

# PPAs in the Netherlands: Developments in an Emerging PPA Market

Public Report



# Aurora provides market leading forecasts & data-driven intelligence for the global energy transition

A U R  R A

Power markets



Renewables



Storage



Electric vehicles



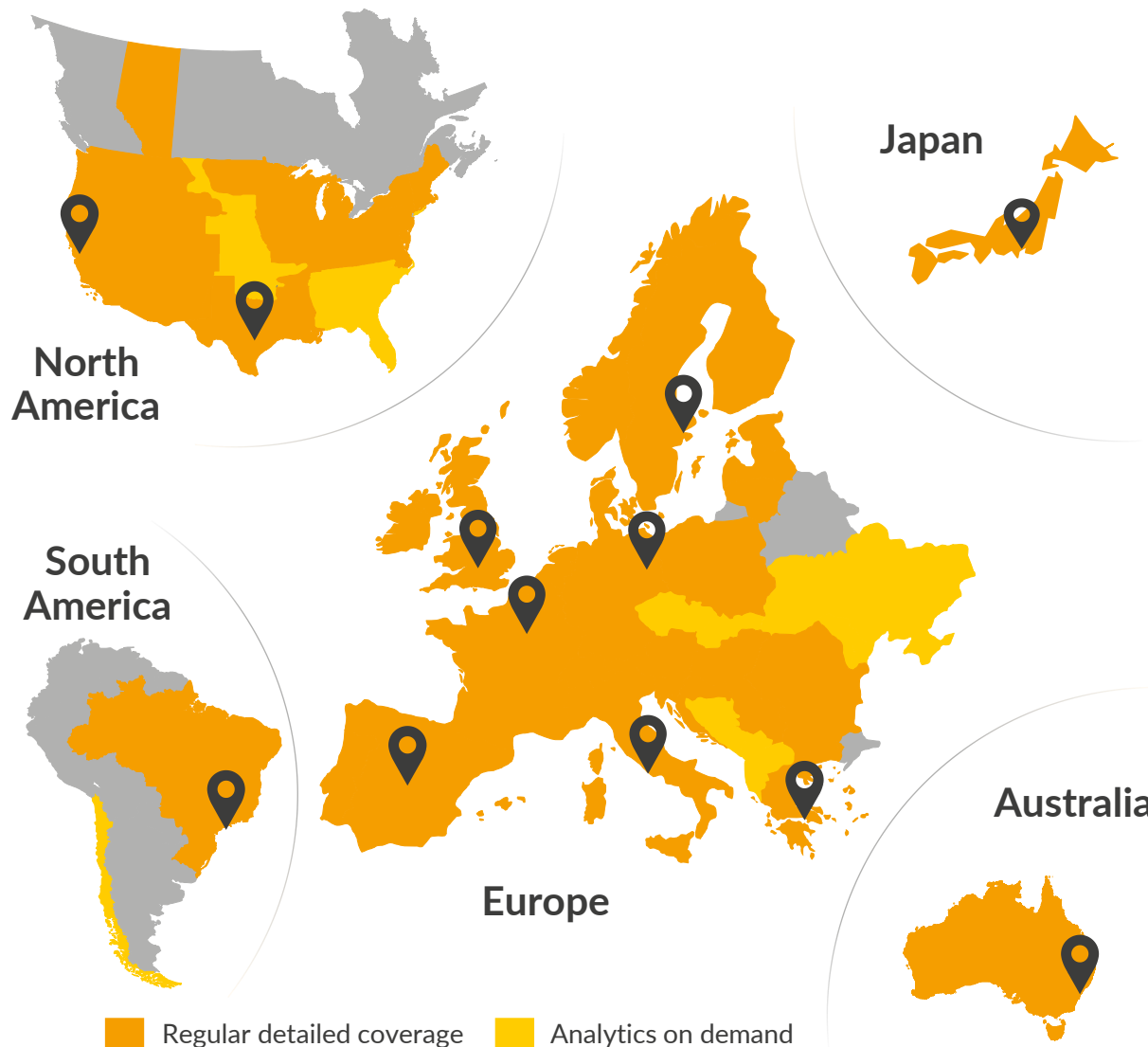
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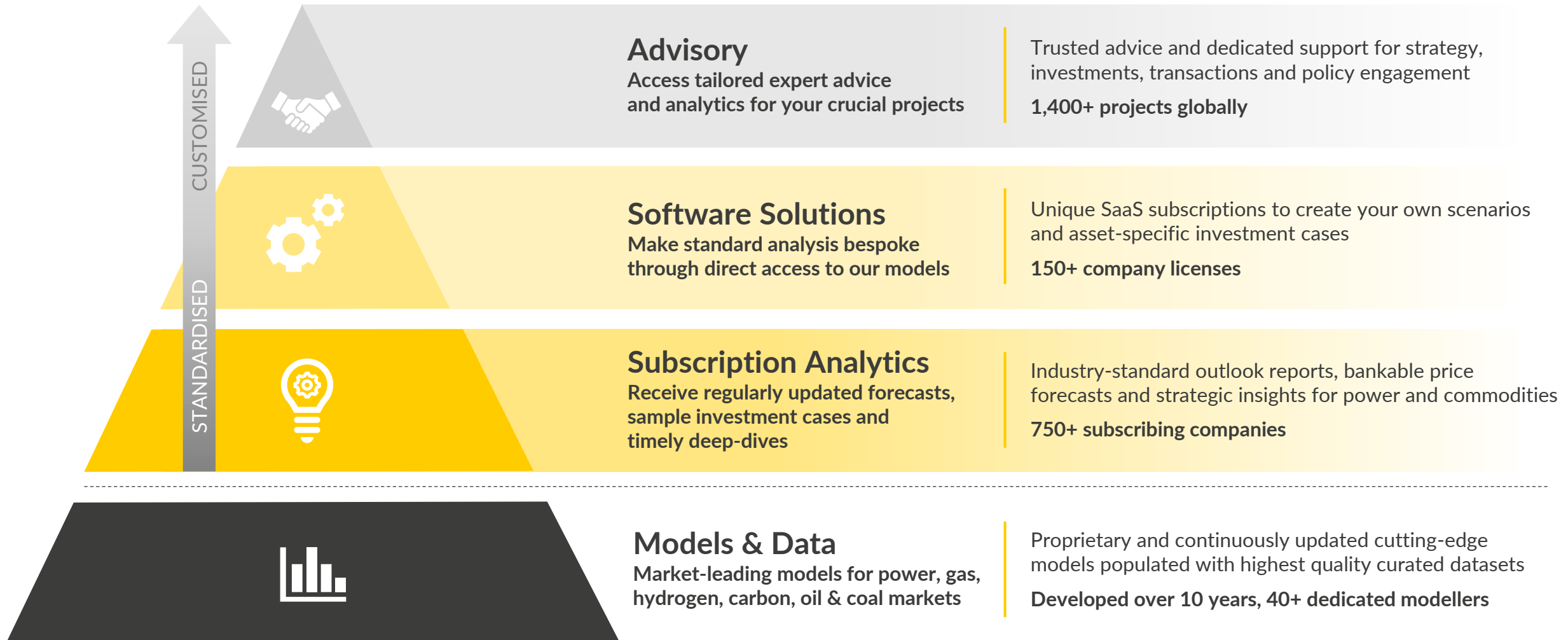


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"With its capabilities, intellect and with its credibility Aurora plays an essential role bringing the dialogue [in the global energy transition] to a different plane"

Ben van Beurden, CEO, Shell



"Aurora analysis and the provision of reliance was crucial for our debt funding. Their ability to explain market logics and revenue streams was vital for this successful financing."

Jeremy Taylor, Director, Green Frog Power



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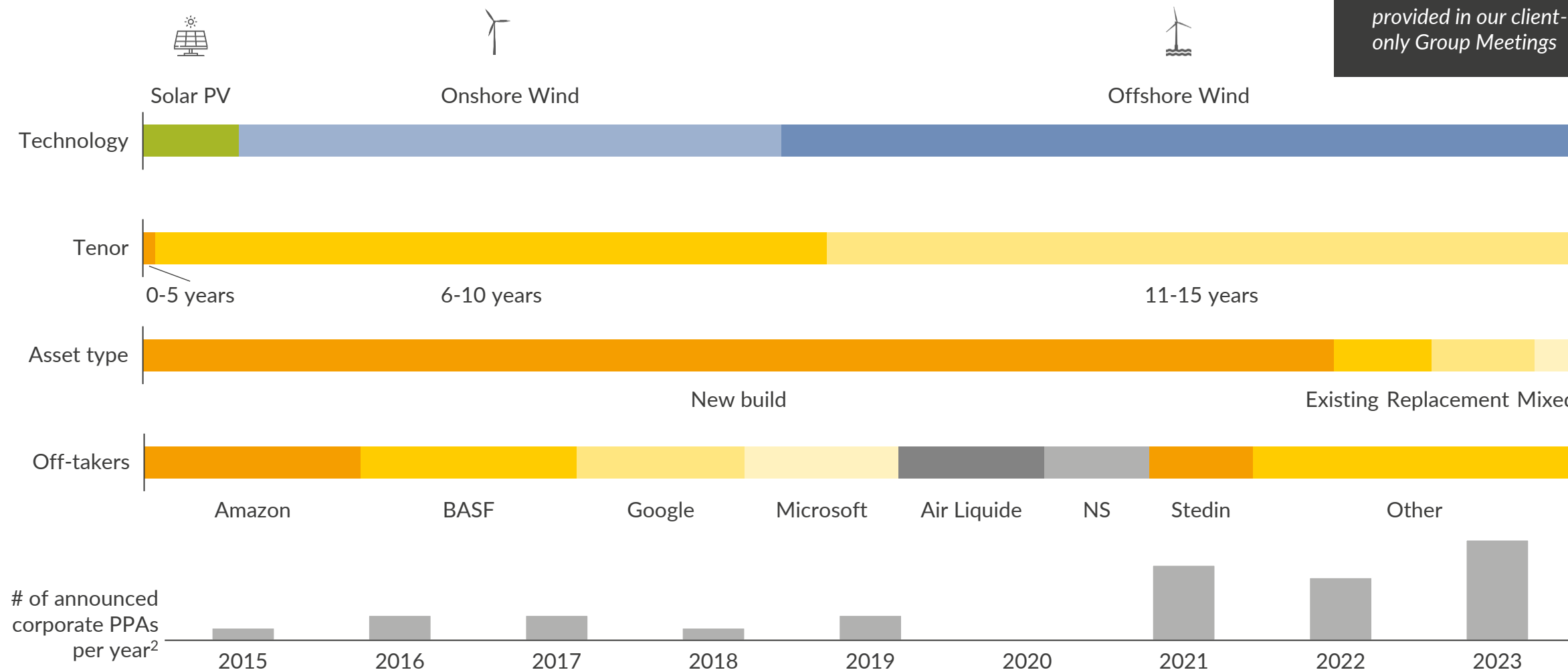
## Policy & regulation



- I. Introduction
- II. Aurora's outlook on the Dutch PPA market
- III. Pricing Dutch PPAs and financing renewables with PPAs
- IV. Key takeaways and conclusions

# The Dutch PPA market is dominated by offshore wind, driven by the large volumes of merchant parks coming online in the next years

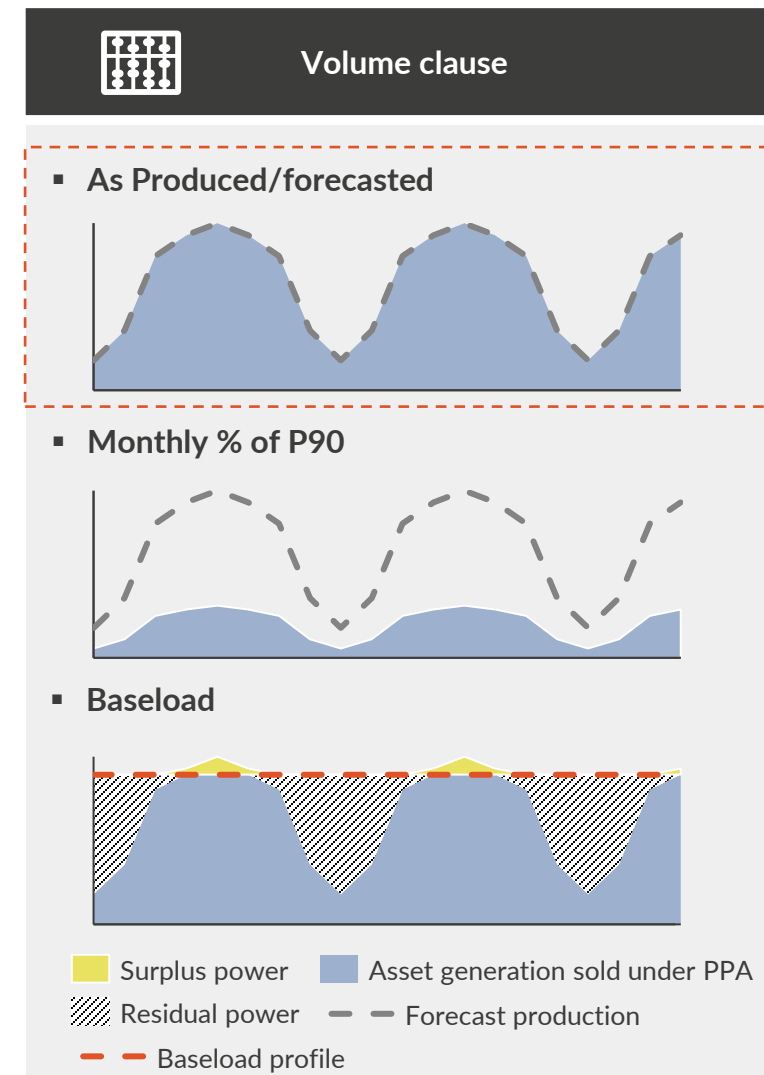
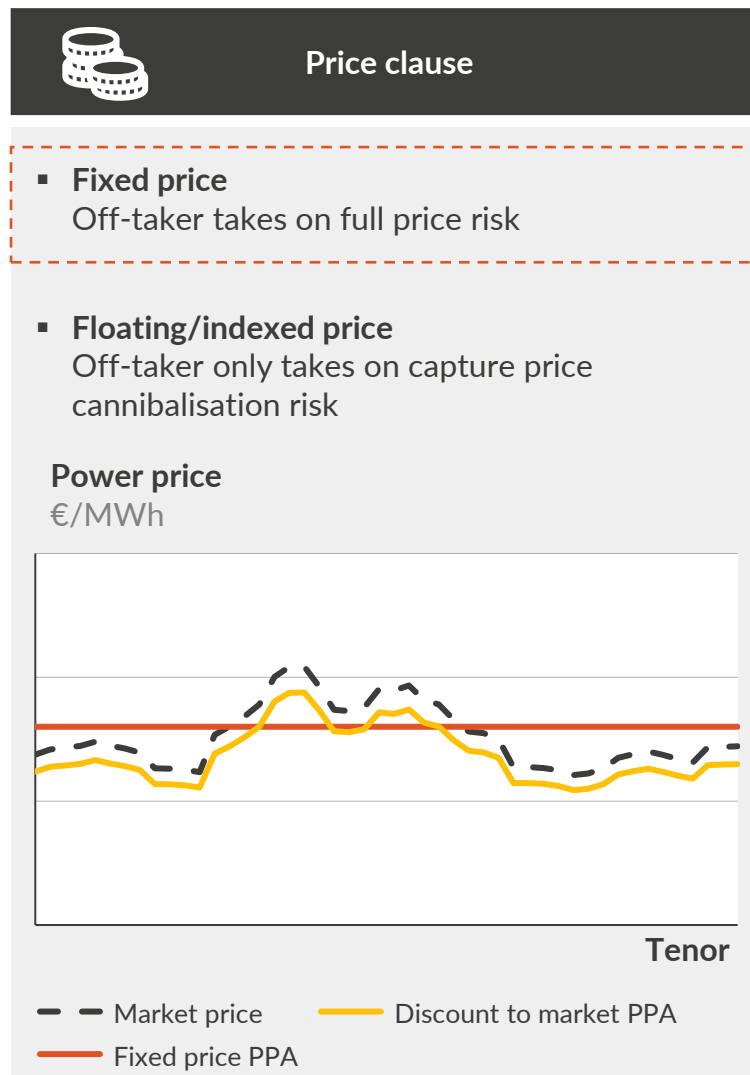
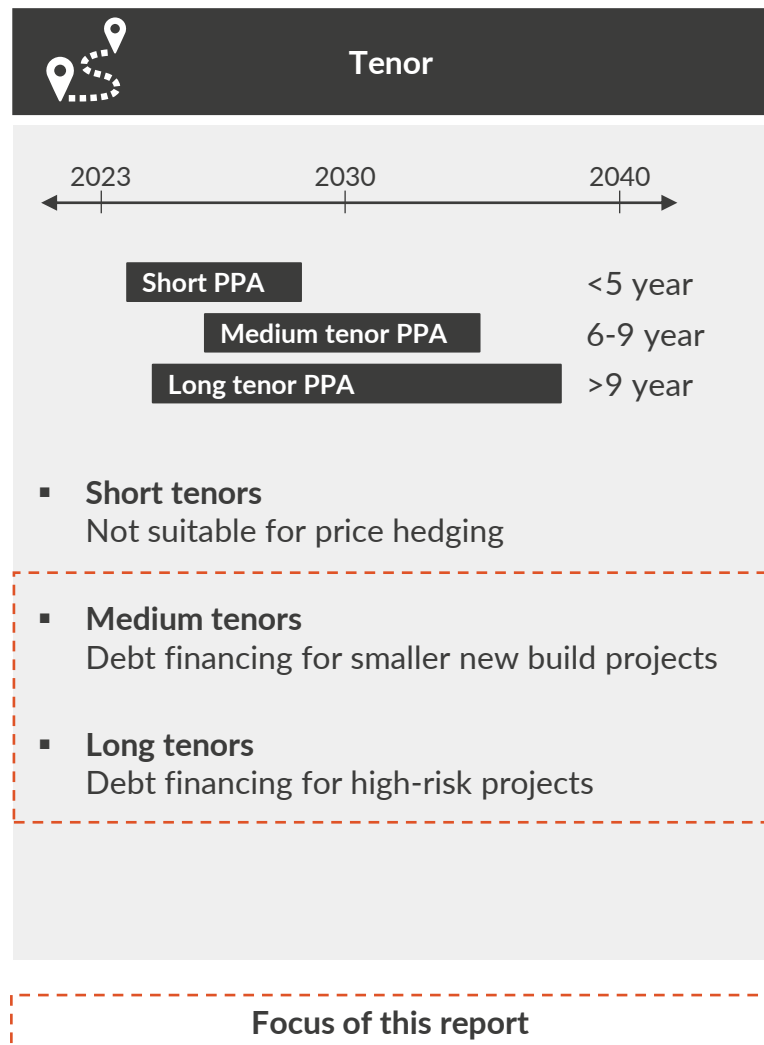
Announced corporate PPAs in the Netherlands 2014-2023<sup>1</sup> weighted by capacity



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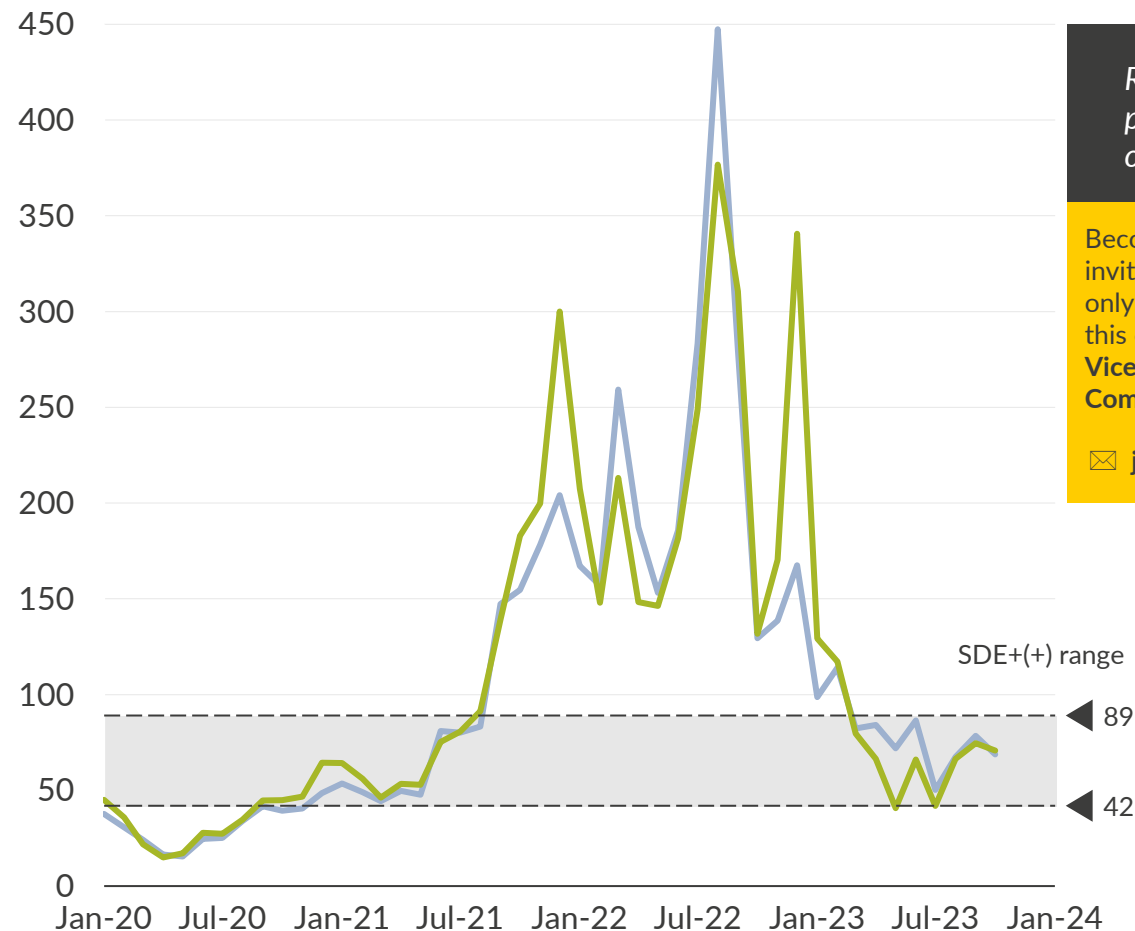
1) Based on the Dutch PPAs in our PPA database containing publicly announced PPAs in Europe; 2) PPAs clustered by announcement date

# Renewable PPAs vary in length, price and volume; in this report, we focus on longer term, fixed-price, pay-as-produced PPAs

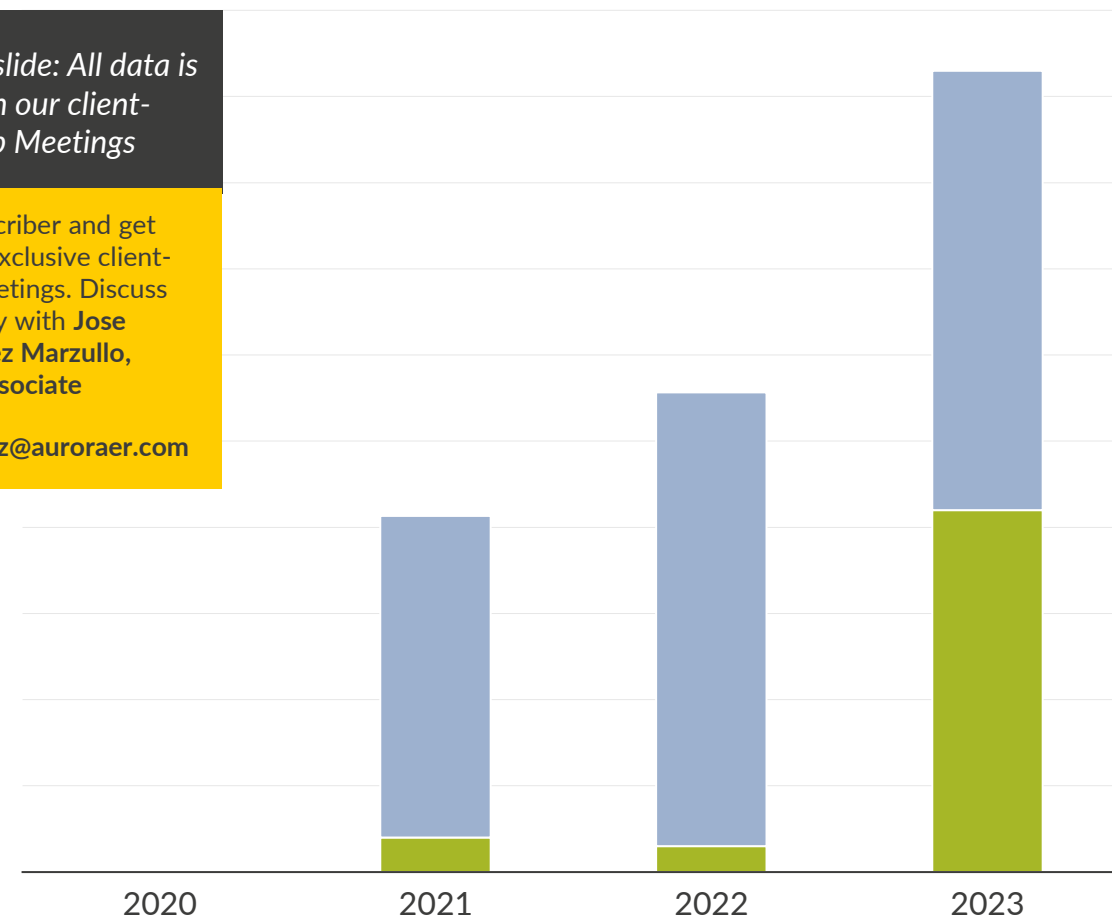


# For onshore wind and solar, the SDE subsidy reduces the need for fixed-price PPAs, but record high power prices since 2021 increased PPA liquidity

Historic capture prices compared to typical SDE+(+) price levels<sup>1</sup>  
€/MWh (real 2022)



Announced corporate PPAs in the Netherlands by date of announcement<sup>2</sup>  
MW



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✉ [jose.ramirez@auroraer.com](mailto:jose.ramirez@auroraer.com)

■ Onshore wind ■ Solar PV

1) P10 and P90 of SDE+(+) levels from 2020-2022 across all onshore wind and solar PV projects. It can be noted that SDE+(+) levels have decreased in recent years – especially when considering them in real terms; 2) Based on the Dutch PPAs in our PPA database containing publicly announced PPAs in Europe

Sources: Aurora Energy Research, Energeia, IJGlobal, RvO

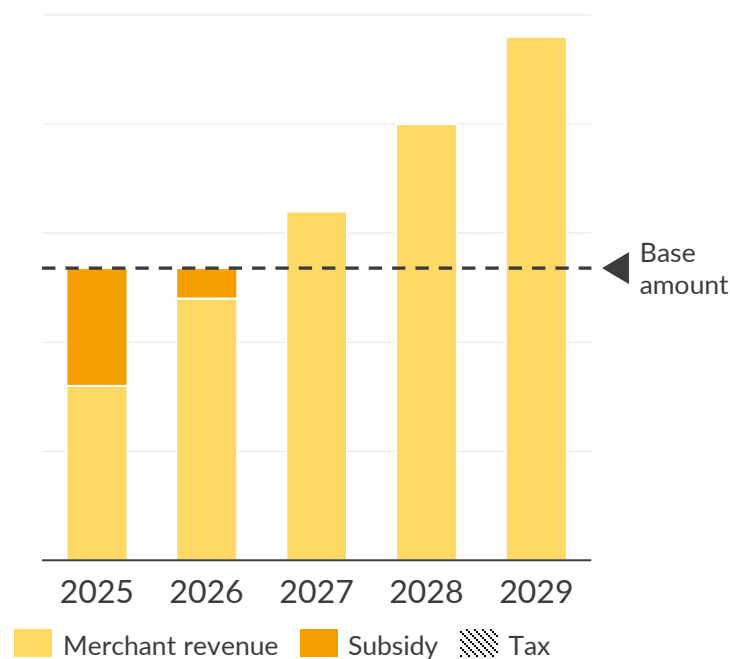


# The planned phase out of the SDE++, by 2025 the latest, brings additional interest in PPAs for onshore renewables

## Current subsidy: SDE++

- Projects receive the subsidy if the market value is below the base amount
- The SDE++ allows projects to sign a PPA

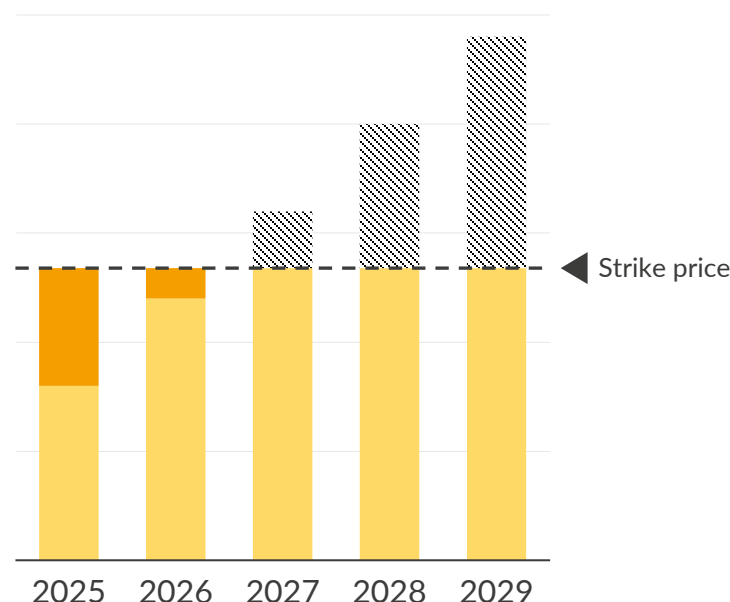
Illustrative: revenue under SDE++  
€/MWh



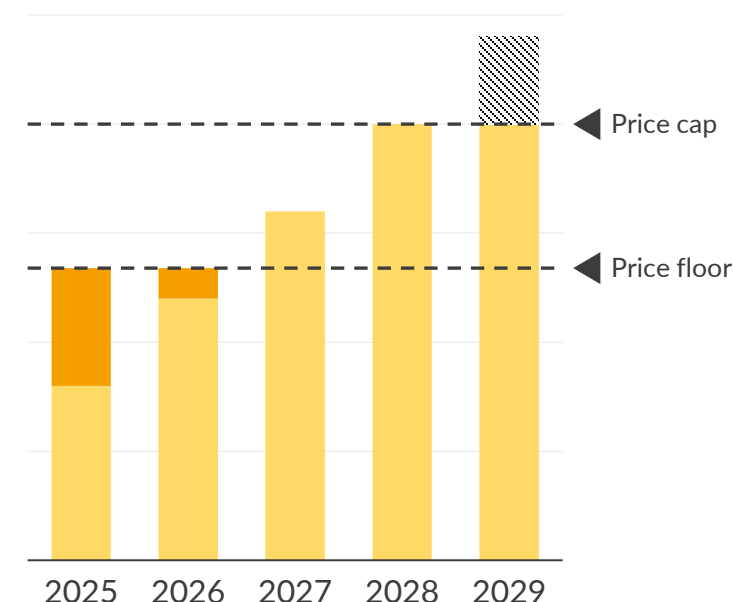
## Proposed subsidy: 2-sided Contract for Difference (CfD)

- As the SDE++ but revenues above the strike price are taxed away
- No incentive to sign a PPA
- A bandwidth CfD has a different price cap and floor
- Projects could sign a PPA above the price floor

Illustrative: revenue under 2-sided CfD  
€/MWh



Illustrative: rev. under 2-sided CfD with bandwidth  
€/MWh

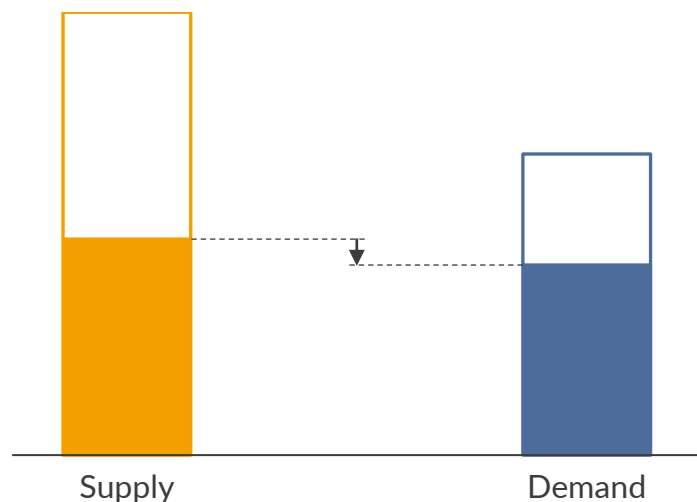


# Our outlook on the Dutch PPA market, insights on PPA price levels and how renewables can be financed with PPAs

## Aurora's outlook on the Dutch PPA market

- We analyse the potential corporate and industry demand for PPAs in 2030
- We analyse the potential renewables supply for PPAs in 2030
- We determine whether the PPA market is a buyer's or seller's market

## PPA market potential until 2030 TWh

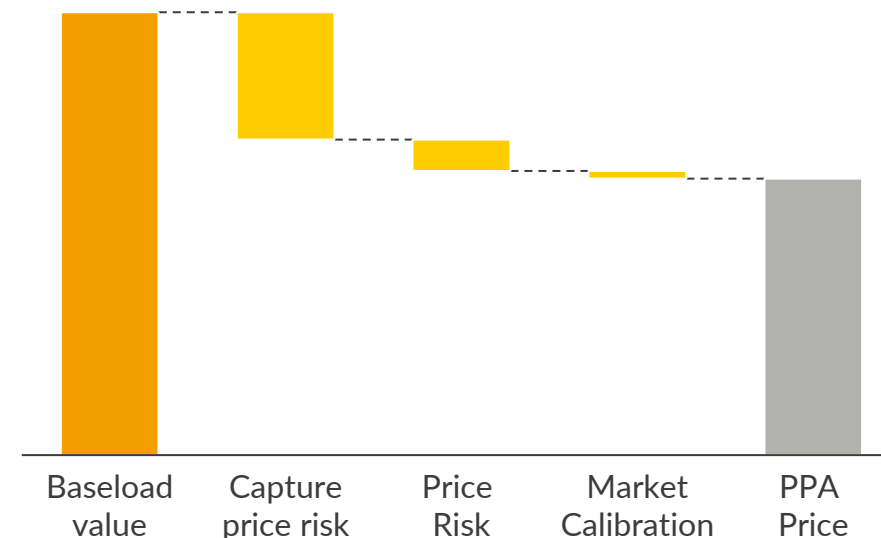


 Optimistic outlook  Pessimistic outlook

## Pricing Dutch PPAs and financing renewables with PPAs

- We discuss the methodology for pricing a PPA
- We analyse the value of a PPA for renewable assets in the Netherlands
- We discuss how a PPA influences cashflow and financing structure

## Aurora PPA valuation €/MWh



I. Introduction

II. Aurora's outlook on the Dutch PPA market

III. Pricing Dutch PPAs and financing renewables with PPAs

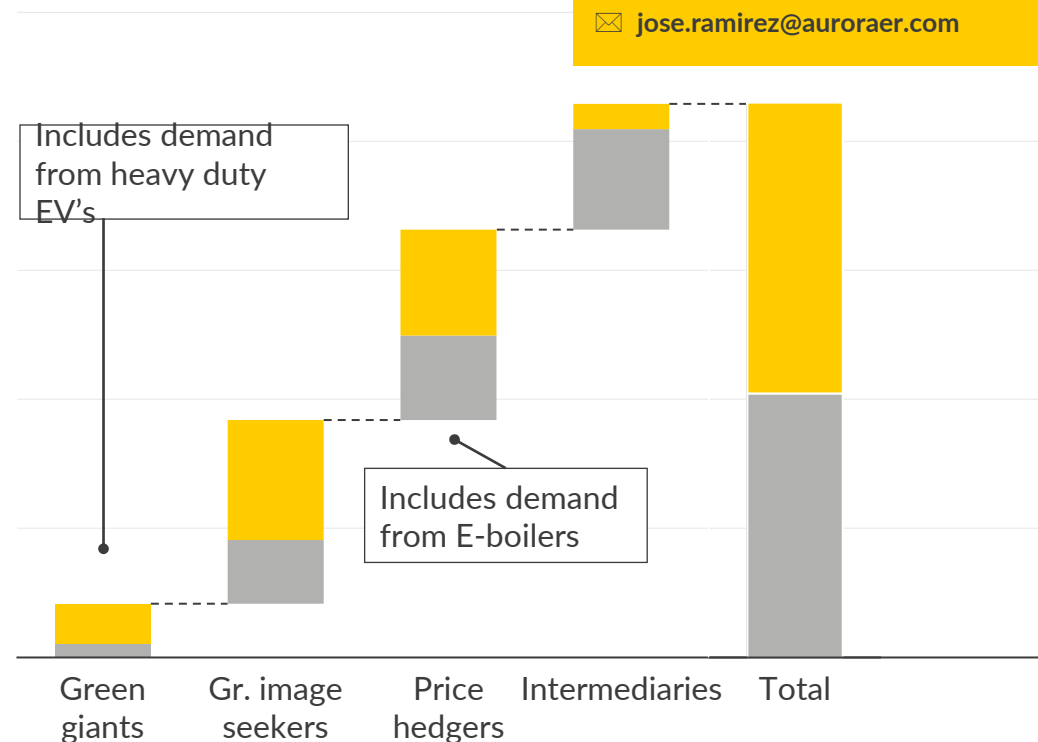
IV. Key takeaways and conclusions

# Decarbonisation ambitions could lead to a significant potential corporate PPA demand by 2030, but only half comes from creditworthy off-takers

Potential corporate PPA off-takers in the Netherlands

		Energy intensity	
		Low	High
Stakeholder pressure	High	Green Image Seekers	Green Giants
	Low	Intermediaries	Price Hedgers

Dutch net industry power demand in 2030  
TWh



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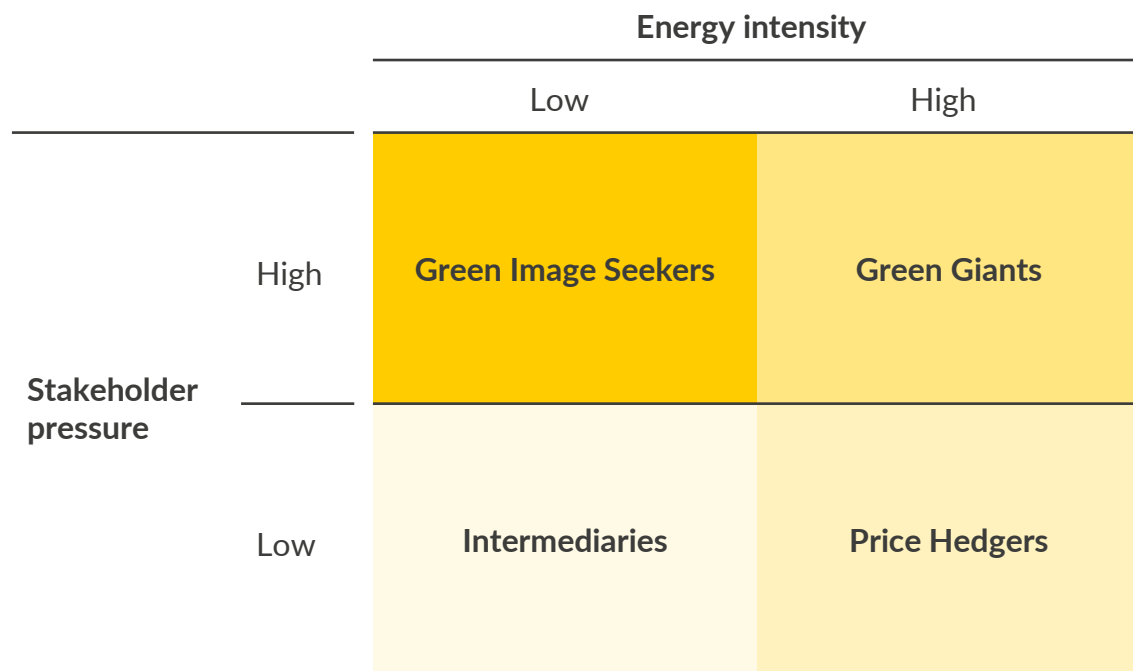
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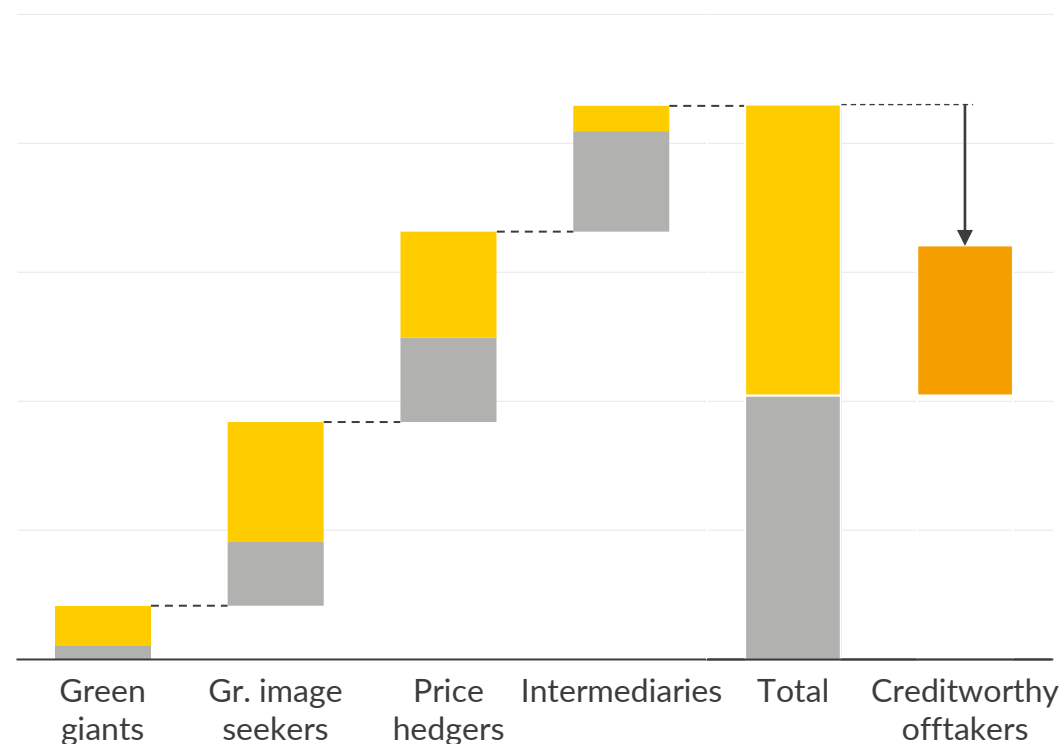
Rest of demand Potential PPA demand

# Decarbonisation ambitions could lead to a significant potential corporate PPA demand by 2030, but only half comes from creditworthy off-takers

Potential corporate PPA off-takers in the Netherlands



Dutch net industry power demand in 2030  
TWh

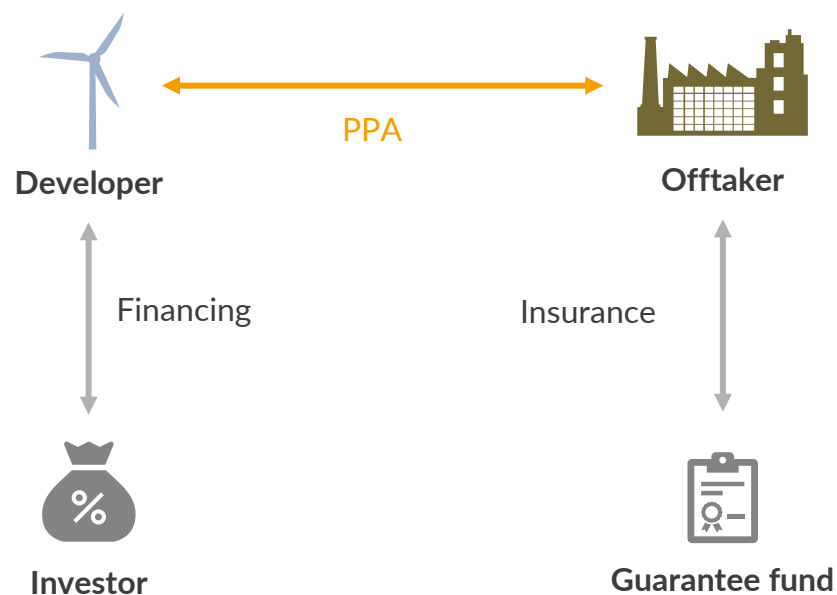


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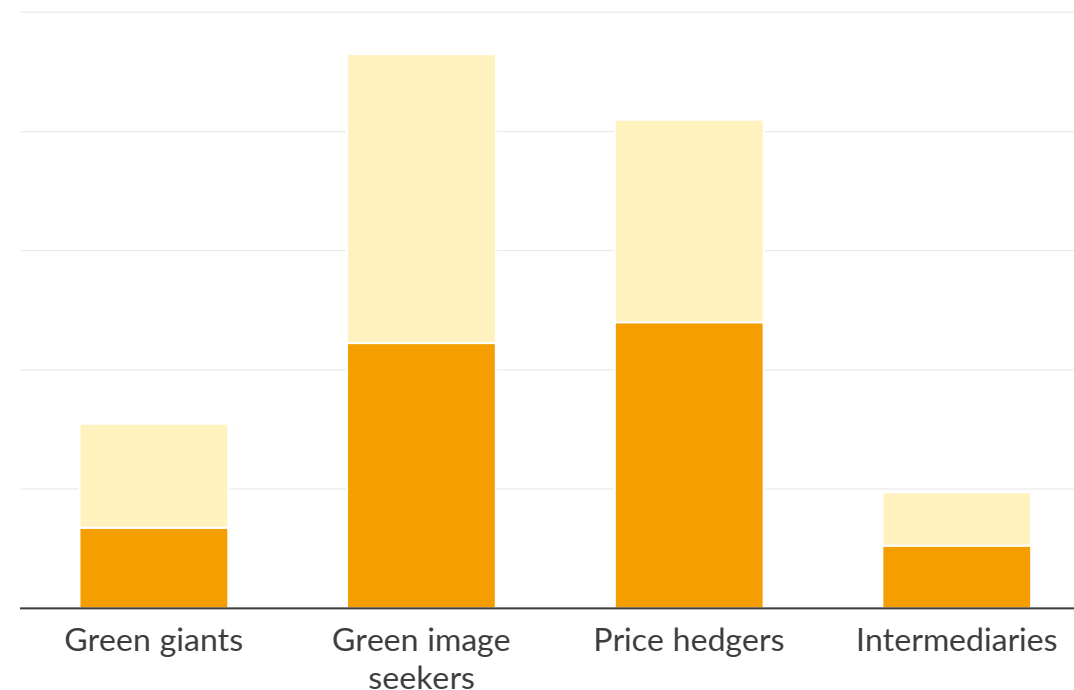
Rest of demand Potential PPA demand PPA demand of creditworthy off-takers

# A guarantee fund, as is currently being considered, could increase demand by enabling off-takers with insufficient creditworthiness

PPA guarantee fund



Potential Dutch PPA demand in 2030  
TWh



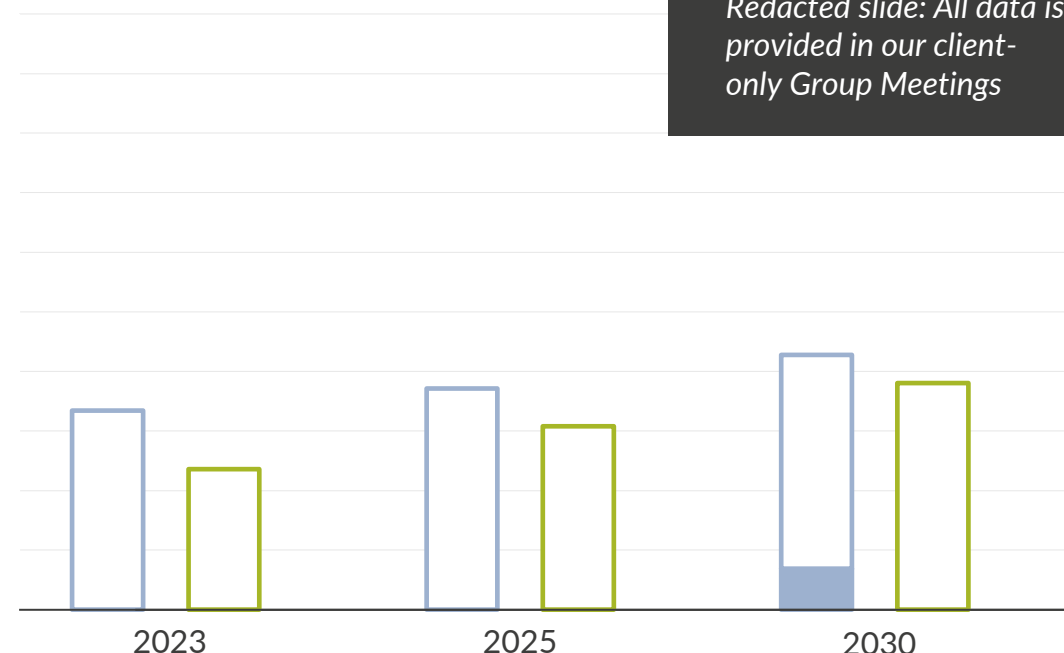
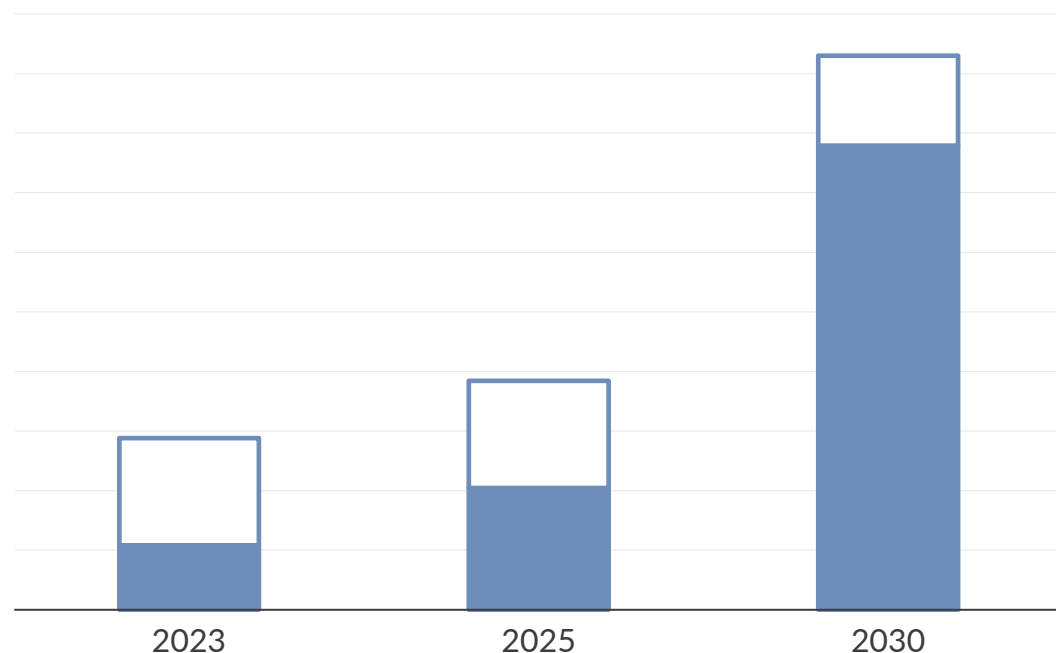
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 Rest of potential PPA demand  PPA demand of creditworthy off-takers

# On the supply side, unsubsidised offshore wind drives projects to look for fixed-price PPAs by 2030, whereas for onshore RES the need is likely limited

Offshore wind power supply  
TWh

Onshore wind and large-scale solar power supply  
TWh

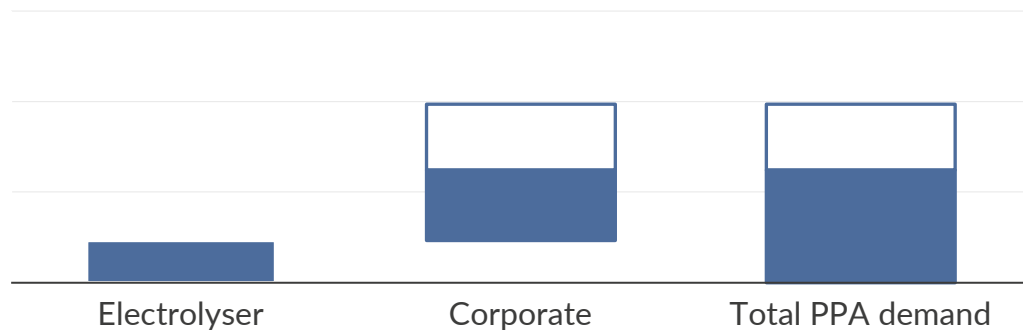


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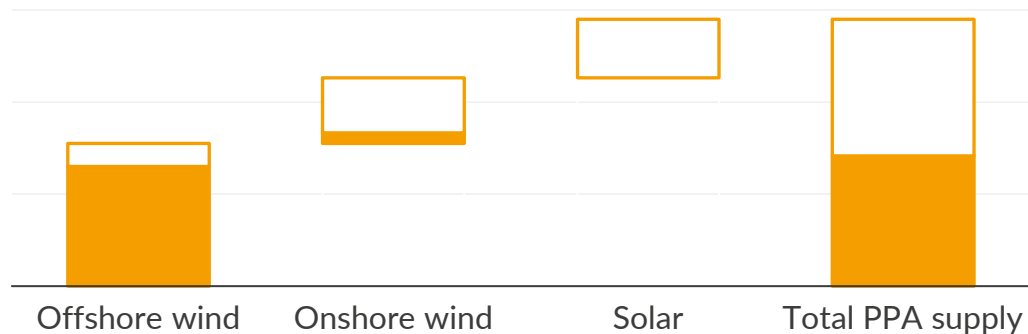


# We expect the Dutch market to be relatively balanced until 2030, but regulatory developments could tip the market balance in either direction

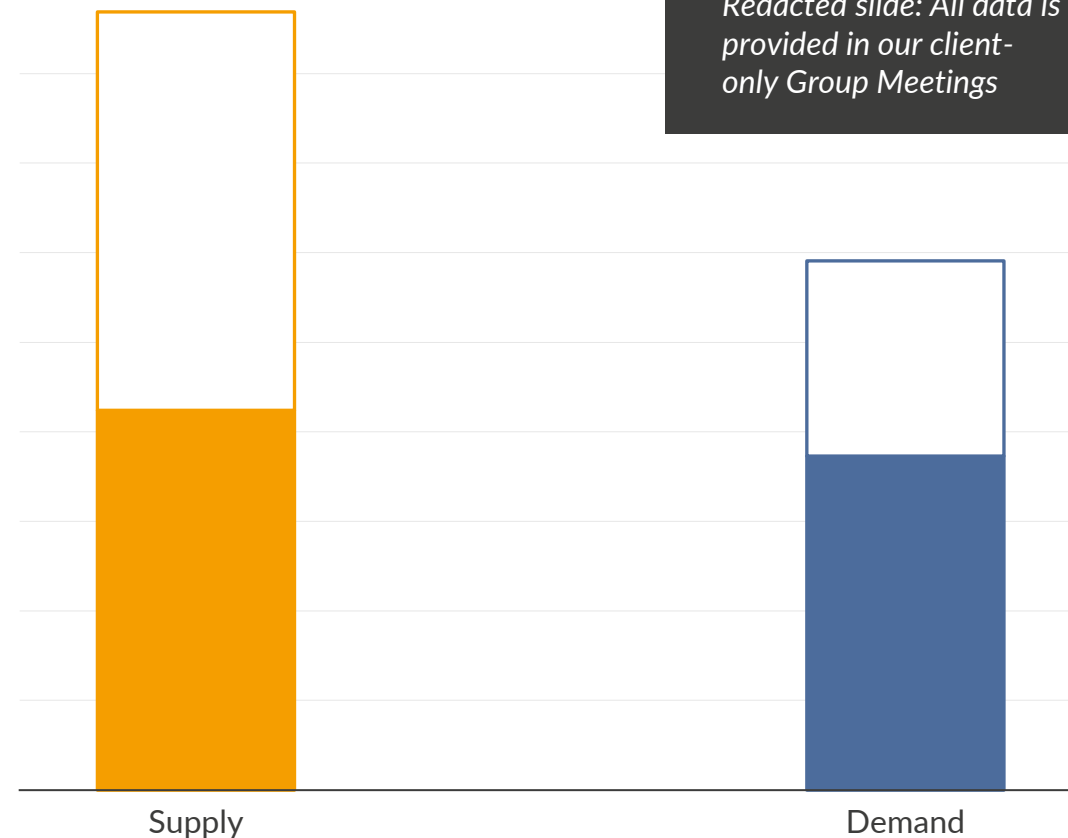
PPA demand potential until 2030, Central TWh



PPA supply potential until 2030, Central TWh



PPA demand and supply potential until 2030, Central TWh



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□ Potential additional demand   ■ Creditworthy demand   □ Potential additional supply   ■ Subsidy-free supply



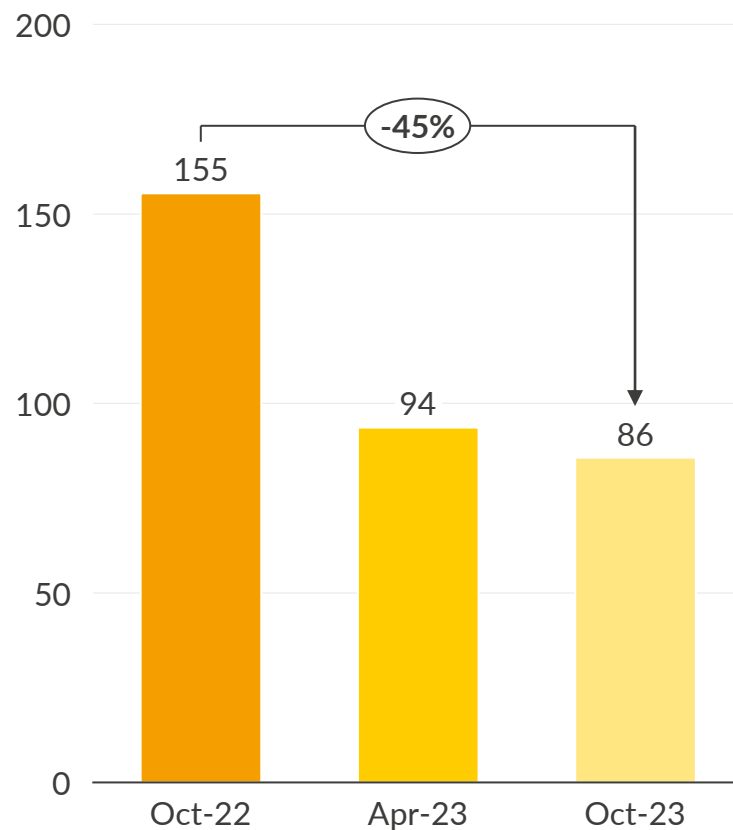
# Agenda

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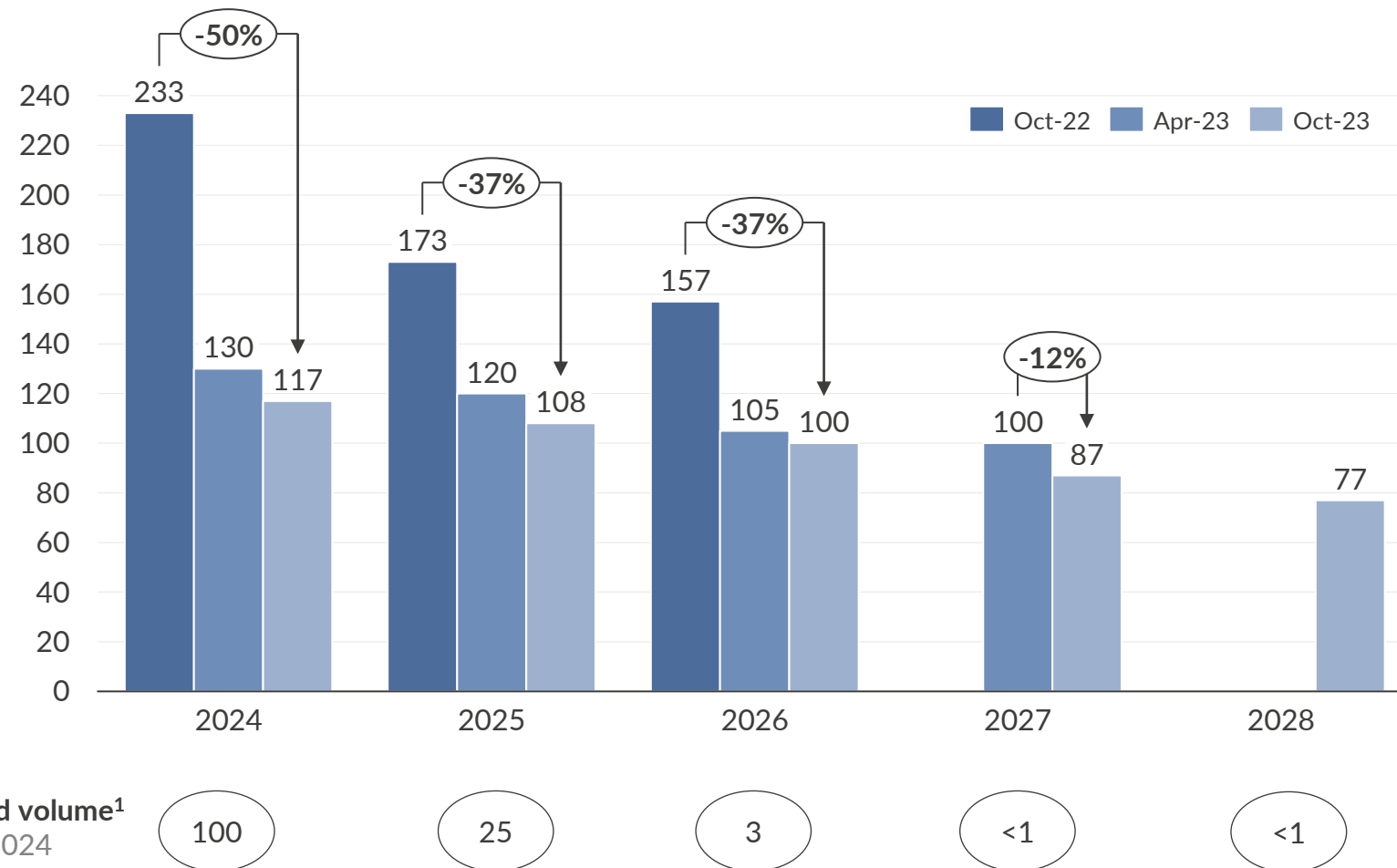
- I. Introduction
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# A fair PPA price needs to account for, but also go beyond historic prices and market futures

Monthly average Dutch day-ahead price  
€/MWh (real 2022)



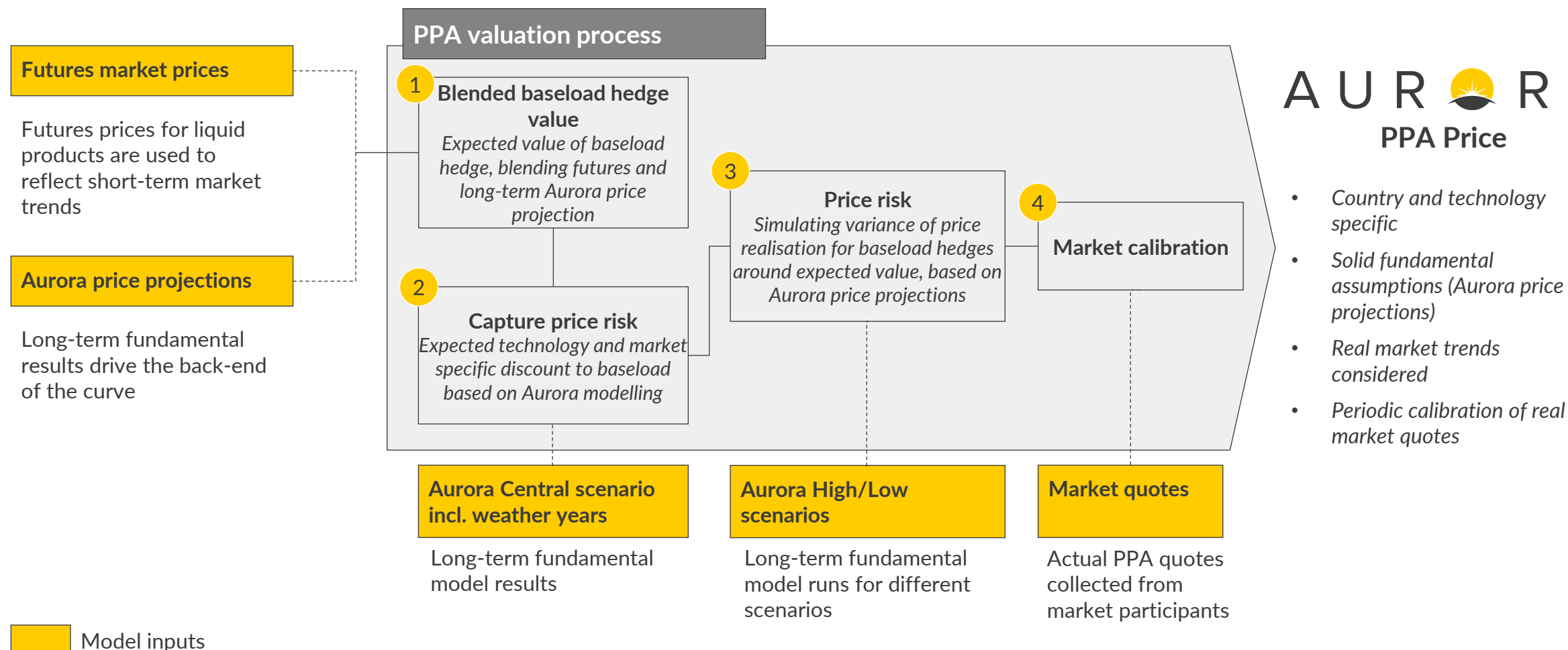
Monthly average Dutch system futures prices  
€/MWh (real 2022)



1) Total futures volume that was traded until Oct-23

# Aurora's PPA valuation tool replicates a hedging strategy of a utility and calculates price levels and risk adjustments

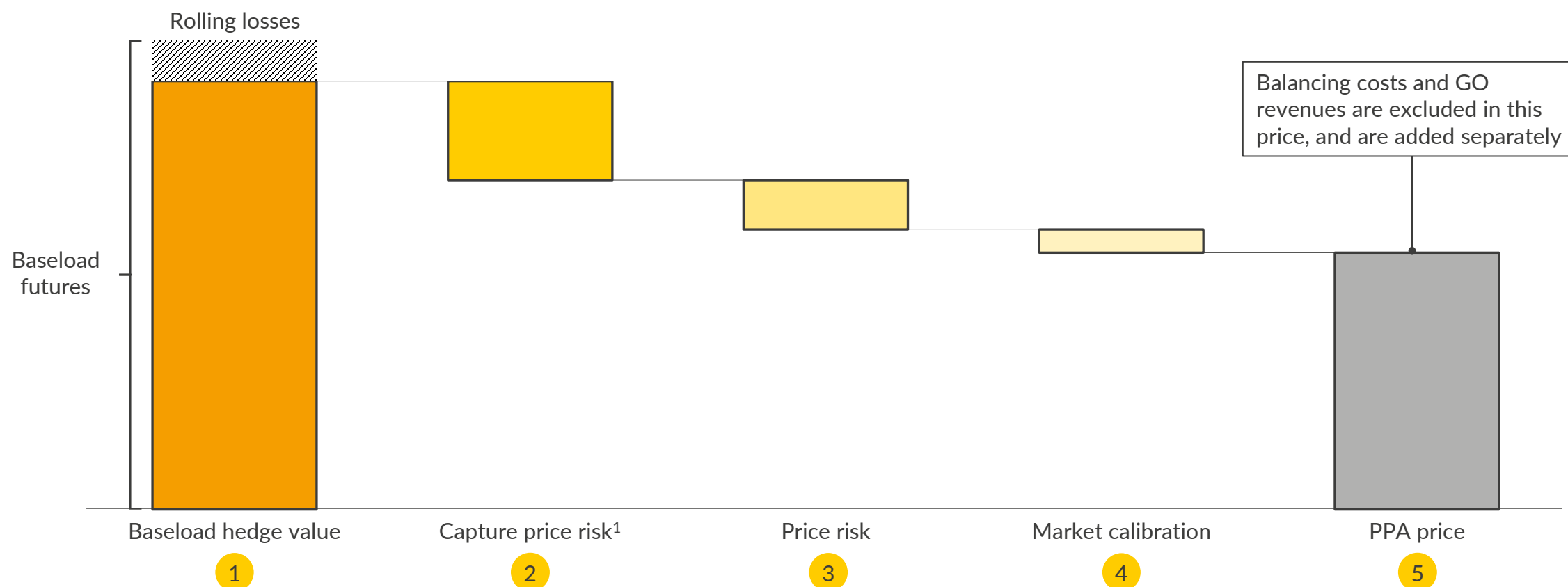
Illustrative representation of Aurora pricing model steps



# The starting point of the PPA valuation is the value of the baseload hedge, adjusted by different risk and cost components

## PPA Price Calculation

€/MWh

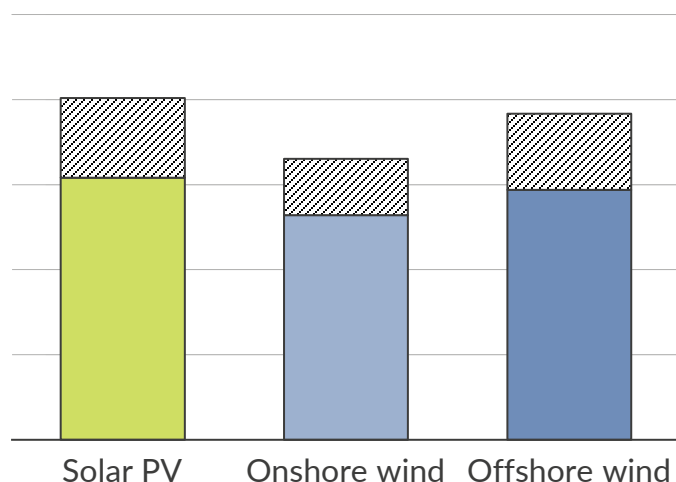


1) Including profile risk

# The financing costs of a project are influenced by the debt sizing, which is determined based on cashflows in a P90 scenario

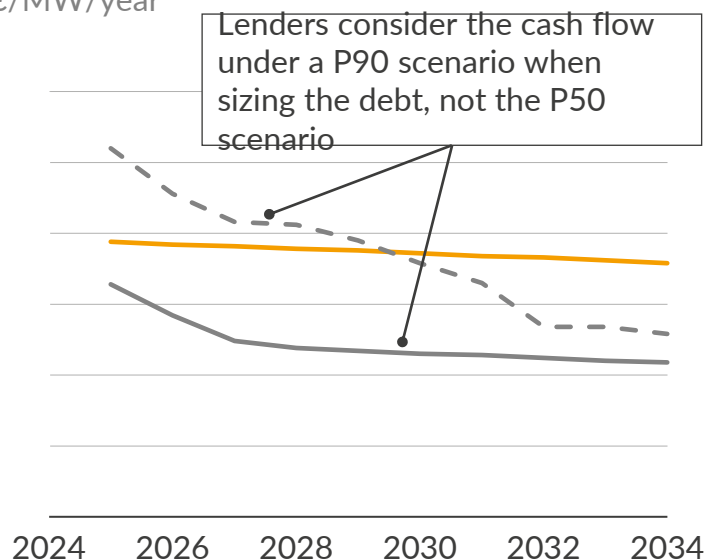
**1** A higher cost of capital increases the LCOE of renewable technologies with up to 25%.

LCOE per technology<sup>1</sup>  
€/MWh



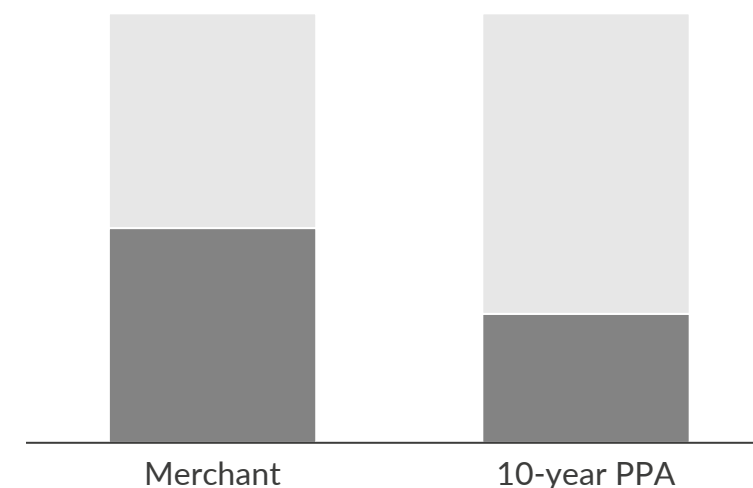
**2** Stable revenues from a fixed-price PPA increase a project's cash flow available for debt service...

Cash Flow Available for Debt service<sup>2</sup>  
k€/MW/year






**3** ... resulting in higher willingness of banks to provide lending and a lower cost of capital.

Financing structure  
%



 Additional cost with a merchant WACC

 LCOE for a subsidised project

 Subsidised project (P90)  Subsidised project (P50)

 Project under PPA

 Debt  Equity

1) Levelised cost of Energy in real terms for projects built in 2025; 2) The annual amount of cash available to service debt obligations considering a project's revenues and operational expenses

# Fixed-price PPAs can positively impact the financeability of both merchant and subsidised projects, by improving the P90 case

## 1 Combining merchant projects with a PPA

- Offshore wind in the Netherlands no longer receives subsidies and projects are built on a merchant basis
- A fixed-price PPA guarantees the generator constant revenues per MWh for the duration of the PPA

Revenues  
EUR/MWh

Constant revenue at the PPA price

## 2 Combining a 1-sided CfD with a PPA

- The current SDE++ scheme, which functions as a 1-sided CfD, can be combined with a PPA
- This only provides an upside if the PPA price is higher than the subsidy strike price

Revenues  
EUR/MWh

The subsidy revenue comes on top of the PPA revenue, when market prices are below the CfD floor

## 3 Combining a 2-sided CfD with a PPA

- 2-sided CfDs have been proposed as the future subsidy scheme for onshore wind and solar
- Under a 2-sided CfD, the projects receives subsidies when the market price is below a strike price, and revenues above the strike price are taxed away

Revenues<sup>1</sup>  
EUR/MWh

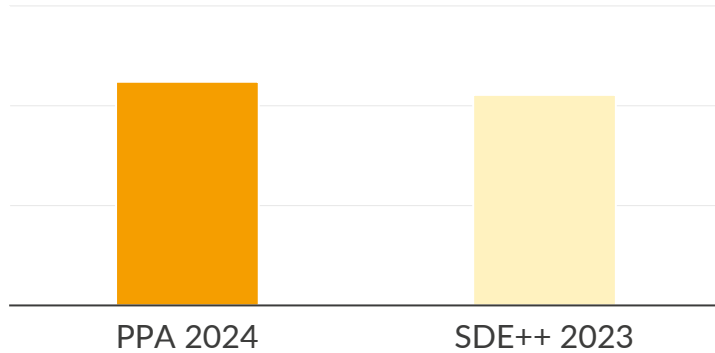
Constant revenue for the volume under the 2-sided CfD

— PPA price — Market price •• CfD floor ..... (CfD ceiling) ▨ Subsidy tax ■ Subsidy revenue ■ PPA revenue

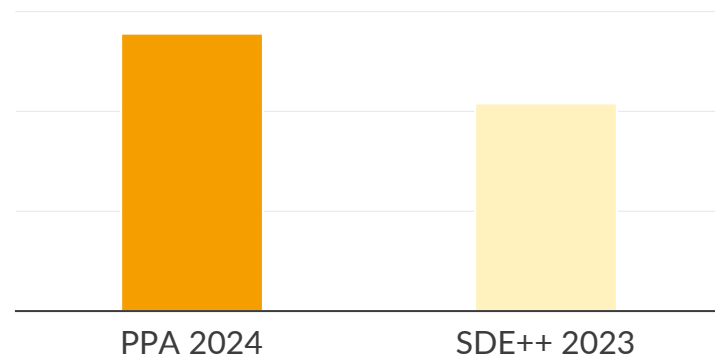
1) PPA volume as in option 1

# For subsidised onshore projects, PPAs boost a project's leverage if the PPA price lies higher than the SDE++ strike price

Solar 10-year PPA price<sup>1</sup> and SDE++ base amount  
€/MWh, nominal

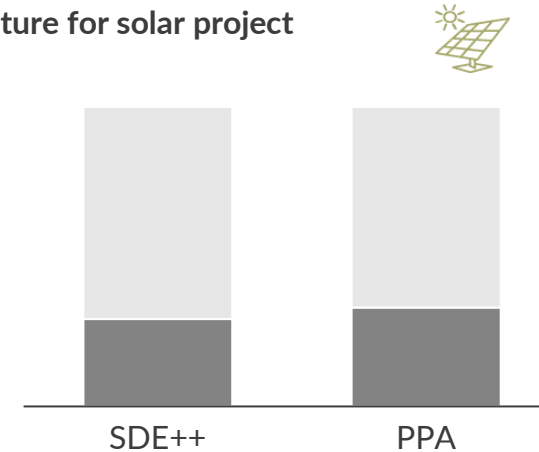


Onshore wind 10-year PPA price<sup>1</sup> and SDE++ base amount  
€/MWh, nominal

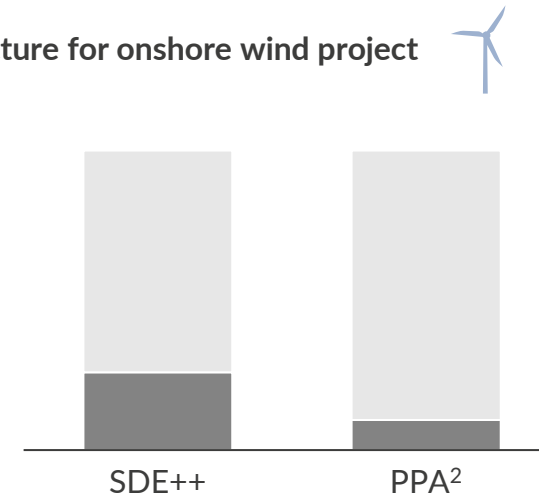


■ PPA base price (incl. balancing cost and GO)  
■ Base amount SDE++

Financing structure for solar project  
%



Financing structure for onshore wind project  
%



■ Debt ■ Equity

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1) pay-as-produced; 2) The maximum debt share is capped to reflect that a bank will require a minimum equity share of equity in a project.

- 1** There is increased interest in the Dutch PPA market, due to the zero subsidy tenders for offshore wind, the phase out of the SDE++ for onshore renewables and record high power prices since 2021. The volume of announced corporate PPAs started picking up from 2021 onwards, with over 1GW of announced capacity since then.
- 2** Towards 2030, we expect the Dutch PPA market to remain a buyers' market, despite corporates' drive to procure green power, but regulatory developments could tip the market balance in either direction. The supply of green electricity looking for a fixed-price PPA will grow by 2030, whereby the new design of the onshore renewable subsidy will play an important role. PPA demand is likely not able to keep up with supply but could grow with support of a PPA guarantee fund.
- 3** Aurora's in-house PPA valuation combines market data, long term fundamental modelling with stochastics and calibration based on price quotes. Build year and contract length have a large impact on PPA prices, and the revenue from Guarantees of Origin and imbalance costs need to be considered.
- 4** Fixed-price PPAs can positively impact the financeability of renewable projects by guaranteeing higher revenues, thereby increasing a project's cash flow available for debt service resulting in a lower cost of capital. For subsidised onshore projects, PPAs boost a project's leverage if the PPA price lies higher than the subsidy's strike price.



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# AURORA PPA NAVIGO

## The most advanced PPA pricing methodology on the market

PPA Navigo enables a market proven and adequate valuation of PPA prices

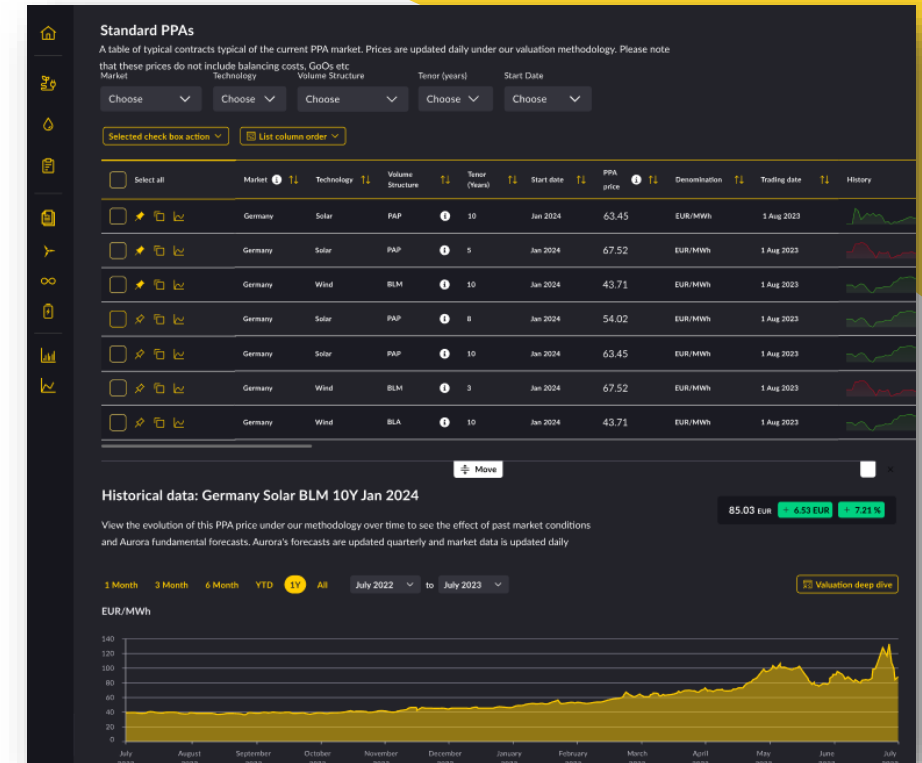
**Leading:** Proven methodology combining short term Futures power prices with Aurora's market standard on long term power price forecasts

**Fully stochastic:** Monte Carlo based methodology, incorporating the full range of possible power price developments, including weather year analysis, reflecting ranges in renewable production and capture prices

**Cutting-edge:** Continuous calibration of PPA prices with data from market participants

**Precise:** Location and technology specific

**Clear:** Transparency on price components and risk factors



## Where is our PPA valuation applied?



PPA  
Transactions



Strategy



Risk analysis

AURORA



ENERGY RESEARCH

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### Publication

PPAs in the Netherlands: Developments in an emerging PPA market

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12 December 2023

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