

AFRY MANAGEMENT CONSULTING
A evolução do preço da eletricidade no
mercado ibérico





Disclaimers

AFRY's disclaimers and rights

This report has been prepared by AFRY Management Consulting Ltd ("AFRY") solely for use by the clients (the "Recipients"). All other use is strictly prohibited and no other person or entity is permitted to use this report, unless otherwise agreed in writing by AFRY. By accepting delivery of this report, the Recipient acknowledges and agrees to the terms of this disclaimer.

NOTHING IN THIS REPORT IS OR SHALL BE RELIED UPON AS A PROMISE OR REPRESENTATION OF FUTURE EVENTS OR RESULTS. AFRY HAS PREPARED THIS REPORT BASED ON INFORMATION AVAILABLE TO IT AT THE TIME OF ITS PREPARATION AND HAS NO DUTY TO UPDATE THIS REPORT.

AFRY makes no representation or warranty, expressed or implied, as to the accuracy or completeness of the information provided in this report or any other representation or warranty whatsoever concerning this report. This report is partly based on information that is not within AFRY's control. Statements in this report involving estimates are subject to change and actual amounts may differ materially from those described in this report depending on a variety of factors. AFRY hereby expressly disclaims any and all liability based, in whole or in part, on any inaccurate or incomplete information given to AFRY or arising out of the negligence, errors or omissions of AFRY or any of its officers, directors, employees or agents. Recipients' use of this report and any of the estimates contained herein shall be at Recipients' sole risk.

AFRY expressly disclaims any and all liability arising out of or relating to the use of this report except to the extent that a court of competent jurisdiction shall have determined by final judgment (not subject to further appeal) that any such liability is the result of the willful misconduct or gross negligence of AFRY. AFRY also hereby disclaims any and all liability for special, economic, incidental, punitive, indirect, or consequential damages. Under no circumstances shall AFRY have any liability relating to the use of this report in excess of the fees actually received by AFRY for the preparation of this report.

All information contained in this report is confidential and intended for the exclusive use of the Recipient. The Recipient may transmit the information contained in this report to its directors, officers, employees or professional advisors provided that such individuals are informed by the Recipient of the confidential nature of this report. All other use is strictly prohibited.

All rights (including copyrights) are reserved to AFRY. No part of this report may be reproduced in any form or by any means without prior permission in writing from AFRY. Any such permitted use or reproduction is expressly conditioned on the continued applicability of each of the terms and limitations contained in this disclaimer.

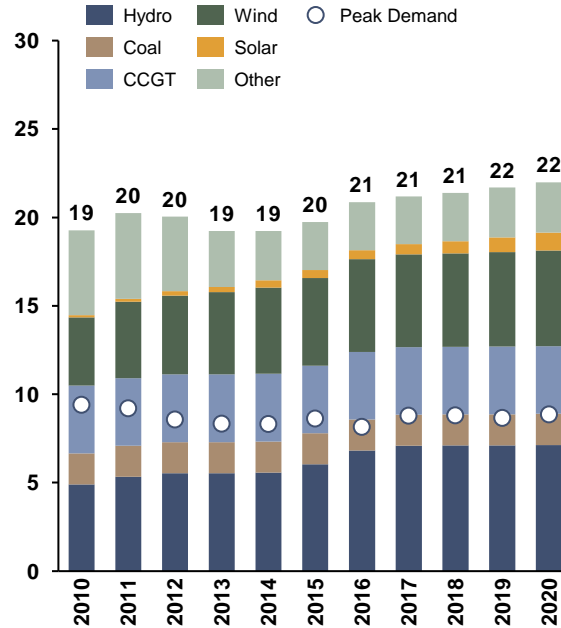


**Current
market
conditions**

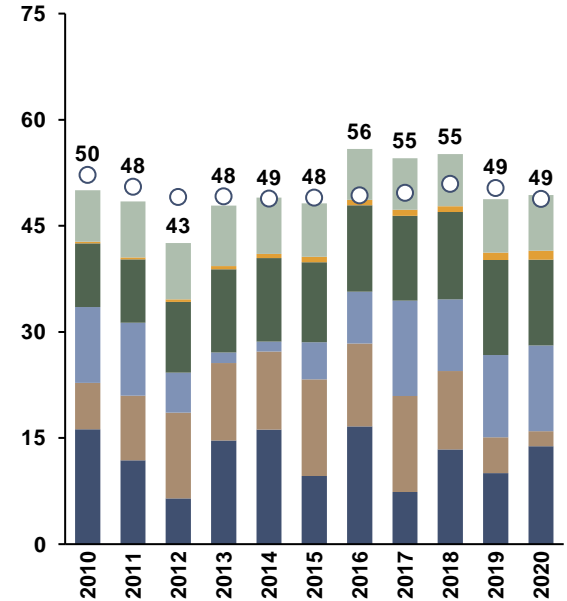
Portugal

Historical Generation capacity mix & demand levels

INSTALLED CAPACITY & PEAK DEMAND (GW)



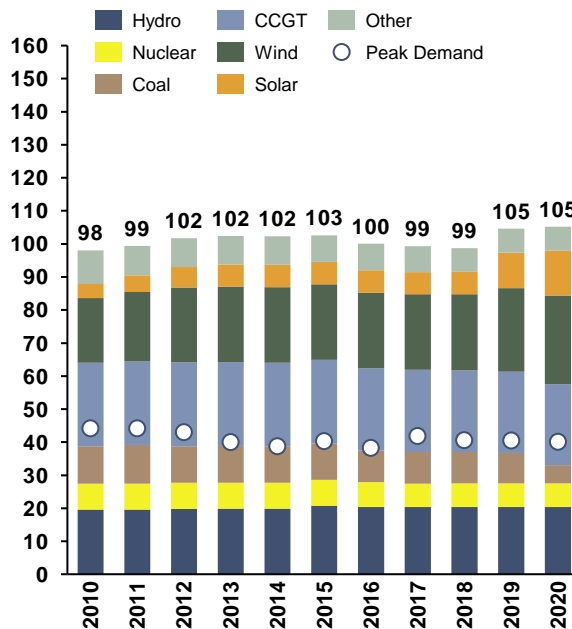
ELECTRICITY GENERATION & ANNUAL DEMAND LEVELS (TWH)



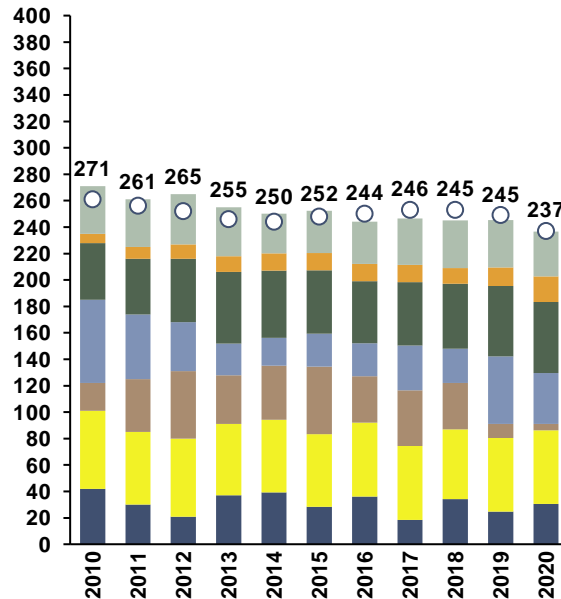
Spain

Historical Generation capacity mix & demand levels

INSTALLED CAPACITY & PEAK DEMAND (GW)



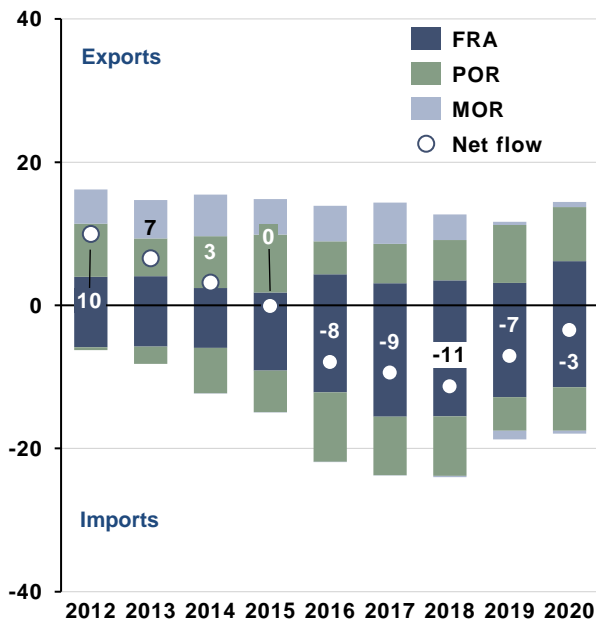
ELECTRICITY GENERATION & ANNUAL DEMAND LEVELS (TWH)



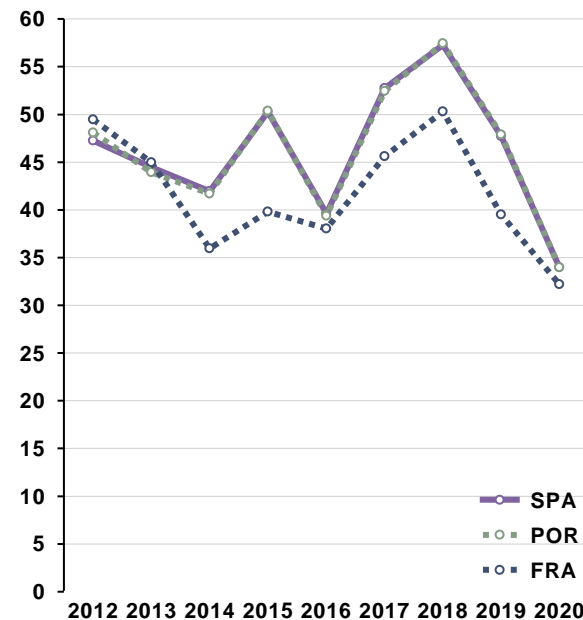
Interc. Flows Iberia

Interconnection flows & day-ahead market prices across selected markets

INTERCONNECTION FLOWS (TWH)



DAY-AHEAD PRICES (€/MWH)

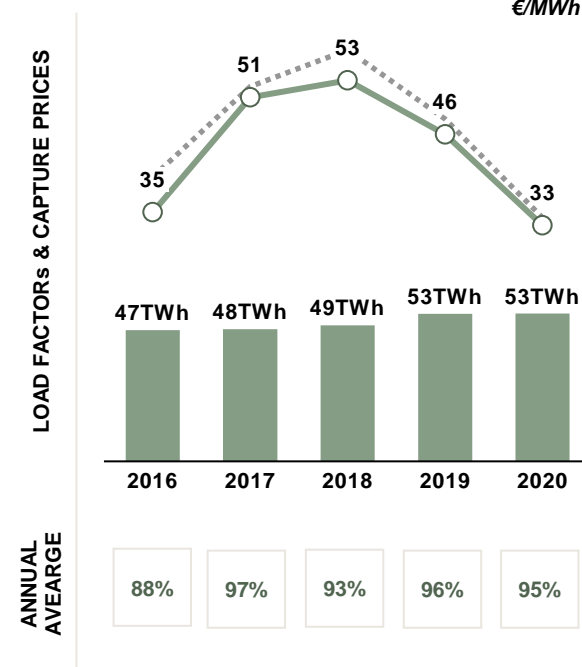


Sources: REN, REE, OMIE and EPEX

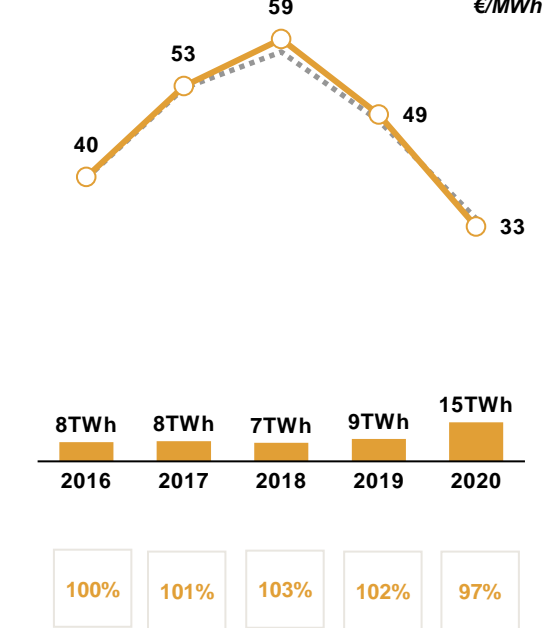
Spain

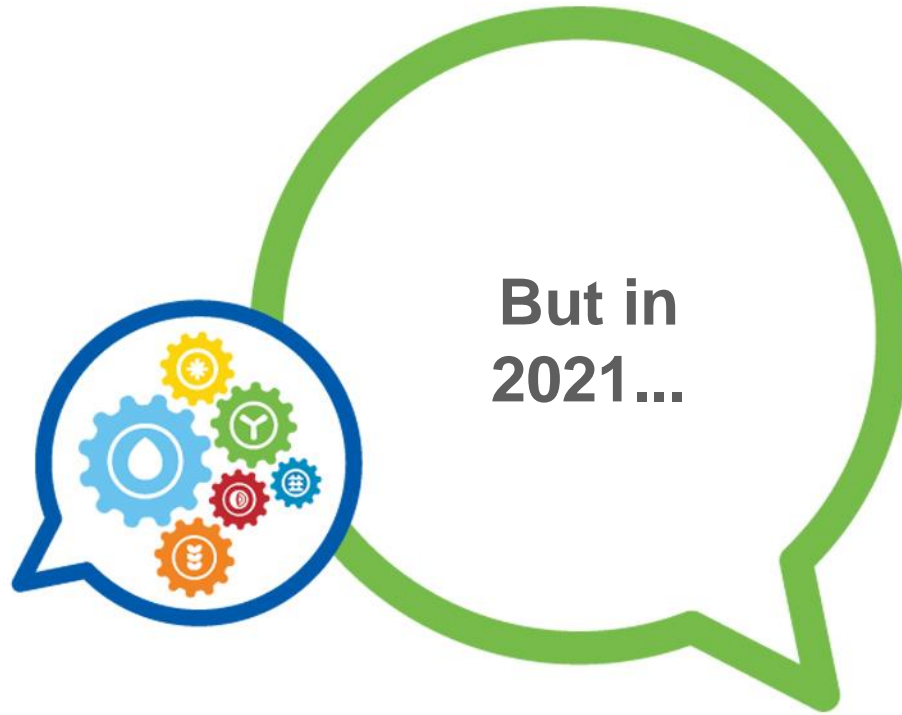
Evolution of RES generation levels & capture prices

ONSHORE WIND



SOLAR PV

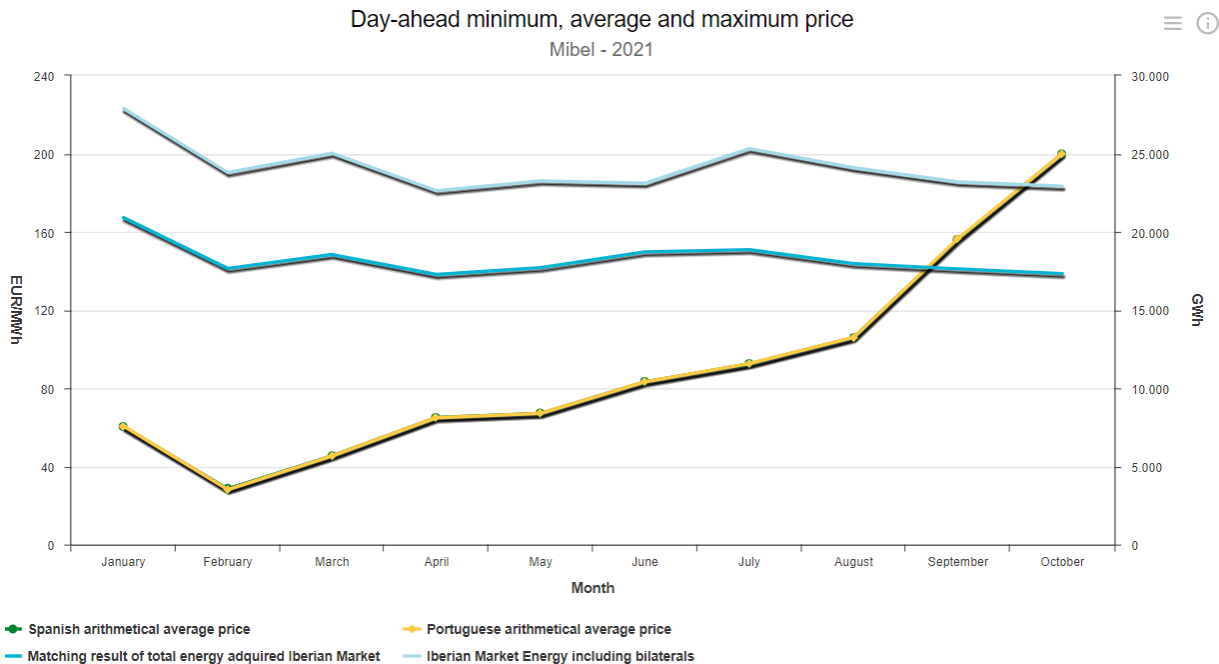




**But in
2021...**

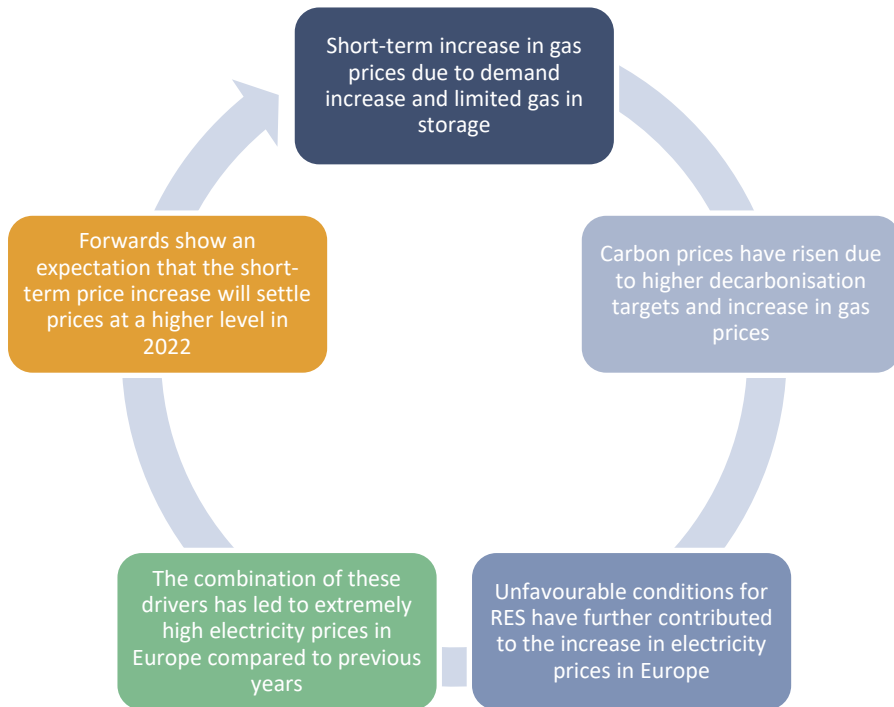
Crazy prices!

Current market conditions have led to record high prices in electricity markets



Which are
the
reasons?

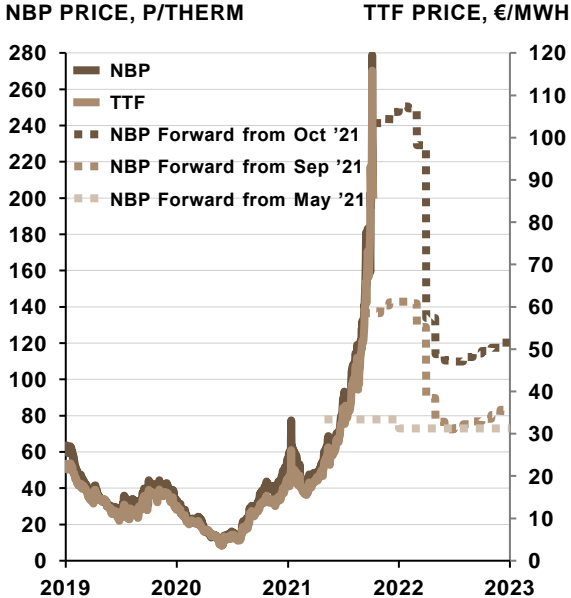
Unprecedented high levels of electricity prices in Europe are due to high commodity prices as well as unfavourable conditions for RES



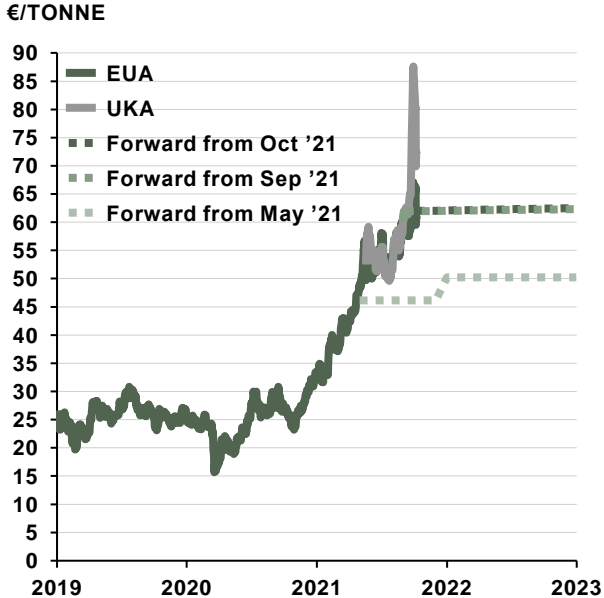
Gas and carbon markets

A combination of high demand, low storage and tighter decarbonisation targets have increased the price expectations for gas and CO₂

GAS FUTURES



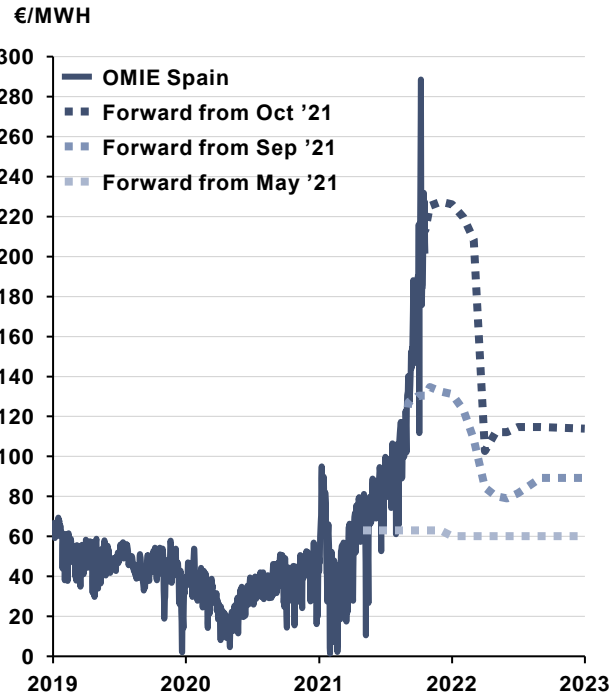
CARBON FUTURES



Sources: ICE and EEX
Note: forwards extracted in mid October 2021

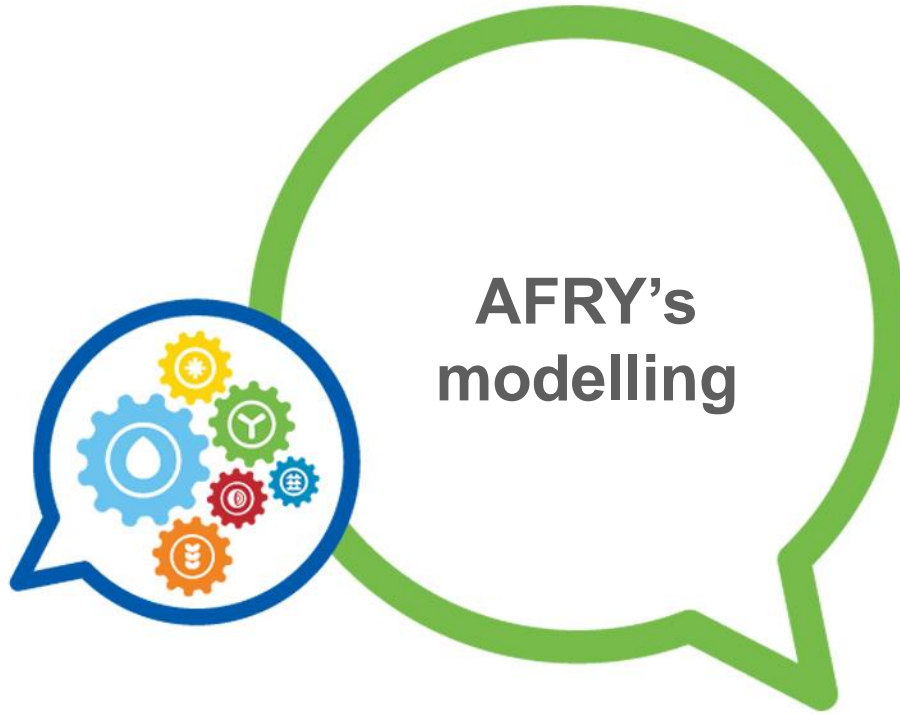
Spanish electricity futures

High gas and carbon prices coupled with high demand and low RES generation has increased electricity prices and forward prices



KEY DRIVERS	IMPACT*
High gas prices	35%
High carbon prices	15%
Covid-19 recovery	10%
Summer heat waves	15%
Market expectation	10%

* This shows the indicative magnitude of the key price drivers (does not add up to 100% as there are other price drivers).
Sources: OMIE and EEX
Note: forwards extracted in mid October 2021



**AFRY's
modelling**

AFRY's modelling

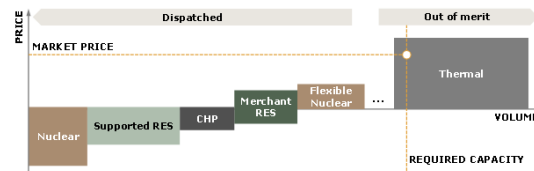
BID3, AFRY's market leading optimisation software

1. BID3 PROJECTS PHYSICAL OPERATION AND ECONOMIC BEHAVIOUR OF ALL PLANT TYPES

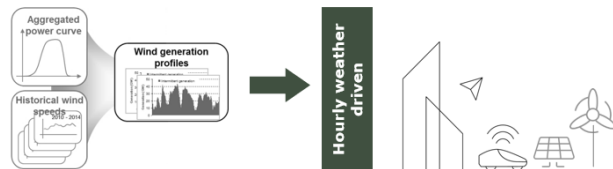
- Cost optimising electricity market dispatch model – optimisation on an **hourly basis out to 2060**.
- Optimal **regional power flows** subject to transmission constraints.
- Comprehensive modelling of **thermal plant dynamics**.



2. COST BASED DISPATCH WITH COMPLEX THERMAL PLANT DYNAMICS & ADDITIONAL SCARCITY PRICING



3. MULTIPLE HISTORIC WEATHER PATTERNS DETERMINE HOURLY RES GENERATION & DEMAND



4. DETAILED STORAGE & HYDRO MODELLING OPTIMISES RESERVOIRS AND STORAGE DISPATCH

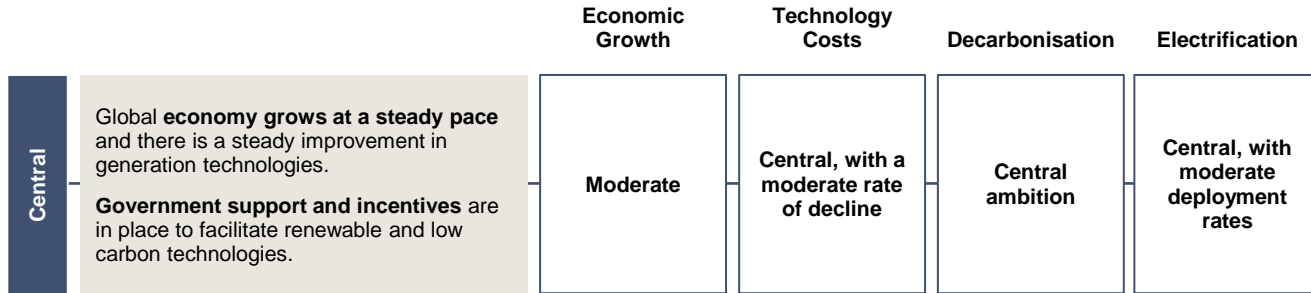
- Multi-stage optimisation captures **physical limits/ decisions on storage & reservoir hydro**.
- Detailed weekly simulation to **optimise storage charging, pumping & generation**.



Approach allows detailed analysis of asset specific dispatch profile, revenues and generation-weighted prices across AFRY standard and bespoke scenarios for both thermal and RES assets

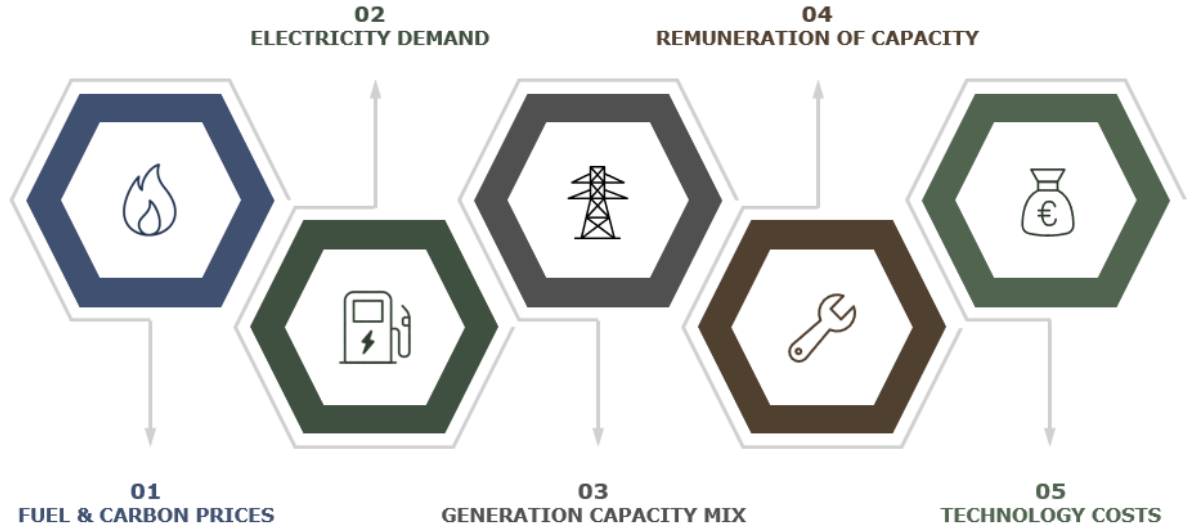
AFRY's scenarios

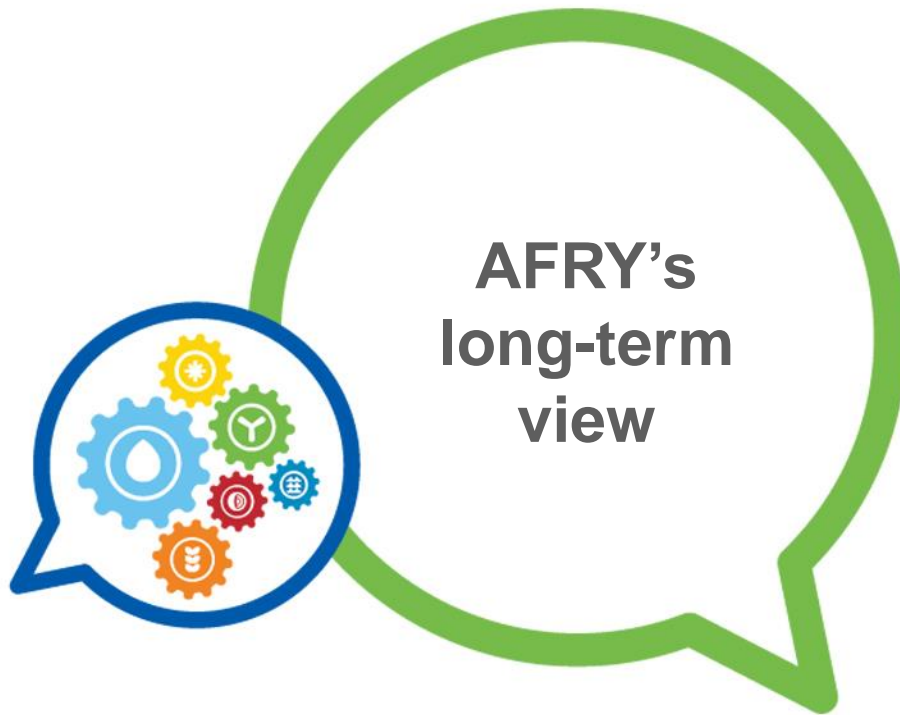
Scenario framework & our four key scenario drivers



AFRY's
drivers

Principal drivers of electricity price projections





**AFRY's
long-term
view**



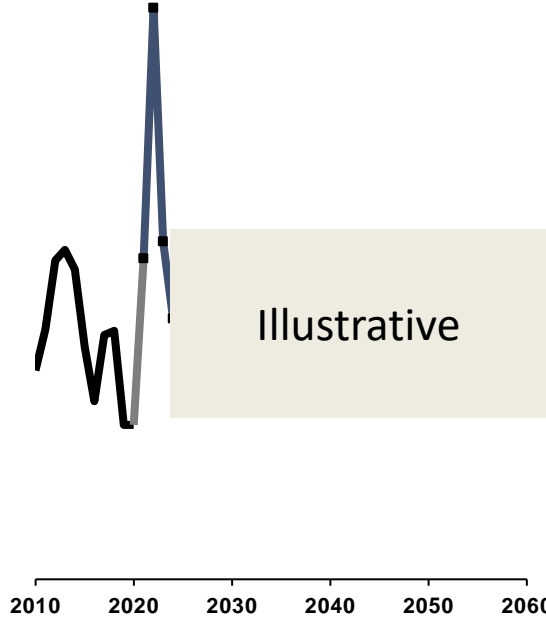
Fuel prices



Estabilization of gas prices and increasing carbon prices as a result of tighter decarbonisation targets

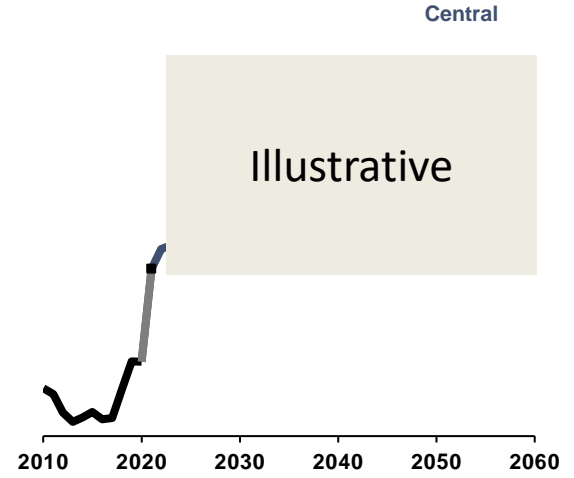
GAS, €/MWH

—■— YTD + forwards



CARBON, €/TONNE

—■— YTD + forwards



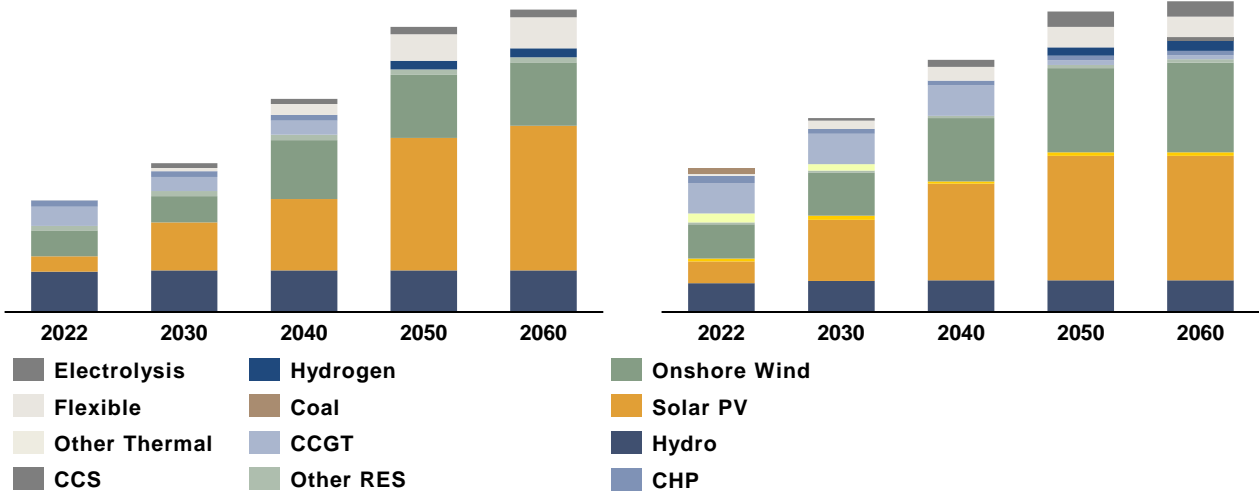
Capacity,
generation
& demand



Increasing renewable deployment, alongside flexible technologies

PORTUGAL

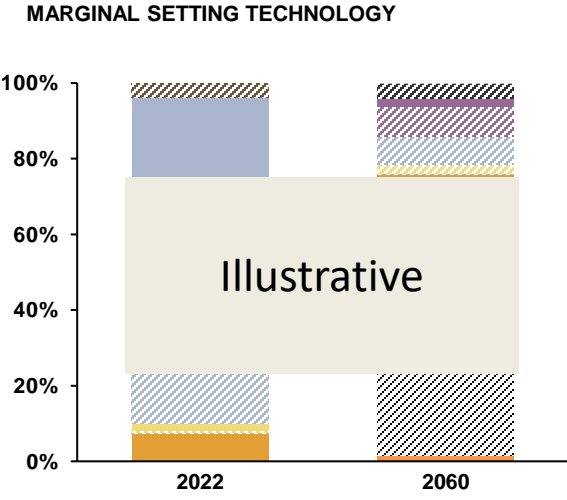
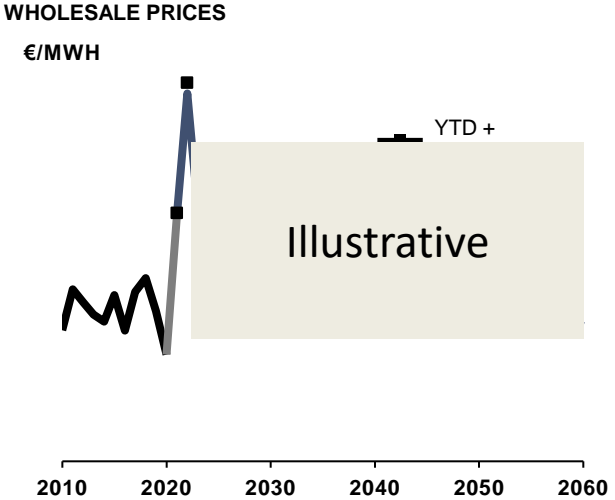
SPAIN



Wholesale prices in Iberia



Stabilization of wholesale prices and offset of increasing commodities due to the increasing RES



- | | | | | |
|---------------|----------------|---------|------------------|--------------|
| Demand | CCS | CCGT | Nuclear | Electrolysis |
| Demand | Hydrogen | CCGT | Other RES | Electrolysis |
| Other thermal | Hydrogen | CHP | Other RES | Other |
| Other thermal | Coal & Lignite | CHP | Wind or Solar PV | Other |
| CCS | Coal & Lignite | Nuclear | Wind or Solar PV | |

What to do then?

We are entering in an uncertain era for renewables, and understanding, assessing and mitigating risks will be key

HYBRIDISATION



PORTFOLIO DIVERSIFICATION



RISK MANAGEMENT TOOLS





Ignacio Cobo
Principal Consultant at AFRY

ignacio.cobo@afry.com

+34 611 481 021





APREN Associação
de Energias
Renováveis

www.apren.pt