

CURSO EJECUTIVO

TÍTULO: The Energy Transition: Global, European and Iberian region perspective

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Executive Summary

Energy Transition has **slowed down globally**, and geopolitical context is **reprioritizing cost-effective solutions over Net-Zero**

Spain and Portugal have a **privileged position to lead the** energy transition in Europe and have a good **starting point to reindustrialize**

If we overcome the existing challenges, energy transition could have a **substantial positive impact** on the **region**

Key trends affecting the new energy transition paradigm

1 Secure, sustainable and affordable supply



- 10-years since the Paris Agreement, **geopolitical context is reprioritizing security of supply over Net-Zero** in many countries
- Stakeholders have rapidly adopted **low-carbon technologies** when they are low-cost or support energy security and reliability goals

2 Volatility



Multiple drivers of volatility

- **Energy transition:** The volatile geopolitical context is opening a wider range of energy transition scenarios
- **Energy price volatility:** High degree of cost volatility, where geopolitical shocks can ignite extreme price volatility, as seen in 2022 gas crisis
- **Energy mix:** At the same time, the mix is shifting, introducing additional volatility into the system (e.g., *Blackouts in Iberia*)

3 Affordability



- At present, the **price of energy** varies greatly between different countries and regions
- **Highest average prices can be seen in Europe, where, since the energy crisis, Europe has paid 2-3x more for energy** compared to **US and Chinese peers**
- **Countries are reprioritizing cost-effective solutions over Net-Zero** and pursuing security of supply
- Significant improvements have been made on technology and costs that enable a **cheaper renewables deployment**

4 Electrification momentum



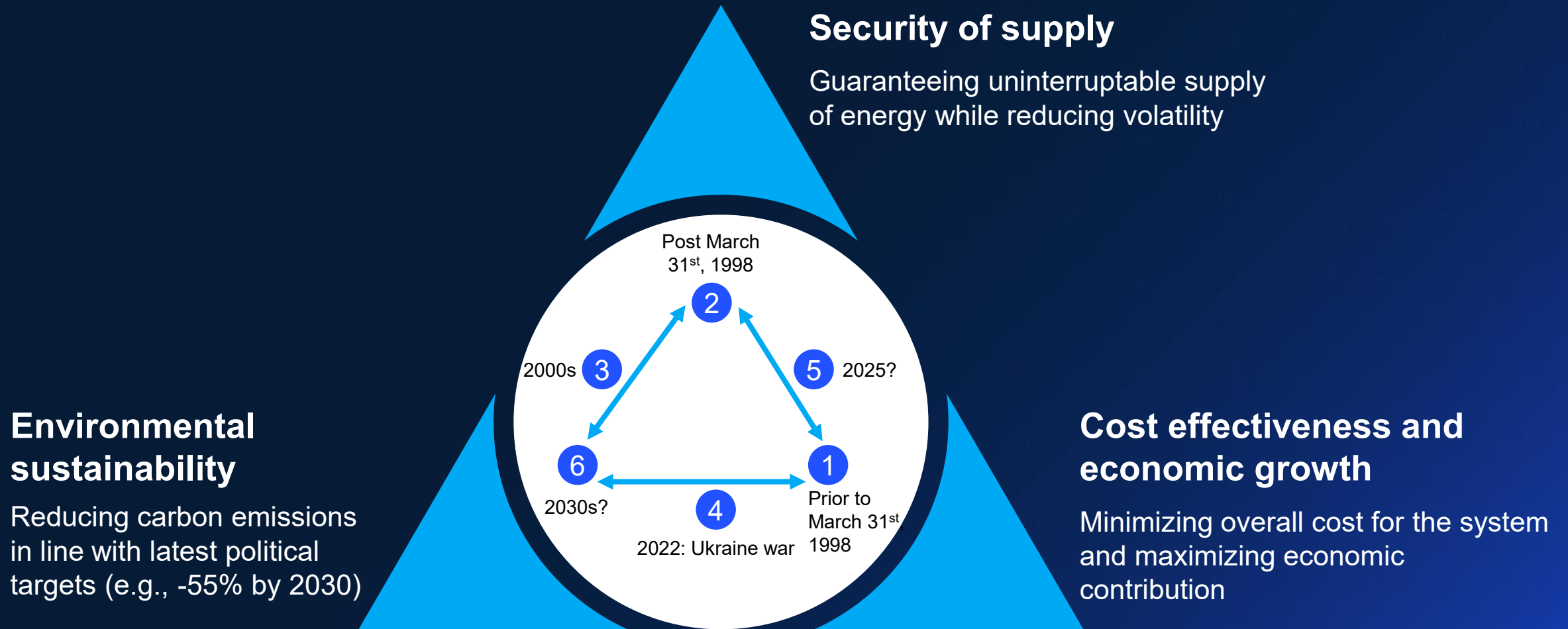
- Global **electrification is expected to grow at ~3% annually**, with economic viability and policy challenges setting different speeds across regions and sectors
- **Alternative decarbonization pathways to compete based on cost parity** to achieve an economically viable solution for hard-to-abate sectors **over the next two decades**
- The future of CCS, hydrogen, and sustainable fuels remains uncertain, **reliant on macro context**, and **policy mandates**

5 Supply chain under pressure



- **Multiple bottlenecks**, including supply chain limitations in a fragile international trade context, **hinder the scalability of the transition**
- Long-term planning required to secure reliable power supply

1. The new energy transition paradigm implies optimization of mitigation actions on the energy trilemma



2. Cost volatility: Geopolitical shocks can ignite extreme price volatility, as seen in 2022 gas crisis

Henry Hub historical natural gas spot price, \$/MMBtu



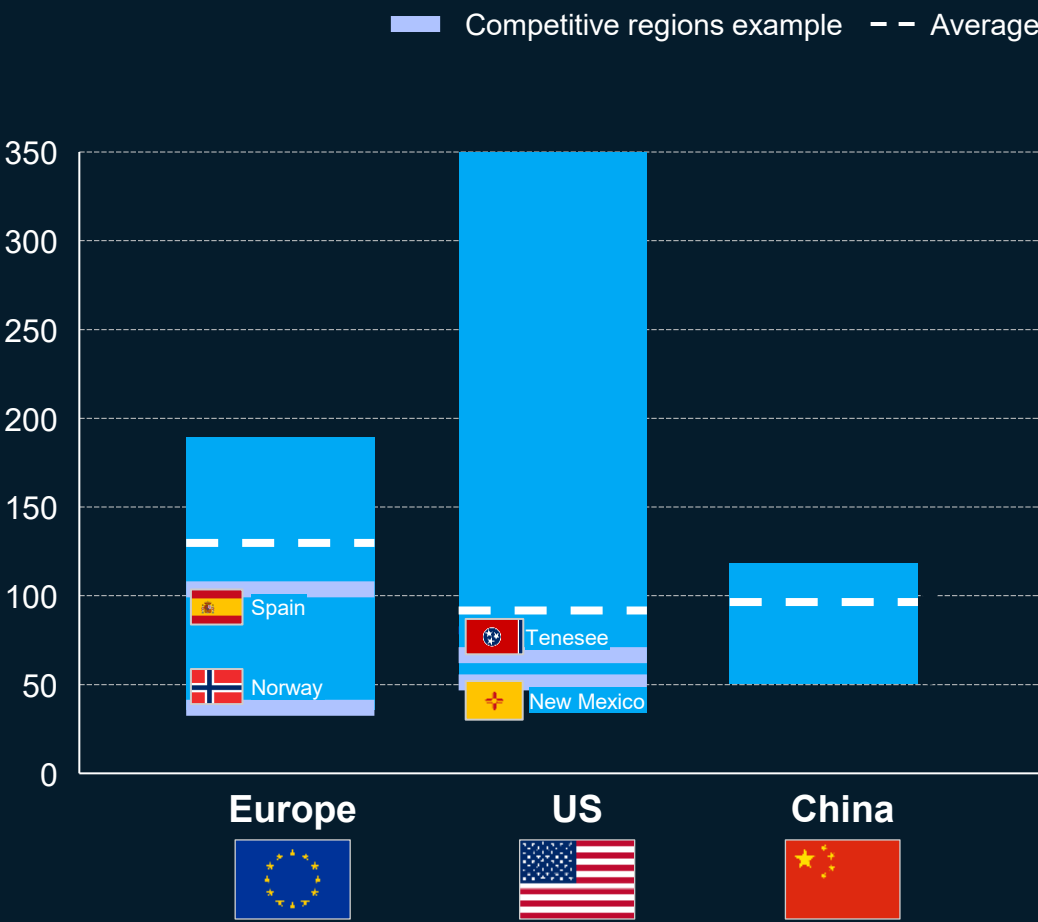
Russian invasion of Ukraine impacted the operation of Russian gas pipelines to Europe and global natural gas prices increases as a result, even in the U.S.

Energy prices significantly increased and drove increased costs across downstream sectors (e.g., heating)

3. Comparison of industrial power prices across regions

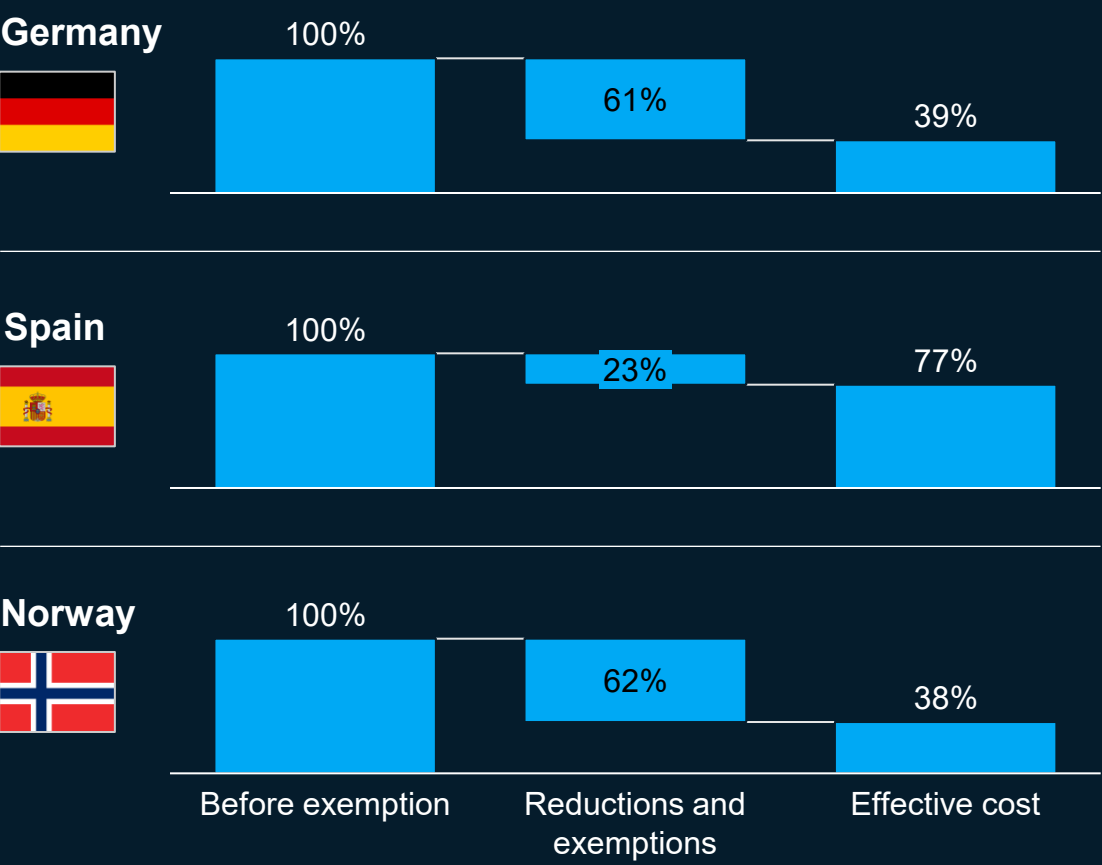
Range of industrial electricity prices

EUR/MWh, 2024



Landed cost of electricity for industrial users

EUR/MWh, 2024



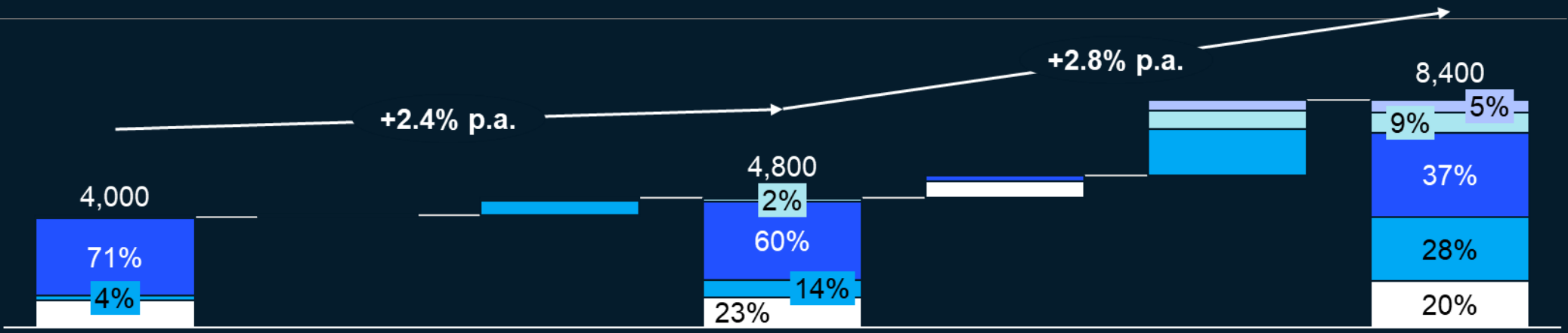
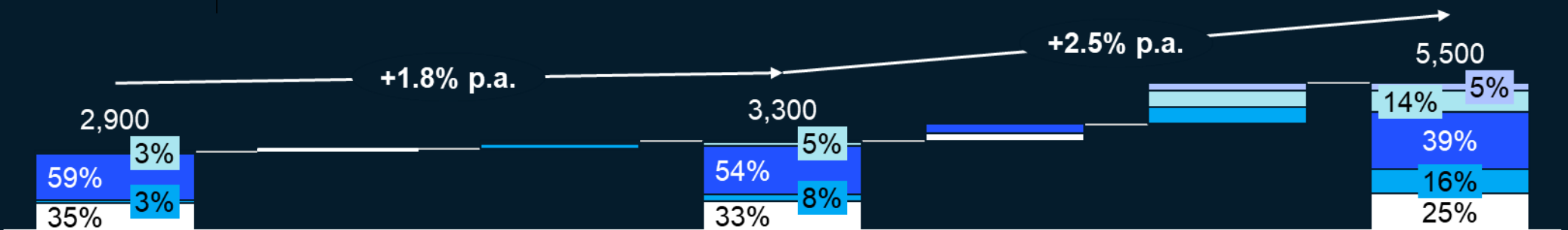
Reductions and exemptions can significantly impact Spain's price competitiveness

4. Power consumption expected to accelerate 2030-50 driven by Data Centers demand

2023-2050, TWh

Continued Momentum Scenario

H2 and Synfuels Transport Buildings Data Centers Industry



2023 Traditional Sectors¹ New Sectors² 2030 Traditional Sectors¹ New Sectors² 2050

1. Industry, Buildings | 2. H2 and Synfuels, Data Centers, Transport
Source: McKinsey Energy Solutions' Global Energy Perspective 2025, IRENA, IEA

5. Supply chains for key energy transition technologies are stretched



	Procurement 		Manufacturing 		Logistics 	Construction 
	Raw materials	Processed materials	Components	Assemblies		
Wind turbines 	EU only provides 1% of the raw materials ; expected supply shortage for neodymium and praseodymium       	Permanent magnets are sourced mostly from China  	High dependence on Asia for power electronics Suppliers have full order books for months     	EU plays major role in the assembling stage, where its share is ~60% Western OEMs with financial headwinds   	Potential shortage of XL vessels for offshore wind turbines after 2025   	Demand for construction workers will increase towards 2026 – already scarce today   
Solar 	Silicon is the materials with the highest risk; 50% supply from China    	China covers about 70% of the global production capacity of polysilicon    	China's role becomes quasi monopolistic at components High dependence on Asia for power electronics Full order books for months     	EU has only 1% of silicon-based PV assemblies   		
Batteries 	1% of materials from EU ; 74% dependence on China (lithium and cobalt), Russia (Class 1 nickel), Africa (cobalt), LATAM (lithium)       	The EU is fully dependent on anode materials and NCA cathode material supply   	China supplies 66% of finished Li-batteries; High dependence on Asia for power electronics Full order books for months     	EU fully dependent on battery cell imports European capacity expected to ramp-up   		
Grids 	Potential shortage in copper driven by demand increase     	Increased demand for electrical steel 	High manufacturing presence in Europe 	High manufacturing presence in Europe 		

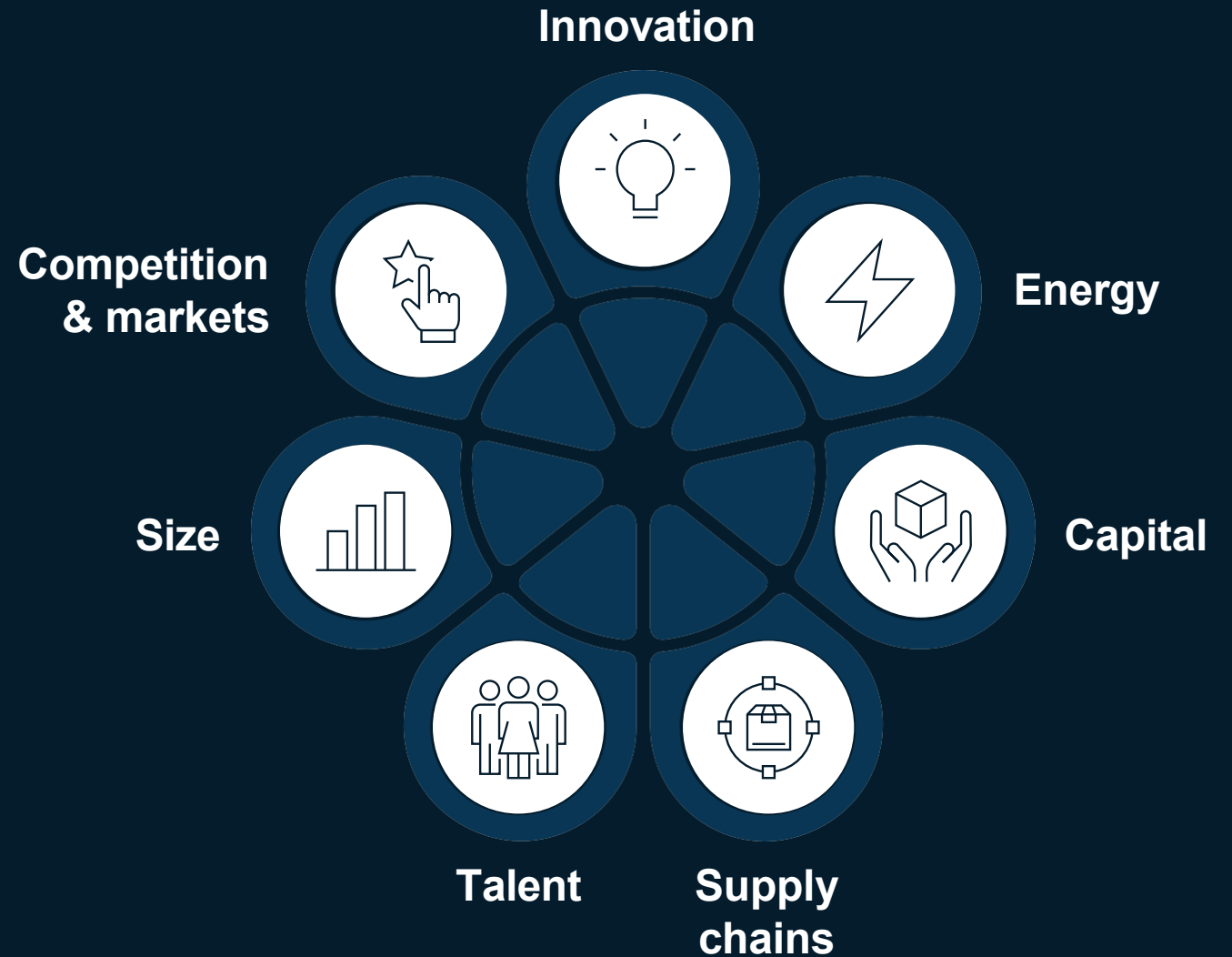
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7 forces are redefining competitiveness for Europe



Within Europe, we have 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



We can 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)

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

Country competitiveness

Leading

On-track

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 has a lifetime opportunity of re-industrializing on the back of competitive clean energy

A. Energy play – Lead on low-cost green energy production



Electrification and Renewables



Renewable molecules and circular materials

Green Hydrogen and derivatives
Sustainable fuels
Biogases



Modernization of power systems and resiliency investments

Others...

Low cost of decarbonized energy in Iberia

B. Industrial play – Scale up existing industries and develop new ones through decarbonization levers



Data Centers



Electric Vehicles & Battery Ecosystem



Industry Competitiveness and Decarbonization



Defense

Others...

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 15	720
 Batteries	~ 1.6	75 25	290
 Power ³	~ 1.2	65 35	50
 Green hydrogen	~ 1.0	70 30	35
 Green heavy ind. ²	~ 0.4	85 15	20
 Renewable molecules and circular materials ¹	~ 0.3	70 30	20
 Lithium ref. & min.	~ 0.2	90 10	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!

