NERA

The development and future of market premium contracts for onshore wind in Germany

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Your presenter today

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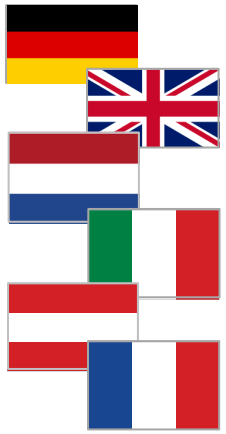
- Economist with ten years of experience advising on the economics of renewable energy and climate change
- Policy advice in relation to:
  - Design of support mechanisms (CfDs)
  - Auction design
  - Recent work includes projects for Romanian, Serbian and Albanian government
- Support to bidders in wind auctions (offshore)

NERA is an international economic consultancy that works on a variety of projects in the wind and broader renewables sector

Auction analysis and bid support (offshore wind)

- Auction simulation and bid optimisation
- Competitor analysis
- Analysis of PPA-market and co-investors
- "War Gaming"

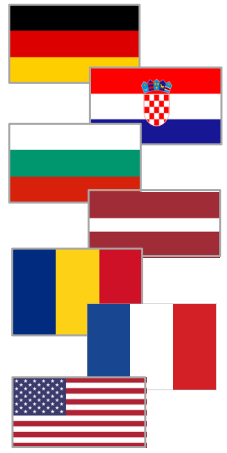


Economic analyses for renewables developers and investors

- Due diligence of the regulatory framework for market entry decisions (e.g. support mechanisms)
- Electricity price prognosis in various scenarios
- Analyses of auction scenarios

Design of support mechanisms and associated auction schemes

- CfD and auction design for onshore wind in various Eastern Europe countries (on behalf of EBRD)
- Impact assessment of WindSeeG 2023 for German offshore wind association
- Analyses of different tender mechanisms for offshore wind in NL



Economic expertise in court and arbitration proceedings

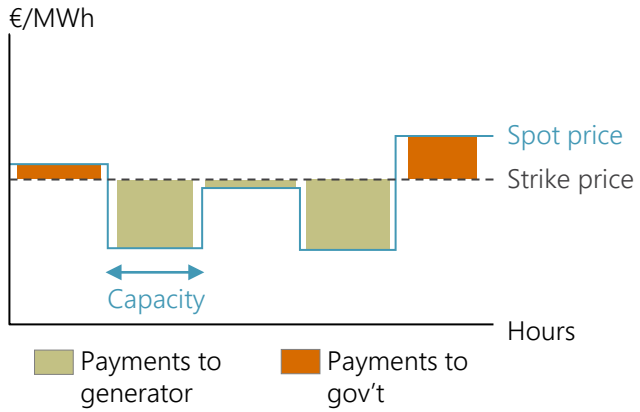
- Adjustment of regulatory framework conditions for offshore wind (ICSID)
- Adjustment subsidy conditions hydro power, biomass (both ICSID)
- Various, e.g. grid connection, financial feasibility, post-M&A (FERC, ad hoc)

Overview: Market premium contracts in Germany

- Support for onshore wind currently takes the form of a **one-sided market premium** (price floor)
  – Generators receive premium payments if market prices are below the strike price
  – But there is **no repayment obligation** in case of prices above the strike price
- Given EU-wide momentum in favour of (two-sided) **Contracts of Differences (CfDs)**, there is a debate if RES support should be switched to CfDs
- Also, shortcomings of existing CfDs have stimulated a new wave of research into **improvements to CfD design**
  – Most significant are recent proposals for **"production-independent" CfDs**
- While there is broad consensus that **some form of market-premium support will be required** for onshore wind in the future, the debate as to how it should look remains very much in flux

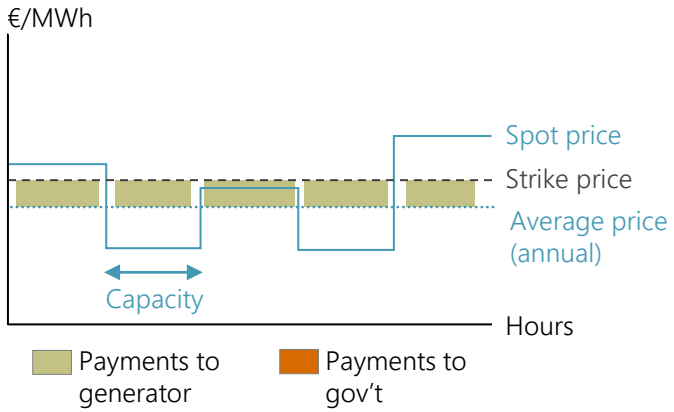
Overview: CfDs versus one-sided market premium contracts

Hourly CfD



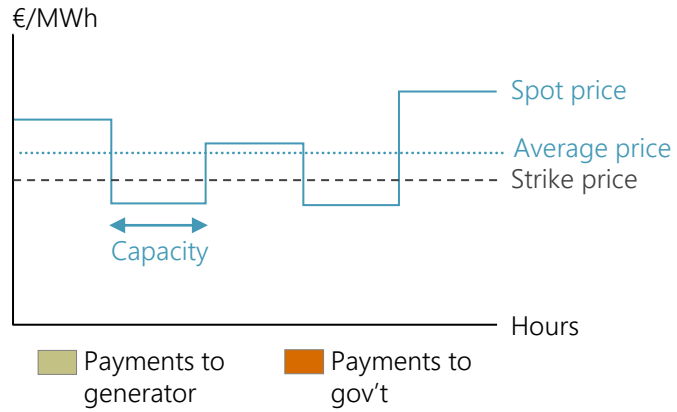
- "Pay-as-produced"
- Payments against **hourly reference price:** Maximisation of output (not revenue)
- Generators must **return "upside"** from high power prices

Annual CfD



- Payments against **annual reference price**
- Otherwise, same as "hourly"

One-sided market premium



- Payments against **annual reference price**
- Generators **keep "upside"** from high power prices
- Generators **can switch** between market premium and PPA market

Notes: Charts adapted from Schlecht et al (2024)

Assessment of the status quo (one-sided market premium)

Strengths

- Risk allocation:
  - Protection against **downside price risk** (low prices)
  - Limited impact of **upside price risk** (typically only assumed by equity providers)
- Market integration:
  - Exposure to price signals also in low-price periods
  - Flexible switching to (short-term) PPA market
  - **Zero bids** possible
  - No payments during negative price periods (§51 EEG)

Weaknesses

- Risk allocation:
  - **Upside price risk** may lead to speculative bids
  - Some **basis risk** (captured price differing from reference price)
  - Some **volume risk**, including from negative price periods
- Market integration:
  - **Dispatch** may be distorted because of positive premium payments (see below)
- Affordability:
  - **Overcompensation**: No built-in claw-back mechanism in case of price spikes
  - **Consumers** left exposed to high prices

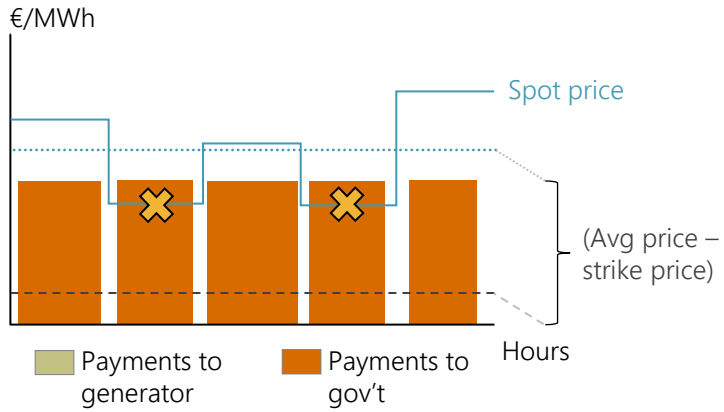
Assessment of CfDs with annual reference prices

Strengths	Weaknesses
• Risk allocation: – Price stabilisation because of two-way payments – No speculative bidding	• Risk allocation: – Some basis risk – Some volume risk, including from negative price periods
• Market integration: – Exposure to price signals: Incentive to **"beat reference price"** both at investment and operational stage – No payments during negative price periods	• Market integration: – **Dispatch** further distorted because of both positive and negative premia (see below) – Switching to PPA market prohibited – More generally, no real incentive to sell outside spot market (DAM) – Zero bids impossible (but can go "below market")
• Affordability: – Built-in claw-back mechanism for price spikes – Repayments in case of high prices can be refunded to consumers	• Affordability: – Higher bids than under one-way premium (but likely offset by repayments during CfD term)

Market distortions under “pay-as-produced” premium contracts

- Generators may have **good estimates of the reference price** (e.g. towards end of the reference period)…and hence the **sign and magnitude of premium payments**
- **Negative premium payments**:
  - Act like an “output tax”;
  - May mean that generators “self-curtail” in case that DAM prices drop below the negative premium;
  - May distort intra-day markets: In case of ID prices below the negative premium, generators have an incentive to self-curtail and buy power on the IDM instead
- **Positive premium payments**:
  - Act like an “output subsidy”;
  - May distort intra-day markets through inefficiently low bidding

Annual CfD (p-as-p)

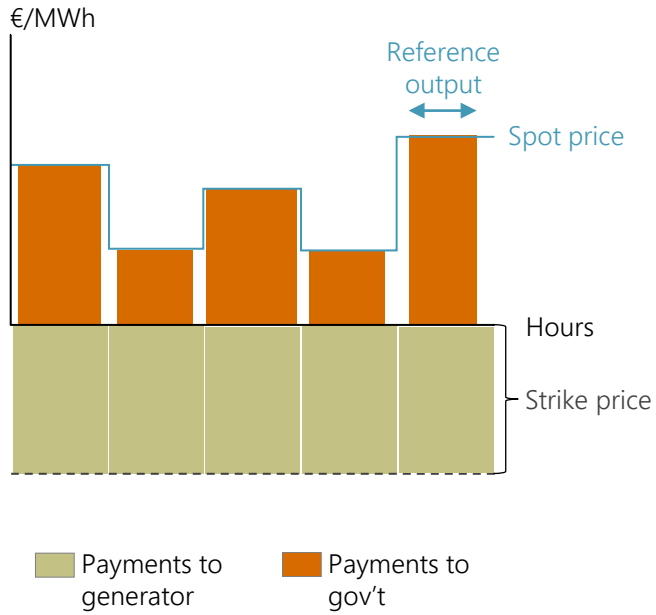


"Financial CfDs" as an example of production-independent CfDs

- Schlecht et al (2024) propose a new form of CfD for supporting onshore wind and other renewables entitled "**financial CfDs**"
- Main idea:
  - CfDs are offered on a capacity basis (multiples of 1 MW);
  - For each MW secured in an auction, a generator will:
    1. Receive a **fixed hourly payment** (based on the strike price bid);
    2. Pay the **benchmarked market revenue**:
       Spot price (whenever positive) x Hourly reference output
- **Strengths**:
  - No market distortions, as payments to generator are production-independent;
  - Incentive to beat reference (revenue maximisation)
  - No price or volume risk (including from negative price periods);
- **Weaknesses**:
  - Basis risk may be significant (shortfall of actual output relative to reference); careful definition of reference therefore crucial
  - Investment stage: Incentive to maximise capacity, not output?

Notes: See also ENTSO-E (2024), *Position Paper on Sustainable Contracts for Difference Design* (link)

Financial CfD



Conclusions: Outlook for support mechanisms for onshore wind in Germany

Market premium support for onshore wind is here to stay

- Market premium contracts are here to stay - at least for onshore wind (less so offshore)
- The current approach (one-sided market premium) is not obviously inferior to two-way CfDs
- Pressures to introduce **two-way CfDs** in Germany are nonetheless likely to increase:
  - Legislative process at EU level (reform of the Electricity Market Design): hedge for consumers;
  - State aid: mitigate risk of overcompensation
- **Production-independent CfDs** are a potential way forward, but crucial design details remain to be specified (in particular, definition of reference output)
- Interaction with **PPA market**: Push for clear market segmentation versus splitting of individual projects (into CfD and PPA part)?
- For more details on the **on-going debate in Germany**, please also refer to the proceedings of Working Group 1 (on CfD design) established under BMWK's *Platform for a Climate-Neutral Electricity System*

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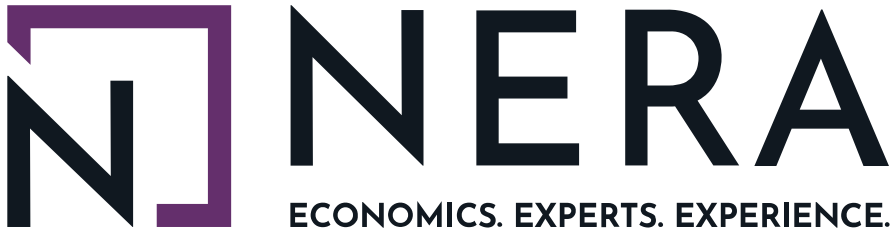
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