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Financing models for Onshore Wind Projects. DFBEW Conference

Can cooperate PPAs substitute renewable tenders (for Onshore Wind)?

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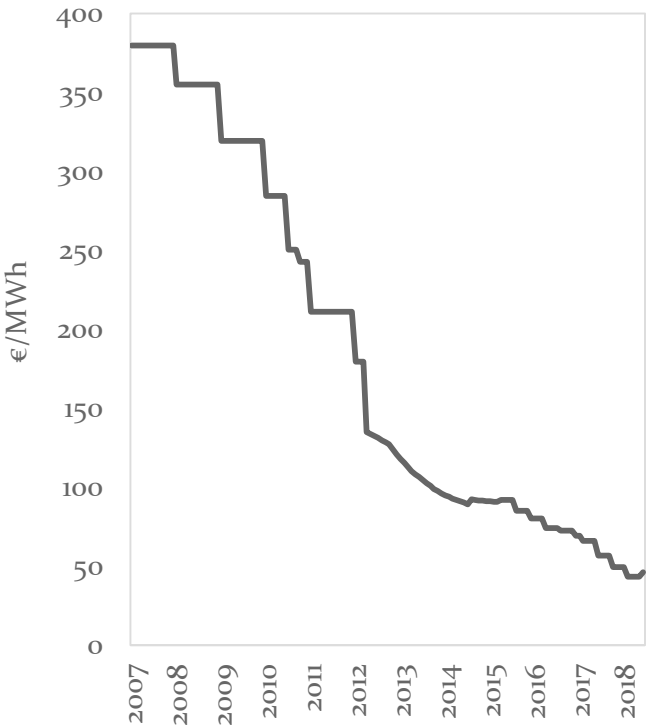
Paris, 9th November 2022

Overview

1. Why are secured cash flows important for renewable (financing) costs?
2. Can PPAs fully substitute public renewable tenders (and at which financing costs)?
3. How could next-generation renewable tenders look like?

Introduction



Remuneration levels of large-scale PV plants in Germany (Based on IWR, 2018 and Bundesnetzagentur, 2018)

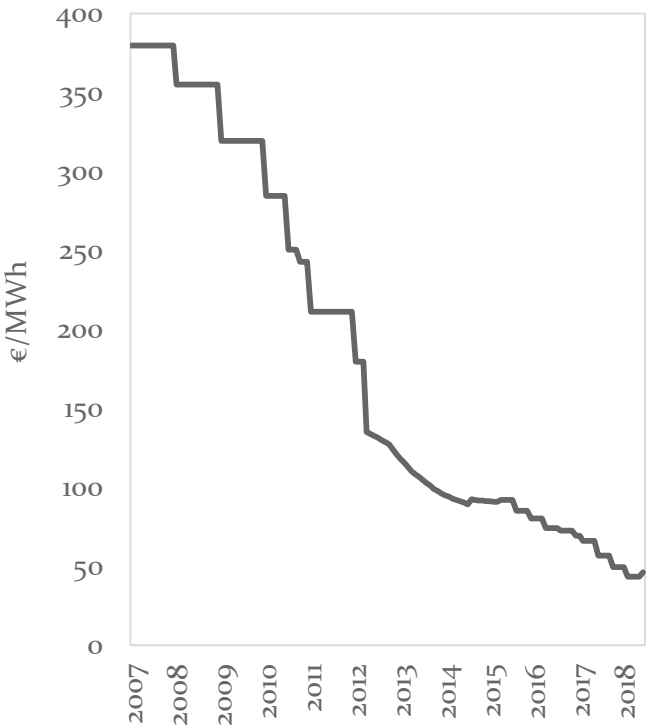
Renewables generation costs have fallen below current (and projected?) wholesale power market prices.

This of course raises the following questions:

- Do we still need renewable policies or can PPAs do the job?
- And what form and role should they take, if the answer is yes?

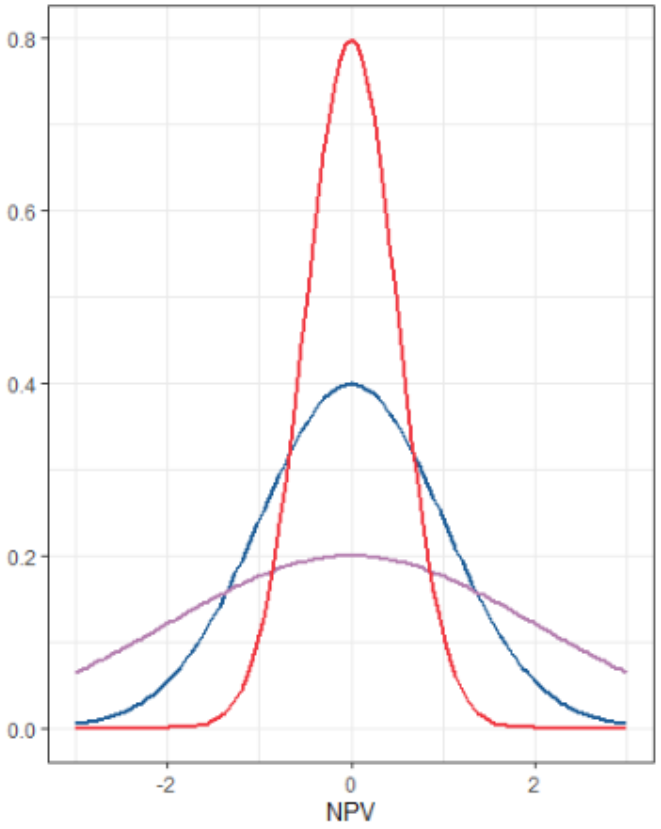
So what do (did) renewable policies do (financially)?

They subsidise(d)



Remuneration levels of large-scale PV plants in Germany (Based on IWR, 2018 and Bundesnetzagentur, 2018)

They provide risk mitigation against market and regulatory risks

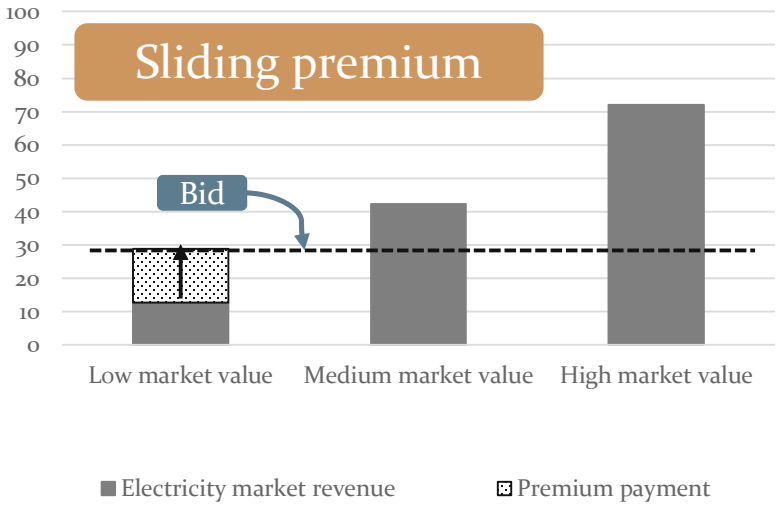


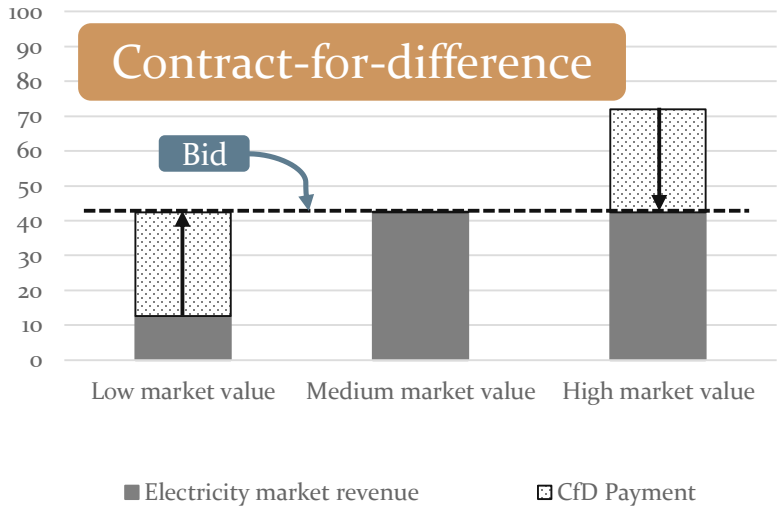
Illustrative depiction of normally distributed NPVs

Case 1: Assuming no PPA

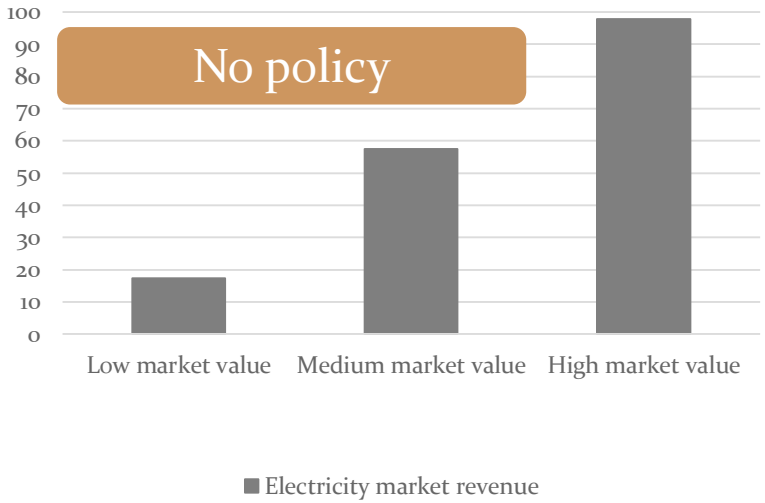
The effect of stabilizing revenues on renewable costs

We compare 2 different policies – and no policy – ignoring PPAs (for now)



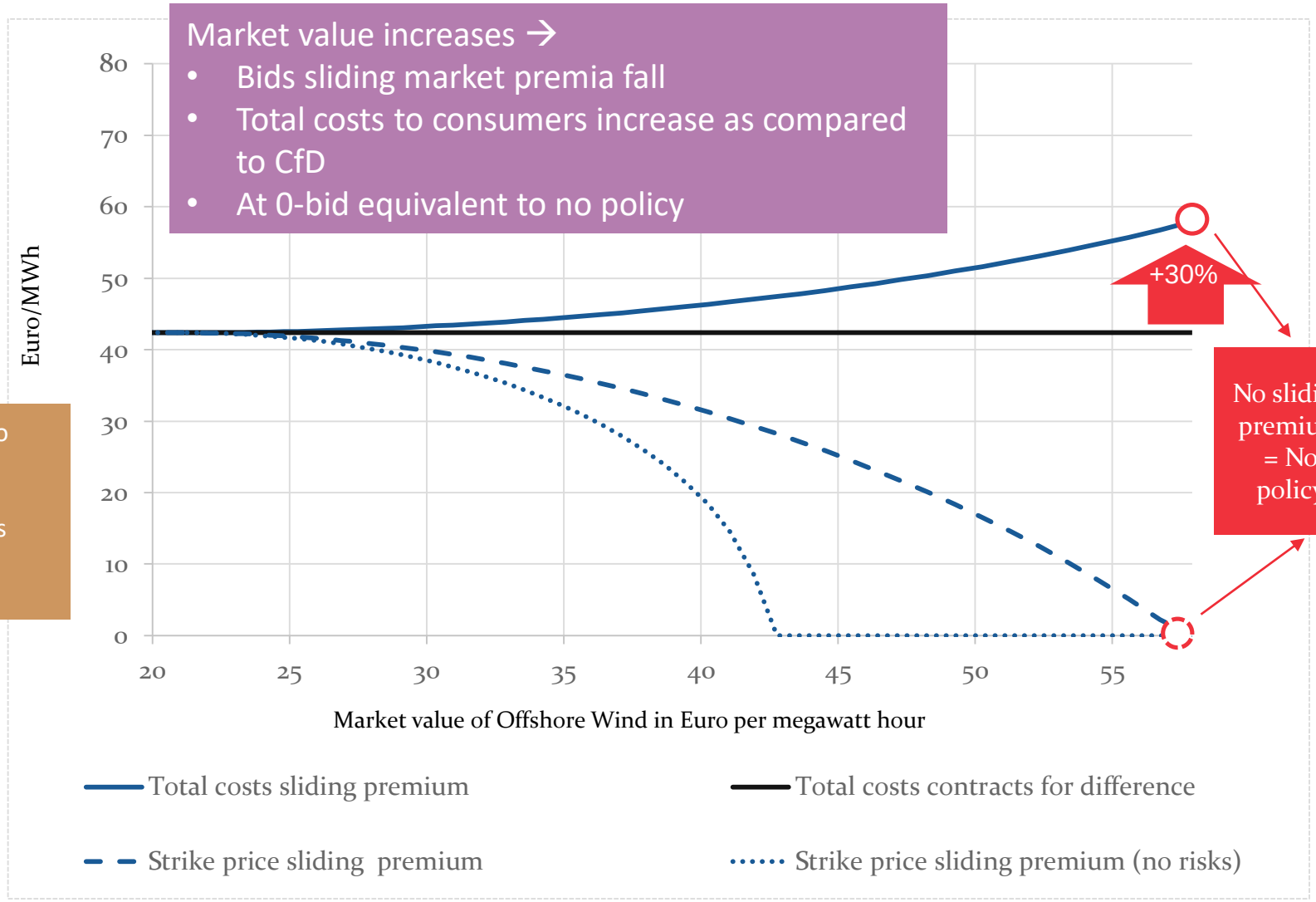


Main model assumptions:
-Project finance
- Only secure revenue raises debt
- Cost of debt > Cost of equity



Analysis based on Neuhoff, May & Richstein (2022)

What happens when market revenues approach – and exceed technology costs?



Case 2: Risks are taken over by electricity consumers in a PPA

The impact on balance sheets and credit ratings

- Mismatch exists between
  - PPA-contract lengths that effectively lower financing costs for RES projects (~ 20 years)
  - Future sales and contract durations of electricity consumers (often <= 5 years)
- Thus entering in a long-term PPA creates an open (unhedged position) → a bet on energy prices

Utilities
- Are exposed to retail competition → final consumers can leave
- Contract length with final consumers limited by law, or consumer preferences / credibility

Final consumers (Industry)
- Have future sales that is usually limited to few years
- Especially energy-intensive industries: yearly energy OPEX exceed CAPEX

Off-takers re-financing cost increase if signing long-term contracts

- Long-term contracts are evaluated as imputed debt
  - If a company signs a long-term contract, it has an obligation (debt) to pay
  - Also if it cannot pass on costs!
- → The increase in the (imputed) debt-equity ratio, leads to a lower credit rating
- Long-term contracts increase off-takers financing cost (Fig 2)- and the higher the debt-equity ratio, the stronger the impact

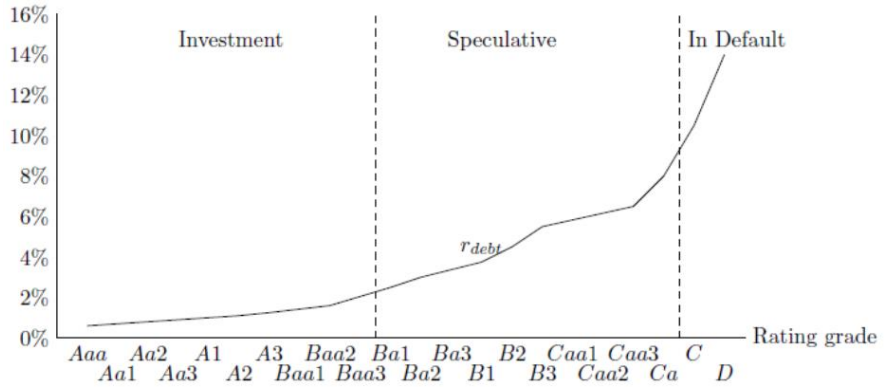


Fig 1 - Relationship of rating grade on Cost of Debt

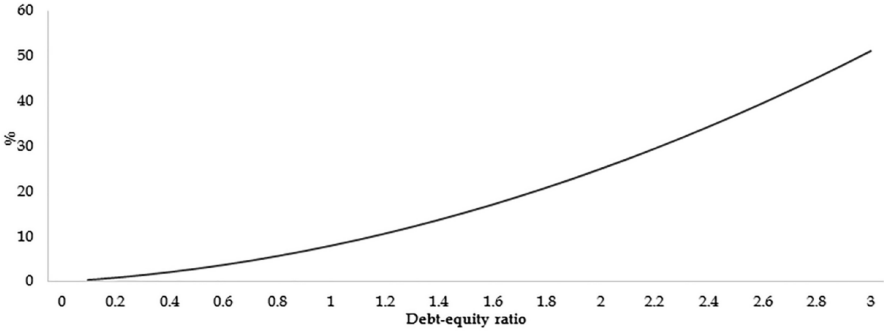
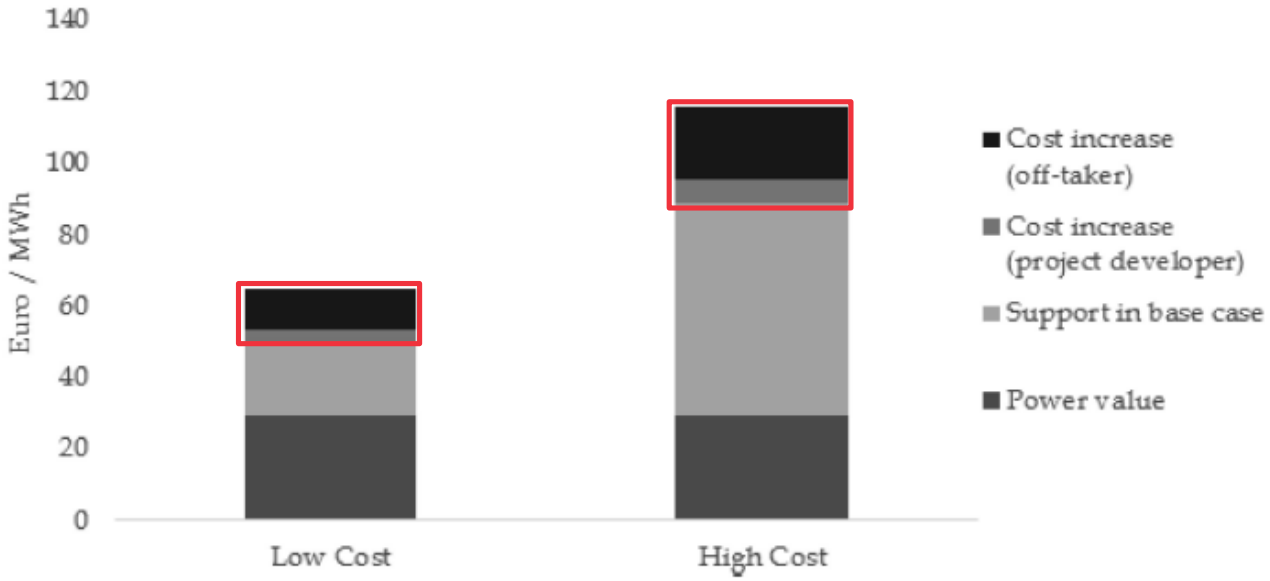


Fig 2 - Extra re-financing costs for private off-takers as share of contract value

Based on May&Neuhoff, 2021

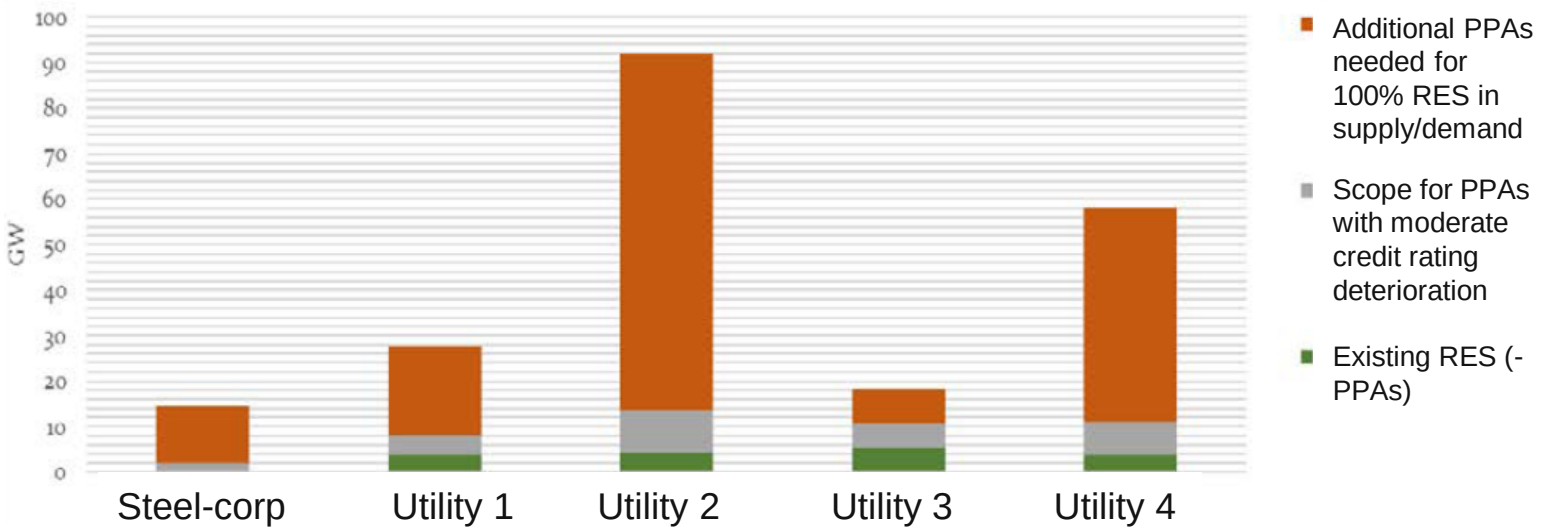
Off-takers re-financing cost increase if signing long-term contracts



- Taken the effect of cost increases into account, exposure to market risks and regulatory risks increase cost by around 29% (assuming D-E ratio of 1.85)
  - → Offtakers will only sign contracts if expected power market prices are higher than their debt cost increase
- This is in line with the stand-alone risk calculations for RES projects exposed to power market risks
- And in-line with estimates by commercial experts of around 30% (Aurora Energy Research, 2018 & Arup, 2018)

Based on May&Neuhoff, 2021

What is the scope for PPAs to meet 100% renewable targets?



Scope for biggest 4 German utilities, and one steel corporation (shifting to Green H2) to sign PPAs without strong increases in credit costs is limited

PPAs are counted 50% towards imputed debt, PPAs are 1/3 Wind Onshore, Offshore and Solar, Debt-equity ratio increase is limited to 0.5, Steel demand based on green electrolysis

Based on May & Neuhoff, 2019

The case for continued and reformed renewable tenders

Risks in the power sector are to a large part political risks (strong CO2 prices needed for decarbonisation, bidding zone reviews, electricity price breaks)

- Political uncertainty[1,2]
- → Incomplete (risk) markets[3,4] for CO_2 and electricity markets
- Renewables are exposed to price risks that incumbents are not, because they are price setting (CO_2, fuel price risks)
- →Transition risks until fossil fuels are not price setting

[1] Helm and Hepburn 2007, [2]Chiappinelli and Neuhoff 2020, [3] Newbery, Reiner, and Ritz 2019, [4] Greenwald and Stiglitz 1986, [5] Vogt-Schilb, Meunier, and Hallegatte 2018

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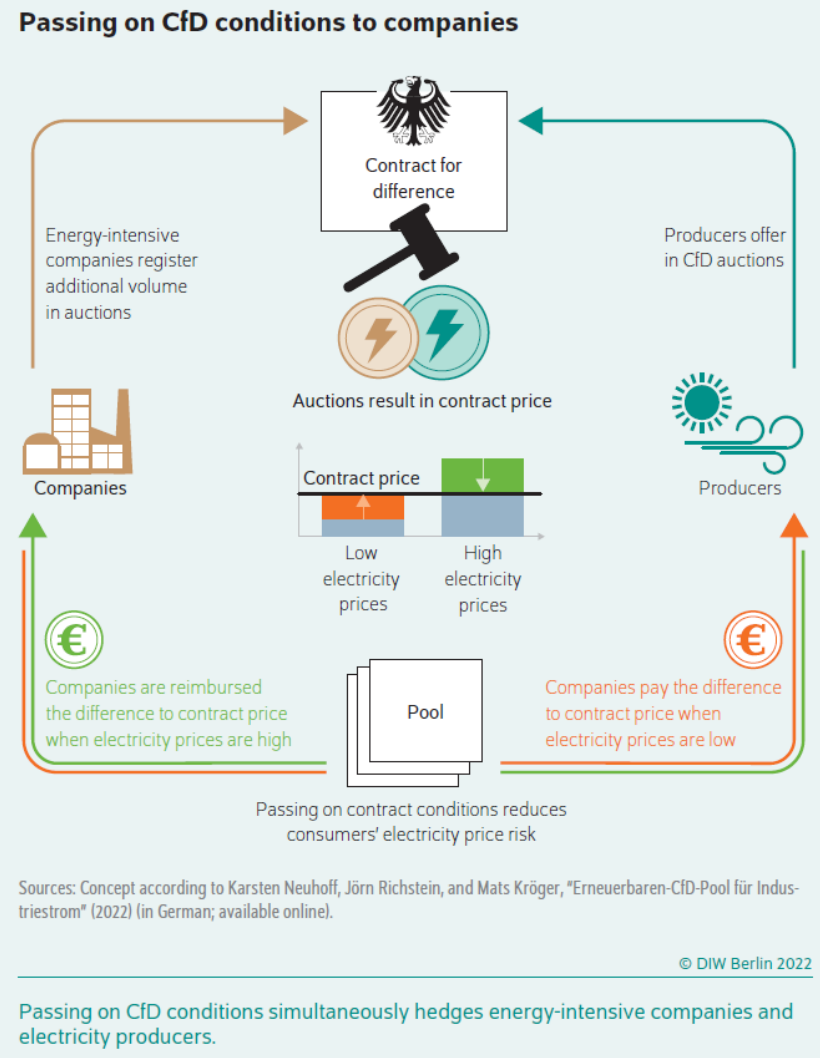
Proposal for renewable tender design



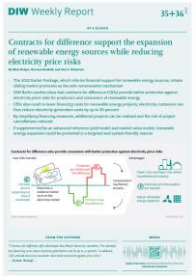
DIW-Proposal

- Governments tender CfDs and pass the conditions on to most electricity consumers (ideally preserving marginal incentives) → consumers are hedged against price risks (in UK CfDs are currently paying back)
- Large energy-intensive consumers can register additional volumes in auction – and are contractually hedged against the pool of renewables
- Limited exit conditions (e.g. for site closures) remove imputed debt as bankruptcy risks drop

Conclusions

- Continued government-backed renewable tenders are needed, as PPAs alone cannot achieve renewable and climate targets
- To reduce renewable and financing costs, and ensure a stable expansion of renewables, tenders should be changed to a CfD design
- CfD conditions should be passed on to final consumers to hedge them against power price risks
- Larger energy-intensive consumers should register their additional demand in these CfD auctions – with exit options (e.g. for site closures) to address the otherwise imputed debt effect of PPAs

References



- **Neuhoff, Karsten, Nils May, and Jörn C. Richstein. 2022. "Financing Renewables in the Age of Falling Technology Costs." Resource and Energy Economics 70 (November): 101330. https://doi.org/10.1016/j.reseneeco.2022.101330. (Basis of presentation)**
- **May, Nils, and Karsten Neuhoff. 2021. "Financing Power: Impacts of Energy Policies in Changing Regulatory Environments." *The Energy Journal* 42 (4). https://doi.org/10.5547/01956574.42.4.nmay. (Basis of presentation)**
- **May, Nils, and Karsten Neuhoff. 2019. "Private Langfristige Stromabnahmeverträge (PPAs) Für Erneuerbare Energien: Kein Ersatz Für Öffentliche Ausschreibungen." DIW Aktuell Nr. 22.**
- **Kröger, Mats, Karsten Neuhoff, and Jörn C. Richstein. 2022. "Contracts for Difference Support the Expansion of Renewable Energy Sources While Reducing Electricity Price Risks." DIW Weekly Report Nr. 35+36. https://www.diw.de/de/diw_01.c.852065.de/publikationen/weekly_reports/2022_35_1/contracts_for_difference_support_the_expansion_of_renewable_energy_sources_while_reducing_electricity_price_risks.html**
- ARUP. (2018, November). Cost of Capital Benefits of Revenue Stabilisation via a Contract for Difference, https://www.arup.com/-/media/arup/files/publications/o/onshore-wind-cost-of-capital-report.pdf+&cd=1&hl=en&ct=clnk&gl=nl
- Aurora Energy Research. 2018. Erneuerbaren-Markt ohne Subventionen bringt neue Risiken. Tagesspiegel Background Standpunkt.
- Chiappinelli, Olga, and Karsten Neuhoff. 2020. "Time-Consistent Carbon Pricing: The Role of Carbon Contracts for Differences." SSRN Scholarly Paper ID 3576402. Rochester, NY: Social Science Research Network. https://doi.org/10.2139/ssrn.3576402.
- Greenwald, Bruce C., and Joseph E. Stiglitz. 1986. "Externalities in Economies with Imperfect Information and Incomplete Markets." The Quarterly Journal of Economics 101 (2): 229–64. https://doi.org/10.2307/1891114.
- Helm, Dieter, and Cameron Hepburn. 2007. "Carbon Contracts." In The New Energy Paradigm, edited by Dieter Helm. Oxford, New York: Oxford University Press.
- Newbery, David M, David M Reiner, and Robert A Ritz. 2019. "The Political Economy of a Carbon Price Floor for Power Generation." The Energy Journal 40 (1).
- Vogt-Schilb, Adrien, Guy Meunier, and Stéphane Hallegatte. 2018. "When Starting with the Most Expensive Option Makes Sense: Optimal Timing, Cost and Sectoral Allocation of Abatement Investment." Journal of Environmental Economics and Management 88 (March): 210–33. https://doi.org/10.1016/j.jeem.2017.12.001.

Vielen Dank für Ihre Aufmerksamkeit.

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