

# Energy projections in the near-to mid-term: will winter 2023/24 see an even bigger crisis?

Montel Iberia Energy Day 2022

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November 2022



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

A U R  R A

Power markets



Renewables



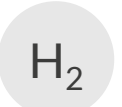
Storage



Electric vehicles



Hydrogen



Carbon



Natural gas



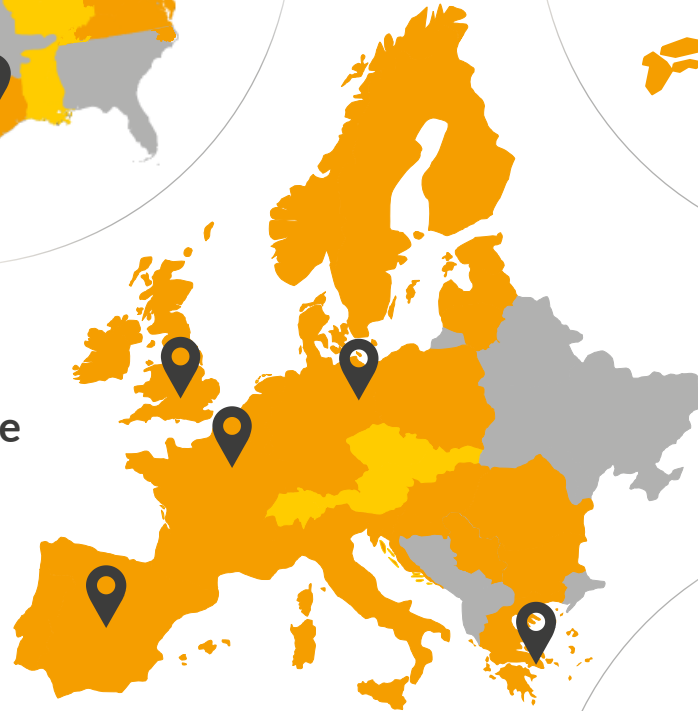
United States



Japan



Europe



Australia



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## **I. Year in review – European energy prices**

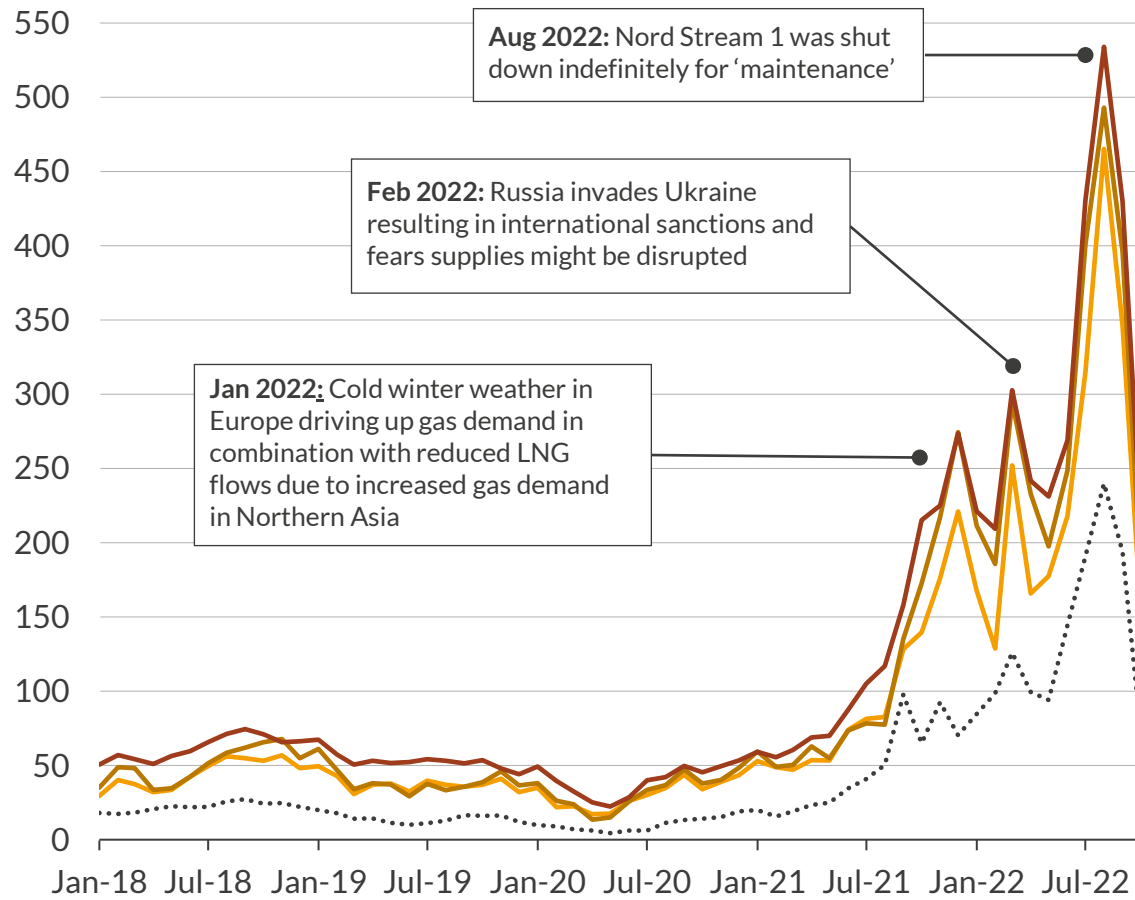
1. Gas and electricity prices
2. Hydro generation
3. French nuclear
4. Natural gas

## **II. Near-term price drivers in Iberia**

1. Iberian regulatory measures
2. Europe-wide measures
3. Continued renewable growth

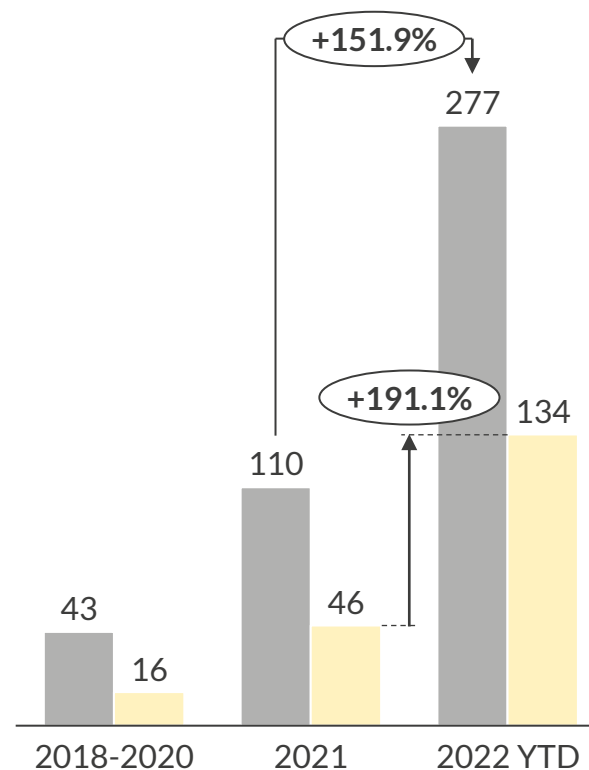
# European energy prices have risen to record highs in recent months, largely driven by Russia weaponising and withholding supplies

**Wholesale gas and baseload electricity prices<sup>1</sup>**  
EUR/MWh (nominal)



— Electricity prices — Germany — France — Italy ... Gas price - TTF

**Avg. wholesale gas and electricity prices**  
EUR/MWh (nominal)



■ Avg. electricity price<sup>2</sup> ■ Avg. gas price<sup>3</sup>

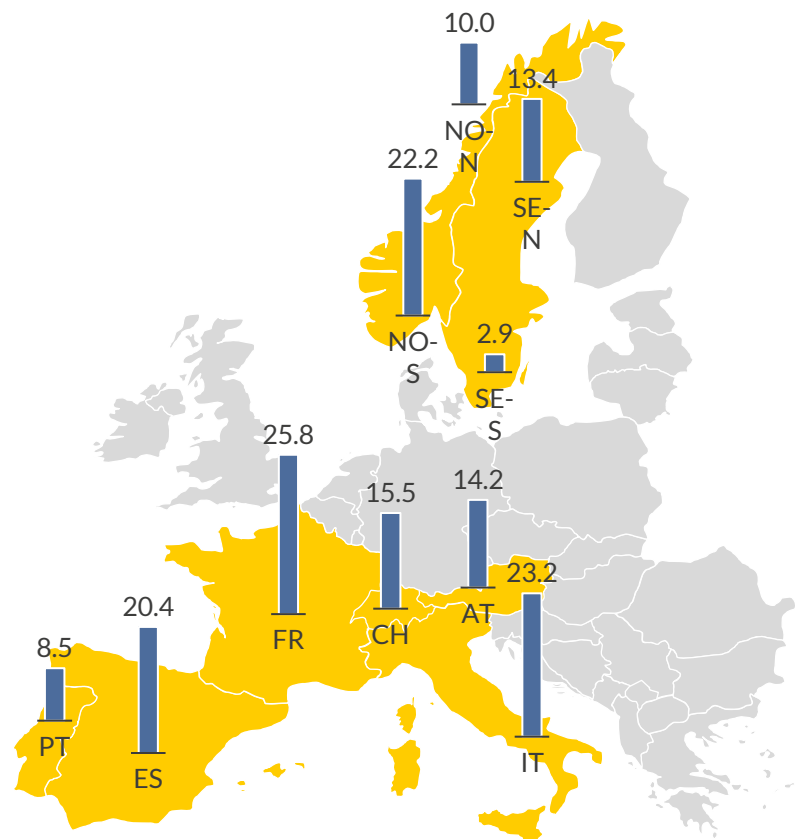
- Following the ongoing Russian-Ukrainian war and spreading geo-political tensions, gas and power prices across Europe have risen to unprecedented levels
- Reductions in supply of gas by Russia have significantly increased gas prices, and in turn power prices due to the fact that gas generators are often price setting in power markets
- A reduction in the availability of hydro across Europe and nuclear in France has also increased demand for gas for power generation, further pushing up both power and gas prices
- Since 2021 gas prices have increased by close to 200%, while power prices rose 152%
- From July to October, gas prices have decreased ~ 62%

1) Monthly average prices shown are estimated based on daily prices up to October 2022. 2) Average wholesale yearly price in Germany, France and Italy. 3) Average wholesale yearly price for TTF.

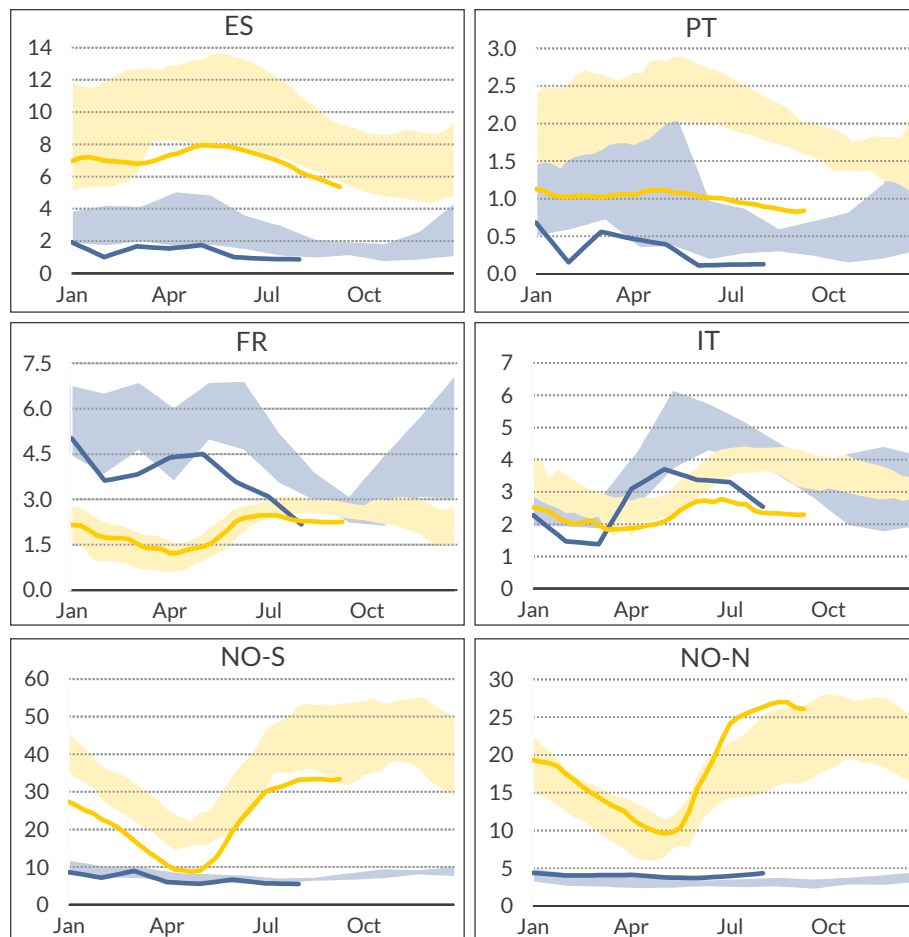
# Hydropower – Europe's largest renewable generation source in 2021 has been impacted hugely by a drought this year

## Generation and reservoir levels

TWh



■ Installed Hydro Cap [GW]



Drought conditions in 2022 have led to higher thermal generation and power prices across Europe. It would require above-average rainfalls in the coming months to refill reservoirs to normal winter levels

### Iberian peninsula

- Spain and Portugal water levels are 33% and 52% lower than the historical average. Generation is below the 6-year historical band

### France and Italy

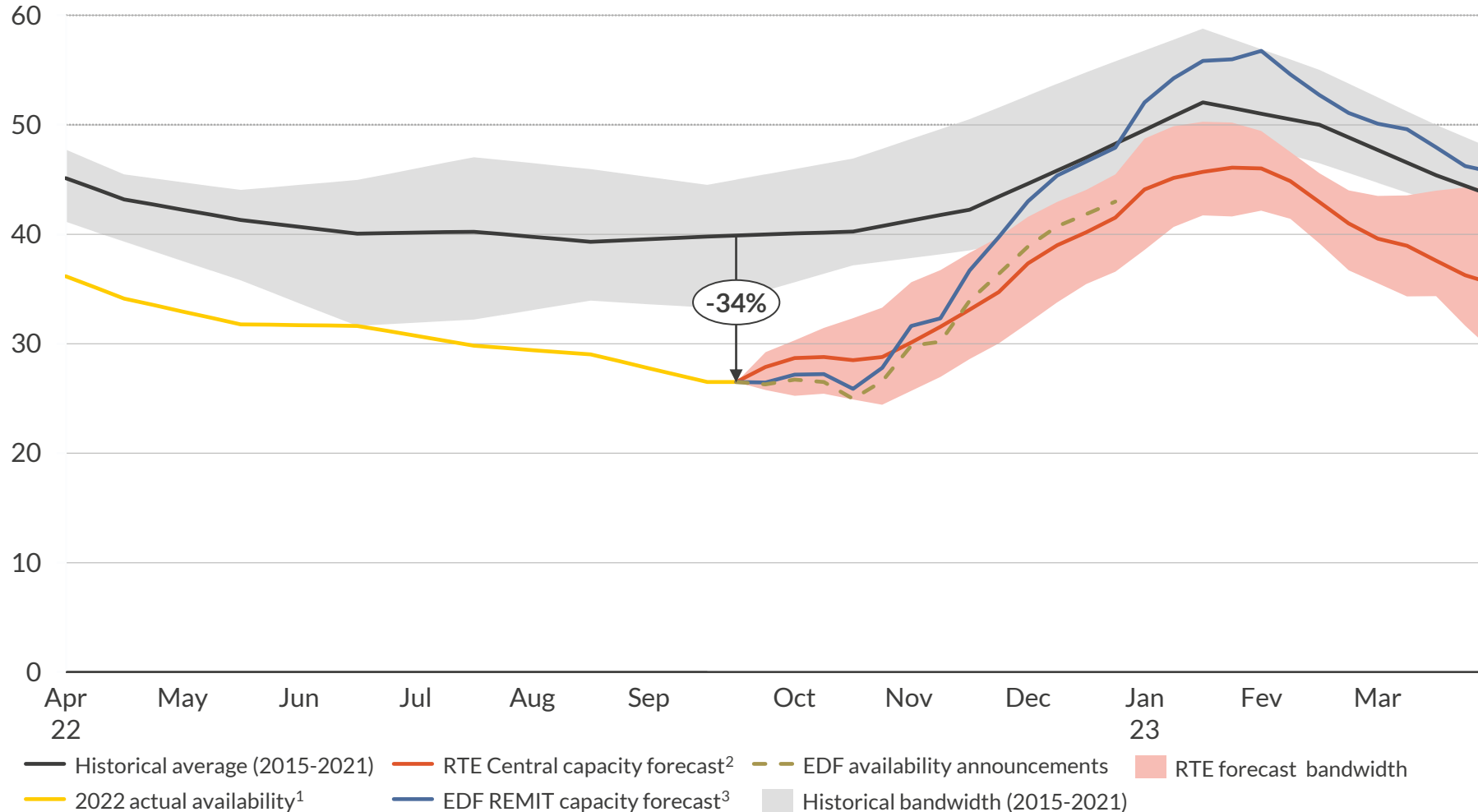
- France and Italy, with 26 and 23 GW of installed hydropower, have seen water levels 14% and 40% below the historical average

### Nordics

- South Norway has had lower water levels for years. Higher water levels from the North cannot be exported due to grid constraints

# French nuclear availability is at an all-time low while the recovery of the fleet for the coming winter is still uncertain

Available French nuclear capacity  
GW



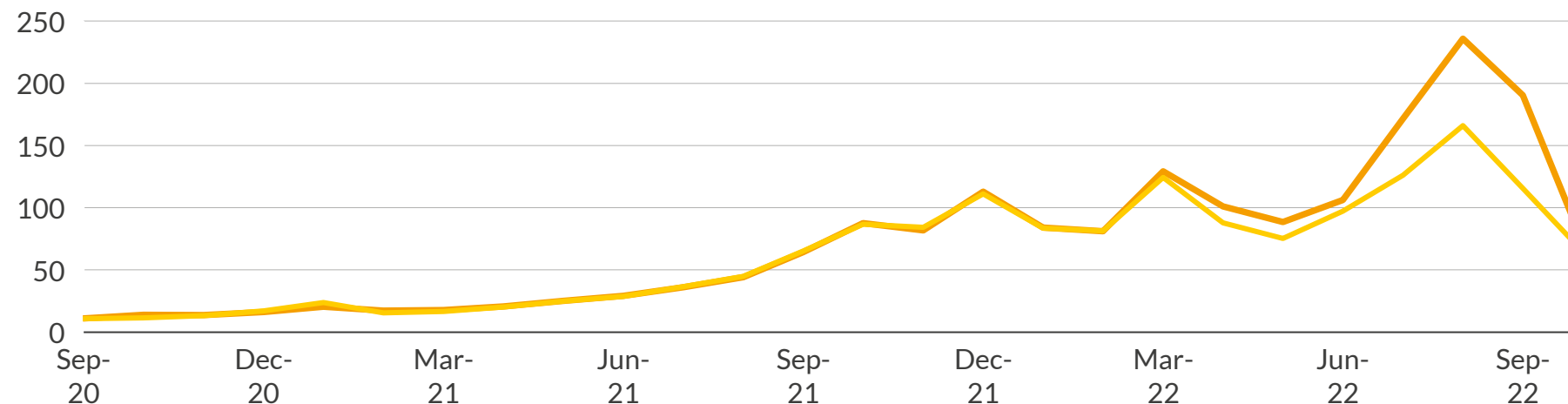
1) Last update on September 21st. 2) RTE is the French TSO who publishes its own nuclear availability forecast apart from operator EDF 3) EDF's forecast available nuclear capacity

- Over the past decade, nuclear power in France has met around 70% of French power demand and contributed to consistent electricity exports from France of around 50 TWh
- On the 21<sup>st</sup> of September 2022, the nuclear capacity available was 34% lower than the average historical value
- EDF's public announcements do not seem to follow their latest REMIT availability forecast nor RTE's (TSO) assessment, adding uncertainty to the potential capacity available during the winter
- Lack of nuclear capacity leads to more expensive thermal generation. Uncertainty around winter temperatures, nuclear output, and demand reduction has led traders to price in risk of loss of load during winter months

# European gas prices have increased since mid-2021, reaching record levels in August 2022; spread to MIBGAS has also increased

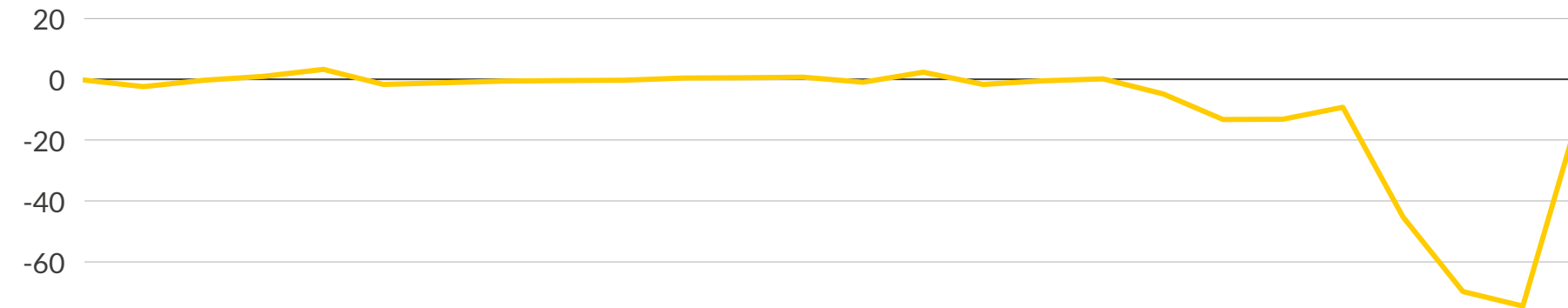
## Traded average monthly gas prices<sup>1</sup>

EUR/MWh



## Delta to the TTF

EUR/MWh



— Netherlands - TTF — Spain - MIBGAS<sup>2</sup>

1) Monthly average of daily DA prices. 2) Since Jun-22 Spain has incorporated a price cap on gas-for-power use

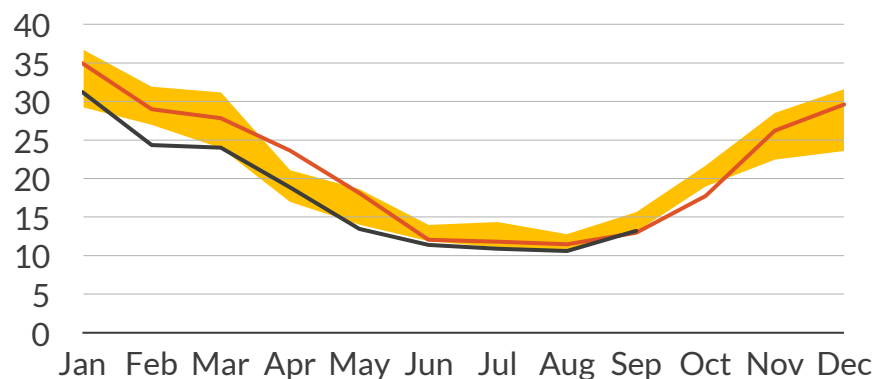
- The European benchmark TTF averaged 190.2 EUR/MWh in Aug-22, down 19% from the record high in Aug-22. MIBGAS traded at a steep discount to TTF due to high LNG regasification capacity in conjunction with export bottlenecks
- The halt of flows through NS1 from 31 Aug-22 lifted European gas prices above 300 EUR/MWh in late August. An explosion in both lines of NS1 on 26 Sep-22 makes the return of any flows via NS1 very unlikely for a couple of winters
- Prices could remain exceptionally high considering the following:
  - 1 Risk of further Russian supply disruption
  - 2 Global competition with NE Asia to secure LNG cargoes ahead of winter
  - 3 Risk of Norwegian supply disruptions due to maintenance
  - 4 Cold winter outlook

# High gas prices have cut into NWE industrial and power demand, but the Iberian price cap has led to higher consumption in Iberia

Northwest Europe<sup>1</sup>

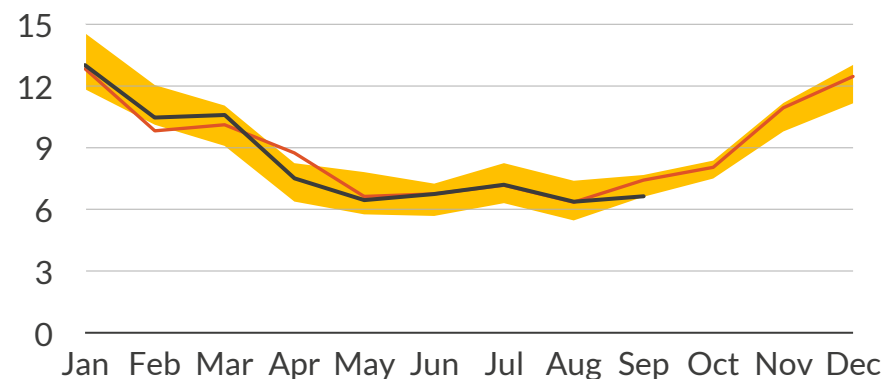
Monthly gas demand

bcm

Southern Europe<sup>2</sup>

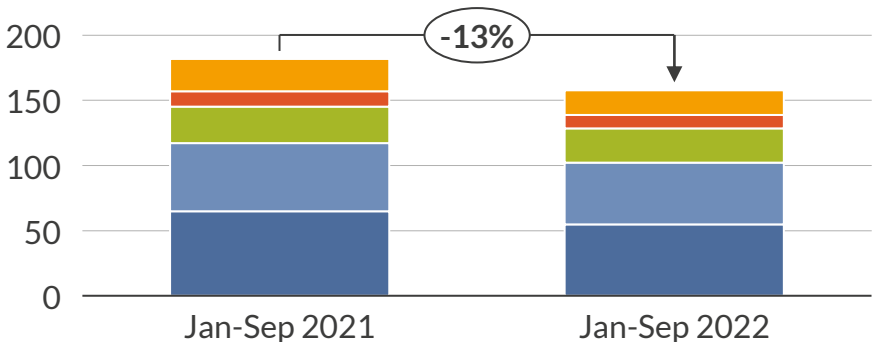
Monthly gas demand

bcm



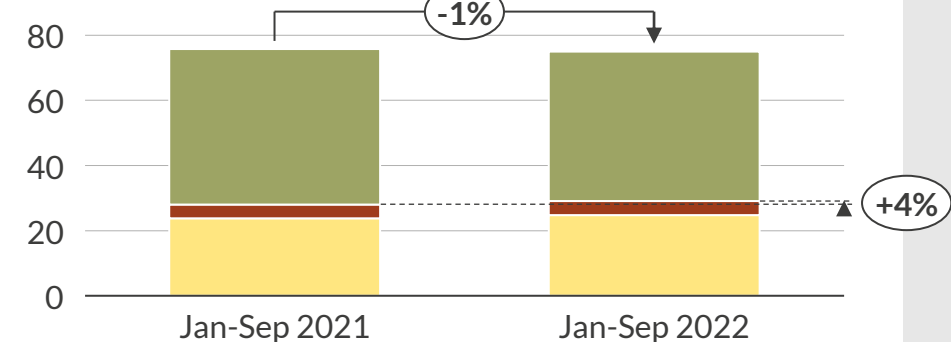
Total gas demand

bcm



Total gas demand

bcm



■ Netherlands ■ Belgium ■ France ■ Great Britain ■ Germany

■ Italy ■ Portugal ■ Spain

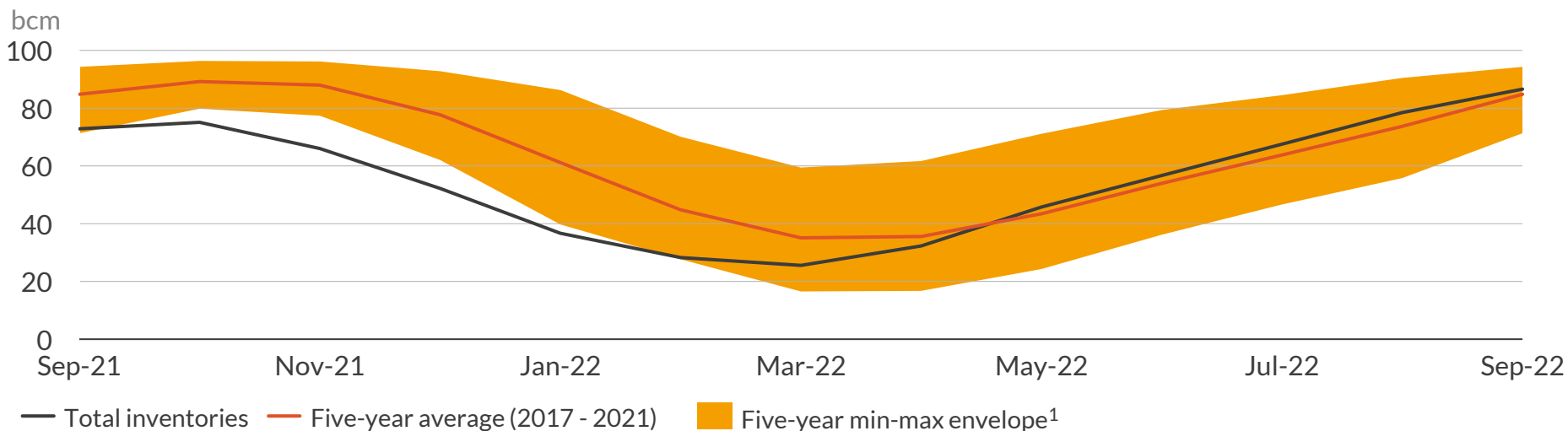
1) Belgium, France, Germany, the Netherlands and UK. 2) Spain, Italy and Portugal. 3) Envelopes are calculated by taking the maximum and minimum monthly values from Dec-15 to Feb-20 (up until the start of the global pandemic)

Sources: Aurora Energy Research, JODI-GAS, Refinitiv

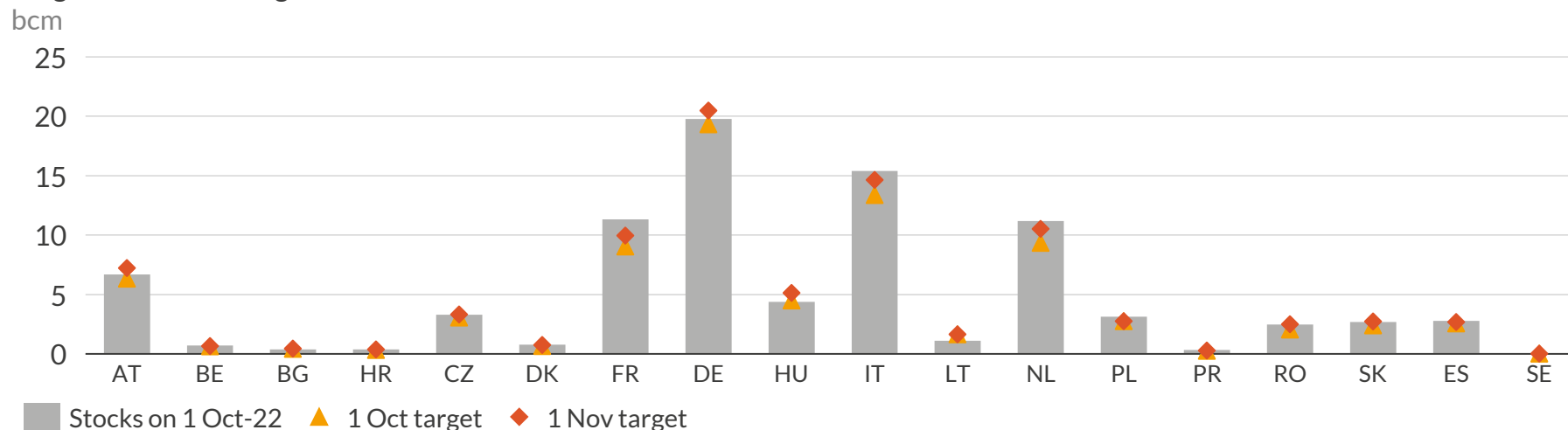
- The high gas price environment has led to industrial demand destruction and gas-to-coal fuel switching across Europe
- Cumulative gas demand in NW Europe was 24 bcm (-13%) lower in Jan-Sep 22 than in Jan-Sep 21, driven by warm weather, industrial demand destruction and gas-to-coal switching
- Germany (-10 bcm) and the Netherlands (-5.6 bcm) led the NWE demand reduction, followed by the UK (-5 bcm) and Belgium (-1.7 bcm). France had the lowest regional reduction (-1.5 bcm) due to low nuclear availability driving high power-sector gas burn
- Gas consumption in Southern Europe for the same period fell by only -0.8 bcm (-1%), as demand destruction in Italy (-1.9 bcm) was countered by higher consumption in Spain (+1 bcm) and Portugal (+0.1 bcm)

# European stocks entered winter 2022-2023 at 90% of capacity, well ahead of Oct-22 targets and above five-year average

## EU UGS inventories



## EU gas stocks and targets



1) Envelopes are calculated by taking the maximum and minimum monthly values from Jan-17 to Aug-21

- Despite European inventories entering Winter 2021-2022 at only 75% of storage capacity, low Q1 2022 consumption due to warm weather and high prices led to March stocks ending above the five-year min-max envelope
- Storage injections started as early as mid-March, compared to May of last year. Exceptionally high LNG sendout through Q2 2022 and NS1 operating at capacity until mid-June helped fill storages above the five-year average rate
- The abandonment of Gazprom's control over some European gas storages (~10% of total capacity) and the EC storage fill mandate (80% by 1 Nov-22) also helped fill storages fast
- Europe started Winter 2022-2023 at 90% of storage capacity, with many countries hitting their targets well ahead of time

## I. Year in review – European energy prices

1. Gas and electricity prices
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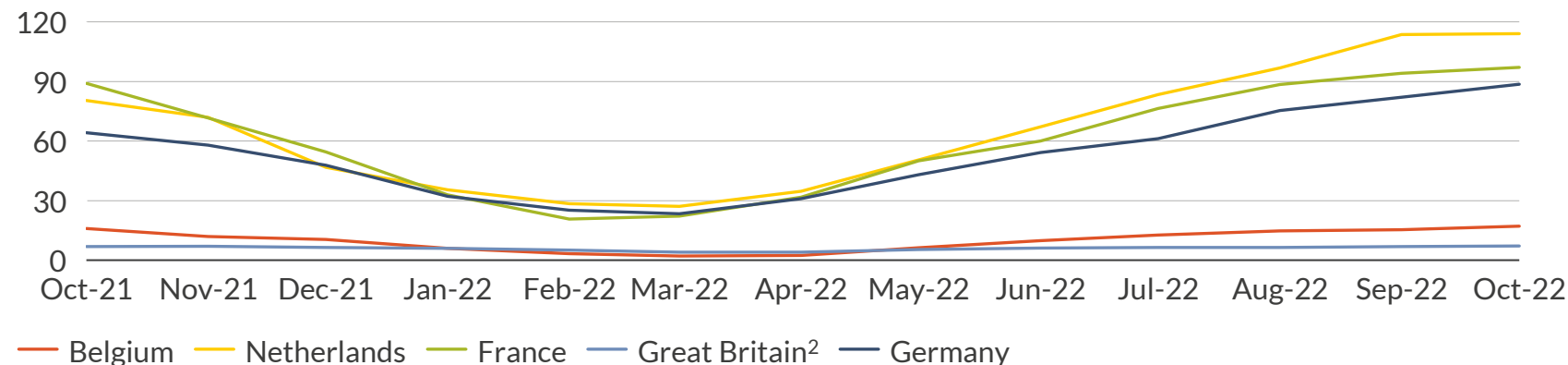
## II. Near-term price drivers in Iberia

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# While current storage levels will help mitigate the risk during the winter of 2022/2023, prices during next winter will depend on several factors

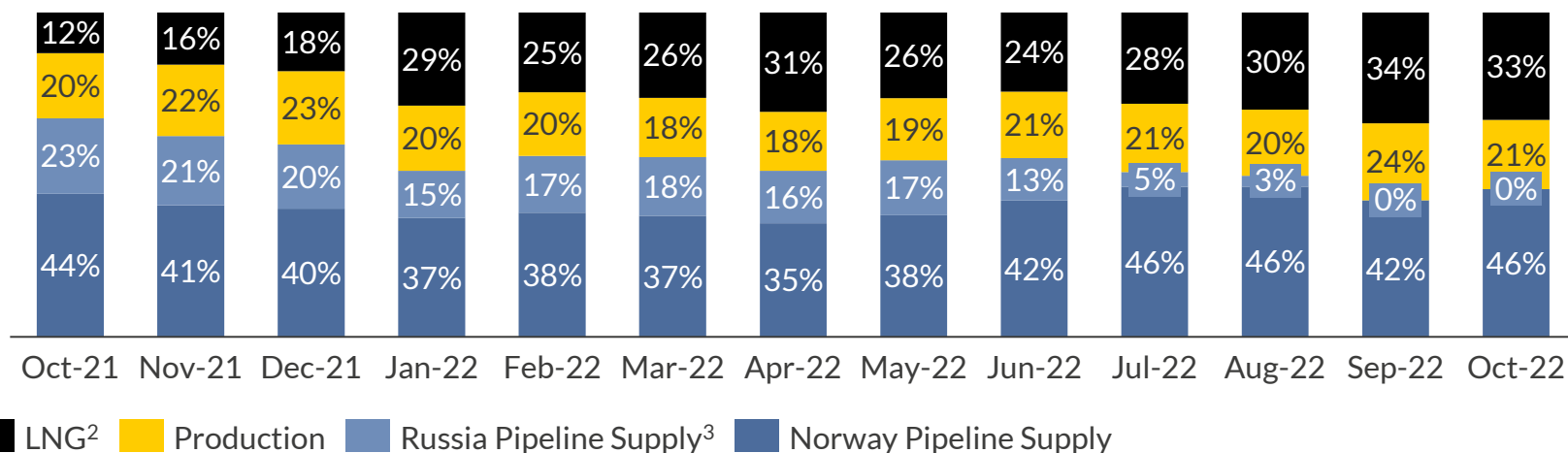
## Storage margin<sup>1</sup>

days



## Share of gas supply<sup>3</sup>

%



2023 and 2024 market prices will depend on the interaction of several drivers:

### Meteorology

- Winter temperatures
- Hydro reservoir levels

### Demand

- Global gas demand affecting LNG prices

### Regulation

- Iberian regulatory measures
- Europe-wide mechanisms

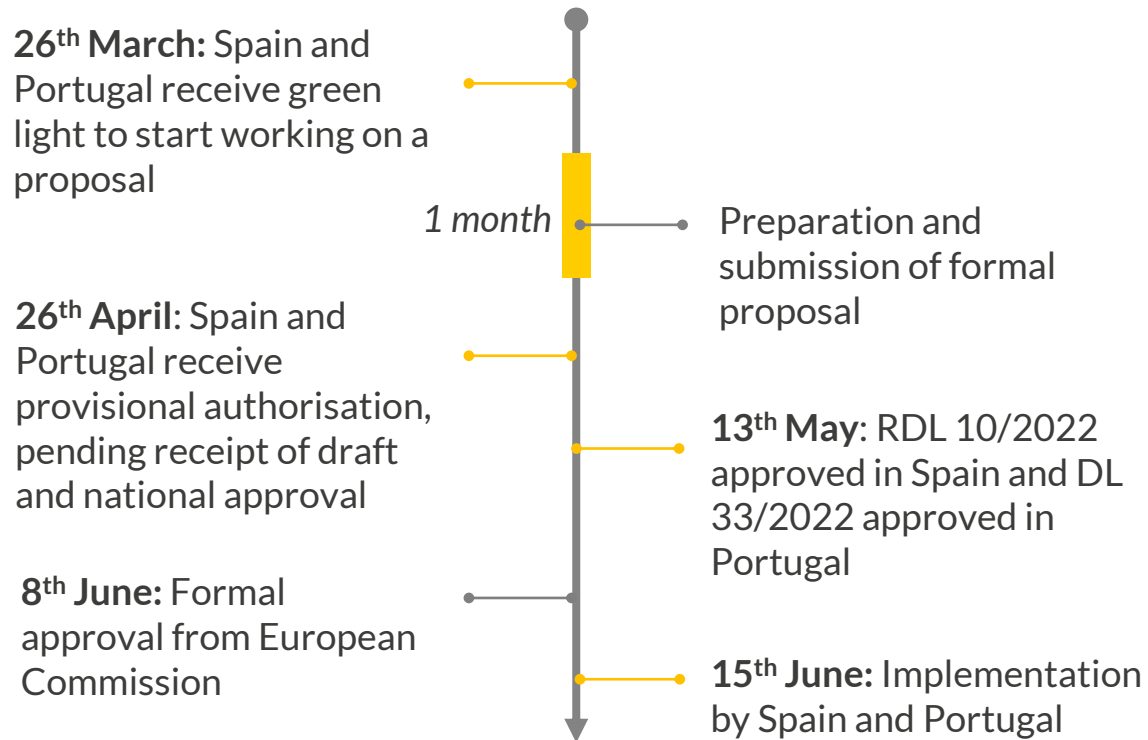
### Supply-side factors

- European gas production
- French nuclear availability
- Continued renewable growth

# 1 The Iberian market is, for now, isolated from the direct impact of wholesale gas prices thanks to the “cap on gas” or “Iberian exception”

## RDL 10/2022 (Spain) and DL 33/2022 (Portugal) Journey

The proposed cap on the gas price was implemented on the 15<sup>th</sup> June 2022 after the European Commission final approval



## Key parameters of the mechanism

The adjustment value is calculated taking into account the difference between the MIBGAS price and the reference price:

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

- $Y_i$  (€/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

### Duration

- The mechanism will be in force until 31/05/2023
- During the first six months, the capped price will be 40€/MWh, increasing by 5€/MWh per month for the remaining months

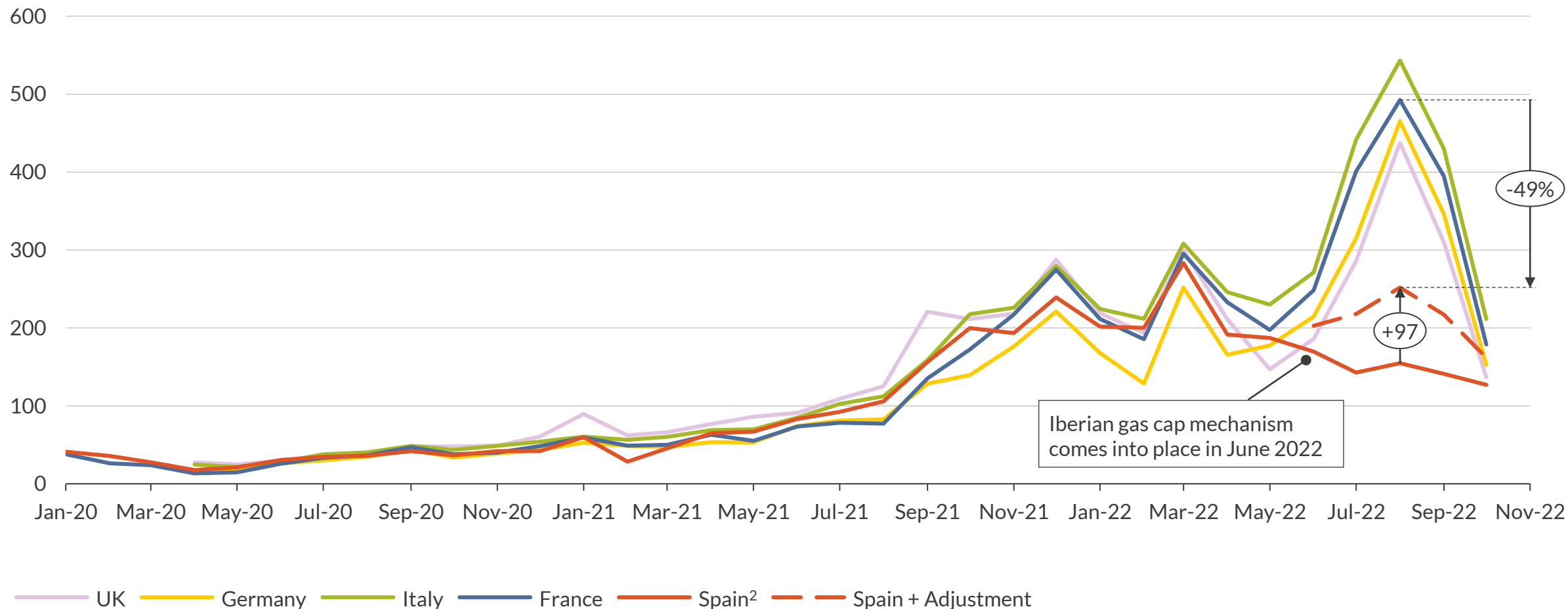
### Funding the mechanism

- The cost of the adjustment mechanism is distributed across unhedged demand bids

1) Portugal approved the same mechanism in [Decree Law 33/2022](#) on the same day. 2) Impuesto sobre el Valor de la Producción de Energía Eléctrica. 3) Projects already in the EIA process when the promulgation of the RDL will not be affected by this change. 4) Period set by RD 1183/2020. 5) Modification aims to avoid double sanction, i.e., a cancellation of permits on top of the penalties from not complying with grid auction deadlines.

# 1 At its peak, the Iberia gas price cap resulted in power prices clearing at about half of other European benchmarks

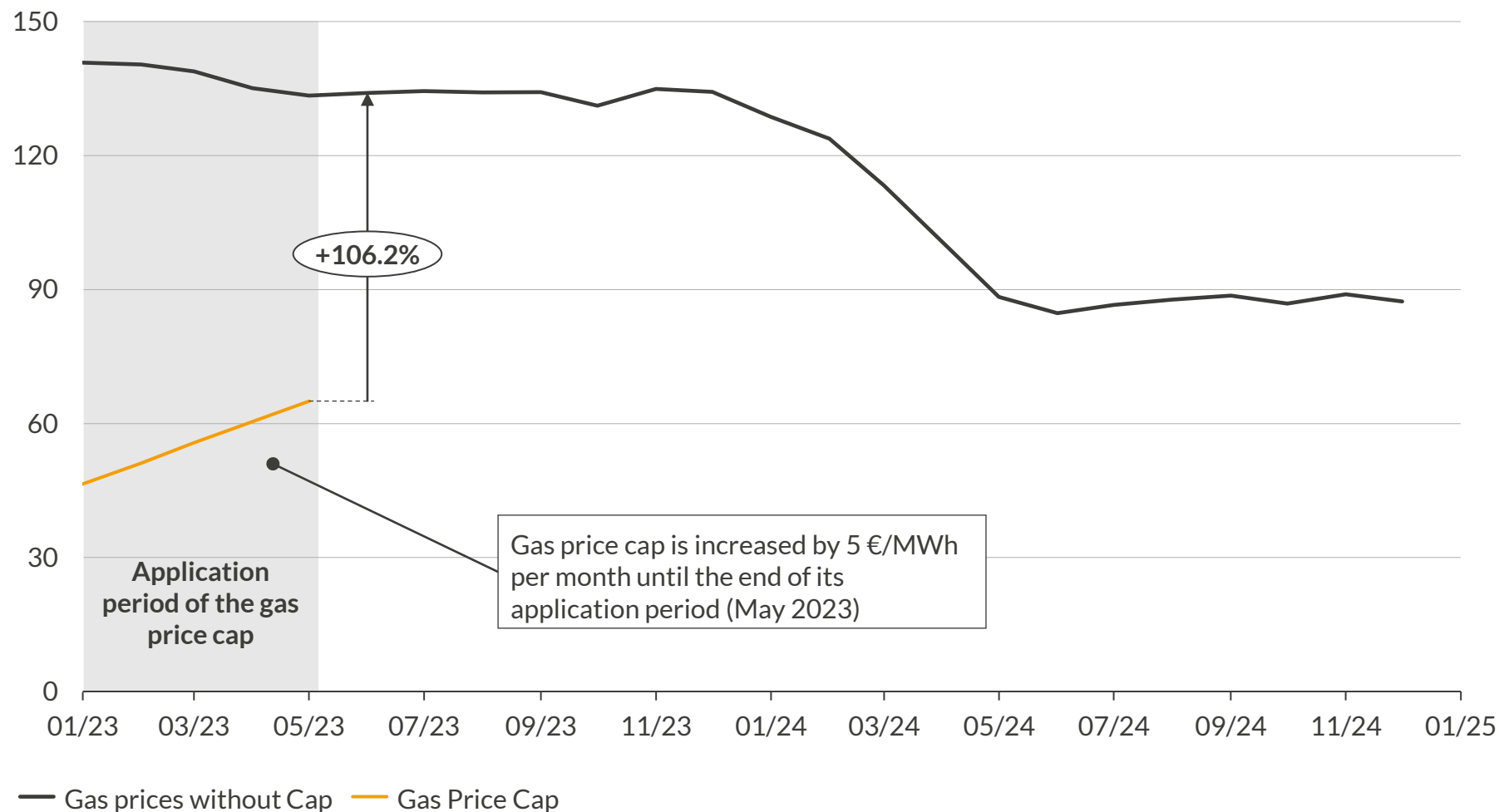
EU monthly wholesale electricity prices<sup>1</sup>  
EUR/MWh (nominal)



1) Values updated until 10<sup>th</sup> August; 2) Portuguese power prices are extremely similar to the Spanish ones and not represented on this graph.

# 1 Gas prices would increase by more than 100% if the gas price cap is phased out, and will average 88 EUR/MWh in the second half of 2024

Natural gas price 2023/2024  
EUR/MWh, real 2021



- The cap on gas prices is currently in place until the end of May-2023, leading to prices below 70 EUR/MWh
- Without the cap in place, gas prices could increase by more than 100%, with an average of 130 EUR/MWh between June-2023 and March-2024
- After the winter 2023/2024, gas prices are expected to decrease, averaging 88 EUR/MWh in the second half of the year 2024 (July to December)

## 2 So far, three of the initial five Commission proposals to address surging power and gas prices have been adopted by Member States

<div>Applicable for Spain</div> <div>Coordinated Demand Reduction</div> <div>1</div>	<p>Aims to achieve a 10% overall reduction in power demand by Mar 2023, including a mandatory 5% reduction in peak power demand. Main instruments to achieve demand reduction could include <b>demand reduction tenders</b> implemented by some member states in the gas sector.</p>	<ul style="list-style-type: none"> <li>✓ Potentially lower prices during peak hours, preserves fuel reserves for industrial sector</li> <li>✗ Significant societal coordination to implement</li> </ul>
<div>Revenue cap for inframarginal technologies</div> <div>2</div>	<p>Implementation of a revenue cap for inframarginal technologies (i.e., non-price setting technologies) until June 2023; <b>mandatory</b> for all member states. Cap would apply to electricity market revenues for all<sup>2</sup> inframarginal generators but is optional for balancing markets.</p>	<ul style="list-style-type: none"> <li>✓ Does not affect price formation in wholesale markets, so bidding behaviour is preserved</li> <li>✗ Introduces regulatory risk into PPA and futures transactions, potentially reducing volumes<sup>1</sup></li> </ul>
<div>Applicable for Spain</div> <div>Fossil fuel solidarity contributions</div> <div>3</div>	<p><b>Mandatory</b> temporary tax on the profits of fossil fuel companies, from FY 2022 and/or 2023, above a 20% average increase of profits generated from the four fiscal years after 1 Jan 2018, will contribute towards a solidarity payment that should go towards supporting vulnerable households and hard hit businesses.</p>	<ul style="list-style-type: none"> <li>✓ Directly benefits households and funds can be used to develop domestic renewables sources</li> <li>✗ May discourage investment into securing domestic supplies of natural gas</li> </ul>
<div>Energy utilities support measures</div> <div>4</div>	<p>Volatility in energy prices has caused energy utilities to have large quantities of capital tied up in the form of collateral, increasing their risk of insolvency. Sweden, Finland, Denmark, and other countries have reactively put in place collateral loans and guarantees worth over EUR 46 billion but there has not been a unified recommendation from EU energy ministers yet.</p>	<ul style="list-style-type: none"> <li>✓ Maintains liquidity of derivatives and futures markets</li> <li>✓ Governments are the last line of support</li> </ul>
<div>Price cap on Russian/all gas imports</div> <div>5</div>	<p>Aims to reduce the cost of high wholesale gas market prices for European consumers as well as Russian gas export revenues that might be used to finance the war in Ukraine, without compromising gas supply.</p>	<ul style="list-style-type: none"> <li>✓ Lower short term household and industry bills</li> <li>✗ Limits market price signals which discourages LNG flows into Europe and does not incentivise gas demand reduction</li> </ul>

Confirmed in 30 September 2022 energy minister meeting

Remains under consideration

1) PPA backed assets may be subject to the cap if associated payments exceed national price cap (which is unlikely for most older contracts). 2) Exceptions are plants that have higher marginal costs than the revenue cap, plants that use technologies that substitute gas (bio-methane), demonstration plants, and plants' revenues that have already been capped by CfDs or FiTs

Sources: Aurora Energy Research, European Commission, Valtioneuvosto, Reuters

## 2 The EC has proposed a “safety price ceiling” on the month-ahead TTF derivatives

The TTF emerged in the past years as the reference benchmark trusted by the market

- The European Commission proposed on 22<sup>nd</sup> November 2022 a gas price cap on the Dutch exchange that serves as Europe’s gas price benchmark
- The proposed instrument consists of what has been called a “safety price ceiling” of **275 €/MWh** and would be **triggered automatically** when both of the following conditions are met:
  1. The front-month TTF derivate settlement price exceeds 275€/MWh for two weeks;
  2. TTF prices are 58€/MWh higher than the LNG reference price (still to be determined) for 10 consecutive trading days within the two weeks
- If the mechanism is triggered, the Agency for the Cooperation of Energy Regulators (ACER) will immediately publish a market correction notice
- If approved by EU countries, this cap mechanism would be in place **for one year from January 1st**

The mechanism targets TTF month-ahead products to avoid affecting short-term market liquidity and security of supply

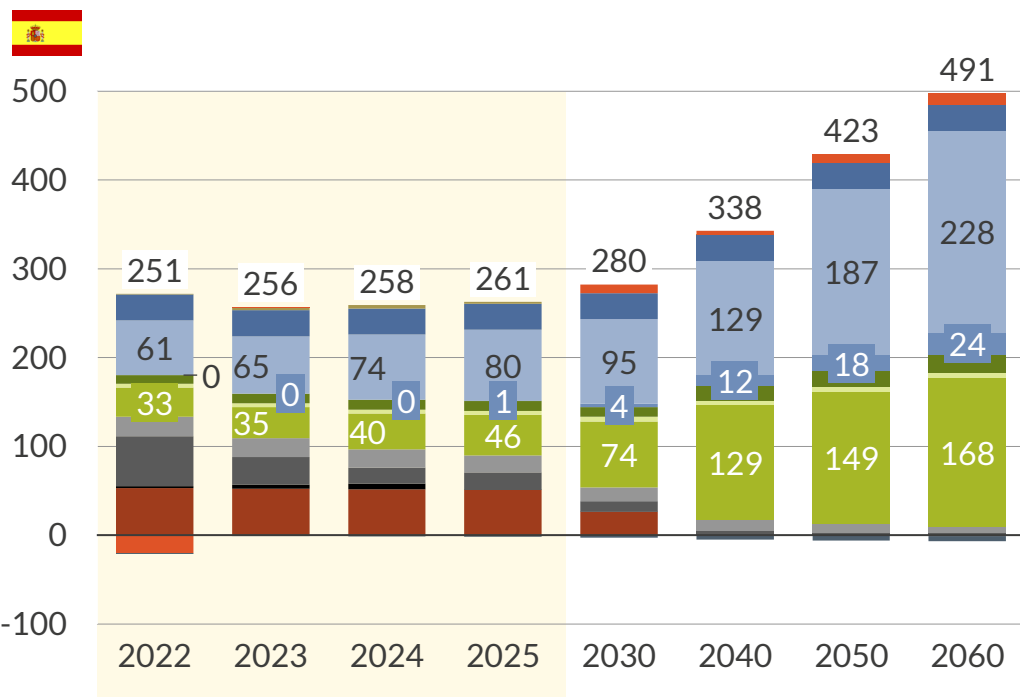
Due to its liquidity and transaction volume, TTF serves as an index for other hubs. An intervention in TTF is expected to affect transaction prices across the EU

- There will be constant monitoring of the mechanism by ESMA, ECB, ENTSO-E and ACER
- The mechanism can be suspended immediately at any time:
  - Automatically, with a deactivation, when its operation is no longer justified by the situation on the natural gas market;
  - By a Commission suspension decision when risks to the Union's security of supply, to demand reduction efforts, to intra-EU flows of gas, or financial stability are identified
- Even if no de-activation conditions are triggered, the mechanism will be suspended after one year

*Energy ministers from the EU will debate the measure on November 24<sup>th</sup>*

### 3 As new renewable projects come online, an increasing share of generation will come from generation sources not exposed to fuel prices

Generation mix  
TWh

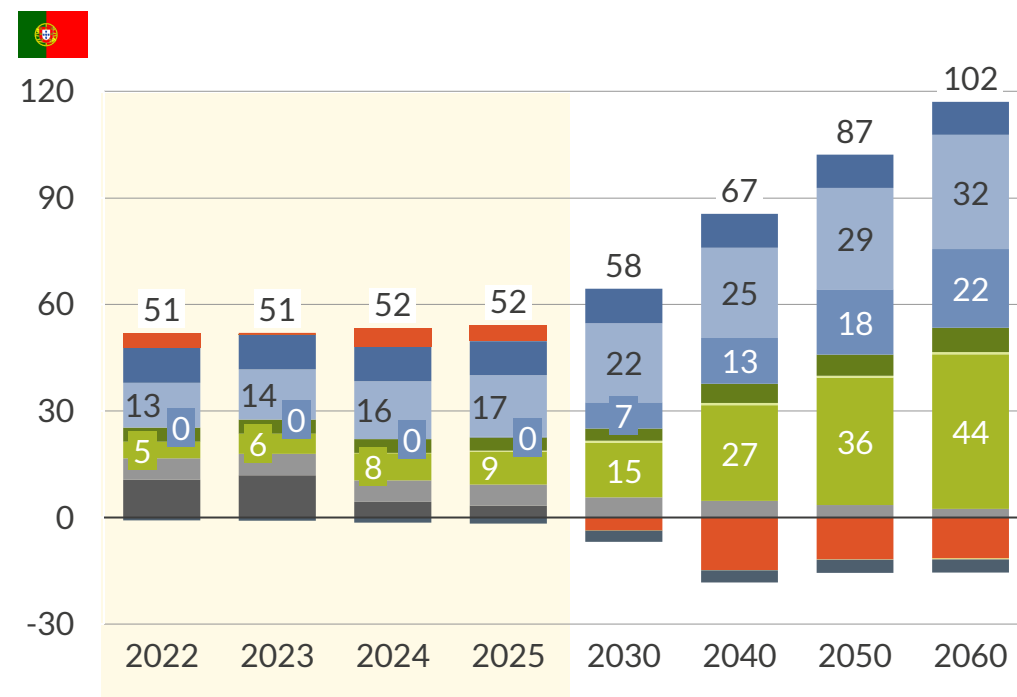


Share of renewables in the generation mix

51%

65%

98%



65%

81%

98%

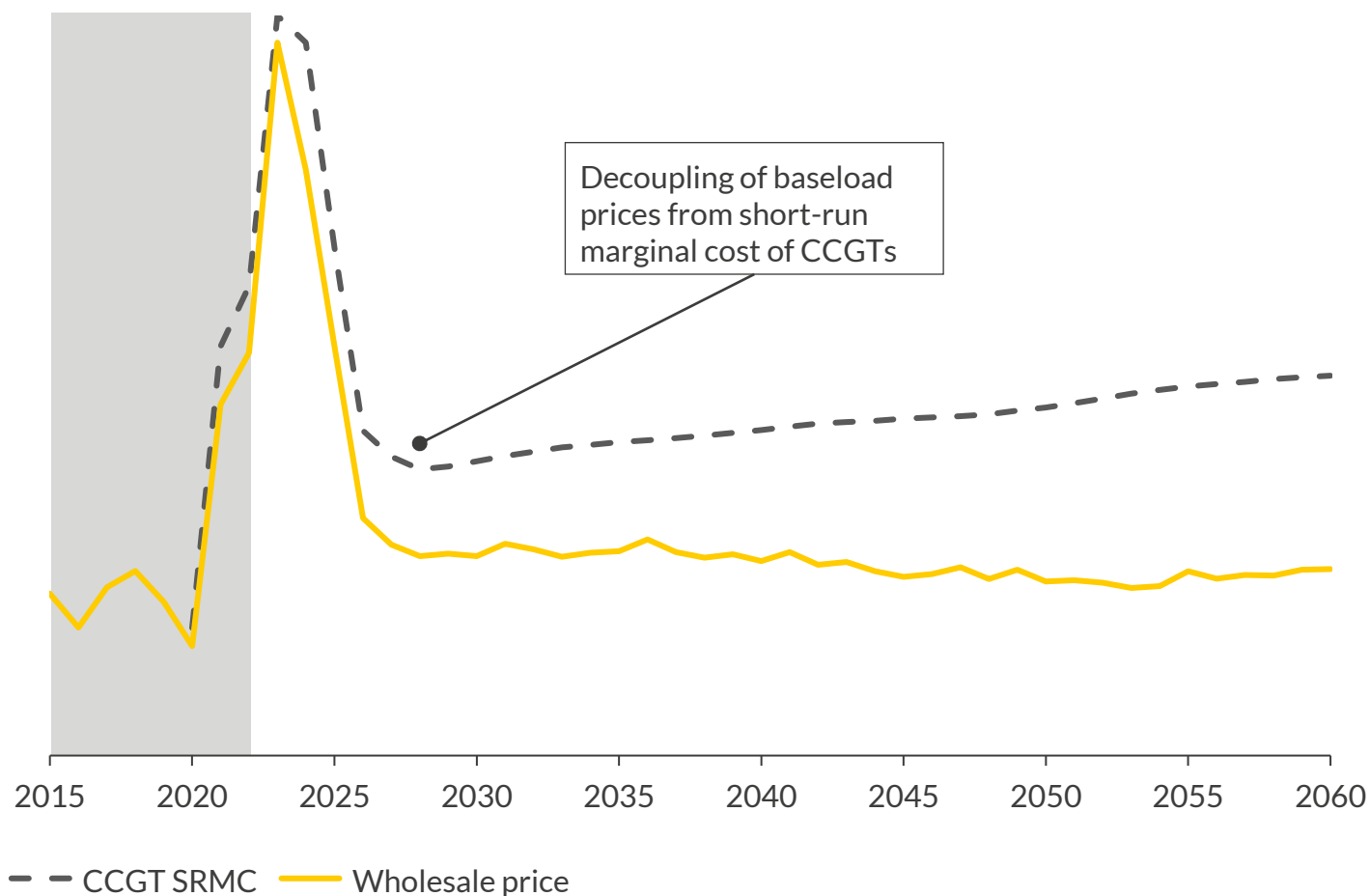
■ Interconnectors<sup>1</sup>
■ Battery storage
 ■ Pumped storage
 ■ Onshore wind
 ■ Other RES<sup>3</sup>
■ Solar PV<sup>4</sup>
■ Gas CCGT
 ■ Nuclear
 ■ DSR
 ■ Peaking<sup>2</sup>
■ Hydro
 ■ Offshore wind
 ■ Solar CSP
 ■ Other thermal<sup>5</sup>
■ Coal

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) Includes solar rooftop PV, solar ground-mounted PV. 5) Other thermal includes fossil fueled cogeneration.

Sources: Aurora Energy Research

### 3 The impact of commodity prices on wholesale power prices will be counterbalanced by renewable deployment

Baseload prices<sup>1</sup> vs Short Run Marginal Cost (SRMC) of CCGTs<sup>2</sup>  
EUR/MWh, real 2021



We expect prices to decline in the next 5 years as gas prices decrease; over the long term, renewables help offset increasing commodity prices

#### 2022 - 2030

- Baseload prices decline in the early 2020s, due to decreasing gas prices in the short term
- Despite increasing gas and CO<sub>2</sub> prices after 2025, the baseload price continue to decrease as renewable generation grows

#### 2030 - 2040

- Despite continually increasing commodities and demand, the baseload price remains stable in the 2030s, due to continued growth in renewables

#### 2040 - 2060

- The baseload price falls in the 2040s, as the high penetration of renewables more than offsets the upward pressure from higher commodity prices and electricity demand

1) Prices are inclusive of the generation tax, which we assume to continue throughout the forecast horizon. 2) Calculation based on CCGT efficiency of 49.13% and carbon intensity of 0.18 ton CO<sub>2</sub>/MWhTh. VOM is estimated to be 3 €/MWh.

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