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## Aurora provides data-driven intelligence for the global energy transformation



## Aurora brings a sophisticated approach to the provision of analysis and insight to the energy industry

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- Industry-standard market outlook reports and price forecasts for power and gas markets
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- Cloud-based tools for guick, accurate, asset- and site-specific valuations using Aurora's trusted forecasts
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 Market-leading long-term models for power, gas, carbon, oil and coal markets

 Continuous model improvements through client feedback

## Around 40% of net zero power demand today comes from industry



## Rising fuel prices and demand are the main drivers behind increasing power prices until 2050

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Decomposition of drivers for German power price 2020 to 2050 EUR/MWh (real 2019)



1) Indicates the effect of total future renewables buildout, including subsidised, merchant-risk and behind-the-meter renewables;

## On average RES capture prices increase 22% until 2042, before dropping 13-16% due to increased merchant buildout

Baseload and renewables capture prices<sup>1</sup> EUR/MWh (real 2020)





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#### **Outlook for renewables**

### Offshore wind

 Offshore wind capture prices show the lowest average discount to baseload prices due to the more homogenous production profile and later buildout

### Onshore wind

 The discount of onshore wind capture prices to baseload prices is more stable than the other RES technologies as buildout potentials are exhausted earlier

#### Solar

 Solar capture prices show the largest discount to baseload prices in 2050 as increasing capacities amplify price cannibalisation – particularly in the 2040s when merchant risk buildout intensifies

Sources: Aurora Energy Research

## Most existing PPAs in Germany are from solar PV

**Technology Share PPAs in Germany** % of installed capacity





### Price clauses in Germany



## Commercial contract clauses determine the risk distribution and the fair value of the PPA

Who holds the risk? Offtaker Developer **Commercial clause** Description Price clauses Fixed price Fixed long-term price, offtaker takes on full price risk Price follows capture price, contract guarantees a max/min Collared price Price linked to baseload index, offtaker only takes on capture Floating/Indexed price price cannibalisation risk Tenor clauses Not suitable for price hedging as futures liquid, suitable if no Short term (<=5 years) debt financing required. E.g. Onshore / solar > 20 yrs COD (out of EEG) Allows debt financing for smaller new build projects. E.g. solar Medium term (6 - 9 years) and onshore merchant Allows for highly debt-leveraged finance required for high risk Long term (>9 years) projects, e.g. offshore wind (zero bids) Volume clauses As produced Offtaker receives asset generation profile Monthly % of P90 Asset(s) guarantees minimum pattern Asset delivers power at a pre-agreed fixed pattern Fixed pattern/ baseload Few cases uncommon common

#### Source: Aurora Energy Research



## Strong industrial demand and corporates seeking green image suggest a strong demand for PPAs in Germany

Corporate PPA demand segmentation

**Energy intensity Green Image** Price Total Seekers **Green Giants** Hedgers Intermediates High Low **Green** Image **Green Giants** 240 **Seekers** High 202 Stake-88 72 holder 54 pressure 79 56 26 Intermediates **Price Hedgers** 53 12 14 38 16 0 Low 6.4 Rest of net electricity demand PPA demand potential

TWh

Net industry electricity demand (2030 estimate)<sup>1</sup>

1) Excluding minor service and industry that could not be categorised in these segments

### **Corporate demand for PPAs may exceed merchant renewable supply** in 2030



1) We assume that 20% of solar plants leaving the EEG between 2027 and 2030 will sign a PPA and supply of >20MW solar plants will grow to 10TWh by 2030, 20% of onshore parks leaving the EEG between 2027-2030 will sign a PPA, and that 20% of offshore capacity in 2030 (excluding zero bids from 17/18) will sign a PPA 2) Excluding minor service and industry that could not be categorised in these segments Sources: Aurora Energy Research

### The main challenge for the growth of the market is to bridge the gap between what developers and off-takers need from the PPA



Asset requirements		Off-taker requirements		Bridging the gap
Long term predictable revenues	VS	Low energy costs and access to green pipeline	<b>&gt;&gt;</b>	Asset specific fair value assessment (based on power price forecasts)
Flexible, modular PPA contracts	VS	Standardisation (reduction of transaction costs)	<b>&gt;&gt;</b>	e.g. EFET standard contract
Creditworthy offtakers (reduction of default risk)	VS	Enabling decarbonisation no matter the creditworthiness	<b>&gt;&gt;</b>	e.g. Off-taker pooling, government backed securities
Generation profile	VS	Consumption profile	<b>&gt;&gt;</b>	Baseload PPA, offering trading service on top
Planning flexibility	VS	Power provision to a certain date	<b>&gt;&gt;</b>	Contractual agreement to deliver power
Renewable build-out where conditions are favourable	VS	Local CO2 reduction	<b>&gt;&gt;</b>	Single supplier approach to incentivise local build- out

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