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SPAIN'S ENERGY AND GREEN TRANSITION

Potential opportunities and partnerships for Swedish companies within Spain's energy sector

EXECUTIVE SUMMARY

Spain ranks as the second-largest producer of solar and wind power in Europe. The country has ambitious goals for achieving carbon neutrality by 2050 and generating at least 81% of its electricity from renewable sources by 2030. This strategy is strengthened by Spain's numerous advantages for further development in renewables, including an abundance of natural resources, a high-quality electrical system, thriving industrial and technological clusters, robust research, and development centres, and a highly-skilled and competitive workforce.

Both national and international investments and funds will be leveraged to successfully reach Spain's climate neutrality goal. The National Recovery and Resilience Plan (NRRP) will allocate €163 billion in both grants and loans by 2026, focusing on the promotion of renewable energy, green hydrogen, and electricity storage. Offshore wind investments are currently prioritised together with technical investments in photovoltaic cells and modules, green hydrogen, and the manufacturing of cathodes for energy storage.

Spain's targets for 2030 include 62GW of wind energy and 76GW of photovoltaic energy. In line with its commitment to decarbonisation, the Spanish government is set to invest €8.9 billion in green hydrogen, targeting 25% consumption in industries by 2030.

Recognising the necessity of grid reinforcement to accommodate the expanding renewable energy deployment, Spain has made it a national priority. Investments in grid enhancement, including initiatives announced by MITECO and Red Eléctrica, demonstrate a concerted effort to strengthen the grid infrastructure both reinforcing the national grid and European interconnections.

Business opportunities for Swedish companies can be found in relevant engineering, materials, components, and expertise for the deployment of Spain's wind energy, photovoltaic, green hydrogen, and grid infrastructure. Currently, Spain aims to attract international technical investments for offshore wind, photovoltaic cells and modules, green hydrogen, and manufacturing of cathodes for energy storage.

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Spain is a leading renewable energy producer in Europe, aiming for 81% renewable electricity by 2030 and a complete dependency on renewables by 2050. The national strategy and European funding prioritise the development of renewables, green hydrogen, and electricity storage.

1.1. National energy and climate plan 2021-2030

Spain is the second-largest producer of both solar and wind power in Europe. In 2023, 61.3% of its electricity capacity was derived from renewable energy sources. Wind energy stood out as the primary electricity source, followed by combined cycle plants (20.9 %) and photovoltaic installations (20.3%).

Spain's commitment to sustainable energy is reflected in its National Integrated Energy and Climate Plan (PNIEC) for the period of 2021 to 2030. The overarching aim of this plan is for Spain to achieve carbon neutrality by 2050. By 2050, Spain aims to attain 100% reliance on renewable energies and reduce greenhouse gas emissions by 90%. This strategy is structured into two distinct phases: 2030 and 2050. In June 2023, a proposal for an updated PNIEC was published, updating the 2030 targets to:

- Reduce greenhouse gas (GHG) emissions by a minimum of 32% below 1990 levels.
- Generate at least 81% of Spain's electricity from renewable energy.
- Guarantee 48% of final energy consumption from renewable energy sources.
- Improve energy efficiency by 44%.

Installed power capacity structure 2023 (%)

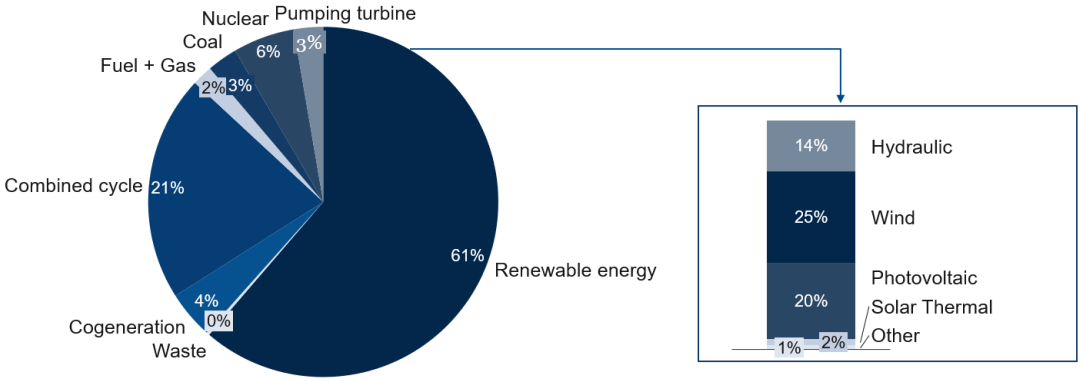

Figure 1: Power generation structure Spain 2023. Source: Red Electrica (2023.a.).

In recent years, Spain has undertaken a significant expansion of its renewable energy infrastructure. By December 2023, more than half of Spain's electricity was generated from renewable sources, primarily wind and solar. Moreover, there was a notable 28% rise in installed photovoltaic solar capacity, reaching current capacity of 25.5 GW. Additionally, hydropower saw a remarkable 41.1% increase in its contribution compared to the previous year.

In contrast, concerning non-renewable technologies, Spain aims to maintain 26.6 GW of combined cycle gas and 3 GW of nuclear power by 2030, all from existing plants.

Aligned with the PNIEC, by 2030 Spain aims to install the following electricity capacity mix:

Table 2: Prospects for installed capacity for electricity generation by technology Spain 2030 (National Integrated Energy and Climate Plan (PNIEC 2030)).

Source	Capacity 2025	Capacity in 2030
Wind energy	42.14 GW	62 GW
Photovoltaic solar	56.7 GW	76.38 GW
Combines cycle	26.61 GW	26.61 GW
Hydraulic	14.26 GW	14.51 GW
Storage	8.82 GW	18.53 GW
Biomass	1 GW	1.4 GW
Cogeneration	4.06 GW	3.78 GW
Nuclear	7.39 GW	3.18 GW
Biogas	0.24 GW	0.44 GW
Coal	0 GW	0 GW

Advantages for the further development in the renewable energy sector in Spain include abundant natural resources, a high-quality electrical system, thriving industrial and technological clusters, robust research and development centres, and a skilled and competitive workforce. However, several challenges persist such as the rapid influx of grid connection applications for new solar projects, which has created bottlenecks in several pre-construction phases. Furthermore, the grid infrastructure in Spain is currently stressed, although this issue is less severe compared to other European countries.

1.2. European funds

Spain has currently received different types of funding from the European Commission aimed at supporting the decarbonisation of the economy and the energy transition. These financing possibilities are available to the public and private sectors.

- **Recovery and Resilience Plan (RRP)**

Spain's National Recovery and Resilience Plan (NRRP) will mobilise up to €163 billion, in both grants and loans, in the period 2021-2026, with 40% allocated for investments in the green transition. The NRRP includes several strategic projects (PERTE) to boost economic growth, employment, and competitiveness in specific sectors, along the whole value chain. The government has launched the PERTE-EHRA initiative to promote renewable energy, green hydrogen, and electricity storage, mobilising over €12.25 billion in public investment by 2026, and a PERTE for industry decarbonisation with a public investment of €3.17 billion.

The Spanish payment framework from public investments is administratively heavy and requires a lot of previous preparation and strategic dialogues. Specifics of the remuneration framework remain unclear and could be a concern to some investors lacking direct contact with the ministries and leading energy companies. Important to note is that to apply for these grants, the company must have a Spanish company registration number. The registration process in Spain can take from 3-6 months. Business Sweden can provide a company with support regarding strategic stakeholder engagement and company registration.

- **European Regional Development Fund (ERDF)**

The European Regional Development Fund serves as the European Union's tool to address developmental disparities among its member states. In March 2023, the EU and Spain ratified new funding programmes for the period of 2021-2027. The EU's contribution of €23.4 billion will be allocated to Spain's ERDF programmes, which will consist of one national thematic programme and 19 regional programmes. Over €9 billion will be dedicated to facilitating the regions' transition to a resource-efficient, climate-neutral, and competitive economy. Notably, €3.3 billion will support Spain in reaching its goal of generating 81% of its electricity from renewable sources by 2030.

2. BUSINESS OPPORTUNITIES FOR SWEDISH COMPANIES

Spain's targets for 2030 include 62GW of wind energy and 76GW of photovoltaic energy. Investment is currently concentrated on offshore wind and the advancement of new photovoltaic materials. Green hydrogen is also a key investment area, with 11 hydrogen valleys seeking international collaboration. Grid reinforcement to facilitate renewable energy integration is a top priority, leading to increased investments in both national grid reinforcement and European interconnections.

> ***Spain aims to attract international technical investments for offshore wind, photovoltaic cells and modules, green hydrogen, and manufacturers of cathodes for energy storage.***
>
> **Eduardo Vivo, FDI Projects Deputy Director, Spanish Institute for Foreign Trade (ICEX)**

2.1. Wind energy

2.1.1. Strategy and planned investments

Spain ranks as the world's fifth-largest country for installed wind power capacity, following China, the United States, Germany, and India, and stands as the second largest in Europe, trailing behind Germany. With an accumulated capacity exceeding 30 GW, wind energy was the primary source of electricity generation in Spain in 2023, covering over 24% of demand. In line with the revised targets outlined in the Spanish National Energy and Climate Plan (PNEC), Spain aims to install 62 GW in onshore and offshore wind capacity by 2030.

Table 3: Spain's forecasted installed capacity for onshore and offshore wind 2025 and 2030.

Source	Capacity 2020	Capacity in 2025	Capacity in 2030
Wind energy	26.75 GW	41.14 GW	62 GW

Investments in onshore wind farms aim to innovate for cost reduction and improved manageability. Meanwhile, offshore wind investments focus on advancing technologies to lower costs, particularly emphasizing floating solutions and environmentally-friendly manufacturing and maintenance techniques. Component 7 of the Recovery, Transformation, and Resilience Plan aims to update regulations to support the growth of offshore wind and marine energy in Spain, fostering the development of the blue economy.

On 20th March 2024, the Spanish Ministry for the Ecological Transition and the Demographic Challenge (MITECO) and the Spanish Wind Energy Association endorsed the National Wind Energy Charter, highlighting six initiatives to advance the wind energy sector. These include enhancing forecasts, improving auction design, streamlining decision-making, reducing volatility, monitoring trade practices, and supporting manufacturing capacities. Additionally, on 21st March 2024, MITECO issued a regulation to simplify offshore wind development by granting grid access and concessions simultaneously through public tenders.

2.1.2. Open calls

MITECO holds responsibility for issuing national tenders for grid access node capacities allocated for renewable energy generation and storage facilities. On 19th March 2024, MITECO asked Spanish stakeholders to formally express their interest regarding the available grid nodes. The objective was to assess the nodes in which Spanish energy stakeholders intended to bid, the technologies stakeholders plan to utilise, whether hybrid projects will be proposed and if the projects are associated with self-consumption modalities. Following the evaluation of interest, MITECO plans to release dedicated tenders for offshore wind projects throughout 2024.

2.1.3. Business opportunities

Swedish companies can provide relevant engineering, materials, components, and expertise for the deployment of offshore wind in Spain. It is important to initiate dialogue with the key developers active in the public tender to analyse their timelines, needs and openness for business collaborations.

2.1.4. Relevant stakeholders

The relevant stakeholders within Spain's wind energy sector are Iberdrola, Acciona, Enel Green Power, EDPR, Naturgy, and ENGIE.

2.2. Solar energy

2.2.1. Strategy and planned investments

In line with the revised targets outlined in the Spanish National Energy and Climate Plan (PNIEC), Spain aims to install 76 GW of photovoltaic power by 2030, including 19 GW of self-consumption PV. In 2023, Spain increased its national photovoltaic solar capacity by 28%.

Table 3: Spain's forecasted installed capacity for photovoltaic power 2025 and 2030.

Source	Capacity 2020	Capacity in 2025	Capacity in 2030
Photovoltaic power	11 GW	56.74 GW	76.39 GW

In Spain, photovoltaic (PV) energy presents several advantages, such as low operating costs, abundant resources, and a consumption curve that closely mirrors solar energy production. This alignment between consumption and production enhances the efficiency of PV energy utilisation in Spain. On the other hand, Spain faces specific limitations concerning the integration of renewable energy into its electricity grid, although this issue is not as severe compared to other European countries.

Investment in PV energy will focus on developing new materials and technologies, reducing costs in development and operation, integrating solar energy into various sectors like buildings and transportation, enhancing manageability and grid integration, and advancing manufacturing techniques. Spain also has a strategy for self-consumption PV which aims to install between 9GW of self-consumption PV by 2030.

2.2.2. Open calls

Estimates from the International Energy Agency (IEA) indicate that Spain will install approximately 29 GW of solar energy in 2024, of which the Ministry reports that nearly 12 GW of photovoltaic solar energy projects have already been processed for construction in the country this year. According to the Spanish Institute for Foreign Trade, the increase in self-consumption PV will mainly focus on industrial usage and purposes.

As part of the Recovery and Resilience Plan, on 15th March 2024, MITECO initiated a new public consultation on aid for manufacturing renewable technologies and storage, allocating a budget of €750 million. These subsidies aim to foster innovation and knowledge in various areas, including electric storage, photovoltaic solar energy, wind energy, renewable aerothermal, and renewable hydrogen, focusing on manufacturing essential components for each.

2.2.3. Business opportunities

The Spanish energy sector is interested in attracting companies able to produce photovoltaic cells and modules, as well as manufacturers of cathodes for energy storage. It is important to initiate dialogue with the key developers to study their timelines, needs and openness for business collaborations, both for large PV-plants as well as industrial self-consumption PV.

2.2.4. Relevant stakeholders

The relevant stakeholders within Spain's solar energy sector are: Prodiel, Solaria, Total Energies, Holaluz, Self-Energy, EDP Solar, Endesa X and Soltec.

2.3. Green hydrogen

2.3.1. Strategy and planned investments

Green hydrogen is emerging as a pivotal component in achieving the decarbonisation goals outlined in the European Directive (EU) 2018/2001. Spain's national objectives revolve around both the production and utilisation of green hydrogen across sectors with significant potential. The estimated investments are €8.9 billion and the objectives for 2030 are as follows:

- Establish 4GW of electrolyser capacity, strategically located near end-users.
- Ensure 25% of hydrogen consumption in industries, both as feedstock and energy source.
- Introduce 150-200 buses powered by green hydrogen.
- Transition 5,000-7,500 light and heavy-duty vehicles to green hydrogen fuel.
- Establish 100-150 public hydropower plants accessible to the public.

In September 2023, Technical Manager of the Spanish gas system, Enagas, launched a 'call for interest' to assess the Spanish energy sector's plans in renewable hydrogen infrastructure. The study revealed that Spain is forecasted to produce 2.5 million tons of green hydrogen yearly and achieve a 23.3 GW electrolysis capacity by 2030. Green hydrogen holds strategic significance across industries like refining, chemicals, metallurgical, transportation, and energy, especially in storage and grid flexibility.

Spain's green hydrogen sector is driven by leading projects and stakeholders, including 11 hydrogen valleys. The key initiatives include the Andalusian Hydrogen Valley, led by CEPSA, and the Catalan Hydrogen Valley involving Repsol and Enagas. The Shyne consortium, driven by Repsol, aims to establish green hydrogen plants in 10 regions by 2030 with a €3.23 billion investment. Other significant projects include the Tarragona Hydrogen Network ('T-HYNET') and the Puertollano project led by Iberdrola. Additionally, the H2med project seeks to create a hydrogen corridor linking the Iberian Peninsula to Europe, supported by a €350 million investment.

2.3.2. Open calls

The H2 Pioneros, funded by the NextGenEU, is a programme for supporting pioneering green hydrogen projects. In April 2023, the programme allocated €200 million to aid 37 green hydrogen projects under PERTE EHRA and in June 2023, an additional €100 million was granted for large electrolyser projects. The second round of applications, with a budget of €150 million, concluded in July 2023, attracting new applicants such as Acciona, Petronor, Redexis, Enel, Sener, ET Fluels, and Universal Kraft.

2.3.3. Business opportunities

According to the Spanish Institute for Foreign Trade (ICEX), Spain is interested in attracting international companies covering the entire green hydrogen value chain. Therefore, Swedish green hydrogen companies with relevant offerings in engineering, materials, components, and expertise could find new business opportunities within the deployment of green hydrogen in Spain. It is important to initiate dialogue with the key developers in the green hydrogen valleys as well as the Shyne consortium.

2.3.4. Relevant stakeholders

The relevant stakeholders within Spain's green hydrogen sector are: Cepsa, Iberdrola, Enagas, Endesa, Naturgy, Fertiberia, ArcelorMittal, Repsol.

2.4. Grid infrastructure

2.4.1. Strategy and planned investments

According to the PNIEC, Spain is focusing on investments to enhance the integration of renewable energy into the grid, with a total budget of €53 billion. In December 2023, the Ministry for Ecological Transition, and the Demographic Challenge (MITECO) began planning for Spain's electricity for 2025-2030, aligning with PNIEC's goal of achieving 81% renewable energy generation. In January 2024, MITECO announced 64 actions for 2026, with €321 million allocated to reinforce the grid. This investment aims to support strategic projects for industry decarbonisation, hydrogen production, and renewable energy integration.

Further, Red Eléctrica, the corporation operating the national electricity grid in Spain, plans to invest around €1 billion during 2024 and onwards in grid electricity infrastructure with the aim of integrating the huge renewable deployment that is underway. This is almost 22% more than 2023 and double the budget for 2022.

The Spanish electrical system is interconnected with the Portuguese system, forming the Iberian electricity system, with North Africa via Morocco, as well as with the Central European electricity system through the French border. However, it currently falls below the European Commission's recommended minimum interconnection level of at least 10% of installed capacity. To address this, the European Commission aims to accelerate the implementation of South-West Europe interconnections, enhancing interconnection capacity between the Iberian Peninsula and France. Additionally, efforts will support Portugal and Spain in implementing the Minho-Galicia interconnection. Aligned with this strategy, in February 2024, the Spanish and French governments agreed to promote the construction of two new electrical connections across the Pyrenees and address technical and financial aspects for a future underwater corridor for transporting green hydrogen between both countries.

2.4.2. Open calls

The new interconnections between Spain and France will increase the interconnection capacity to 8GW. The three main projects will be:

- Aquitaine (FR) and the Basque Country (ES)
- Aragon (ES) and Pyrénées-Atlantiques (FR)
- Navarra (ES) and Landes (FR)

In parallel, Spain will also build a new interconnection with Portugal, which will increase capacity to 3GW.

2.4.3. Business opportunities

Swedish businesses can provide relevant engineering, materials, components, and expertise for the reinforcement of Spain's grid infrastructure, as well as critical raw materials necessary to produce the equipment and key components.

2.4.4. Relevant stakeholders

Red Eléctrica, Edistribución Redes Digitales, i-DE Redes Eléctricas Inteligentes, S.A.U. (Iberdrola), UFD Distribución Electricidad, Naturgy.

3. CONCLUSIONS AND RECOMMENDATIONS

In summary, Spain offers significant opportunities for Swedish companies within the renewable energy sector. As Europe's second-largest producer of solar and wind power, Spain is committed to achieving carbon neutrality by 2050 and drastically increasing its production of renewable energy by 2030.

This strategy is reinforced by Spain's favourable climate and infrastructure conditions as well as national and international investments funds being allocated to successfully reach Spain's climate neutrality goal, such as the National Recovery and Resilience Plan (NRRP). Offshore wind investments are currently prioritised together with technical investments for photovoltaic cells and modules, green hydrogen, and the manufacturing of cathodes for energy storage.

This situation presents an opportunity for collaboration between Swedish companies and strategic public and private projects in Spain. Sweden can provide expertise and resources in engineering, materials, components, and specialised knowledge for renewable energy and grid development, which can significantly contribute to Spain's green energy transition. The Spanish renewables remuneration framework is very administrative heavy, requiring lots of previous preparations and strategic dialogues. It is therefore important to initiate dialogue with key developers to study their timelines, needs and openness for business collaborations. Important to note is that to apply for public Spanish grants, a Swedish company must have a Spanish company registration number. The registration process in Spain can take from 3-6 months. Business Sweden can provide a company with support regarding strategic stakeholder engagement and company registration.

Business Sweden, in collaboration with the Swedish Embassy, can help Swedish companies capture market potential in Spain's energy market, by providing strategic advice, stakeholder engagement, sales execution, and operational support. Business Sweden will shorten time to market, find new revenue streams, and lower risks for international investments.

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