

# Outlook of Iberian markets to 2060 & impact of regulatory changes

Public webinar – 8<sup>th</sup> June



# Today's presenters and other key information

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**Ana Barillas**  
Head of Iberia



**Christina Rentell**  
Senior Associate



**Alexandre Danthine**  
Senior Associate



**Enilio Álvarez**  
Commercial Associate

For more information, please contact  
**Enilio Álvarez, Commercial Associate**



[enilio.alvarez@auroraer.com](mailto:enilio.alvarez@auroraer.com)



+34 613 120 636

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

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Power markets



Renewables



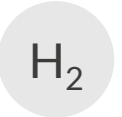
Storage



Electric vehicles



Hydrogen



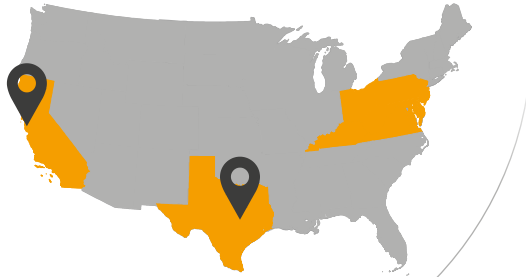
Carbon



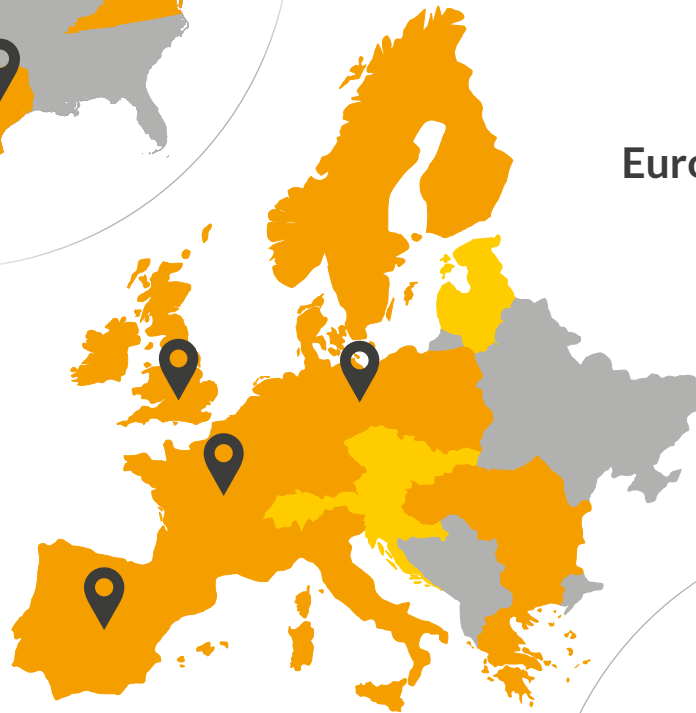
Natural gas



United States



Europe



Australia



 Regular detailed coverage  Analytics on demand



7 Offices

Oxford | Berlin | Madrid | Paris  
Sydney | Austin | SF Bay Area



225+  
market experts



550+  
subscribing companies



100+  
transactions supported in 2021

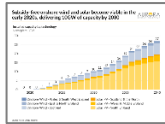
# We are working with key Iberian and international utilities, investors, lenders, developers and government

## Iberia subscribers



# Iberia Power Market Service

## Summary of service



### Biannual market outlook reports

- Full update on energy policy developments in Spain and Portugal
- Market outlook and capacity development to 2060
- Forecast of wholesale market prices
- Evolution of the economics of renewables and batteries
- Brief quarterly updates to reflect near-term commodity price changes



### Forecast data

- Full forecast dataset in .xls until 2060 for use in investment cases
- Wholesale prices, capture prices, capacity and generation mix, etc.



### Strategic Insight reports

- Regular deep-dive analysis on topical issues in the evolving renewables market and new business models (e.g. pricing structures in corporate PPAs, Net Zero in Iberia, portfolio diversification, etc.)



### Group Meetings

- Presentation of forecast update and new research
- Networking opportunity with developers, investors and Government



### Workshops and analyst support

- Bilateral workshops to discuss Aurora's analysis and specific implications
- Ongoing analysis support to answer questions about our research



### Aurora Spring Forum

- Our annual Spring Forum brings together senior executives of the European energy industry to discuss issues that impact the industry; full day in Oxford

↑  
Access  
anytime  
via EOS  
online  
platform<sup>1</sup>  
↓

1) Subscribing companies can set up unlimited user accounts on EOS

# Iberia flexibility Market add-on service: Provides detailed power market analysis and investment case data for batteries



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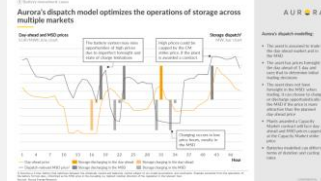
R A

## Flexibility Market add-on service

### Forecast reports & data

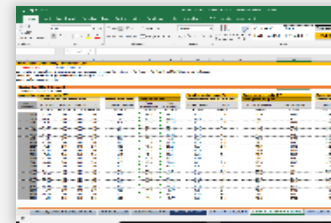
#### Technology and market development reports

- Overview of battery pipeline development
- Overview of regulatory framework for batteries
- Revenue stacking models for batteries
- Projections for battery CAPEX and OPEX by delivery year
- Reports and datasets follow the same format with content tailored to specific markets



#### Forecast data

- Central case forecast prices provided at settlement period granularity until 2060
  - Wholesale power prices
  - Balancing market prices
  - Ancillary services prices



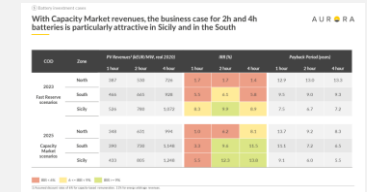
### Ongoing analyst support

Throughout the year you can contact us to discuss questions related to our analysis and our thoughts on flexibility market and policy developments.

### Investment cases

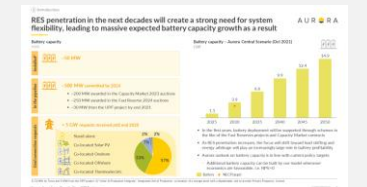
#### Standalone Battery

- At least six investment cases per country including:
  - Arbitrage of wholesale market and balancing market
  - Secondary reserve participation
- Annual project margins to 2050. IRR and NPV for entry years 2025



#### Co-location

- At least two investment cases for battery co-located with solar PV and onshore wind
- Annual project margins to 2050. IRR and NPV for entry year 2025



## I. Aurora central scenario

### 1. Key assumptions

### 2. Results

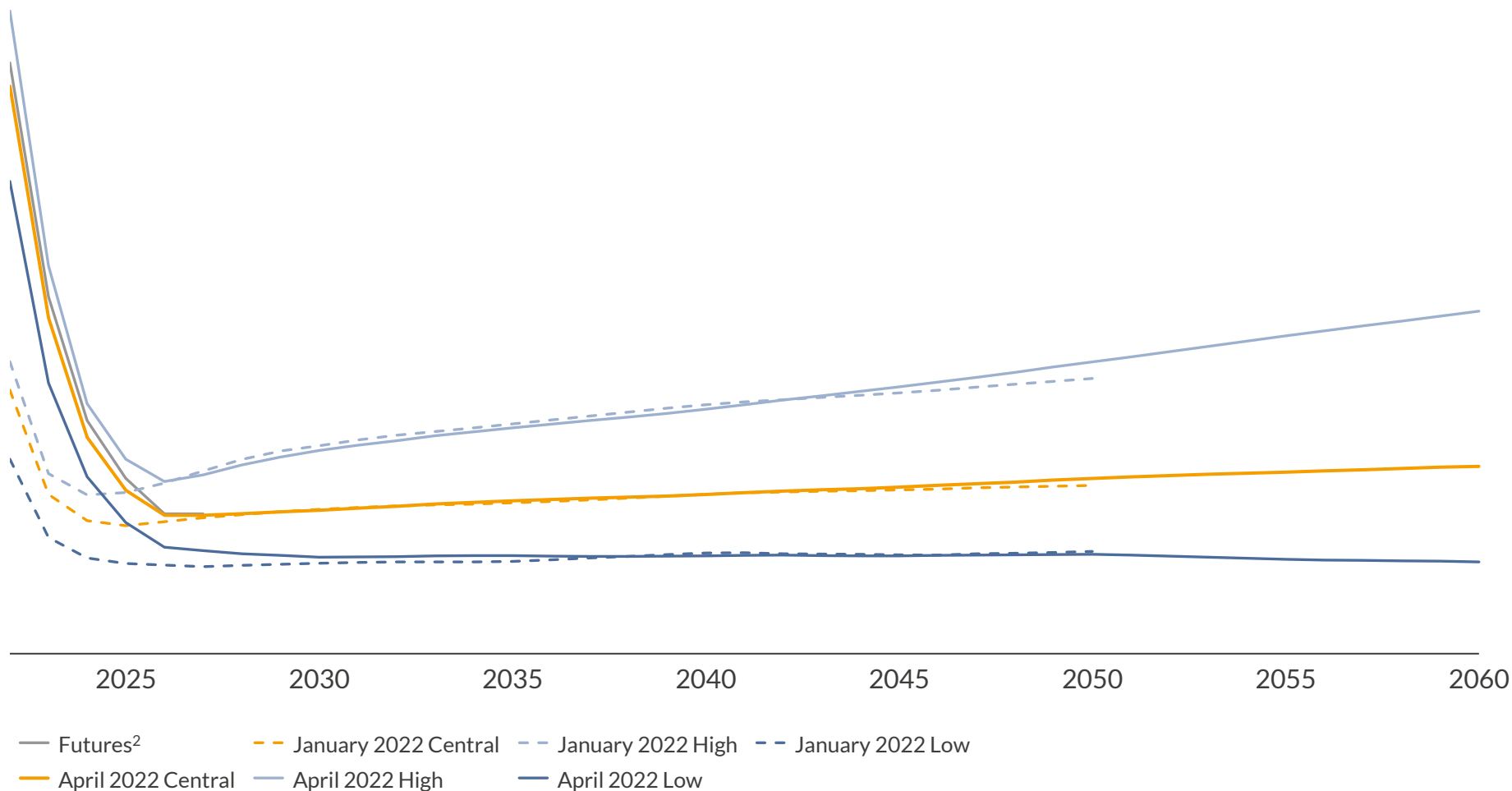
## II. Market design discussion

## III. Appendix



# European gas prices rebalance by 2026 as Russian dependence is reduced and then increase to 2060 due to rising global gas demand

MIBGAS gas prices  
EUR/MWh (real 2021)<sup>1</sup>



1) For years 2022-2027, the prices shown consider current futures prices for the years in question, with declining weights. 2) A rolling 30-day average as of 14/03/2022.

## 2022-2027

- The gas price in the period to 2027 averages above 40 EUR/MWh, 64% higher than the previous forecast
- The market has further tightened due to uncertainty around future Russian supply, indefinite suspension of NS2 and global competition to secure LNG supply
- By 2026, the market is expected to rebalance below 25 EUR/MWh as LNG liquefaction and regasification infrastructure comes online

## 2028-2050

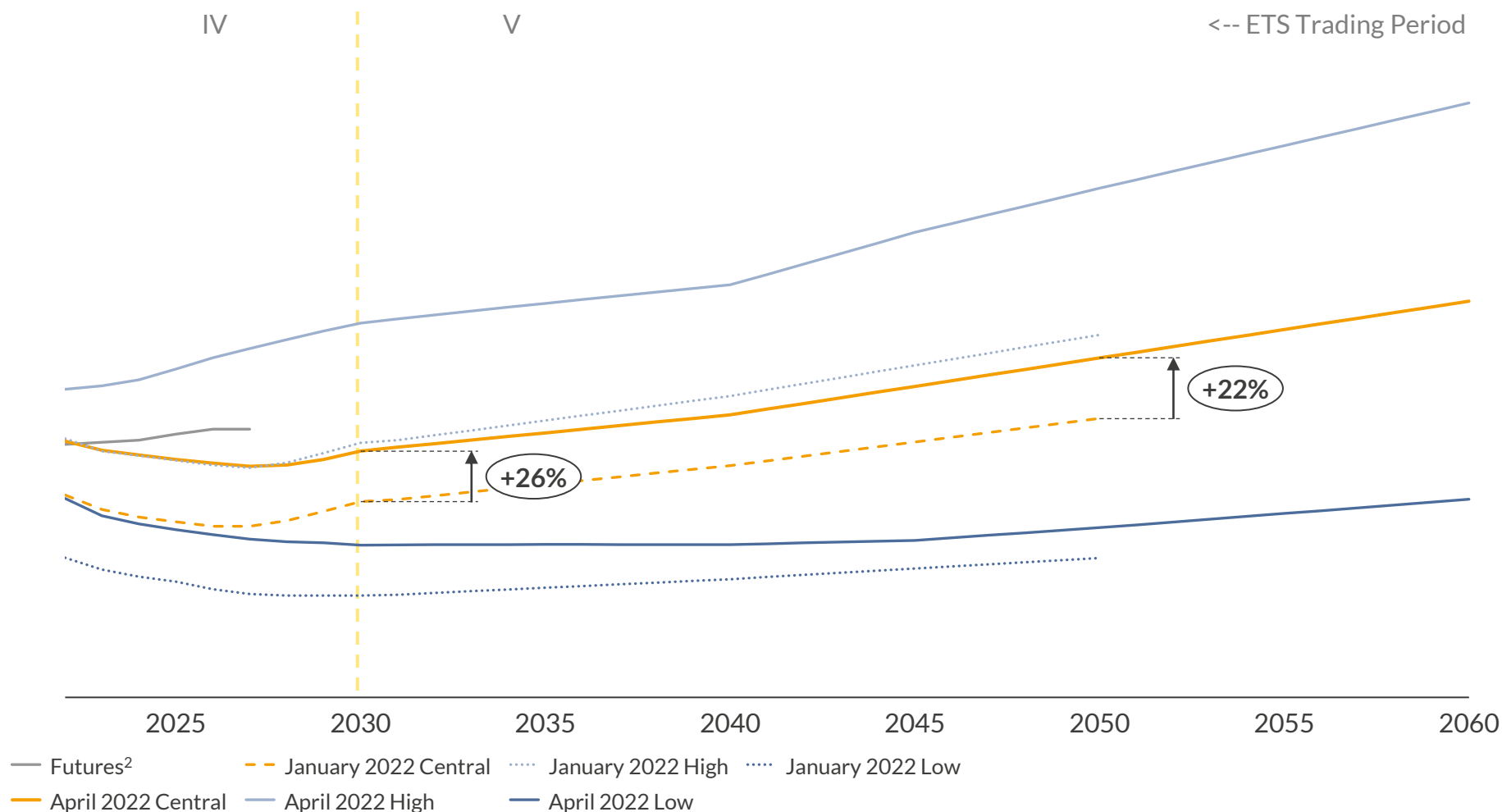
- The gas price in the period to 2050 averages 28 EUR/MWh, 1% higher than the previous forecast
- The gas price rises in the 2030s as Asian gas demand continues to rise, tightening the global LNG market, and indigenous production falls



# EUA price forecast rises by 26% in 2030 due to impact of Fit-for-55 proposals and higher EUA carry-over to hedge against future scarcity

## Carbon prices<sup>1</sup>

EUR/tCO<sub>2</sub> (real 2021)



1) 2022 price is a mix of historical price and forecast YTD as of 14<sup>th</sup> March 2022. For years 2022-2027 the prices shown take into account current futures prices with declining weights. 2) A rolling 30-day average as of 14/03/2022.

Source: Aurora Energy Research

## 2022-2027

- While futures influence short-term prices through 2027, we expect prices to decrease slightly from current levels to align with fundamental abatement costs

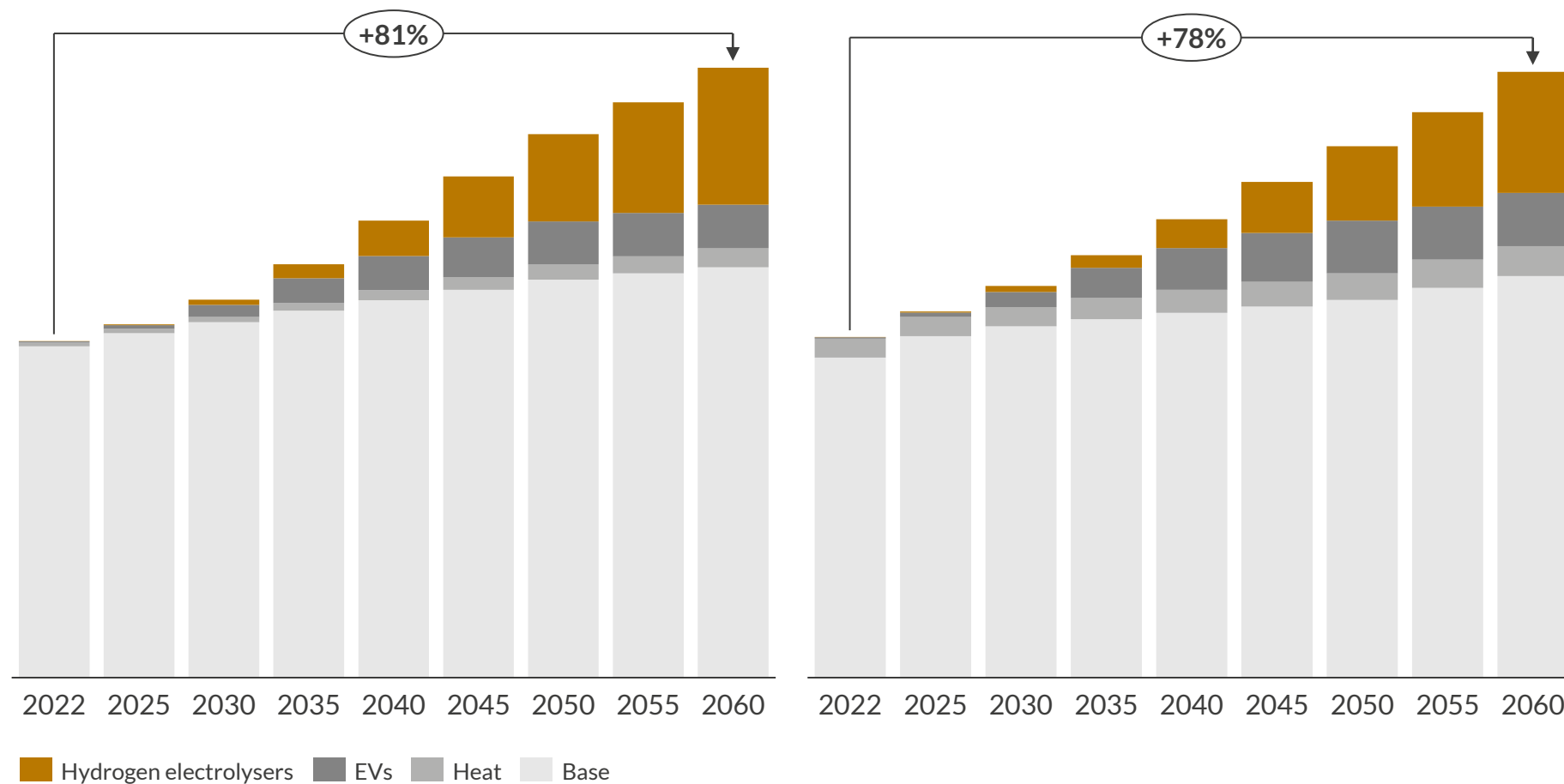
## 2028-2060

- From a temporary low in 2027, EUA prices are expected to rise above 75 EUR/ tCO<sub>2</sub> in 2030. This price increase of 26% over our previous forecast reflects more ambitious expectations of future climate policy
- We expect investors to bank significant amounts of EUAs until 2030 to hedge against faster decarbonisation in the 2030s
- Without a binding year for zero ETS emissions, our Central forecast assumes ETS auctions end in the 2060s with a price above 120 EUR/tCO<sub>2</sub>, approaching what would be required for fuel switching to hydrogen

# Demand in Iberia is expected to increase significantly due to the electrification of industry and transport

## Total electricity demand

TWh



1) Based on our assumptions for total hydrogen demand and the supply of grey and blue hydrogen, the model decides at an hourly level on the optimal utilisation of hydrogen electrolyzers. Green hydrogen production decisions are based on hourly wholesale market prices.

Sources: Aurora Energy Research

- Total electricity demand increases by 81% by 2060 compared to today's levels in Spain while in Portugal demand increased by 78%
- In Iberia, demand has an annual growth rate of 2.1% between 2022 and 2060, as there are more ways to continue the decarbonisation and electrification of industries
- Demand from electrolyzers is determined by the model<sup>1</sup> through an endogenous methodology

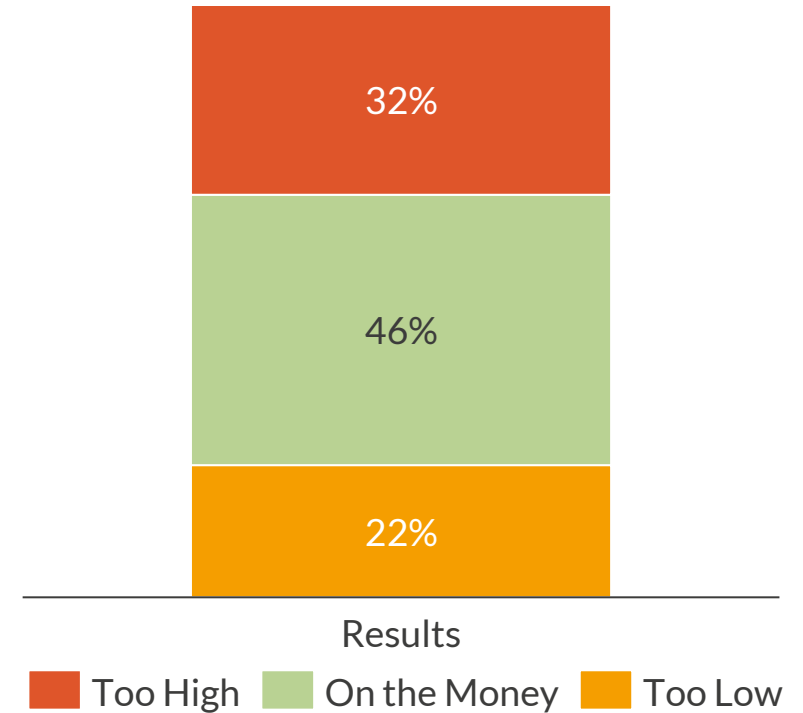
## Opinion poll 1 – [www.menti.com 3760 8228](https://www.menti.com/37608228)

**Aurora's Central scenario assumes that green hydrogen electricity demand reaches slightly more than 20% of the total Spanish electricity demand in 2060.  
How do these assumptions compare to your view?**

**A** Too high – hydrogen demand will be much lower

**B** On the money – this is a realistic assumption

**C** Too low – hydrogen demand will increase even further



## I. Aurora central scenario

1. Key assumptions

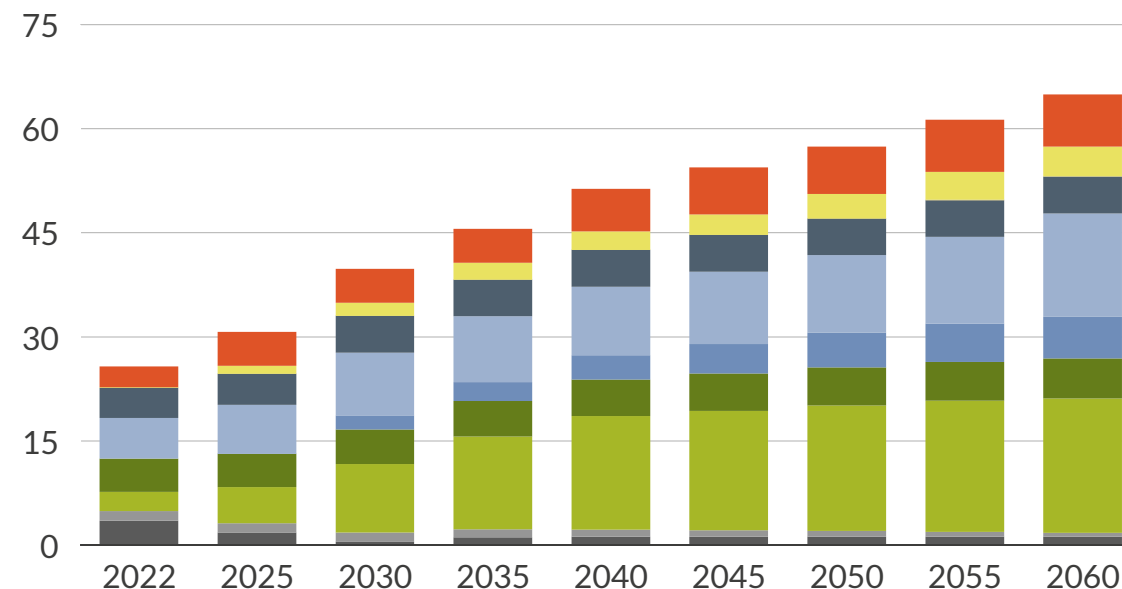
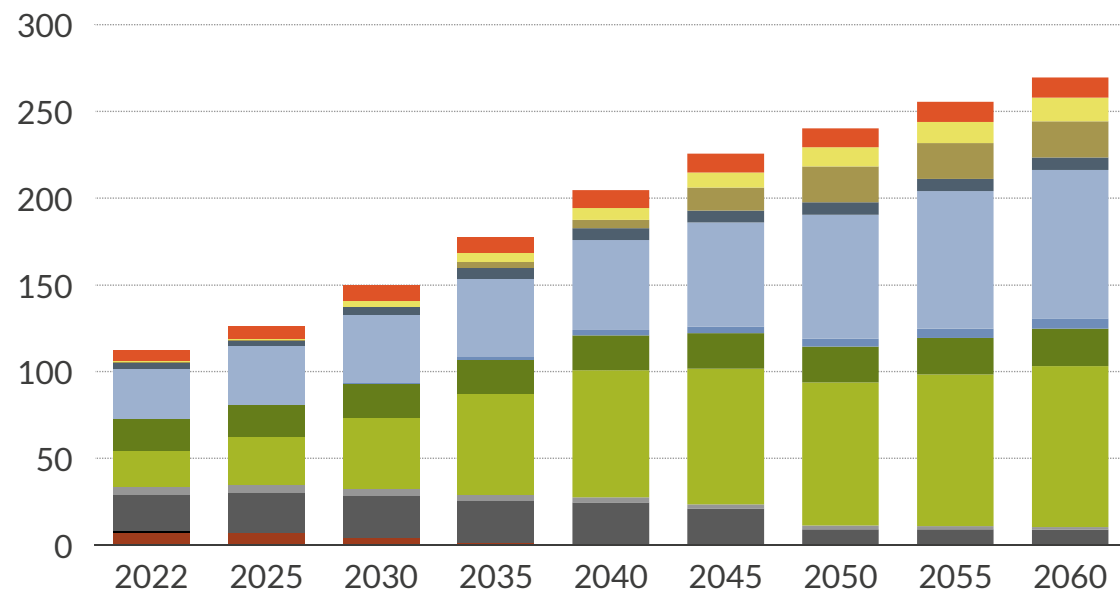
2. Results

## II. Market design discussion

## III. Appendix

# As renewables boom, the retiring coal & nuclear capacities are replaced by batteries & other peaking plants to ensure security of supply

Total installed capacity  
GW



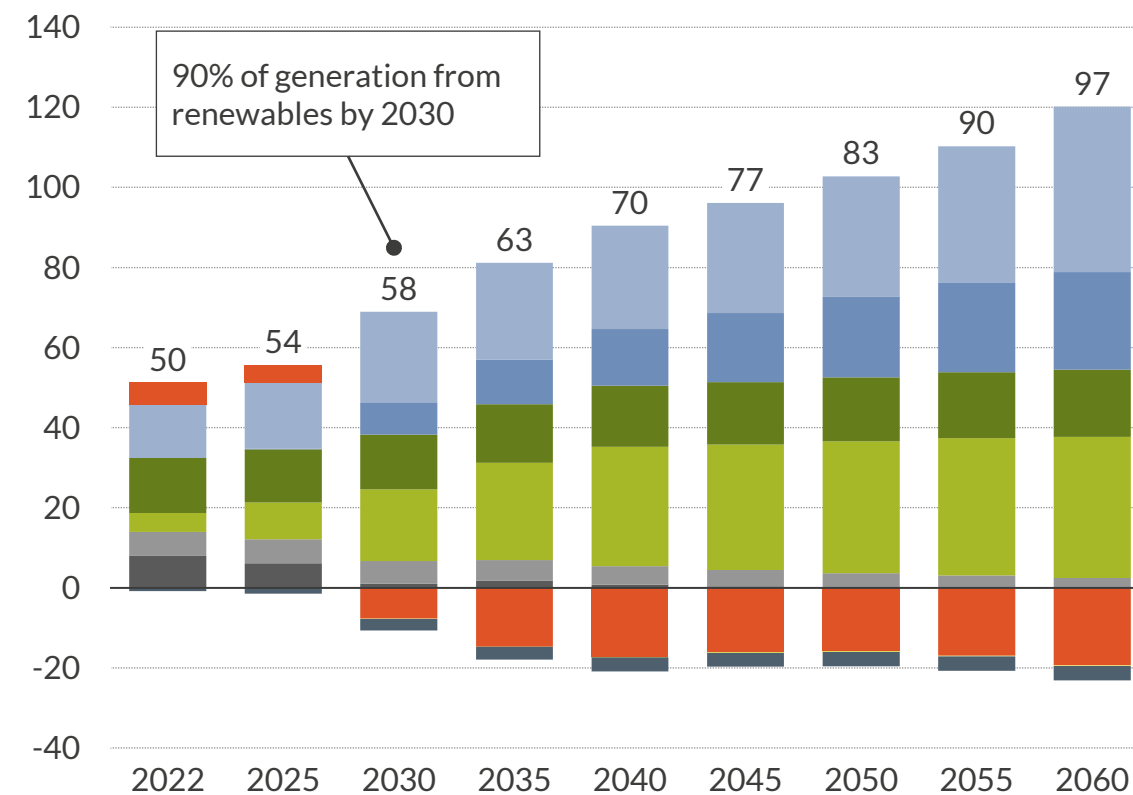
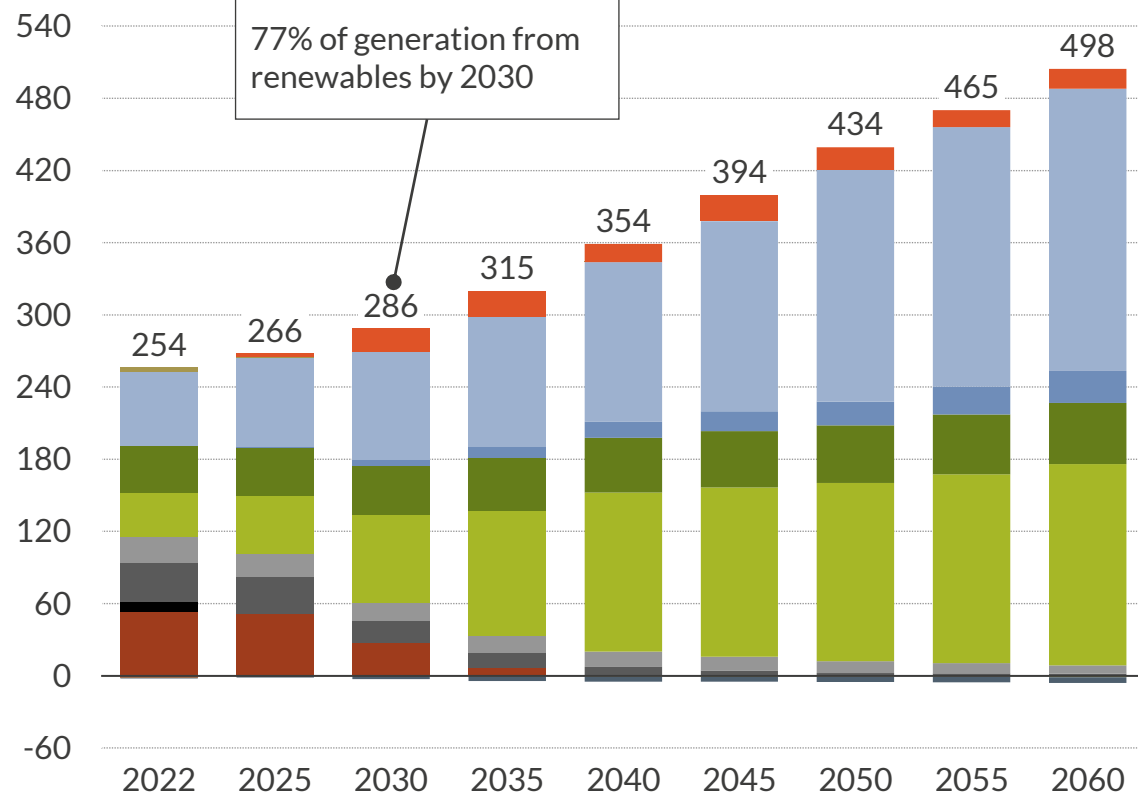
- A drive towards ambitious decarbonisation objectives sees renewable capacity increasing significantly in Iberia – total installed capacity of wind and solar increases by 135 GW (or 270%) in Spain and 32 GW (or 365%) in Portugal from 2022 to 2060
- To ensure that security of supply standards are met, retiring baseload and dispatchable capacities are replaced by a combination of peaking capacity and batteries in Spain, and predominantly batteries in Portugal

■ Interconnectors   
 ■ Peaking<sup>1</sup>   
 ■ Onshore wind   
 ■ Other RES<sup>2</sup>   
 ■ Other thermal<sup>4</sup>   
 ■ Coal  
■ Battery storage   
 ■ Pumped storage   
 ■ Offshore wind   
 ■ Solar<sup>3</sup>   
 ■ Gas CCGT<sup>5</sup>   
■ Nuclear

1) Includes OCGTs, small gas peakers and existing oil peakers. As the capacity market rules are finalised, this might be replaced by carbon-free technologies. 2) Other RES includes biomass, renewable cogeneration, run-of-river, and hydro reservoir. 3) Solar includes solar rooftop PV, solar ground-mounted PV, and solar thermal. 4) Other thermal includes fossil fueled cogeneration. 5) We assume that a portion CCGT plants are able to retrofit at lower CAPEX than new build plant.

# The evolution of generation mimics capacity, with renewables' share of generation exceeding 95% in Spain and Portugal by 2050

Generation mix  
TWh



■ Interconnectors<sup>1</sup>
■ Peaking<sup>2</sup>
■ Onshore wind
 ■ Other RES<sup>3</sup>
■ Other thermal<sup>5</sup>
■ Coal
   
■ Battery storage
 ■ Pumped storage
 ■ Offshore wind
 ■ Solar<sup>4</sup>
■ Gas CCGT
 ■ Nuclear

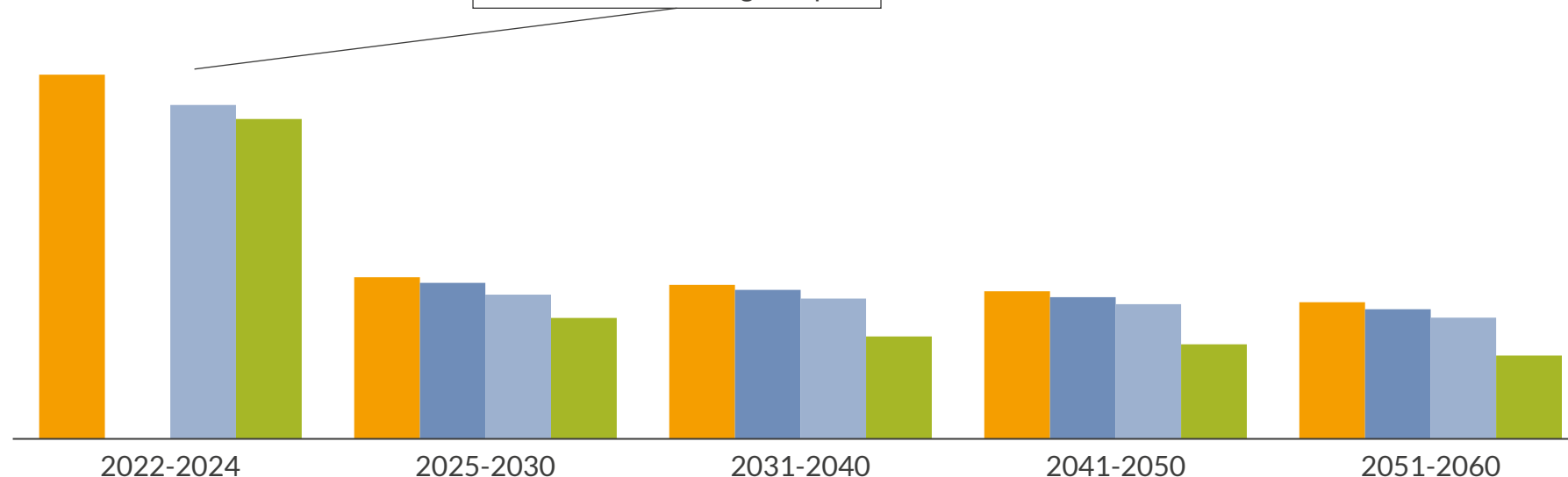
1) Net imports. 2) Includes OCGTs, small gas peakers and existing oil peakers. As the capacity market rules are finalised, this might be replaced by carbon-free technologies. 3) Other RES includes biomass, renewable cogeneration, run-of-river, and hydro reservoir. 4) Solar includes solar rooftop PV, solar ground-mounted PV, and solar thermal. 5) Other thermal includes fossil fueled cogeneration.

Sources: Aurora Energy Research

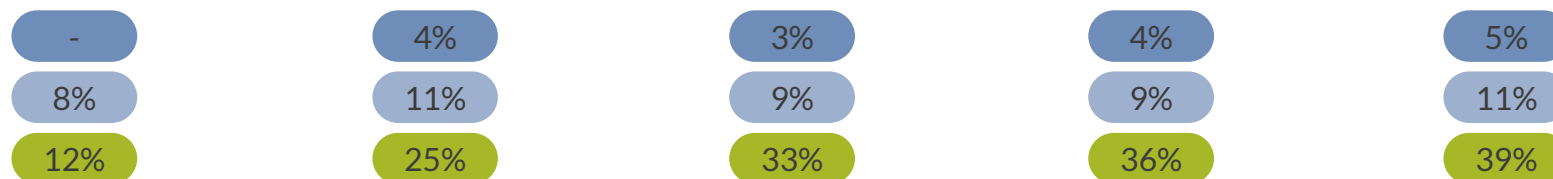
# Aurora's Central forecast sees solar capture prices decrease as solar generation grows, but cannibalisation stabilises due to flexible demand

Baseload and renewables capture prices<sup>1</sup>  
EUR/MWh (real 2021)

2022 and 2023 prices do not include the latest gas cap



## Average discount to baseload



Baseload Offshore wind Onshore wind Solar

## Outlook for renewables

- Renewables capture prices follow a similar trend to baseload prices throughout the forecast horizon
- The level of cannibalisation for each technology increases as a result of additional renewable generation throughout the forecast. This is most prominent for solar assets which reach an average discount to baseload of 33% in the 30s due to the high correlation in their production patterns across the peninsula
- In the 2030s, average annual capture prices are:

Offshore wind	60 - 65 EUR/MWh
Onshore wind	55 - 60 EUR/MWh
Solar	40 - 45 EUR/MWh

1) Uncurtailed generation weighted average across fleet.



# Agenda

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## I. Aurora central scenario

1. Key assumptions
2. Results

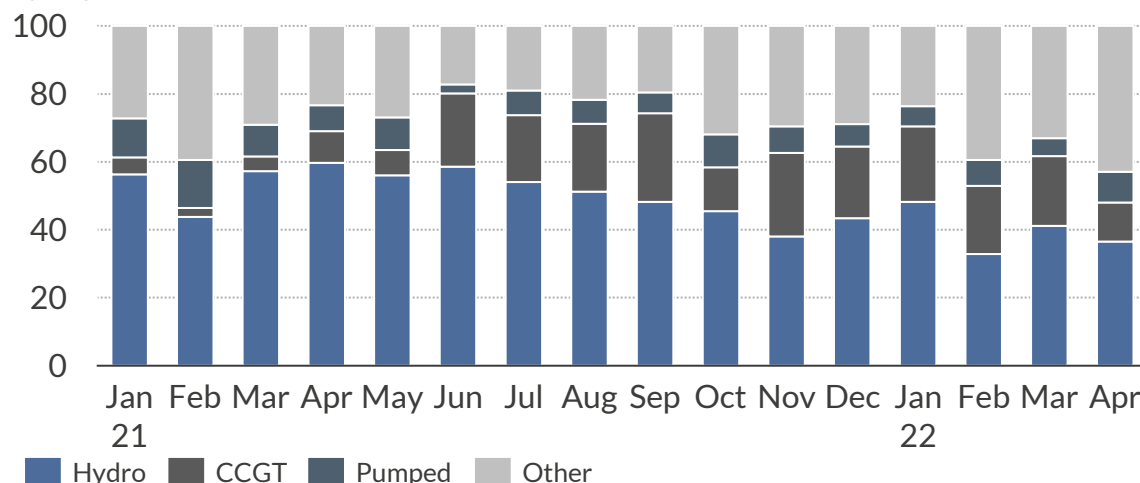
## II. Market design discussion

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# The Iberian Peninsula suffers from high prices despite low CCGT marginality and a significant percentage of renewables in the mix

## Marginal Technologies

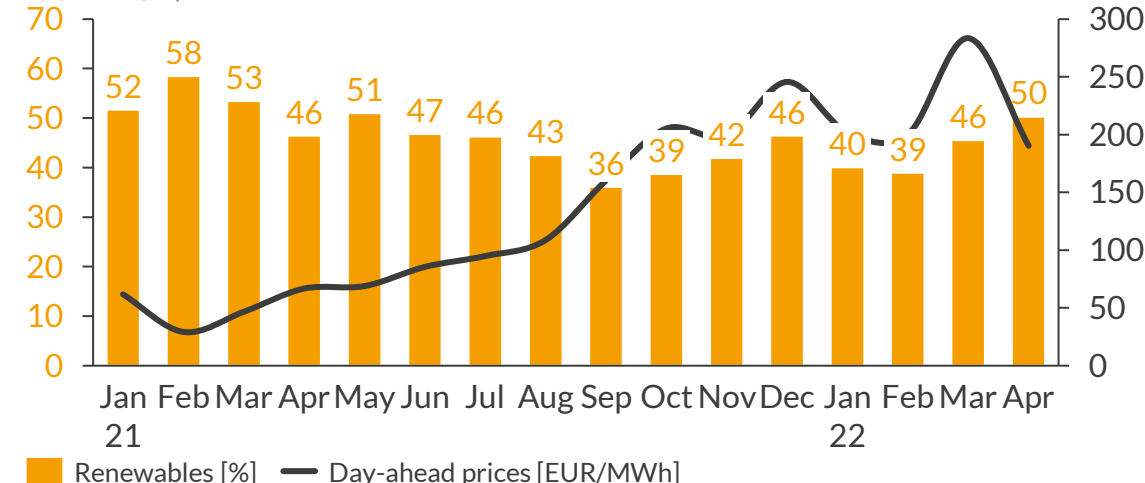
% of time



- Despite gas being marginal less than 25% of the time, the Iberian Peninsula suffers from high prices as hydro tries to bid off gas
- Two distinctive periods can be highlighted:
  - May to September 2021: CCGTs start to become more marginal as gas prices increase
  - October 2021 to now: Due to the application of the claw back mechanism, the number of times hydro was marginal decreased in order to avoid triggering the mechanism

## Renewables in the energy mix and evolution of wholesale market prices

% and EUR/MWh



## Challenges to retail tariffs are exacerbated by volatility in the wholesale market

- Retail clients can choose their preferred tariff from two options:
 

**1 Free Market:** Fixed Price consumer tariff

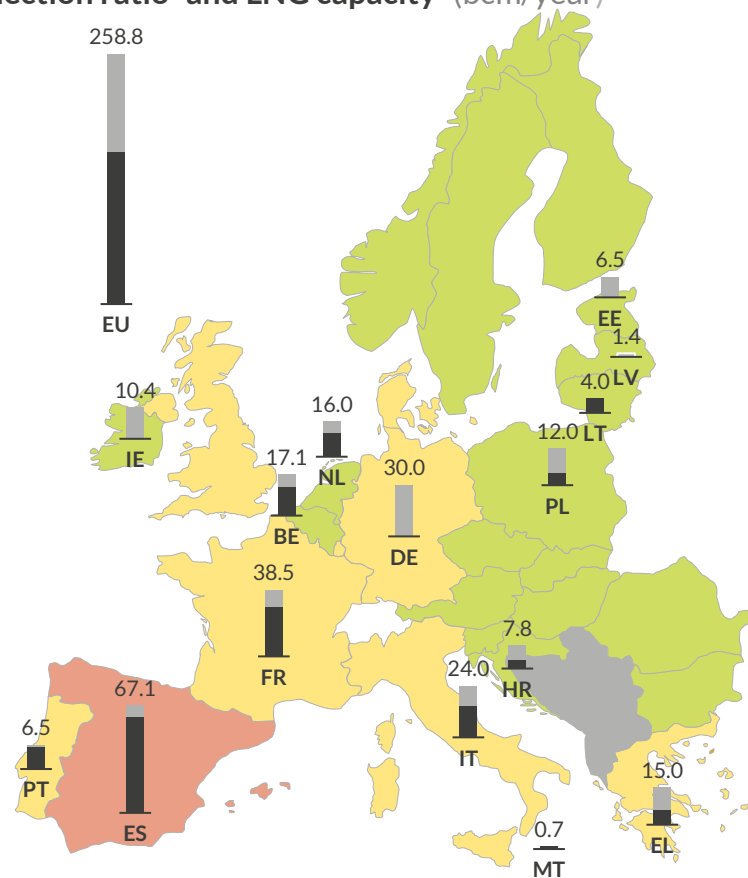
**2 Regulated Market:** Variable Price consumer tariff (**PVPC**<sup>1</sup>)
- However, the PVPC Tariff is mandatory for those consumers who receive the social bonus, meaning that the most vulnerable customers are exposed to fluctuations in wholesale markets, in both positive and negative directions
- According to the CNMC, the 40% of retail consumers in the Regulated Market experienced an average increase of 45% on their electricity bill in 2021, equivalent to 229€, compared to 2020<sup>2</sup>

1) Precio Voluntario del Pequeño Consumidor. 2) Calculated on the basis of average energy consumption.

# With low interconnections, significant LNG capacity and low liquidity in forward markets, the Iberian peninsula can be seen as an European exception

- 1 Spain has a low electrical interconnection with the rest of Europe while not being dependant of Russian gas due to high LNG imports

Interconnection ratio<sup>1</sup> and LNG capacity<sup>2</sup> (bcm/year)

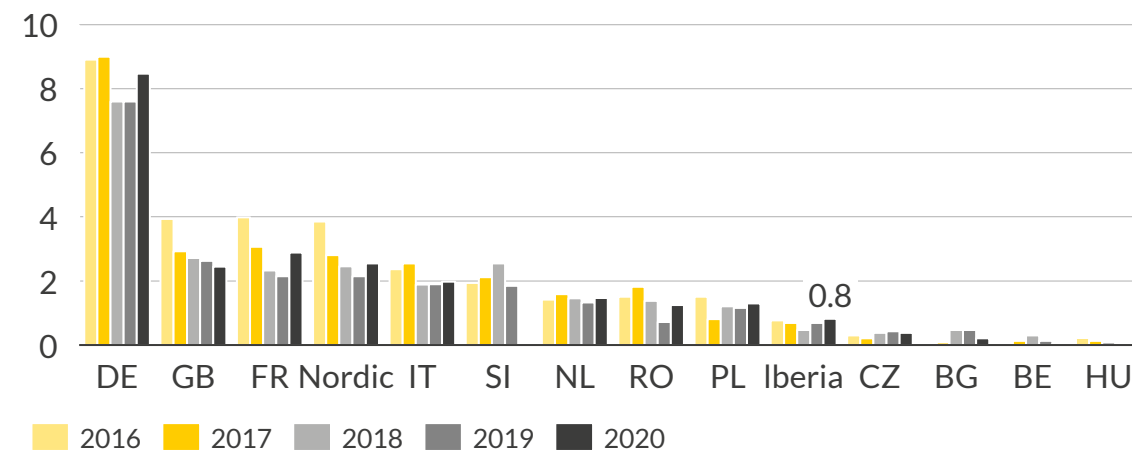


Interconnections 5-10% 10-15% >15%

LNG Operational (LNG) Planned or under construction (LNG)

- 2 Low liquidity of forward markets in Iberia reduces hedging opportunities against high prices

Churn factors<sup>3</sup> in major forward market in Europe



- **Interconnections:** Spain did not meet the European Union targets of an interconnector ratio of 10% by 2020 and 15% by 2030
- **LNG capacity:** More than one third of LNG capacity in Europe is installed in Spain and Portugal (74.7 bcm). This reduces dependence on Russian gas supply, although the market is still affected by LNG supply issues
- **Forward market liquidity:** Low liquidity in forwards markets reduces opportunity for companies to hedge and reduce the price volatility that is affecting consumers. With a churn factor lower than one, the Iberian peninsula compares poorly to the rest of Europe

1) Interconnection ratio is the sum of the importation capacities versus the installed generating power (2020 values). 2) Values estimated in March 2022 (UK excluded). 3) Churn factor is defined as the overall volume traded through exchanges and brokers expressed as a multiple of physical consumption.

# Spanish and Portuguese governments have approved Decree Laws for a cap on the gas price internalised in wholesale market offers

**1** On 13<sup>th</sup> May, Spain and Portugal approved RDL 10/2022 and DL 33/2022 respectively, effective once the EC<sup>1</sup> issues final approval

- The mechanism will compensate fossil fuel generators for the difference between the MIBGAS price and a capped gas price. The compensation will be payable to fossil fuel generators<sup>2</sup>
- Offers will take into account lower fuel costs, directly impacting the wholesale market price when these technologies are marginal

## Duration

- The mechanism is expected to be in force for 12 months, and in any case until 31/05/2023 at the latest
- During the first six months, the capped price will be 40€/MWh, increasing by 5€/MWh per month for the remaining months

## Funding the mechanism

- The cost of the adjustment mechanism will be distributed across market agent bids, proportional to the energy purchased
- In the case of Spain, exports to France can be expected to increase as prices further diverge. The government intends to use the surplus in congestion rents to reduce the overall cost of the adjustment mechanism

## Exceptions

- Energy under PPAs will not be considered<sup>3</sup>
- Energy purchased by storage (batteries and pumped hydro) is exempt

## Obligations for Market Agents

- All agents bidding in the market will be required to present financial guarantees covering the potential cost of the Adjustment Value
- Hedges and their maturities must be declared to be exempt

**2** The adjustment value will be calculated taking into account the difference between the MIBGAS price and the reference price

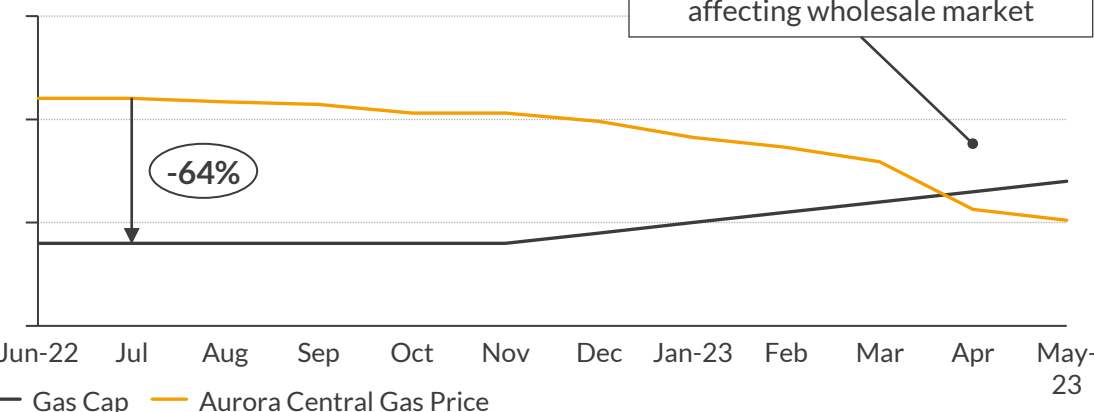
The formula applicable for calculating the adjustment value is the following:

$$Y_i = \frac{(P_{GN} - P_{RGN})}{0.55}$$

- $Y_i$  (€/MWh): Daily adjustment value
- $P_{GN}$  (€/MWh): Average MIBGAS daily price<sup>4</sup>
- $P_{RGN}$  (€/MWh): Gas reference price, initially set at 40€/MWh
- 0.55 is the efficiency of a standard CCGT plant

**3** The gas price cap is below Aurora's central gas price until April-23 after which point there is no impact on baseload prices in Aurora Central

Gas price, EUR/MWh (real 2021)



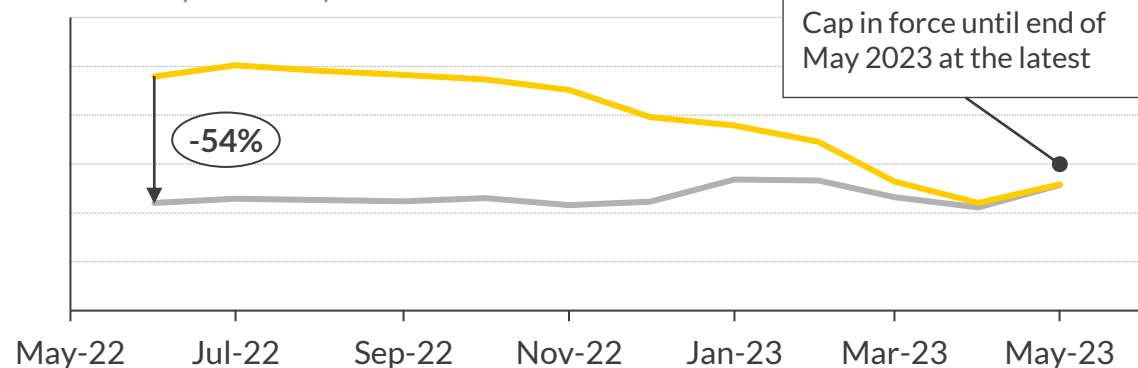
1) European Commission. 2) The payment will apply to CCGT, cogeneration and coal plants. 3) Energy committed under PPAs will be exempt in case of the PPA being signed before 26<sup>th</sup> April 2022. 4) Price is determined as the weighted average of all daily transactions (D+1 onwards) and end-of-week (if applicable) products with next day delivery.

# Cap on gas prices would decrease electricity prices but would provide an incentive for CCGTs to increase generation levels

**1** If approved by the European Commission, electricity prices would decrease drastically

Baseload prices

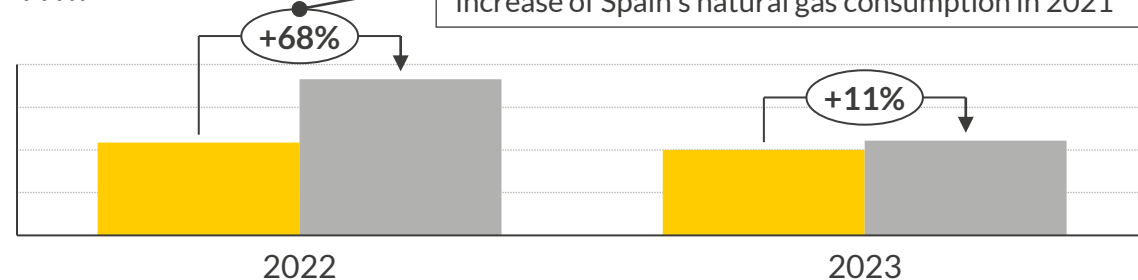
EUR/MWh (real 2021)



**2** The reduction in gas prices in Iberia<sup>1</sup> will incentivise CCGT generation to supply demand from abroad

CCGT generation

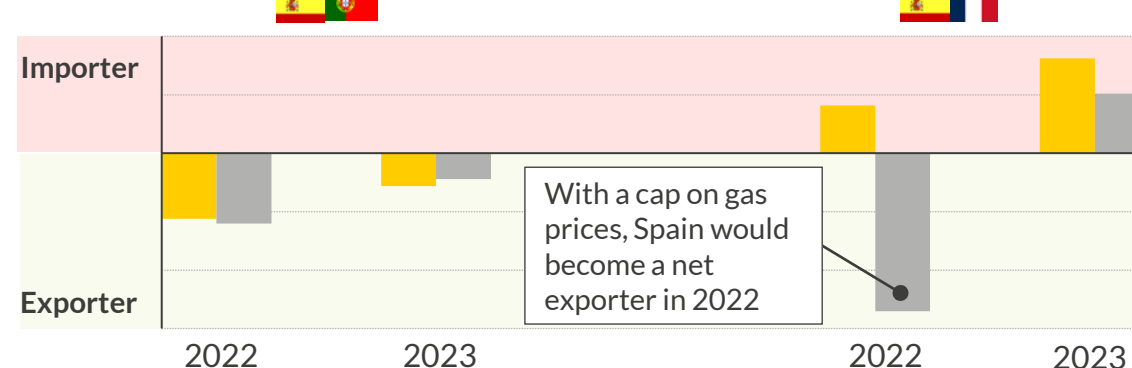
TWh



**3** The increase in CCGT generation would flow towards France as much as the interconnection capacity allows

Net imports by Spain

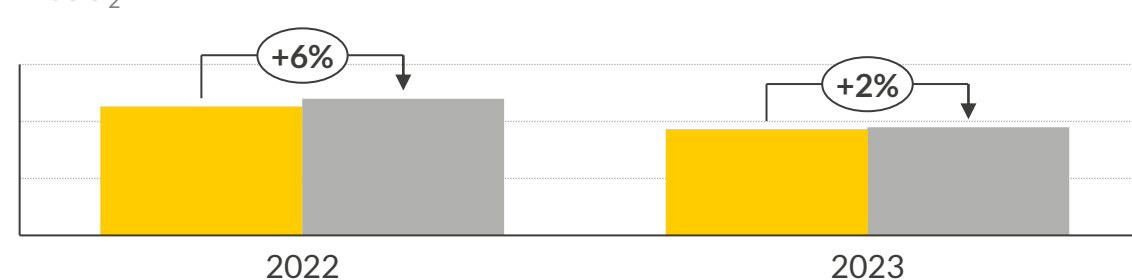
TWh



**4** Carbon emissions would increase in net terms, although not drastically, as some currently operating coal plants would be pushed out of merit

Power sector carbon emissions

MtCO<sub>2</sub>e

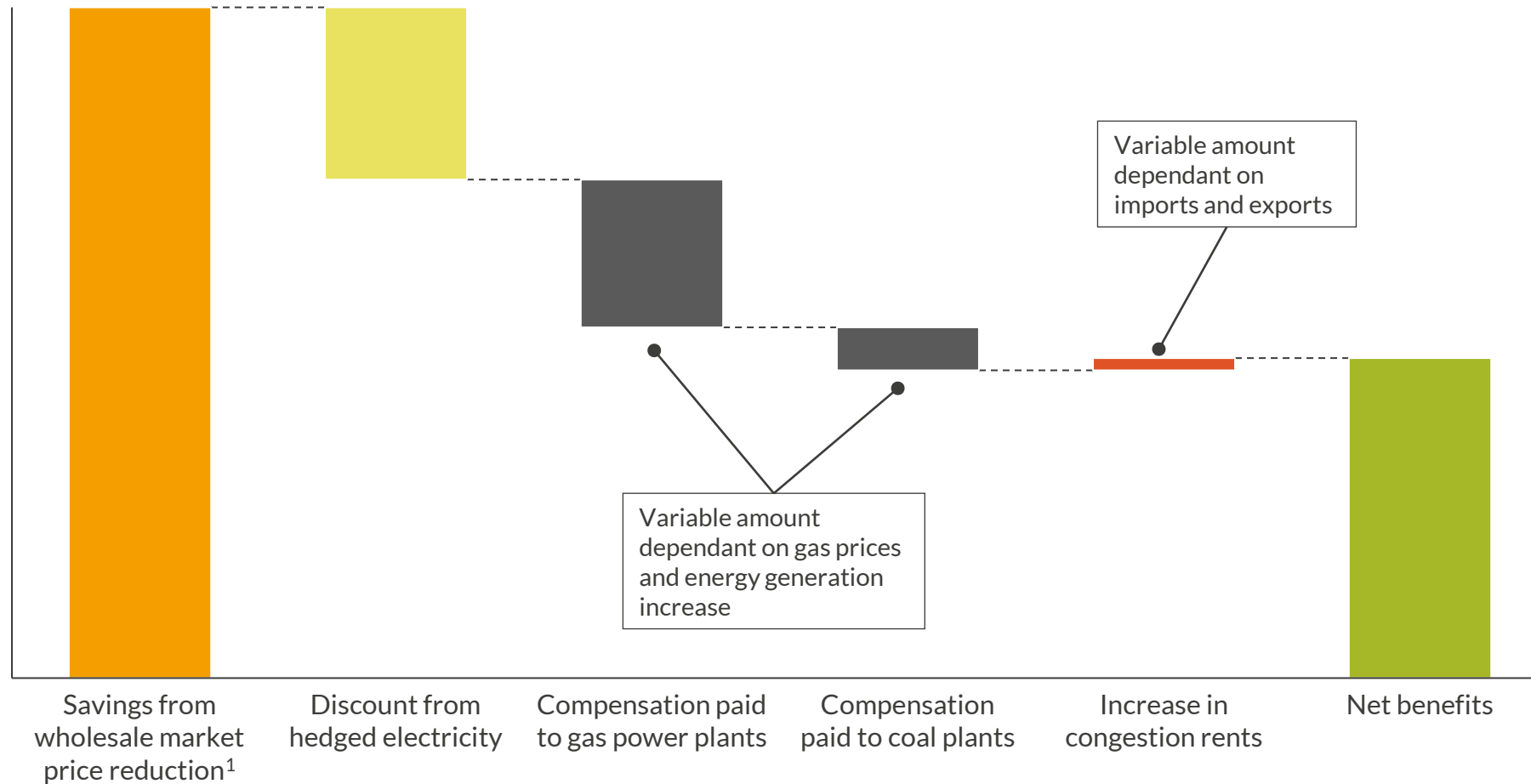


**Legend:** ■ Aurora's Central scenario ■ Capped gas scenario

1) Portugal approved the same mechanism in DL 33/2022 on the same day (13<sup>th</sup> May).

# Total net benefits for the consumer are difficult to estimate due to uncertainty over hedged volumes and increase in congestion rents

Illustrative Example of Consumer Net Benefits (2022- 2023)  
Billions EUR



1) Calculated by multiplying the price difference by total demand in Iberia.

Total compensation cost depends on two factors

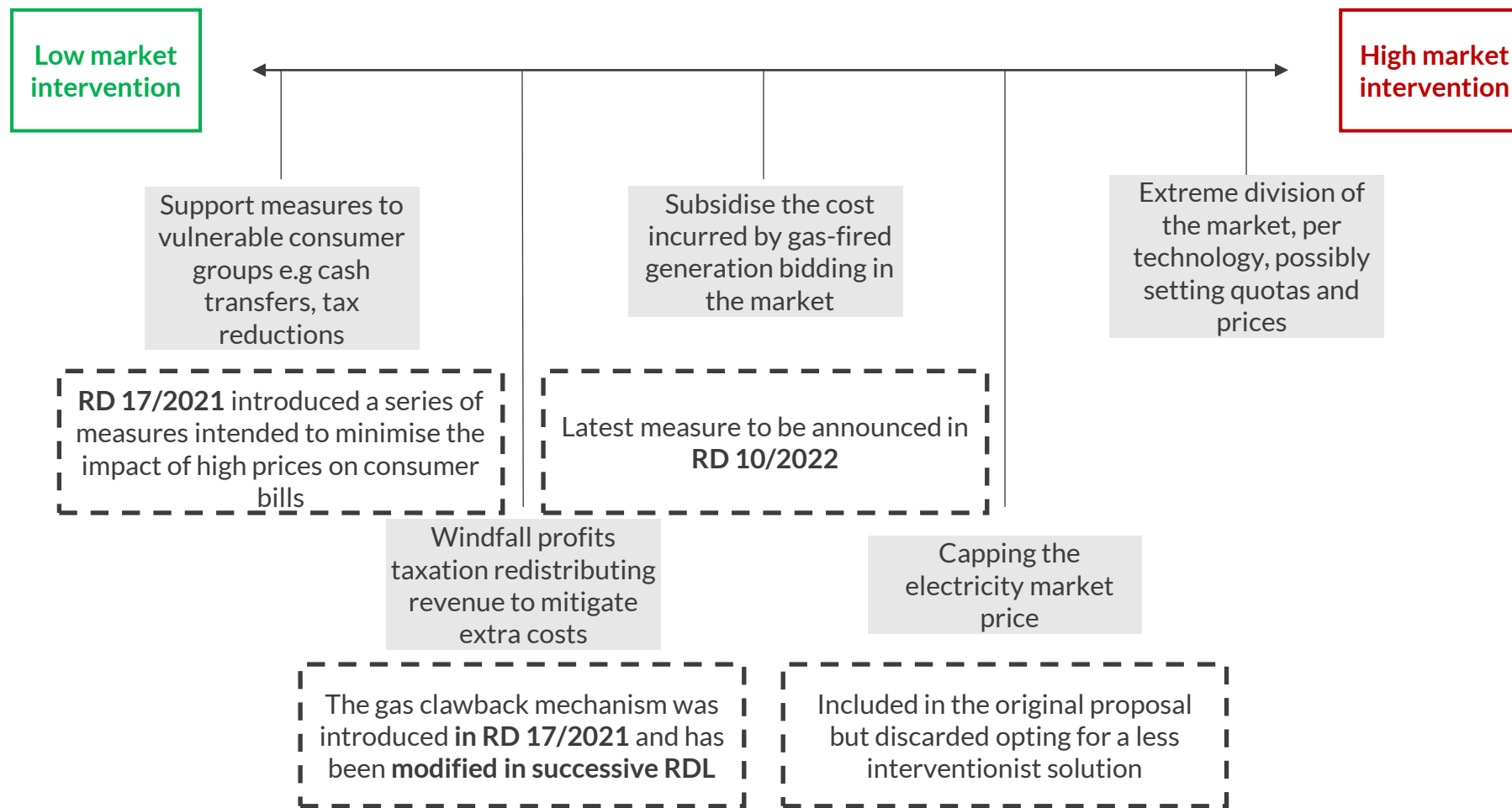
- 1 Future gas prices
- 2 Amount of energy generated that is subject to compensation

The cost impact on consumers will depend on two factors

- 1 Percentage of the demand in the wholesale market that will cover the cost
- 2 Change in congestion income

# High levels of market intervention can have long term effects on future investment and security of supply

Spectrum of possible structural-interventionist measures



## Risks brought by interventions in the wholesale market

- **Investor confidence**  
Government intervention in the market can lead to a decrease of investor confidence and might slow renewables growth
- **Innovation**  
Price intervention might disincentivise demand-side response and efficiency
- **Price signals**  
Granular and predictive price signals are critical to incentivise storage and desired consumer behaviour
- **Forward market liquidity**  
Market players might decrease their trading in the forward market as they will fear regulatory intervention
- **Cross-border market integration**  
Varying degrees of market intervention threaten European market integration



# Iberia Power & Renewables Market Service: Key market analyses and forecasts for all participants in the Iberian power market

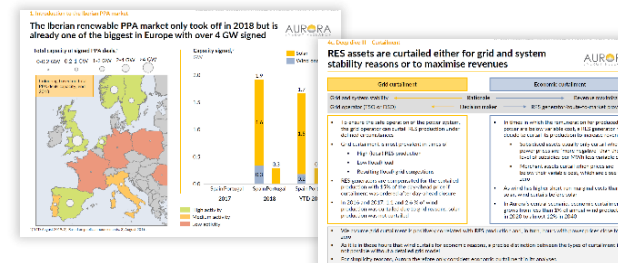


## Quarterly data and market reports to assess business models

- All the latest trends and forecasts – recent market developments and full policy and regulatory overview
- Annual forecasts of wholesale market prices across four scenarios (Central, High, Low, Net Zero) through 2060
- Capture prices of key technologies (solar, onshore, offshore), load factors
  - Hourly prices available
- Yearly forecast of capacity payments until 2035
- Price distributions, capture spark spreads, peak prices
- Capacity development, generation mix, interconnector capacity, capacity buildout, exports
- EU-ETS carbon price forecasts
- Includes both **Spain** and **Portugal**

## Group Meetings, Strategic Insight Reports and Policy Updates

- In-depth thematic reports on topical issues
- Three multi-client roundtable discussions per year in Madrid to discuss reports with actors across the Iberian power market
- Past and future topics include
  - Corporate PPAs in Iberia
  - Economics of batteries in Iberia
  - The economics of green hydrogen in Iberia
- Monthly policy updates on the latest regulatory changes



## Interaction through workshops and ongoing support

- Bilateral workshops in your office or over video call to discuss specific issues on the Iberian market
- Ongoing availability (calls, access to market experts, modellers) to address any questions across European power markets
- Discounted invitations to Aurora's annual **Spring Forum** - the leading annual gathering of Europe's energy industry



For more information, please contact  
Enilio Álvarez, Commercial Associate



enilio.alvarez@auroraer.com  
+34 613 120 636

# Agenda

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I. Market design discussion

II. Key market updates

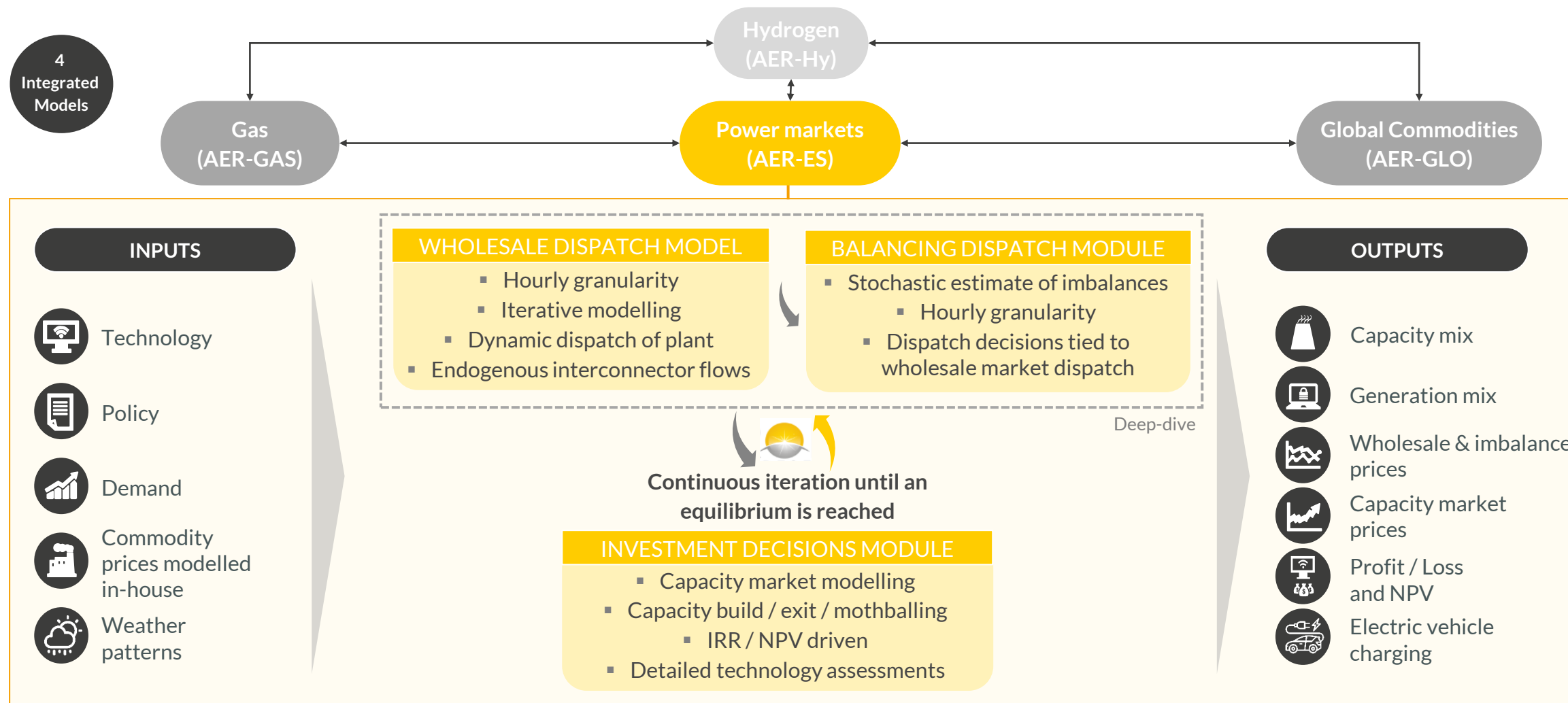
III. Aurora central scenario

1. Key assumptions

2. Results

IV. Appendix

# Unique, proprietary, in-house modelling capabilities underpin Aurora's superior analysis



1) Gas, coal, oil and carbon prices fundamentally modelled in-house with fully integrated commodities and gas market model.

## Details and disclaimer

### Publication

Outlook of Iberian markets to 2060 & impact of regulatory changes (Public Webinar)

### Date

9 June 2022

### Prepared by

Christina Rentell  
Eduardo Campillos  
Alexandre Danthine

### Approved by

Ana Barillas  
Richard Howard

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