

CURSO EJECUTIVO TRANSICIÓN ENERGÉTICA EN ESPAÑA 2024

TÍTULO: The Energy Transition: Global, European and Spanish perspective

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Executive Summary

- 1 Energy Transition has **slowed down globally**, and even in the most optimistic scenario **global emissions** remain **above a 1.5° pathway**
- 2 Spain has a **privileged position to lead** energy transition in Europe and has a good **starting point to reindustrialize**
- 3 If we overcome the existing challenges, energy transition could have a **substantial positive impact** on the **Spanish society**

Key trends in Energy in 2023

Synthesis of the key statistics in 2023



In 2023, global emissions reached new record level as fossil fuel demand is at an all time high...

- 2023 was the first year where global temperatures were ~1.5°C above pre-industrial levels as global CO₂ emissions reached an all-time high
- Fossil fuel demand reached new record level as:
 - Coal demand exceeded 8,500 Gt for first time
 - Oil surpassed its pre-COVID peak at 101.7 MMb/d
 - And Natural Gas returned to growth



...simultaneously, 2023 was a record year in low-carbon technology deployment, with investments exceeding fossil by 60%...

- Renewable investments increased by 8% to an all-time high of 1,740 bn USD, driven by renewables (+63 bn USD), Electric vehicles (+34 bn USD) and battery storage (+16 bn USD)
- Investments in fossil fuels grew for the 3rd consecutive year, but remained below 2015 values – majority still in Upstream O&G



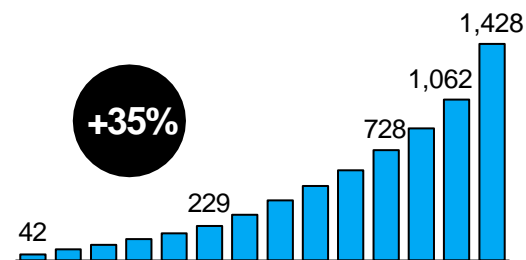
...where China continued to lead as two-thirds of all new EVs, Solar panels, and Wind turbines was added in China

- Global EV sales surpassed 13.7mln last year, especially driven by China where 1 in every 4 new sold cars is electric
- Renewable capacity increased by 24% globally reaching ~2.5TW of installed capacity in 2023 with China contributing to 60% of global solar and 70% of global wind expansion

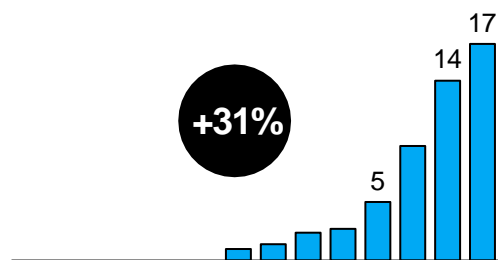
Investment in low-carbon technologies continued to grow in 2023 ...

Investment into low-carbon technologies was **\$1,740 billion** in 2023

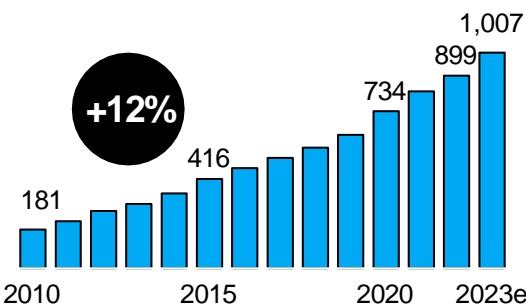
Solar capacity
GW



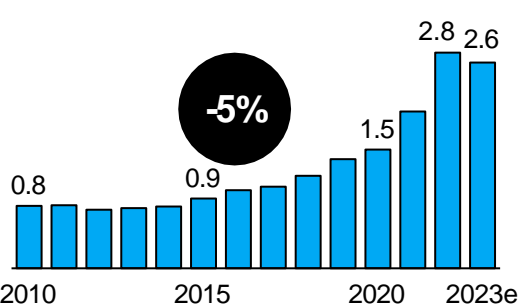
EV sales
%



Wind capacity
GW



Heat pump sales Europe¹
Millions



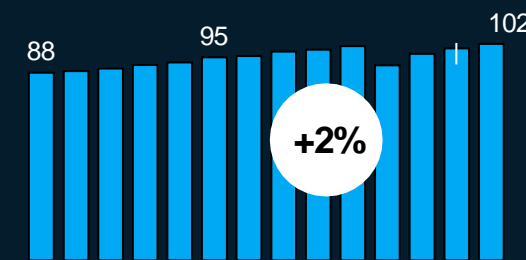
1. EU 21
2. Gross energy related CO2-emissions excluding process emissions

... alongside a persistent demand in fossil fuels and increase in emissions

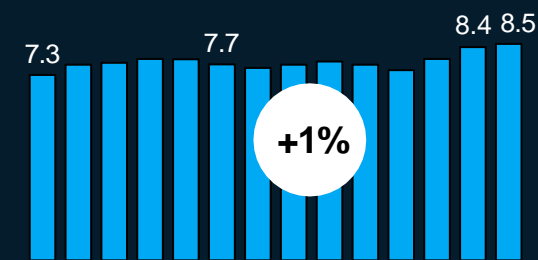
YoY growth 2022-23

Fossil-fuel investment was **\$1,050 billion** in 2023

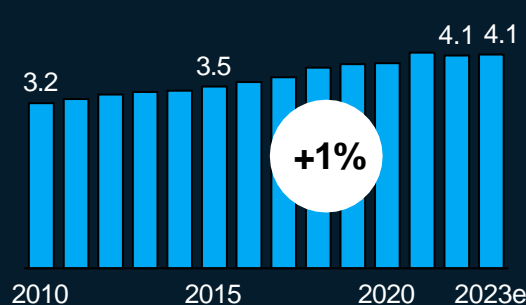
Liquids consumption
MMb/d



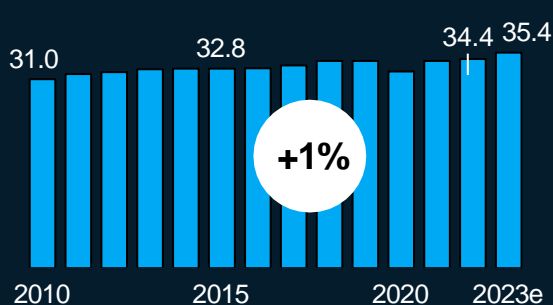
Coal consumption
Gt



Gas consumption
thousand bcm



Gross energy-related emissions²
Gt

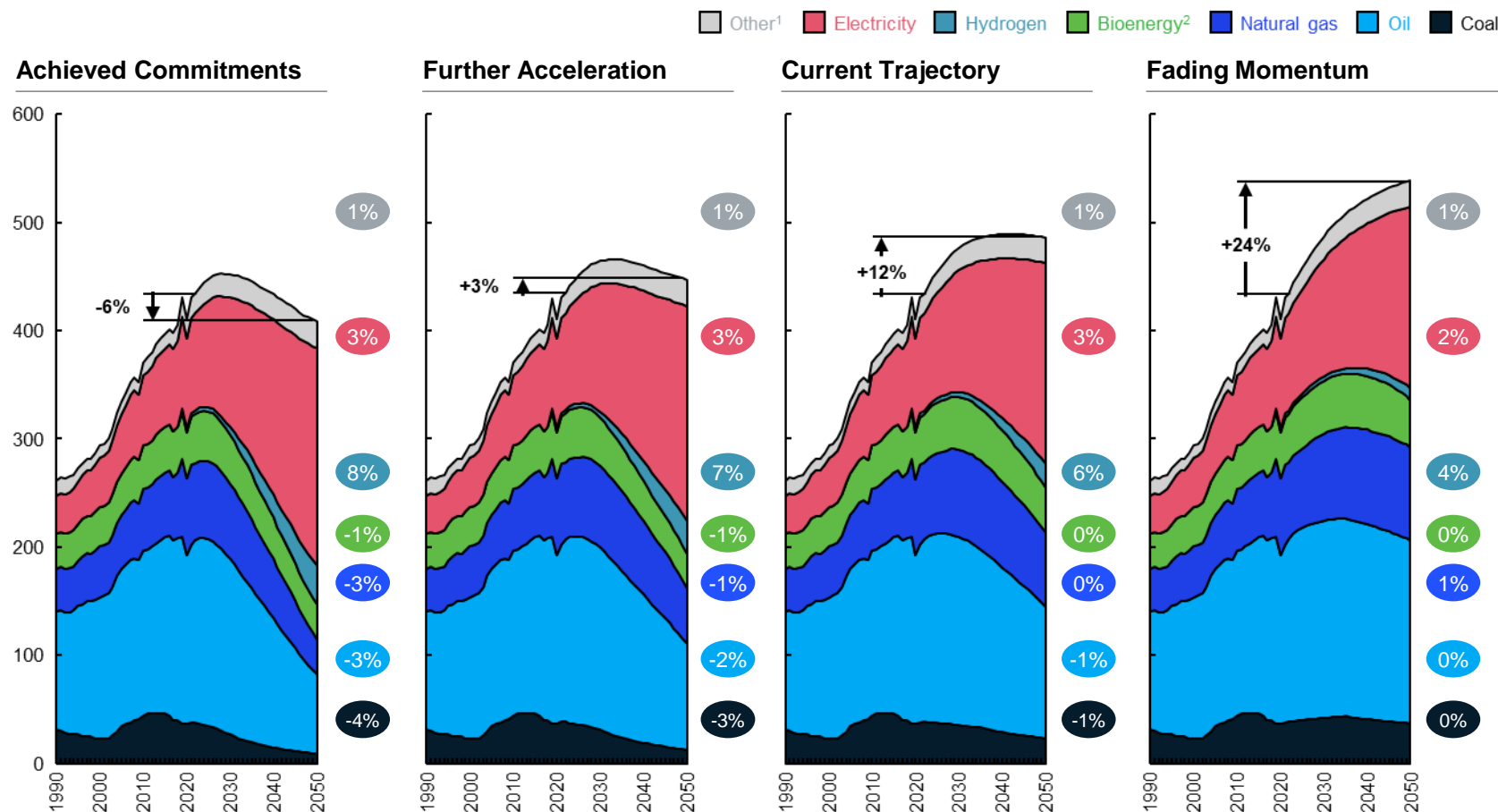


Faster transition scenarios show stronger energy-efficiency gains and a faster uptake of electrification and low-carbon fuels

Share of electricity and hydrogen in final consumption is projected to be 27–37% by 2035 and 35–60% by 2050 across our energy transition scenarios

Final energy consumption by fuel, million TJ

● CAGR³ 2019–50



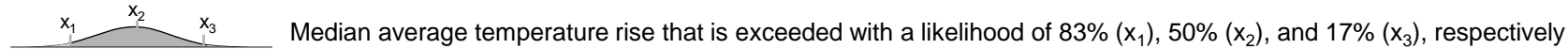
Overall energy consumption is flattening or even declining in more progressive scenarios as the share of electrification increases (to 31–49% of the total energy mix). Electrification includes more efficient technologies:

- An **electric vehicle** is ~3-4x more efficient than an internal combustion engine vehicle
- A **residential heat-pump** is ~2-4x more efficient than a natural gas boiler
- An **industrial heat-pump** is ~3-5x more efficient than a coal or gas furnace for low to medium temperature heat

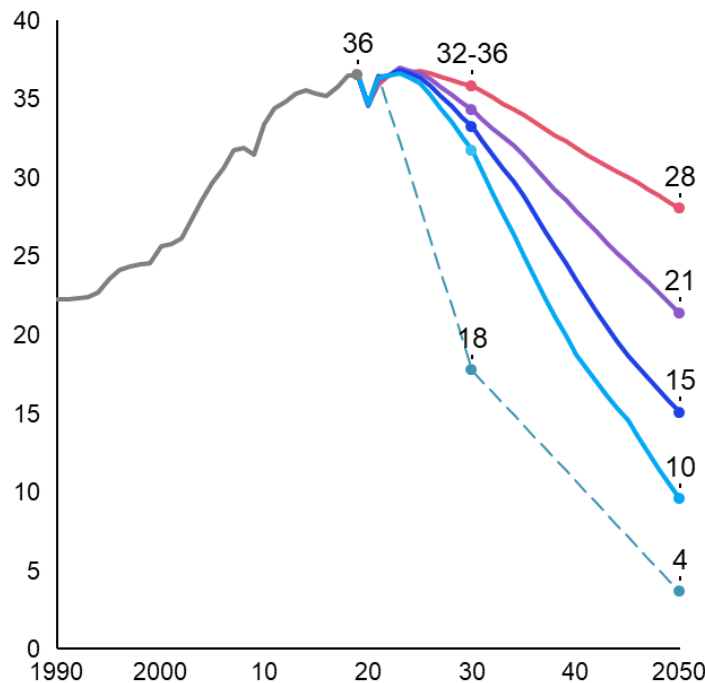
1. Includes heat, geothermal and solar thermal. 2. Includes synthetic fuels, biofuels, and other biomass 3. Compounded Annual Growth Rate

Global emissions remain above a 1.5° pathway even if all countries deliver on their current commitments

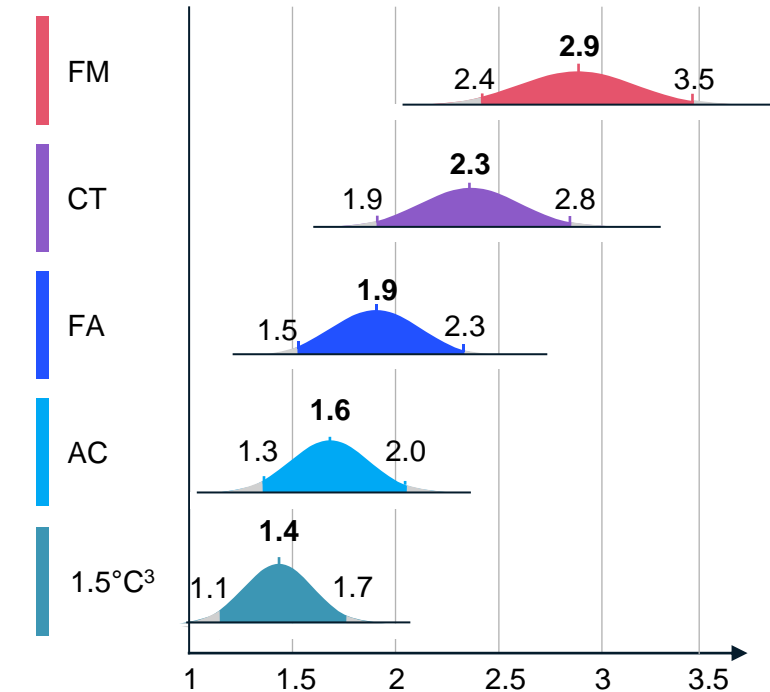
Knock-on effects and regional differences could drive significantly higher temperature increases locally



Global CO₂ emissions from combustion and industrial processes¹
GtCO₂ p.a.



Average global warming projection²
°C increase compared to 1850



Emissions are expected to peak in the mid-2020s across energy transition scenarios.

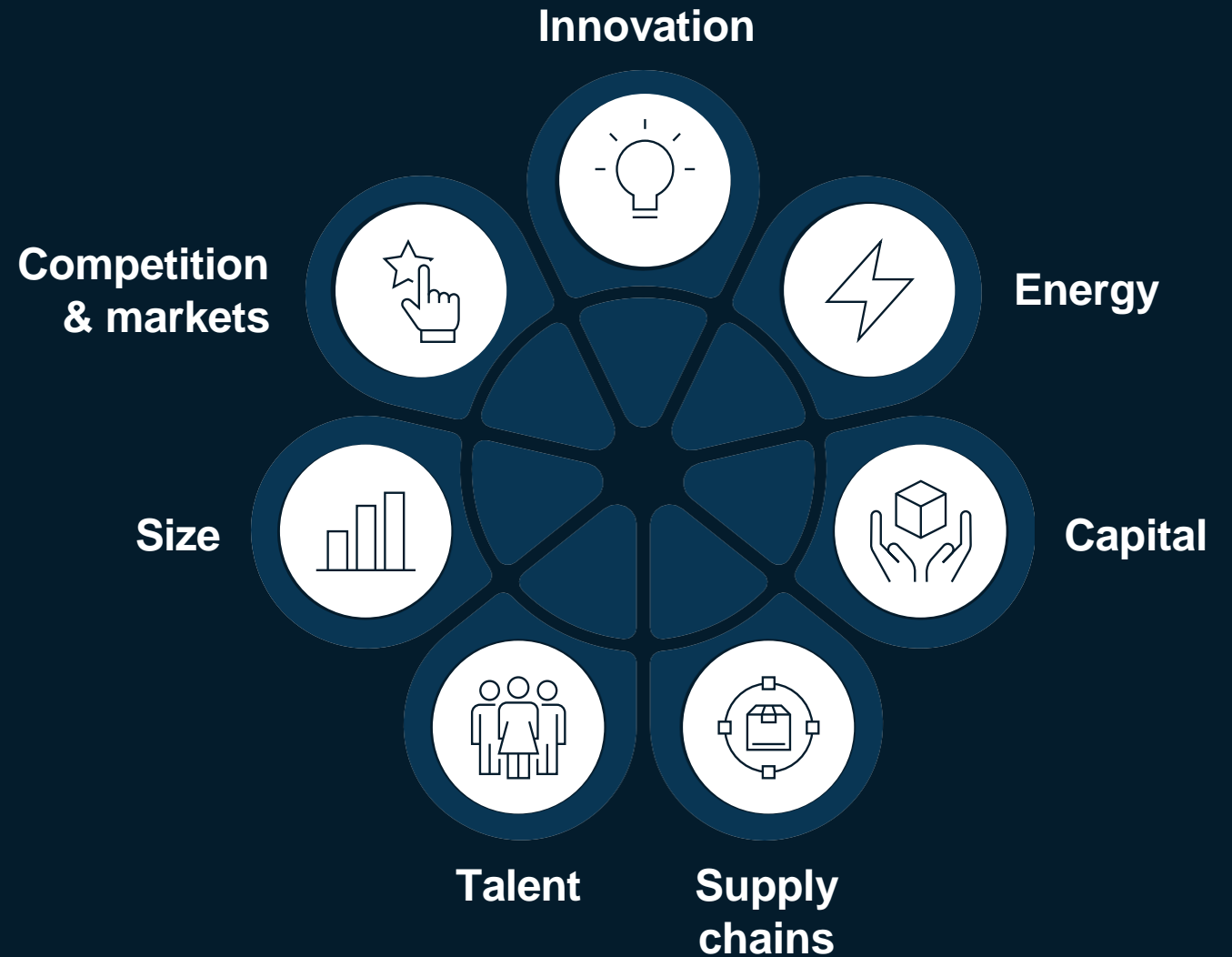
- Global warming estimates, suggest that even with significant emission reductions, all four bottom-up scenarios exceed the net-zero target needed for a 1.5°C warming pathway
- These scenarios project average warming of 1.6°C to 2.9°C. To limit warming to 1.5°C, emissions need to decline much more steeply, especially in the next decade
- Post-2030, the 1.5°C pathway envisions a more gradual reduction in emissions, aiming for net zero by 2050

1. Includes process emissions from cement production, chemical production and refining, and negative emissions from applying CCUS
 2. Warming estimate is an indication of global rise in temperature by 2100 versus pre-industrial levels, based on MAGICCv7.5.3 as used in IPCC AR6 given the respective energy and non-energy (eg, agriculture, deforestation) emission levels and assuming continuation of trends after 2050 but no net-negative emissions
 3. The remaining emissions in 2050 (i.e., ~4Gt) are compensated by negative emissions from DACCS, BECCS, and Reforestation

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7 forces are redefining competitiveness for Europe



Within Europe, Spain has a privileged position to lead energy transition and a good starting point to reindustrialize (1/2)



Illustrative examples

Comparison  vs. 



Low renewable **energy** prices as key to remain competitive in green industries

20%

Lower cost for renewable electricity generation in Spain vs. Central Europe



Attraction of **highly specialized talent** essential to drive innovation and deployment of projects

+1.4M

Engineers and scientists in Spain

&

4th

Largest pool in the European Union



Capital deployment as key to create value within the energy transition

2nd

Largest beneficiary in Europe of European Investment Bank energy transition fund in 2022



Need to ensure **supply chain** security as rising disruptions affect trade patterns

2nd

Largest car manufacturer in Europe

&

3rd

Largest steel producer in Europe



Larger-sized companies needed to enable economies of scale and drive profitability

Several Spanish companies present on the **Top10** for the largest utilities and O&G companies better prepared for the Energy Transition¹



Lead on **innovation** as tech innovations challenges current industrial models

12%

Increase in Spain's R&D expenditure in 2022 compared to 2021 while the EU registered -4,5% decrease



Regulation and industrial policies as an enabler to empower competitiveness

9th

Rank position (out of 69) of Spain on the OECD FDI Regulatory Restrictiveness Index 2020, indicating low restrictions on international investments

























Spain to lead the way, aiming at an industrial reemergence, thanks to its leading position to capture green growth and deliver its economic competitiveness

1. According to BloombergNEF Transition Scores
Source: Bloomberg, INE, ICEX, Press research, Eurostat and OECD

Within Europe, Spain has a privileged position to lead energy transition and a good starting point to reindustrialize (2/2)

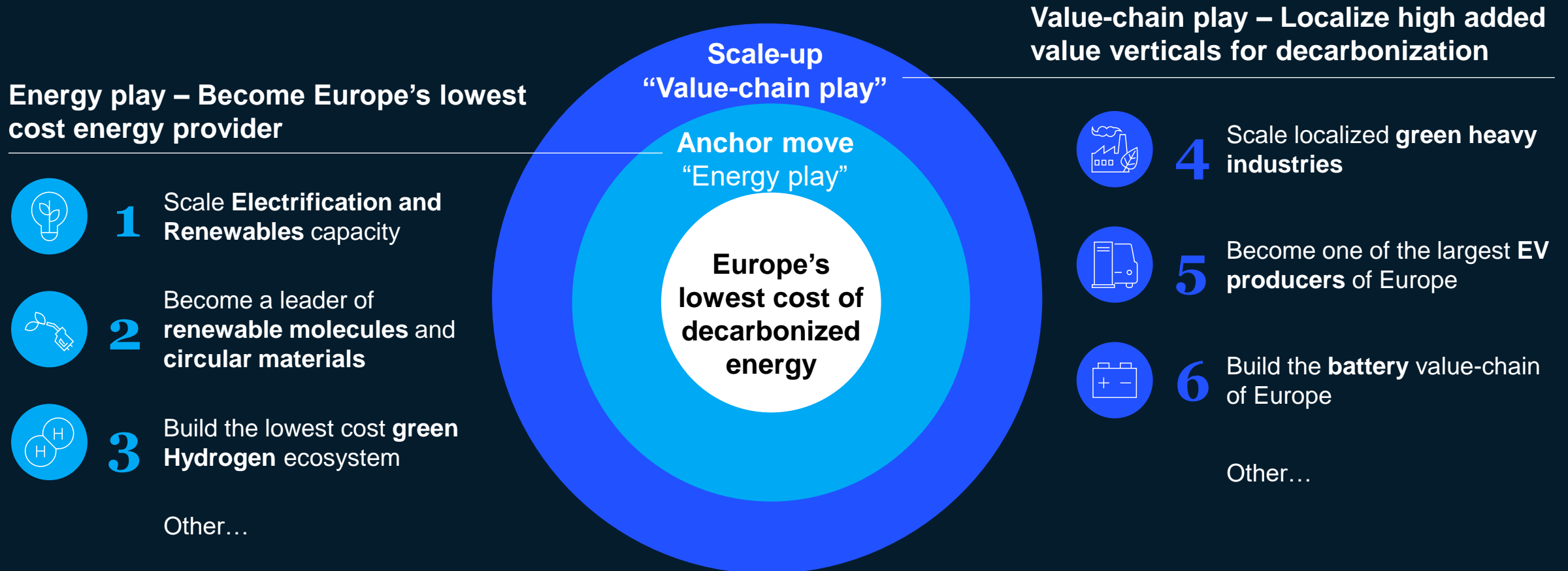
Country competitiveness

- Leading
- On-track
- Lagging

Competitiveness dimension	Indicator		 			
 Energy OPEX	 Renewables share	On-track	On-track	On-track	On-track	Leading
	 Solar LCOE	On-track	Leading	Lagging	Lagging	Lagging
	 Onshore wind LCOE	Lagging	On-track	On-track	Lagging	Leading
	 Cost of green hydrogen ¹	Lagging	Leading	On-track	Leading	Leading
 Input materials OPEX	 Lithium mining capacity	Leading	Leading	Lagging	On-track	Lagging
	 Biogenic CO2 supply	On-track	Leading	Lagging	Leading	Lagging
 Industrial base CAPEX	 Steel production	Leading	On-track	Lagging	Lagging	Lagging
	 Vehicles produced	Leading	Leading	Lagging	On-track	Lagging
	 Refining capacity	Leading	Leading	On-track	On-track	Lagging
 Existing infrastructure CAPEX	 Annual container port traffic	Leading	Leading	Leading	On-track	Lagging
	 Pipeline export capacity ²	Leading	Lagging	On-track	On-track	Leading
	 LNG terminals capacity ³	Lagging	Leading	On-track	Leading	Lagging

1. Considering current LCOEs for the best locations within the countries | 2. Considering the maximum of exports and imports pipeline capacity | 3. Only considering large-scale LNG terminals

Spain could aspire to become a leader in 6 key areas in both existing and new industries



Energy play – What is the size of the opportunity until 2030?



RES power capacity increase,
to **~140-150 GW**

vs current capacity



Up to 1.7X

Green H₂ production increase,
to **~0.6-1.1 mtpa**



Up to 2.5X¹

Biomethane production increase, with
total capacity of **~15-25 TWh** per year



Up to 11X²

Biofuels supply increase, with total
production capacity of up to **~2-3mtpa**



Up to 3X

CAPEX needed to become **Europe's
lowest cost energy provider**



~160 Bn€

1. Considering green (1.1mtpa) and grey (0.4mtpa) hydrogen production in 2030 versus grey (~0.6 mtpa) hydrogen production in 2023 | 2. Considering 0.5TWh of operational capacity and 1.3TWh under construction as current capacity | 3. Combined CAPEX required for both Biomethane and Biofuels opportunity

Value chain play – What is the size of the opportunity until 2030?



Up to 4 p.p.



potential **EBITDA uplift** in industries, due to **~20%** lower RES costs

Up to 2X



potential **RES industrial consumption increase** vs. 2022, **+25-30 TWh**

~40+ Bn€



of **CAPEX needed** to deploy and scale **5 new industries**; incl. green steel, ammonia, EVs, battery ecosystem

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Challenges on bankability, regulation and system stability found across key areas

Energy play key areas cross-topics






Non-exhaustive

Highest relevance for:  Electrification  Biofuels  Biomethane  Hydrogen






Lack of cost competitiveness

- 
-  **x2-5 times costlier green H2 solution** vs conventional fossil alternatives for some applications
 -  **Slower-than-expected H2 cost reduction** trajectories (exp. 4-5.5€/kg by 2030); limited **tech maturity**
 -  **+1-4k USD/t costlier biofuels** than **current fossil alternatives**






Regulatory burden

- 
-  **Tax burden** for **decarbonization levers** vis-à-vis other countries
 -  Long and **complex permitting processes** (up to 4 years) with **+17 frameworks**, one per **CCAA**
 -  **Unclear HVO demand**, uncertain regulatory outlook from new feedstock additions, and threats from non-EU markets
 -  Strict **EU Delegated Act requirements** for **green H2** production and uncertain **RFNBO non-compliance penalties**

System instability

- 
-  Insufficient **grid investments** to handle the increase of both **demand** and **RES**
 -  Limited **firm capacity availability** and **uncertainty** of future **RES profitability**
 -  **Power grid capacity constraints** for new connections
 -  Lack of **transparency** over existing **distribution grid** and **injection points**

Financing hurdles

- 
-  High **electrification upfront costs** for **industry** and long lifetime of **existing equipment**
 -  **20-80% higher upfront costs** of **EVs** vs **ICE**
 -  High uncertainty regarding **long-term demand**, **feedstock availability**, and **technology maturity**
 -  Limited **willingness** for long-term **offtake agreements**

5 key unlocks could accelerate Spain's Energy-play leadership translated into specific actions across themes

Energy play key areas cross-topics

Highest relevance for :  Electrification  Biofuels  Biomethane  Hydrogen


Non exhaustive list of examples



Effective incentives schemes

Deploy **effective incentive schemes** to close the **cost competitiveness gap** between **green solutions** and **fossil-based alternatives**




 Explore **public guarantees for offtake agreements** (e.g., CESCE fund in Spain for PPAs)



Clear and stable regulation

Provide **effective** (simple and flexible) and **stable** (long-term certainty) **regulatory frameworks** to ensure **projects' predictability** and **robustness**




 Assess measures to increase **PPA and futures market liquidity**



Faster and smoother permitting

Reduce **administrative burdens** and **shorten permitting processes** (e.g., one-stop-shops, homogenization) to minimize **long permitting periods**



 Enable **"fast track" permitting in areas with high feedstock density**

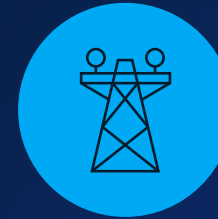


Strengthen project bankability

Develop strong **project cases** (e.g., long-term agreements, alliances) to ensure **robust and stable financing schemes**




 Form **alliances** (e.g., technological partner, suppliers, equity partner) with **capital contribution capabilities**



Substantial grid deployment

Plan and deliver **efficient grid deployment programmes** to ensure coordinated **uptake** between **projects** and **electrification increase**



 Plan **grid capacity enhancements** (both for RES and electrolyzers) in line with **advanced H2 announced projects**

This could have a substantial impact on the Spanish society...



Impact on GVA

(% 2022 GDP)



Up to **+15%**

Total Jobs,
#



~**1M**

...of which,
qualified positions,
#

~**200k**

Increased exports

(% 2022)



Up to **+10%**

Additional state income,
(% 2022)



+8-9%



GVA impact of up to **15%**, depending on the level of **reindustrialization** or **nationalization of local industry** adding **+1Mn jobs** to the sector

Exports could up to **10%**, fueled by an **increase in the share of exports in high-value products**

An added impact in the income for the **Spanish state** of up to **9%** of current state income, including **VAT, corporate, and individual taxes**

...creating ~1 million jobs, and generating ~15% of GDP by 2030



■ % Non-qualified ■ % Qualified

Vertical	Impact on GDP % of GDP in 2022	Share of skilled and unskilled jobs	Total jobs, #k
EVs	~ 6.0	85% Non-qualified, 15% Qualified	720
Batteries	~ 1.6	75% Non-qualified, 25% Qualified	290
Power ³	~ 1.2	65% Non-qualified, 35% Qualified	50
Green hydrogen	~ 1.0	70% Non-qualified, 30% Qualified	35
Green heavy ind. ²	~ 0.4	85% Non-qualified, 15% Qualified	20
Renewable molecules and circular materials ¹	~ 0.3	70% Non-qualified, 30% Qualified	20
Lithium ref. & min.	~ 0.2	90% Non-qualified, 10% Qualified	20
NetZero reforms ⁴	~ 2.2	N/A	-
Total	~ 15%		1 160

Impact of up to **+15%**
in value created (GDP)
by 2030

Main focus on **battery
and electric vehicle
value chains** with the
**reconversion of
factories** playing a
decisive role

Creation of **+200k
qualified jobs** in Spain as
new **green industries** set
up shop and traditional
ones get **reindustrialized**

1. Including biomethane, biofuels, and synthetic fuels | 2. Composed of green ammonia and green steel production, as well as CCUS as a facilitator | 3. Implementation of renewables, mainly from solar photovoltaics, onshore and offshore wind, and battery storage | 4. Including renovations to buildings, transport infrastructure, electrification of industry, and upgrading of machinery

¡MUCHAS GRACIAS!

