Enlit Europe 2021

AURORA
ENERGY RESEARCH

Introducing Aurora & our Italian Market Views

December 2021

Agenda

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1. **About Aurora**
2. **Aurora Market Outlook**
   - I. Commodities Prices Assumptions
   - II. Central Scenario
   - III. Low Scenario: Methodology and Results
3. **Italian PPA Market**
   - I. PPA Valuation
   - II. PPA Market Sizing
4. **Net Zero Scenario Analysis**
5. **The Ancillary Services Market and Investment Case for Batteries**
6. **Italian Power & Renewables Market Service**
7. **Modelling Methodology**

Aurora provides data-driven intelligence for the global energy transformation

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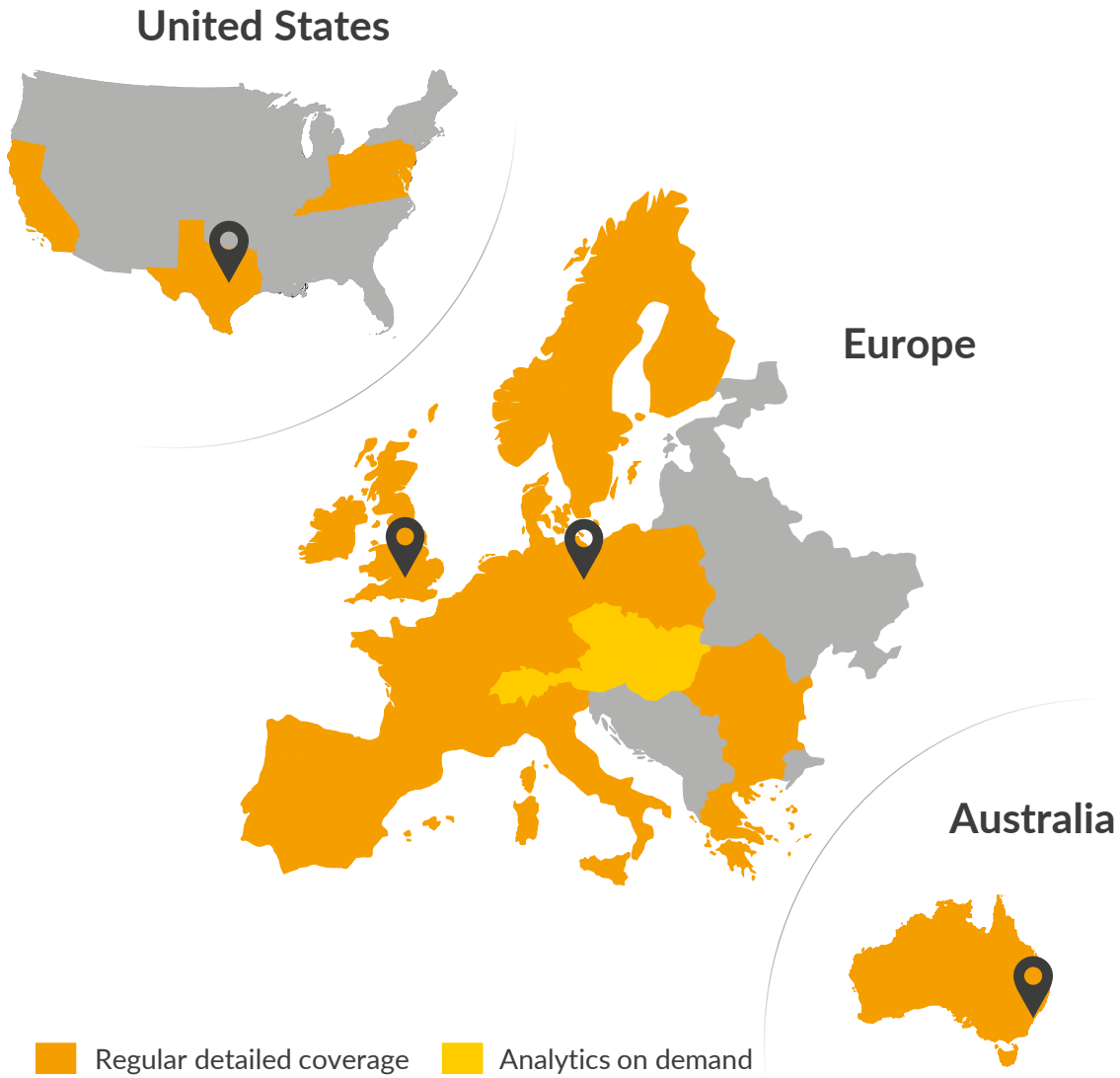
- Power markets
- Renewables
- Storage
- Electric vehicles
- Hydrogen H_2
- Carbon CO_2
- Natural gas



4 Offices
Oxford | Berlin | Sydney | Austin

180+
market experts

350+
subscribing companies

100+
transactions supported in 2020

Source: Aurora Energy Research

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

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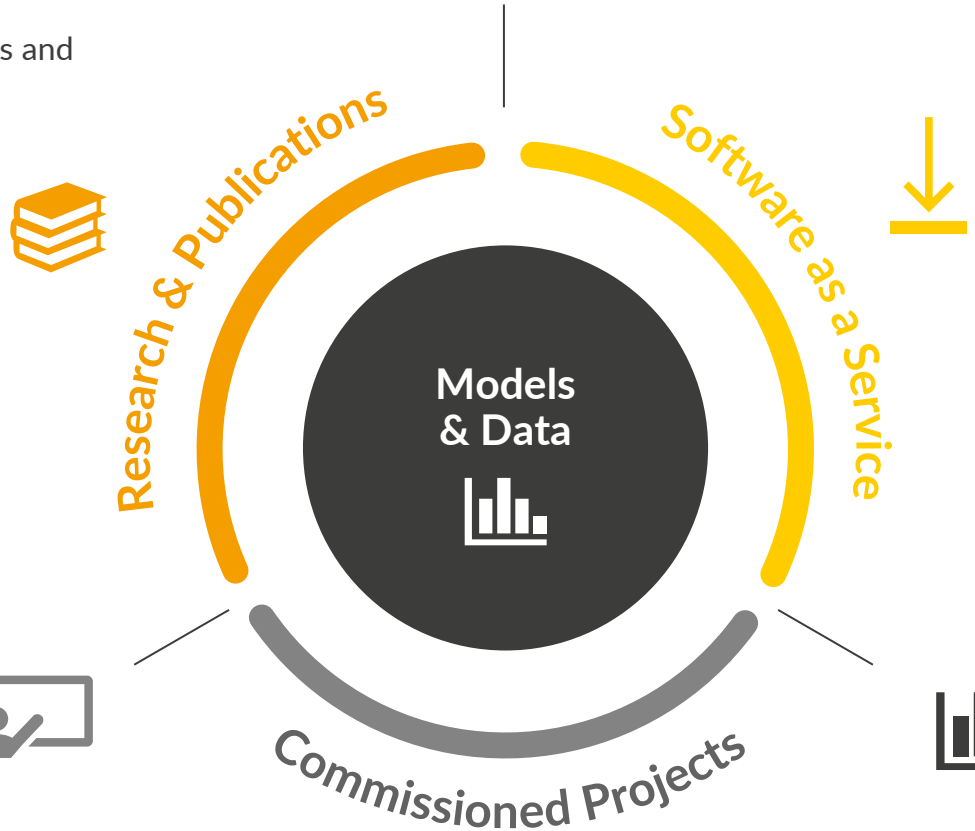
Research & Publications

- Industry-standard market outlook reports and bankable price forecasts for power, gas, carbon and hydrogen markets
- Strategic insights into major policy questions and new business models
- Read and constantly challenged by 350+ subscribers from all industry sectors



Software as a Service

- Out-of-the-box SaaS solutions, combining cutting-edge sophistication with unparalleled ease of use
- ***Origin*** provides cloud-based access to Aurora's market model, pre-populated with our data
- ***Amun*** automates asset-specific wind farm valuations for over 30 leading funds, developers and utilities

Commissioned Projects

- Bespoke analysis, drawing upon our models and data
- Trusted advice for all major market participants proven in 500+ projects: transaction support, valuations, strategy & policy engagement

Models & Data

- Market-leading long-term models for power, gas, hydrogen carbon, oil and coal markets
- Continuous model improvements to reflect policy and market developments

Source: Aurora Energy Research

Our clients tell us there are five areas in particular where we distinguish ourselves from our competitors

Analytical rigour and objectivity

- Independence is hard wired into our operation: we give the balanced answer, not the convenient one
- Our business combines industry-standard subscription reports with cutting edge bespoke consultancy services, providing all-encompassing analyses

Dedication to wholesale markets

- We are Europe's largest dedicated wholesale power market analytics company
- Executive and board level commitment to this strategy means no distractions from the core business

In-house modelling

- We own our own power and commodities models and do not rely on black box third-party models
- Our model is highly sophisticated and continuously enhanced and tested

Centre of the industry

- Our annual flagship event, the Aurora Spring Forum, is the meeting point for energy industry seniority
- Our broad subscriber base encompasses all facets of the energy industry

Close proximity to policy

- We are well-connected with policy makers, government and industry leaders who keep us updated on upcoming and unexpected policy amendments
- Our directors are advisors to the government further strengthening our relationship

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"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

GreenFrog Power

"We have found Aurora's innovative work on flexibility both stimulating and timely. We welcome their contribution to the debate"

Dan Monzani, Head of Energy Security, BEIS

Department for Business, Energy & Industrial Strategy

Source: Aurora Energy Research

The approach has succeeded – we are working with the industry's biggest players …

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> *"Aurora Energy Research is, I think, one of the smartest energy modelling companies around, and helped us on this Energy Outlook and continue to help us"*
>
> **Spencer Dale, Chief Economist, BP**

> *"Aurora's ability to forecast all the revenue streams relevant to UKPR's business model in a joined-up way sets them apart from their peers and has been very helpful to us in investment and business planning"*
>
> **Tim Emrich, CEO, UKPR**

Power & utilities

Energy consumers

Financial sector & investors

Oil & gas

Project developers

Policy & regulation

… assisting them with analysis that underpins their most important decisions and transactions

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Flexible generation

- Green Frog Power, support for £100m debt financing of gas peakers by Lloyds, HSBC, NIBC
- Battery investment strategy and sizing analysis for PE-backed Spanish renewables developer
- Gas peaker and battery storage portfolios, sell side advisory for UK Power Reserve
- German battery storage market strategy development for a major infrastructure investor
- Battery storage, support equity and debt raise ahead of DS3 auction
- SIPS battery storage (300MW/450MWh) in Victoria, supported Neoen in project debt financing by CEFC

Thermal generation

- 870 MW CCGT, sell side commercial advisory
- Evaluation of a high-temperature heat storage technology for a major German utility
- Cory Riverside EfW plant, advisory for successful bidder
- EfW plant, buy side advisory for final bidder
- Bidding strategy development for participants in Germany's coal closure auctions
- District heating decarbonisation strategy development for a major infrastructure developer
- Support of financing of a newbuild CCGT asset

Renewable generation

- Onshore wind, sell side market advisor for 400MW subsidy-free project
- Merkur offshore wind farm, sell-side advisory for Partners Group
- Potegowo 220MW onshore wind, supported the debt financing of €49m provided by EBRD
- Borssele 3&4 offshore wind farm, buy side advisory for the successful bidder
- Market entry support for an oil & gas company diversifying into renewables
- Race Bank offshore wind farm, advisor to successful buyer Macquarie
- Wento renewables portfolio sale to Equinor, sell-side market advisor
- Buy-side for major European infra fund into +200MW solar farm with batteries in Australia
- Market analysis for sovereign wealth fund looking to provide mezzanine debt to large Spanish wind and solar developer

Hydrogen

- Localised hydrogen demand sizing for a major German utility
- Assessment of hydrogen fuel switch option and economics for a CCGT
- Evaluation of H2 transport cost to North-Western Europe for a solar hydrogen project developer

Oil & gas

- UK National Grid distribution network (>£8bn), buy side advisor for successful bidder consortium
- TransitGas pipeline, buy side advisor for successful infrastructure fund
- Eustream, commercial advisor to obtain credit rating for ~€1.2bn bonds
- North-Sea gas upstream asset (>€4bn), advisor to successful bidder

Source: Aurora Energy Research

Aurora has a strong track record of acting as a lender advisor across Europe & Australia

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Aurora's price forecasts have been relied upon by lenders in recently completed transactions:

LBBW, NatWest, Siemens, Ulster Bank, Santander, AIB

€370m debt financing

220MW onshore wind portfolio of NTR in Ireland and GB

ABN AMRO, BBVA, Sabadell, Bankia, UniCredit, bankinter

€380m non-recourse financing

487MW merchant onshore wind farm of CIP

cefc

AUS $50m financing

First project financing of a battery in AUS

bpifrance, Unifergie Groupe Crédit Agricole

€133m debt financing

93.5MW portfolio of solar assets for Technique Solaire

ING, mBank, European Bank for Reconstruction and Development

€28m debt financing

First subsidy-free wind financing in Poland

HSBC, Lloyds Bank, NIBC

£100m debt financing

Gas peaking plant development portfolio of Green Frog Power

Santander

100 MW portfolio of battery projects of Zenobe

First battery project financing in UK

Societe Generale, ING, MUFG, Mizuho, SMBC, ICBC

AUS $400m financing

430MW Murra Warra onshore wind farm of Partners Group

Caisse d'Epargne CEPAC

21 MW onshore wind farm of Akuo Energy

European Bank for Reconstruction and Development

€48m debt financing

220MW Potegowo onshore wind farm of Israel Infrastructure Fund

Aurora is currently active on a number of ongoing project financings:

Large European investment fund

Offshore wind farm in Germany

Developer/Fund

Biomass plant in the UK

Major Utility

Greenfield energy-from-waste plant

Large offshore developer

1,400MW offshore wind project in the UK

Project developer

20MW solar project

Project developer

32MW solar project

Most European debt providers subscribe to Aurora's forecasts to validate their financing decisions

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Source: Aurora Energy Research

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Italy has four main electricity markets, and from 2022 the Capacity Market will substitute the current system of Essential Units

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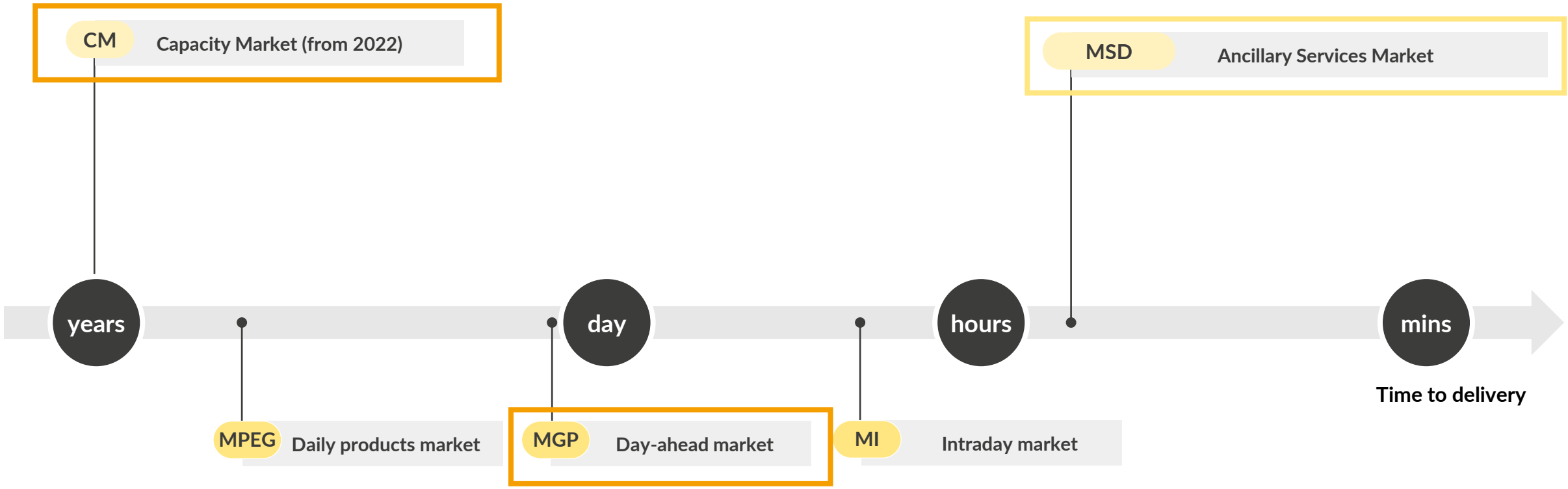
Italian electricity markets



Markets modelled by Aurora Italian Power Market model

Markets modelled by Aurora Italian Power Market model starting from Q4 2021

Sources: Aurora Energy Research

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Gas prices have historically been the main driver of Italian baseload power prices

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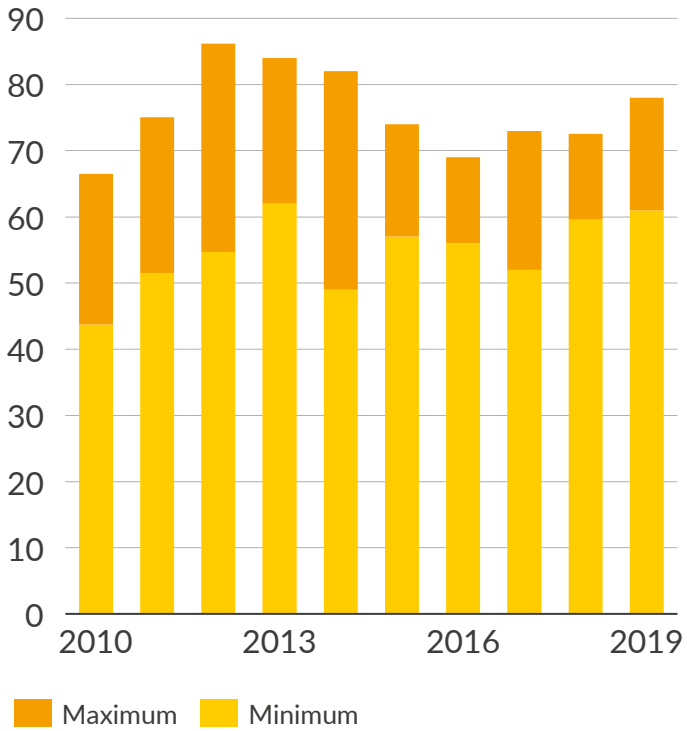
Natural gas plants are the main price-setting technology in Italy

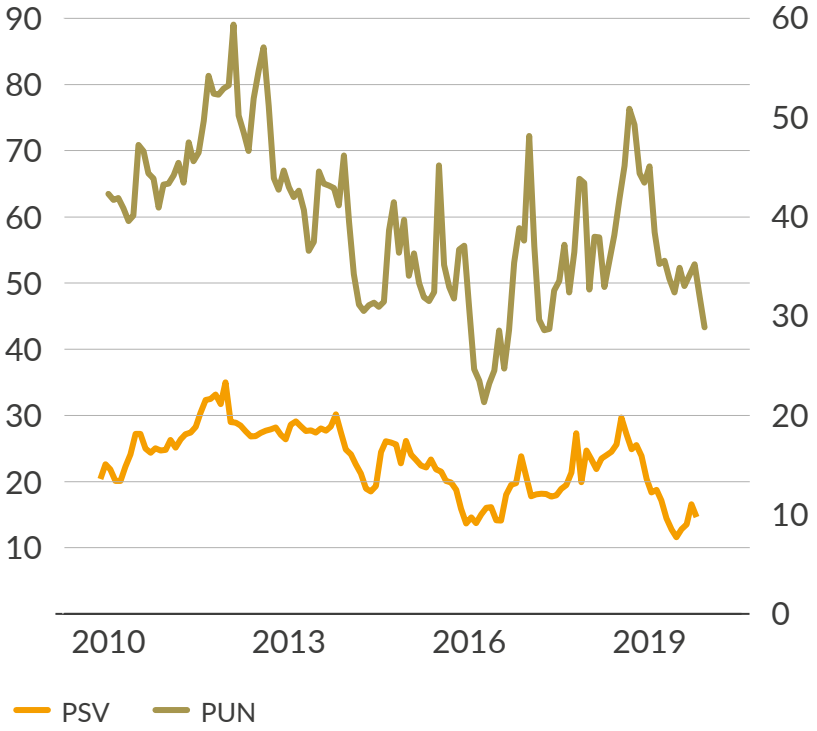
Marginality of gas plants across Italian zones
% hours[1]



Average PUN has decreased over time, following gas price developments

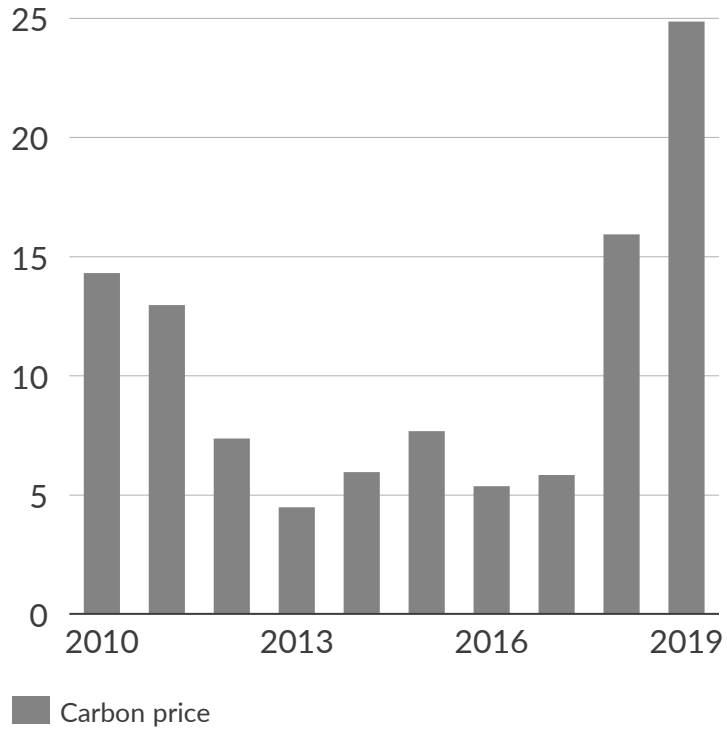
Italian electricity price (PUN)
€/MWh$_{el}$

Italian Gas hub price (PSV)
€/MWh$_{th}$



The price of carbon has increased in recent years improving the economics of gas with respect to coal generation

Yearly carbon price
€/tonne CO_2

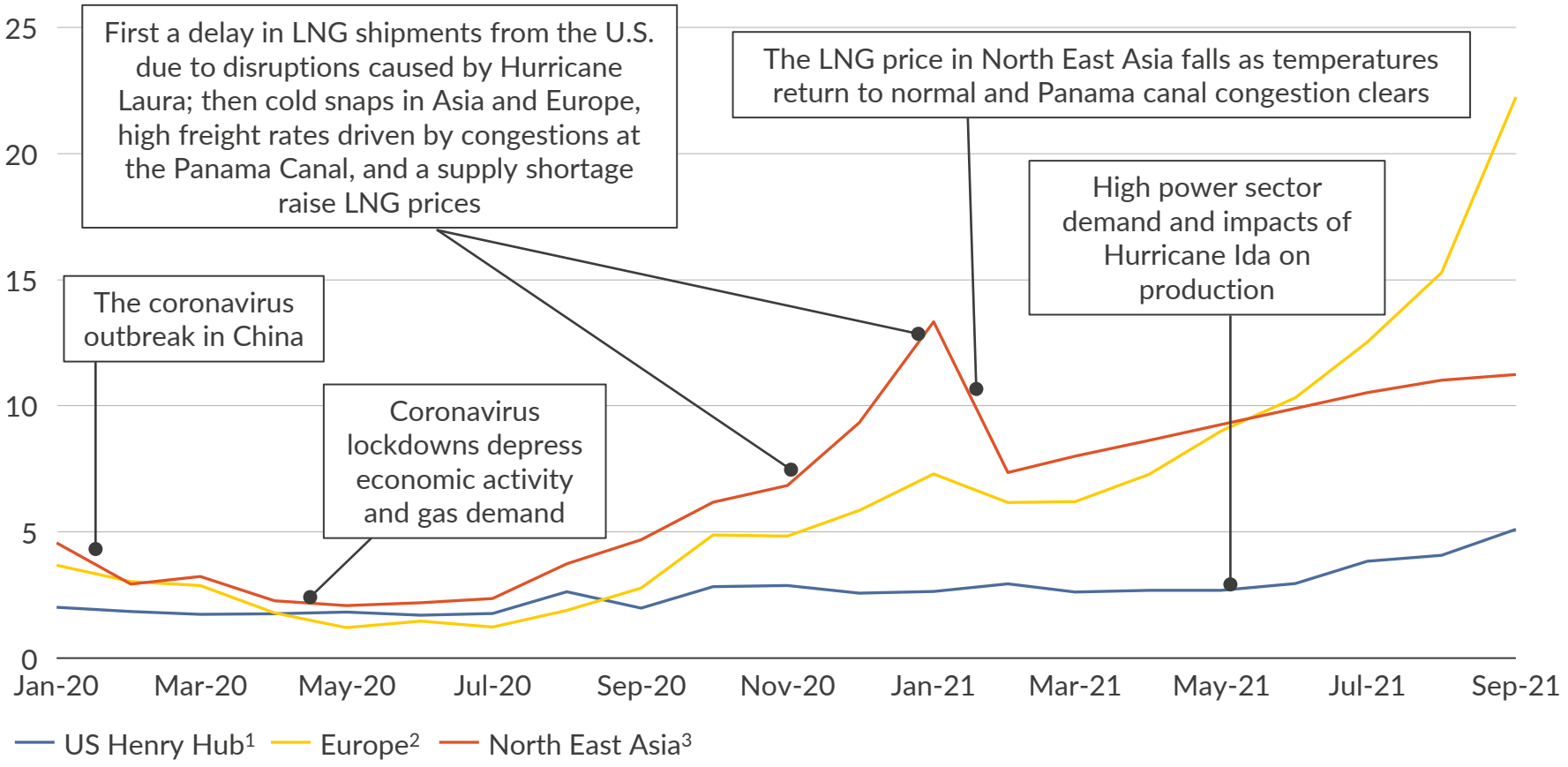


1) Calculations are based on hourly marginality results for each of the zones that contribute to the Italian power market.

Sources: Aurora Energy Research; GME

Gas prices in Europe and Asia have increased significantly since Feb-21 due to economic recovery amid tight pipeline and LNG supply

Traded average monthly gas prices
$/MMBtu



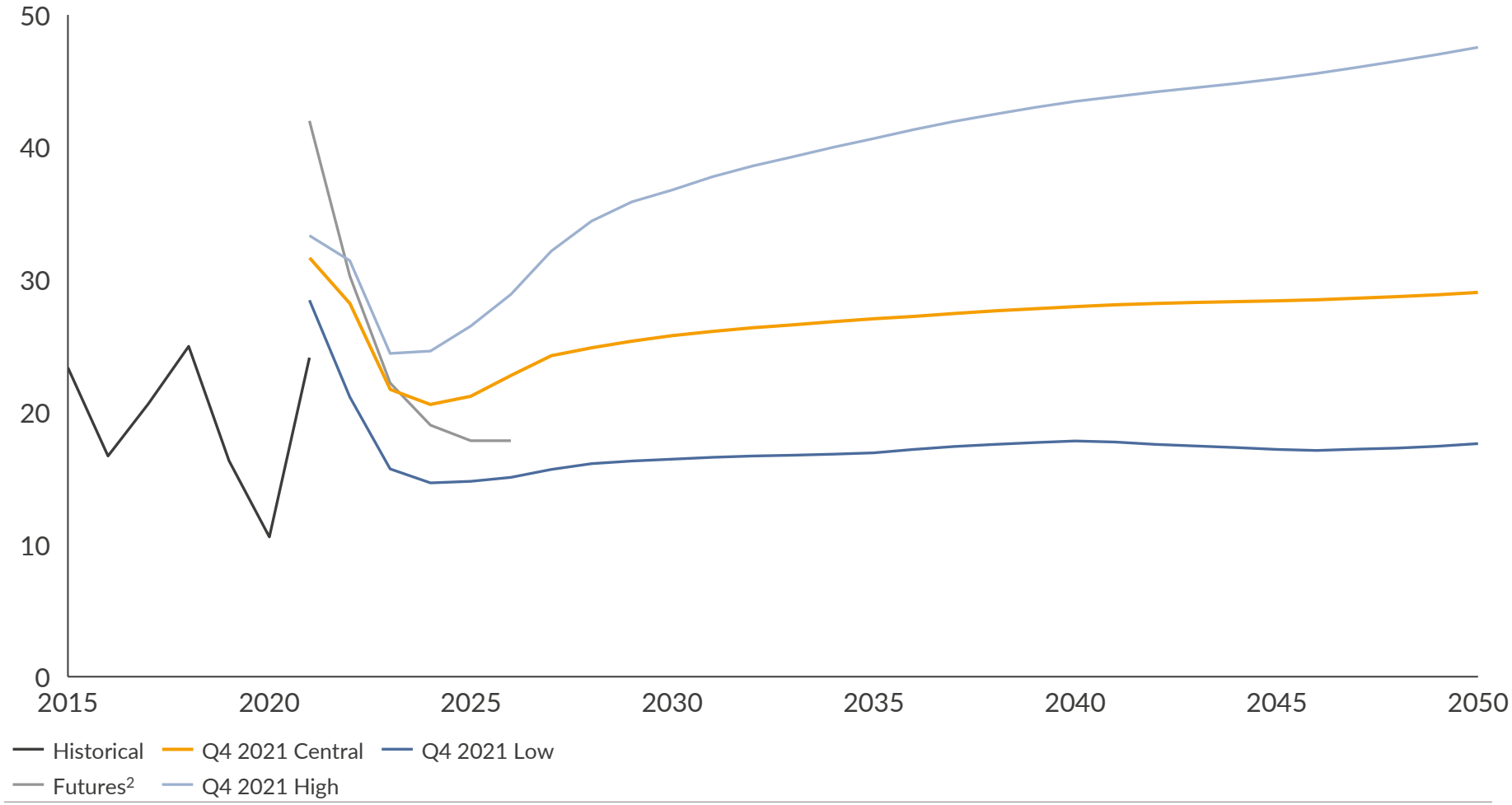
- European and Asia gas prices have been on the rise since Feb-21. North East Asia gas price reached $11.2/MMBtu in Sep-21, growing by 52.2% in seven months. TTF averaged $22.2/MMBtu (or €61.5/MWh) in Sep-21, increasing 20.7% m-o-m on average since Mar-21, surpassing Asian price levels in May-21
- The surge in European gas prices was driven by a combination of
  1. High demand as Europe emerges from lockdown
  2. Asian demand driving a tight LNG market
  3. Fall in indigenous production
  4. Flat Russian pipeline supply
  5. Low inventories following colder-than-normal weather

1) Average monthly price for September as of 29/09/2021. 2) The reference hub is TTF in the Netherlands. 3) The reference country is Japan.

Sources: Aurora Energy Research EOS, EIKON

Current gas market tightness eases by the mid 2020s, but continued demand growth in Asia sustains prices in the long term

PSV gas prices[1]
€/MWh (real 2020)



1) For years 2021-2026, the prices shown take into account current futures prices for the years in question, with declining weights. 2) A rolling 30-day average as of 23/08/2021.

Source: Aurora Energy Research

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2021-2026

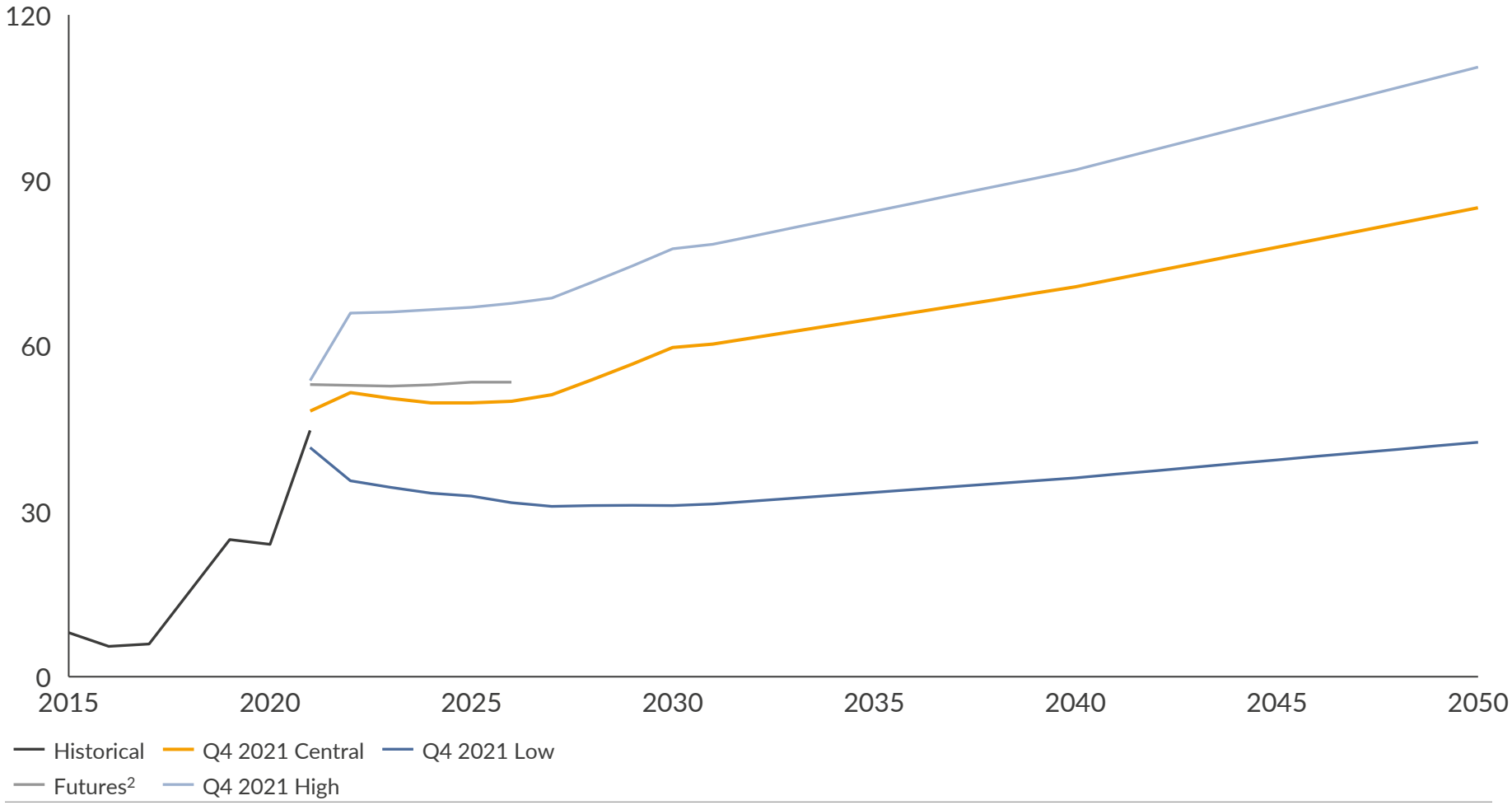
- For 2021 and 2022 the gas market is tight due to low gas inventories, strong Asian gas demand, flat Russian supply via pipeline and a tight LNG market amidst strong domestic demand
- From 2024 to 2026 the market is expected to rebalance on increased supply from Russia and LNG, and normalised storage stocks and gas demand

2027-2050

- The gas price rises in the 2030s as Asian gas demand continues to rise, tightening the global LNG market
- From 2040 onwards, the gas price broadly flattens out as rising renewables generation slows down Europe's LNG imports

EUAs forecasted prices increase as a result of the confirmation of tighter EU emissions targets

Carbon prices[1]
€/tCO_2 (real 2020)



1) For years 2021-2026, the prices shown take into account current futures prices for the years in question, with declining weights. 2) A rolling 30-day average as of 23/08/2021.

Source: Aurora Energy Research

2021-2026

- EUA prices increase driven by expectations of more ambitious decarbonisation targets, such as the EU policy to achieve 55% GHG emissions abatement vs 1990 levels by 2030, and increased coal burn in the power sector

2027-2050

- EUA prices are expected to rise in the medium to long term, as the ETS is used as a tool to help decarbonise Europe's economy

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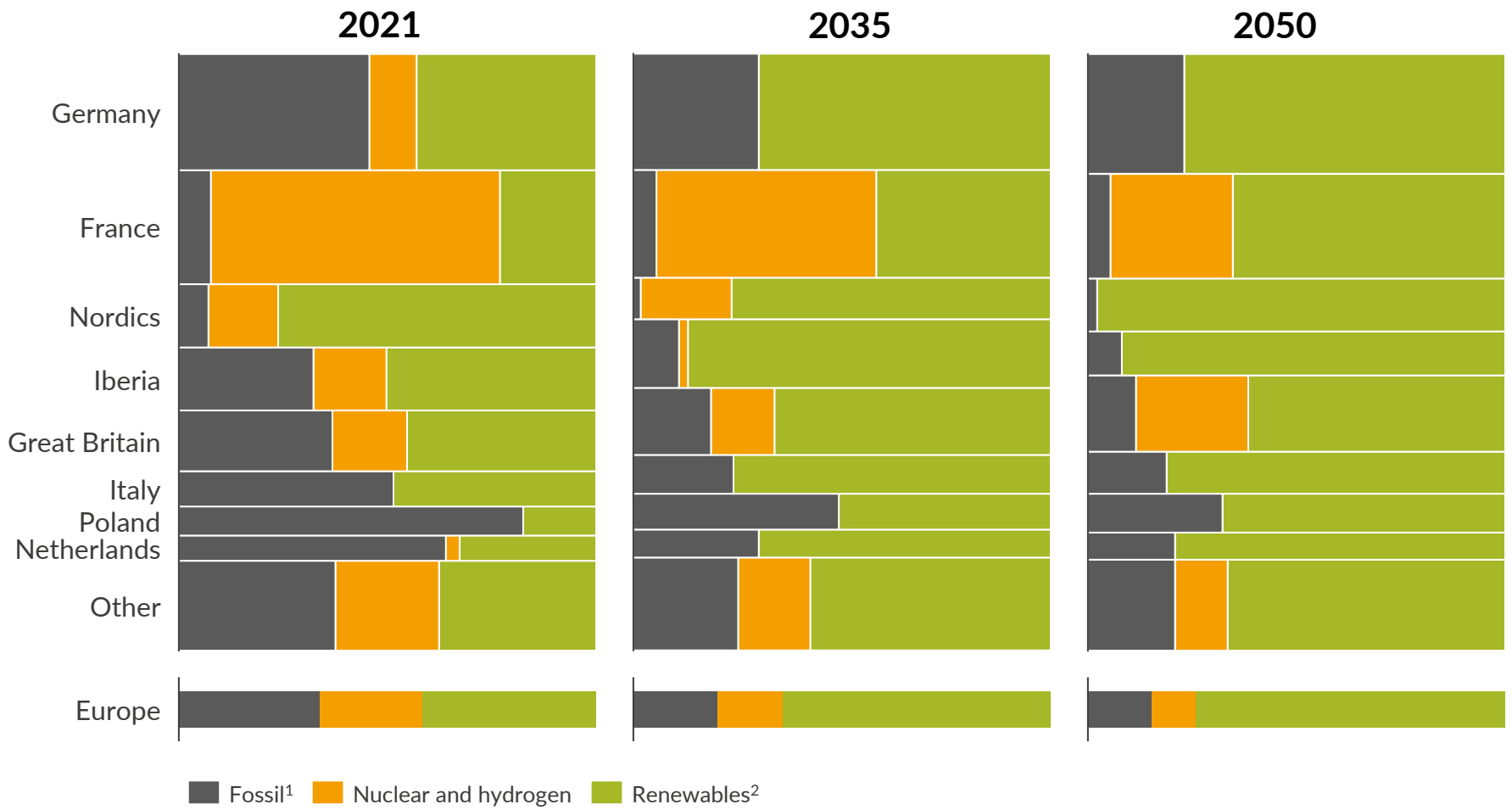
Renewable share of generation increases to nearly 75% in 2050, whilst fossil fuel share diminishes to below 15%

Share of total generation

%



1) Fossil include coal, lignite, gas, oil, peat. 2) Renewables include wind, solar, hydro, biomass, geothermal.

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Renewables share of generation increases to nearly 75% by 2050 across Europe. The Nordics already achieve this share of renewables generation and this further increases to almost 100%.

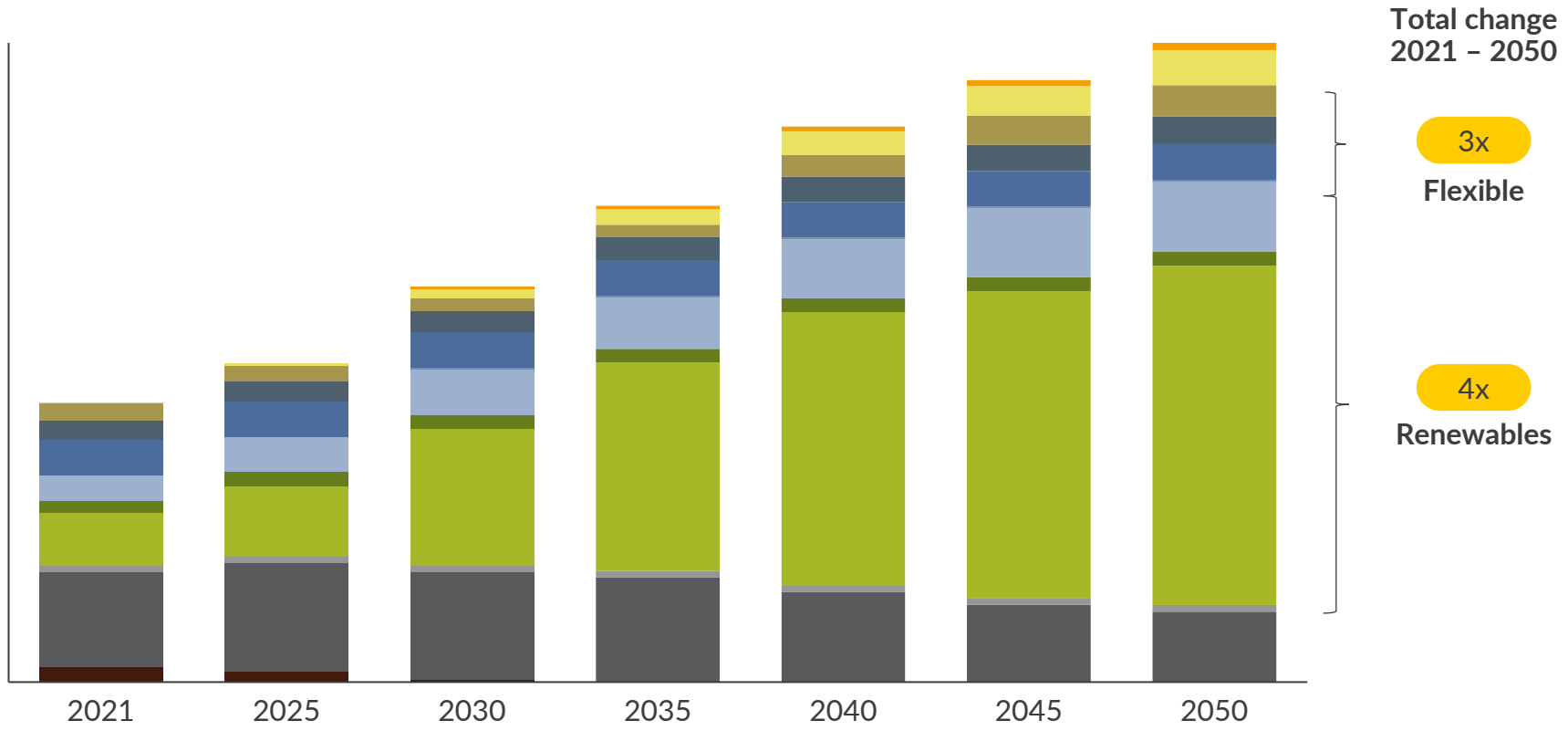
Growth in renewables share is most rapid in Poland, the Netherlands and France.

Correspondingly Europe sees a decline in fossil fuel generation from one third today to less than one sixth by 2050, with the decline most pronounced in Poland, Netherlands and Italy.

Nuclear is phased out in Germany and Iberia. France sees a reduction in nuclear generation as well as its overall generation share in Europe, leading to a reduction in power exports.

Renewable and peaking capacity more than triple over the forecast horizon, replacing coal and CCGT plants

Installed capacity
GW



1) Peaking includes OCGT, flexible gas CHP, micro CHP and reciprocating engines; 2) Other RES includes bioenergy, geothermal other gas renewables.

Sources: Aurora Energy Research

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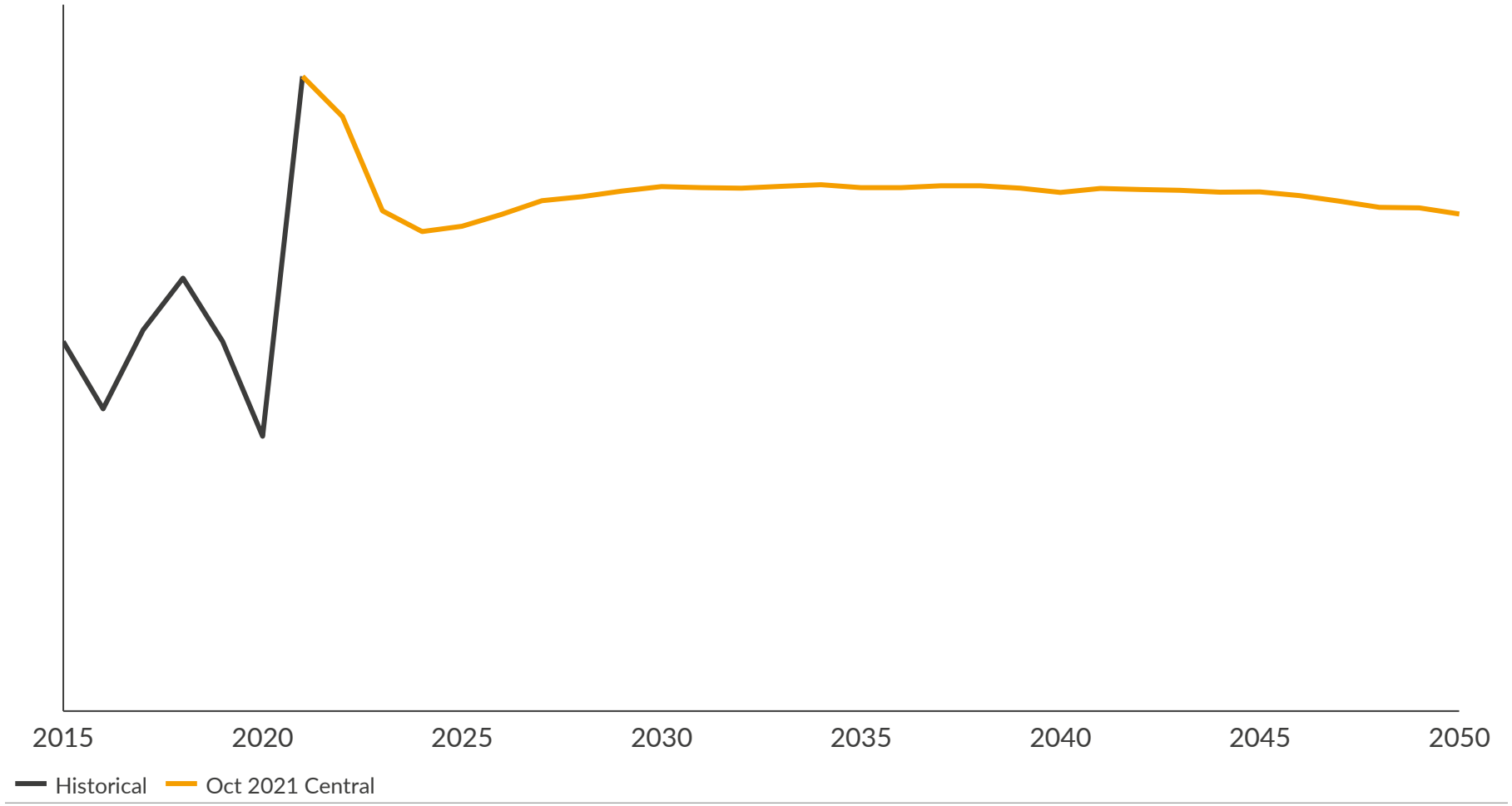
Outlook for the capacity mix

- Despite the coal-exit, total baseload capacity increases until 2030 thanks to high CM targets that bring new CCGTs online
- Total renewable capacity grows from x4 by 2050, thanks to higher solar and onshore penetration
- The resulting increase in volatile generation makes flexible capacity rise 3x by 2050, largely driven by the buildout of new OCGT and batteries

After short-term fluctuations driven by commodity prices, baseload prices stabilize around 70 EUR/MWh in the long-term

Baseload wholesale electricity price
EUR/MWh (real 2020)



Sources: Aurora Energy Research

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Outlook for baseload prices

Short-term

- Power prices return to pre-COVID-19 levels, due to the rebound of power demand and commodity prices after the crisis

2025-35

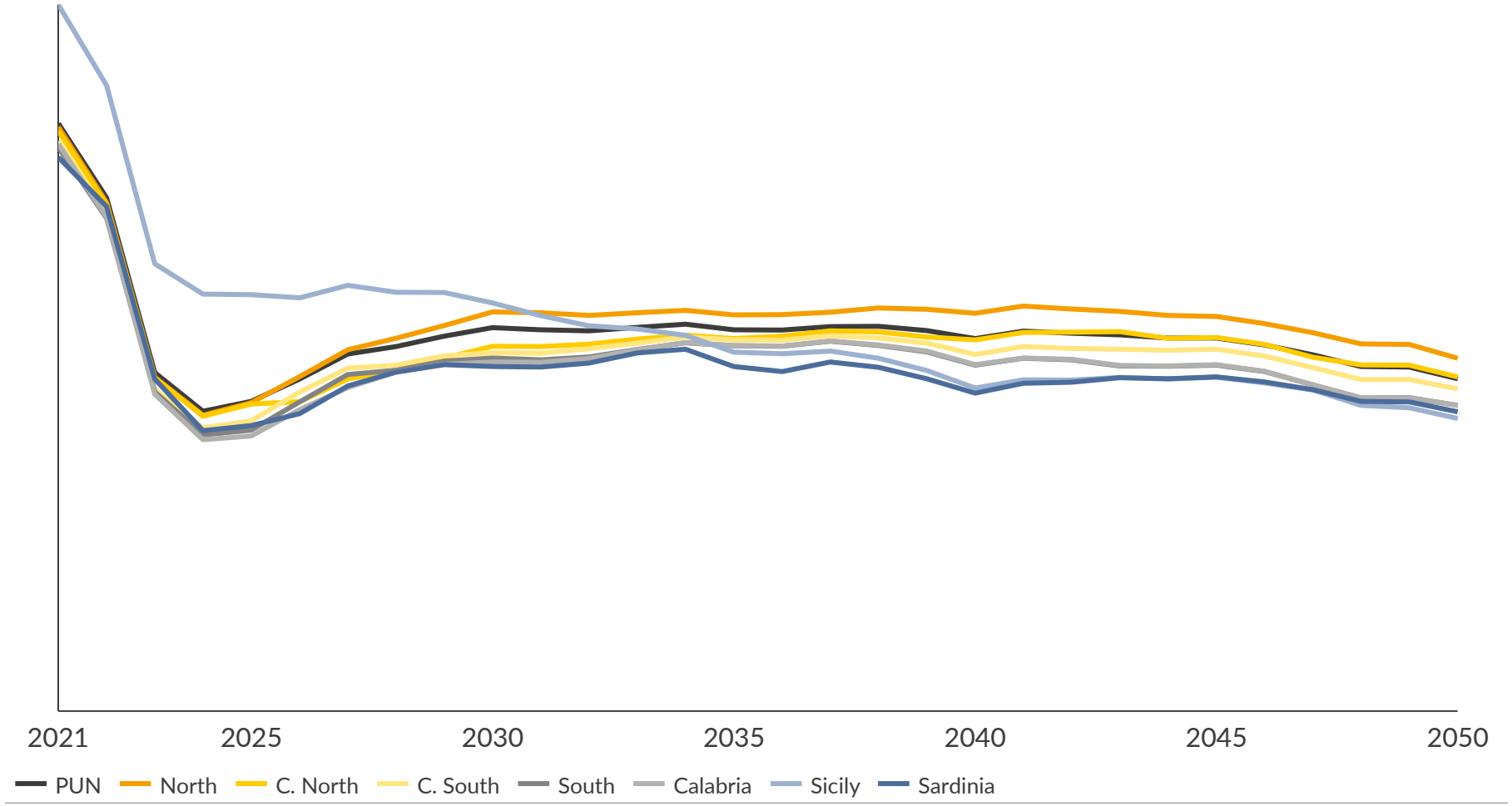
- Retiring coal capacity and rising commodity prices drive power prices up to 75 EUR/MWh in 2035

2035-50

- Prices slowly decrease as upward pressure from demand growth is offset by increasing penetration of renewables

After 2030, Northern and Southern zonal prices start diverging due to geographical mispatch of demand and RES resources

Baseload wholesale electricity price under Aurora Central
EUR/MWh (real 2020)



Sources: Aurora Energy Research

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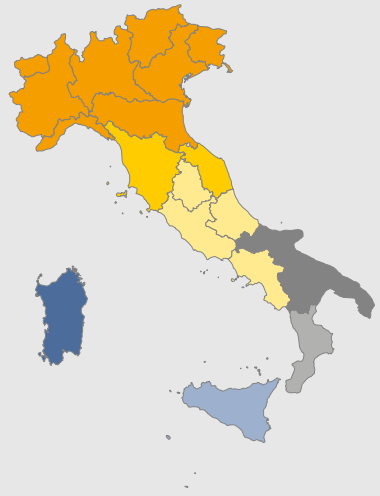
Outlook for zonal prices

- After the realization of the Tyrrhenian Link and as more RES are deployed, Sicily converges to the other Southern zones
- High power demand in the North and favourable RES conditions in the South will put increasing pressure on the transmission grid, resulting in diverging zonal prices



Solar capture prices cannibalization increases rapidly in the coming decades, particularly in the zones with higher load factors

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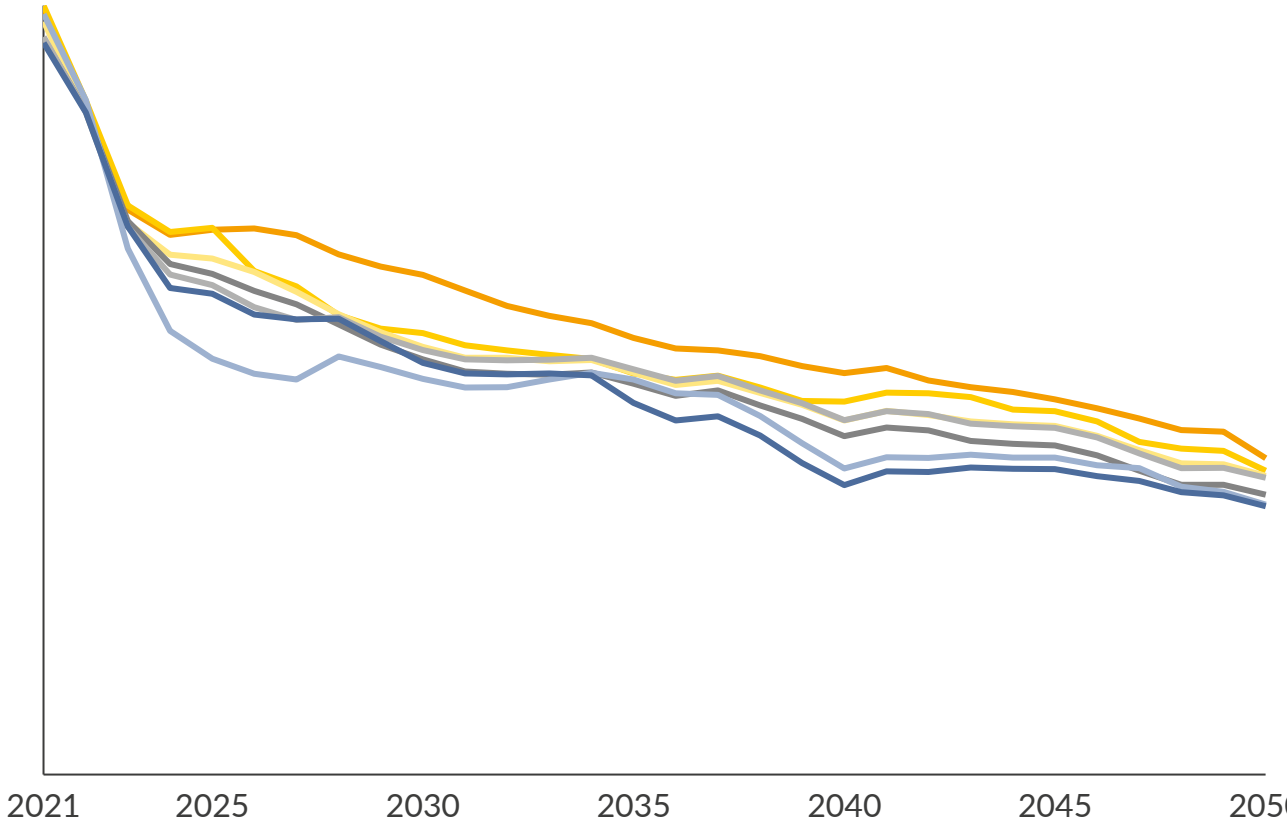
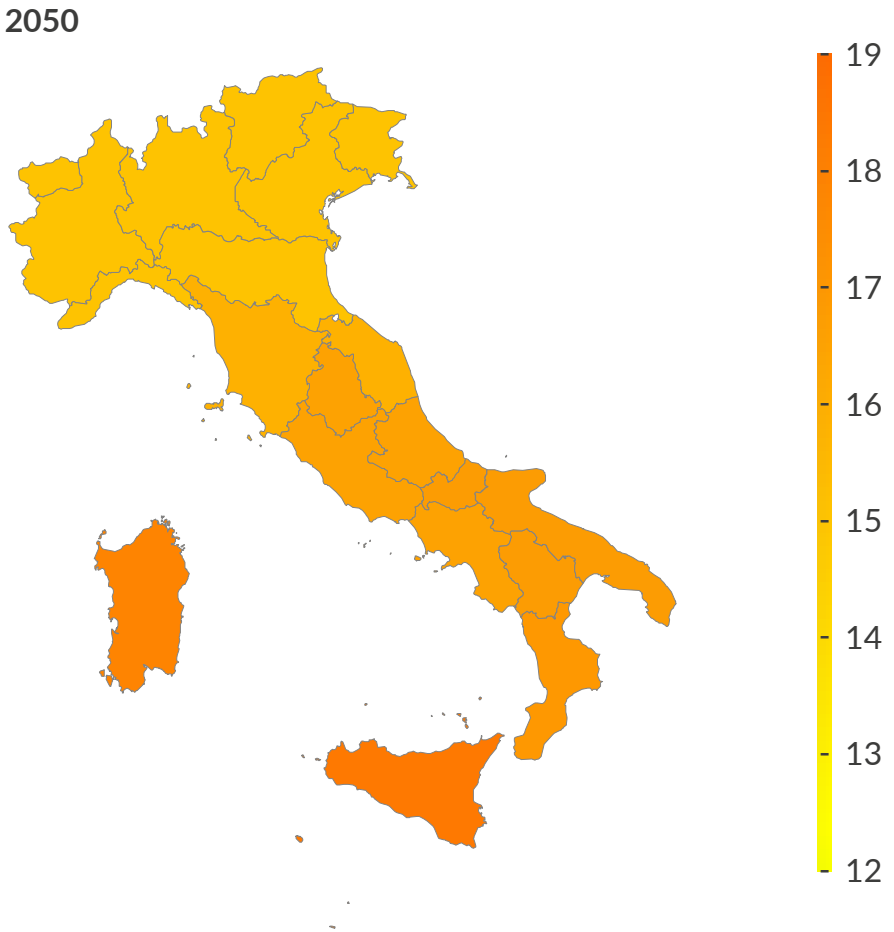
Solar PV capture prices - Aurora Central (October 2021)[1]
€/MWh (real 2020)



Solar PV load factor by zone[3]
%, avg. across fleet



North C. North C. South South Calabria Sicily Sardinia

1) Italian national wholesale power price. 2) Capture prices are uncurtailed generation-weighted average. 3) Before curtailment.

Sources: Aurora Energy Research

Cannibalization of onshore wind capture prices is concentrated in the southern regions, where most of the development is expected

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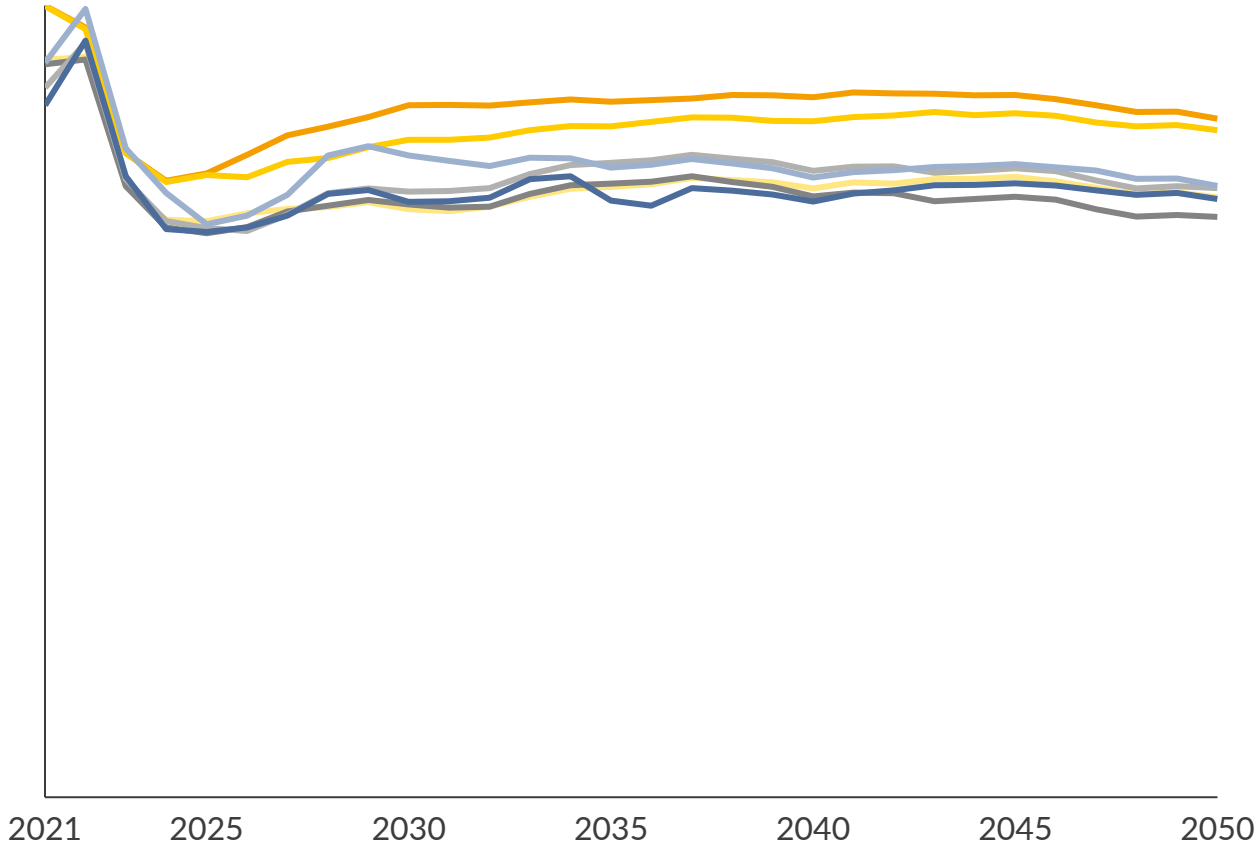
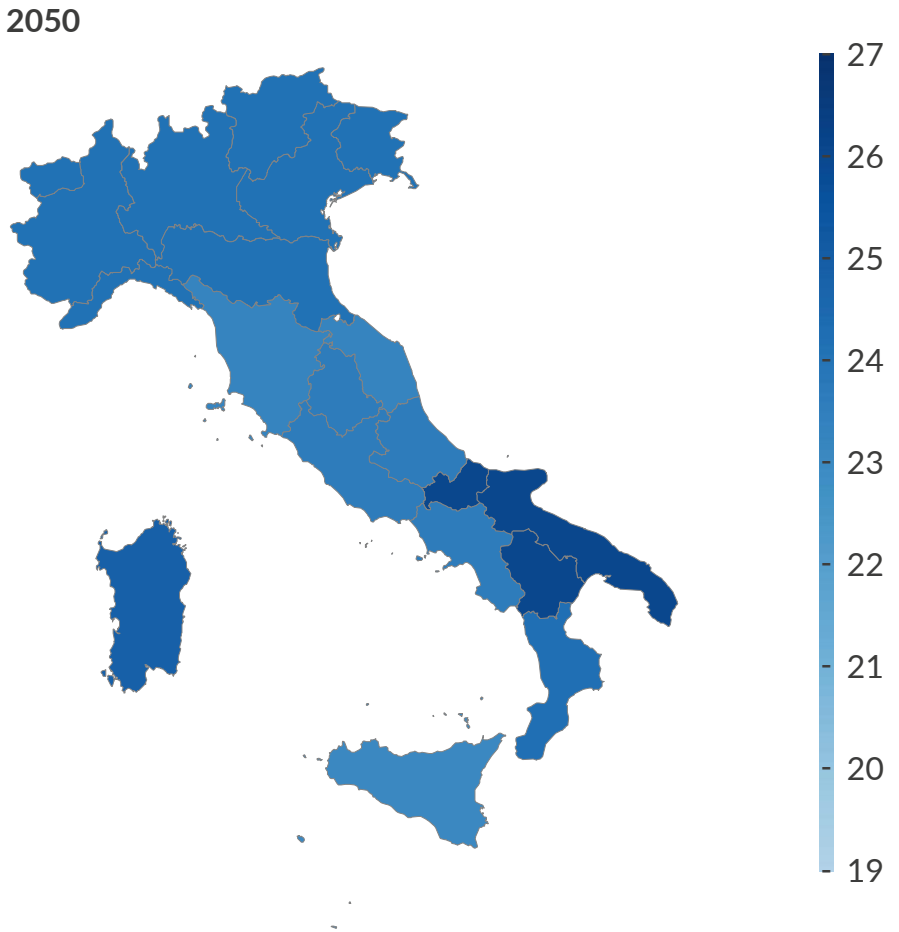
Onshore wind capture prices - Aurora Central (October 2021)[1]
€/MWh (real 2020)



Onshore wind load factor by zone[3]
%, avg. across fleet



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Sources: Aurora Energy Research

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To calculate a robust downside scenario, we account for the main risks, their correlation and impact on power prices

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Construction of a downside case scenario for the wholesale market

	Low Gas Price	Low Coal Price	Low Carbon Price	NECP RES Targets	Low Demand
Low Gas Price		Chance of combination is >P90	Coal to gas switch reduces EUA demand	Low baseload/capture price, requires high subsidies	Weak GDP growth affects both gas price and demand
Low Coal Price			Low coal price, more coal generation, more demand for EUAs	Low baseload/capture prices, requires high subsidies	Weak correlation
Low Carbon Price				Low baseload/capture prices, requires high subsidies	Weak GDP growth affects both CO2 price and demand
NECP RES Targets					NECP targets for electrification entails higher demand
Low Demand					

In the downside case (*Low scenario*), we assume lower bounds for carbon and gas prices as well as lower demand. All other assumptions remain unchanged.

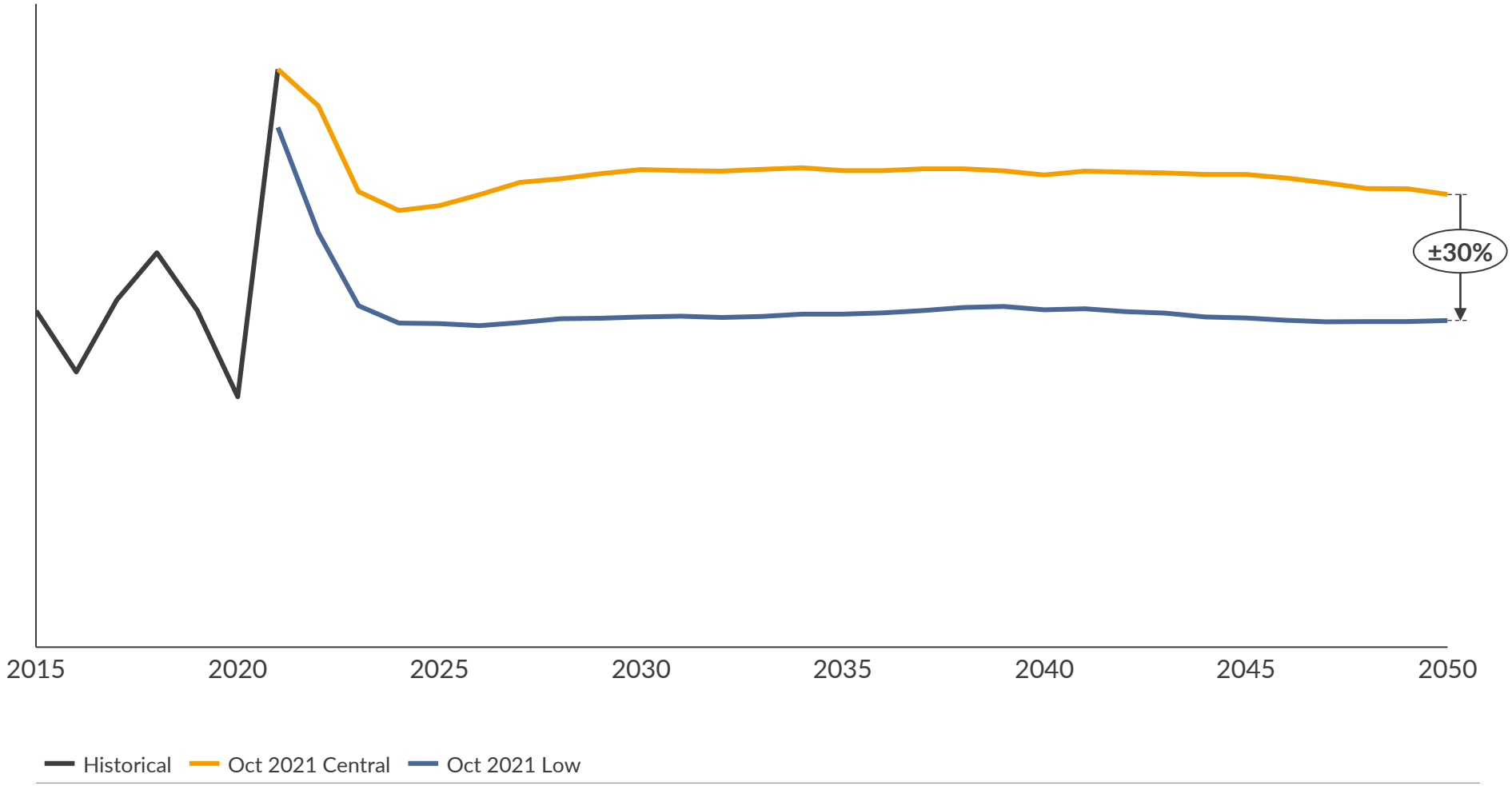
Positive correlation | No/ambiguous correlation | Negative correlation | High impact

Sources: Aurora Energy Research

Power prices in the Low scenario are around 40% lower than in the Central, driven by lower demand and commodity prices

Baseload price

EUR/MWh (real 2020)



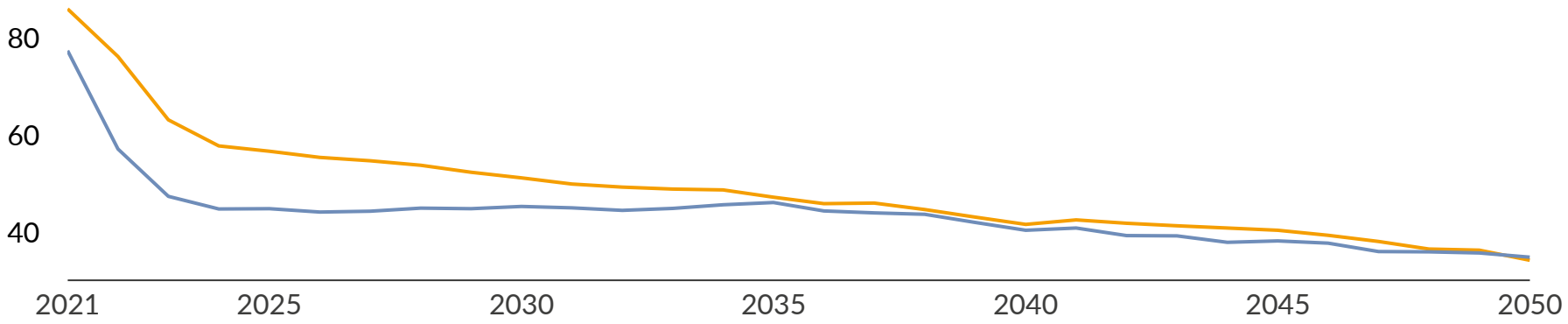
Low scenario

- Baseload prices in this scenario are driven by low CO_2 and gas prices, alongside weak power demand
- After the short-term peak, the annual baseload price remains depressed between 50 and 55 EUR/MWh across the horizon
- On average, the Low Scenario sits around **±30%** below the Central forecast

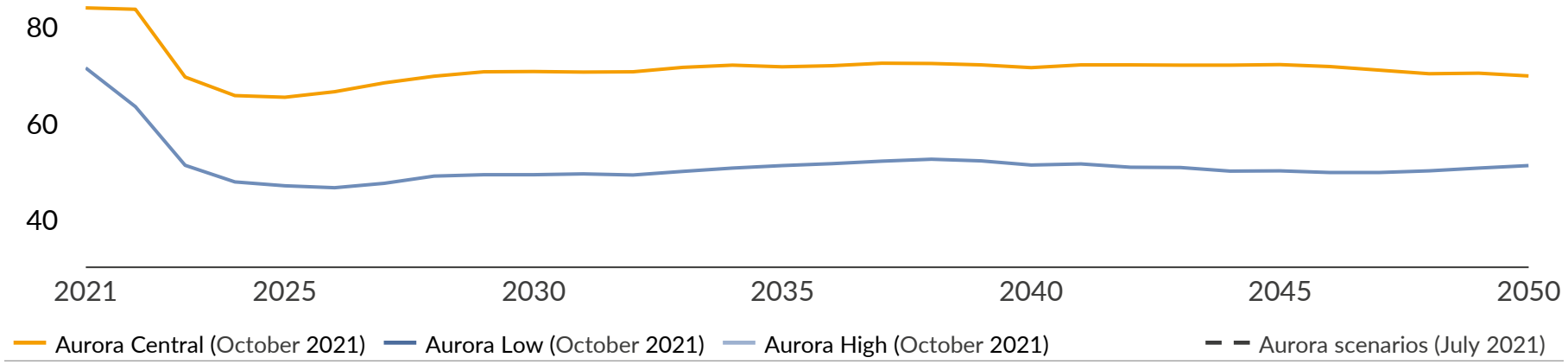
Sources: Aurora Energy Research

The reduction in renewables capture prices from the Central Scenario is mitigated by lower buildout and cannibalization

Solar capture prices[1]
EUR/MWh (real 2020)



Onshore wind capture prices[1]
EUR/MWh (real 2020)



1) Capture prices are uncurtailed generation-weighted average.

Sources: Aurora Energy Research

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Low scenario

- Low and Central prices tend to converge in the long-run as subsidised RES leave the system and low baseload prices discourage merchant buildout
- For solar, capture prices in the Low Scenario are aligned with the Central already by 2040

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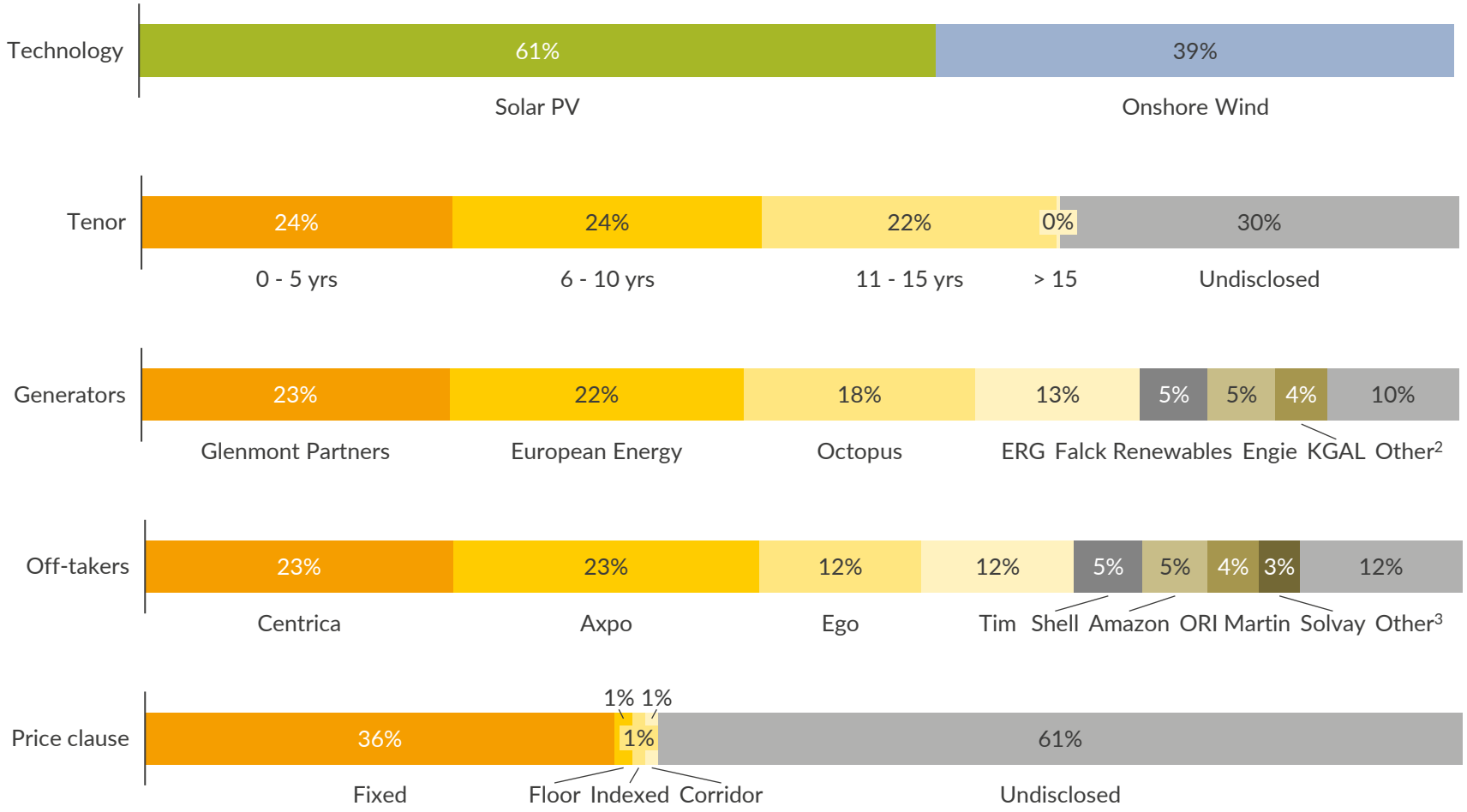
7. **Modelling Methodology**

Most existing PPAs in Italy are from solar PV, have relatively short tenor and follow fixed price structures

Details on closed PPA deals in Italy[1]
% of contracted capacity



1) Based on Aurora's PPA database; 2) Others include Canadian Solar, Eni, BAS FV Italia, Sonnedix, RWE, Axpo, Fera, Enersol and BayWa; 3) Others include Trailstone, Audax, Ferrero, Sofidel, ACEA, Unilever, Duferdofin, Illuminia, Wienerberger, L'Oreal, Viteso, Acciaierie Venete and undisclosed.
Sources: Aurora Energy Research

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- Total RES PPA contracted capacity in Italy amounts to 1.35 GW
- Solar PV is the main technology for PPA deals in Italy, accounting for 61% of PPA-contracted capacity
- Contract duration varies depending on type of project (new build vs existing)
- Glenmont is the largest supplier, followed by European Energy and Octopus; Centrica is the largest off-taker, followed by Axpo and Ego
- The vast majority of the disclosed price clauses include a fixed price; while volume clauses are mostly undisclosed, we expect the PPAs to have both as-produced and baseload profiles

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Different contractual clauses can be used to allocate commercial risks between PPAs generators and offtakers

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Commercial clause		Description	Who holds the risk? Offtaker ... Developer
Price clauses			
Fixed price	common	Fixed long-term price, offtaker takes on full price risk	
Collar	common	Price follows capture price, contract guarantees a max/min price	
Floating/Indexed price	uncommon	Price linked to baseload index, offtaker only takes on capture price cannibalisation risk	
Tenor clauses			
Short term (<=5 years)	common	Not suitable for price hedging, suitable if no debt financing required e.g. post-subsidy assets	
Medium term (6-10 years)	common	Allows debt financing for smaller new build projects e.g. solar and onshore merchant	
Long term (>10 years)	common	Allows for highly debt-leveraged finance required for high risk projects, e.g. offshore wind	
Volume clauses			
As produced	common	Offtaker receives asset generation profile	
Baseload	common	Asset(s) guarantees firmed baseload profile	
Fixed pattern/as consumed	uncommon	Asset delivers power at a pre-agreed fixed pattern	

common uncommon

Sources: Aurora Energy Research

The fair market value of a PPA depends on market expectations, the value of green benefits and valuation of risk

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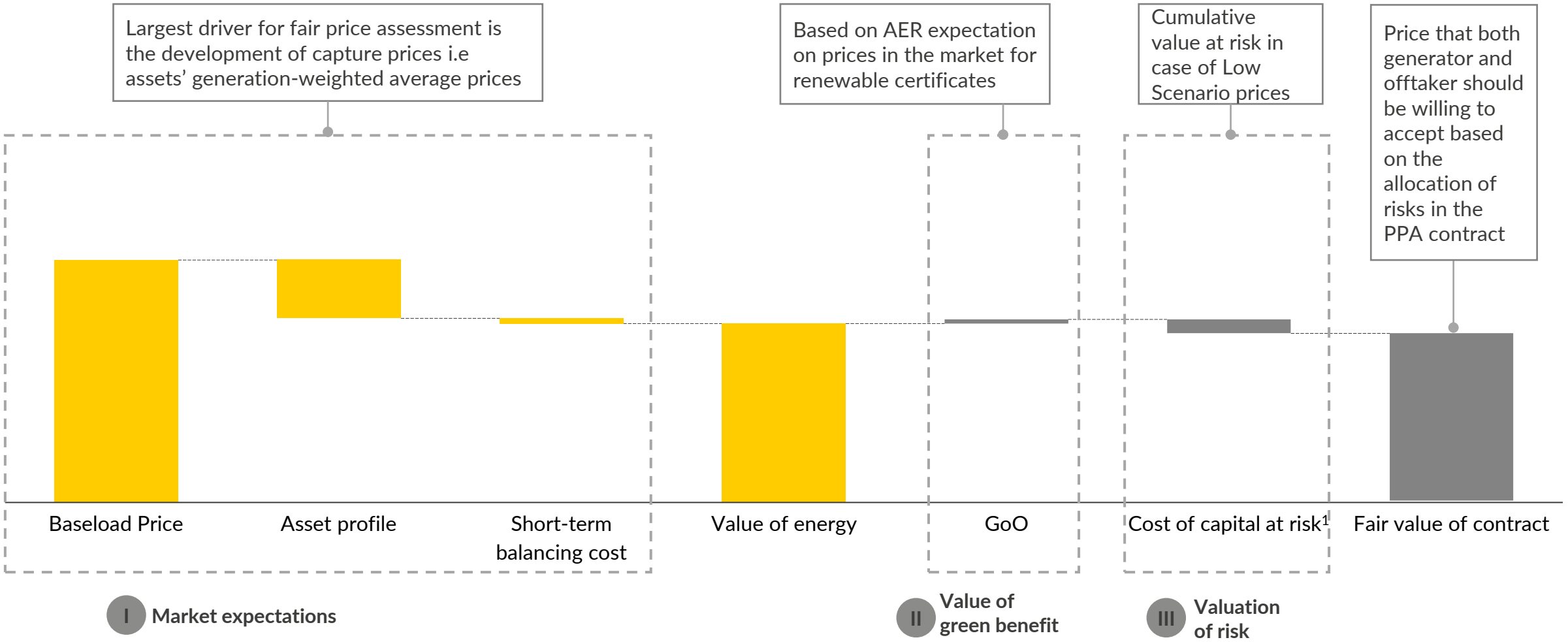
Fair price calculation – Approach overview
Fixed price structure EUR/MWh



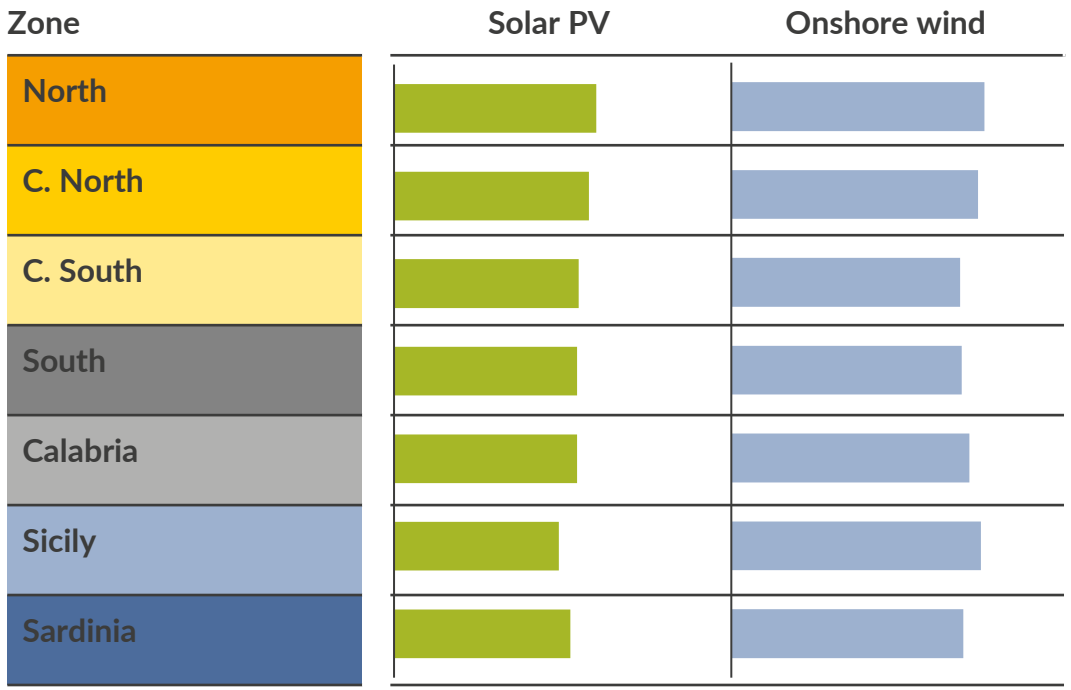
1) Cost of capital at risk: Cost of holding capital to cover expected cumulative value-at-risk i.e. the contract value risk between Central (P50) and Low (P90) price forecasts.

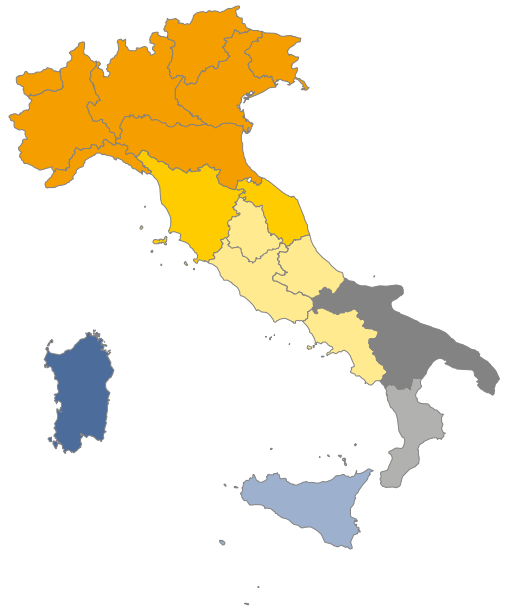
Sources: Aurora Energy Research

PPA fair price follows the development of capture prices across zones, with solar PV in Sicily having the lowest level

Contract clause: Tenor: *10 years starting 2023* // Price: *fixed price* // Volume: *as forecasted* // WACC: *9%*

Fair price calculation[1] as forecasted for PPA with fixed price[2]
EUR/MWh (real 2020)





- The fair value of a 10-year, fixed price, as produced PPA starting 2023 ranges between -11% and -27% of the respective PUN price for solar PV and between -7% and 2% of the respective PUN price for onshore wind
- The main driver of the fair value are the underlying capture prices: solar PV in Sicily presents the lowest price due to the expected cannibalization of revenues
- For onshore wind, prices are mostly homogeneous in the Southern zones, with Sicily at a higher level due to higher baseload prices and relatively low cannibalization

1) Fair price represents market value of 10-year solar PPA contract signed in 2023 that considers all upside and downside risks, revenue streams, and costs associated with wholesale markets: 2) Based on Aurora Central Scenario – April 2021. Updated results to be published with the October 2021 version of the Italy Power & Renewables Market Forecasts report

Sources: Aurora Energy Research

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Aurora's PPA demand analysis considers potential green power demand coming from the corporate world, utilities and electrolysers

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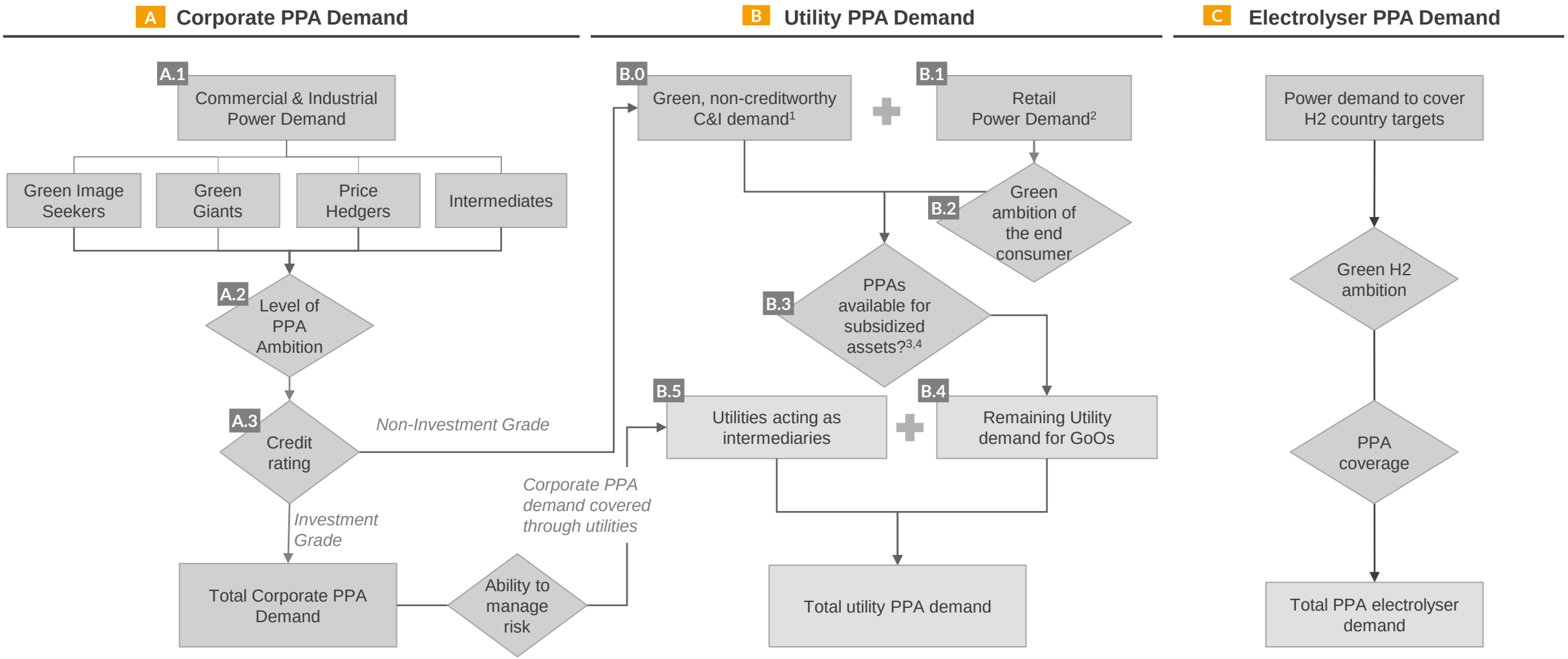
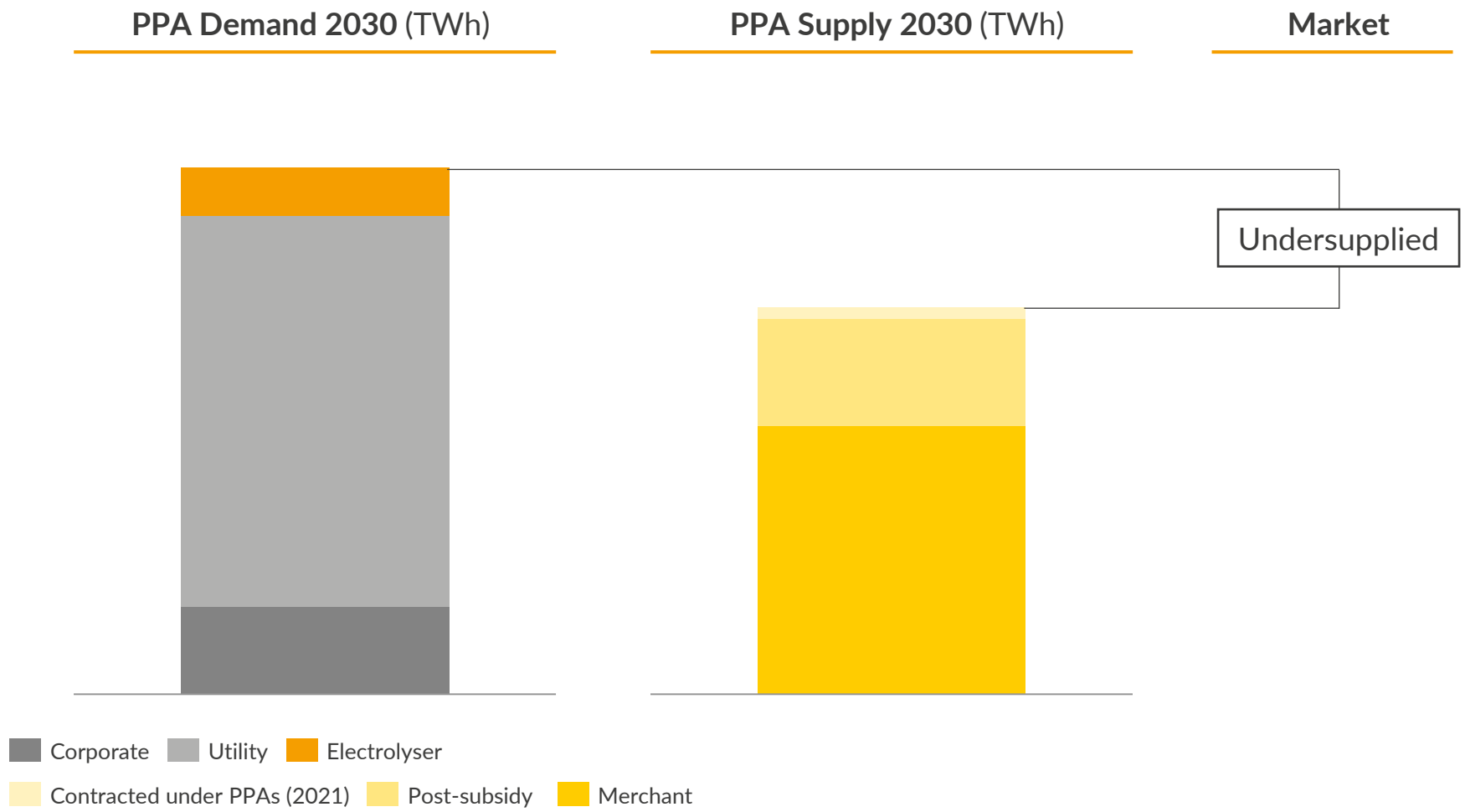


1) We assume this green demand to be covered by green GoOs. In Italy, subsidized assets receive GoOs. 2) Includes incremental demand from utilities where PPAs are procured for strategic reasons, 3) Total subsidized capacity – (Demand from C&I from non PPA ambition)*RES share 2030.

Source: Aurora Energy Research

By 2030 the Italian PPA market could be undersupplied, mainly thanks to increased utilities green power demand



Source: Aurora Energy Research

Comment

- In Italy we expect undersupply of PPAs by 2030 – merchant buildout will not be enough to cover demand for PPAs
- The majority of PPA demand will come from utilities:
  - We expect large share of utilities' green power demand to be satisfied via PPAs rather than subsidies; this is due to the poor performance of RES subsidy auctions in Italy
  - Utilities are likely going to play the role of intermediary to supply green power to corporates, due to the large share of SMEs and non-creditworthy companies
- In this market, developers looking to sign PPAs will be able to do so at favourable conditions

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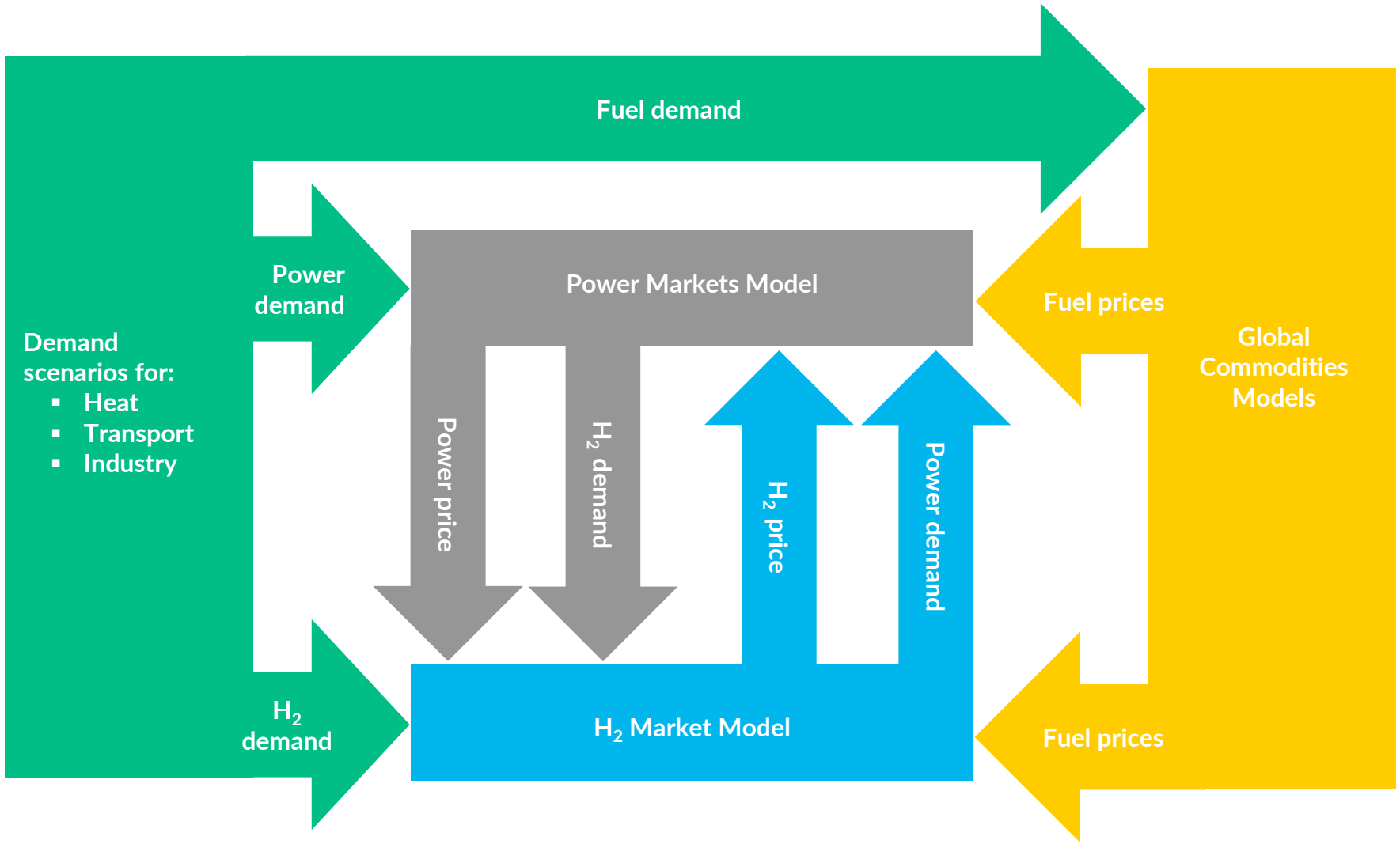
Aurora's analytical framework now includes detailed hydrogen modelling



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Aurora has an integrated energy system framework:

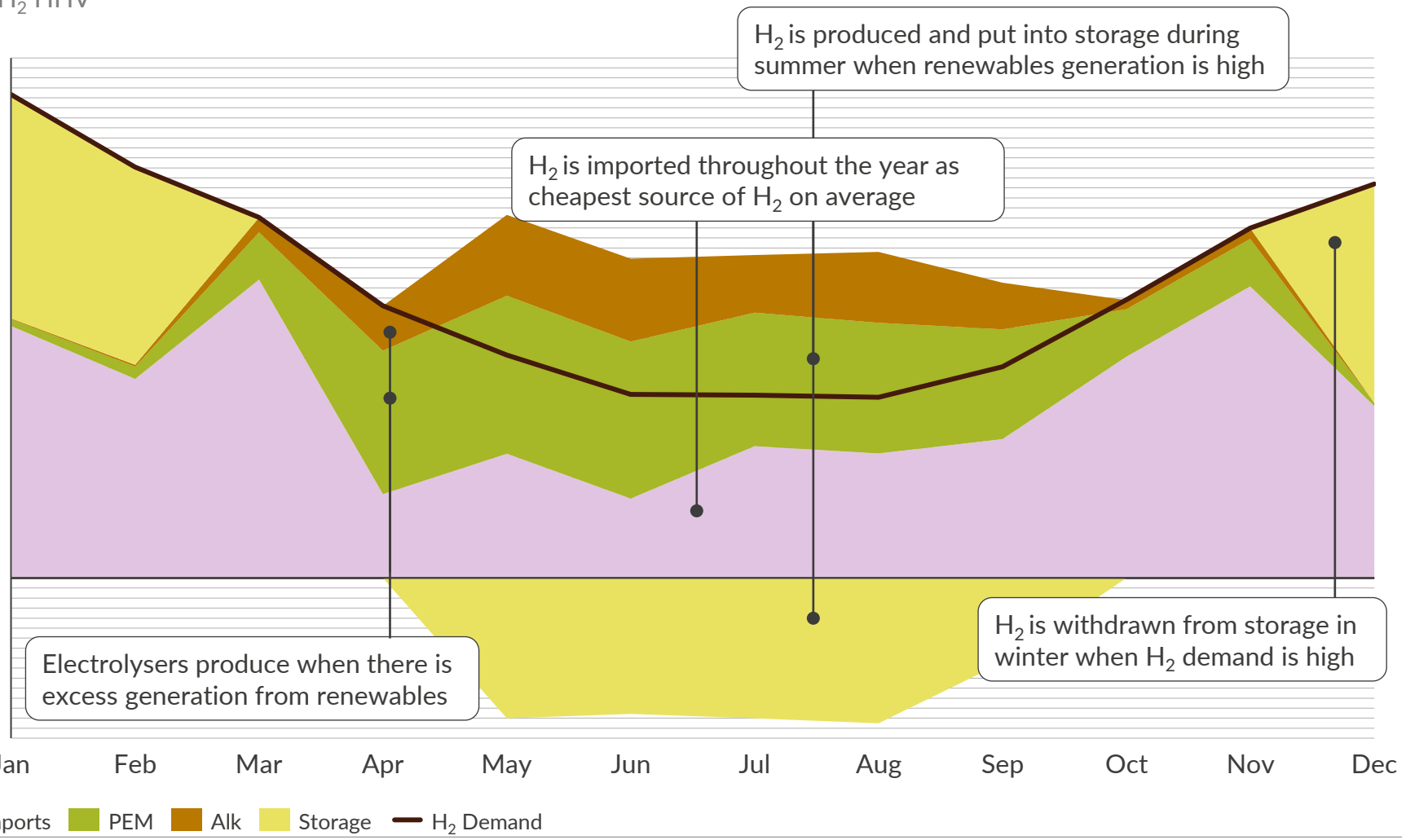
- Internally consistent gas, power and H_2 demand scenarios for heat, transport and industry
- Unified commodity price forecasts
- A modelling suite that highlights feedback loops across H_2 and power markets

By integrating H_2 and power market modelling, Aurora's approach captures the interactions of power and H_2, and specifically the mutual benefits of H_2 adoption and deployment of RES

Sources: Aurora Energy Research

Hydrogen storage allows to shift hydrogen production from renewable and imports across time periods

Monthly H_2 production in 2050
GWh H_2 HHV



Sources: Aurora Energy Research

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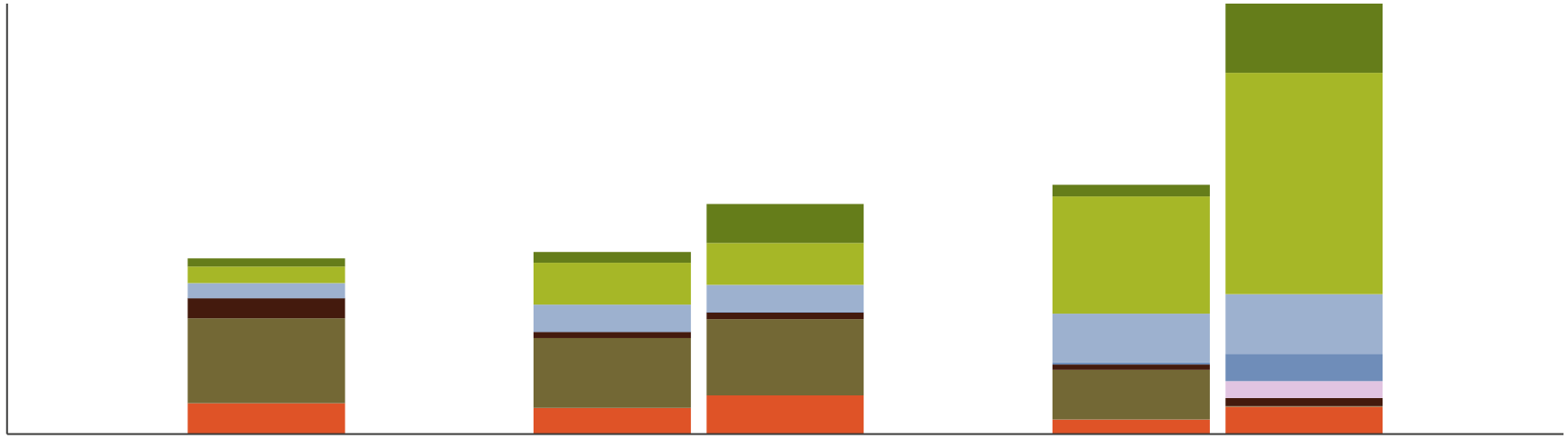
Comments

- Electrolyser production remains intermittent throughout the year, depending mainly on renewables output
- Most of the excess is produced in Q2 and Q4 when the residual power demand is low (when power demand is low and renewable output high)
- Electrolysers buy electricity to meet H_2 demand until they are no longer competitive with imports
- H_2 storage enables inter-seasonal shifting of hydrogen
- Excess supply during high renewables output periods is stored, shifting H_2 generation to periods of low residual demand for the power system

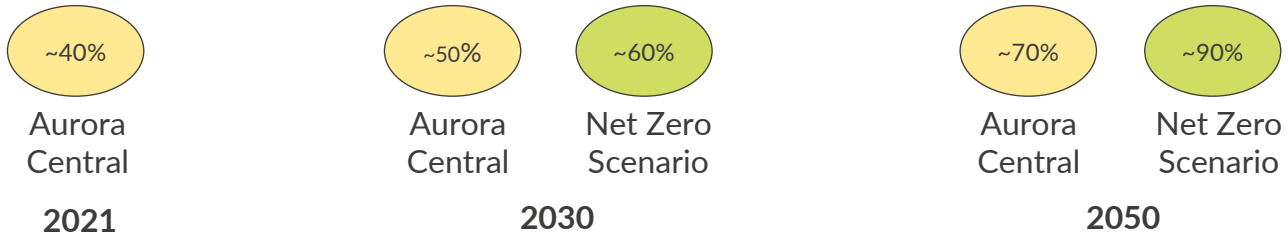
Thanks to the flexibility provided by batteries, renewable generation provides more than 90% of total power generation in 2050

Electricity generation[1]
TWh



Battery discharge
TWh

RES share of total generation
%



Other RES | Solar | Onshore wind | Offshore wind | H_2 | Other thermal | Gas | Net Imports

1) Excluding behind-the-meter generation.

Sources: Aurora Energy Research

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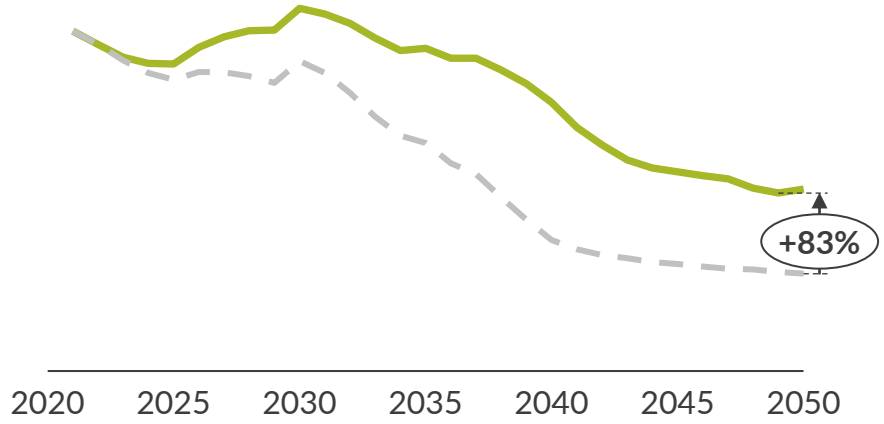
Comments

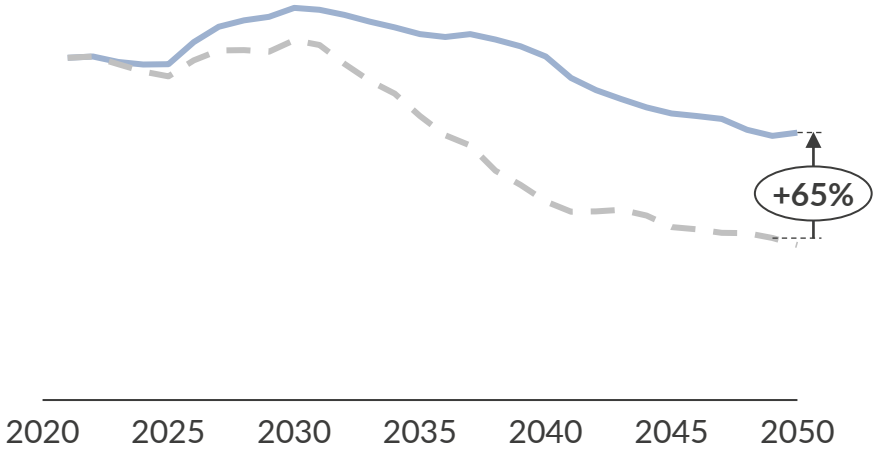
- RES generation rises from ~90 TWh in 2021 to 512 TWh in 2050 in the Net Zero Scenario, but only to ± 430 TWh in absence of demand from electrolysers
- Thermal generation strongly declines from ±150 TWh in 2021 to ± 40 TWh in 2050 under Net Zero assumptions
- By 2050, only ±5% of demand is be covered by dispatchable plants, the rest is met by RES
- Biogas and hydrogen turbines are expected to replace gas plants, and will generate in hours of low RES production, as well as to satisfy heat demand (± 20 TWh of H_2 generation comes from CHPs)

Electrolysers add further flexibility to renewables, supporting RES capture prices in 2050 even in a Net Zero scenario

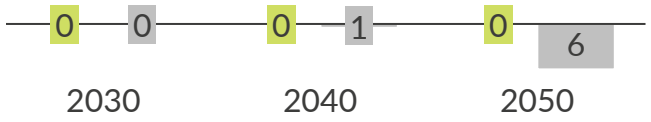
Solar capture price – Net Zero Scenario
€/MWh (real, 2020)



Onshore wind capture price – Net Zero Scenario
€/MWh (real, 2020)



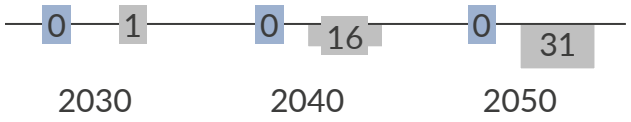
Solar curtailment
%



IRR (real, pre-tax)
%

Electrolysers — No electrolysers

Onshore wind curtailment
%



IRR (real, pre-tax)
%

Electrolysers — No electrolysers

Sources: Aurora Energy Research

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Comments

- Electrolysers, provide flexible demand to match RES intermittency
- Electrolysers generation reduces cannibalisation in periods of high RES production
- Electrolysers raise demand for renewable power, with a positive effect on capture prices, as well as demand for PPAs and their fair value
- The real, pre-tax rate of return of renewables is forecasted to range around 9% even in a Net Zero scenario, signifying they can be deployed without direct subsidies if the necessary sources of flexibility are supported

Due to the predominant role played by RES generation, the residual demand is covered mostly by batteries and imports

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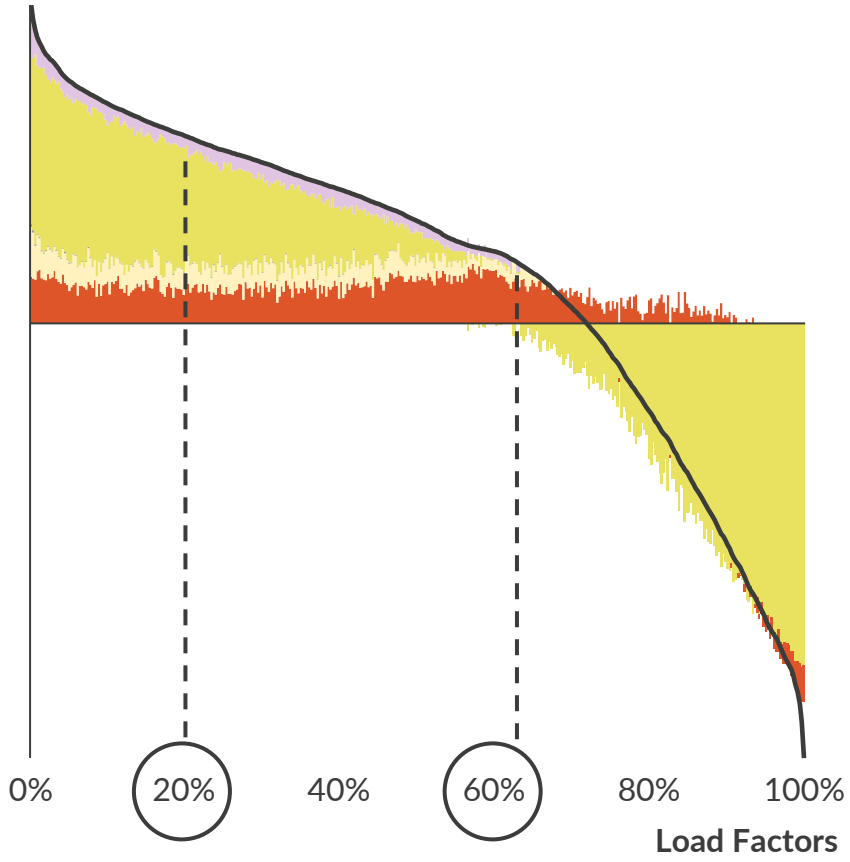
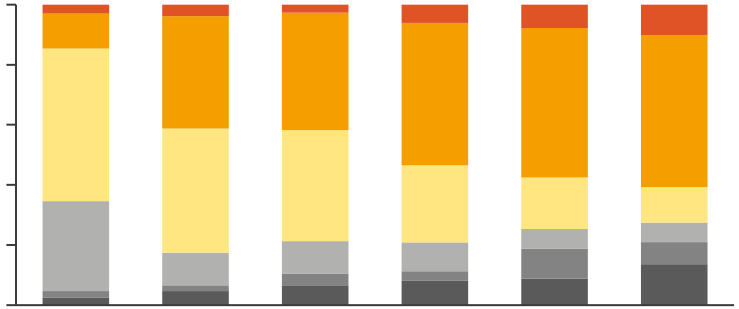
Daily residual load duration curve (excluding CHPs) in 2050
TWh

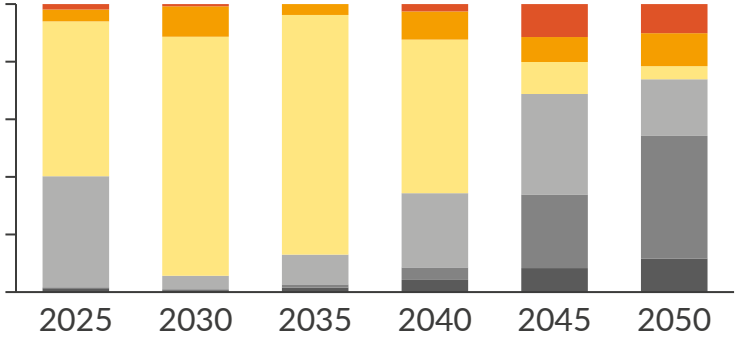


Frequency distribution of the Italian power price (PUN)
%

Aurora Central:



Net Zero Scenario:



Residual Demand
Hydrogen
Battery and pumped storage
CHP extra generation
Bioenergy/other
Net imports
>100 €
80-100 €
60-80 €
40-60 €
20-40 €
<20 €

Comments

- The residual demand is covered mostly by batteries and imports
- The frequency of low prices (<40 €/MWh) increases to 55% in 2050 as renewables set prices more frequently
- Therefore batteries will purchase electricity at cheap times and discharge in peak times
- H_2 peakers will cover the peak hour residual load seen in 'net zero'
- Due to the high CAPEX of CCS, gas-powered thermal peakers with CCS are more expensive than hydrogen peakers at low utilisation levels

Sources: Aurora Energy Research

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Our next Italian Market Group Meeting will investigate how the ancillary services market impacts the investments case for batteries

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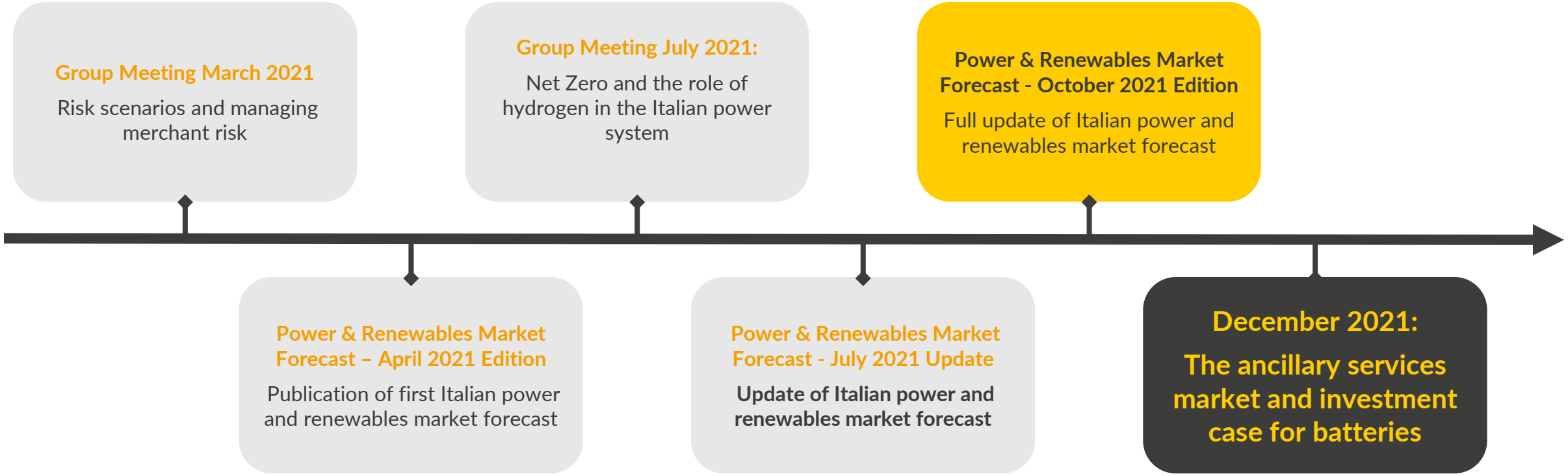
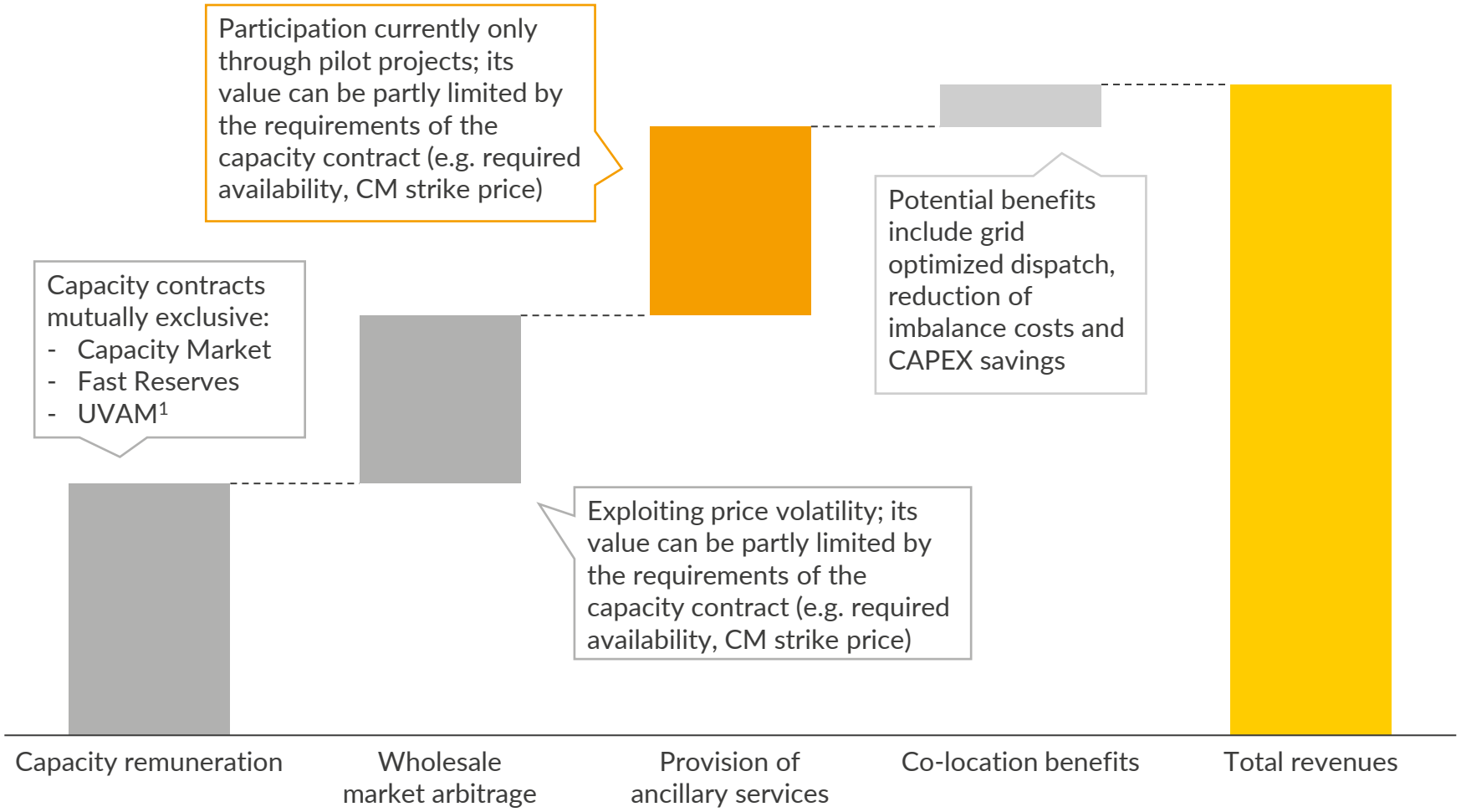


Sources: Aurora Energy Research

The investment case for batteries will depend on the revenue stacking opportunities in the different markets they will access

Revenue stacking opportunities for batteries (illustrative)
k€/MW



1) "Unita' Virtuali Abilitate Miste", Mixed Enabled Virtual Units.

Sources: Aurora Energy Research

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Potential for revenue stacking

- Several capacity mechanism are accessible to batteries in the Italian power market with different requirements, remuneration and maturity
- Depending on the capacity contracts, batteries can participate to different extends to the energy markets
- Co-location with RES plants unlocks further revenues and cost savings
- Revenue stacking can lead to sound business cases for batteries in the Italian power market

Prices on the MSD market have a substantial spread with respect to the prevailing prices in the day-ahead market

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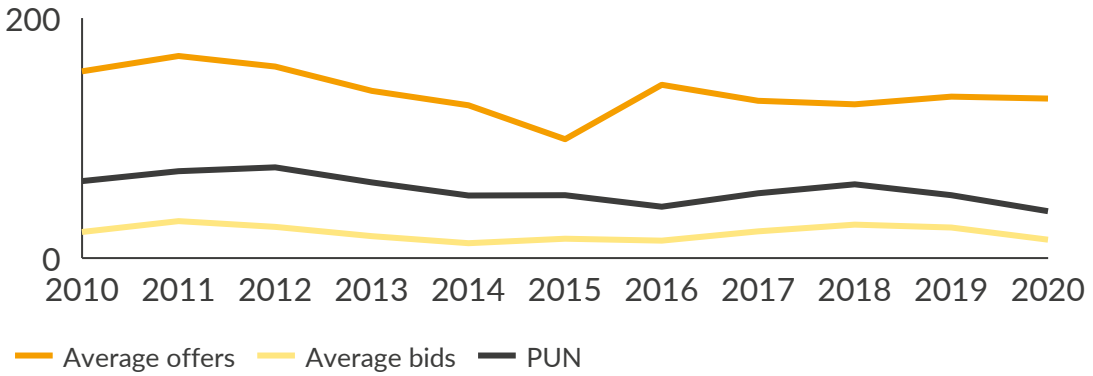
Terna follows a prudential approach to power dispatch

- Terna, on average, exits the MSD ex-ante in a long position, and then purchases the downward volumes needed to balance the system in the BM in real time

Prices on the MSD market have a substantial spread with respect to the PUN

Average yearly prices in MSD[1]

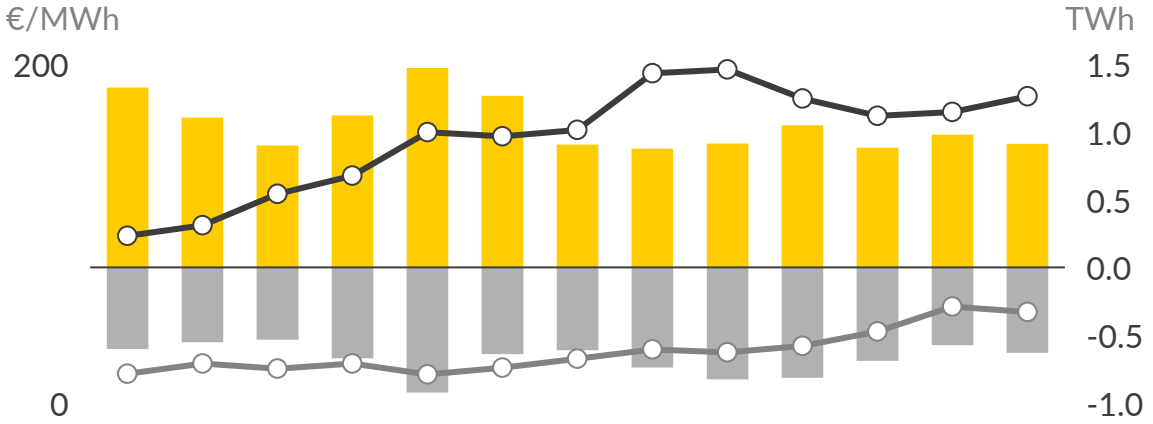


- Historically, CCGT have been the resource most used by Terna for the provision of ancillary services, due to the high flexibility and reliability. Coal-fired plants have been used only on critical grid points, while thermal cogeneration and pumped storage only to provided downward balancing
- Trading on the MSD has been the main source of marginality for CCGTs

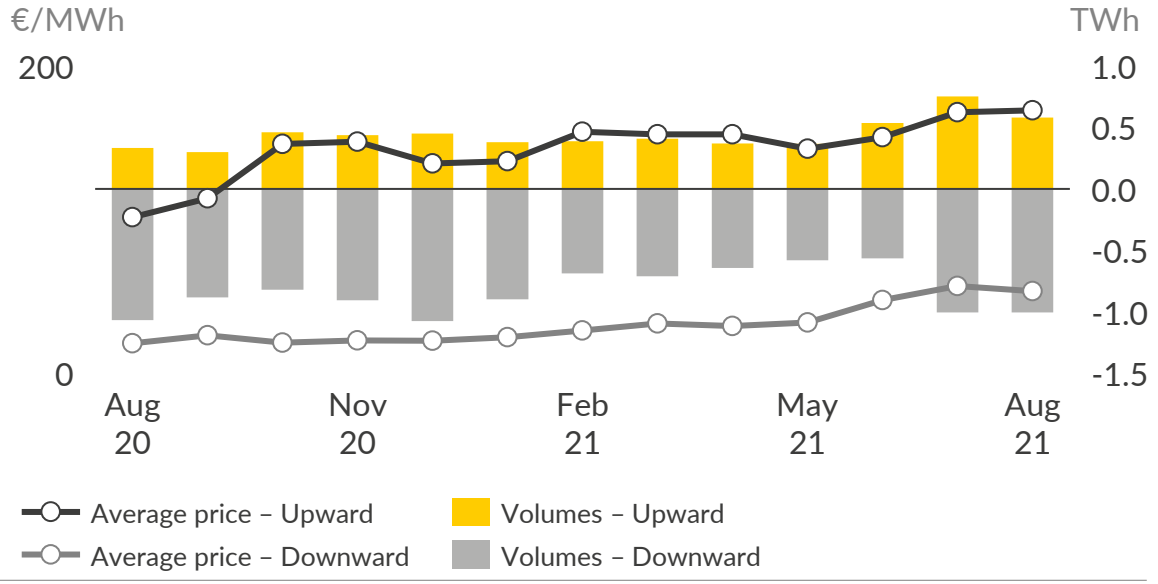
Terna charges the costs for procurement in the MSD through the so-called "Uplift"

- "Uplift" is estimated by Terna on a quarterly basis and is billed to dispatching users for the actual electricity withdrawn during the quarter

MSD ex-ante (Dispatch Services Market)



MB (Balancing Market or MSD ex-post)



1) Weighted average MSD prices, offers (upward) and bids (downward).

Sources: Aurora Energy Research

We will run multiple sensitivities to identify the optimal business case for batteries across zones, duration and revenue opportunities

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ILLUSTRATIVE

Assumptions

- COD
- CAPEX
- OPEX
- Round-trip efficiency
- Degradation

Results under Aurora Central scenario

Price zone	Duration	Capacity revenues	Energy revenues	NPV	IRR (%)
North	1 hour	Fast Reserves: … k€/MW	… k€/MW	… m€/MW	
	2 hour	CM: … k€/MW	… k€/MW	… m€/MW	
	4 hour	CM: … k€/MW	… k€/MW	… m€/MW	
C. South	1 hour	Fast Reserves: … k€/MW	… k€/MW	… m€/MW	
	2 hour	CM: … k€/MW	… k€/MW	… m€/MW	
	4 hour	CM: … k€/MW	… k€/MW	… m€/MW	
Sicily	1 hour	Fast Reserves: … k€/MW	… k€/MW	… m€/MW	
	2 hour	CM: … k€/MW	… k€/MW	… m€/MW	
	4 hour	CM: … k€/MW	… k€/MW	… m€/MW	

IRR

< 3 % | 3–7 % | > 7 %

Sources: Aurora Energy Research

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We offer Power Market Intelligence Services across key markets and specialised products focussing on renewables and flexibility

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	Power market	Renewable power	Flexible and distributed power	Amun	H_2 market
	GB Power Market Service	GB Renewables Service	GB Distributed & Flexible Energy Service	Locational Wind Valuations Software	European Hydrogen Market Service
	Ireland Power & Renewables Market Service		Ireland Flexibility Service		
	German Power Market Service	German Renewables Service	North-West European FCR Forecast		
	French Power & Renewables Market Service				
	Dutch Power & Renewables Market Service				
	Belgian Power & Renewables Market Forecasts				
	Iberian Power & Renewables Market Service				
	**Italian Power & Renewables Market Service**		**Italian Flexibility Service** *starting in Q1 2022*		
	Nordics Power & Renewables Market Service				
	Polish Power & Renewables Market Service				
	Greek Power & Renewables Market Forecasts				
	Bulgarian Power & Renewables Market Forecasts				
	Romanian Power & Renewables Market Forecasts				
	ERCOT Power & Renewables Market Service				
	Australian Power & Renewables Market Service		Australian Flexibility Service		

Source: Aurora Energy Research

Aurora's Italian Power & Renewables Market service offers everything you need to understand the market, as well as upsides and risks for your assets

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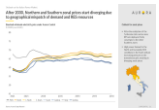
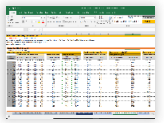
Italian Power & Renewables Market Service



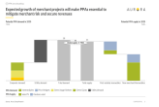
Bi-Annual Market Forecast reports with quarterly data updates

- **Yearly forecasts of wholesale market prices along three scenarios** (High, Low, Central) until 2050, both at **national and zonal** level
- **All the latest trends and forecasts,** recent market and policy developments
- **Price distributions**, capture spark spreads, peak prices
- **Capacity development**, generation mix, interconnector capacity, capacity buildout, exports
- **Capture prices** of key technologies (onshore, solar), load factors
- **PPA valuation**, example of fair price valuation (Available from Q4)
- **MSD Market** (Available from Q4)
- **EU ETS carbon price & gas price** forecasts



Underlying dataset

- **An Excel spreadsheet** containing all key input assumptions, baseload price, and fleet-wide onshore wind and solar capture prices on an annual basis through 2050. This will be provided for Aurora's Central, High and Low Scenarios and will include RES capture prices at a national level



Workshops and analyst support

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

Group Meetings

- Invitation to our **Italian Power Market and Renewables Group Meetings** in Milan/Rome (no less than two meetings per year) on topical issues, such as Hydrogen and the Balancing Market
- **In-depth thematic reports** on these topical issues

Access anytime via Aurora's EOS online platform

For more information, please contact
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☎ **+49 30 166390535**

Agenda

Contents Overview for the Italian Market Forecast Report (October 2021)

Our Group Meetings are 'idea generating' sessions to collectively discuss topical issues in the Italian market

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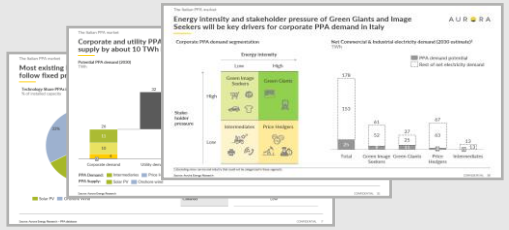
Group Meetings & Strategic Insight Reports

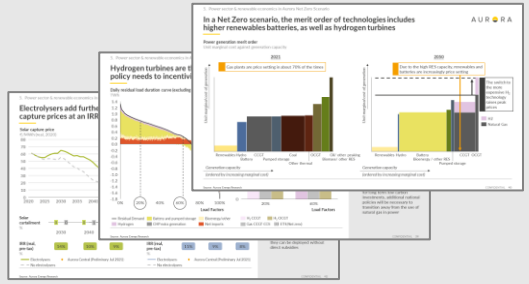
- We organize at least two Group Meetings per year, where we present and discuss a bespoke piece of research agenda on key industry trends in the market – our topics are determined in close collaboration with our subscribers.
- You can access all our strategic insight reports associated to the sessions on our online platform EOS.

Past and Future topics for Italy:

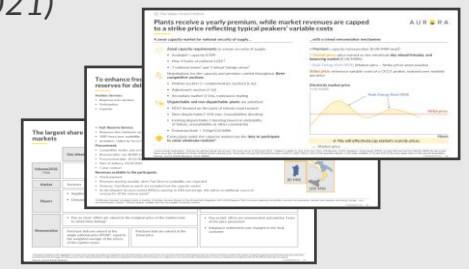
- *The future of Italy's PPA market (March 2021)*



- *Net Zero and the Role of Hydrogen in Italy (July 2021)*



- *The Italian balancing market: opportunities for flexible assets and implications for renewables (November 2021)*



- *The Impact of Weather on Revenues for Renewables (March 2022)*

High level representatives from the following organisations typically participate in Group Meetings:

PACIFICO, VALECAP valore e capitale, Terna, Santander, sorgenia YOUR NEXT ENERGY, ING, CanadianSolar, ENERGY INFRASTRUCTURE PARTNERS, Bank of America, UniCredit, RWE, uniper, Cubico SUSTAINABLE INVESTMENTS, ARERA Autorità di Regolazione per Energia Reti e Ambiente, COMMERZBANK

Agenda

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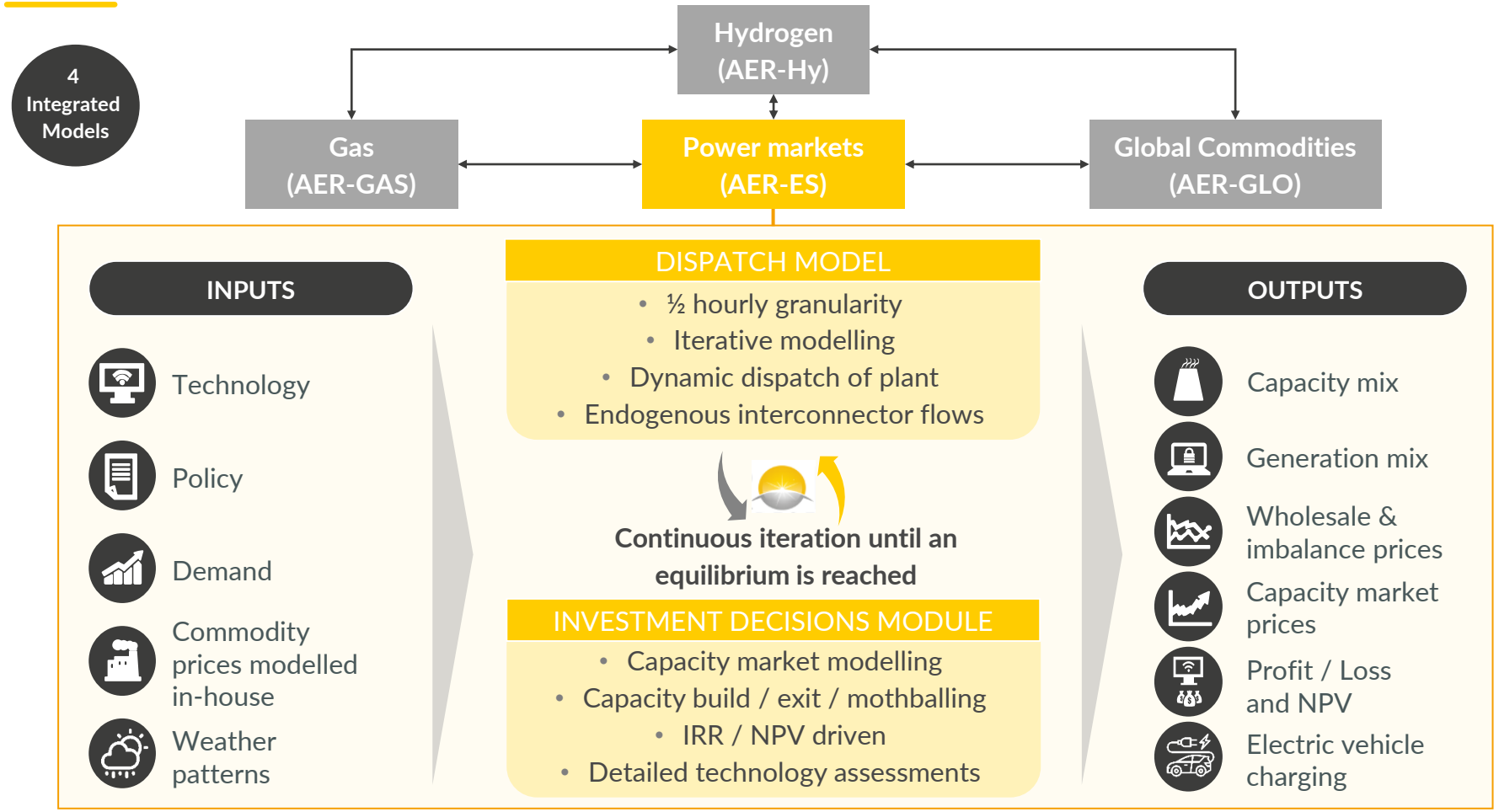
1. **About Aurora**
2. **Aurora Market Outlook**
   I. Commodities Prices Assumptions
   II. Central Scenario
   III. Low Scenario: Methodology and Results
3. **Italian PPA Market**
   I. PPA Valuation
   II. PPA Market Sizing
4. **Net Zero Scenario Analysis**
5. **The Ancillary Services Market and Investment Case for Batteries**
6. **Italian Power & Renewables Market Service**
7. **Modelling Methodology**

Our analysis of power markets uses our unique, proprietary, in-house modelling capabilities



Up to 70
specifications modelled for each plant

c. 55k
investment hours on modelling capabilities

3k - 4k
model runs per week

30+
strength of modelling team globally

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Advantages of our approach:

- Aurora have invested heavily in developing our dispatch models since 2013 and believe they are the most sophisticated available
- Our models have been rigorously tested and refined in a wide range of client contexts
- Flexible and nimble because we own the code
- Transparent results
- State-of-the-art infrastructure
- Zero dependence on black-box third-party software (e.g. Plexos)
- Constantly up to date through subscription research
- Ability to model complex policy changes quickly

We model the whole of Europe in an integrated manner

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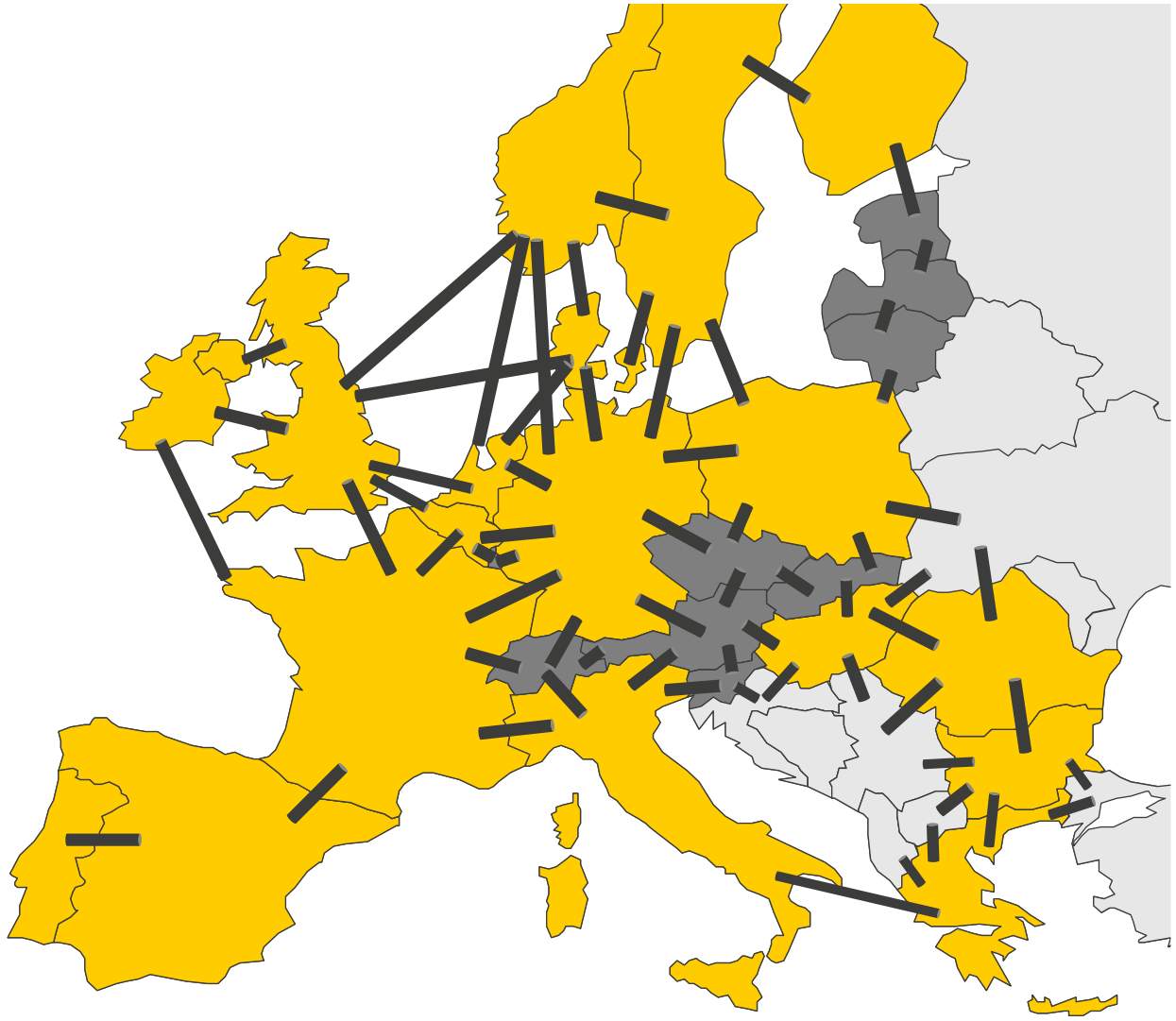
Endogenous interconnector flows based on price differentials

Interdependence of prices and capacities in different regions

High granularity right down to individual plant level



1) Sizes and lengths of interconnectors are for visual representation only, illustrative and are not to scale

Source: Aurora Energy Research

Fuel and carbon are the number #1 driver of power prices in Europe – we don't outsource this to third parties

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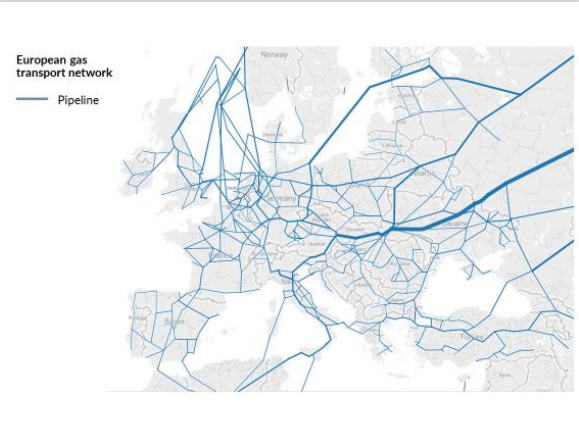
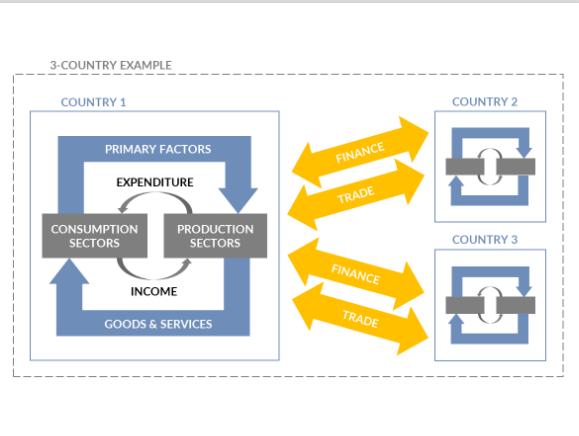
Gas dispatch modelling



- Gas demand capturing volatility and fuel substitutions through integration with power and global commodities models
- Global upstream and LNG capacities
- Highly detailed transport and storage network
- Realistic flows and prices to 2040
- European coverage and global LNG

Global commodities



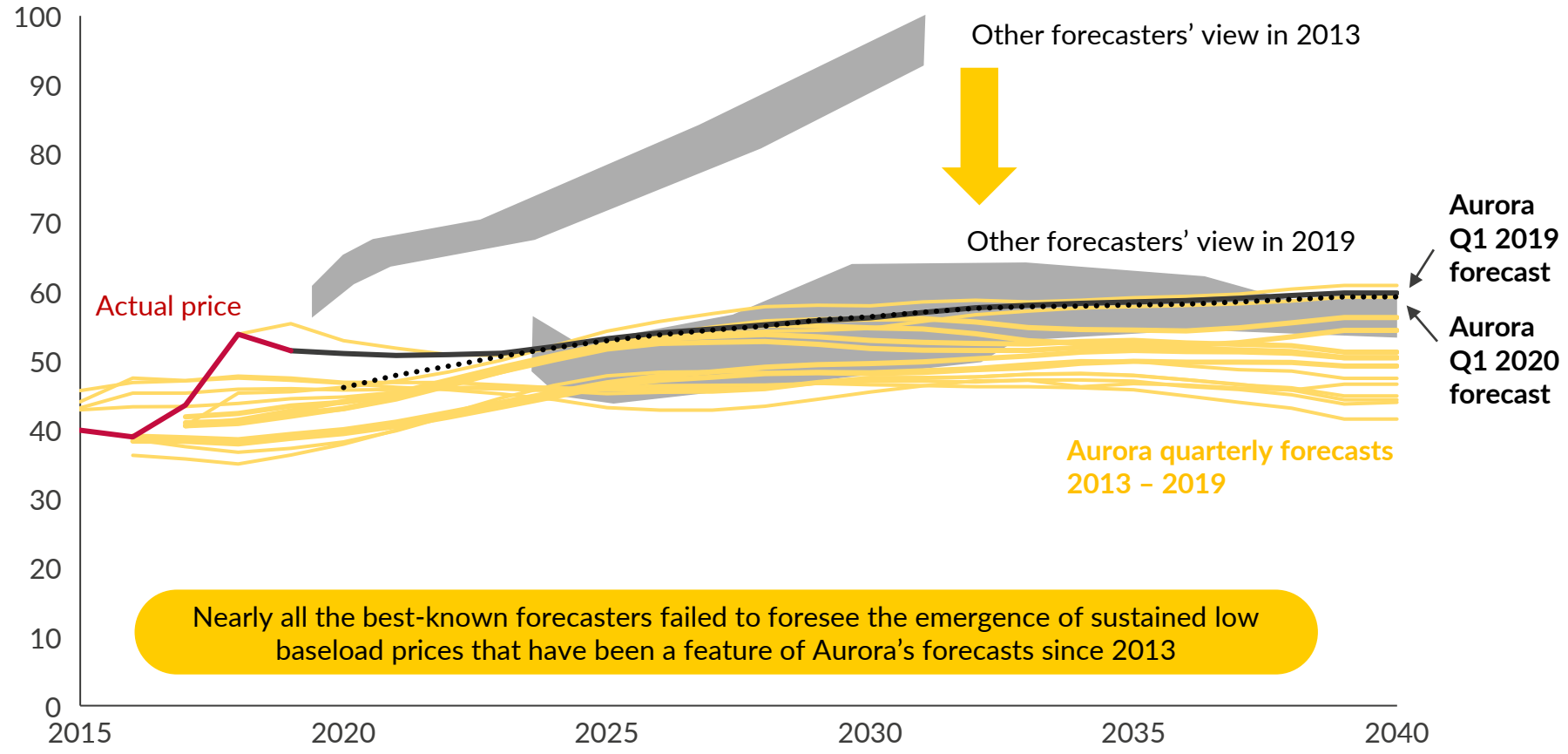
- Global Energy Market Model for price, volume forecasting and scenario analysis
- Full substitutability between coal, oil and gas on global scale
- Integrated 'bottom up' approach to modelling resource extraction and power dispatch

Aurora's modelling has supported the long-term analysis teams of Europe's two largest oil and gas companies (BP's Energy Outlook, and Shell's Scenarios) since 2014

Source: Aurora Energy Research

Our forecasts have outperformed those of our competitors, foreseeing only a moderate rise in baseload prices since 2013

GB baseload wholesale power price
£/MWh (2016 real)



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Aurora's long-term forecast doesn't move with transient market changes:

- Aurora's ability to model the long-term fundamental drivers of commodity prices and power markets leads to stable forecasts over time, only changing when we see long-term shifts in costs, demand/supply balance and regulation
- Independence is hard wired into our operations and approach, with clients across the entire industry, yet none to whom we are beholden
- We seek to give the best answer, not the convenient one; we are not worried to be "out of consensus" when we believe that's what the data tells us

Contacts

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Source: Aurora Energy Research

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Forward-looking statements

This document contains forward-looking statements and information, which reflect Aurora's current view with respect to future events and financial performance. When used in this document, the words "believes", "expects", "plans", "may", "will", "would", "could", "should", "anticipates", "estimates", "project", "intend" or "outlook" or other variations of these words or other similar expressions are intended to identify forward-looking statements and information. Actual results may differ materially from the expectations expressed or implied in the forward-looking statements as a result of known and unknown risks and uncertainties. Known risks and uncertainties include but are not limited to: risks associated with political events in Europe and elsewhere, contractual risks, creditworthiness of customers, performance of suppliers and management of plant and personnel; risk associated with financial factors such as volatility in exchange rates, increases in interest rates, restrictions on access to capital, and swings in global financial markets; risks associated with domestic and foreign government regulation, including export controls and economic sanctions; and other risks, including litigation. The foregoing list of important factors is not exhaustive.

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