



Previsiones para la electricidad de 2024: ¿ha pasado ya el peligro?

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JAVIER REVUELTA

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Agenda

1. Geopolitics and gas market
2. Demand
3. Regulation
4. Capacity mix
5. Energy prices
6. Market design
7. Key messages

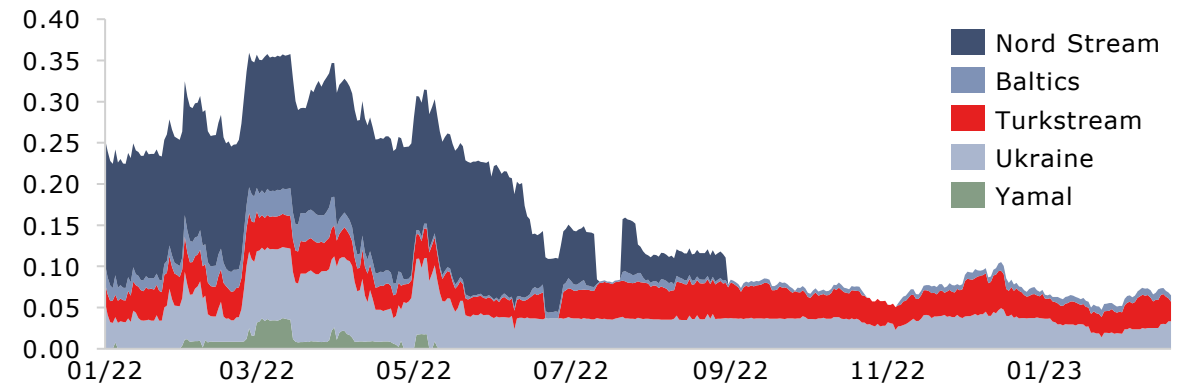


Currently, the only remaining routes for Russian gas to Europe are via Ukraine and Turkstream which dropped to 25 bcm/y since end of 2022

ROUTES OF RUSSIAN GAS INTO EUROPE



DAILY RUSSIAN GAS FLOWS 1 JAN – 19 FEB 2022 (BCM/DAY)



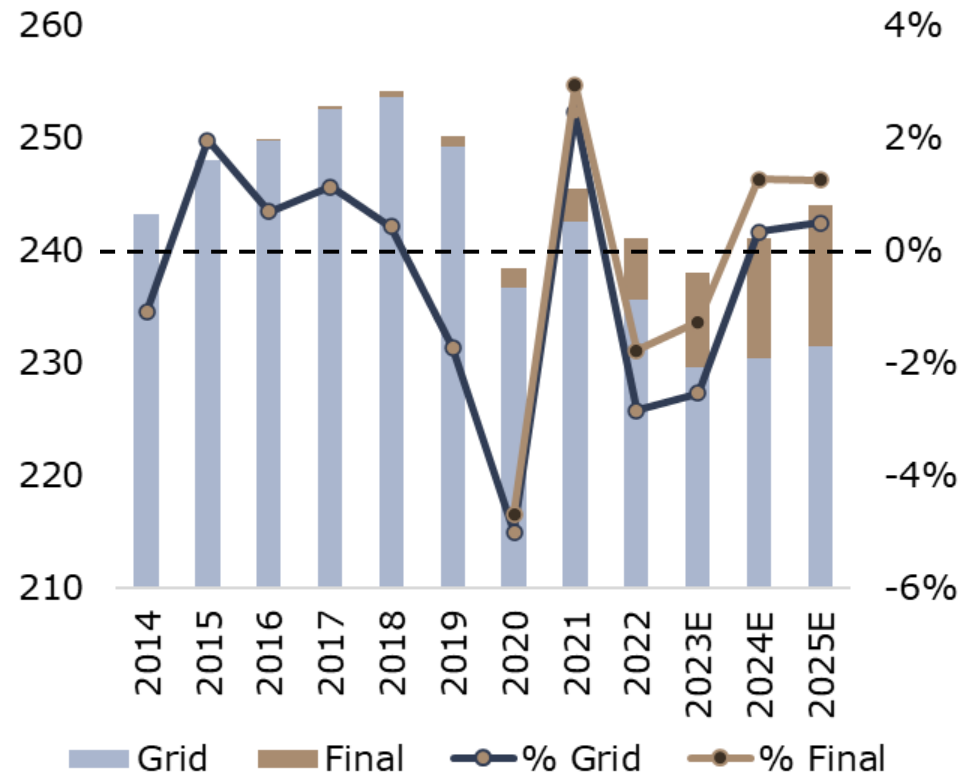
- Very high seasonal storage, but... What about price?
- Winter temperatures in Europe and Asia, rainfall..?
- Potential further reductions of Russian pipe gas
- Ukraine, Israel, Chinese LNG demand, European recession?
- New LNG (US, Qatar, Australia..)
- Deployment/closure delays of some nuclear + new RES
- Electrification and energy efficiency (e.g. insulation)
- Expensive gas in 2024 (€47/MWh) and 2025 (€42/MWh), and volatile!

Sources: IEA WDS, ENTSOG, S&P

DEMAND

Electricity demand seems falling sharply, but is significantly affected by self-consumption (final vs. 'grid' demand) and possibly transitory high prices

DEMAND EVOLUTION (TWH AND % GROWTH)



- Covid
- Industry
- Self-consumption
- Data centers, EV, Heat pumps, H2...?
- Energy efficiency, insulation, demand response to high prices

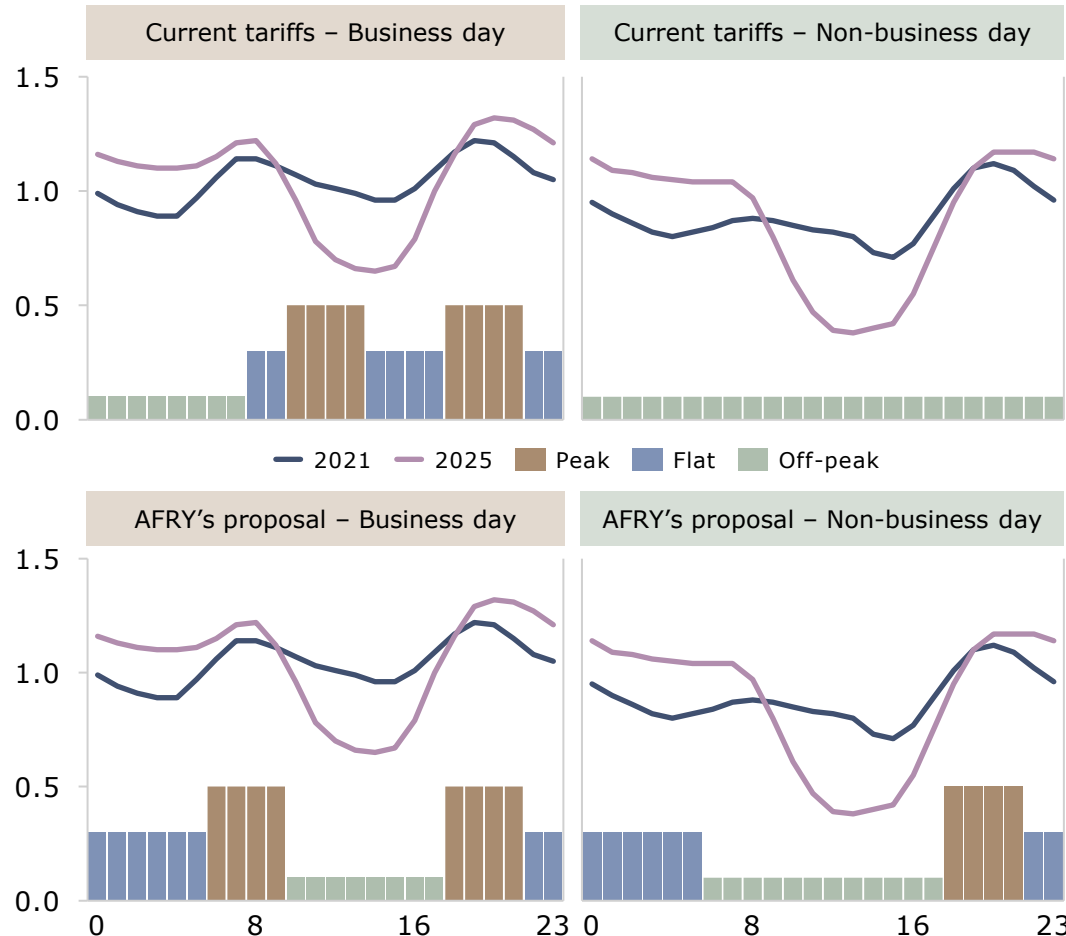
Sources: REE and AFRY estimates

Uncertain regulatory elements may affect power prices directly and indirectly

PENDING REGULATORY DECISIONS

- RDL 23/2020: milestones extension, pipeline >July 2025
- RES auctions: indicative calendar (wind 1.5GW/y, PV 1.8GW/y) vs. PNIEC targets (wind 4GW/y, PV 7GW/y)
- 'grid access tenders': link with 60 months milestone extension, and COD>2026?
- 'gas cap' and RDL 17/2021 'windfall profits' temporary measures
 - Direct impact on prices
 - Indirect impact on RES investments
- Grid charges and tariff structure
- Use of the very high 'tariff surplus', and high income from CO2 auctions --> potential reduction of grid charges
- Tax measures: IVA, 'electricity tax', IVPEE (7% tax)

Tariff design is likely to keep evolving, and should consider changing system needs



GRID CHARGES

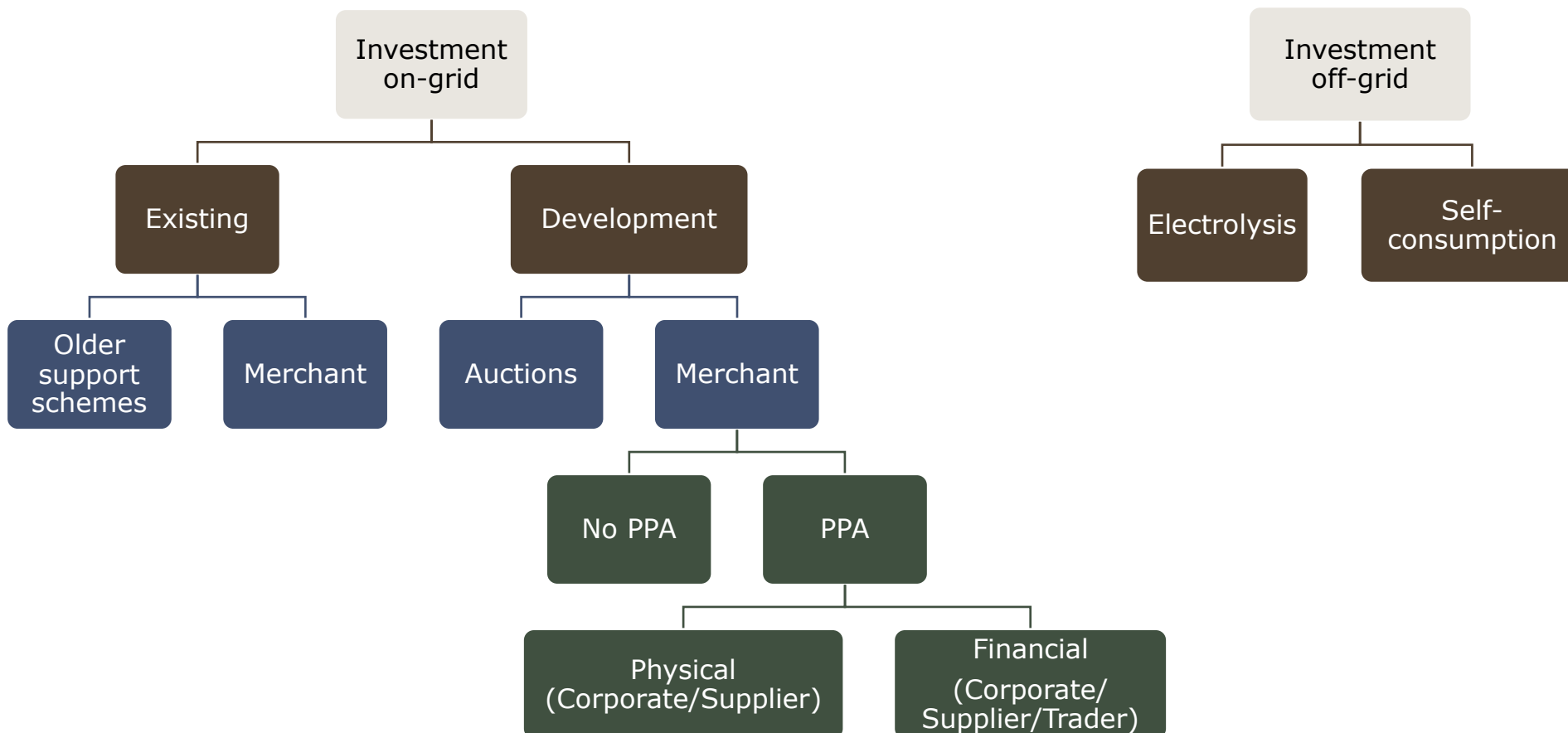
- High grid charges in hours of solar cannibalisation, which disincentivises EV charging and load management to maximise RES integration
- Charges incentivise self-consumption, which does not need incentives, or can be incentivised through other mechanisms (e.g. 'IBI' property tax discounts)
- Problematic 'evening peak' not addressed in weekends

Proposals:

- modify hourly periods to give RES integration signals (vs. grid utilisation)
- as total grid charges reduce, shift from 3 periods to 2 periods (Peak and Off-peak)
- stronger price differentials to incentivise demand response or batteries
- Incentivise distributed storage

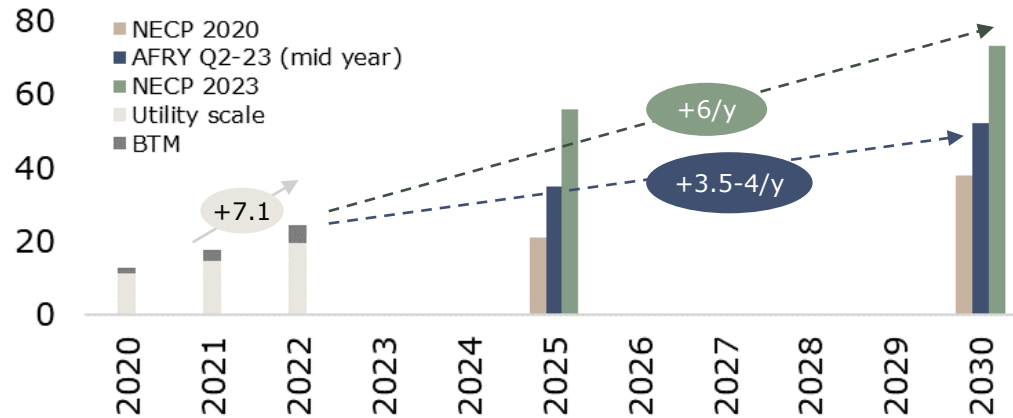
Different RES investment regulatory categories have different merchant and regulatory exposure triggering different investment decisions

INVESTMENT OPTIONS IN RES ASSETS



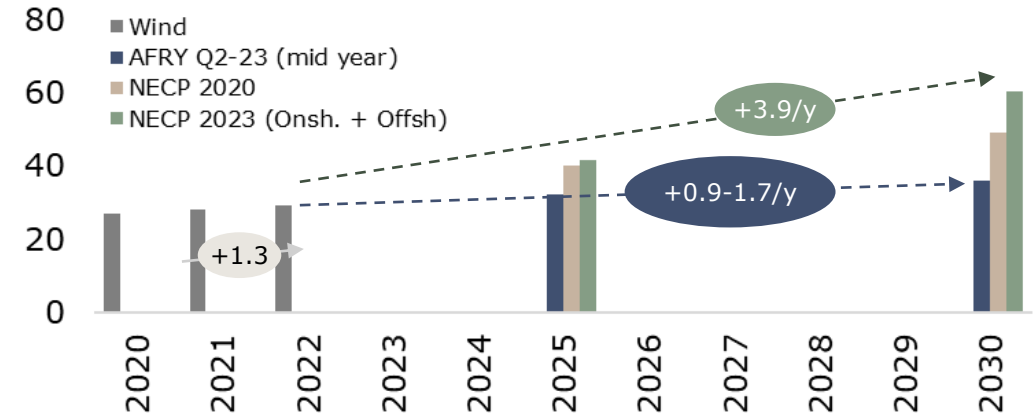
Very ambitious RES plans, but can the market, PPAs and auctions deliver before flexibility elements arrive?

SOLAR PV CAPACITY (GW)



- Technically possible targets, but unlikely economics and insufficient PPA / auction volumes / storage
- Probably higher pace in 2024 & 2025
 - 4-6GW/y utility scale
 - ~1.5GW/y self-consumption

WIND CAPACITY (GW)



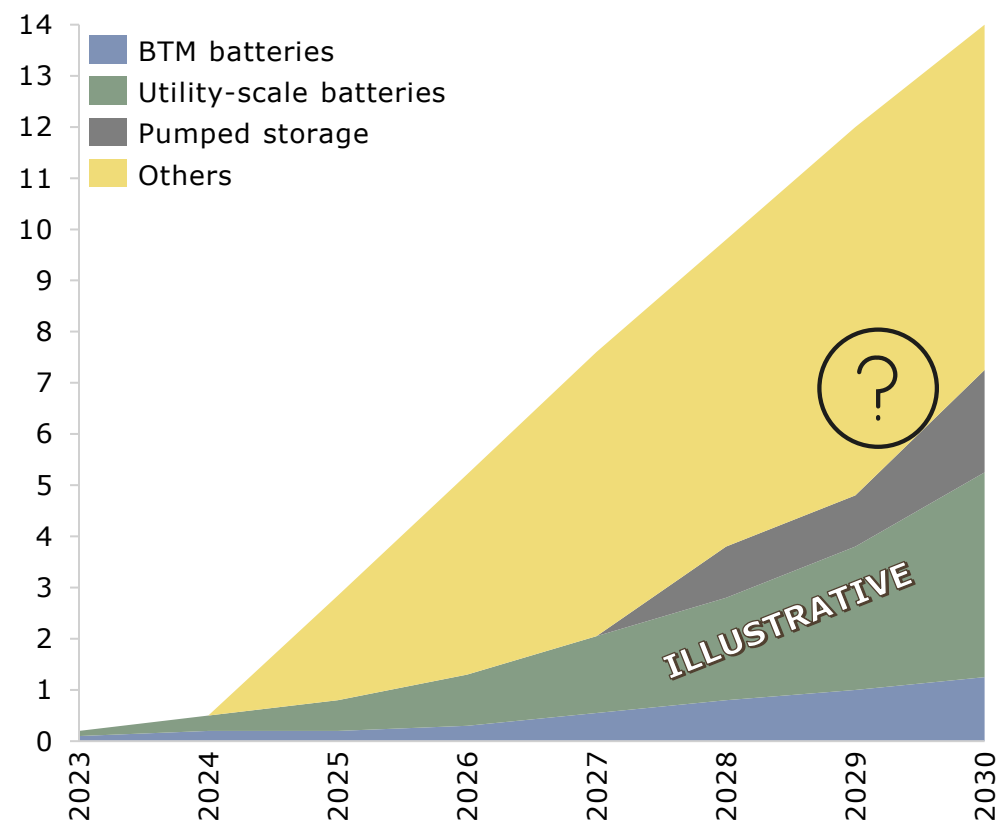
- Targets technically unlikely driven by permitting and construction bottlenecks

STORAGE DEVELOPMENT

The new Spanish NECP sets the target of 22GW of energy storage by 2030, but further investment incentives will be needed

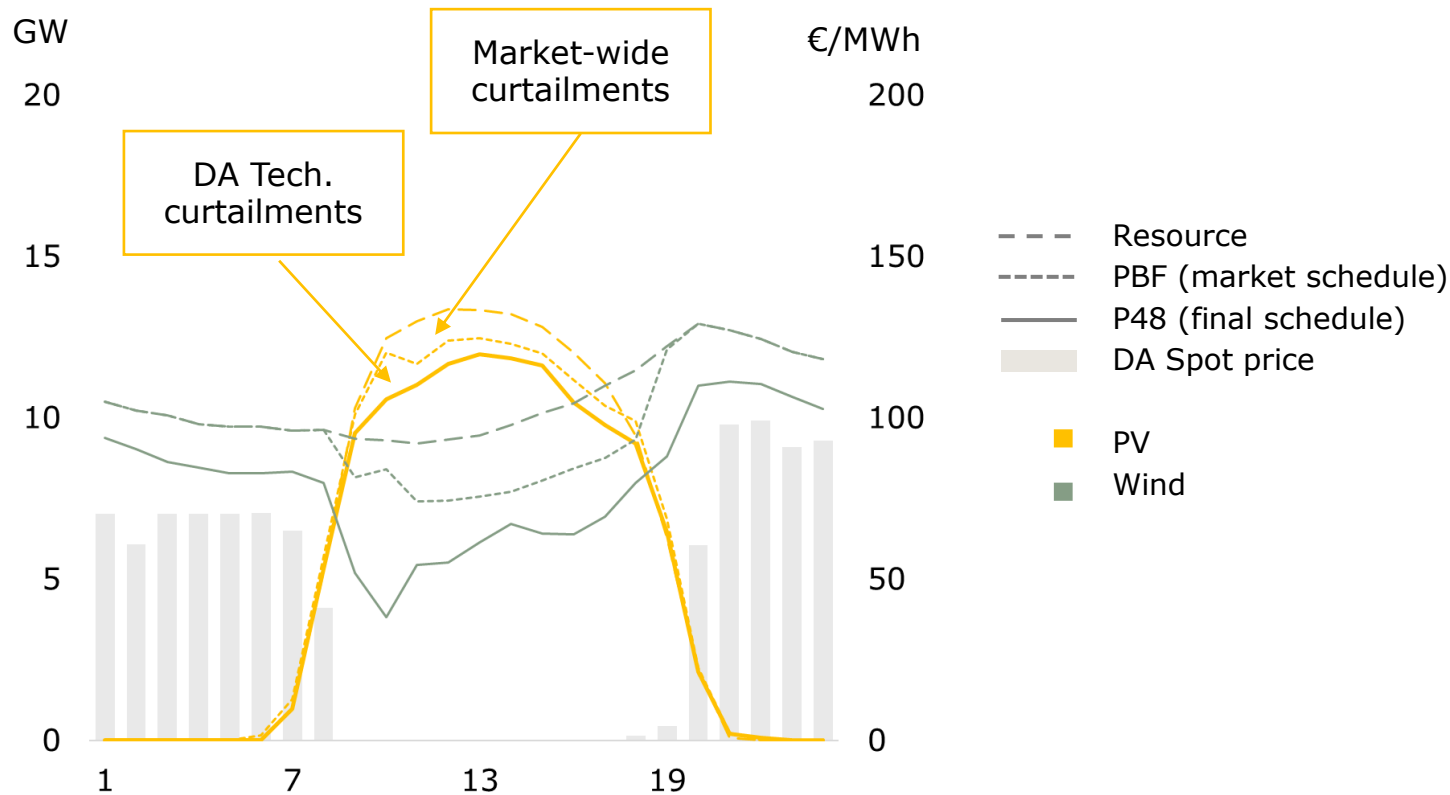
- Capex grants from EU funds
- Capacity market launched in 2025?
- Grid access tenders point system
- Other new mechanisms?

ILLUSTRATIVE STORAGE CAPACITY BREAKDOWN, GW
GW



RES resource is 'curtailed' first by economics in the unconstrained market schedule and further by technical constraints from the grid operator

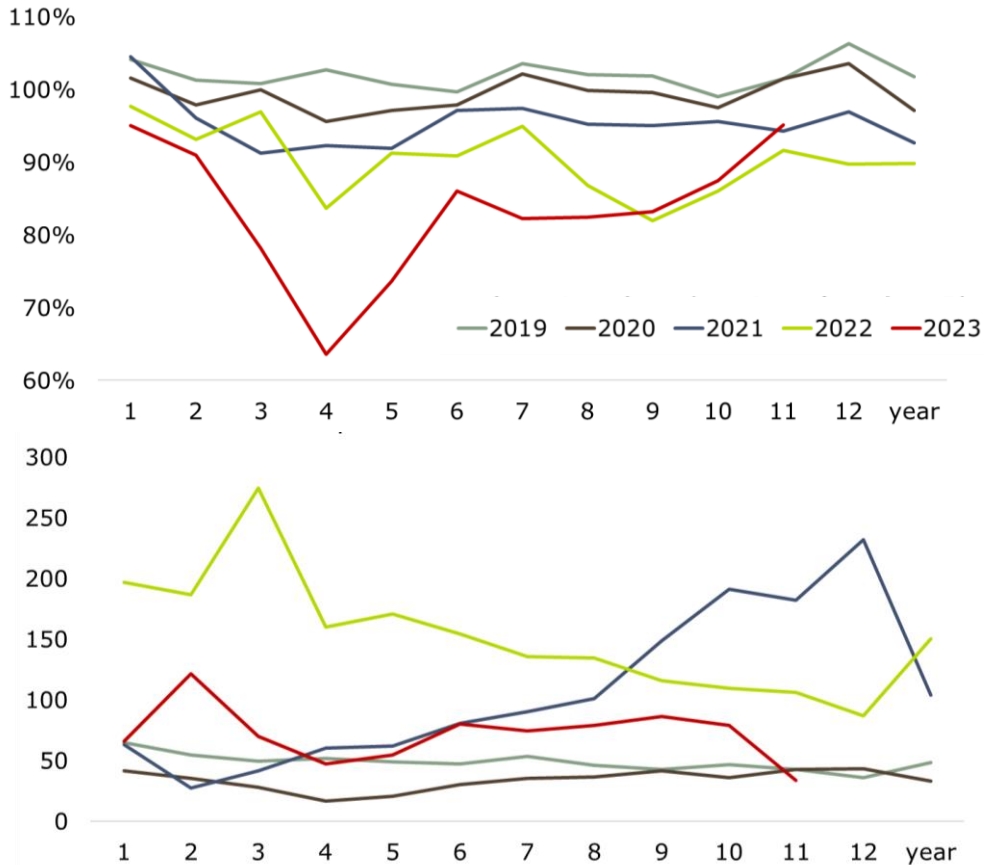
MARKET PERFORMANCE ON 14 MAY 2023



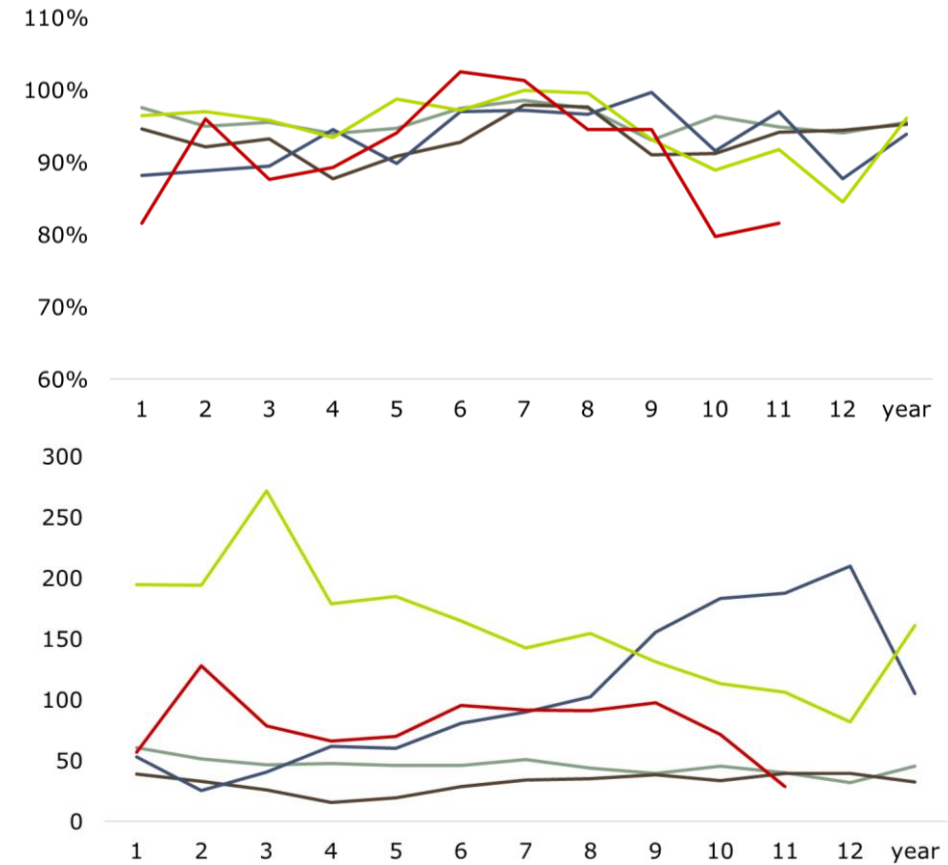
Source: REE and AFRY

Spring brings higher frequency of curtailment, decreasing capture rate for both wind and solar PV, due to higher wind and hydro resource

SOLAR PV CAPTURED RATES AND PRICES (% AND €/MWH)



WIND CAPTURED RATES AND PRICES (% AND €/MWH)

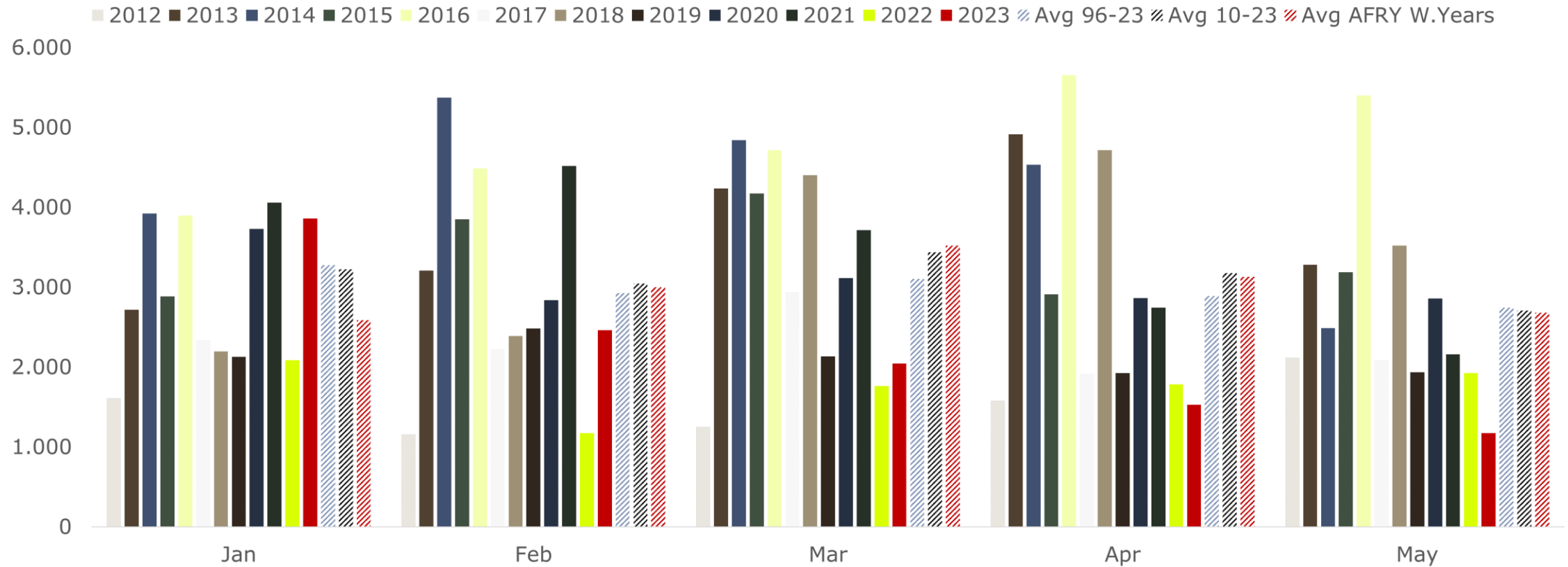


Captured prices are in €/MWh per unit of resource, excluding 'market wide curtailments'

HYDRO

Importance of 'Weather Years', not only annual energy but mostly RoR flows

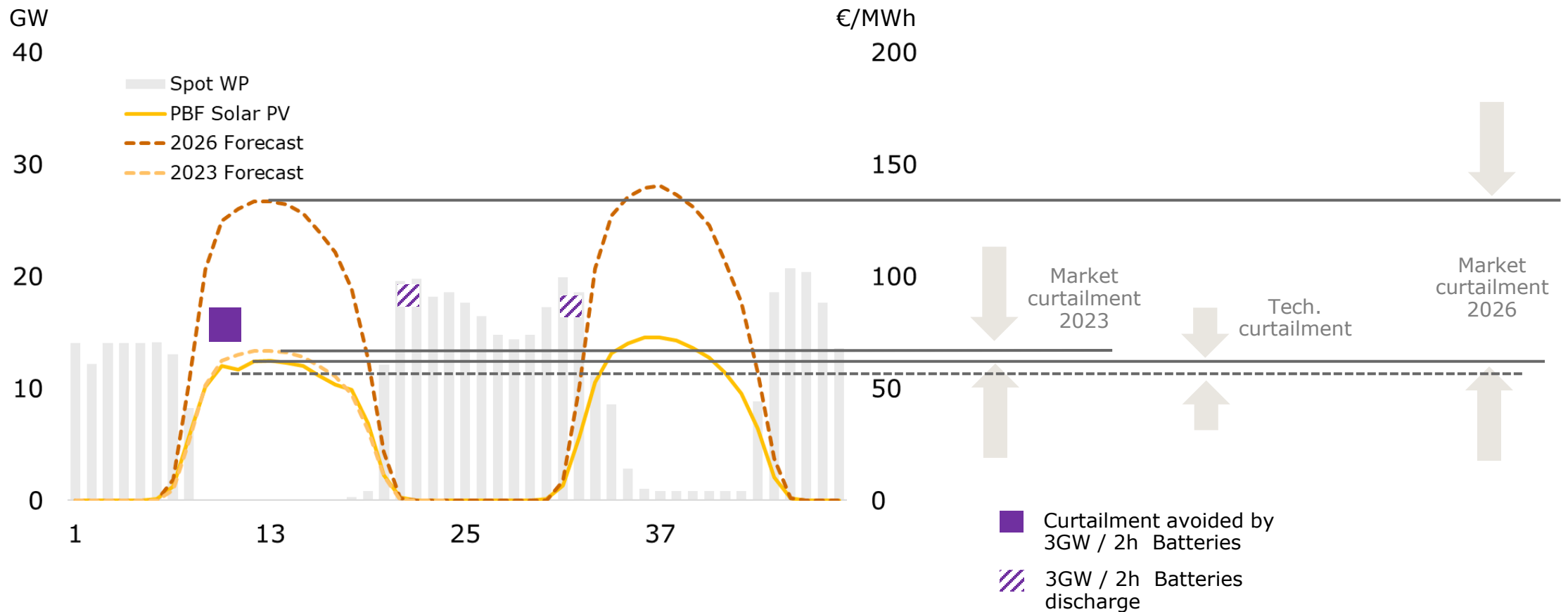
HYDRO PRODUCTION IN THE SPANISH POWER SYSTEM (GWH/MONTH)



Source: REE

Market RES curtailments will increase substantially in absence of substantial additional storage

ILLUSTRATIVE MARKET PERFORMANCE ON 14 TO 15 MAY 2026

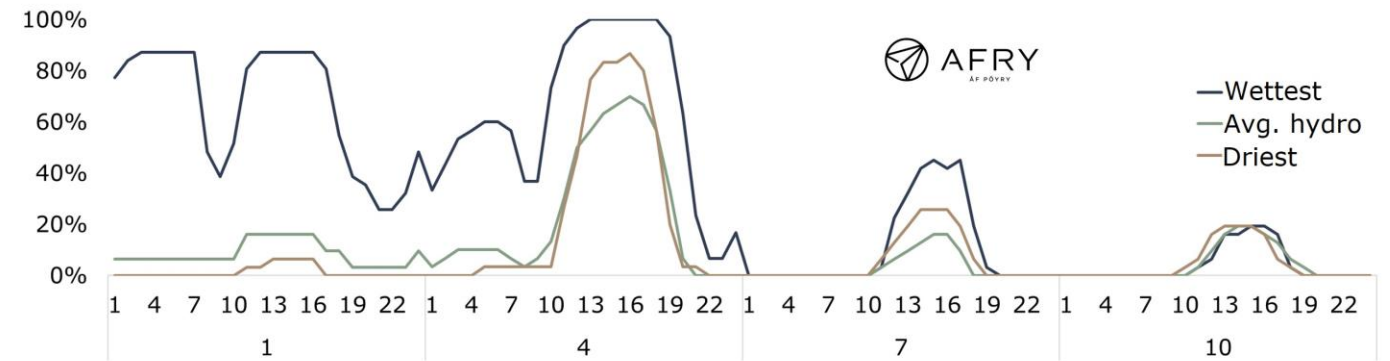


Source: AFRY

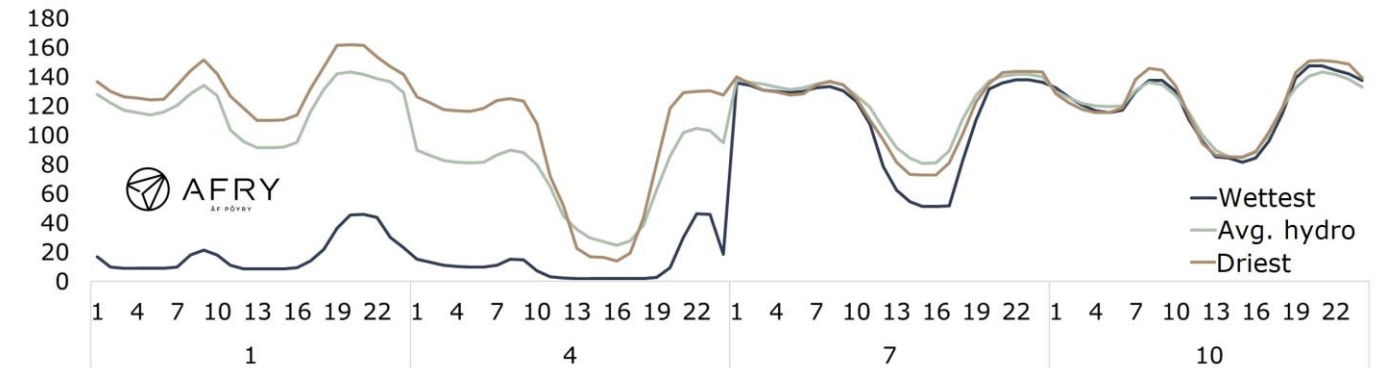
Frequency of low price periods will keep rising in the ST and MT

- High dependence of weather patterns (RoR hydro, wind)
- Shift of low price periods to solar hours
- Regulatory changes of Time-of-Use regulated tariffs (grid tolls, and system costs levies)

WEATHER SENSITIVITY ON FREQUENCY OF LOW PRICE PERIODS IN THE SPANISH MARKET



WEATHER SENSITIVITY ON WHOLESALE PRICES IN THE SPANISH MARKET (€/MWH)

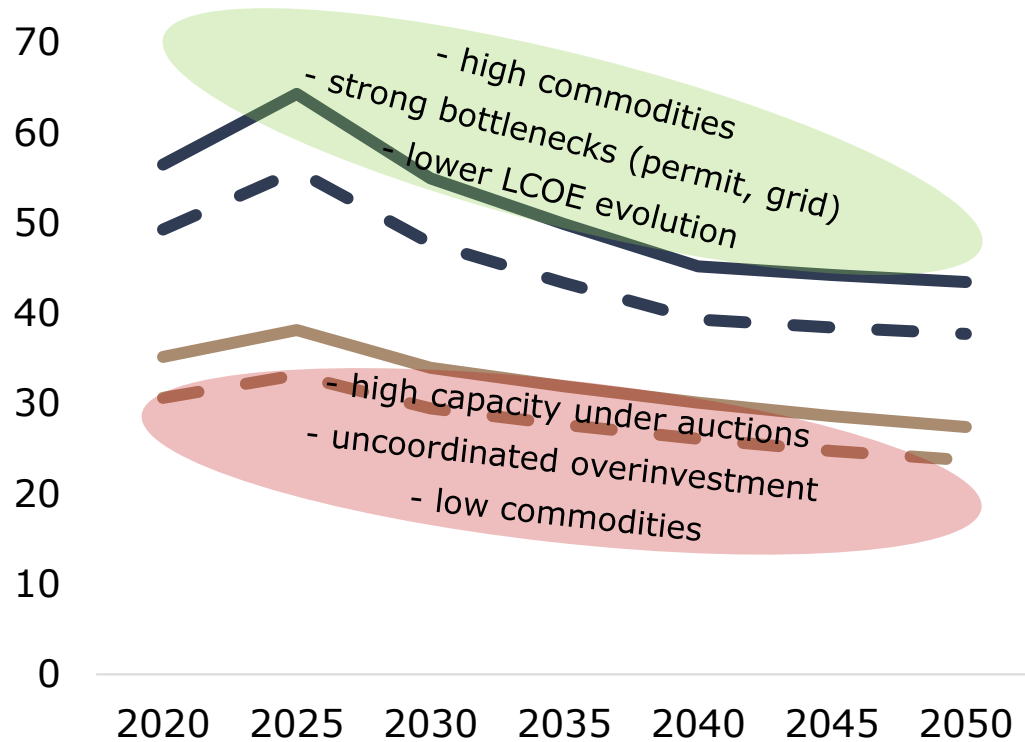


Source: AFRY Management Consulting, Q2-2023. Illustration under assumption that RDL 17/2021 is not extended beyond 2023.

2023 modelling corresponds to Q4-2022. 2025 modelling corresponds to Q2-2023 with updated (increased) solar PV capacity

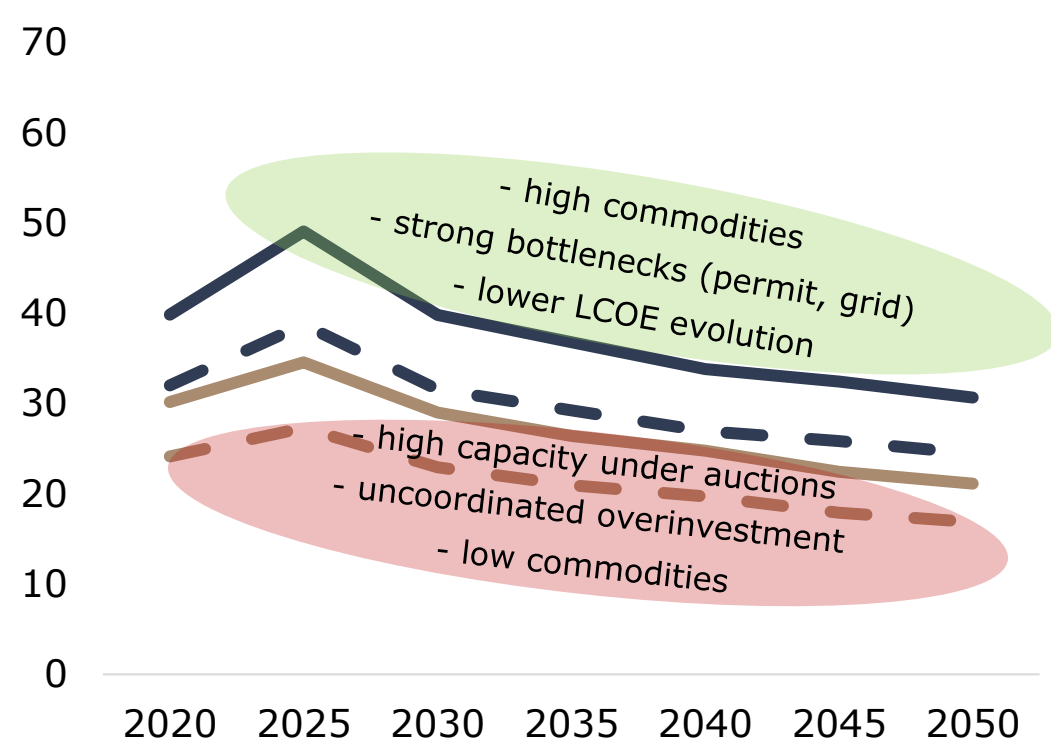
Potential LCOE evolution of renewable technologies will determine minimum revenue requirements... and possibly market captured prices

LCOE ESTIMATES FOR ONSHORE WIND* (€/MWH)



- HIGH Capex/Opex & LOW Load Factor
- LOW Capex/Opex & HIGH Load Factor

LCOE ESTIMATES FOR SINGLE TRACKER SOLAR PV* (€/MWH)



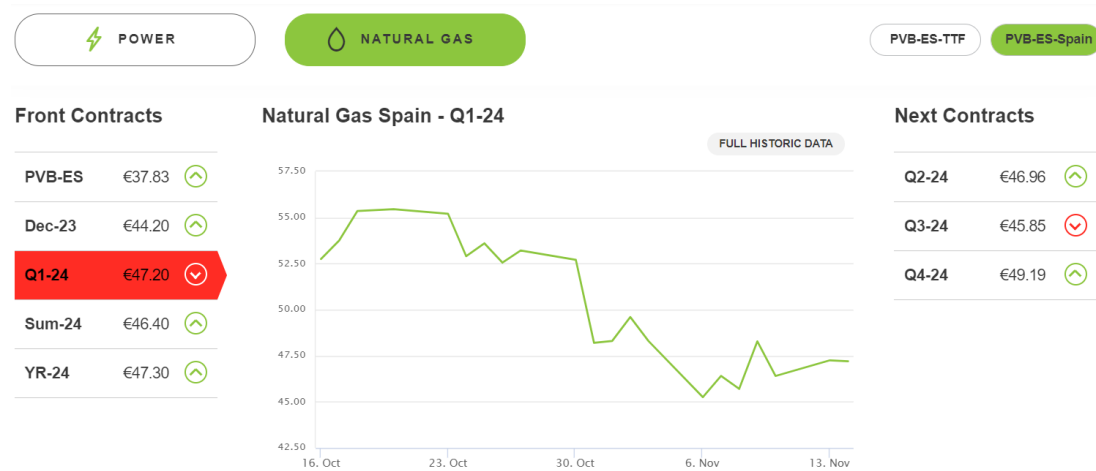
- HIGH Merchant IRRs
- - LOW Feed-in-Tariff IRRs

* AFRY's own estimates for a fairly wide range of observed and expected Capex, Opex, and load factors; and own views on projected hurdle rates.

FORWARD PRICES

Potential LCOE evolution of renewable technologies will determine minimum revenue requirements... and possibly market captured prices

IBERIAN GAS FORWARDS (€/MWH)



– High gas prices until >2026

IBERIAN ELECTRICITY FORWARDS (€/MWH)



- Implicit solar captured rate of 82% in 2024, 80% in 2025
 - 10-20 percentage points higher than AFRY
- AFRY models a delta of c.35€/MWh between extreme wet-dry weather patterns (do Forwards consider wet years?)

Forward prices from OMIP as of 14/11/2023



Impossible to model accurately all drivers of power prices, but...

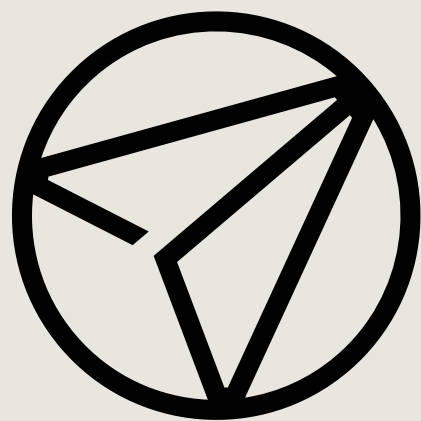
- High gas volatility, around a high average of 45-55€/MWh_{gas} in 2024 & 2025
- High impact of solar cannibalisation, with rapidly falling captured rates for PV
- High impact of additional solar PV installed, yet 2024 does not seem to slow down
- High impact of weather patterns, and statistically 2024 or 2025 should be wet (unless climate change affects more and earlier)
- More reasons for Forwards over rather than under-forecasting, particularly in solar hours
- Potential reduction of grid charges, and modification of hourly tariffs structure to better integrate RES through demand shifting

CONTACT INFORMATION

AFRY MANAGEMENT CONSULTING

JAVIER REVUELTA
Senior Principal

Plaza Marqués de Salamanca 3-4, quinta planta,
28006 Madrid | Spain
javier.Revuelta@afry.com



AFRY

ÅF PÖYRY