

Outlook on renewables in Poland: CfD and merchant opportunities

Aurora Public Webinar

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Introducing Aurora's speakers



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I. Introduction

II. Deep dive into the Polish CfD system

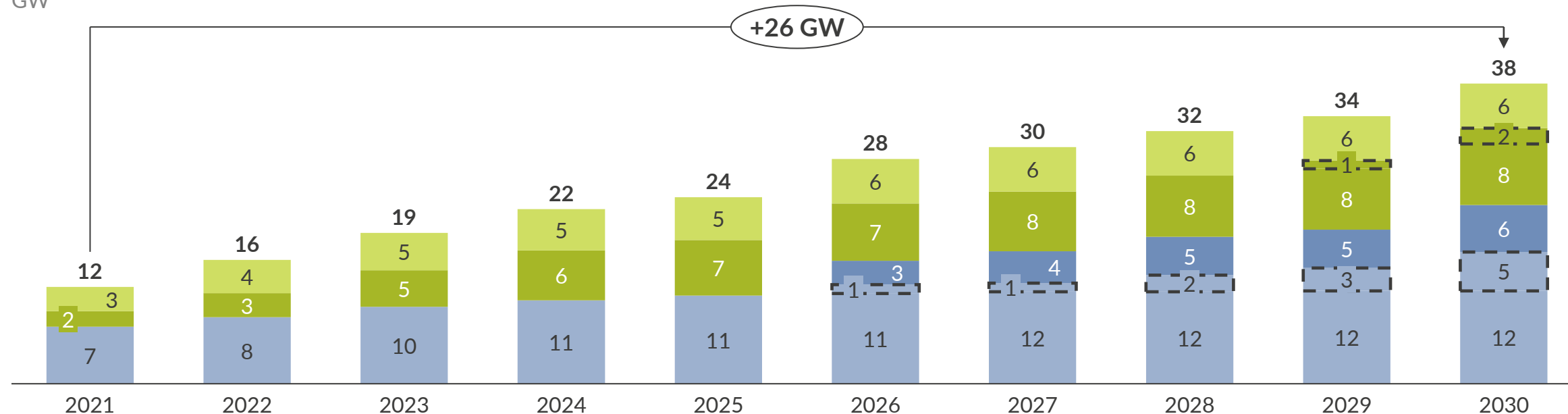
III. Optimising renewable investor returns

IV. Closing remarks

V. Q&A

We expect at least 26 GW of RES capacities to be constructed over the next decade, creating strong investment opportunities

Polish renewable capacity
GW



2021-25

- Poland's renewables auction scheme has procured some 4 GW of onshore wind and 6 GW of solar since the first auction in 2016
- Only 4 GW of this has so far been commissioned. The rest is still yet to be constructed, creating strong ongoing demand for financing
- Additionally, partial merchant exposure of auctioned projects means they have stimulated investment in around 3 GW of additional capacity

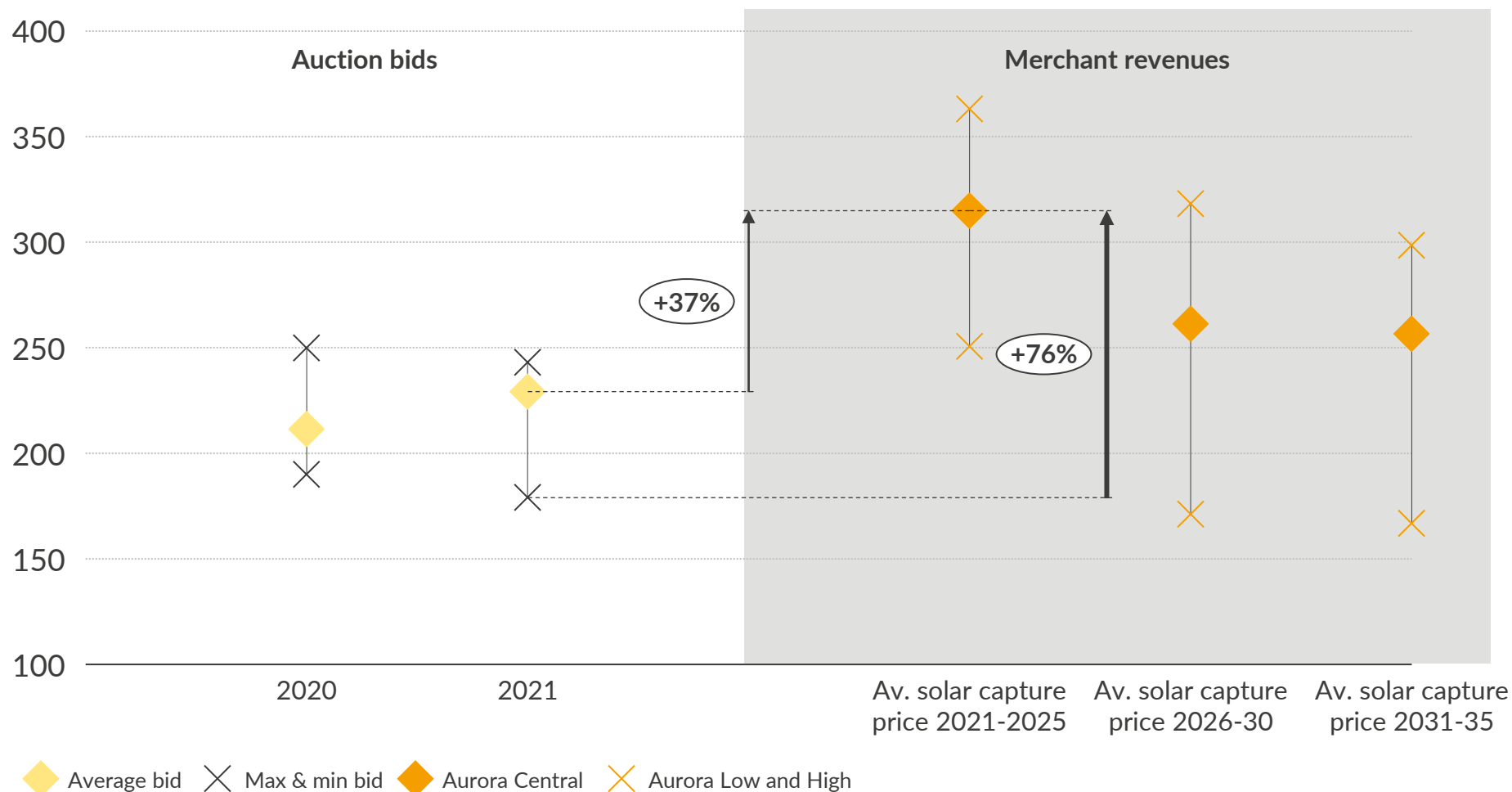
2026-30

- Looking forward, we forecast an additional 3 GW of solar and 4 GW of onshore wind to be commissioned on a merchant or PPA-backed basis in the second half of the decade
- Auctions in 2022-7 will have a budget of EUR 9.4 bn, Ministry of Climate expects to procure 9 GW of additional capacities, but this could be higher given small onshore pipeline and partial merchant exposure.

 Rooftop solar
  Merchant solar
  Subsidised utility solar
  Offshore wind
  Merchant onshore wind
  Subsidised onshore wind

Merchant exposure can allow investors to benefit from high prices, but auctions are seen as a more stable revenue stream

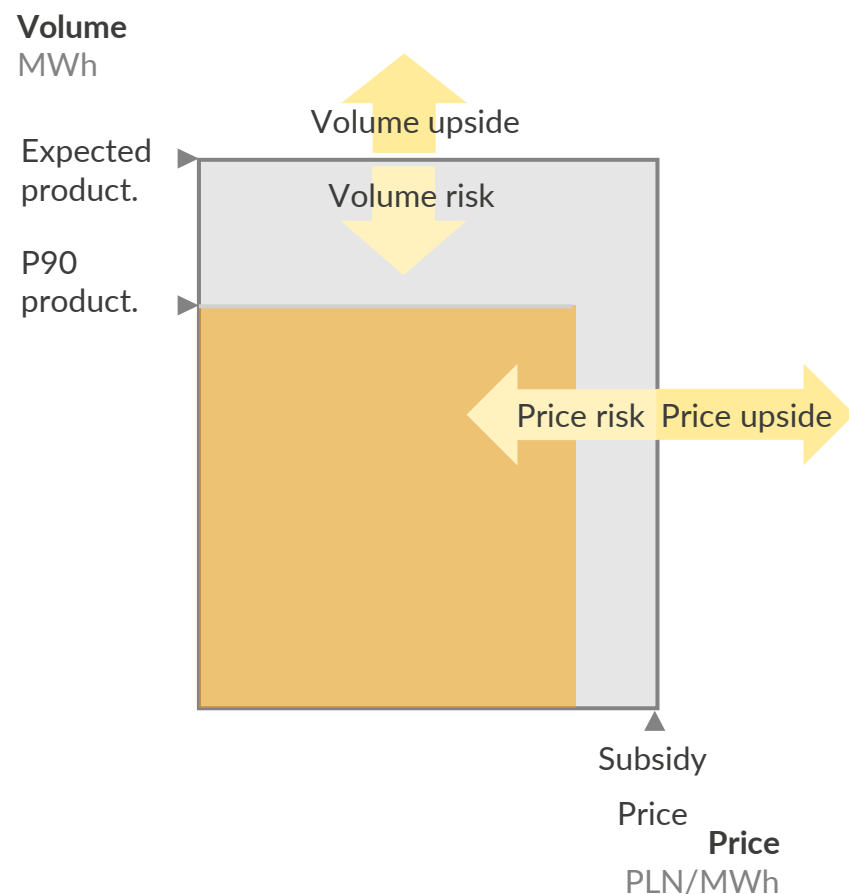
RES large bucket auction results and solar capture prices, PLN/MWh (real 2020)



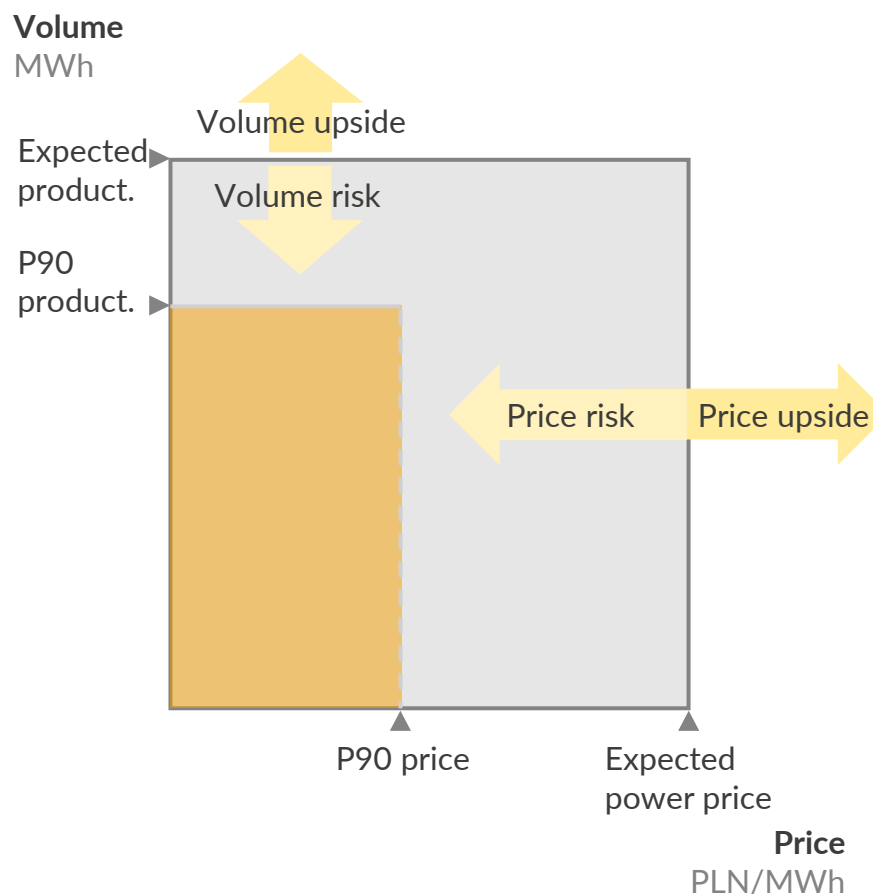
- The average successful auction bid level rose for 2021, in part due to the small size of the remaining pipeline of onshore wind projects
- However, bid levels remain well below wholesale market prices for all cleared projects. The difference is especially large during the first five years
- The recently announced budgets for the 2022-7 RES auctions is much lower on a per annum basis than historical auctions, which will cause downward pressure on prices
- Developers are increasingly facing a dilemma between bankable CfD contracts and a merchant market which offers much higher revenues

The added complexity of the Polish system means that price risk needs to be understood for both merchant and subsidized assets

CfD-supported asset



Fully merchant asset



- Perfectly subsidized projects face downside risk only for generation. However, the structure of the Polish CfD means that an element of price risk also remains
- Merchant exposure brings higher revenue expectations, but also increases the exposure to price risk. Both a central and low view on price development are needed to understand project economics
- Debt financing is typically assessed based on downside risk, so low scenario revenues determine debt size available to a project
- A central view informs equity return expectations, but a lower bound view is also necessary to inform investment risk

Expected Revenue (basis for equity return)
 Minimum Revenue (basis for debt financing)
 Known Lower Bound
 Unknown Lower Bound

CfDs can be combined with merchant exposure or short-tenor PPAs for a business model that captures high wholesale market prices

Fully hedged

Power Purchase Agreements

- Long-tenor PPAs allow projects to hedge prices without entering auction system
- Basic structures do not capture high short-term prices

CfD with full generation

- Provides hedged revenues and bankability
- High competition in auction results in low prices and lower returns

CfD with merchant share

- Auction legislation allows CfD to be combined with merchant exposure
- CfD provides necessary hedging while merchant flexibility allows high market prices to be captured

Focus of today's session

Full merchant project

- Face difficult debt financing conditions
- Can capture short-term prices and has favorable economics

Full market exposure

0 20 40 60 80 100
Generation share under CfD %

Key takaways

- Current market prices are significantly above CfD auction prices and they continue to remain more profitable over longer term horizon
- Going out of CfD system leaves two options:
 - PPA hedged revenues
 - Full merchant exposure
- Functioning outside CfD nevertheless is more difficult from debt financing perspective given limited PPA supply and market risk inherent in the full merchant exposure
- Construction of CfD allows for flexible generation schedule, allowing for CfD and merchant exposure combination

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Generation under CfD can be specified annually allowing for bespoke merchant exposure; settlement rules create upside potential and risks

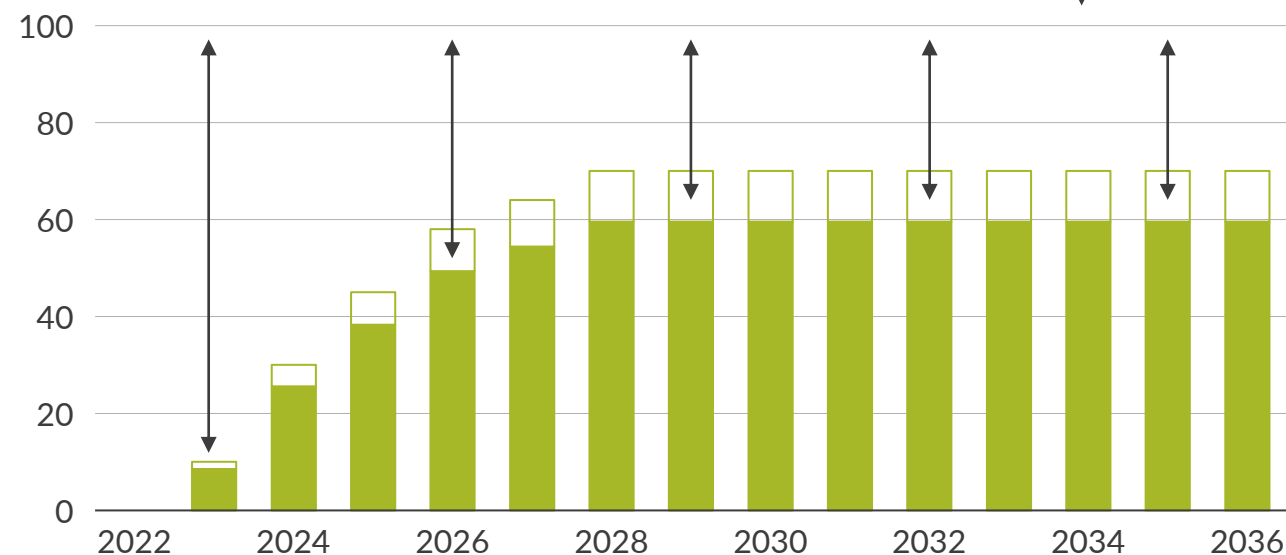
Exemplary auction bid

% of P50 generation

Possible underdelivery¹

Minimum delivery

Merchant exposure

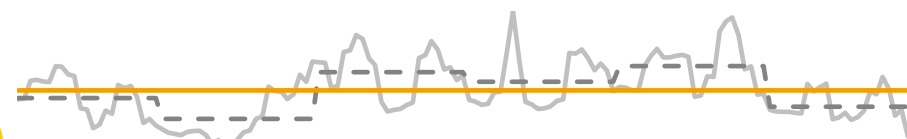


- CfD auctions are awarded for a certain **volume of generation for each year, rather than capacity**, which allows for flexible generation timeline below asset generation
- This enables market exposure, the extent of which can be varied on an annual basis allowing for **bespoke merchant exposure**.
- Moreover this also allows CfDs to be combined with PPAs of shorter tenor while preserving bankability

▪ **Subsidy settlement rules** due to their construction bring additional complexity

Profile risk remaining under CfD

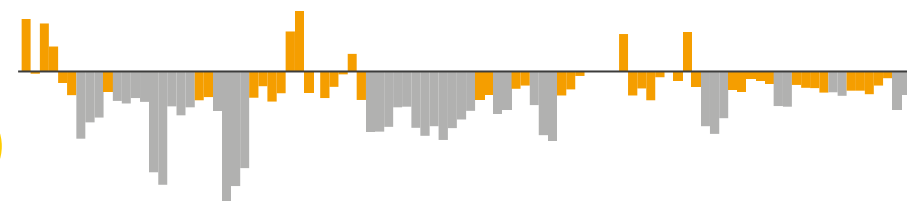
A



- Polish CfD scheme is based on the daily average market price, leaving intraday profile risk with the operator
- Hence, effective revenue under the CfD scheme will differ from strike price and will be dependant on technology

Monthly settlement allocation

B



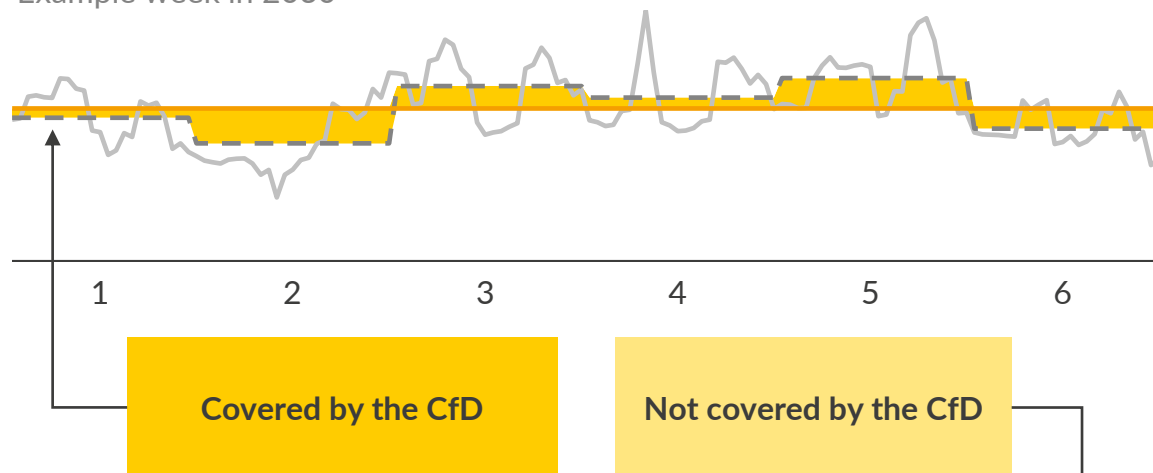
- Subsidy settlement is realised *ex post* at the end of a month, allowing to split generation between subsidy and merchant
- This creates revenue optimisation potential, which is dependent on chosen merchant exposure and risk appetite

1) There is an obligation to deliver at least 85% of bided volume, leaving additional 15% flexibly to be also used for merchant exposure on a 3 year rolling basis

A The Polish CfD protects from seasonal and daily price variations, but not from within-day price variations

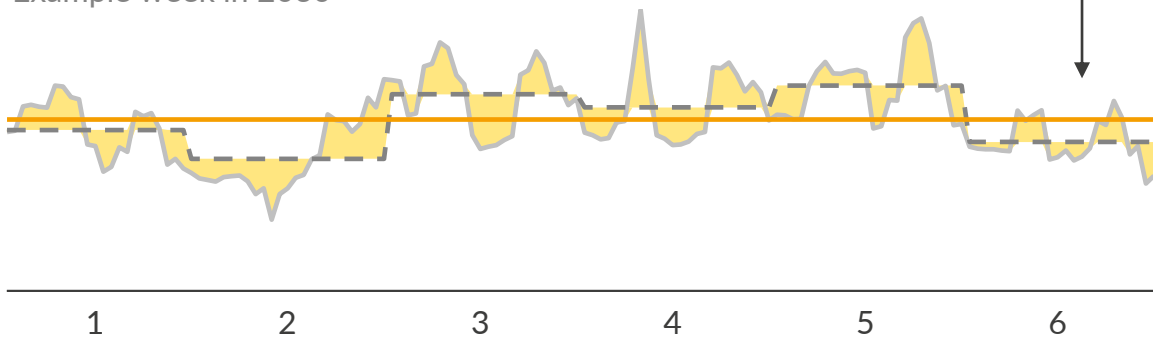
Risk from daily variation in wholesale price

Example week in 2030



Risk from intraday variation in wholesale price

Example week in 2030



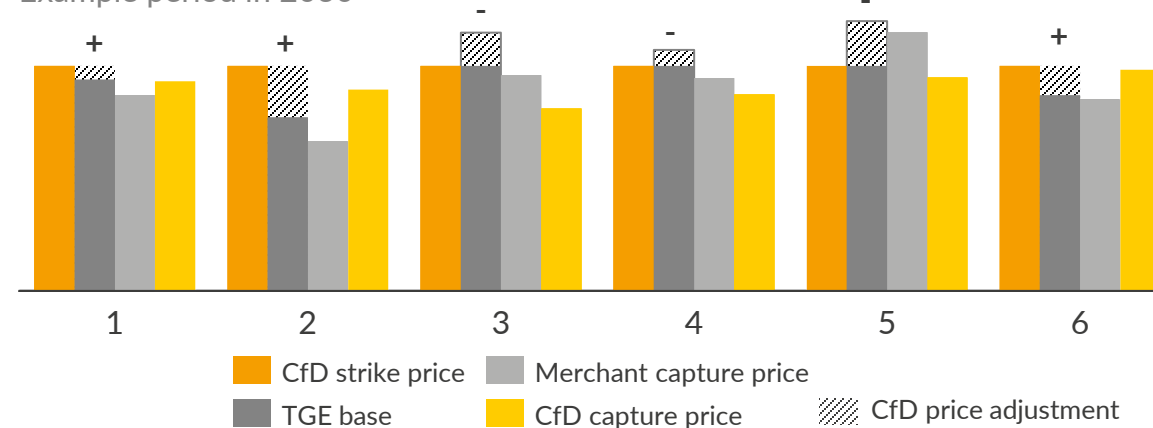
— Wholesale price - - TGE Base — CfD strike price

CfD payment is calculated on a daily basis

- CfD-backed assets are marketed through the wholesale market and their **daily capture price** is the average generation-weighted spot price.
- For every MWh remunerated through the CfD scheme on a given day, the generator receives or pays a fixed daily payment (**CfD price adjustment**) equal to the difference between the **CfD strike price** and the **TGE Base** index.
- While the CfD covers the difference between the **strike price** and **TGE Base**, it does not cover the difference between **TGE Base** and the **daily capture price**, leaving within-day cannibalisation risk with the asset operator
- The **CfD discount to the strike price** is the yearly generation-weighted average of the difference between the **daily merchant capture price** and the daily **TGE Base price** (*TGE Base is the time weighted average price in the day*)

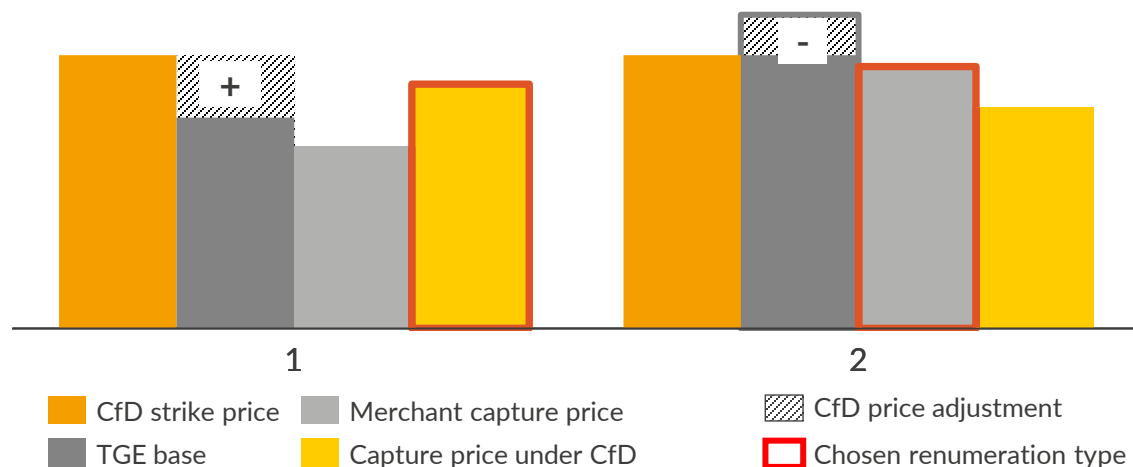
Average daily prices for a solar generator

Example period in 2030



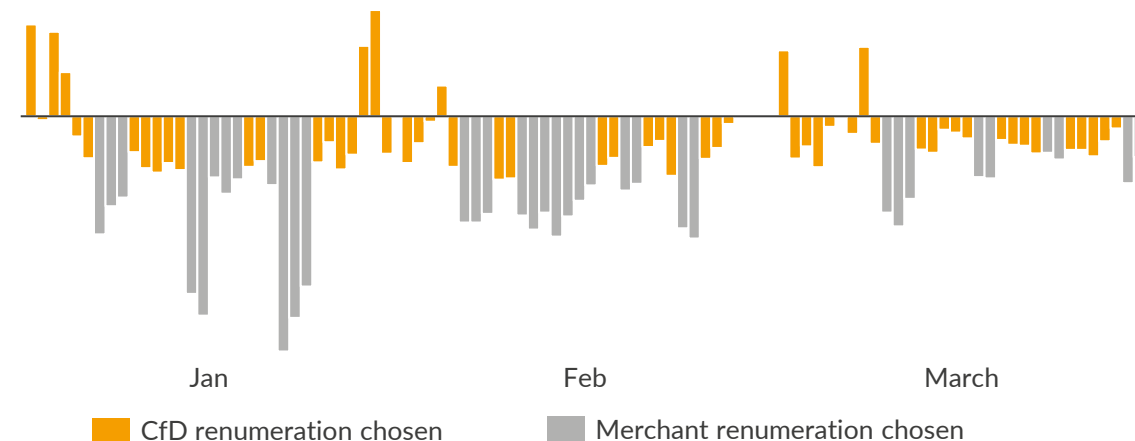
B Retrospective allocation of generation for CfD remuneration allows merchant exposure to be chosen on most valuable days

Example CfD reporting decisions
PLN/MWh (real 2020)



- At the end of each month, the operator must retrospectively report generation to the remunerating authority (URE)
- The operator must submit for each day of the month the **generation to be remunerated** on that day. The generation may be anything between zero and the actual generation of the asset
- The operator is therefore free to choose days where TGE Base is higher than the strike price for the merchant market, avoiding returning money to URE. Days in which the baseload price is low can benefit from CfD payments
- The operation limits the two-way nature of the CfD, with only the generation obligation acting as a limitation

Daily CfD capture price adjustment in example period in 2030
PLN/MWh (real 2020)

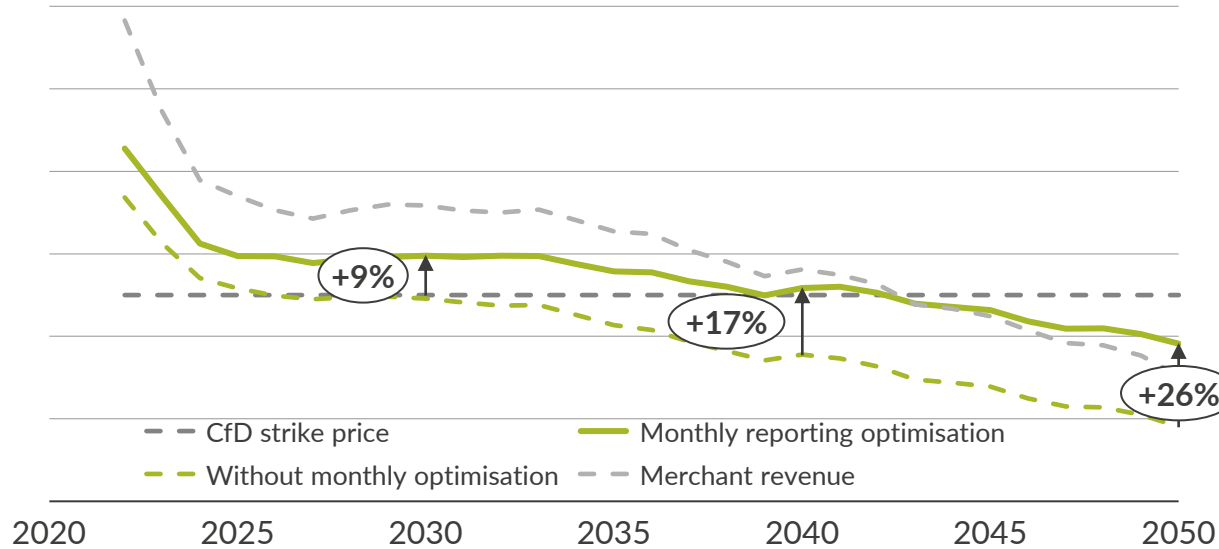


- Selecting the days where the CfD is most valuable allows the operator to avoid expensive repayments and maximises the value of the asset generation
- Reporting optimisation across months is theoretically possible but introduces risk as it moves away from retrospective selection. We calculate that sufficient daily price variability exists within a month to capture the majority of the revenue upside from reporting optimisation within a month only
- The selection of days is typically done by the trader marketing the asset
- Through our hourly price and generation forecasts, we can calculate a forecast for the additional value such reporting optimisation can bring. This creates a more accurate outlook for revenues available to an asset

B Reporting optimisation couples revenue streams and creates a significant upside to uncoupled revenue analysis

Solar revenue, 220 PLN/MWh strike price, flat 60% CfD share
PLN/MWh (real 2020)

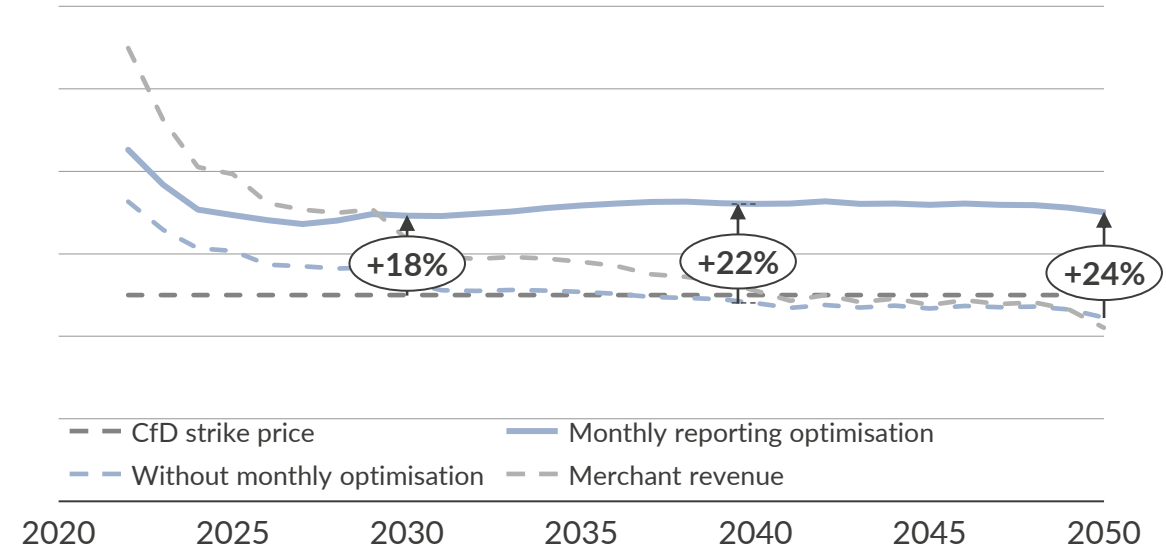
Central



- CfD optimisation avoids the return of positive balance on the most expensive days within any given month
- For the case of solar, this effect compensates for the significant profile discount which the CfD-backed component of revenue sees
- The upside is particularly large approaching 2050, when the solar profile is largest due to the buildout of merchant capacities. However, over the next ten years we still see an upside around 10 percent

Onshore revenue, 220 PLN/MWh strike price, flat 60% CfD share
PLN/MWh (real 2020)

Central

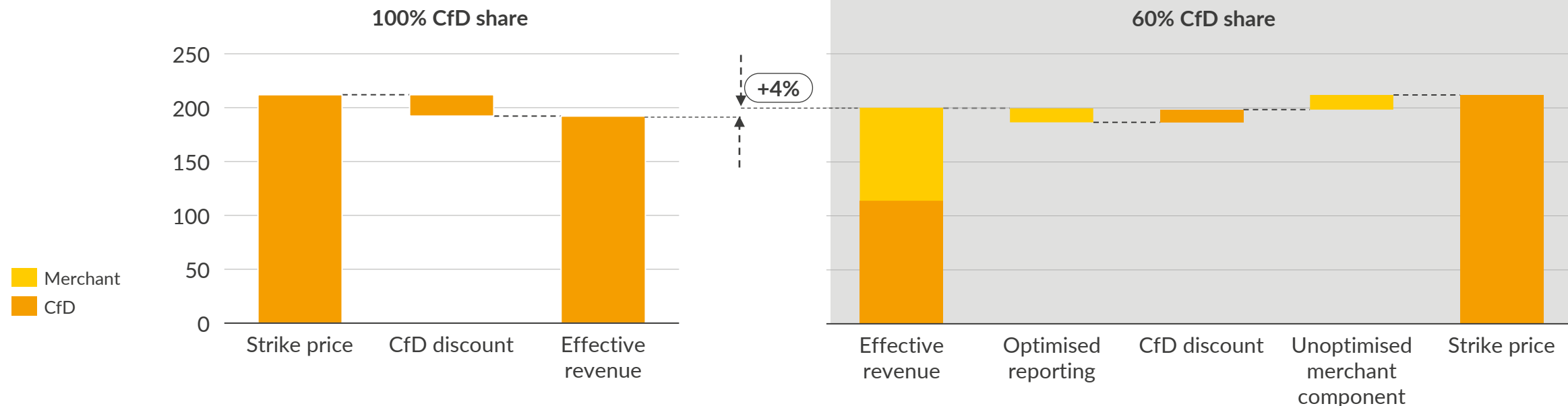


- Onshore wind sees a much lower profile risk within the CfD than solar, meaning it can expect higher revenues for the same strike price compared to solar – in both the optimised and unoptimised case
- A more consistent generation profile means onshore wind generates more than solar on the more expensive days and benefits more by avoiding return of positive balance through reporting optimisation
- Upside can reach 20 percent over the lifetime of current projects

Low

Even under a Low scenario, a high merchant share can offer a revenue upside compared to a fully CfD-backed project

Average annual solar revenue 2022-36, P90, 220 PLN/MWh strike price
kPLN/MW



Strike price

- We begin the comparison with the assumption that both projects receive exactly their strike price
- 220 PLN/MWh is an average strike price for recent auctions

Merchant component

- We compare the fully subsidised project to one with 40% of generation retaining merchant exposure each year
- In the Low case average solar capture price is below 220 PLN/MWh; this brings a downside

CfD discount

- CfD discount applies to the CfD-backed component of revenues
- This has a larger impact for an asset fully covered by the CfD since a larger component of generation is remunerated through the system

Optimised reporting

- Reporting optimisation requires flexibility of generation assignment, and so a merchant element
- An optimised asset with merchant exposure performs better under Low than a fully-subsidised asset

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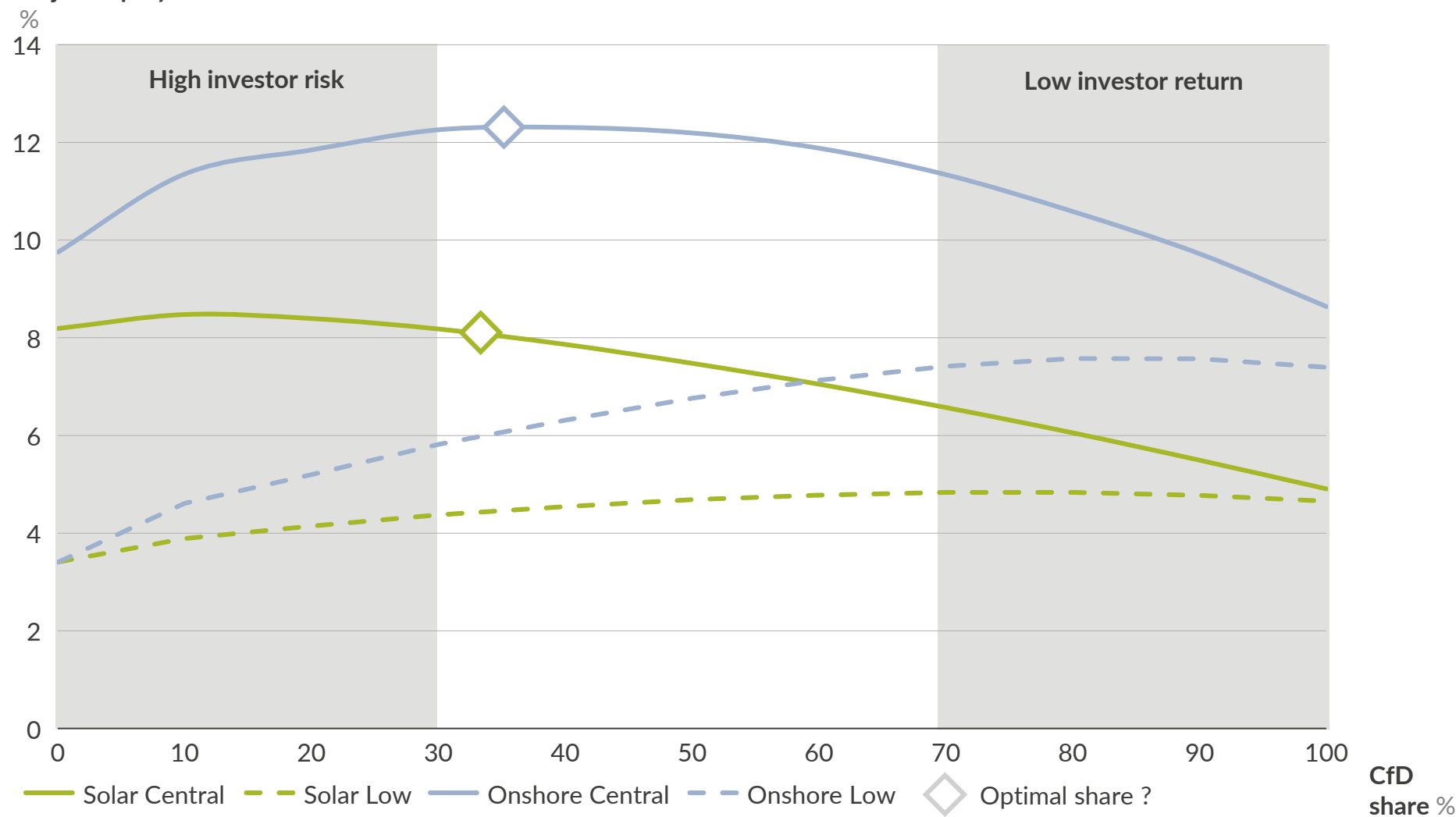
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Considering flat CfD timelines, high merchant exposure maximises project returns but also introduces additional risk for investors

Project equity IRR



1) For projects with 220 PLN/MWh strike price

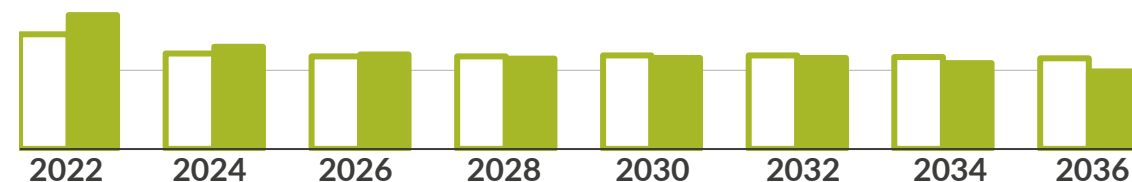
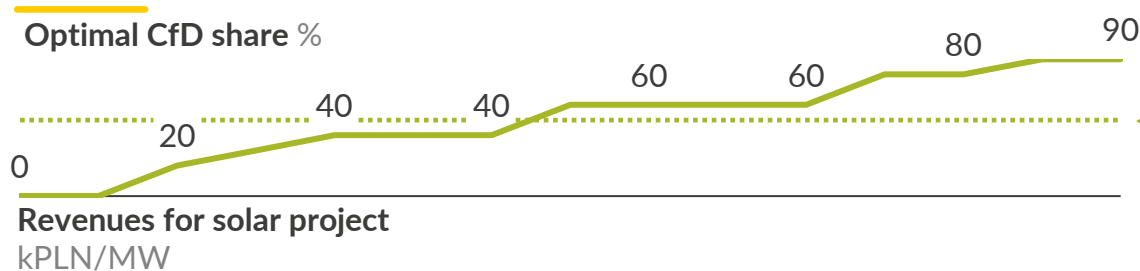
Solar typically sees optimal equity IRRs under high merchant exposure

- The size of profile risk remaining for solar under the CfD is comparable to that under a merchant formula, while strike prices are significantly below baseload
- However, highly merchant projects remain most exposed to downside risk

Onshore wind sees optimal IRRs for merchant shares around 40% of generation

- The significantly lower profile risk for onshore under the CfD, combined with the high value of optimal reporting, mean that mixed projects can outperform the revenues of fully merchant projects
- Downside scenario at 50-60% CfD coverage provides similar returns to fully subsidised projects

Shaping CfD timeline on an annual basis can maintain minimum hedging over project lifetime while maximising equity IRR



Equity IRR %



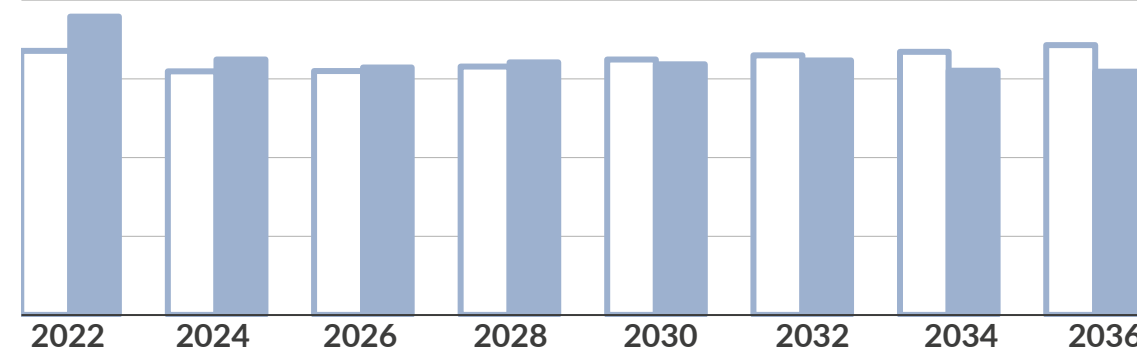
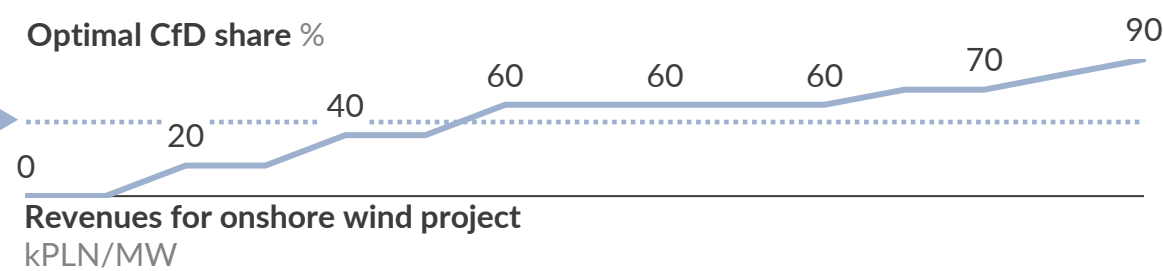
Both solar and onshore wind can benefit most from merchant nose structures

- CfD coverage is minimal in the first 5 years of the project, while the final part of the subsidy period is most strongly hedged
- Total revenues remain similar, but their timing is shifted by the CfD structure. Debt sizing also remains constant between two timelines

Central revenue - optimal Central revenue - flat

1) Projects with 220 PLN/MWh strike price

Source: Aurora Energy Research



Equity IRR %



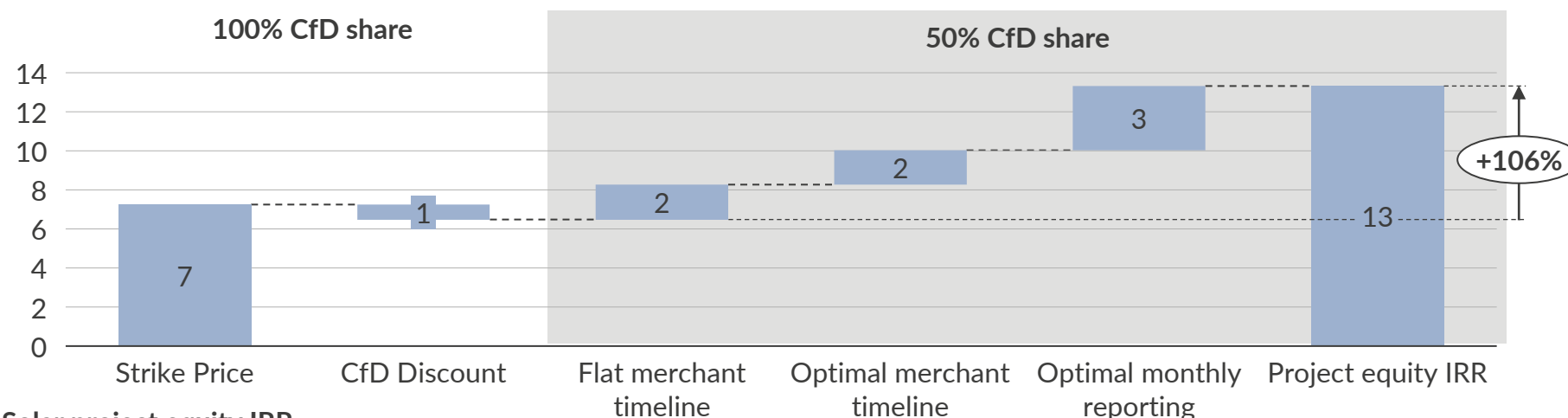
Merchant nose captures high short-term prices

- Renewables capture prices are highest in the short term due to high baseload prices and low existing buildout
- Maximising short-term merchant exposure also provides more immediate project returns on investment

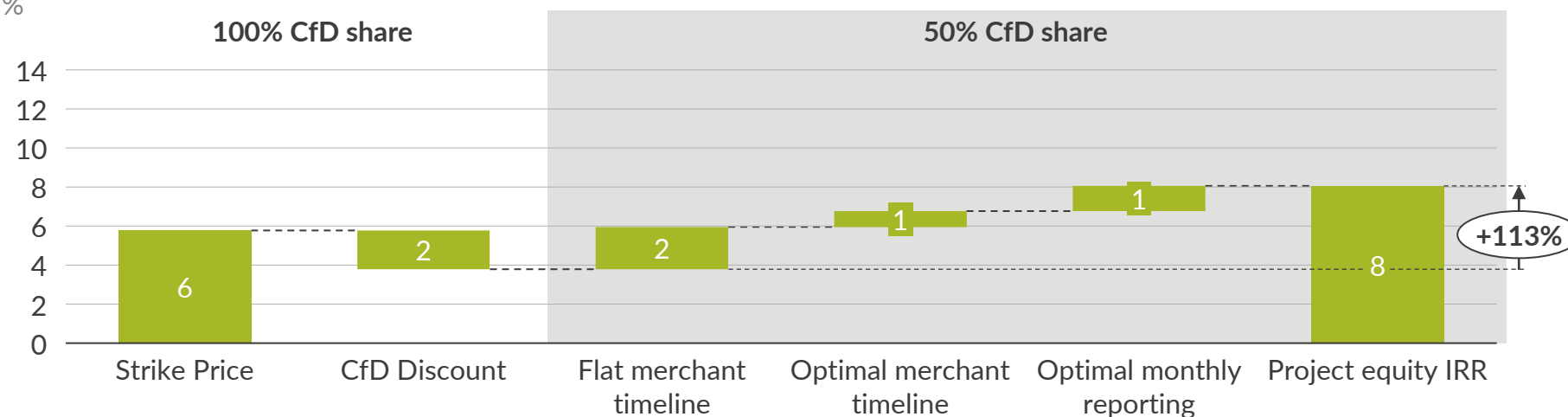
Central revenue - optimal Central revenue - flat

A 50% merchant share with optimal timeline and reporting improves equity IRRs by over 100% relative to fully-subsidised projects

Onshore wind project equity IRR
%



Solar project equity IRR
%



Both onshore wind and solar can double IRRs through optimisation

- The CfD system is less well suited to solar and leads to lower IRRs than for onshore
- The optimal level for merchant exposure is higher for solar than for onshore wind
- Selecting the optimal timeline for merchant exposure brings a large upside even if optimal monthly reporting is not considered
- Optimal reporting leads to a 19% IRR increase for solar and 33% for onshore wind
- Well-optimised merchant exposure can provide an equity IRR upside of over 100% compared to a fully-subsidised project

1) Projects with 220 PLN/MWh strike price, 2022 COD

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Key takeaways

1. The Polish CfD system leaves **within-day profile risk with the projects**, creating **significant long-term downside exposure especially for solar**
2. However, this **exposure can be mitigated through optimised monthly reporting** of projects with merchant generation shares; in the short and medium term, even a **substantial upside** compared to the CfD strike price can be generated in this way
3. **Optimal CfD share depend on CfD strike prices**, but are likely in the **30-50%** range from an equity return perspective
4. **Financing risks of high merchant shares can be mitigated by “frontloading”** merchant exposure and having higher shares of later revenues covered by the CfD,
5. **Full optimisation of all aspects of the Polish CfD** can **more than double equity returns** compared to full CfD coverage

Our Polish research agenda continues... get in touch if you have any questions or would like to discuss in detail



How does Aurora help you understand and mitigate your renewable portfolio risks?

Analytical rigour and objectivity



- Independence is hard-wired into our operation: our Power and Renewables forecasts give the balanced answer, not the convenient one
- Aurora's in-house expertise as Europe's largest dedicated wholesale power market analytics company sets us apart in the market

Software as a service Solutions



- With Aurora's Amun tool you can calculate site-specific capture price scenarios for your wind projects in a matter of minutes
- Have the Aurora model at your fingertips to run your own scenarios through Origin¹

Off the shelf

Auction projects optimisation



- Aurora can optimise CfD auction projects to maximise benefits from merchant exposure
- Analysis can be tailored to client specific needs from financing perspective and be taken into consideration project characteristics

Portfolio & debt optimisation



- Through Aurora's in-house model, we can quantify the compatibility and risk reduction of your assets (of interest) and stress test under different scenarios. Over the past year we have run several of such analyses for investors looking to acquire new assets or optimise their leverage

Client-specific analysis

Co-location



- Given Aurora's market-leading analysis on Hydrogen and the work we've done on hydrogen, we are well positioned to quantify your business case for co-location of your renewable asset

Transaction and Financial Due Diligence



- Aurora continues to be involved in renewables transactions either as a buy-side or sell-side market advisor to the majority of Europe's biggest players in this field
- In 2020 alone, we were involved in over 90 transactions

For questions, contact Anna Donczew-Salawa (anna.donczew-salawa@auroraer.com +49 30 166390531)

¹) Currently available in GB, available for continental Europe from Q2 2022 on.

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