



Power Wholesale Markets and the Energy Transition

Portugal Renewable Energy Summit 2021 - APREN

November 2021

Future confident

Agenda

Analyze fit for 55% and net-zero implications for electric power

Power wholesale market needs in the Energy Transition

Implications for renewables developers



Iberian Peninsula has very ambitious renewable penetration targets (additional 100 GW in Spain and Portugal), x2.5 times current capacity in 2030, and x4 times in 2050

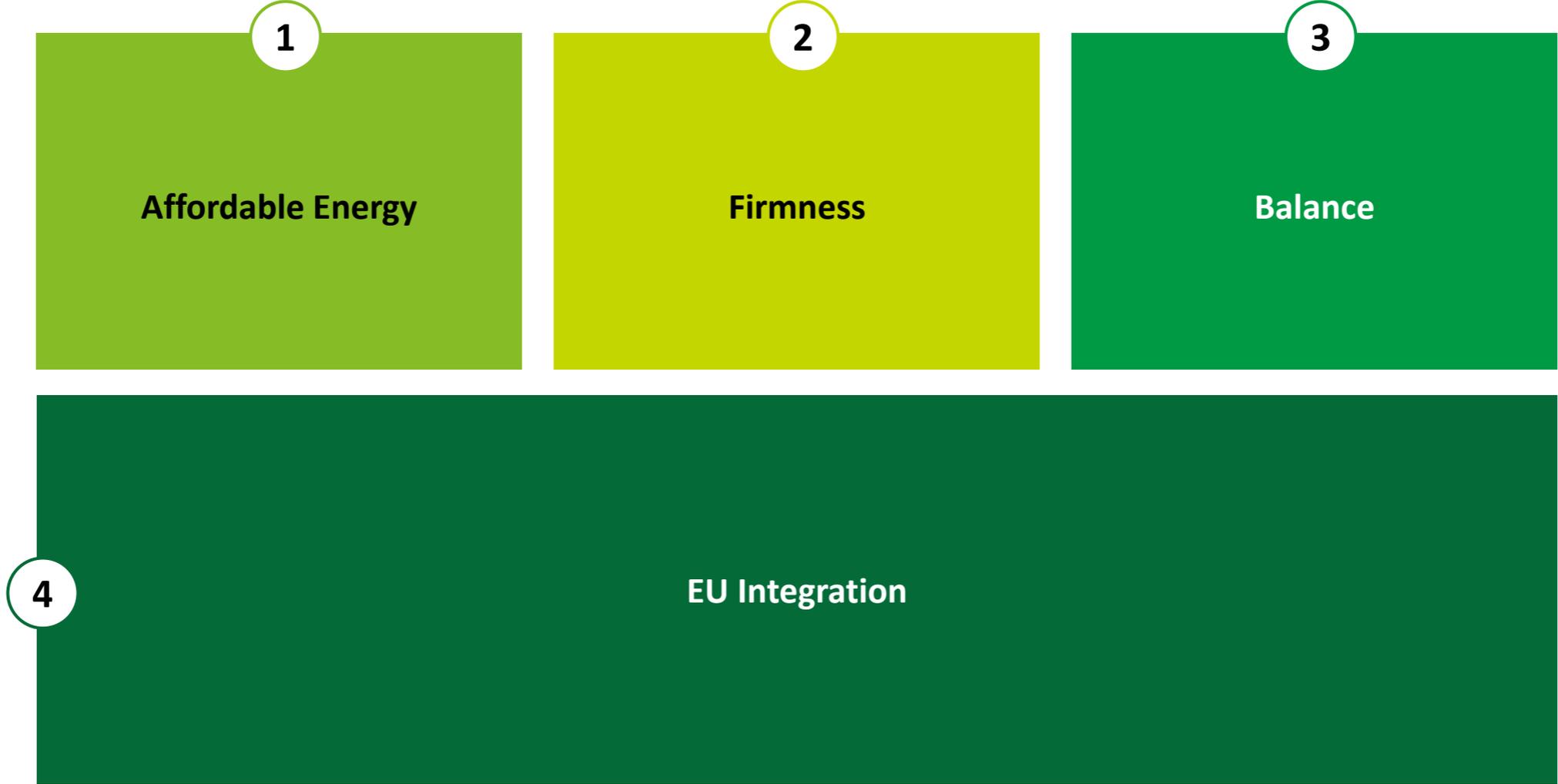


Climate targets in the Iberian Peninsula and implications for renewable assets

	2020 (actual)	2030 (NEPC)	2030 (Fit for 55)	2050 ⁽¹⁾
Emissions reduction (vs. 1990)	-6%	-23% ⁽²⁾	-40% ⁽³⁾	Net zero
Renewable capacity	66 GW	145-150 GW ⁽⁴⁾	160-165 GW ⁽⁴⁾	220-315 GW ⁽⁴⁾
Storage capacity	11 GW	25 GW ⁽⁵⁾	25-30 GW	35-40 GW ⁽⁵⁾
Green hydrogen electrolysis	0 GW	6-6.5 GW ⁽⁶⁾	8-10 GW ⁽⁷⁾	40-60 GW ⁽⁷⁾

(1): Numbers include APREN scenarios for 2050 for Portugal market and Monitor Deloitte scenarios for Spanish market; (2): Spanish 23% target and Portuguese 45-55% target vs 2005, equivalent to 22% vs 1990; (3): Estimation of increased objective derived from EU ambition increase from 40% to 55% GHG reduction; (4): Including renewables for hydrogen production (1.5 GW RES : 1 GW Elect.) and considering a higher renewable objective in power generation of 80% in Spain and 85% in Portugal for the Fit for 55 scenario; (5): National Spanish storage strategy and APREN scenarios (6): Detailed in national hydrogen strategy; (7): Monitor Deloitte Scenarios for Spain and Portugal
 Source: Spanish and Portuguese NECPs, IEA, APREN, Portuguese Environment Agency, Monitor Deloitte

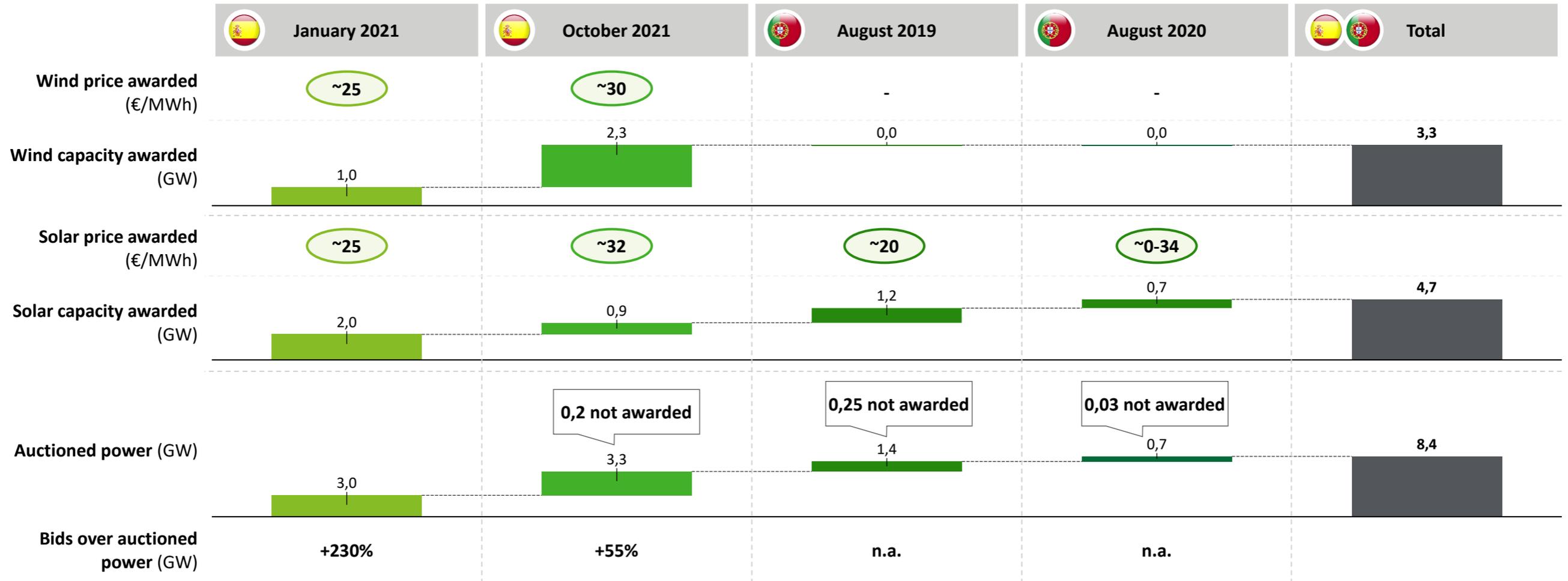
Electricity markets must provide an affordable energy supply, guarantee necessary firmness, secure system balance, and ensure integration with the European Internal Energy market



Source: Monitor Deloitte

1 ~8 GW of renewable energy have been awarded successfully in Iberia during the last 2 years, contributing to NEPC targets and long-term electricity price reduction

Renewables auctions results in the Iberian Peninsula

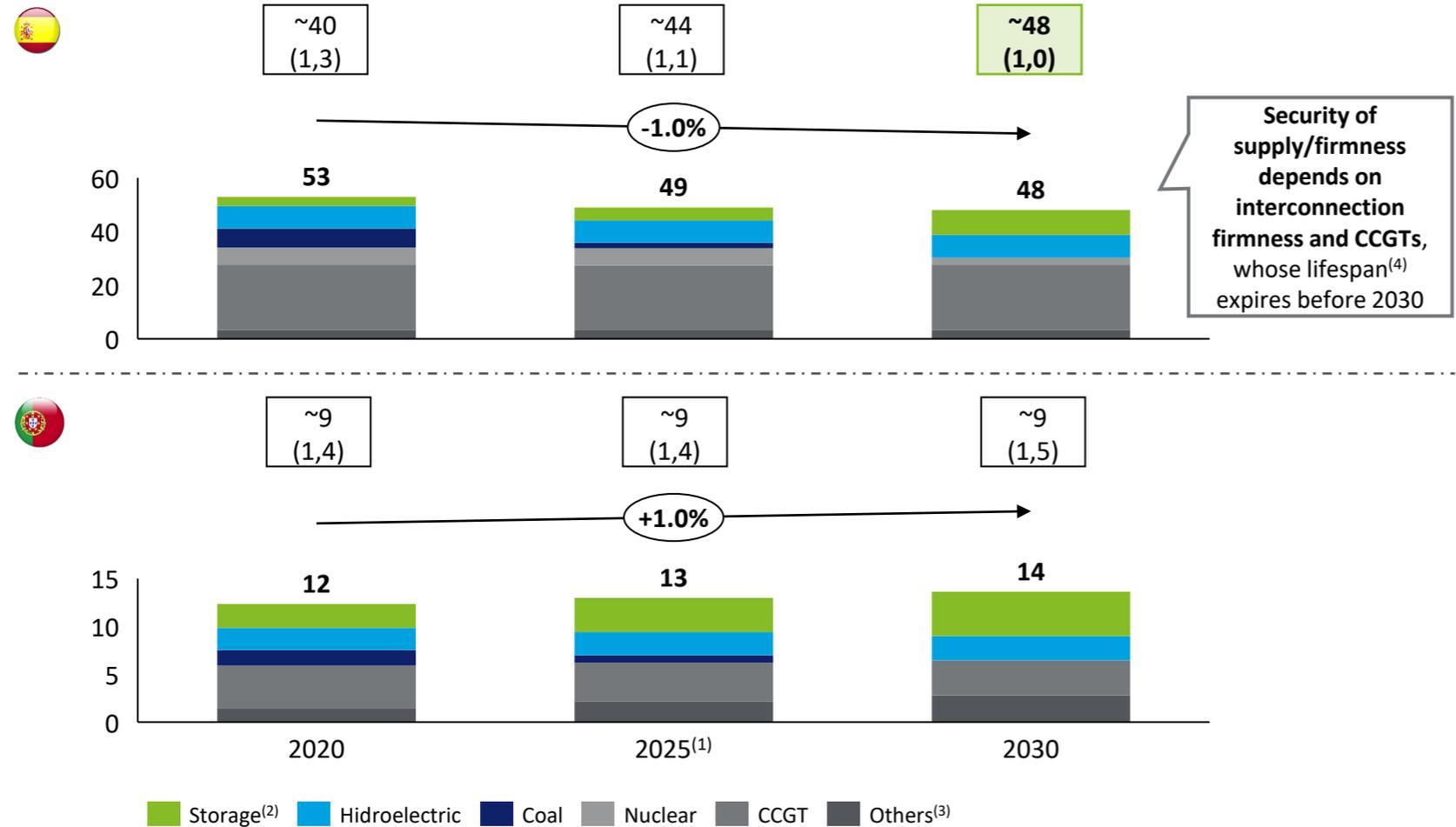


Increasing renewable penetration reduces long-term electricity prices, but also rises price and shape risks

Source: Spanish and Portuguese NECPs, IEA, APREN, Portuguese Environment Agency, Monitor Deloitte

2 Decommissioning of coal and nuclear may jeopardize coverage ratio in Spain, therefore capacity mechanisms should be developed to ensure firmness is rewarded; Portugal seems in good shape regarding firmness

Firm capacity, peak demand and coverage ratio evolution
(all in GW; peak demand and coverage ratio in boxes)



Security of supply/firmness depends on interconnection firmness and CCGTs, whose lifespan⁽⁴⁾ expires before 2030

- Power day-ahead-market prices do not offer an attractive outlook for firm capacity
- **Capacity mechanisms should be developed, in particular in Spain:**
 - **Spain: under development of a capacity market based on pay-as-bid auctions** (5 years period for primary auctions and 12 months period for adjustment auctions)
 - **Portugal: early implementer of a capacity market, which was discarded** as it was considered that there were no reason to subsidize the availability of power

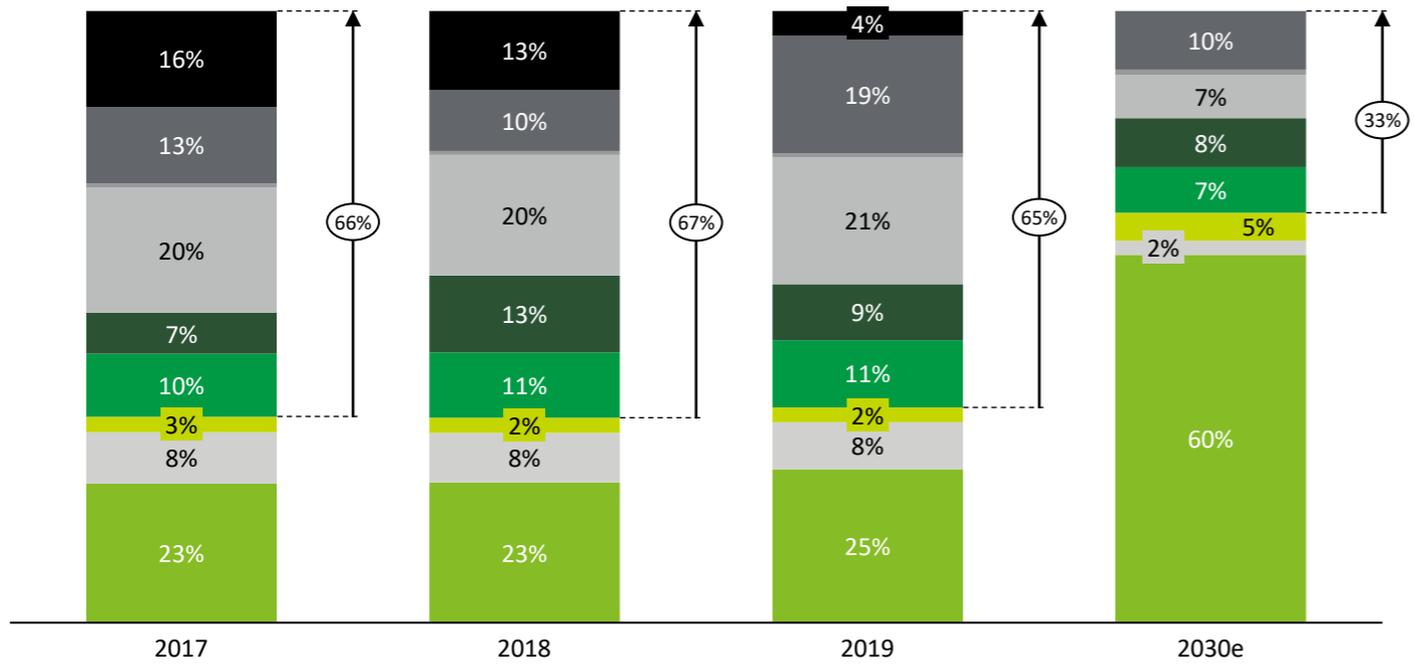
(1) Portuguese 2025 values correspond with average values from 2020 and 2030 available information; (2): Includes pump-storage and electric batteries; (3): It includes Biomass, Biogas, cogeneration, fuel oil (Portugal) and hydrogen (Portugal); (4) 25 years. About 11 GW were installed before 2005 (included in 1,2 coverage ratio)

Note: firmness: cogeneration (50%); Hydro Res (50%); CCGT (91%); Nuclear (88%); Coal (90%); No interconnection firm capacity due to high wind and solar correlation with neighbor countries

Source: Spanish NECP, Long-Term Strategy for carbon neutrality of the Portuguese economy by 2050; Monitor Deloitte

3 High levels of renewable penetration as those expected in 2020s create system operation challenges such as frequency control/reduce system inertia and flexibility needs

Spanish generation mix - Frequency control generation (%)



Implications

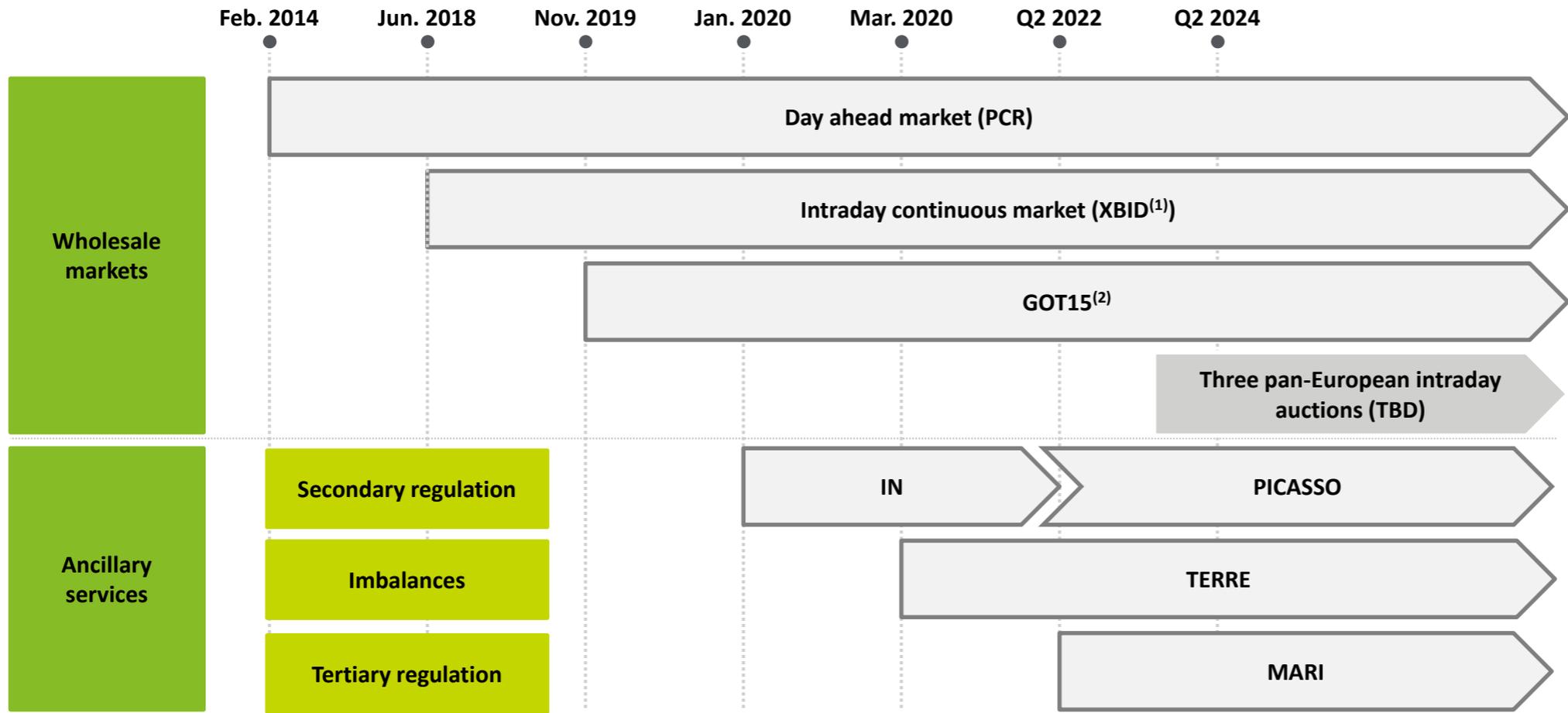
- **System operations will face different problems** in different time horizons:
 - **Milliseconds, seconds and minutes: Total system inertia will be reduced**, since large synchronous generators will represent a smaller part of the energy mix
 - **Hours, days, weeks: Renewable intermittency requires a much higher degree of demand flexibility**
- **In the supply side, System Operations will benefit from battery deployment and hybrid plants as renewable penetration grows**

Storage is not profitable with current market revenues and hybrid plants still don't have clear regulation in many countries, including Spain and Portugal

Source: Monitor Deloitte

4 EU 's planned market integration will impact price formation and negotiated volumes

Integration roadmap



Main implications

- **Wholesale market coupling (PCR, XBID) has reduced spot price differences** among member countries **and lowered price volatility**
- **XBID adds flexibility** to power system and **reduces real time ancillary markets reliance**
- **High interconnection capacity will mitigate price spikes** (both positive and negative) by aggregating generation and demand
- **Integration of ancillary services** among European countries will **increase competitive pressure, lowering captured price**

Increasing interconnections of Iberian Peninsula and rest of continental Europe and between Spain and Portugal is a must

Note: dates are current estimates and are subject to change; (1) Cross-border Intraday Market; (2) Gate Opening Time 15:00
 Source: OMIE, REE, EPEX

Implications

Explore hybrid projects opportunities (solar + wind + storage + other technologies)

Evolve energy management capabilities (long-term outlook, origination, risk management, etc.)

Increase **risk management focus on portfolio rather than project risk** and have the right data, tools, processes and team

Double-down on pro-active regulatory engagement to drive changes in wholesale power markets: hybrid, storage, firmness, ancillary services and others

Increase **investment in the power sector** involves **strict regulatory stability**

Do you want to know more? Don't hesitate to contact us

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Relevant Experience

- Expert in the energy transition, energy management and wholesale markets
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Relevant Experience

- Leads engagements across all areas in the Energy industry, with a focus on business model transformation strategies and regulatory issues
- Works with different industry stakeholders, including Governments, Regulators, Industry associations, Oil & Gas upstream and downstream, Power and Gas TSOs and DSOs and regulated and market retailers for Gas and Power



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