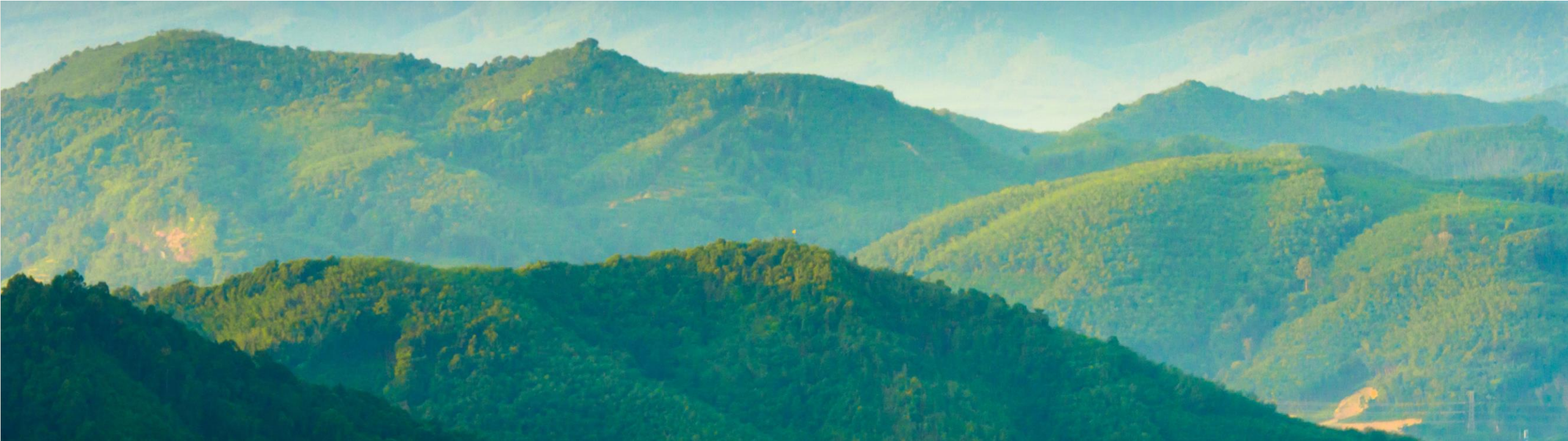


AFRY

ÅF PÖYRY



Renováveis ibéricas

29 de novembro 2023, Portugal Renewable Energy Summit

IGNACIO COBO, PRINCIPAL CONSULTANT AT AFRY MANAGEMENT CONSULTING

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| 1. Who we are | 4 |
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AFRY's Management Consulting is a leading global strategic advisor

- Leading provider of strategic, market, commercial, operational, regulatory and policy advice to clients in key energy markets in Europe, the Americas, Asia and the Middle East.
- Our analytical capability allows us to provide quantitative and qualitative advice with a wide range of services across the energy value chain.
- We have modelled and made projections of the whole European power system for our clients over two decades, with unparalleled software development and a network of country experts.
- ~450 management consultants of which more than ~250 are focused on the energy sector.
- Senior Experts with >30 years of work experience in the team.
- Specialists located across.
- 17 offices in 3 continents.



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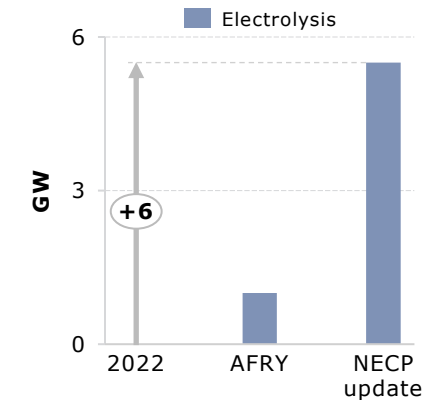
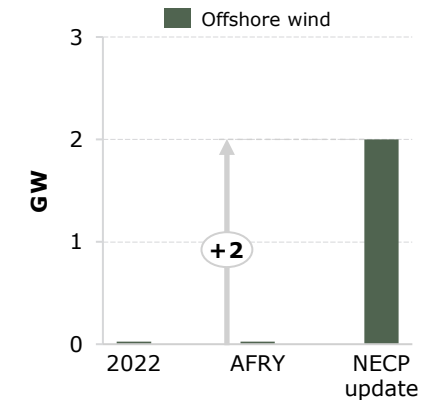
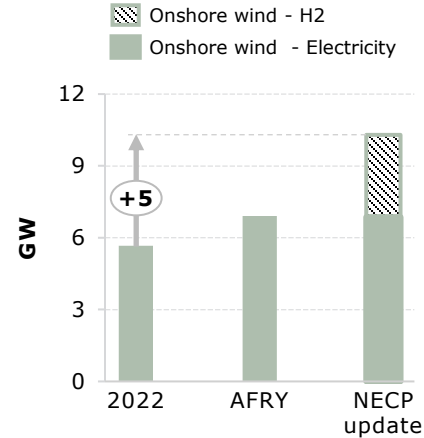
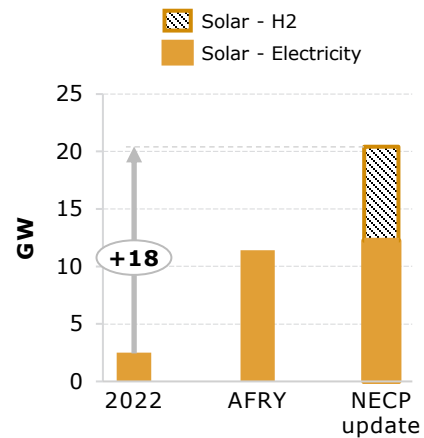




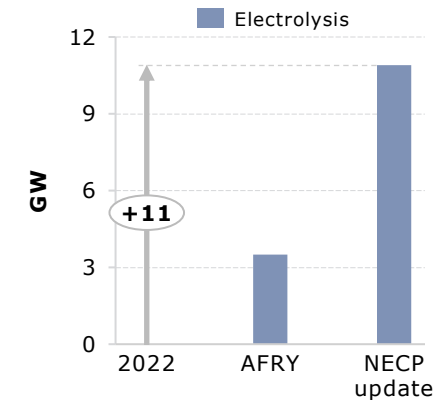
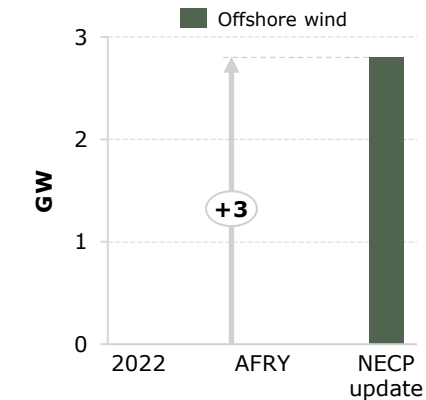
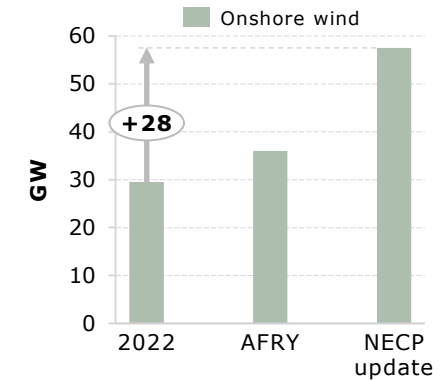
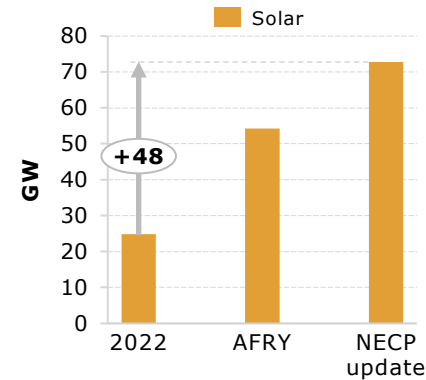
NECP TARGETS

Optimistic targets in terms of renewables have been announced for 2030 during 2023 for both Spain and Portugal

PORTUGAL



SPAIN



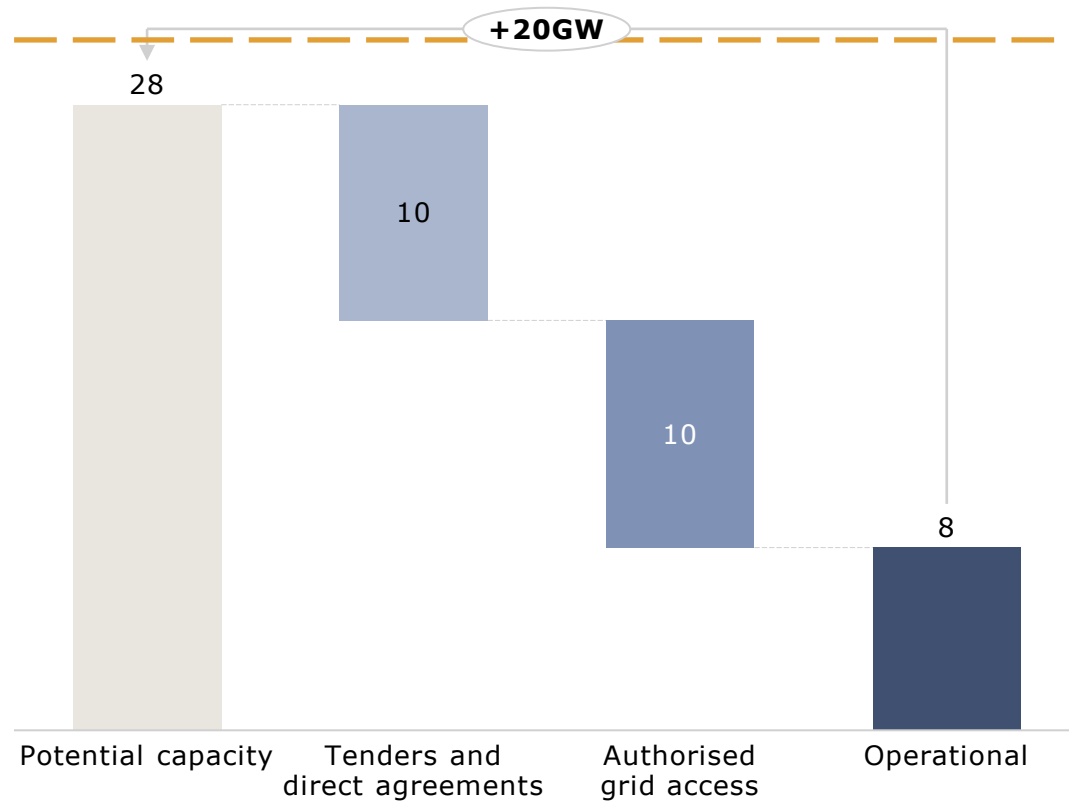
Sources: NECPs and AFRY



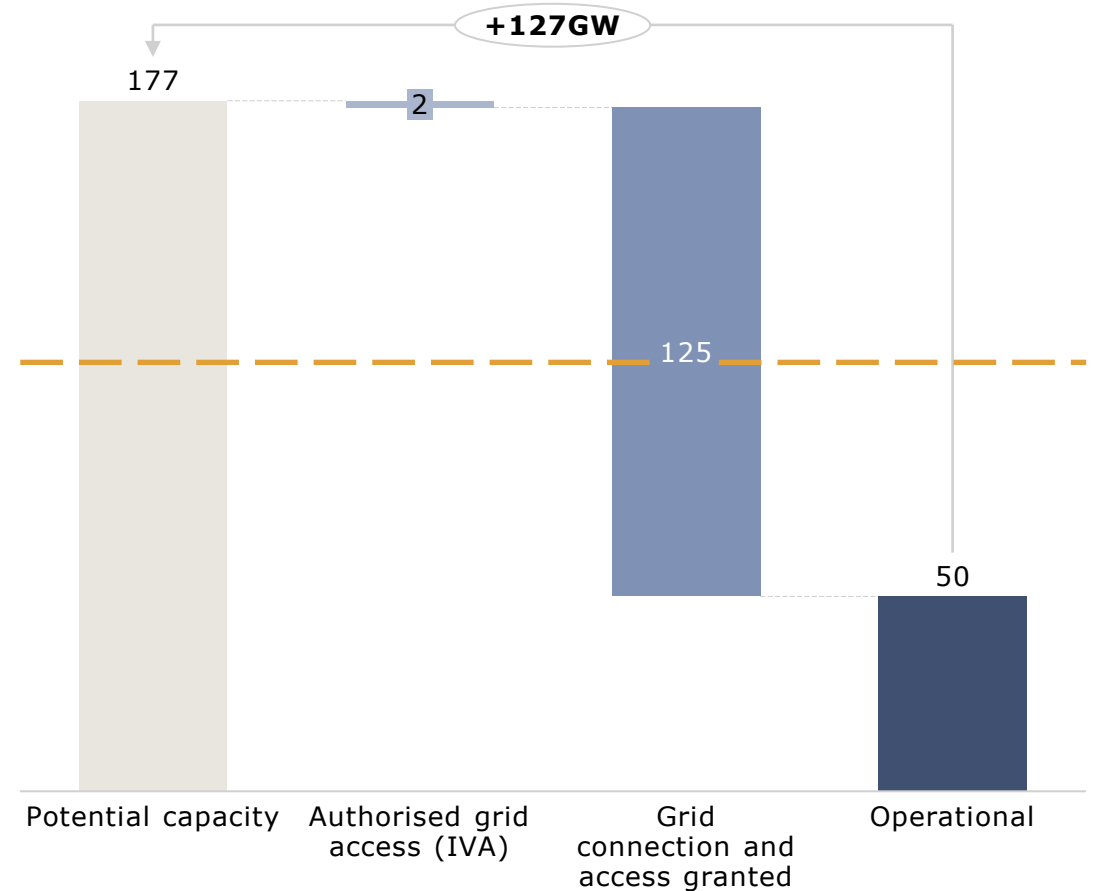
PIPELINE OF RENEWABLES

Investors' appetite, measured through the existing pipeline of renewables, seems in good health

PORTUGAL



SPAIN



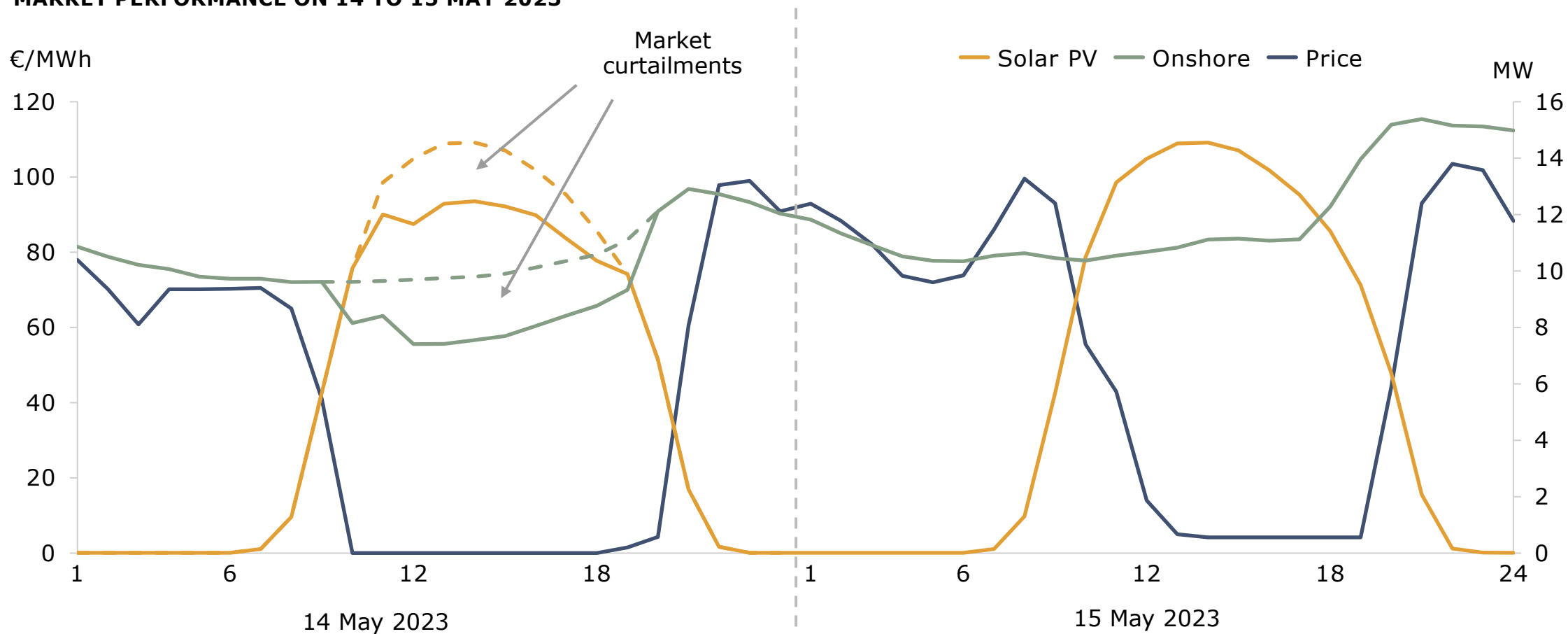
Sources: REN, REE and AFRY



MARKET CURTAILMENTS

The increasing renewable penetration without accompanying storage or demand, will result in increasing periods of market curtailments

MARKET PERFORMANCE ON 14 TO 15 MAY 2023



Sources: REE and AFRY

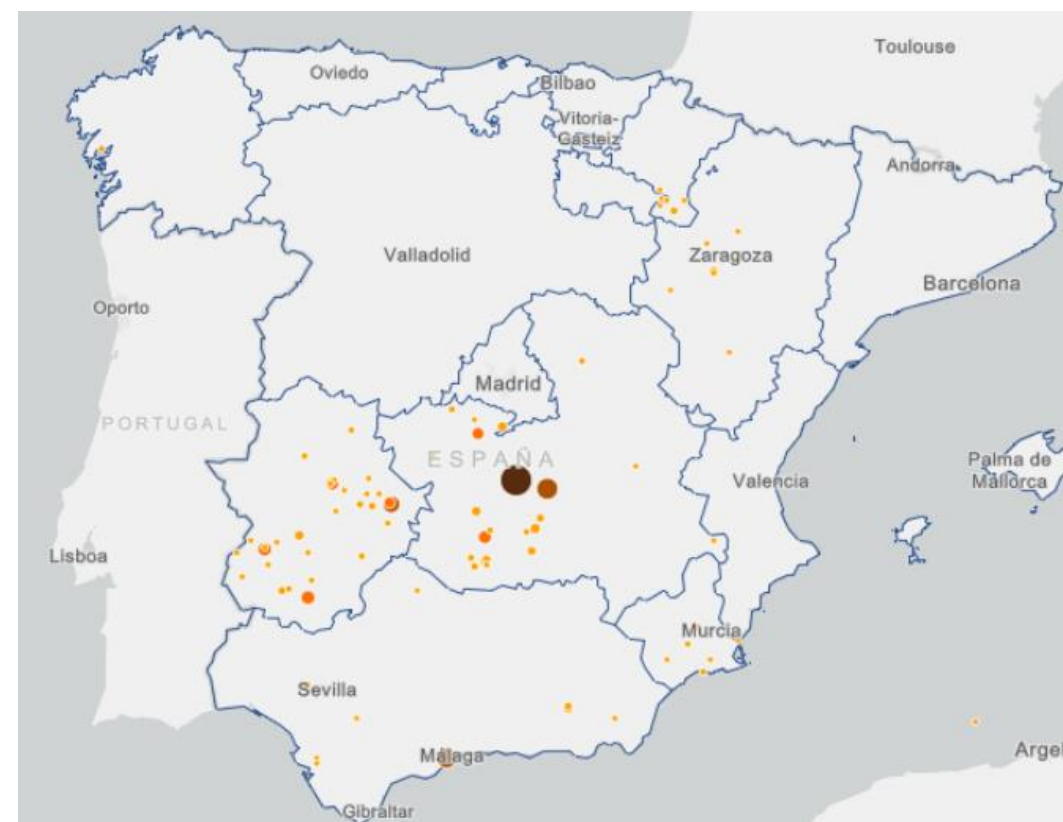
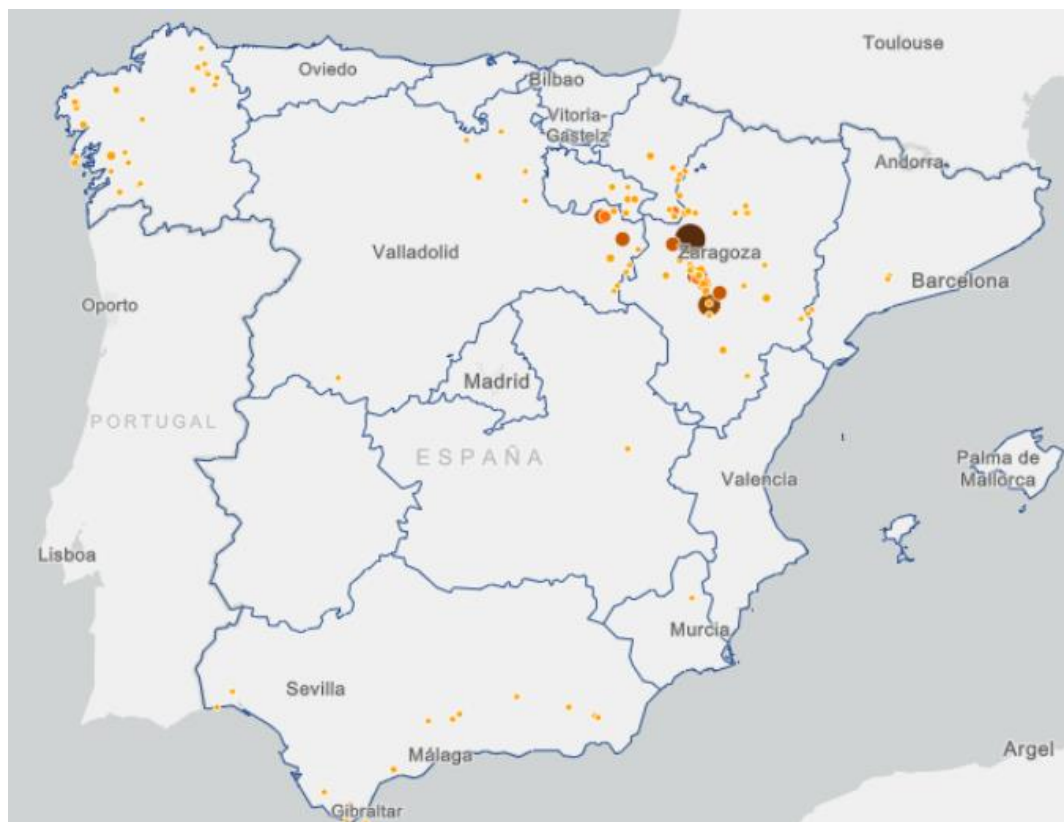


TECHNICAL CURTAILMENTS

Events of technical curtailments have been specially critical in Spain in 2022 and 2023, heavily impacting renewable projects

ONSHORE WIND PROJECTS CURTAILMENT OVERVIEW IN 2022¹

SOLAR PV PROJECTS CURTAILMENT OVERVIEW IN 2022¹



Note: 1) these volumes and the ones of the following slides corresponds to the plants identified by AFRY that account for the c.75% of the total technical restrictions in 2022
Sources: REE and AFRY

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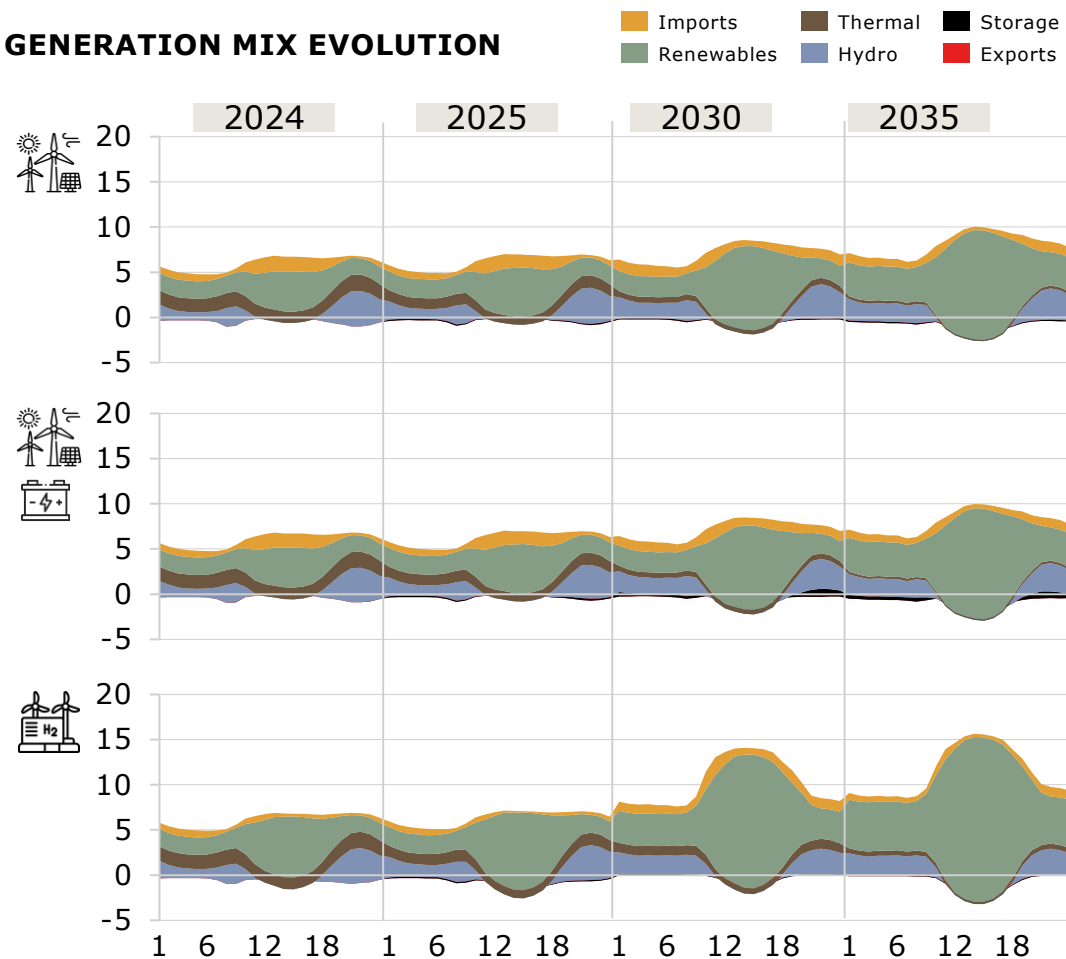




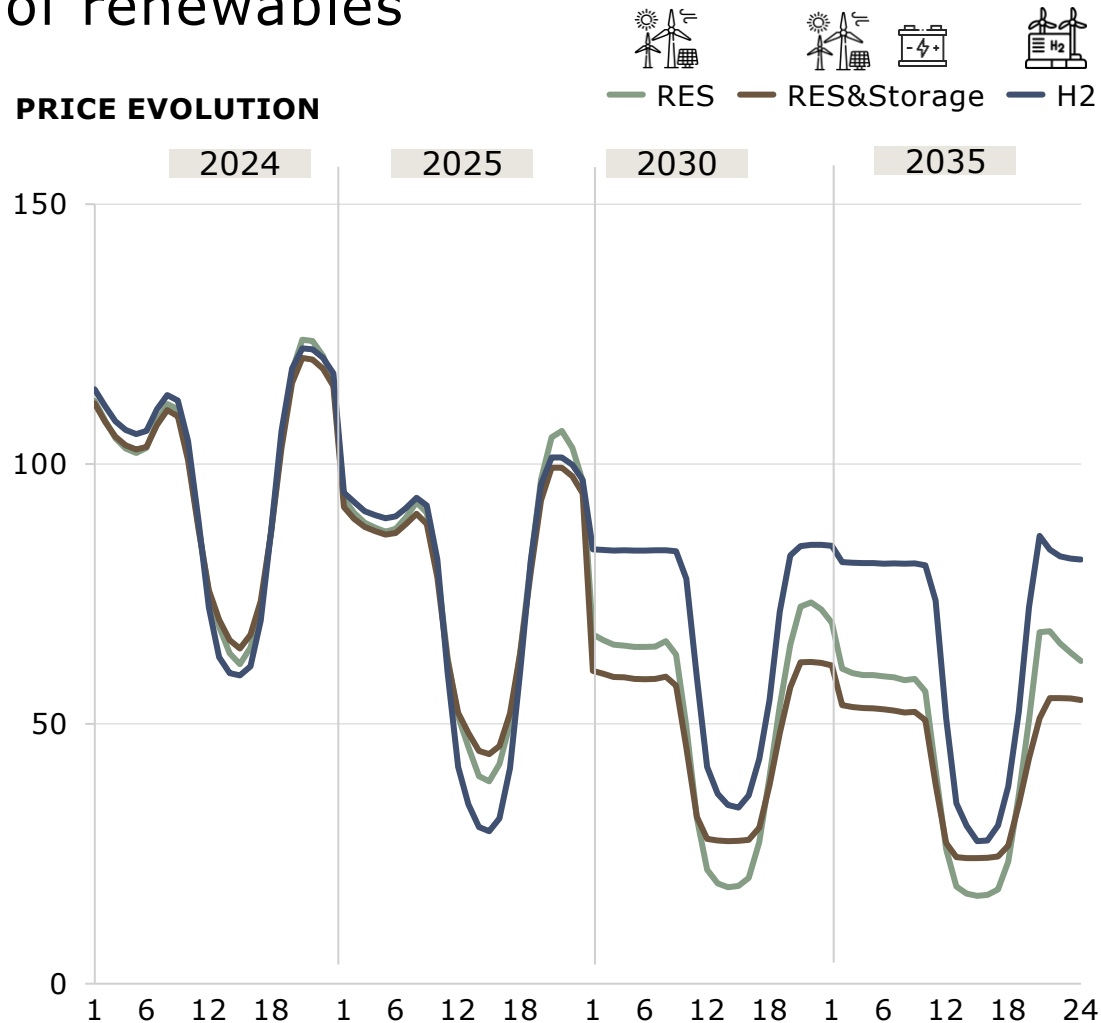
ILLUSTRATION OF DAY-AHEAD RESULTS

The consecution of the NECPs will involve several complexities that will need to be tackled to integrate vast amounts of renewables

GENERATION MIX EVOLUTION



PRICE EVOLUTION



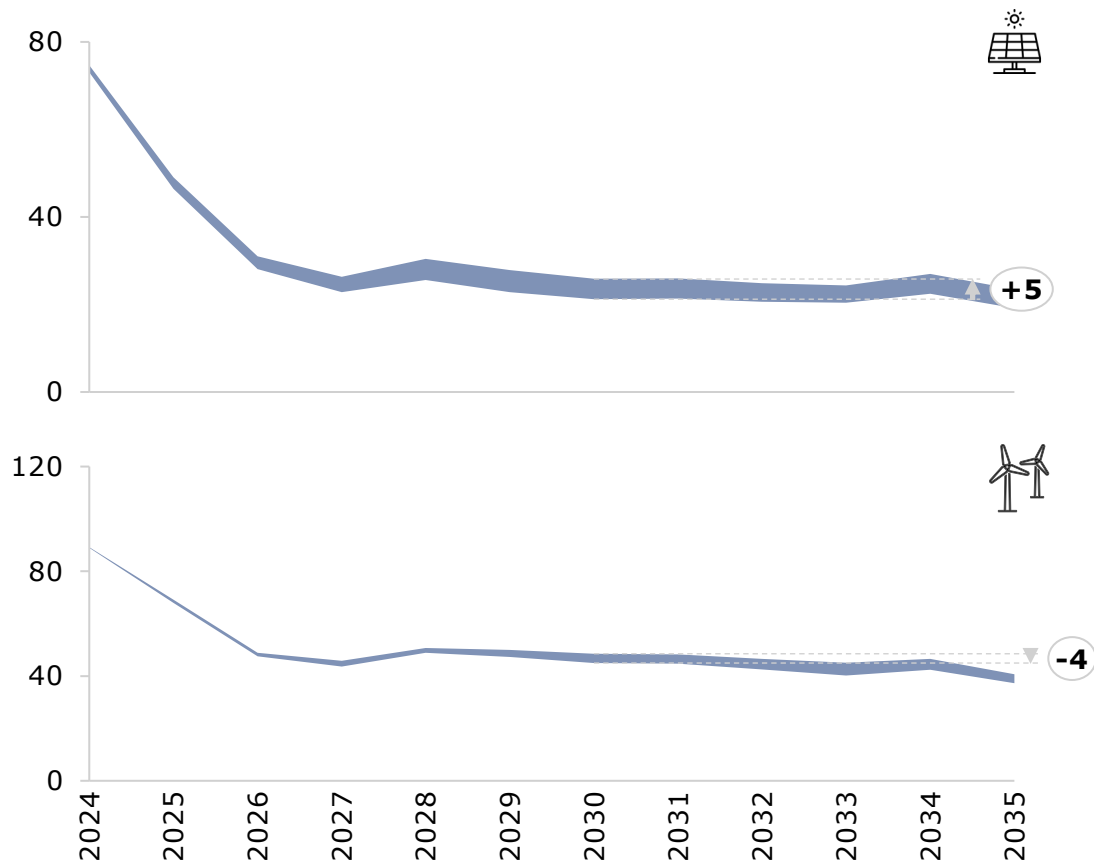
Source: AFRY



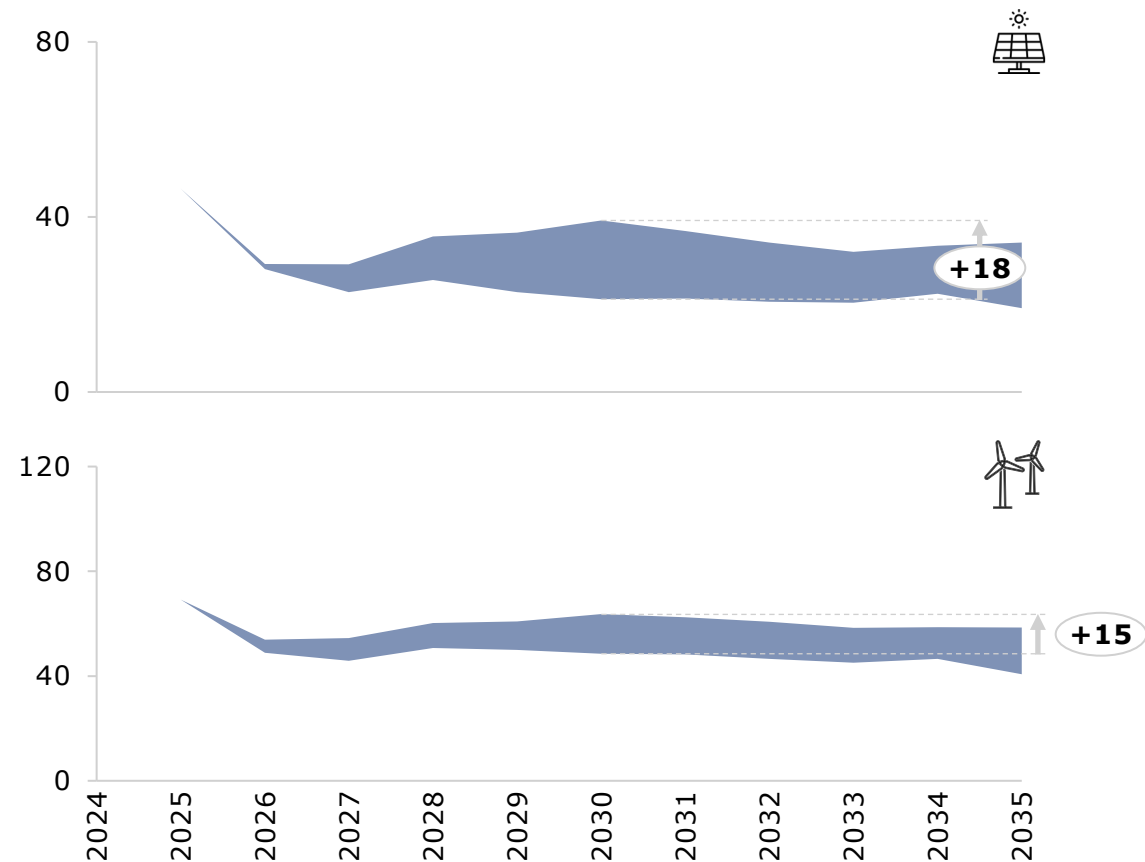
CAPTURE PRICE PROJECTIONS

In a scenario with high presence of renewables, captured prices would collapse without either storage or electrolysis

IMPACT OF STORAGE



IMPACT OF ELECTROLYSIS



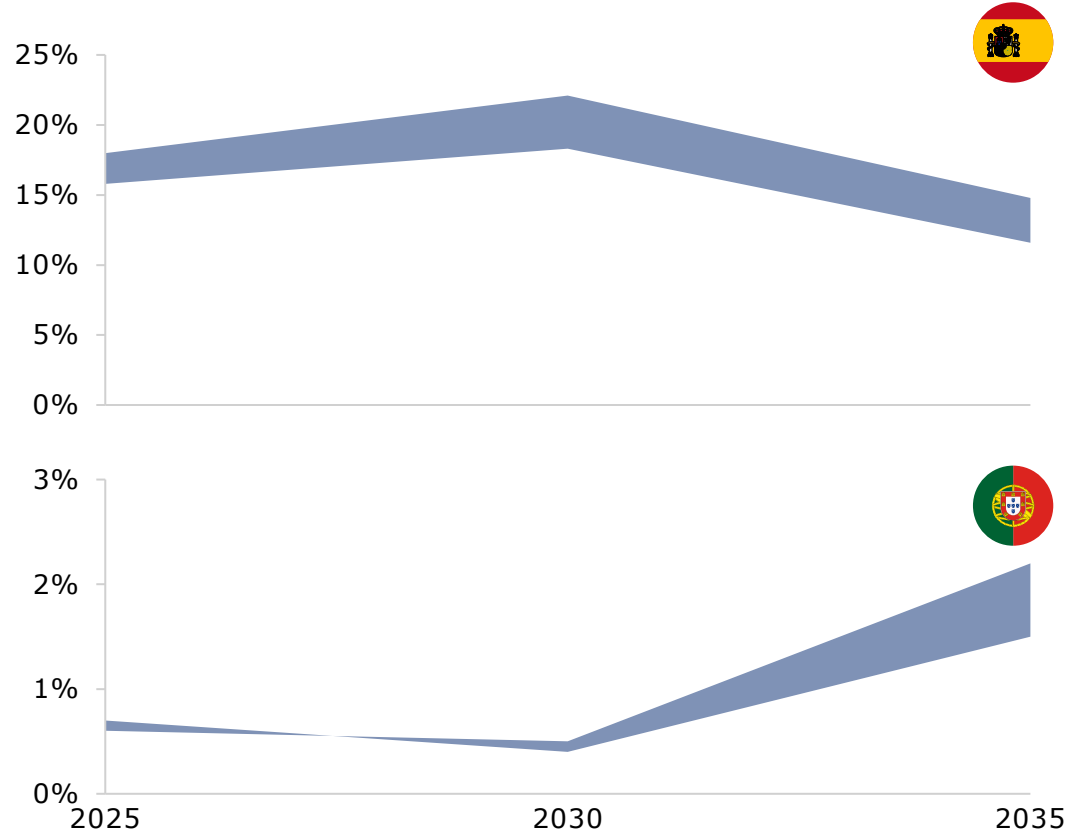
Source: AFRY



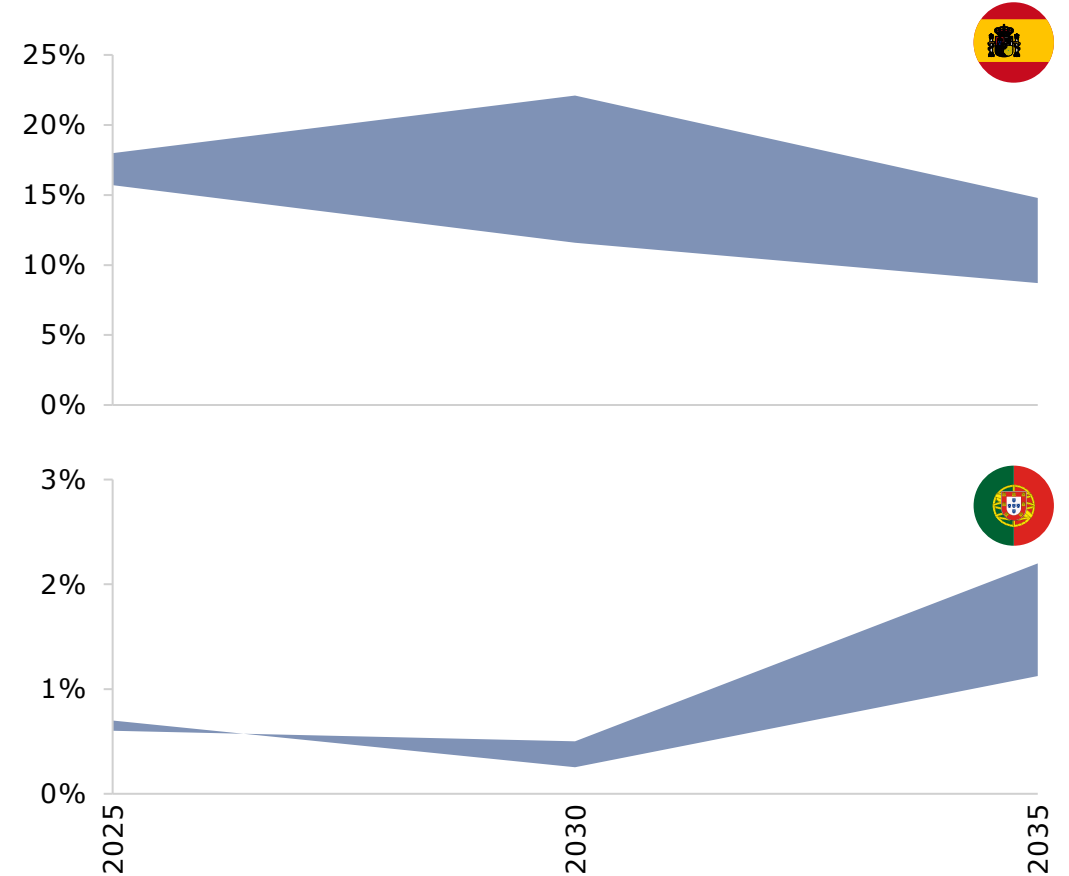
MARKET CURTAILMENT PROJECTIONS

In a scenario with high presence of renewables, captured prices would collapse without either storage or electrolysis

IMPACT OF STORAGE

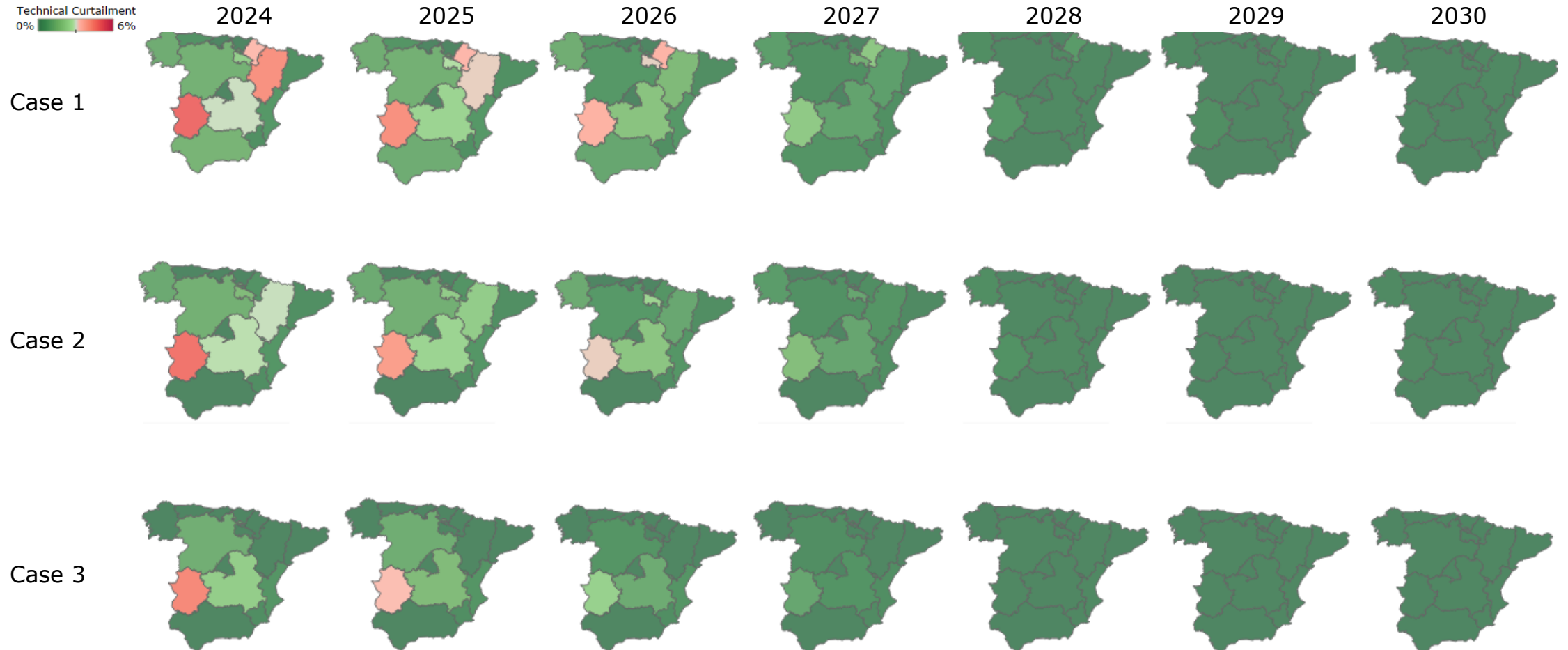


IMPACT OF ELECTROLYSIS



TECHNICAL CURTAILMENT PROJECTIONS

A careful planning of the network and the node allocation process, plus locational signals for demand, would solve technical curtailment issues



Source: AFRY

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Flexible assets such as storage or electrolysers must be carefully analysed in a system with very high levels of renewable pipelines



- In a scenario of a high deployment of renewables, the **cannibalisation** that will appear in the market will likely affect **unhedged and PPA assets**. As a result, **deployment of renewables** in such scenario will most likely be exclusively under **CfD** or similar schemas.
- That scenario may require from **sophisticated analysis** to correctly balance each generation portfolio and **diversify or minimise risk** and impacts on merchant assets.



- Very high amount of **additional storage** (e.g., batteries, pump storage or electrolysis) will be **needed to sustain large renewable developments**. AFRY demonstrated that in Spain¹, more storage than the one targeted in the NECP or the one needed for security of supply can result in benefits for the end-user.
- A careful strategy and **roadmap for the deployment of storage** must be carefully drafted, in order to assure that the **social welfare is maximized**.



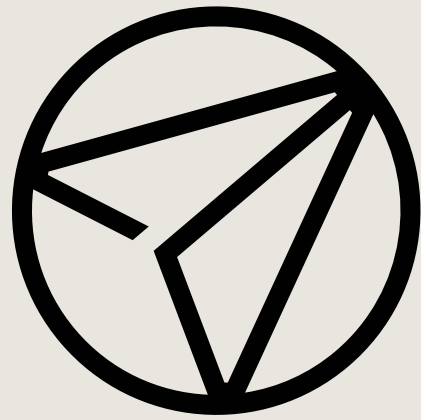
- A correct and timely design of the **transmission network is key to minimise additional technical risks** for renewable projects. Furthermore, **assessing the risks and upsides of each location** will become increasingly important for new developments.
- Aspects such as **ancillary services** and their evolution, and the increasing participation of renewables in them will play a key role for assets to stack **additional value**.

Note: 1) <https://afry.com/en/newsroom/news/afry-and-11-companies-explore-economics-storage-and-regulatory-options-reach>

Contacts

Ignacio Cobo
Principal Consultant
+34 611 481 021
ignacio.cobo@afry.com





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ÅF PÖYRY