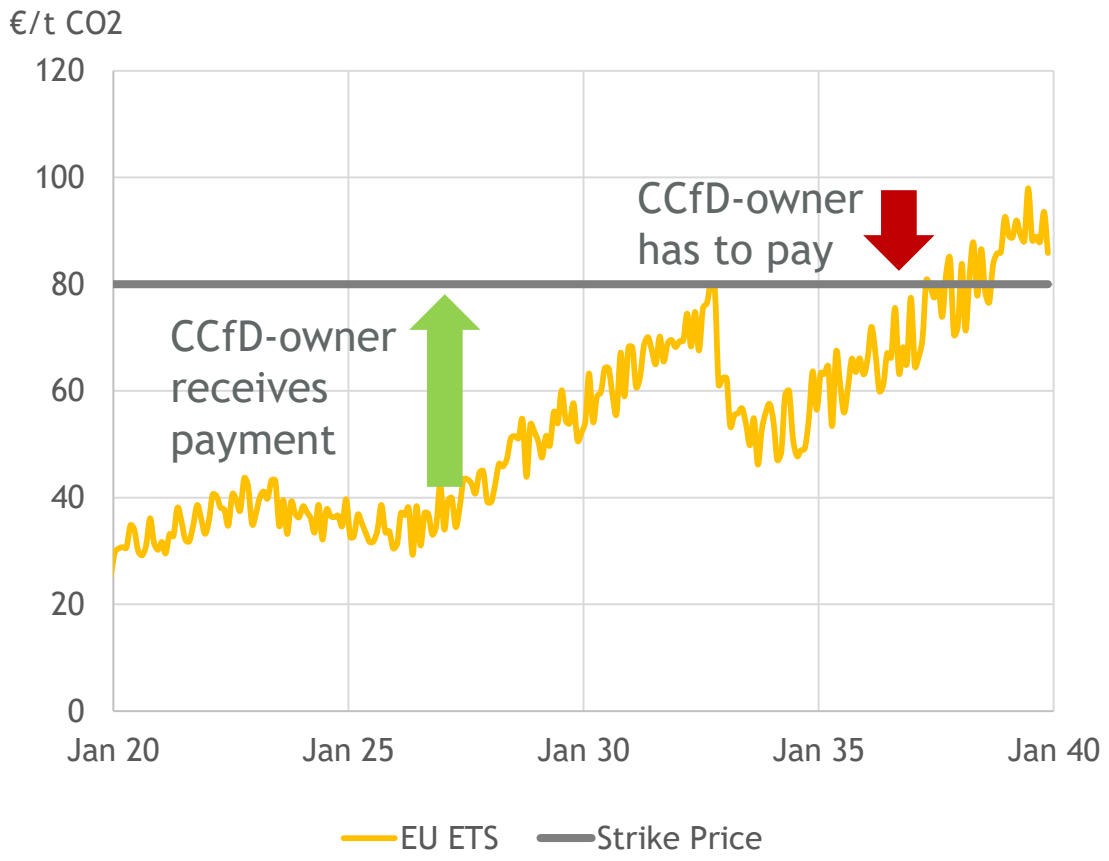
Revenue/Steel price is a function of
Quantatiy
$p_{steel}(p_{CO2})$

Source: Formulas in reference to Richstein (2017)

What is a Carbon Contract for Differences (CCfD)?

A CCfD immitates a future contract for CO_2 certificates.

Fictional future EU ETS Price development

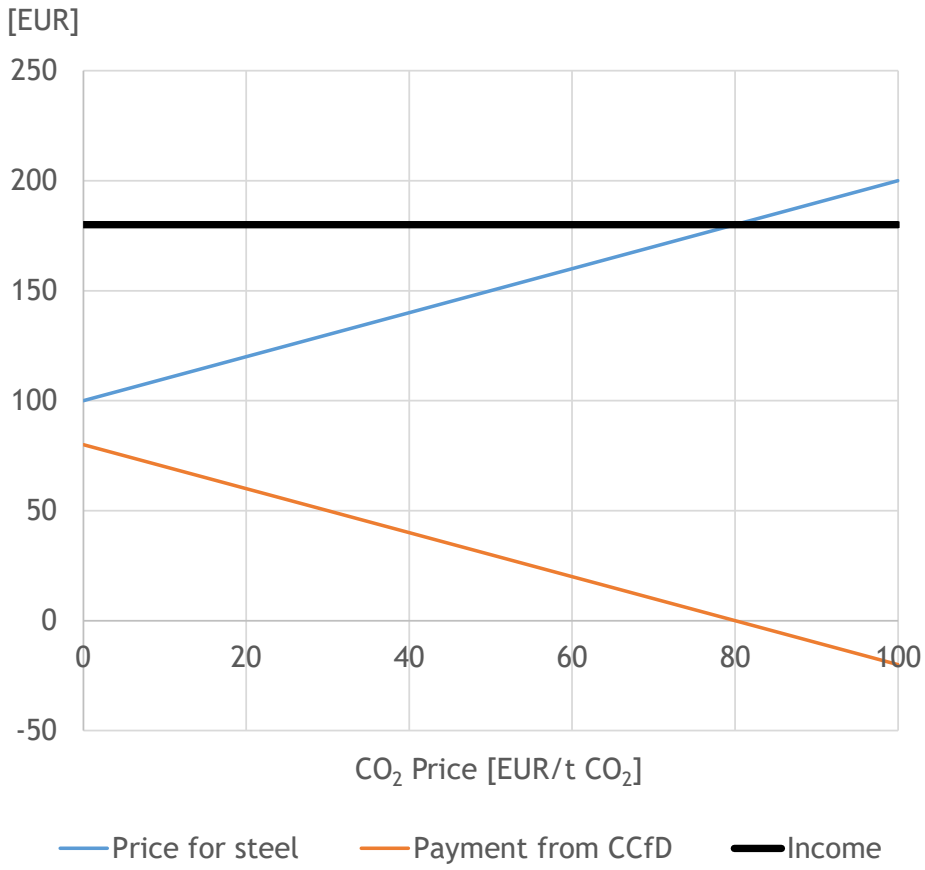


- In the German and the EU Hydrogen Strategy, CCfDs are proposed to support large scale industry investments (e.g. steel plants)
- The owner of a CCfD obtains a pay-off of: $p_S - p_{CO_2}$

HOW DOES A CCFD WORK? – THE SIMPLE SETTING

CCfDs hedge (some) uncertainties of an investment's profitability

Fictional revenue stream with a CCfD



$$\pi = (c_{conv} + \mathbb{E}[p_{CO_2}])q - (c_{conv} + \mathbb{E}[\Delta c])q + \boldsymbol{(p_s - \mathbb{E}[p_{CO_2}])q} - c_{INV}$$
$$= (p_s - \mathbb{E}[\Delta c])q - c_{INV}$$

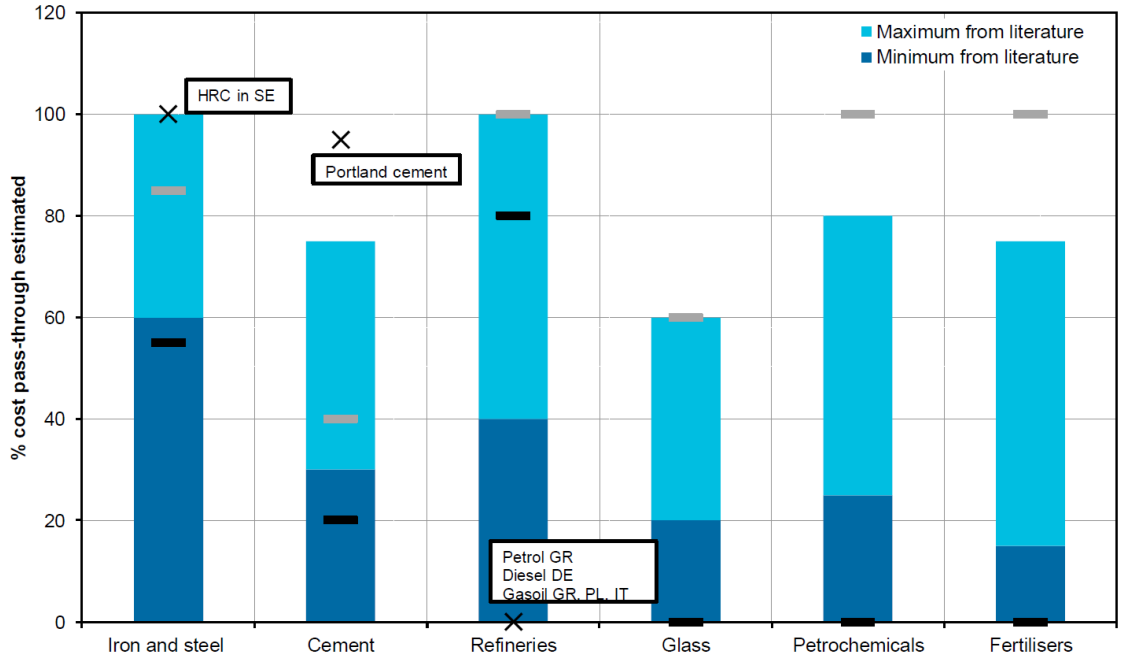
- CCfDs increase the revenue predictability for abatement investments (e.g. in Direct Reduction Ovens)
- Thereby, the instrument reduces the financing costs for firms
- However, this only holds under the strong assumption of complete cost pass-through to end-consumer prices

HOW DOES A CCFD WORK? – MORE REALISTIC SETTING

Several industries cannot fully pass on carbon prices to consumers

Estimated pass-through rates for different industries

$$\begin{aligned}\pi =&(c_{conv} + \alpha\mathbb{E}[p_{CO_2}])q - (c_{conv} + \mathbb{E}[\Delta c])q + (p_s - \mathbb{E}[p_{CO_2}])q - c_{INV} + A_{GF} \\ =&(p_s - \mathbb{E}[\Delta c] - (1-\alpha)\mathbb{E}[p_{CO_2}])q - c_{INV} + A_{GF}\end{aligned}$$



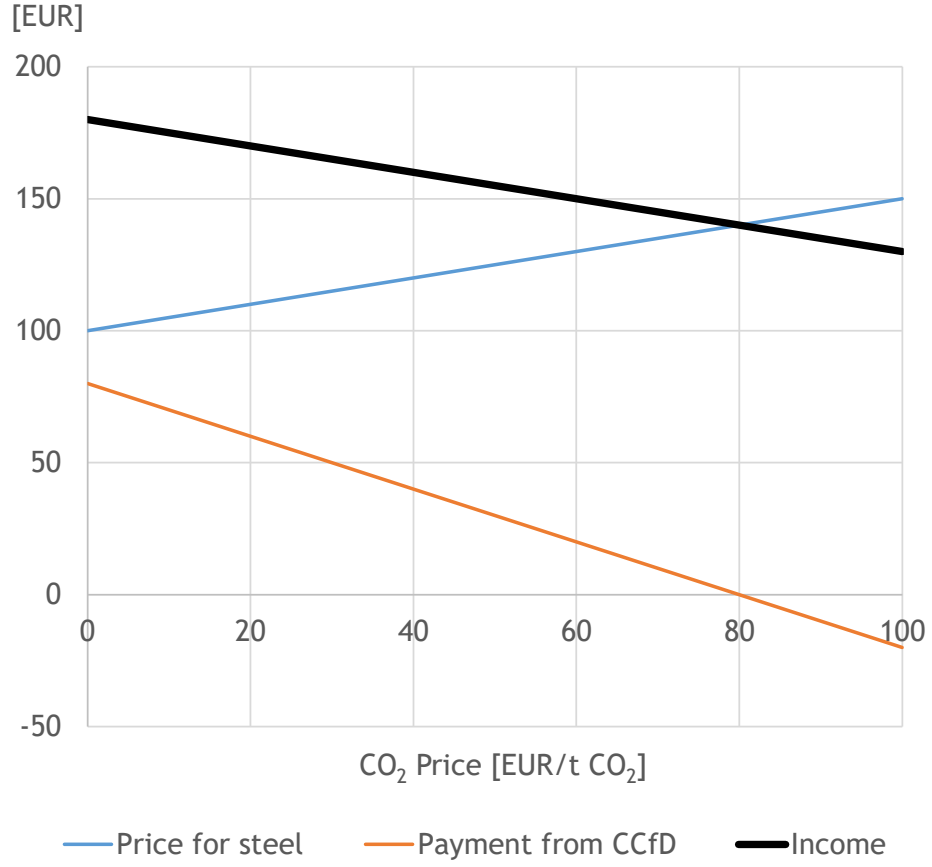
- In most industries, carbon prices are not fully passed through to consumers
- In such a case, CCfDs may not fully hedge the carbon price risk

Source: Cludius et al. (2020)

HOW DOES A CCFD WORK? – MORE REALISTIC SETTING

If carbon prices are not fully passed through, CCfDs may induce over-hedging

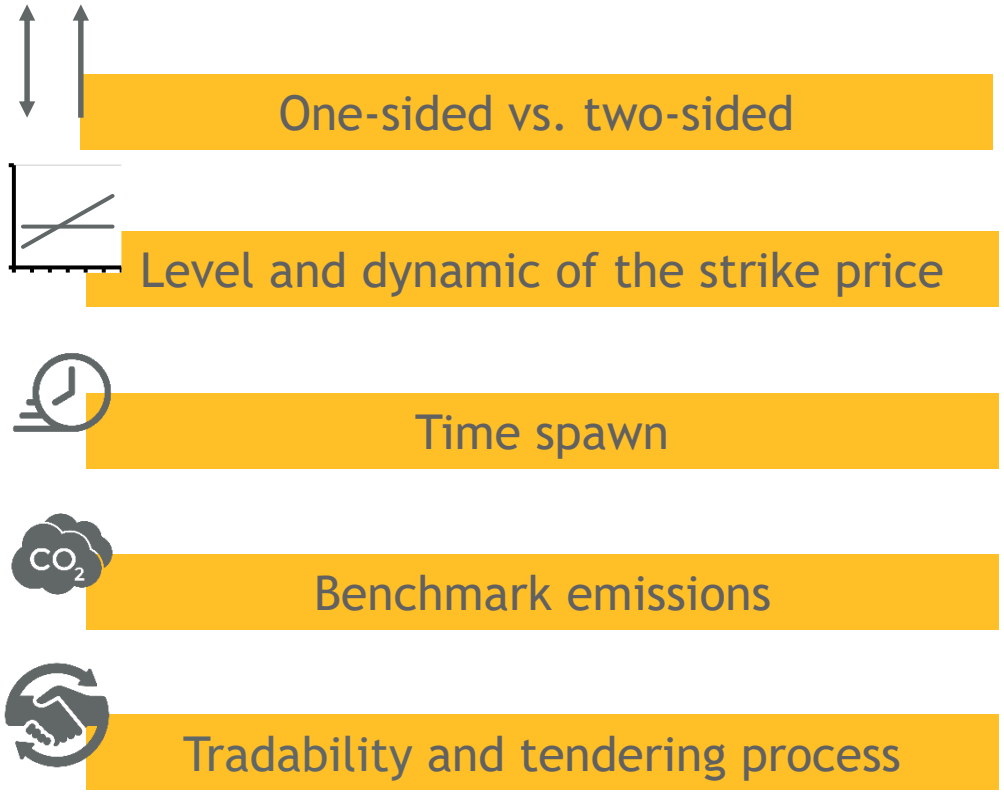
Fictional revenue stream with a CCfD and incomplete cost pass-through



- Standard CCfD configuration may result in over-hedging, if the free allocation is based on historical emissions
- CCfDs design may account for that issue

Many open questions on the design and tendering process for CCfDs

Design Choices



Related questions:

- Would CCfDs be offered technology specific?
- Would there be tenders for CCfD?
  - If yes, are there sufficient bidders to prevent strategic behaviour?
- Do firms want to bear risks associated with CCfD supported investments?
- What about the other abatement cost uncertainties?

Danke für Ihre Aufmerksamkeit.

KONTAKT

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