



Current market disruption and consequences for renewables

Kim Keats-Martínez

+34 606 235 149

kkeats@ekonsc.com

kim.keats@k4kadvisory.com

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- Broad range of services to financiers, utilities, IPPs and governmental agencies.
- Team background in energy consulting, strategic advisory and project development.
- Expert witness testimony in arbitration hearings of renewable arbitrations and commercial arbitrations between gas buyers and sellers.
- Regulatory and market due diligence reports that are relied upon by lenders.
- Supported successful completion of 70GW with a transaction value of US\$43 billion.

Sample Service Range



Pandemic and War: Implications for Market



- Implications
- Impacts on price forecast
- Review of 2022
- Iberian "exception"
- Markets at work
- Final thoughts

IMPLICATIONS FOR ELECTRICITY MARKET



- Things to focus on:
 1. Track the fundamentals
 2. Model to understand what's going on
 3. Don't forget political reactions
 - Supply and demand drivers:
 - Pandemic => forced savings + supply chain disruptions.
 - War in Ukraine => increases fuel costs by disrupting oil and gas supplies from Russia to Western Europe.
 - Traders get nervous and prices rise. Knock on effects in other geographical markets like Asia (JKM) and USA (HH, WTI).
 - Increases in supply costs affecting equipment costs (and delivery timelines).
 - Inflation rising.
 - Political reactions to higher prices:
 - Monetary policy will tighten to combat inflation=> interest rates rise increasing financing costs.
 - Politicians playing to the domestic audience interfere in the market, e.g. Iberian "exception" (cap on gas), windfall profit tax, extraordinary corporate tax.
- All this leads to price uncertainty (volatility) in short term,
AND higher LCOE of renewables which affects longer term target.

Pandemic and War: Implications for Market

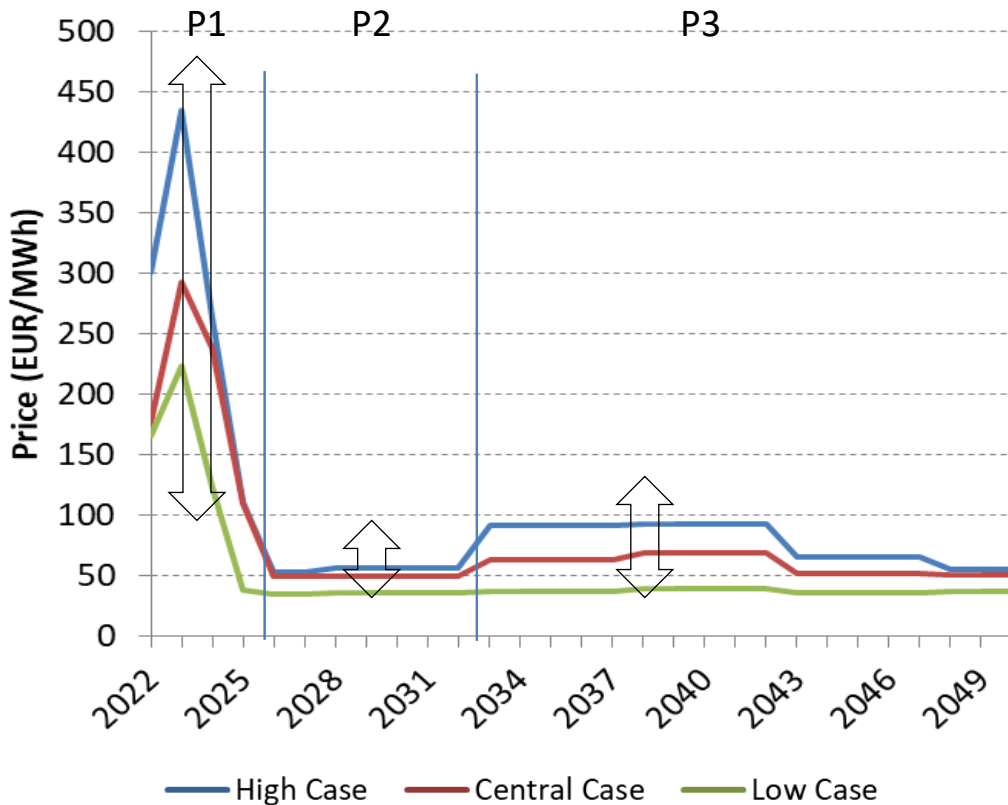


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MARKET PRICE FORECASTS



Baseload price forecasts



1. P1: Prices first move in line with commodity prices and adjust to new additions
 - Driven by gas and CO2 costs, and government's reaction.
2. P2: Prices then plateau.
 - Driven by LCOE, grid access and deployment rates of renewables.
3. P3: As a lot of thermal capacity retires in the 2030s, a step-up in prices is expected in the Central and High Cases. But even in these cases, renewable capacity eventually catches up and prices drop.
 - Driven by LCOE, grid access, deployment rates of renewables and flexibility of the system.

Source: EKON 2022Q3. Prices real 2022 €.

OVERVIEW OF SENSITIVITIES

	Low Case (Low1_20220820)	Central Case (Ref1_20220820)	High Case (High1_20220820)
Fuel prices	Gas price cap 2022Q3-2023Q2, MIBGAS/TTF until 2025, CME futures	Gas price cap 2022Q3-2023Q2, MIBGAS/TTF until 2025, CME futures	No Gas price cap, MIBGAS/TTF until 2025, CME futures
CO2 (EUA prices)	ICE futures	ICE futures	ICE futures
Domestic coal surcharge	None	None	Applied
IED coal output cap	None	None	Annual output caps applied
Generation Tax (7%)	None	None	None
Demand growth	NECP Target	NECP BAU	NECP BAU
Green Cent Tax	None	Applied to Coal	Applied to Coal
Annual hours for New PV	2050	1737 (historical)	1737 (historical)
Annual hours for New Wind	3000	2500	2169 (historical)
TIC of New Wind , PV and Battery (€/kW)	-20%	1000/750/975	1000/750/975
Annual cap on economic New Wind and PV	2/3GW in 2022-23, 3/4GW from 2024, uncapped from 2031	2.0/1.5GW from 2022	2.0/1.5GW from 2022

Most important

- NECP growth rates. Brent, coal and CO2 prices based on CME and ICE futures. Gas indexed to oil from 2026 but linked to MIBGAS in 2022-2024 and TTF futures in 2025. RDL 10/2022 gas-indexed subsidy to fossil fuel-fired plants applied in 2022Q3-2023Q2 in CC and LC.
- HC applies coal transportation surcharge for domestic coal and a more restrictive view of Industrial Emissions Directive (“IED”).
- Generation tax removed due to over-recovery in 2020-2021 and national fund (FNSSE).
- “Firm” additions in 2022 of 1.5GW New PV in CC and HC. Apply annual caps on the deployment of other “economic” New Wind and PV until 2030 in the Low Case but forever in other cases. No cap on New Battery.

Note: Prices real 2022 €.

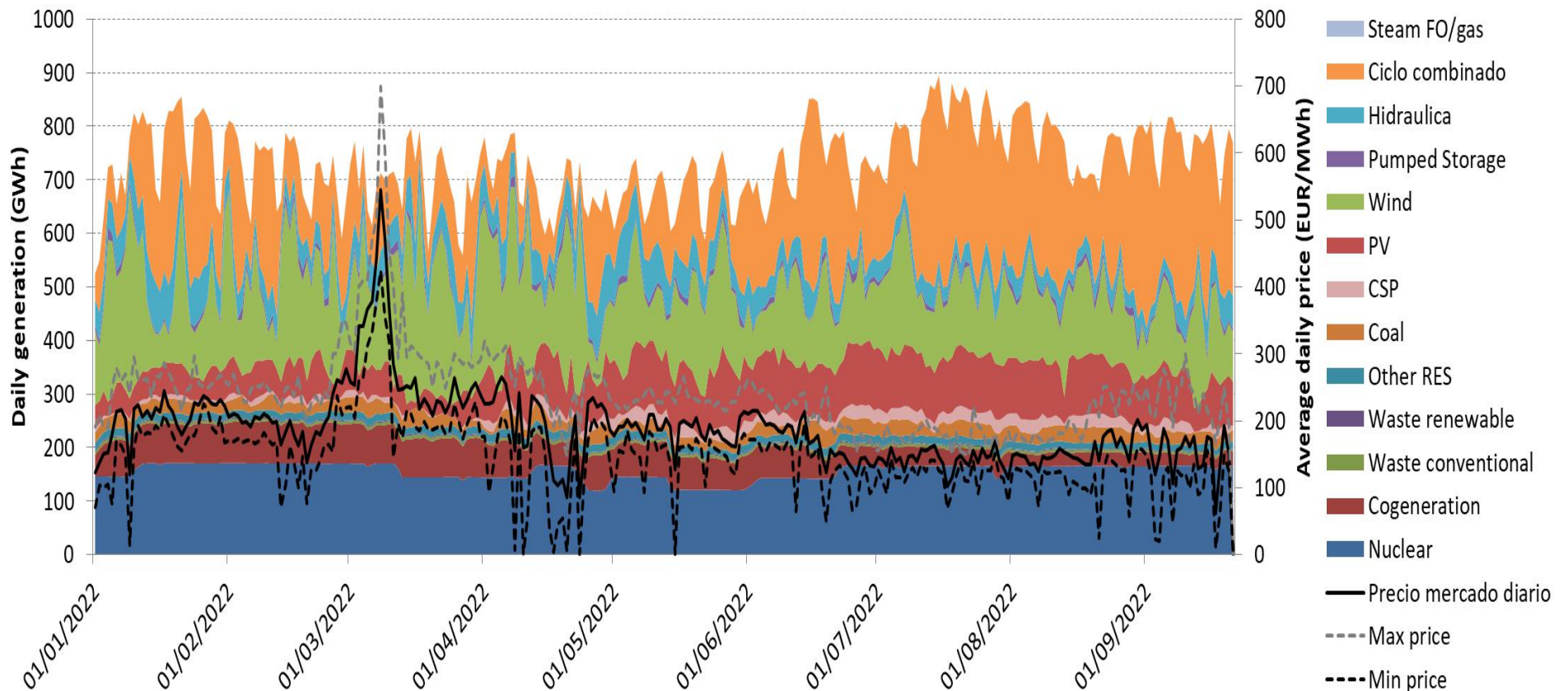
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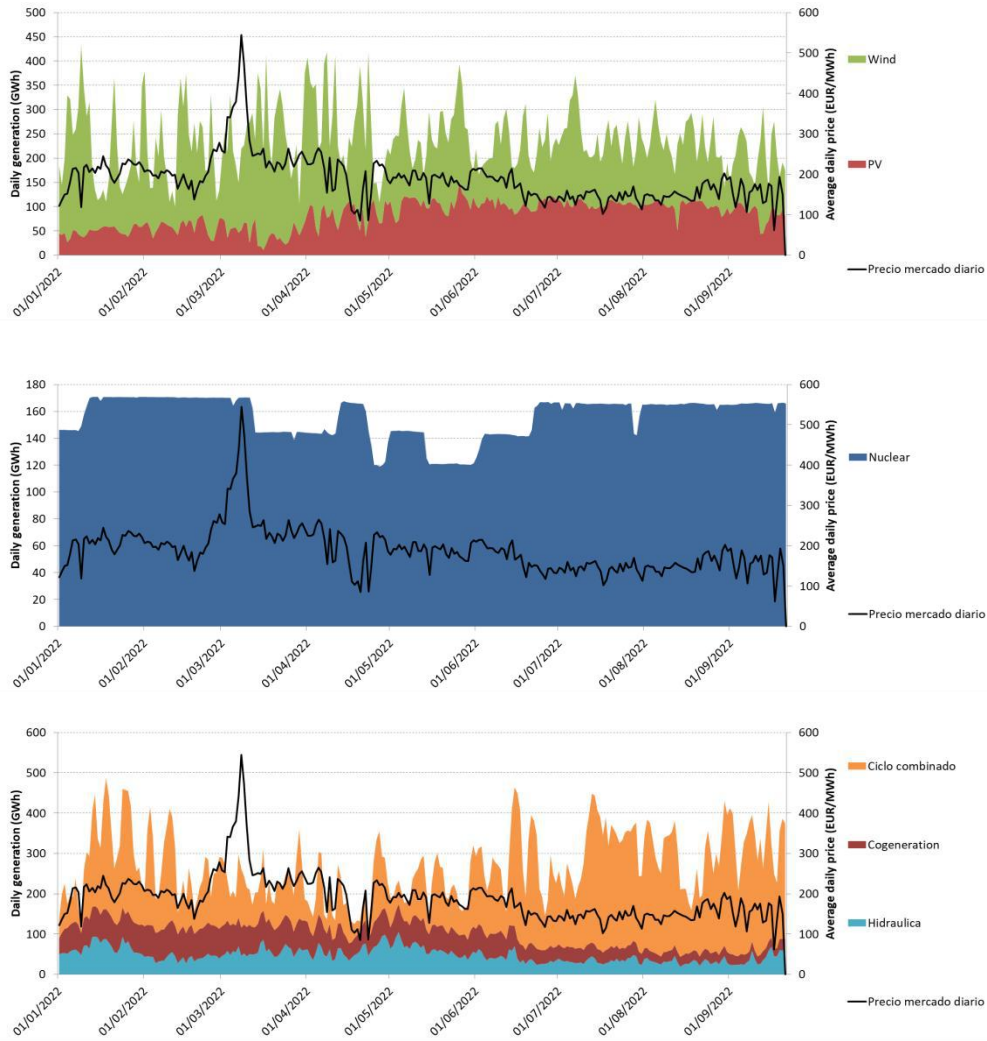
EVOLUTION OF GENERATION AND PRICES (1)

- Daily dispatch by technology and average daily spot prices for Spain in 2022. If you look carefully one can see how the market works...
- Note the large amount of wind and continuing balancing role of gas-fired CCGT.

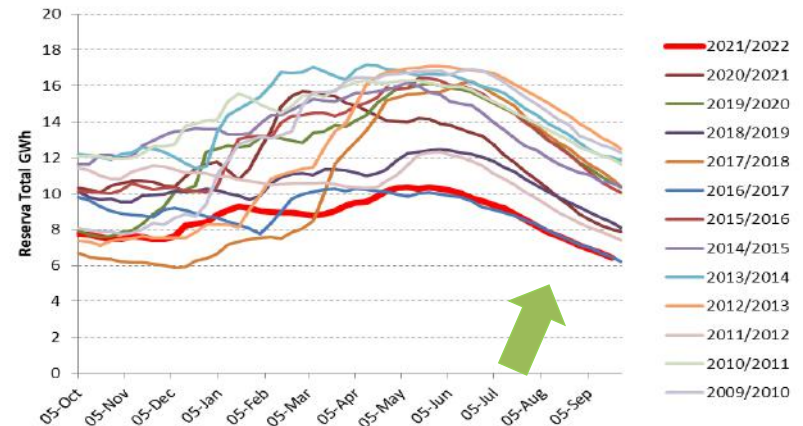


Source: REE and ENTSO-E.

EVOLUTION OF GENERATION AND PRICES (2)

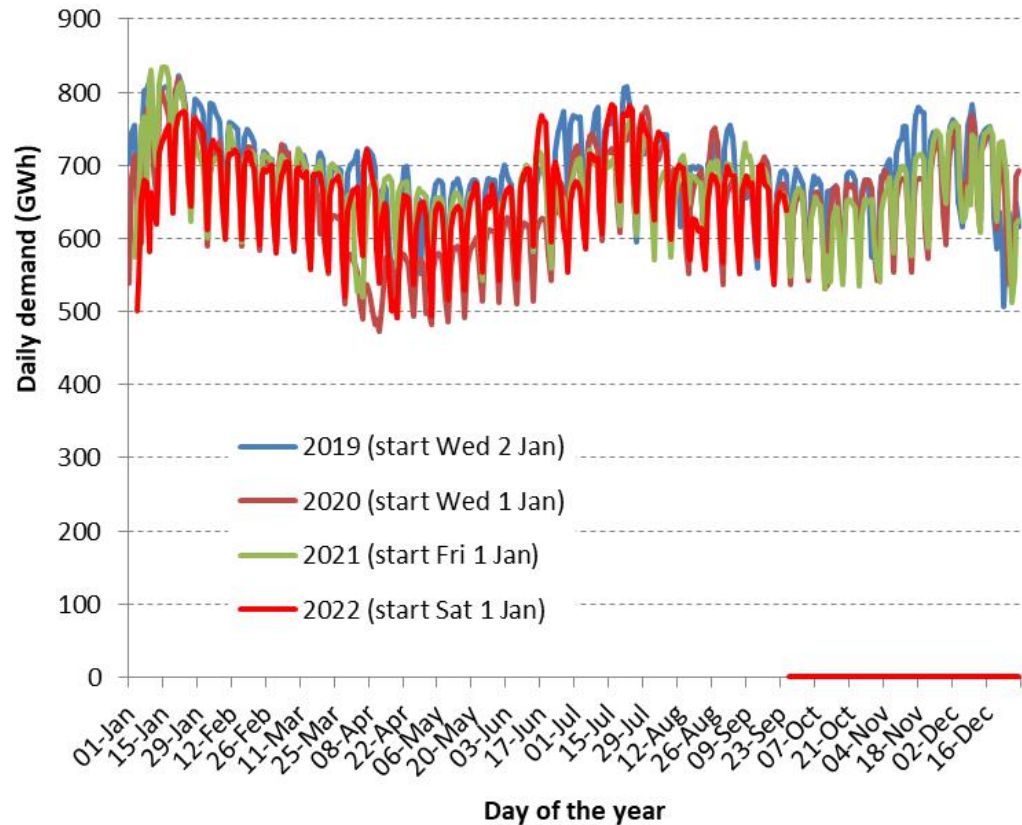


- Renewables clearly inversely proportional to prices. No panacea unless we see greater deployment.
- Nuclear baseload subject to refuelling cycles.
- Daily price spikes not necessarily linked to spikes in dispatch of CCGT. Just need CCGT to be marginal and prices will be set by marginal cost of CCGT. Flexible hydros (and cogens) shadow price CCGTs' marginal cost.
- Note that hydro output in 2022 SUPER LOW! Don't use today as a marker for future.



Source: REE, MITECO, and ENTSO-E.

EVOLUTION OF DEMAND (MAINLAND SPAIN)



- During the COVID-related lockdowns of 2020 demand dropped so that annual demand was 5% below that in 2019.
- 2021 saw demand grow by 2.45% but this still left us with demand still 2.7% below 2019 levels.
- Year to the end of 25 September, demand in 2022 has been 2.0% below that over the same period in 2021, and 4.6% below that in 2019.

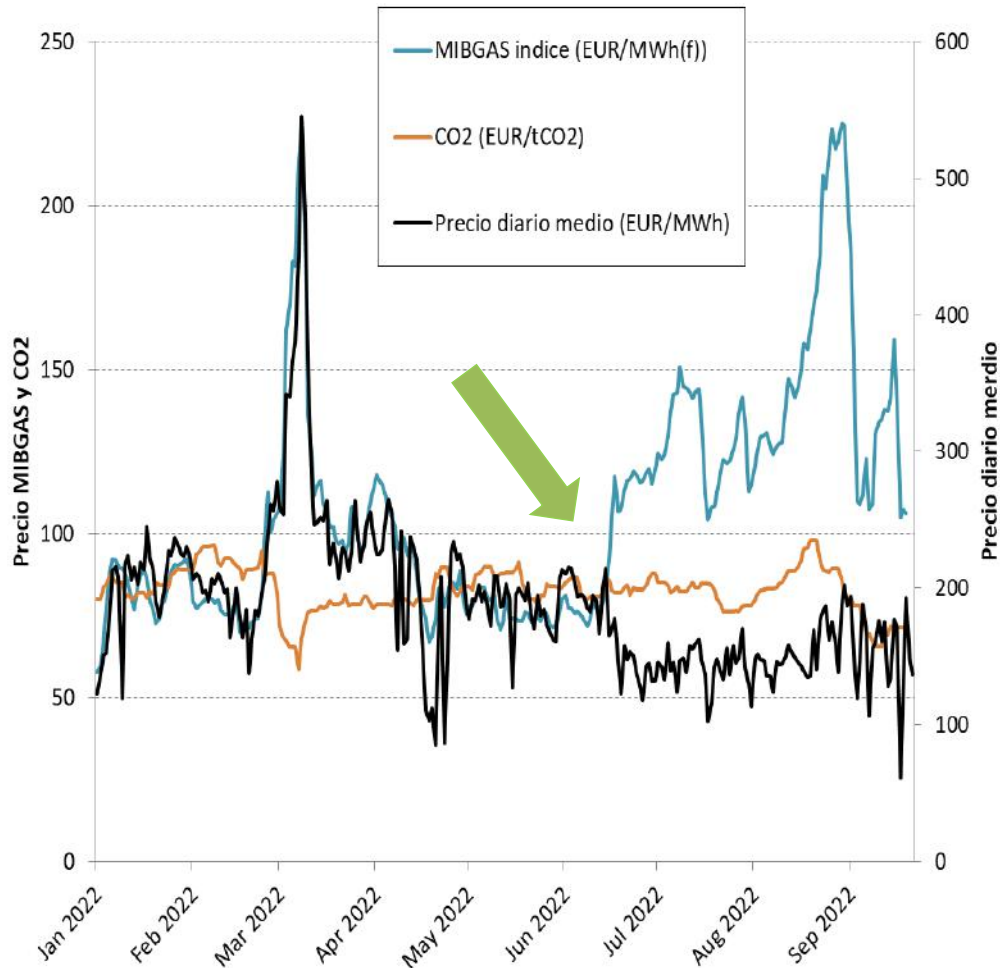
Source: REE.

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EVOLUTION OF MARGINAL COST OF CCGT



- The strong relationship between gas and CO2 prices with electricity prices is irrefutable. (Rule of thumb: with CO2 prices ~80€/tCO2, multiply gas price by 2.4 to get electricity price; or use gas price x 2 and add 0.4 x CO2 price.)
- What is interesting is the recent relative breakdown in the relationship since mid June. Why? RDL10/2022 in Spain (and DL33/2022 in Portugal) which introduced the gas price cap, actually a subsidy to the eligible merchant thermal plants:

$$\text{Green Arrow} \rightarrow Y_i = \frac{(P_{GN} - P_{RGN})}{0.55}$$

Y_i : Subsidy (€/MWh(e))

P_{GN} : Day-ahead MIBGAS price (€/MWh(f))

P_{RGN} : Reference Gas Price to start at 40€/MWh(f) during the first six months and increase by 5€/MWh(f) per month until it reaches a maximum of 70€/MWh(f).

Must end 31 May 2023 but futures say otherwise!

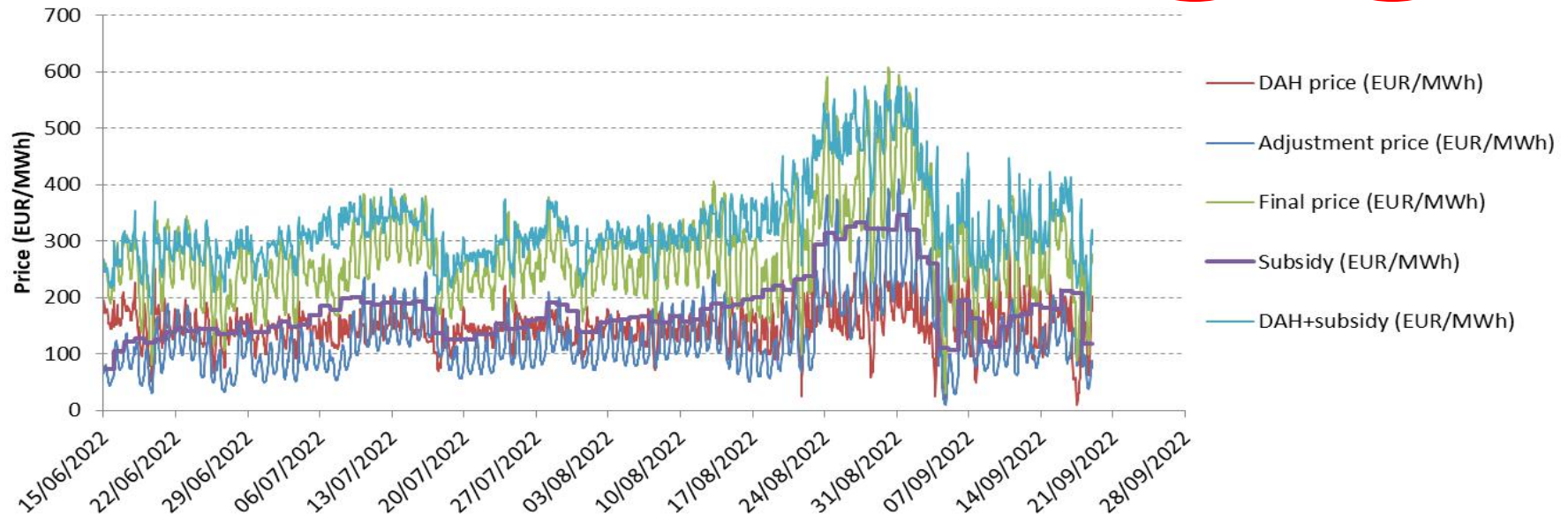
Source: ENTSO-E, MIBGAS, SendeCo.

WHAT ARE VULNERABLE CONSUMERS PAYING?



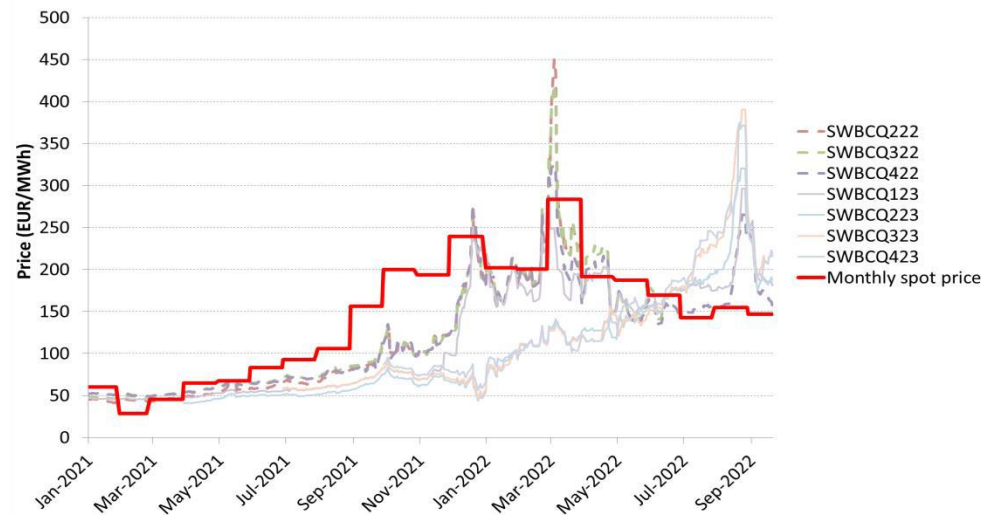
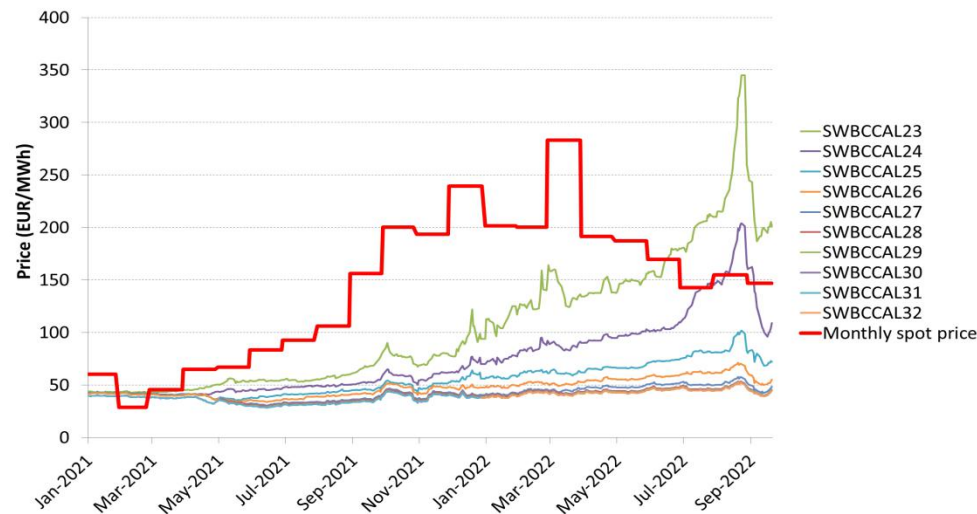
- Those who's energy component of their tariffs is indexed to the pool price will meet the cost of the subsidy to eligible thermal plants. Chart and table cover hourly results for 15 June to 18 Sep 2022. As more consumers renew contracts they will help pay this surcharge and "precio de ajuste" will drop.

DAH price (EUR/MWh)	Precio de ajuste (EUR/MWh)	Precio final (EUR/MWh)	Subsidy (EUR/MWh)	DAH+subsidy (EUR/MWh)	% change to DAH+subsidy	
a	b	c=a+b	d	e=a+d	$=c/e-1$	$=a/e-1$
148.55	126.27	274.82	180.11	328.66	-16.38%	-54.80%



Source: ENTSO-E, MIBGAS, OMIE, EKON calcs.

FORWARD MARKETS ALREADY REFLECT CHANGES



- Futures markets reacting rationally to fundamentals and regulatory changes.
- As Spanish day-ahead prices have risen so too have front-end of the calendar contracts but the tail has moved upwards only a little suggesting market still believes renewables will increase and dominate in the medium to long term.
- But 2023Q3 and 2023Q4 suggest market thinks the Iberian Exception will be extended!
- Ongoing uncertainty is reducing deal flow... Are market participants driven by **fear of making a mistake** (selling “too low”, paying “too much”) especially since risk of regulatory intervention remains high.

Source: BME Clearing, ENTSO-E, and EKON calcs.

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- If you want to take a view on how macro events affect realised prices for PV or wind, think about these:

- Demand growth

- Fuel prices

- EUA prices

← Short-term impact

- Taxes (~~Generation Tax~~, Green Cent Tax, windfall profits)

- Lifetime limit for existing plants (cogeneration and renewables included)

- Hydrology

- Operational hours for New Wind and PV

- Capex, leverage and cost of capital of New Wind and PV

- Rate of deployment of New Wind and PV (including rooftop)

← Longer-term impact

- Measures to meet PNIEC targets (including auctions) and other government interventions to protect vulnerable consumers