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Making the most of the Wholesale Power Market

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SOLAR MARKET PARITY SPAIN

EKON strategy consulting

Members of UNEF (Spanish Solar PV Association)

UNEF Unión Española Fotovoltaica

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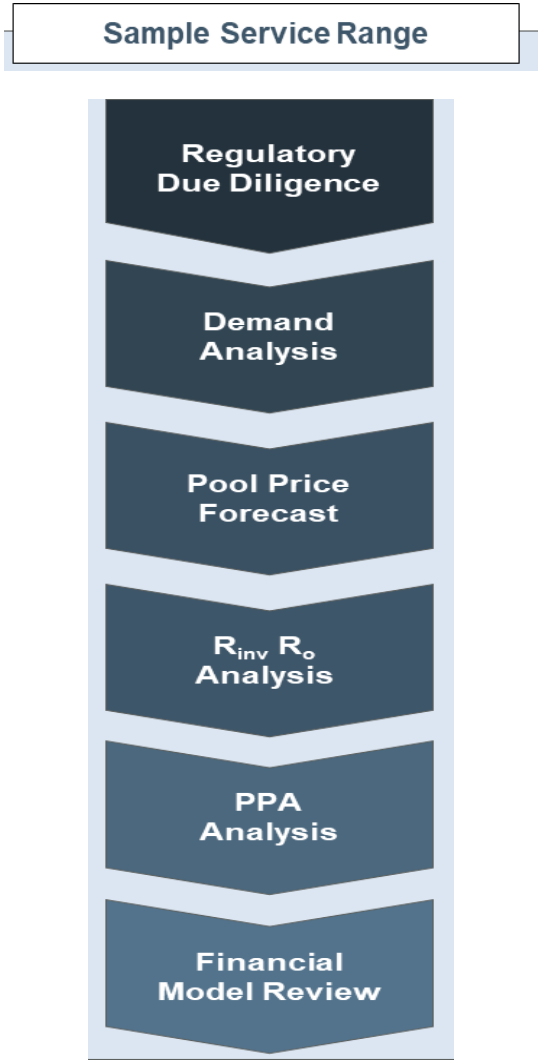
EKON'S SERVICE RANGE IN THE ENERGY SECTOR

- 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 62GW with a transaction value of US$42 billion.



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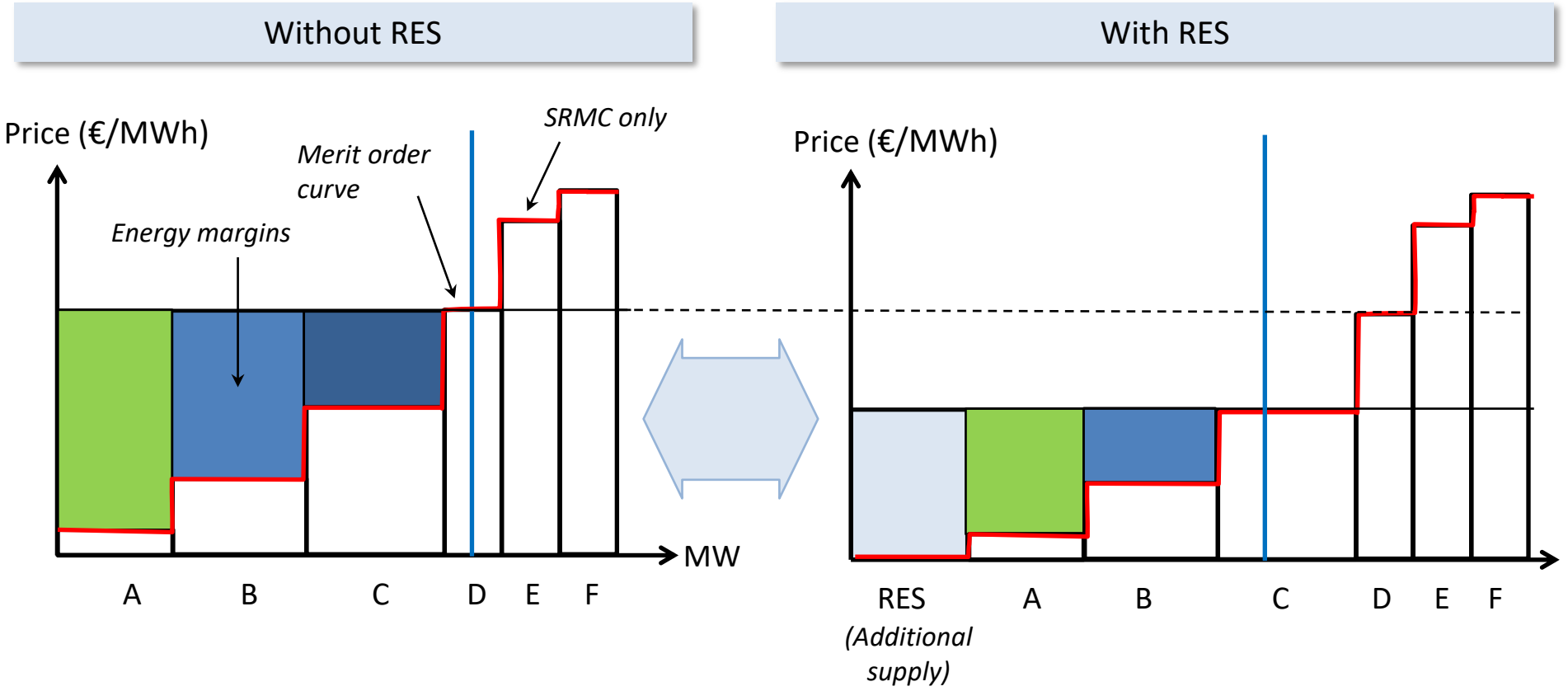
- Context
- Spot market
- Ancillary services
- Futures and PPA markets
- View on future prices
- Final thoughts

IMPACT OF RENEWABLES IN WHOLESALE POWER MARKET

- Market participants make an assessment of profits from the energy market. Renewables energy sources ("RES") are price takers but will still affect market outcomes thereby reducing their remuneration the more they produce.

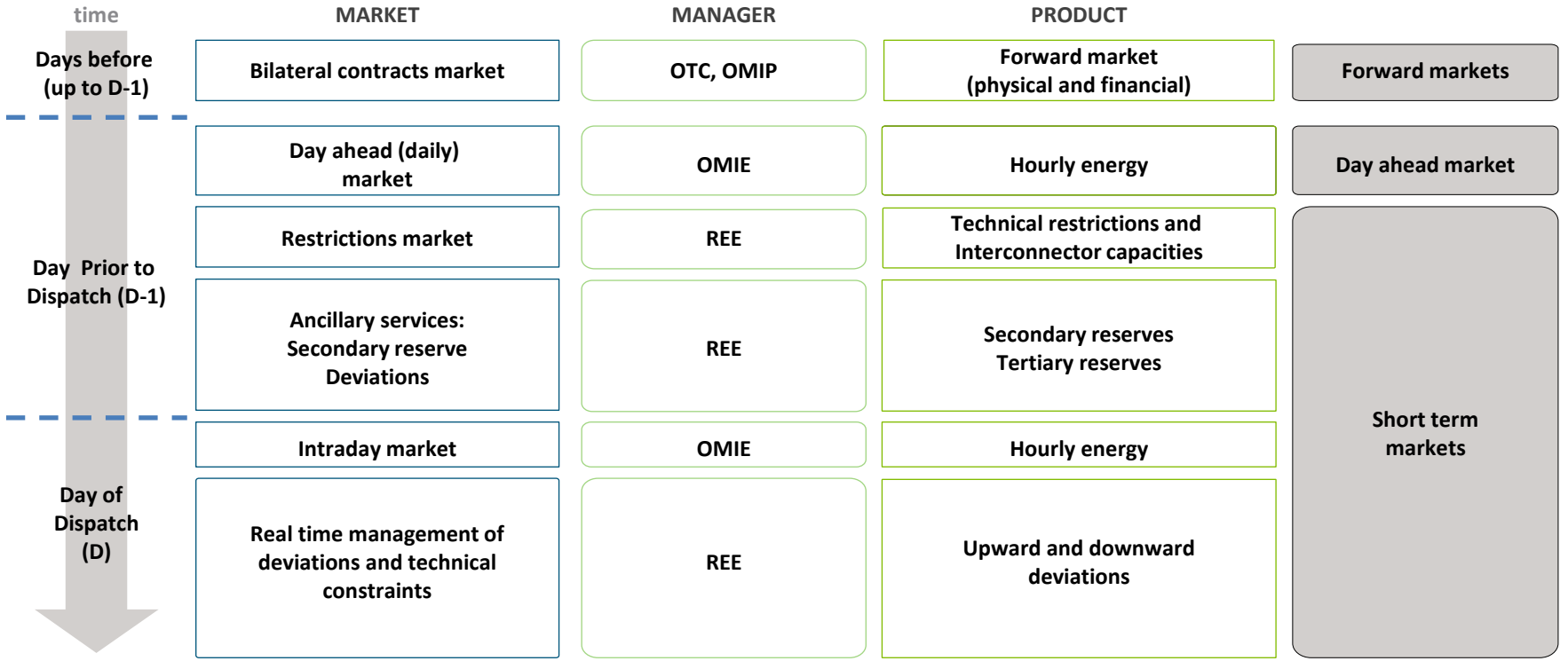


Source: EKON.

Recap https://www.youtube.com/watch?v=pHrUIGTlqt4&feature=youtu.be.

WHOLESALE ELECTRICITY MARKET(S) IN SPAIN

- Agents can contract for delivery periods of varying duration in the forward markets. One day before dispatch (D-1), agents interact in the Day-Ahead (or Daily) market organized by the Electricity Market Operator ("OMIE"). In addition, and within 24 hours prior to the real time, agents can adjust their contractual positions in the intraday markets.
- In the very short term (from a few hours to a few minutes before real time) generators, and in some cases demand, can participate in a number of ancillary services which are managed by REE, as the system operator. And if you are technically proven, you can play too.



Source: EKON.

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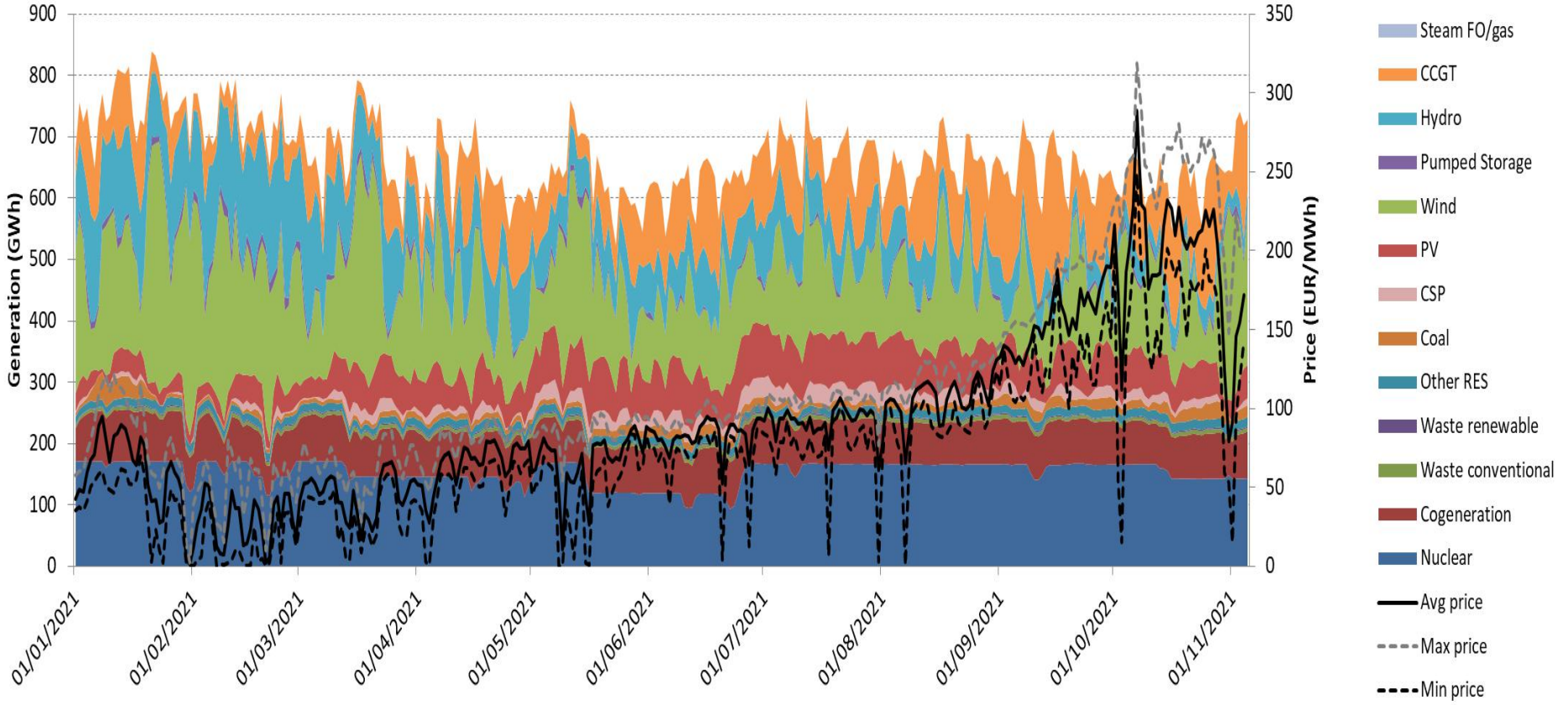
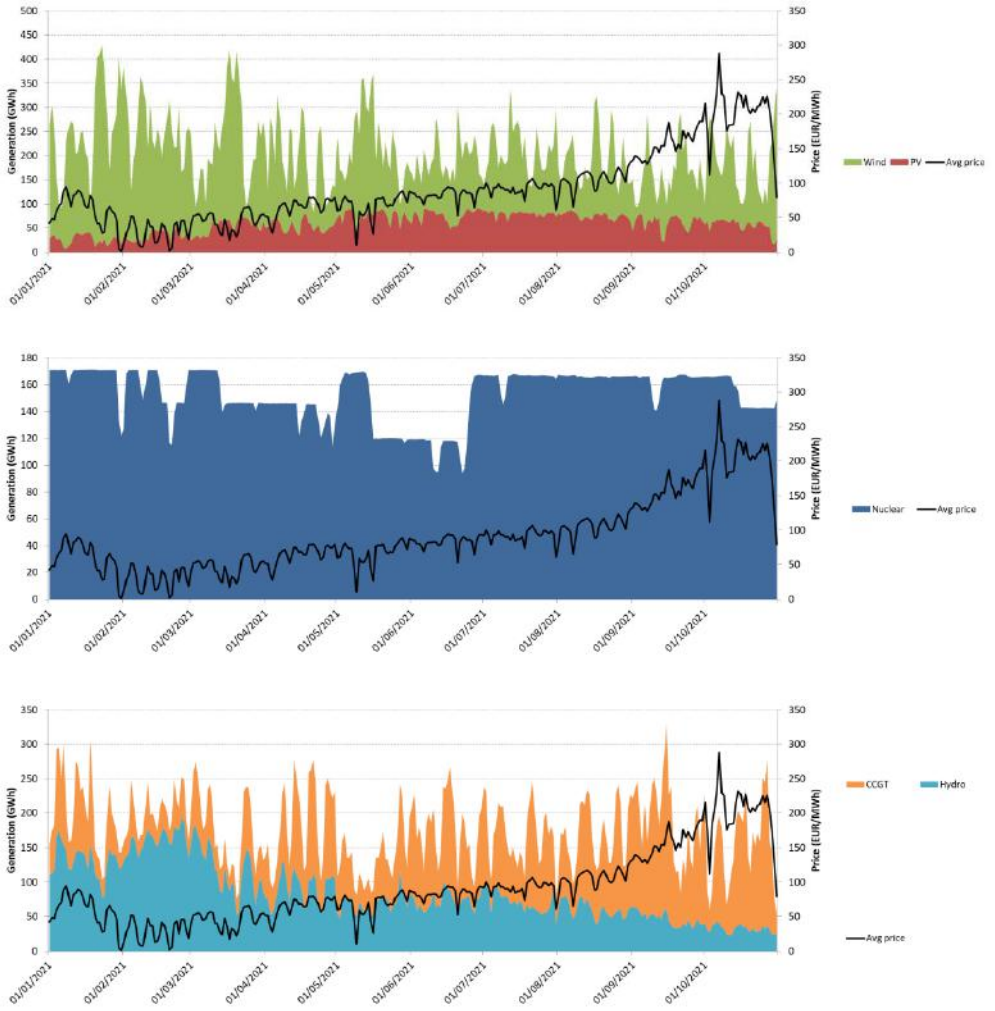
EVOLUTION OF GENERATION AND PRICES (1)

- Daily dispatch by technology and average daily spot prices for Spain in 2021. 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.

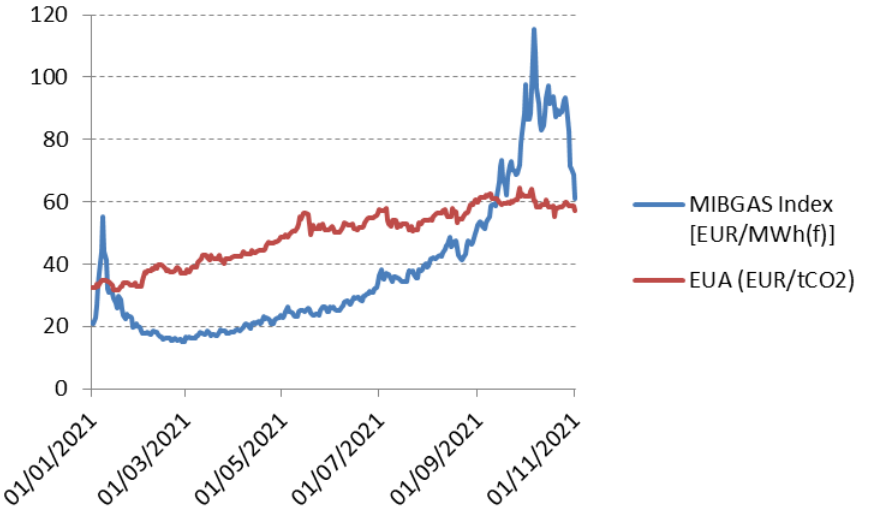


Source: REE and ENTSO-E.

EVOLUTION OF GENERATION AND PRICES (2)



- Wind has been a major driver of lower prices this year.
- Despite drops in prices nuclear output has held.
- A spike in gas prices in January coincided with storm Filomena but prices in October were even higher. Higher gas as well as CO2 prices have pushed electricity prices to historical highs.



Source: REE and ENTSO-E.

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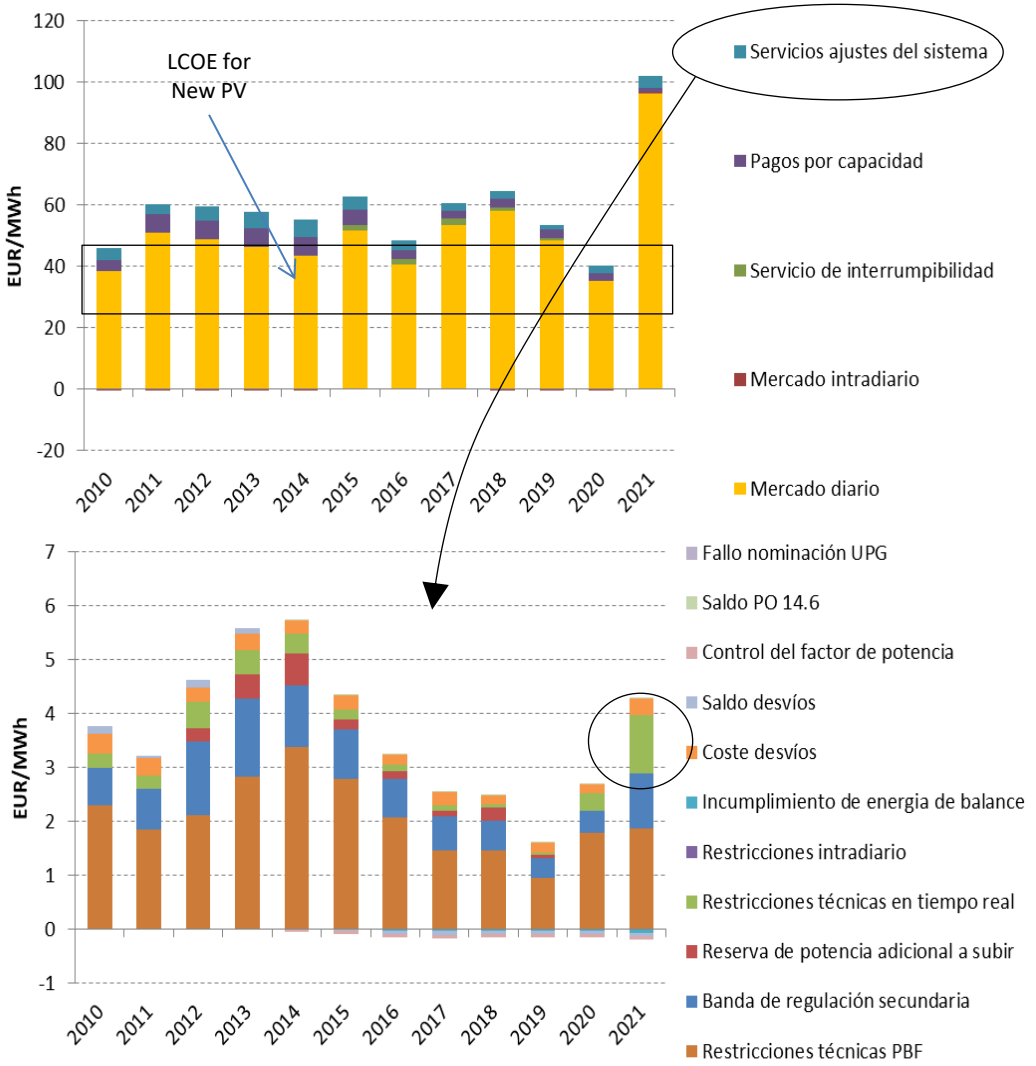
IMPACT OF ANCILLARY SERVICES ON FINAL PRICES



- In economic terms, the ancillary services as a group have a minor impact on final electricity prices, but are nevertheless essential to ensure the security and quality of the power supply.
- Charts compare what component of the final price in Spain in 2010-2021 and highlights the contribution from ancillary services.
- Yes there are lots of them and I will not be going through them! Note the relative increase in real time restrictions.
- Just remember that some pay out for capacity/availability and others for energy.
- Note that end-user prices make retail (inc PPAs) and autoconsumption attractive.

Source: REE data to mid Nov 2021, and EKON calcs.

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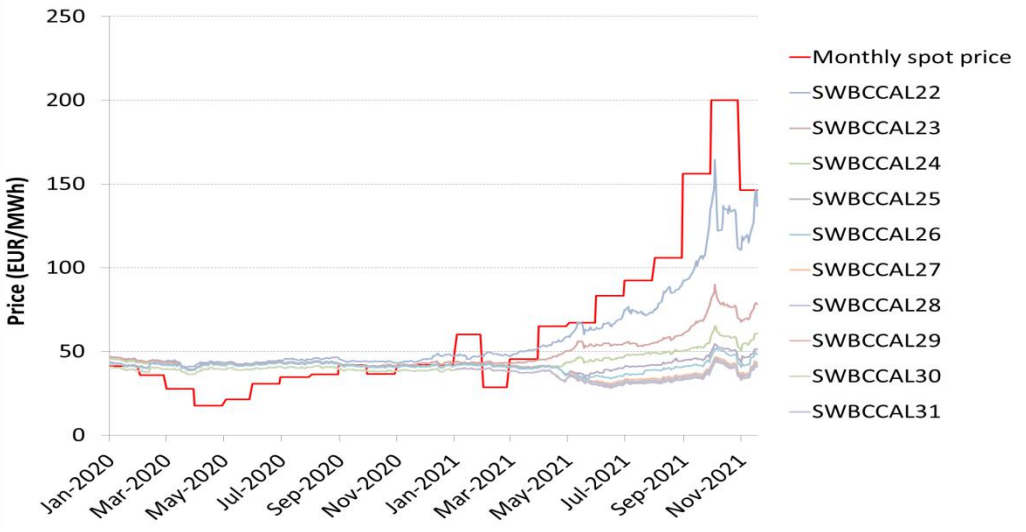
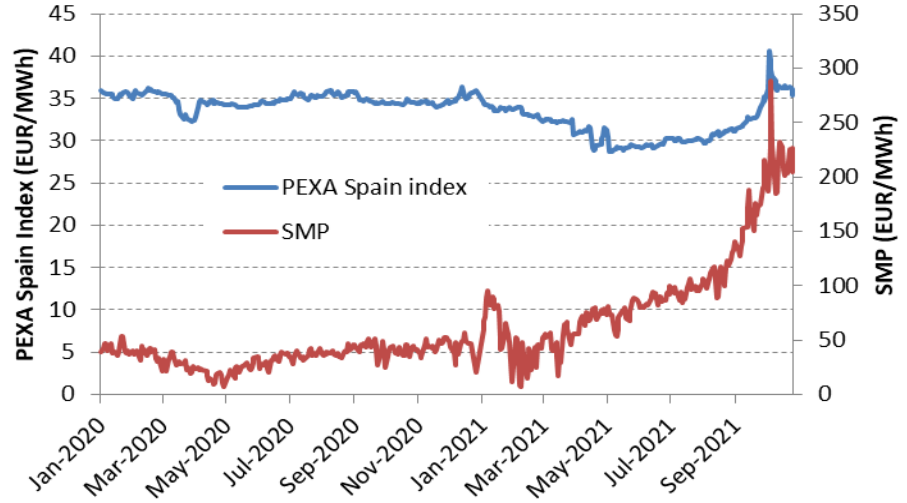
INTERPLAY BETWEEN SPOT, FUTURES AND PPA MARKETS





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

- 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.
- Comparing spot prices with PPA prices indicates that buyers and sellers are adjusting their expectations based on market trends: spot and front-end contracts prices definitely impact the price expectations for long-term PPAs.
- Moreover, expectations of the pass-through from one market to other can change over time; first half 2021 not the same as second half 2021 with increased sensitivity of PPA prices in the latter.

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OVERVIEW OF SENSITIVITIES

	Low Case *(Low1_20211106)*	Central Case *(Ref1_20211106)*	High Case *(High1_20211106)*
Fuel prices	TTF+1 until 2023, World Bank (Oct 2021)	TTF+1 until 2023, World Bank (Oct 2021)	Central Case+30%
CO2 (EUA prices)	CME futures	CME futures	Max(CC, IEA WEO 2020 Stated Policies)
Domestic coal surcharge	None	None	Applied
IED coal output cap	None	None	Annual output caps applied
Demand growth	NECP Target	NECP BAU	NECP BAU
Green Cent Tax	None	Applied to Coal	Applied to Coal
Generation Tax (7%)	None	Phasing out	Phasing out
Annual hours for New PV	2050	1739 (historical)	1739 (historical)
Annual hours for New Wind	3000	2500	2166 (historical)
TIC of New Wind , PV and Battery (€/kW)	-20%	1000/750/975	1000/750/975
Annual cap on New Wind and PV	4/5GW from 2021, uncapped from 2031	2.0/1.5GW from 2021	2.0/1.5GW from 2021

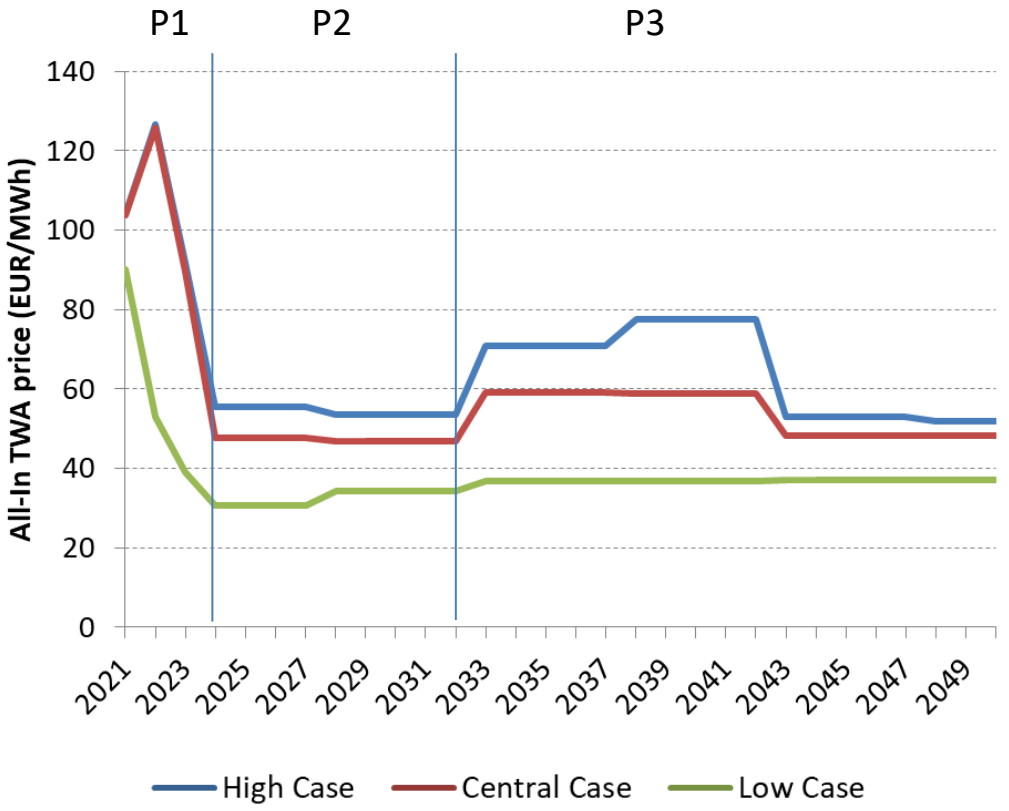
Most important

Note: Prices real 2021 €.

- NECP growth adjusted for COVID19 bounce in 2021 (+4.46pp). Crude and coal prices based on World Bank (Oct 2021). Gas indexed to oil from 2024 but linked to TTF until end 2023.
- CO2 prices set at nearly ~59€/tCO2 or IEA's WEO 2020 Stated Policies Scenario ("SPS").
- The High Case applies transportation surcharge for domestic coal and a more restrictive view of the implementation of the Industrial Emissions Directive ("IED").
- Additions through to end 2020 plus 1.5GW of New PV in 2021 as "firm". 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.

MARKET PRICE FORECASTS

Baseload price forecasts



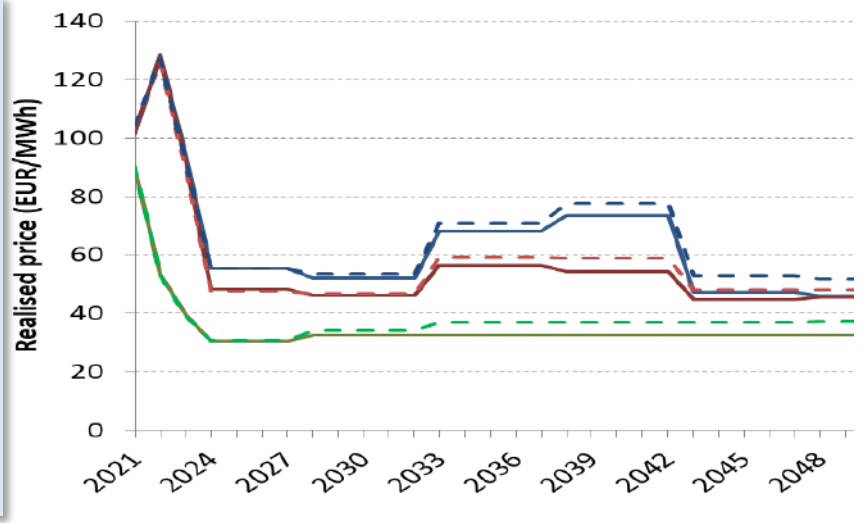
- Prices first move in line with commodity prices and adjust to new additions (P1) and then plateau (P2).
- As a lot of thermal capacity retires in the 2030s, a step-up in prices is expected in the Central and High Cases (P3).
- But even in these cases, renewable capacity eventually catches up and prices drop.

Source: EKON 2021Q4. Prices real 2021 €.

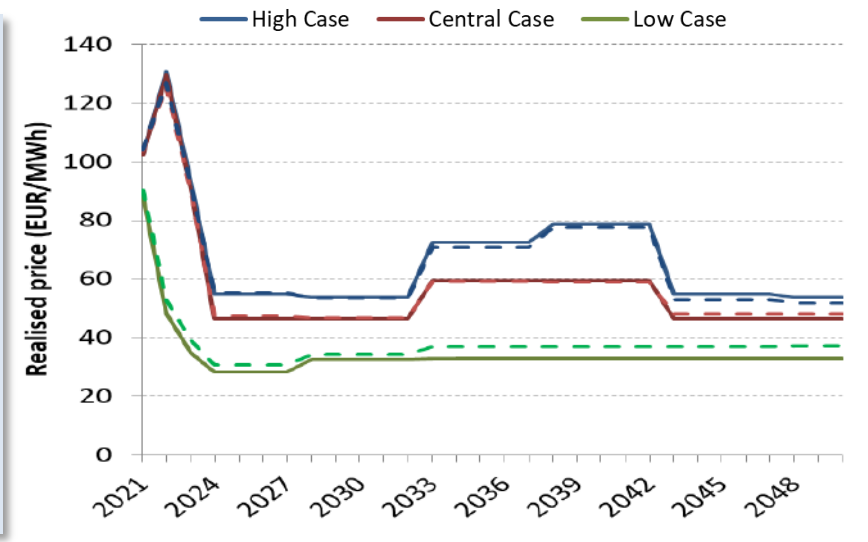
REALISED PRICE FORECASTS

- The PV and Wind Capture Prices track the market price. But as more renewable capacity is introduced, the Capture Prices tend to drop below the baseload price.
- EKON remains optimistic that profitability of renewables will be satisfactory But we are also more pessimistic since we do not believe that market conditions (grid and planning constraints, project "bankability", liquidity of PPAs, etc.) are adequate to reach the government's aggressive capacity goals under the NECP.

PV Capture Price



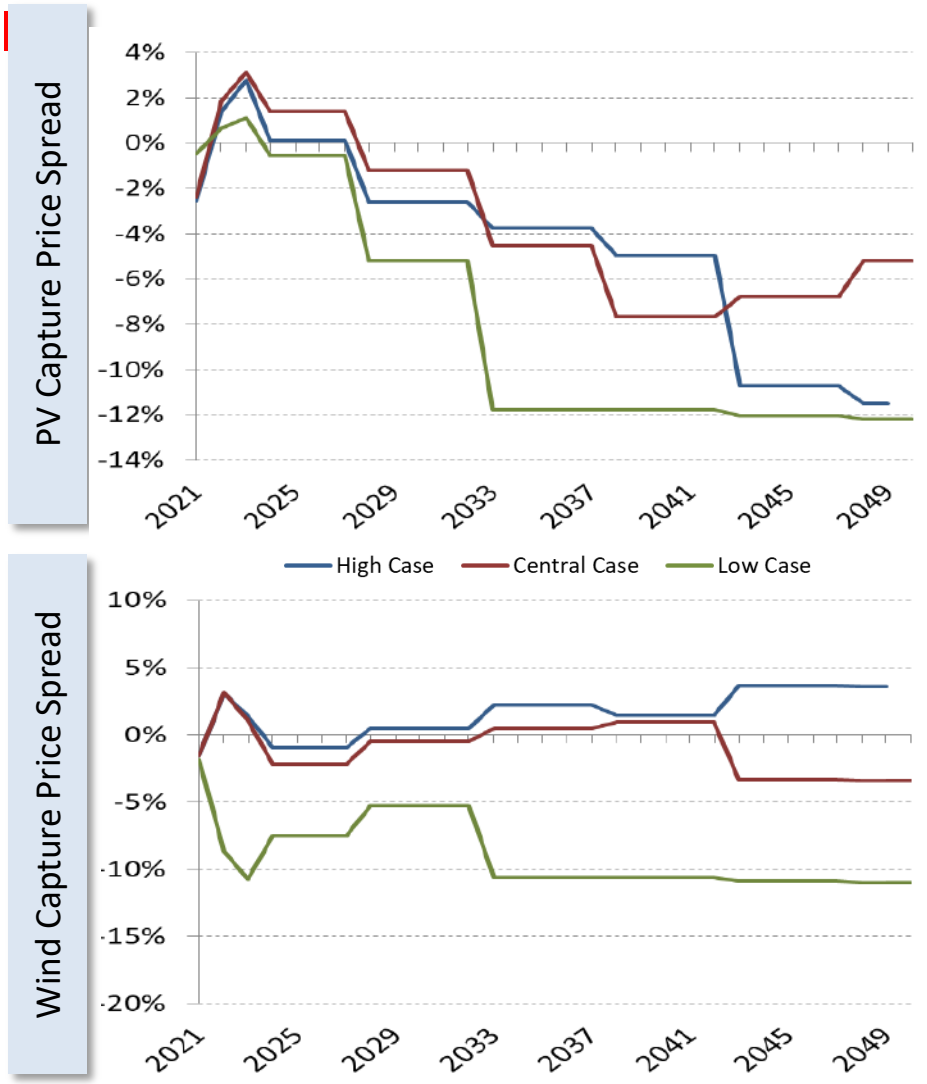
Wind Capture Price



Source: EKON 2021Q4. Prices real 2021 €. Dashed line = Baseload prices.

PV AND WIND CAPTURE PRICE SPREADS

- EKON predicts that the PV Capture Price Spread will go from positive to dropping to between -5% to -12% (on average). The Wind Capture Price Spread will fall less.
- When New PV and New Wind capacity are deployed until the Capture Prices converge on LCOE levels, since New Wind is "quasi-baseload" (since the wind blows both during the day and at night), then
  1. Wind Capture Price Spread = ~0
  2. PV Capture Price Spread = ~(LCOE PV – LCOE Wind) / LCOE Wind



Source: EKON 2021Q4.

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FINAL THOUGHTS

- Don’t just focus on day-ahead prices since there are multiple opportunities to trade and hedge your exposure
  - Spot market
  - Futures and PPA markets
  - Ancillary services
- Look beyond plain vanilla PPAs and government auctions to make sure you are valuing flexibility appropriately.
- Do the maths, you might find low hanging fruit.