PEXAPARK

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Independent Commodity Intelligence Services

Fundamentals vs. Markets

The German PPA Market

02 October 2020

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Matthew Jones - Senior Analyst, ICIS

YOUR PRESENTERS

Luca Pedretti

COO & Co-Founder

- Managerial positions for 10 years at Axpo Trading for front units in origination and trading
- Build renewable energy off-take agreements from renewable energy sources of more than 3,000 MW
- M.A. in International Politics and Governance from the University of St. Gallen

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Senior Analyst – EU Power

- Qualitative and quantitative analysis of European power markets
- Nine years' experience in the energy industry as an analyst and consultant
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Fundamentals vs. Markets

The German PPA Market

October 1, 2020
Joint Webinar ICIS & Pexapark

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Co-Founder Pexapark

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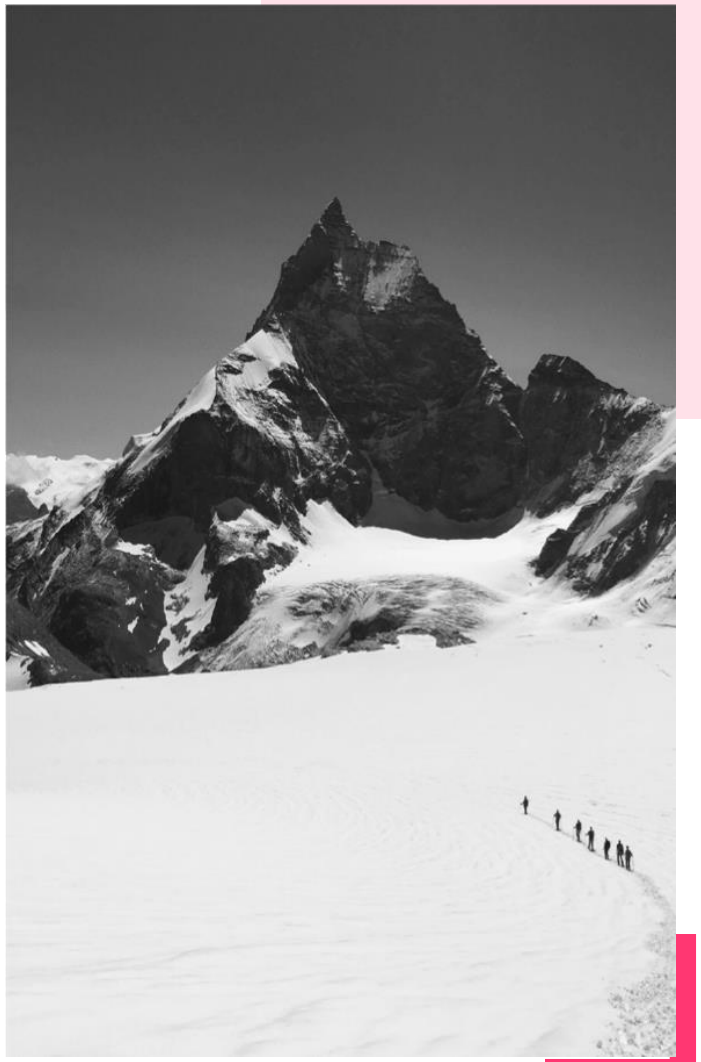
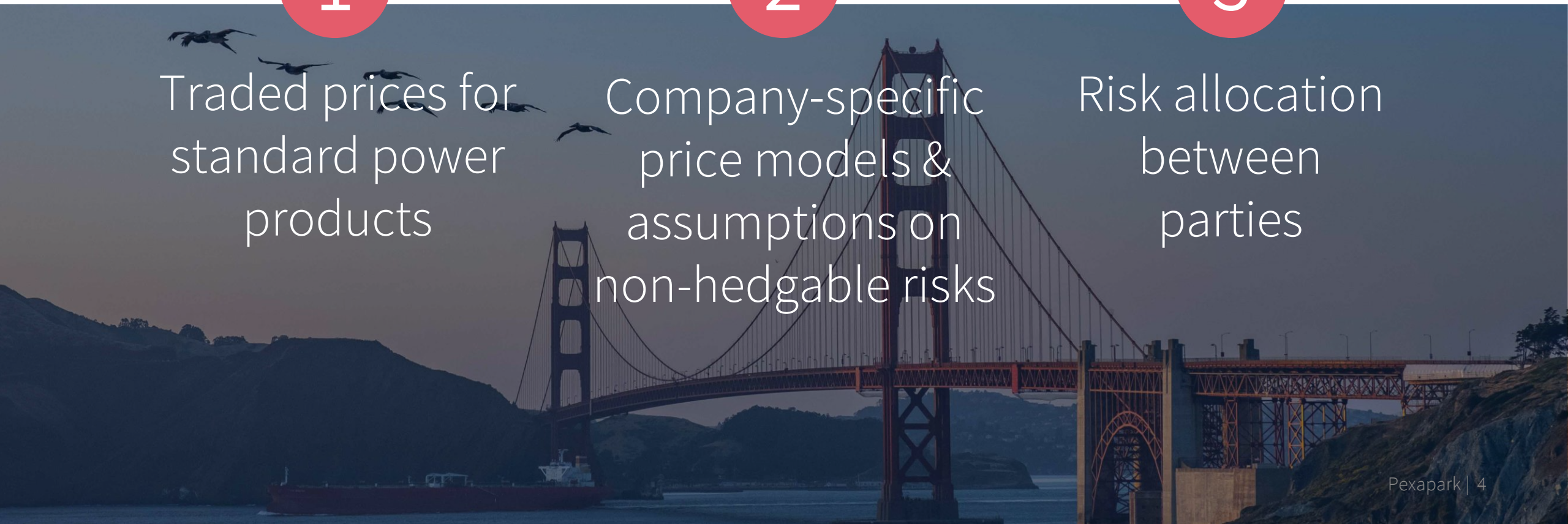
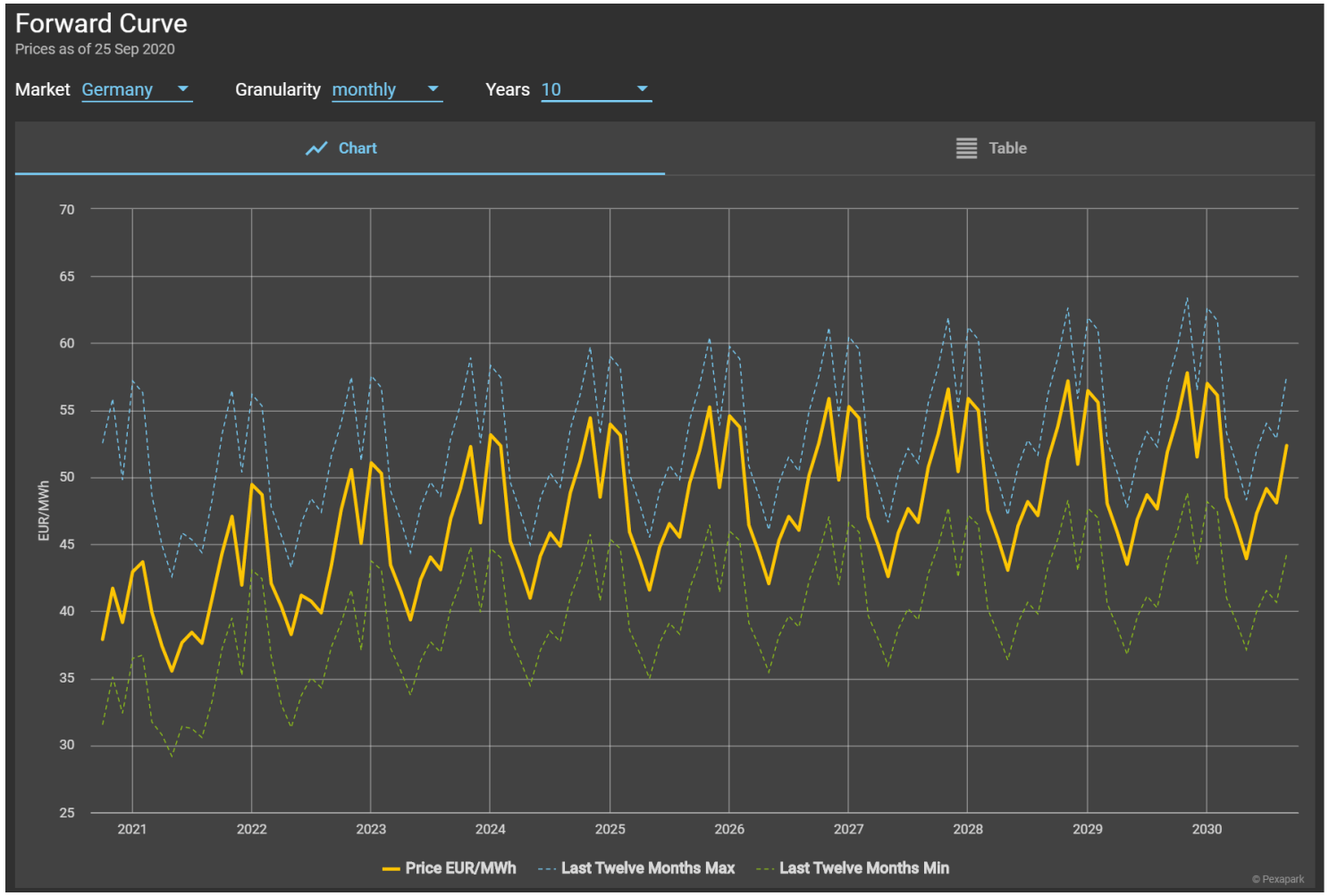


THE PPA PRICE IS A RATIONAL BEAST – WHICH FACTORS SET THE PPA PRICE?



1. Traded prices for standard power products
2. Company-specific price models & assumptions on non-hedgable risks
3. Risk allocation between parties

THE KEY DRIVER IS THE THEORETICAL BASELOAD CURVES DERIVED FROM TRADED PRICES



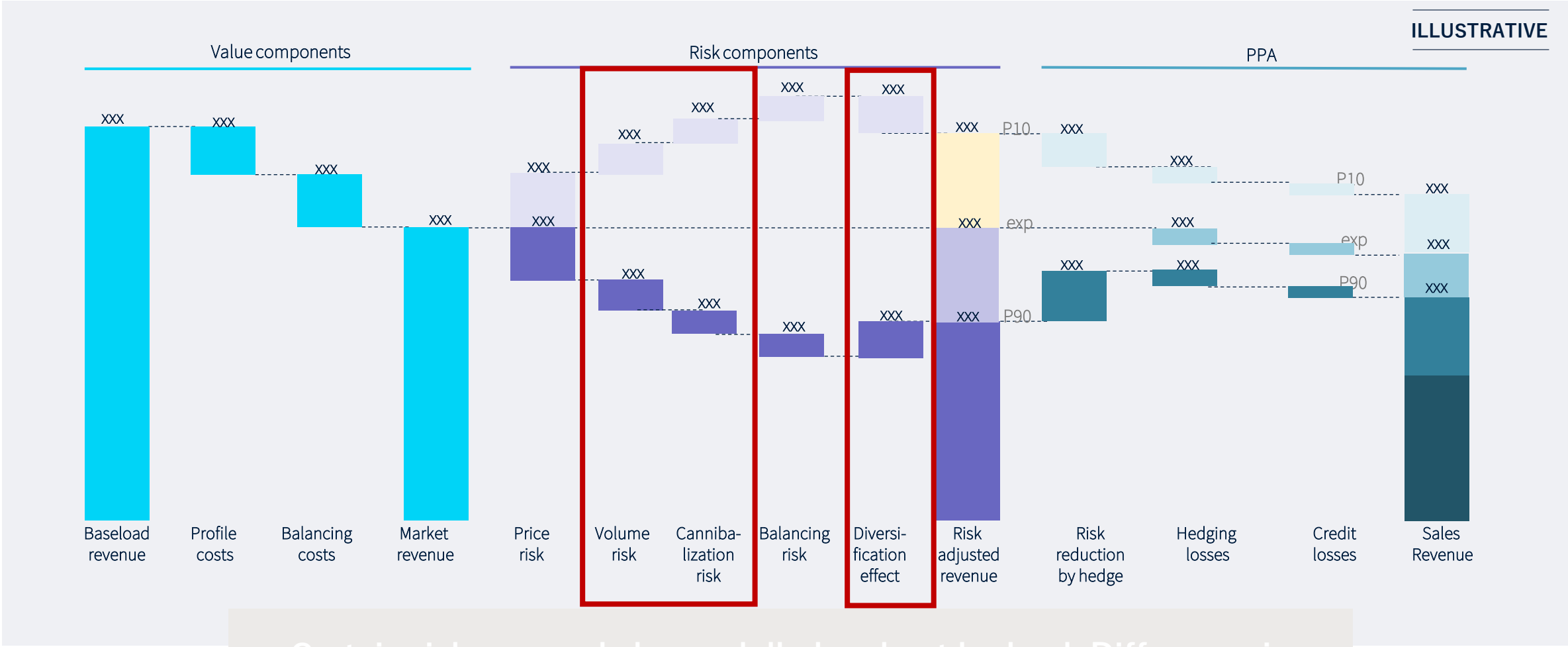
Contract	EUR/MWh
Cal-2021	40.59
Cal-2022	43.90
Cal-2023	45.81
Cal-2024	47.70
Cal-2025	48.40
Cal-2026	48.95
Cal-2027	49.57
Cal-2028	50.12
Cal-2029	50.64
Cal-2030	51.12

RECENT PRICE DEVELOPMENT AND VOLATILTIY FOR GERMANY FORWARD PRICES

- Since autumn last year, prices for front years have been falling
- This decrease was partially compensated during February by raising prices on the long end
- Due to the COVID-19 pandemic, prices started to decrease significantly along the entire curves driven by falling gas and EUA prices and reduced electricity demand
- Prices have since got back to pre-COVID levels. Trading liquidity is lower («fear factor») which increases hedging cost and reduces PPA prices.

Source: PexaQuote

THE SECOND DRIVER ARE RISK MODELS, ASSUMPTIONS AND APPETITE FOR NON-HEDGEABLE RISKS



Certain risks can only be modelled and not hedged. Difference in models, views and finally risk appetite lead to variance in PPA bids

A FINALLY WE HAVE DIFFERING RISK ALLOCATION BETWEEN PARTIES AS PRICE DRIVER

Production Profile

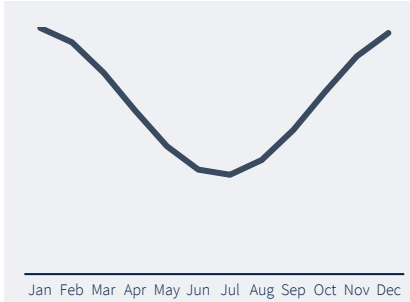
Contract Profile

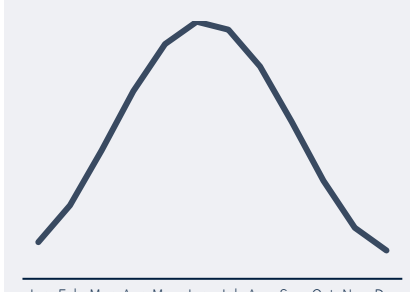
Price

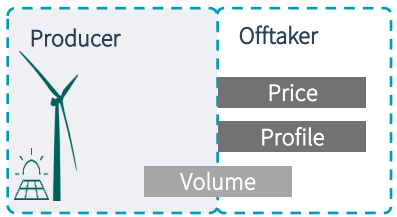
Profile

Volume

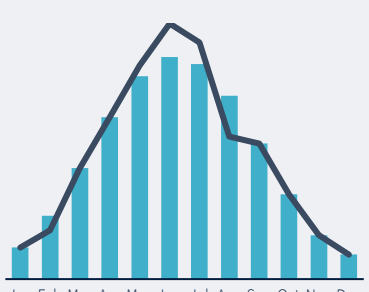
Pay-as-Produced

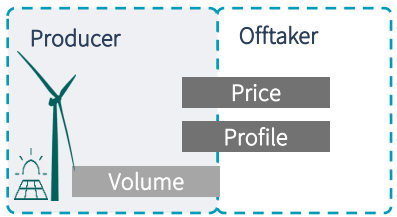




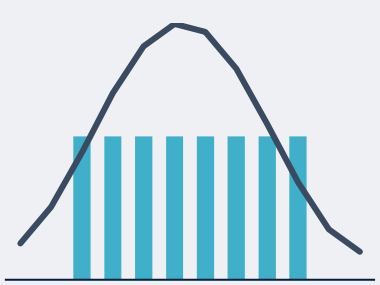


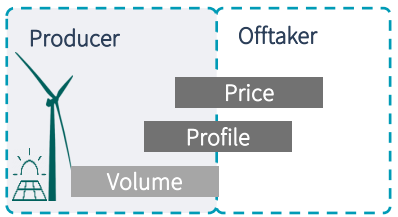
Pre-defined Profile



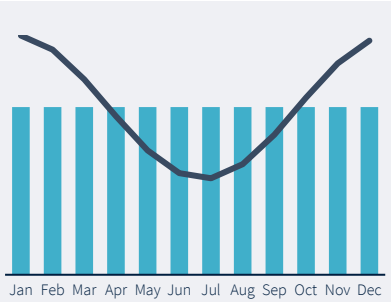


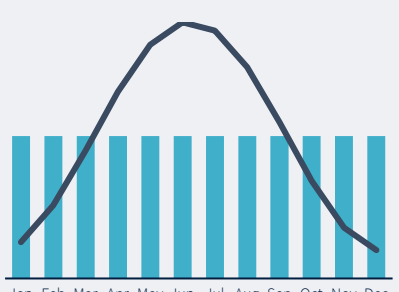
All-day Peak Load

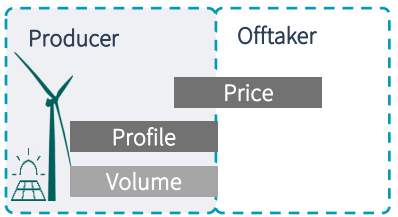




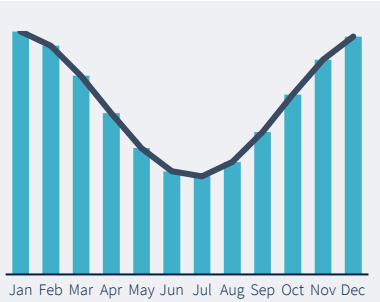
Annual Baseload

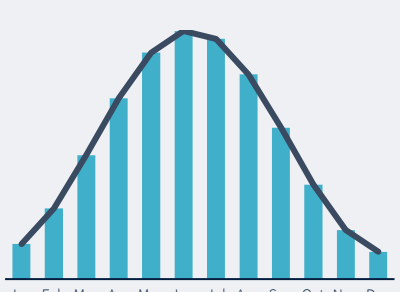


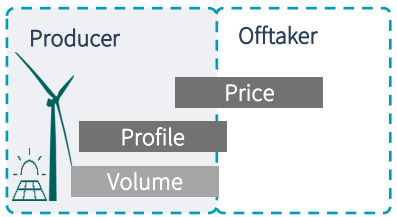




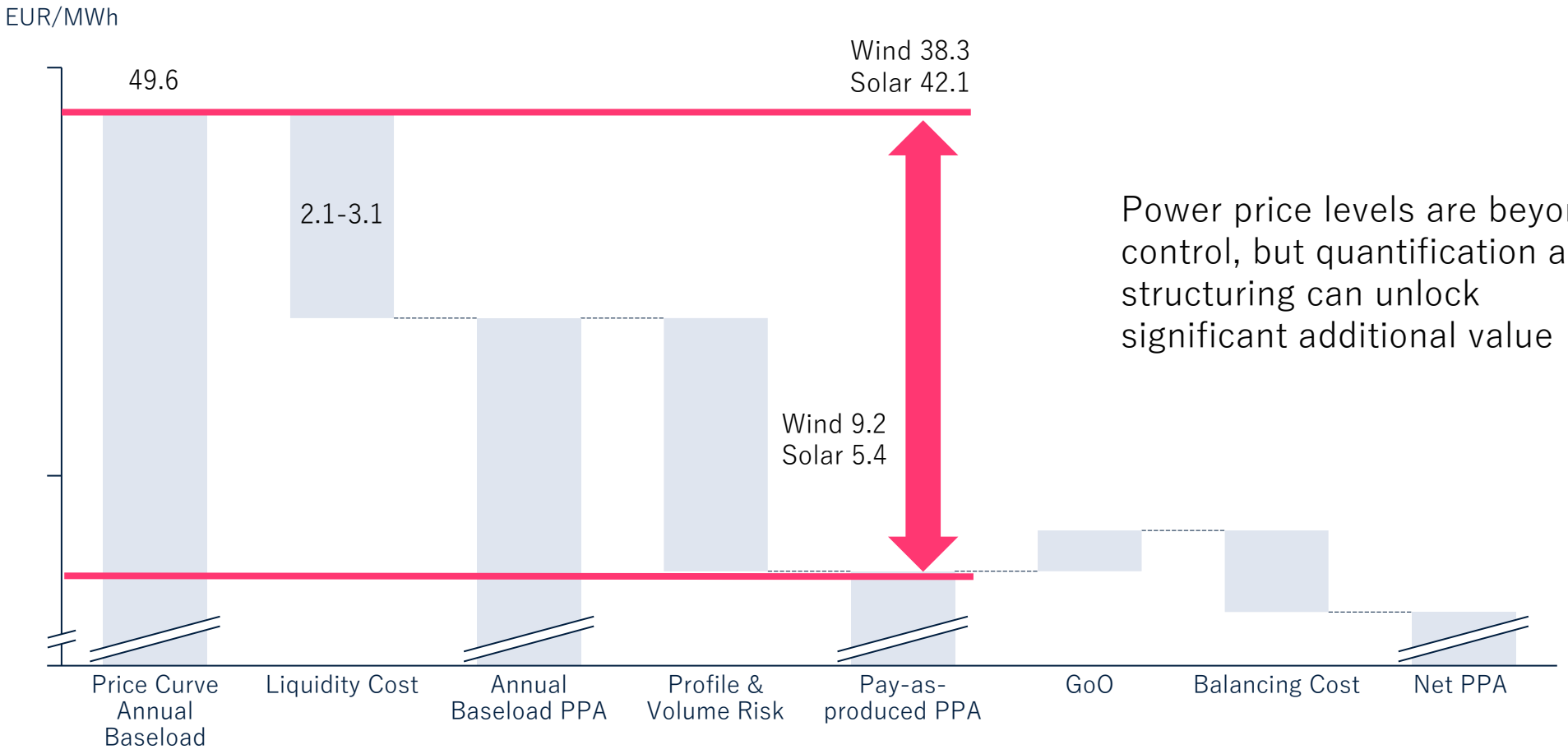
Monthly Baseload







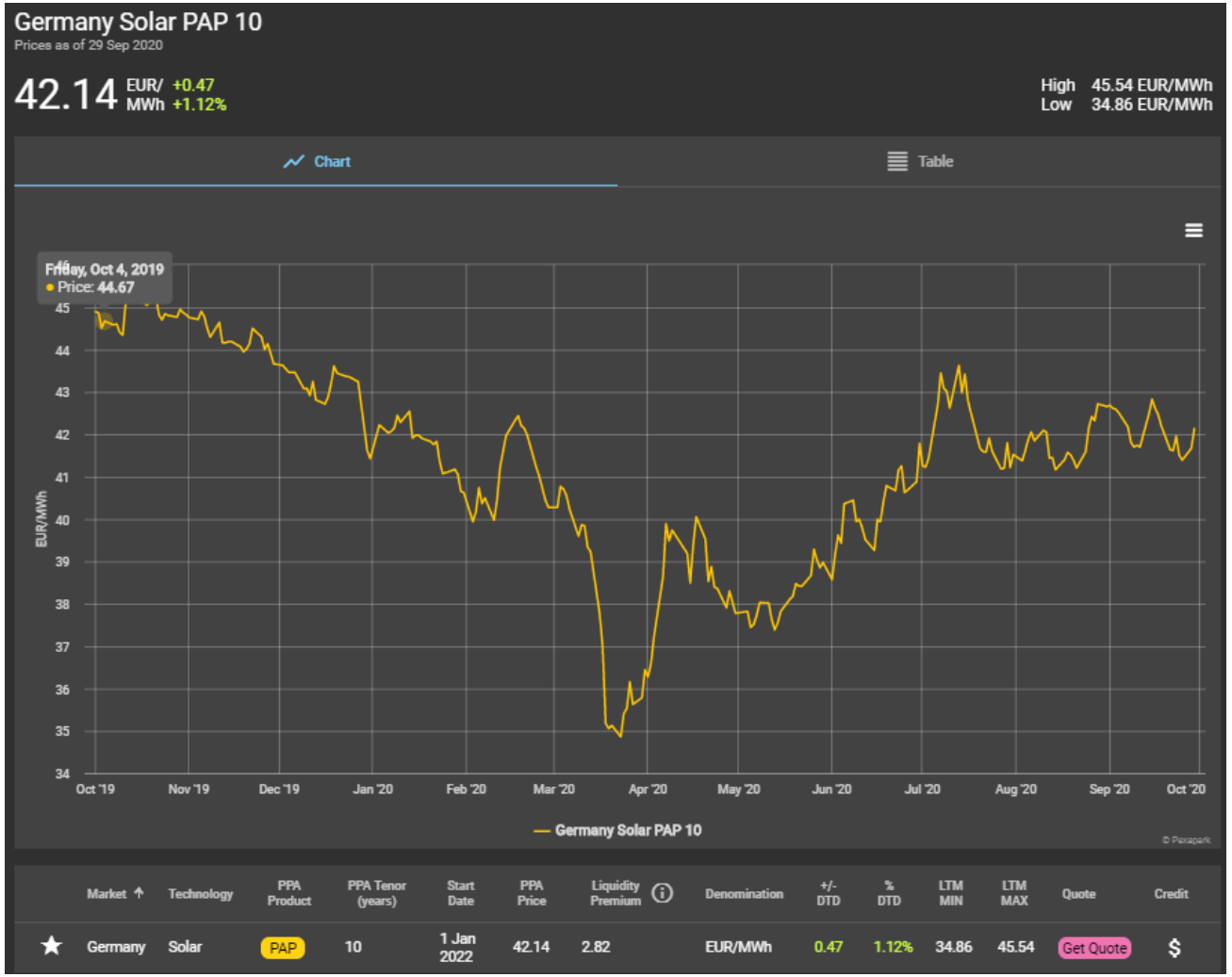
A SUMMARIC VIEW ON THE PPA PRICING CASCADE IN GERMANY – 10 Y PPA, COD 1.1.2022



Power price levels are beyond control, but quantification and structuring can unlock significant additional value

On basis of an average German Solar respectively Wind profile
Source: PexaQuote, last update per September 29, 2020

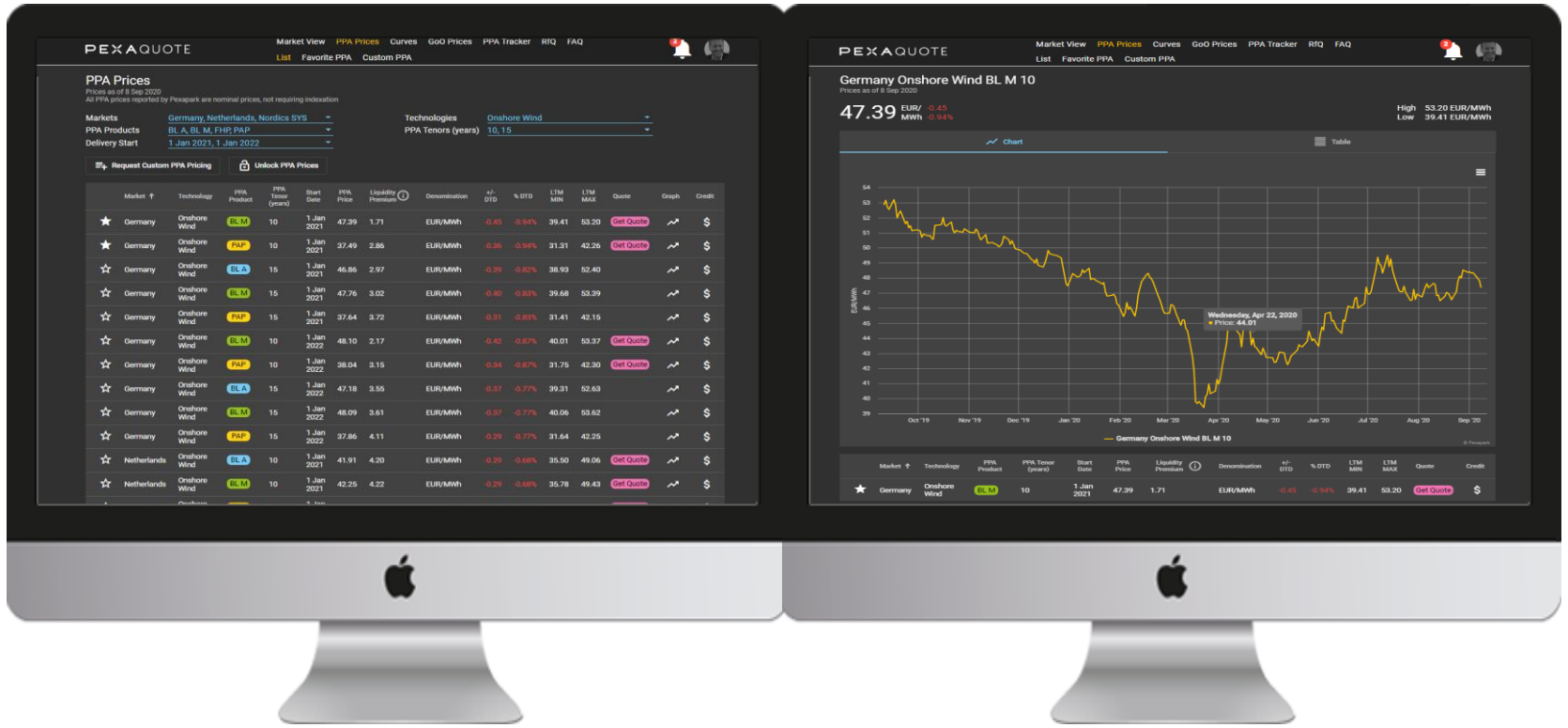
PRICE EVOLUTION SHOWS LARGE VOLATILTIY ON FOR PPA BID PRICES



- Based on a standardized, average solar profile
- Start date per 1.1.2020, tenor of 10 year
- Pay-as-Produced PPA (excl. GoO, credit and ancillary service costs)

UNLOCK FULL PPA PRICE TRANSPARENCY AND ACCESS STATE OF THE PPA PRICING TOOLS

EnergyRisk Awards 2020 Winner — Innovation of the year



- ✓ **THE price reference for renewable PPAs**
- ✓ **Used in PPA negotiations and for asset sales** as price reference
- ✓ **Daily updated PPA prices** leave no room for last-moment surprises
- ✓ Fair value of **corporate and utility PPAs**
- ✓ **Solar, onshore wind, offshore wind**
- ✓ **Source PPAs** from corporate and utility offtakers
- ✓ **Connect with leading offtakers**

Vestas · eex · wpd think energy · BayWa r.e. · MVV · EWE

https://pexapark.com/wind-solar-ppa-prices/

PEXAPARK AT A GLANCE

Company founded	PPAs supported	Assets monitored	# of employees	Offices
August 2017	8+ GW	3+ GW	30+	Zurich, London, Lviv

SOME CUSTOMERS

CREDIT SUISSE, cee Group, SUSI PARTNERS SUSTAINABLE INVESTMENTS, ABO WIND, pka aip, ENCAVIS, TAALERI, LBBW, eex, Vestas, solarcentury, RWE

SOME PARTNERS

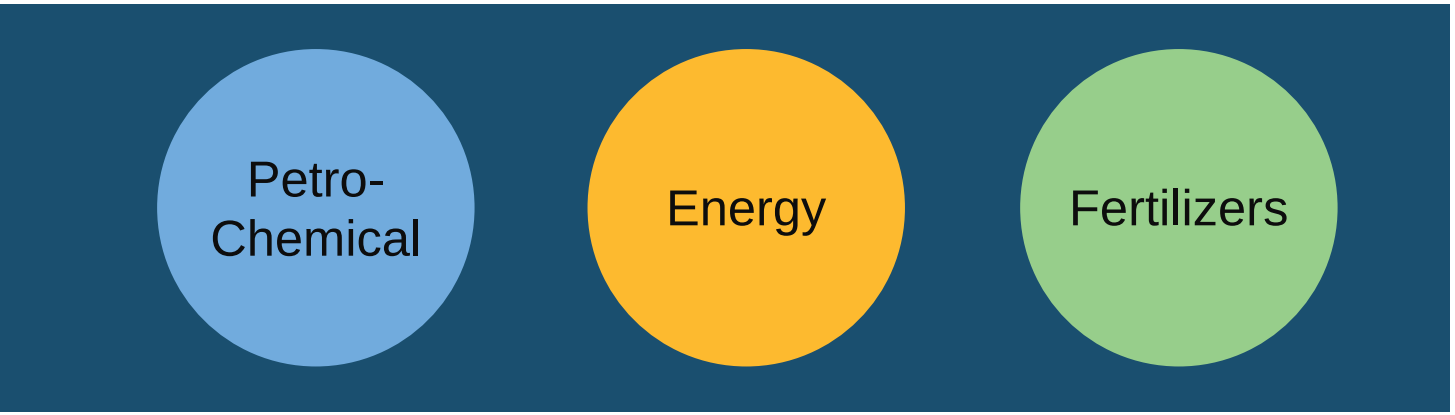
BloombergNEF, RE-Source, MONTEL, WW WOMEN IN WIND GLOBAL LEADERSHIP PROGRAM

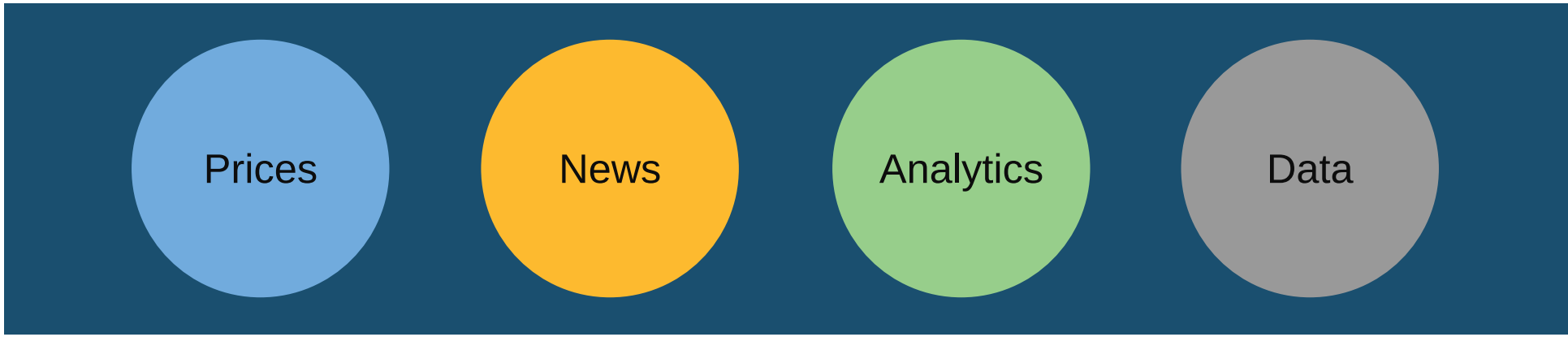
German Power Market Fundamentals

02 October 2020

Matthew Jones, Senior Analyst - EU Power

ICIS is a world leading price reporting agency and analytics powerhouse for commodity markets





Forecasting carbon and power

Power modelling

- Fundamental model matching supply and demand
- All EU power markets, plus NO, CH, UK
- Hourly granularity until 2030 (2050 expansion in November)
- Detailed assumptions on efficiency, must-run, decommissioning etc.
- Modelled on a plant-by-plant approach
- Up-to-date fuel prices

Carbon modelling

- Bottom-up research per sector
- Price induced and planned abatement
- Incorporates trading behaviour of compliance players
- Balancing the market with fuel switch in the power sector and industry abatement
- Emissions to hedge dynamically based on EUA prices

Matrix approach

- Emissions output from the power model is an input to the carbon model
- The carbon price output is an input to the power model
- Feedback loops to optimise

Agenda

01 Fuel/carbon price outlook

02 Capacity developments

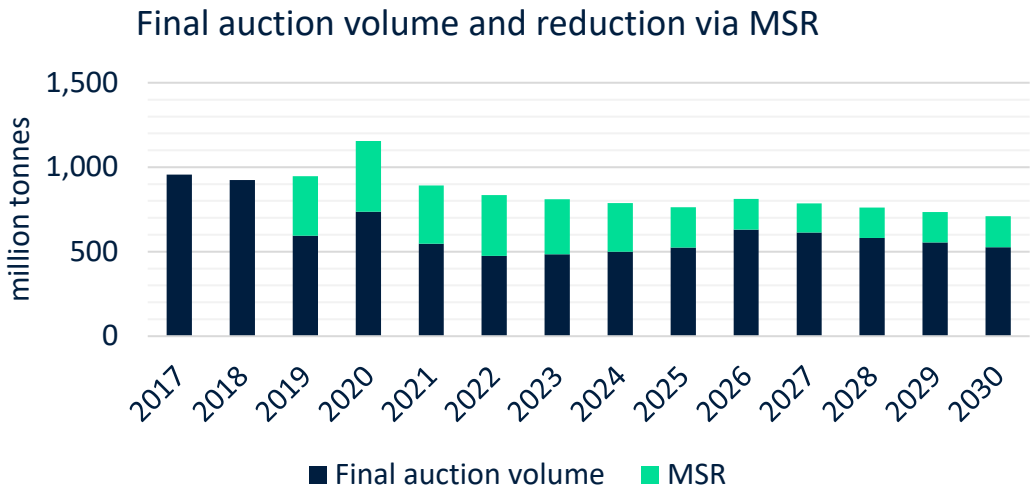
03 Renewable growth expectations

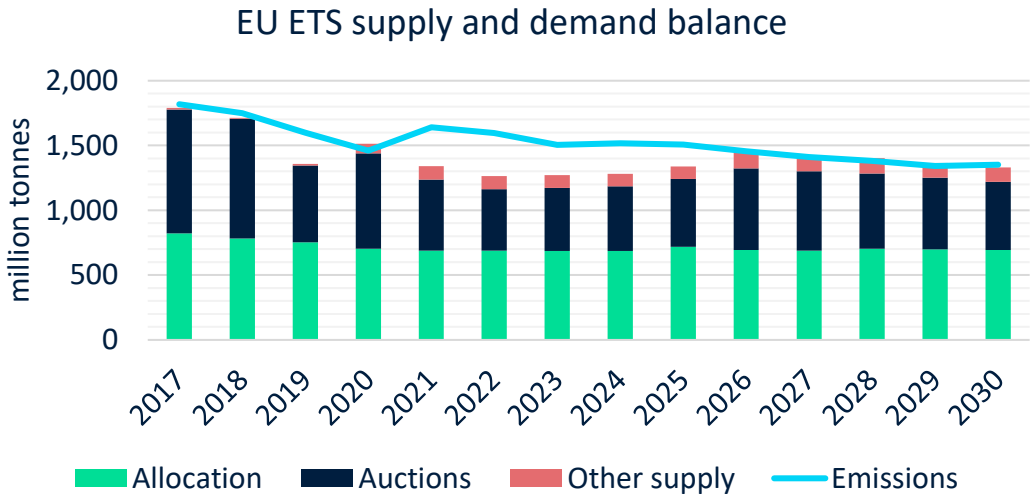
04 Power Price outlook

Fuel/carbon price outlook

EUA price developments: Key drivers

- The MSR introduces a rule-based supply side adjustment mechanism (2019)
- Linear reduction factor increases to 2.2% (2021)
- More stringent rules for industrial free allocation (2021)
- Fuel switch and industrial abatement required in the early 2020s to balance the market

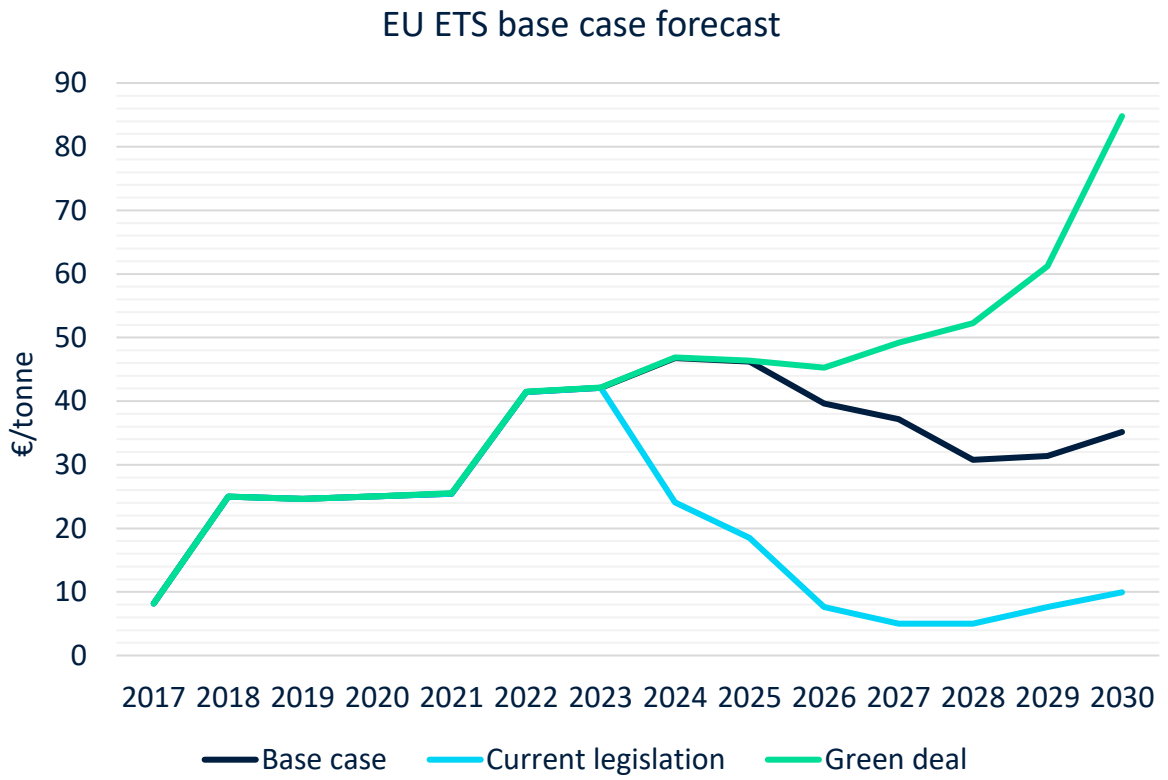




Source: ICIS

EUA price forecast

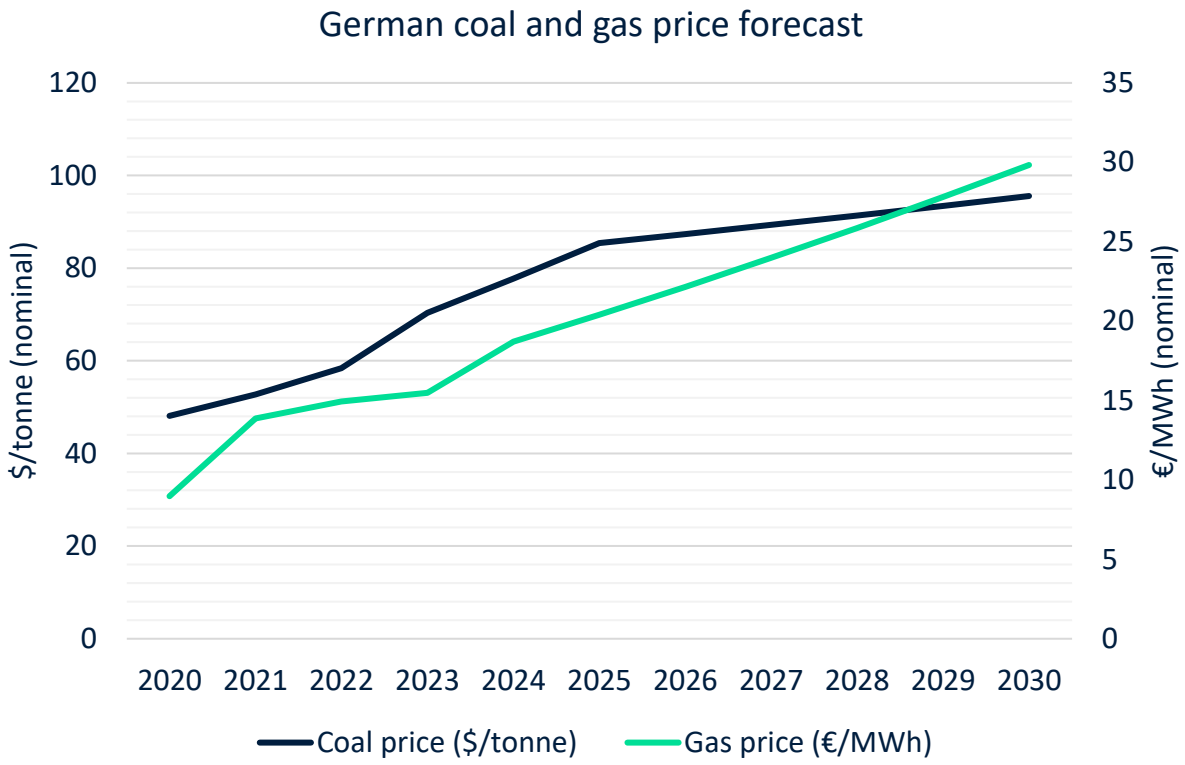
- Under our base case assumptions, the EUA prices are expected to rise to the mid-2020s before falling back
- However, the EU ETS is a policy-driven market. The two main decisions that will influence prices are:
  - The decision on the MSR intake rate and thresholds
  - The 2030 GHG reduction target



Source: ICIS

Coal and natural gas price expectations

- We interpolate between the end of the forward curve and the IEA WEO coal and gas prices for 2030
- Both coal and gas prices are expected to recover from their current lows gradually over the coming decade

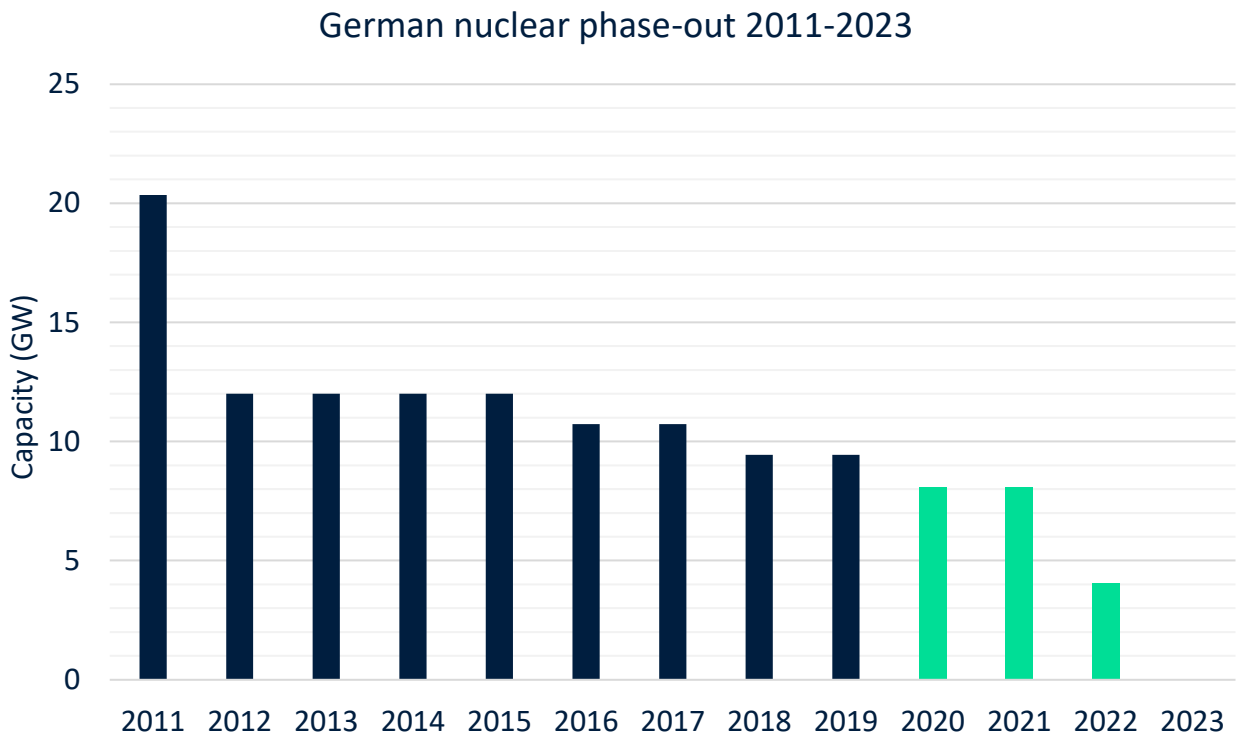


Source: ICIS, IEA

Capacity developments

Nuclear phase-out by 2022

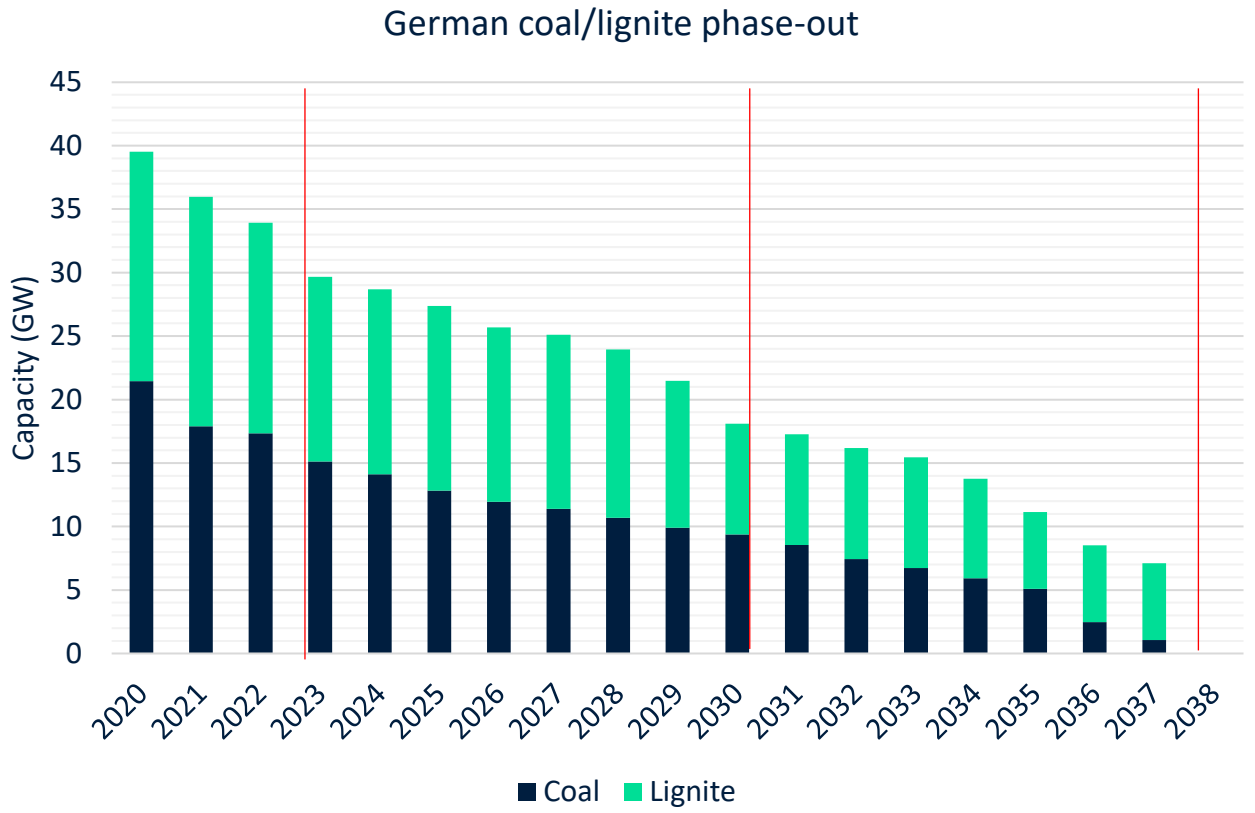
- Germany has six reactors remaining, with a combined capacity of 8.1GW
- They produced 14% of German electricity in 2019
- All six will be phased-out by the end of 2022



Source: ICIS

Coal phase-out plans

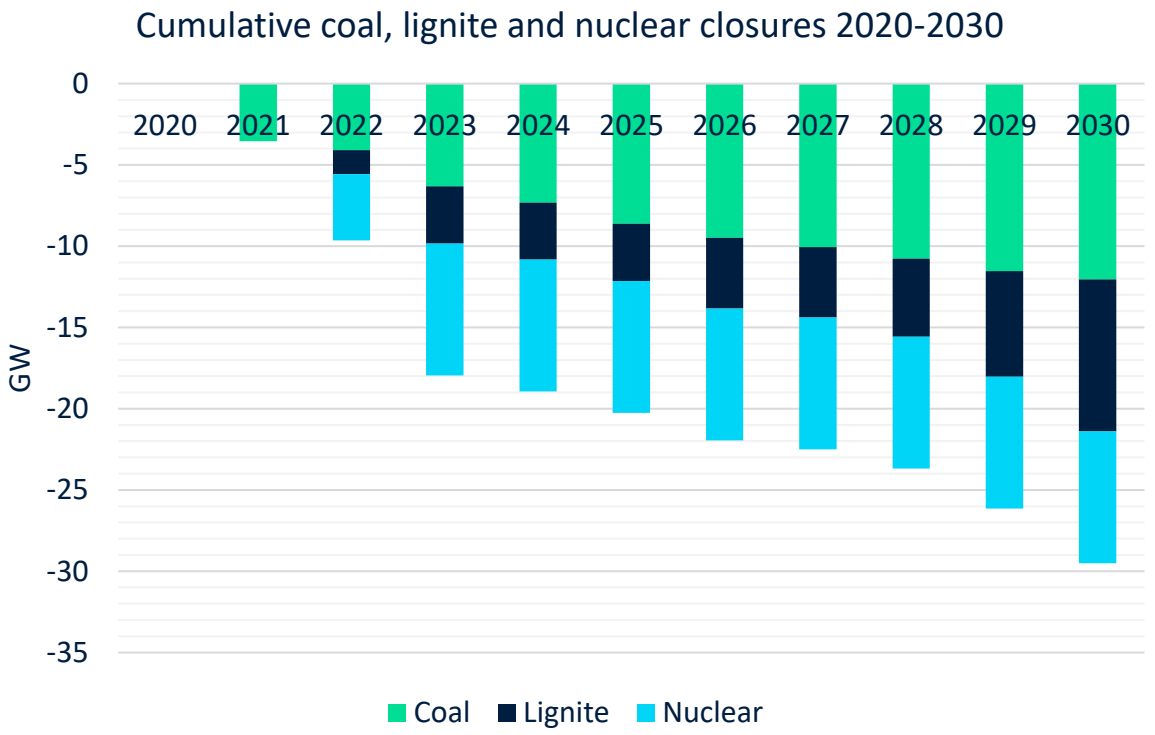
- Targets:
  - 2022: 30GW (15GW coal, 15GW lignite)
  - 2030: 17GW (8GW coal, 9GW lignite)
  - 2038: Full phase-out
- Compensation agreements for lignite operators, tenders for coal closures (through to 2027)
- Potential for phase-out to be sped up by either politics or the market



Source: ICIS

New build gas required

- Cumulatively, 18GW of coal, lignite and nuclear capacity expected to close in the next three years
- By 2030, 29.5GW is anticipated to be retired, based on current plans
- More gas is required in the mid-term to ensure security of supply
  - We assume a 14GW increase to 40GW



Source: ICIS

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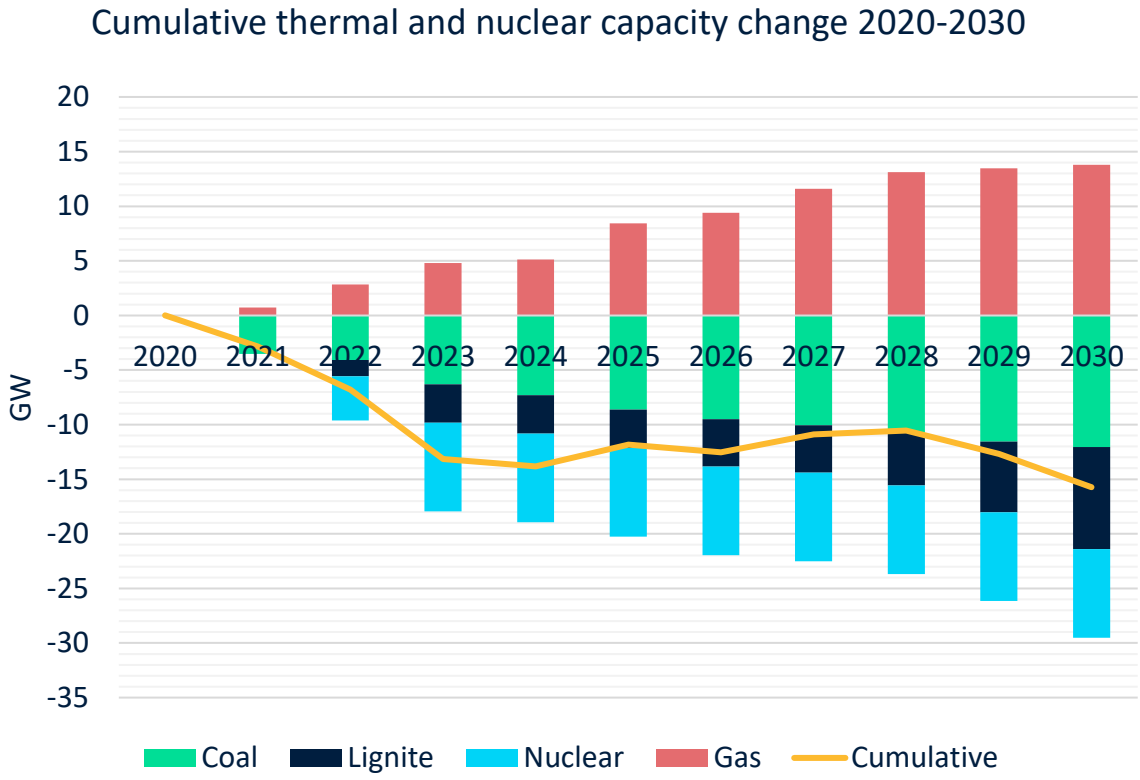
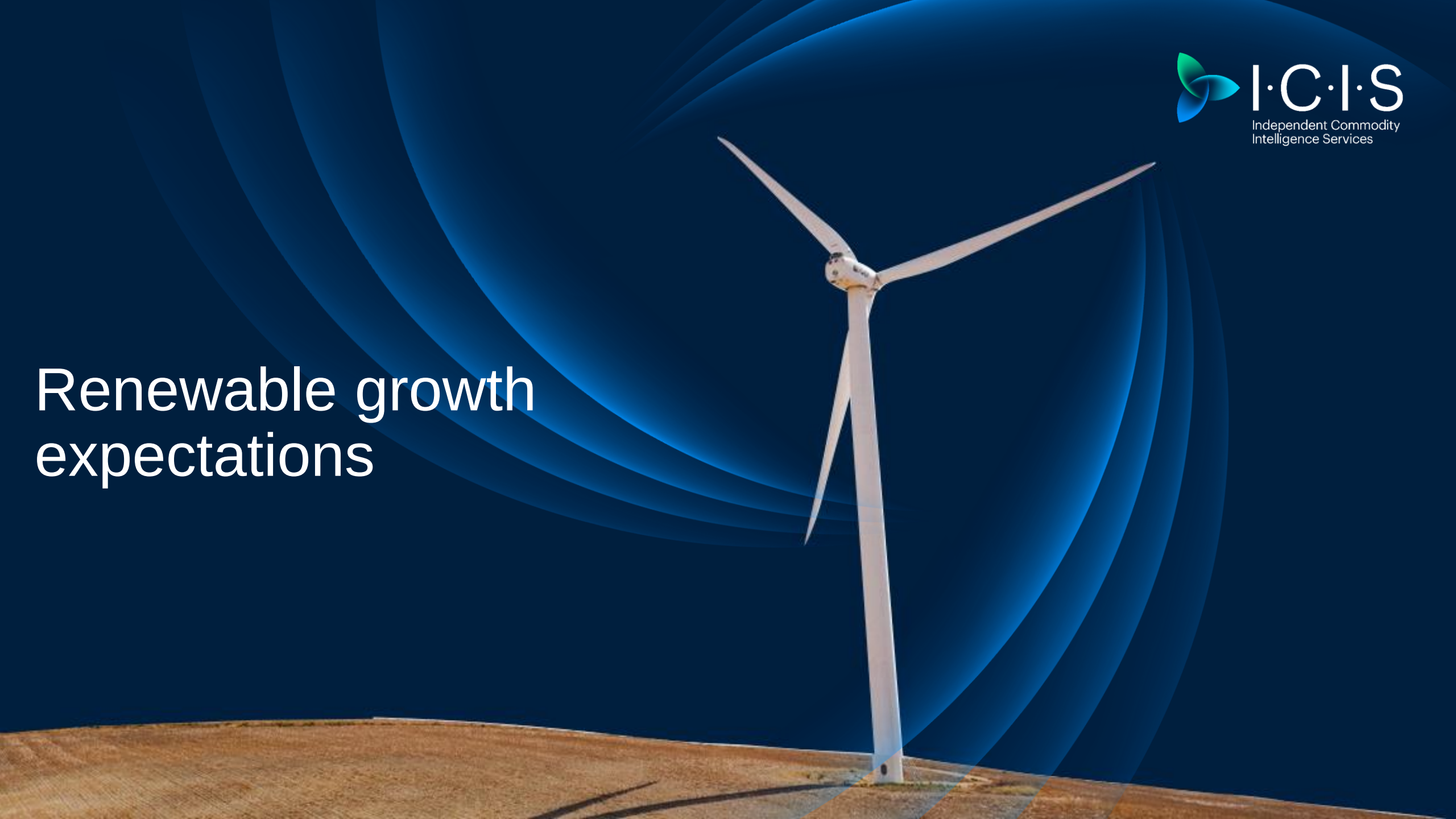
- By 2030, 29.5GW is anticipated to be retired, based on current plans
- More gas is required in the mid-term to ensure security of supply
  - We assume a 14GW increase to 40GW
- After factoring in gas capacity growth, net capacity will decline by 16GW by 2030



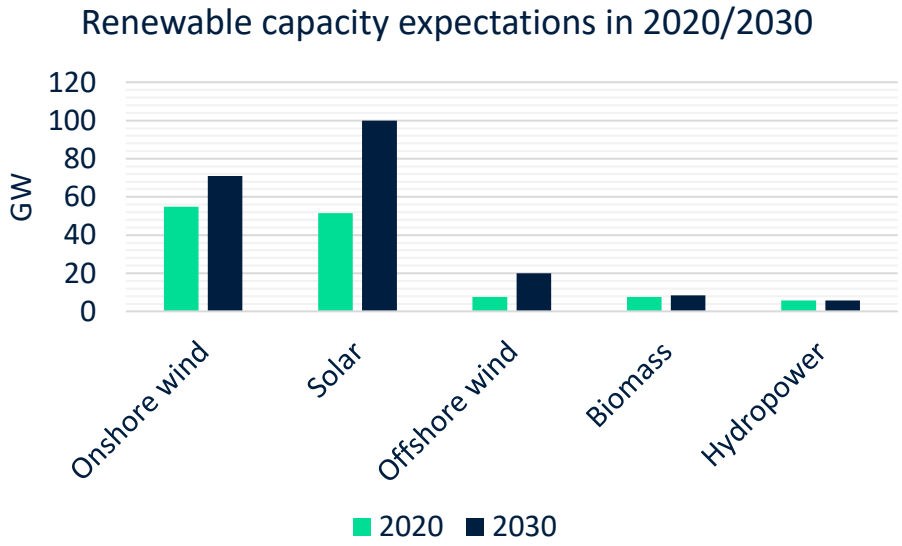
Source: ICIS

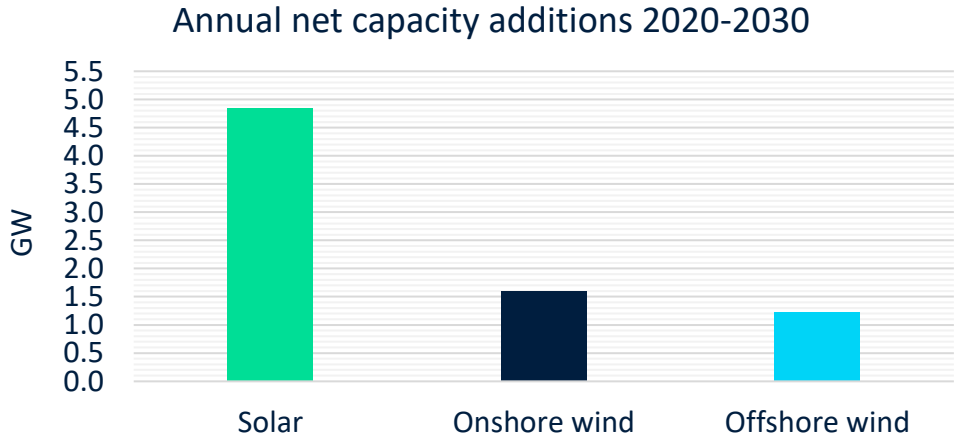
Renewable growth expectations



Germany has a 65% renewable electricity target for 2030

- To reach the target the government suggests that 377TWh of renewable generation will be required in 2030
- Renewable capacity expectations in 2030 (% increase from 2020):
  - Solar: 100GW (+94%)
  - Onshore wind: 71GW (+29%)
  - Offshore wind: 20GW (+160%)
  - Biomass: 8GW (11%)
  - Hydropower: 6GW (+0%)
- Expansion to be driven primarily by the continuation of competitive tenders

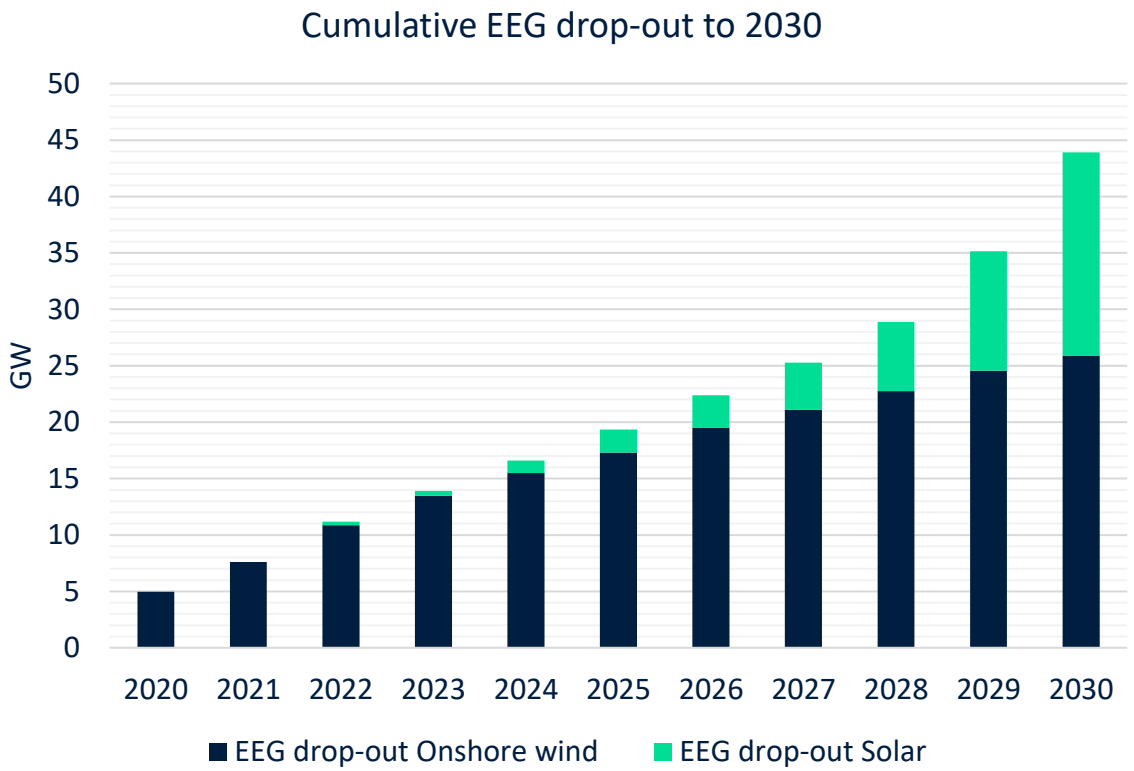




Source: German NECP

~44GW of onshore wind and solar to drop out of EEG by 2030

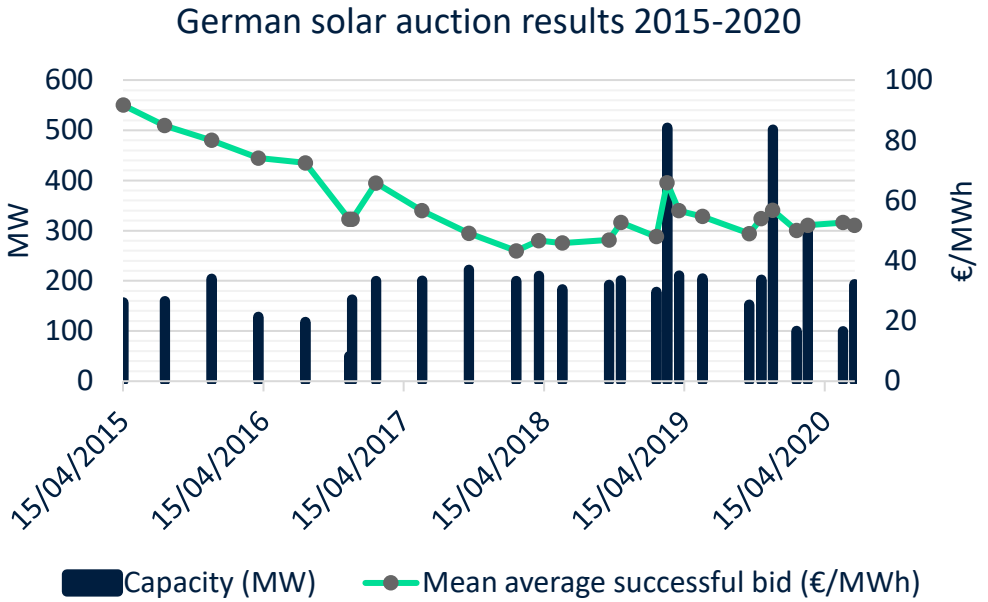
- ~41% of existing solar and onshore wind to drop out of EEG by 2030 (35% solar, 47% wind)
- Onshore wind drop-out is relatively steady; solar picks up from 2028
- Uncertain how much of this capacity will decommission
- Options for remaining online
  - Repowering
  - Direct marketing
  - PPAs

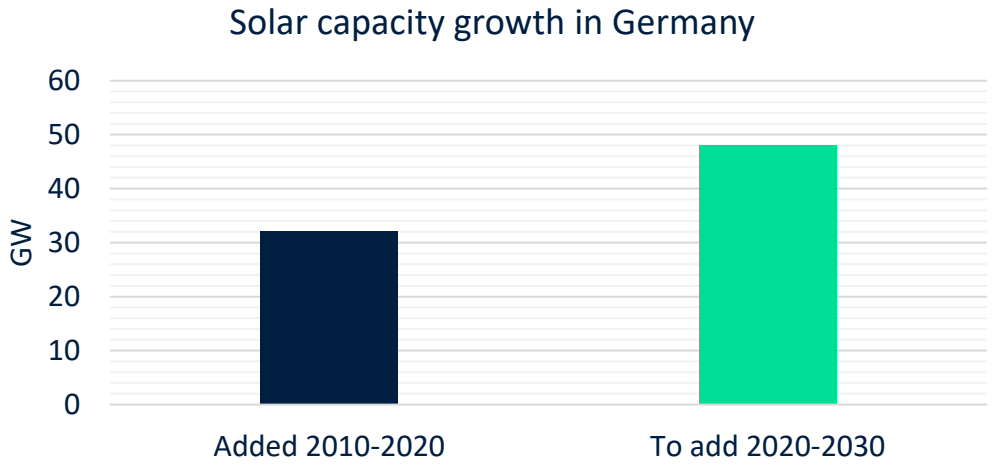


Source: ICIS

Solar

- Auction prices have fallen significantly over the past four years, leading to increased capacity awarded in auctions
- Solar winning all capacity in joint auctions with onshore wind and sol-only auctions over-subscribed
- The main challenge is the scale of the growth required to meet the 100GW target by 2030
- The government plans to auction 18.8GW 2021-2028, which suggests around 20-25GW will need to come from outside the auctions

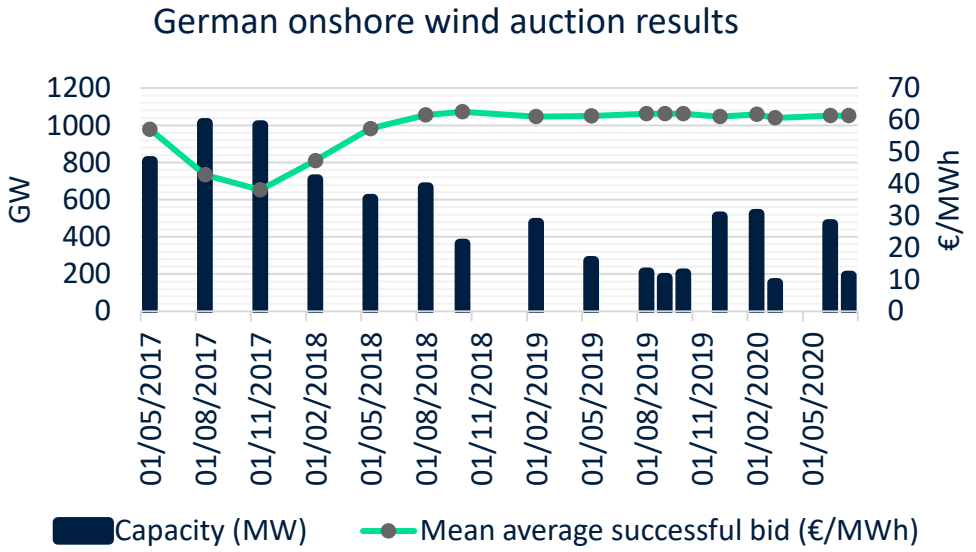


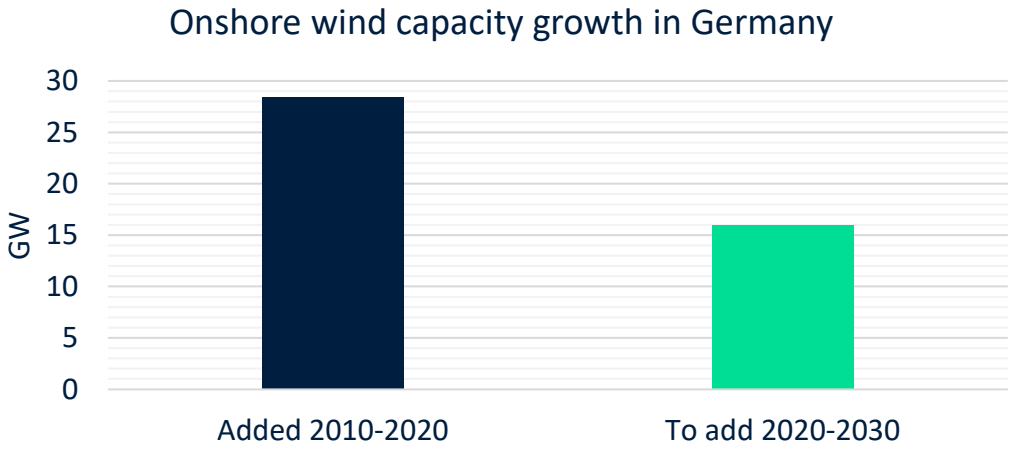


Source: ICIS

Onshore wind

- Onshore wind facing challenges due to a low permitting process and NIMBYism
- Tenders are consistently undersubscribed and additions in 2019 were the lowest this century
- The government is introducing measure to streamline the permitting process
- Net additions of 16GW over the next decade is a modest target, though 26GW of existing wind will drop out of the EEG
- 31GW to be auctioned 2021-2028

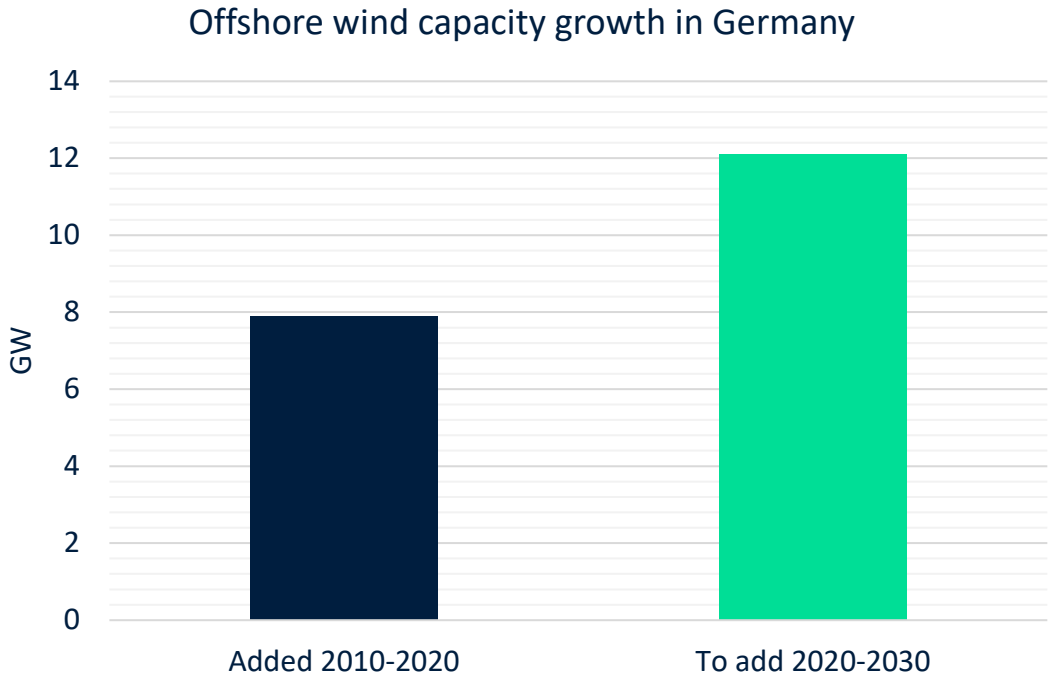




Source: ICIS

Offshore wind

- The offshore wind target for 2030 was recently increased from 15GW to 20GW
- Several subsidy-free offshore wind projects have already been awarded in tenders
- However, the future tender regime for offshore wind remains unclear at present

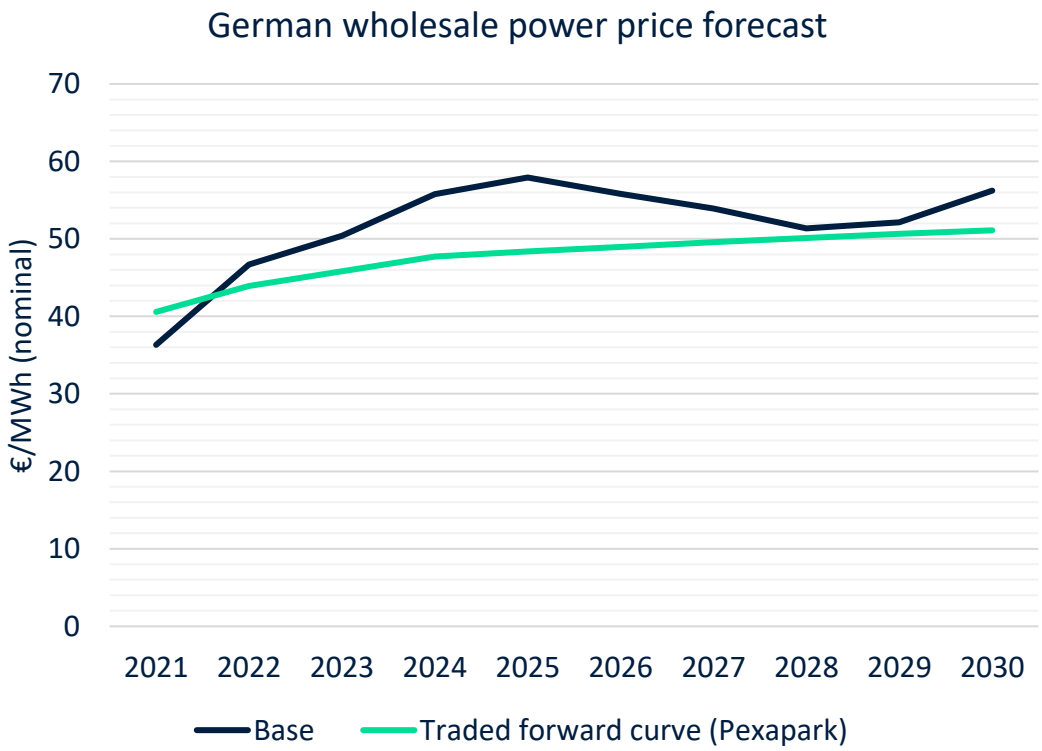


Source: ICIS

Power price outlook

German power price forecast 2021-2030

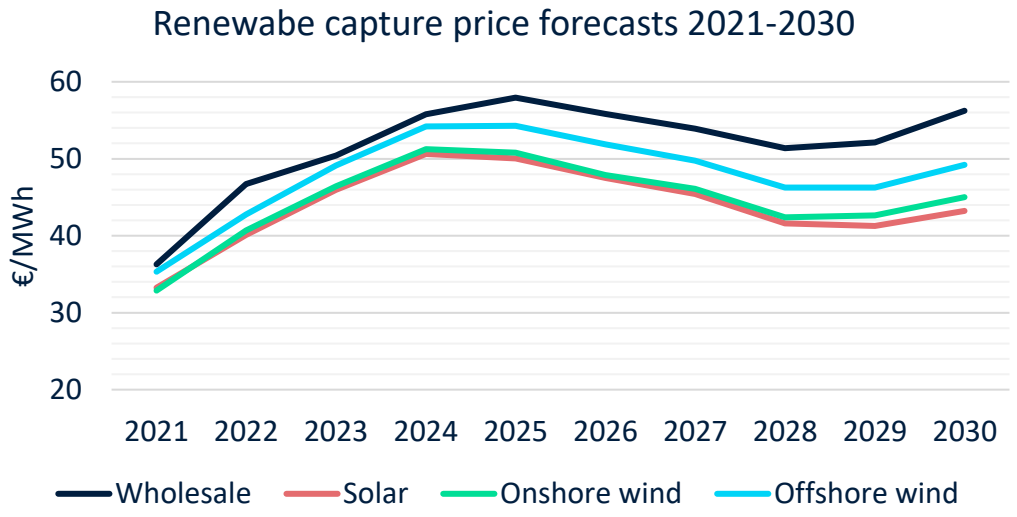
- We expect prices to increase significantly in the mid-term, reaching a peak of €58/MWh in 2025
- Bullish price trend driven by:
  - Increase in carbon prices
  - Recovery in gas and coal prices
  - Phase-out of 20GW of coal, lignite and nuclear 2025
- Prices to decline in the second half of the 2020s as carbon prices soften and increased zero marginal cost renewables come online

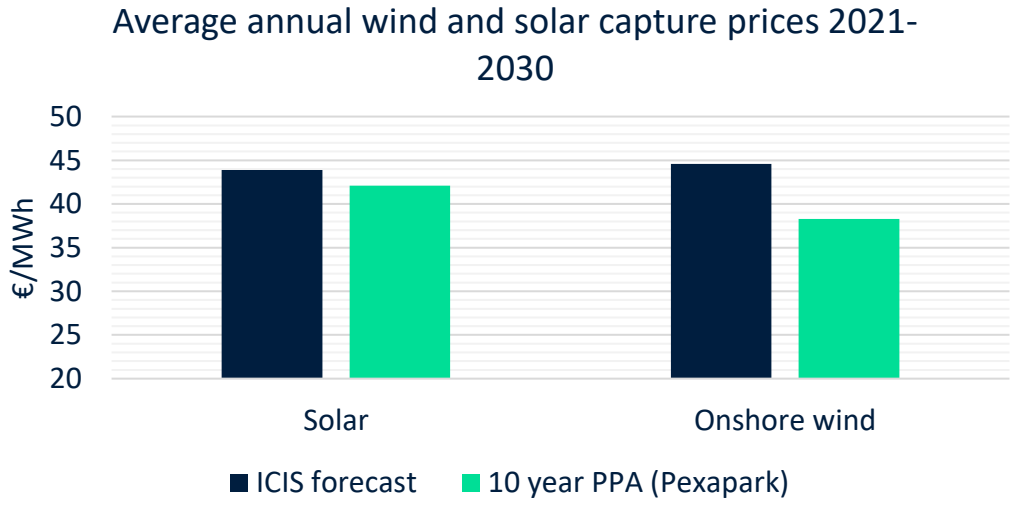


Source: ICIS, Pexapark

German renewable capture price forecasts 2021-2030

- Average capture prices 2021-2030:
  - Solar: €43.91/MWh
  - Onshore wind: €44.61/MWh
- Both technologies will see cannibalisation over the coming decade as renewables increasingly influence price setting in the market
- We anticipate capture prices above the ten year PPA prices identified by Pexapark





Source: ICIS, Pexapark

Thank you

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