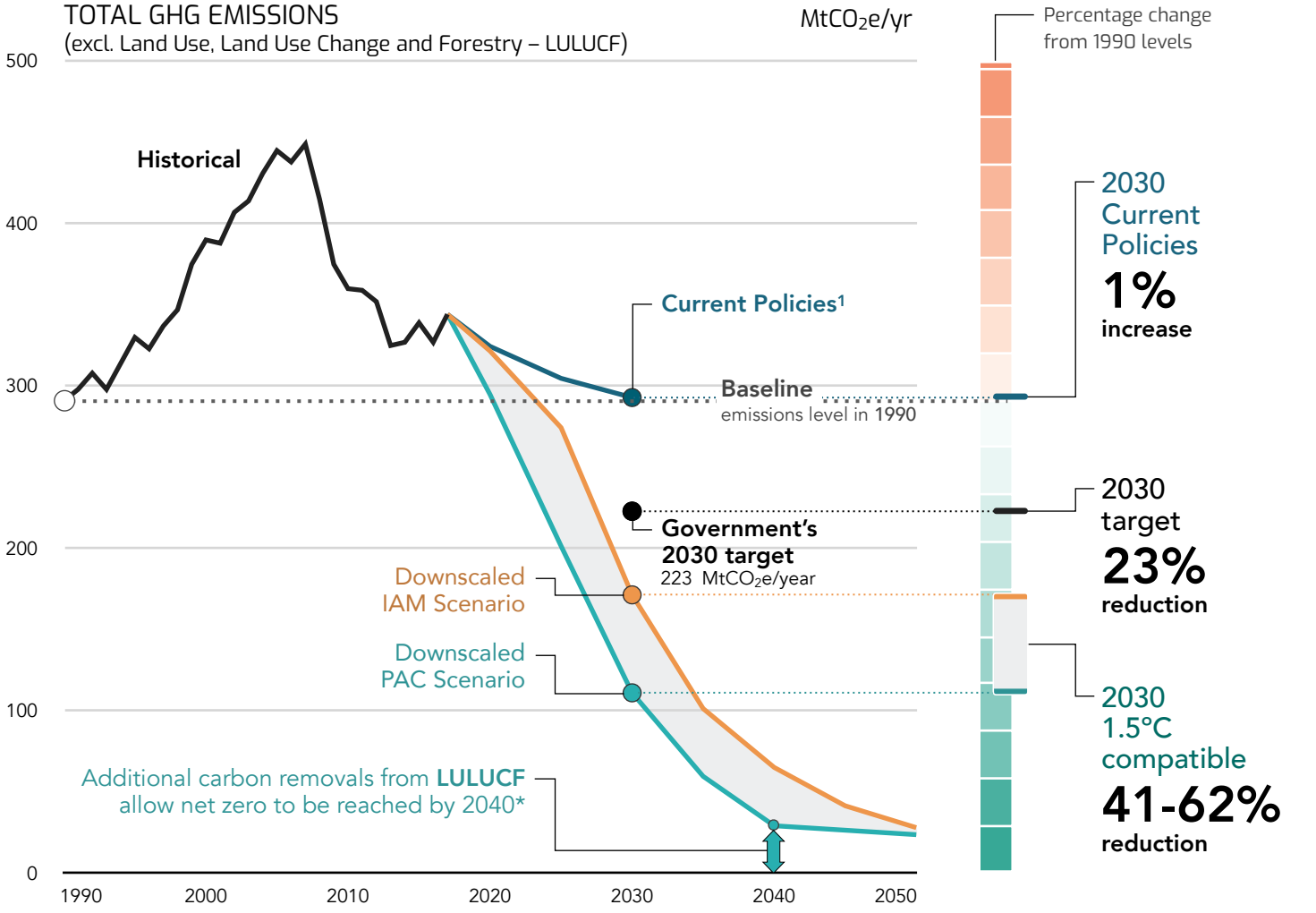
SPAIN

Country Factsheet: 1.5°C Pathways for Europe

EU DE DK **ES** FR
IT PL PT RO SE

Spain's current 2030 emissions target is not 1.5°C compatible



*To achieve the net zero emission target, emissions from LULUCF need to be reduced while increasing the capacity of forests, wetlands, grasslands and farmlands to remove carbon. These carbon removals are not equal to emissions in other sectors and the two cannot simply be considered fungible.

New Spanish NECP policies not in line with 1.5°C compatible target range

Spain has set a 2030 emissions target and has outlined policies that are not ambitious enough to align with the 1.5°C compatible emissions range derived in this project. Under current policies, **total Spanish GHG emissions are projected to remain above 1990 levels, while new planned policies as outlined in Spain's National Energy and Climate Plan (NECP) will only meet the government's current insufficient target.**[1] This demonstrates the need for a simultaneous increase in ambition of its planned climate policies, and a target aligned with the downscaled 1.5°C compatible pathways of between 41-62% below 1990 levels (excl. LULUCF).†

To ensure Spain is contributing its fair share to global climate mitigation efforts, additional emission reduction activities should also be supported in developing countries.[2]

† **Scope and limitations of downscaled emissions and energy mix pathways:**

- Pathways were downscaled using the SIAMESE model developed by Climate Analytics. See 1.5°C Pathways for Europe Report[3] for details
- Land use, land use change and forestry (LULUCF), and international aviation and shipping emissions are not covered by this assessment
- Detailed macro-economic modelling was not conducted as part of this assessment
- Historical and future energy imports and exports were not considered

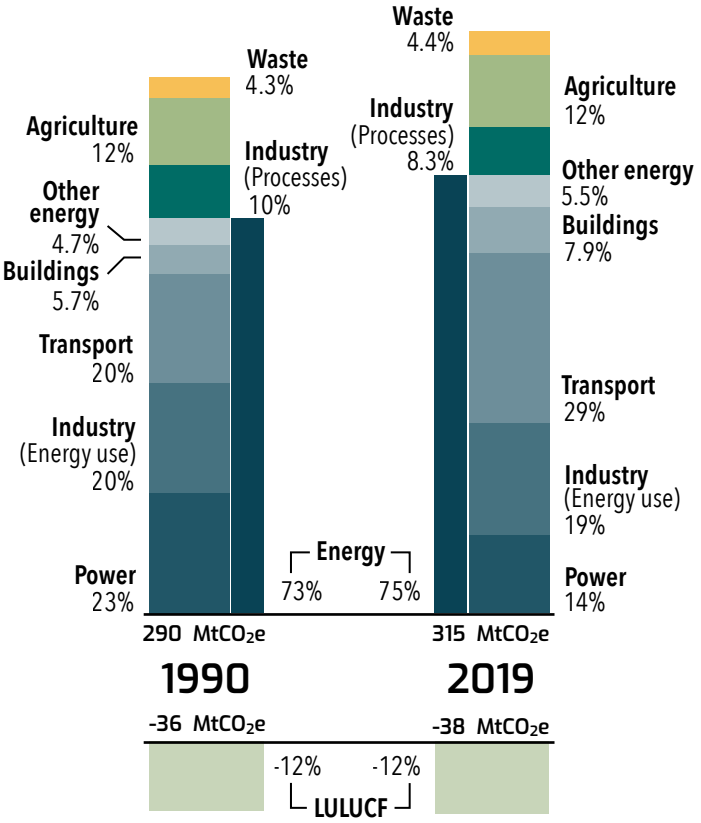
CURRENT SITUATION
Snapshot of Spain's emissions and energy system

Emissions profile

Spain's emissions peaked in 2007, well above 1990 levels, and fell rapidly afterwards due to the global financial crisis and associated economic slowdown.[4] Emissions have been rising again, however, since their 2013 low, and are projected to remain above 1990 levels under current policies.[1] Power sector emissions have fallen from a 24% share of total emissions at their peak in 2007, to just 14% in 2019. Coal demand fell 81% over this period, well above the 52% fall in total power sector fuel combustion.[5]

Emissions in the industry sector fell 34% between 2007 and 2019, while total industrial energy demand declined by only 26% suggesting efficiency gains and the use of cleaner fuels.[5] The share of natural gas in industry energy demand increased five percentage points between 2007-2019, rising to 43% from 38%. The transport and buildings sectors have seen much less steep emissions declines, falling just 15% and 18% respectively over this time, with transport emissions trending higher since 2013.

SPAIN
EMISSIONS BY SECTOR[6]



Energy overview and main policy gaps

Spain has achieved a steep reduction in total coal demand in recent years, reaching 78% below 2007 levels in 2019 while total energy use fell just 24% over the same period.[5] A 2030 coal phase out was announced in 2020, but has not yet been adopted. If formally adopted, this would be aligned with the downscaled 1.5°C compatible power sector pathways. Oil demand fell roughly in line with the overall decline in energy use, while natural gas consumption fell just 3% between 2007 and 2019. Policies to rapidly reduce oil and gas consumption are needed in particular for the buildings and transport sector. Spain has very significant solar resources that it is seeking to tap with its recently adopted 74% 2030 renewable generation target.[1] This is a welcome turnaround from the stifling measures implemented between 2009 and 2015 including a cap on the operating hours of renewable installations, a moratorium on new projects, and a tax on solar prosumers which together led to a sharp decline in new renewable energy capacity.

Civil Society & Global Integrated Assessment Models
1.5°C energy and climate scenarios for Europe

The aim of the 1.5°C Pathways for Europe Project is to derive Paris Agreement compatible emissions and energy mix pathways for key European countries. The project seeks to highlight existing scenarios that demonstrate that a **very high level of ambition on climate and energy policy *is possible* for the European Union.** To reflect the varied methodologies employed to construct such scenarios, we assess the Paris Agreement Compatible (PAC) energy scenario, and a scenario from the global REMIND integrated assessment model (IAM), both embodying high levels of 2030 climate ambition in the European Union region. We use the SIAMESE model developed by Climate Analytics to create country level pathways, using the PAC/REMIND scenario results for the European Union as input and downscaling them based on demographic, economic, energy system, and policy heterogeneity between countries.[7] We outline key differences between the two scenarios used as input for the SIAMESE downscaling process below.

PAC [8]
Paris Agreement Compatible Energy Scenario

The PAC scenario for the EU28 was developed through a bottom-up collective research exercise involving energy and climate experts and incorporating findings from relevant scientific literature.

Around 150 stakeholders from member organisations of the European Environmental Bureau (EEB) and Climate Action Network (CAN) Europe, and from science and industry were involved in the scenario building process.

The PAC scenario is an attempt to construct a European-wide energy scenario which is aligned with the Paris Agreement's objective to limit global warming to 1.5°C and which embodies the demands of civil society.

In doing this it suggests a trajectory with:

- **100%** renewable energy supply by 2040
- **At least 65% GHG emissions reduction** below 1990 levels by 2030 (incl. LULUCF)
- Net zero emissions by **2040**

Carbon Capture and Storage (CCS):

A key assumption underpinning the PAC scenario is that carbon capture and storage **will not be required** to achieve net zero emissions for the European Union.

Global IAM [9,10]
An integrated scenario reaching 1.5°C

We assess the global REMIND 1.7 CEMICS-1.5-CDR8 scenario as an additional line of evidence for pathways for the European Union to achieve the 1.5°C long-term temperature goal of the Paris Agreement. REMIND is a global energy-economy-climate model that maximises inter-temporal welfare. It contains macro-economic, energy system, and climate modules that are integrated to attain exogenously prescribed climate targets.[11]

Population and GDP growth are key drivers of future energy demand and, thus, GHG emissions in IAMs. In our SIAMESE-based downscaling approach, we therefore take growth rates from the shared socio-economic pathway (SSP) scenarios, specifically SSP2, a middle of the road scenario, in order to assess what the EU-region results of this scenario imply for country-specific energy system transformation.

Key outputs for the EU region from this scenario are:

- **90%** renewable energy supply by 2040
- **62% GHG emissions reduction** below 1990 levels by 2030 (excl. LULUCF)
- Net zero emissions between **2045-2050**

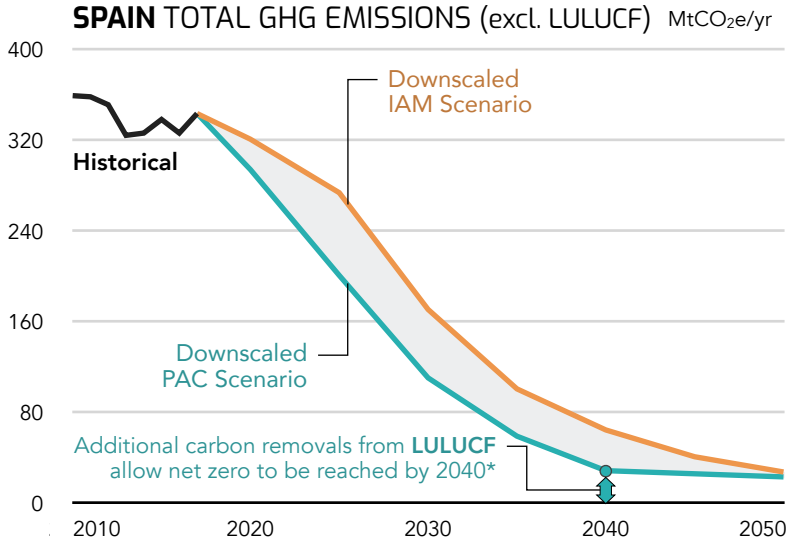
Carbon Capture and Storage (CCS):

This IAM scenario envisages some **natural gas and biomass** combustion with carbon capture and storage.

Economy-Wide 1.5°C Pathways

According to the analysis undertaken in this project, achieving a 1.5°C compatible economy for Spain requires a 41-62% reduction in total GHG emissions by 2030 (excluding LULUCF), and reaching net zero emissions between 2040 and 2050.

There are numerous different pathways to reaching net zero emissions in this timeframe. In the scenarios analysed, a LULUCF sink of 24-28 $MtCO_2e$ would achieve net zero by 2050, while under the PAC scenario, a LULUCF sink of 29 $MtCO_2e$ would achieve net zero emissions in 2040. This is less than the negative emissions projected in the LULUCF sector by the Spanish government under current policies.[6]



*To achieve the net zero emission target, emissions from LULUCF need to be reduced while increasing the capacity of forests, wetlands, grasslands and farmlands to remove carbon. These carbon removals are not equal to emissions in other sectors and the two cannot simply be considered fungible.

1.5°C Compatible 2030 primary energy mix*

	2017[5]	2030
Renewables incl. biomass	13%	**52–68%** IAM PAC
Fossil Fuels	74%	**32–45%** PAC IAM
Nuclear	12%	**0–3%** PAC IAM

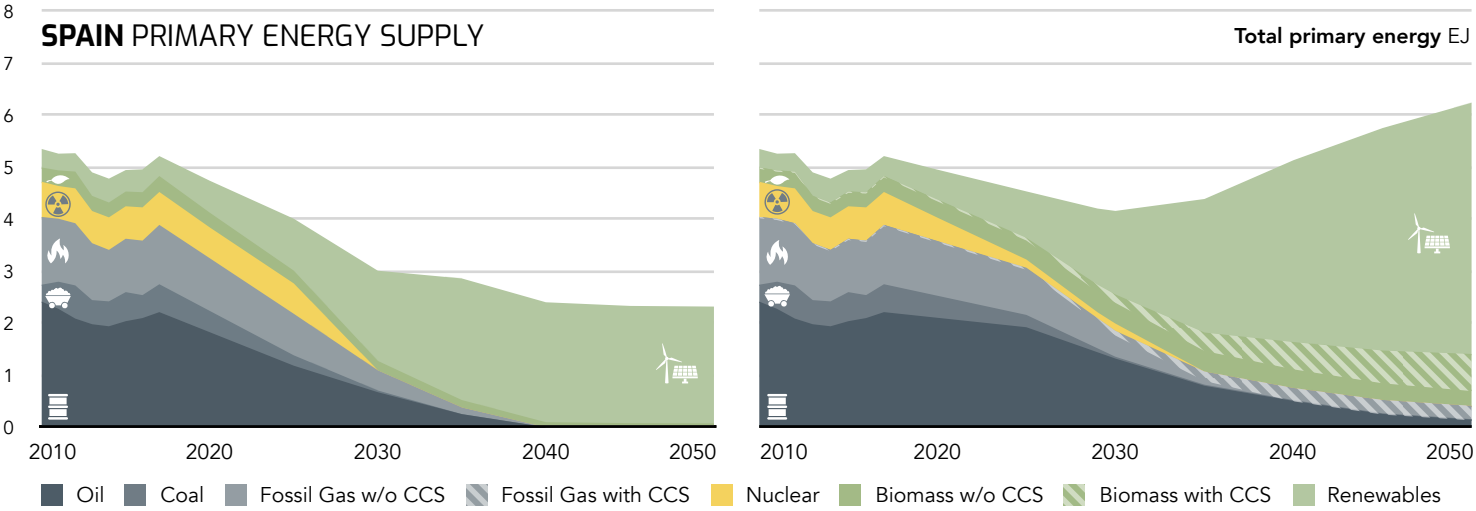
*Primary energy supply includes losses that occur during the conversion of nuclear and fossil fuels to electricity, resulting in a higher proportion of both nuclear and fossil fuels than in total final energy demand

In the downscaled PAC and IAM pathways, the share of unabated fossil fuels in primary energy demand is reduced to between 32-45% by 2030, whereas the share of renewables including biomass reaches 52-68% by the same year.

The transport and building sectors constitute a combined 37% of total GHG emissions in Spain (2019), illustrating the need for strong policies to reduce the oil and natural gas demand that produce these sectoral emissions like those outlined in Spain's Recovery and Resilience Plan.

Downscaled PAC Scenario

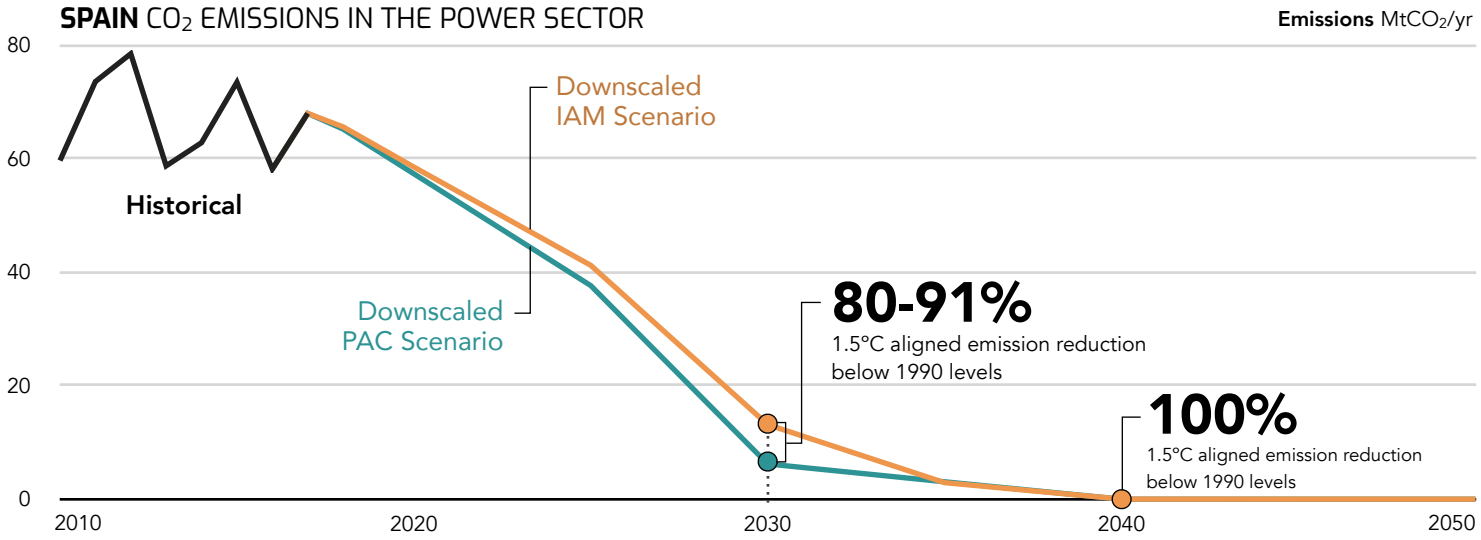
Downscaled IAM Scenario



The PAC scenario depicts a future where total energy use rapidly declines through efficiency gains, largely from switching fossil fuel consumption to renewables, increased rates of material reuse and recycling, and consumer demand reduction.

The IAM scenario also achieves efficiency gains, but assumes energy demand continues to rise over time in line with regional historical growth trends. The large increase in national total primary energy supply reflects the overall increase in the modelled Europe-wide scenario results.

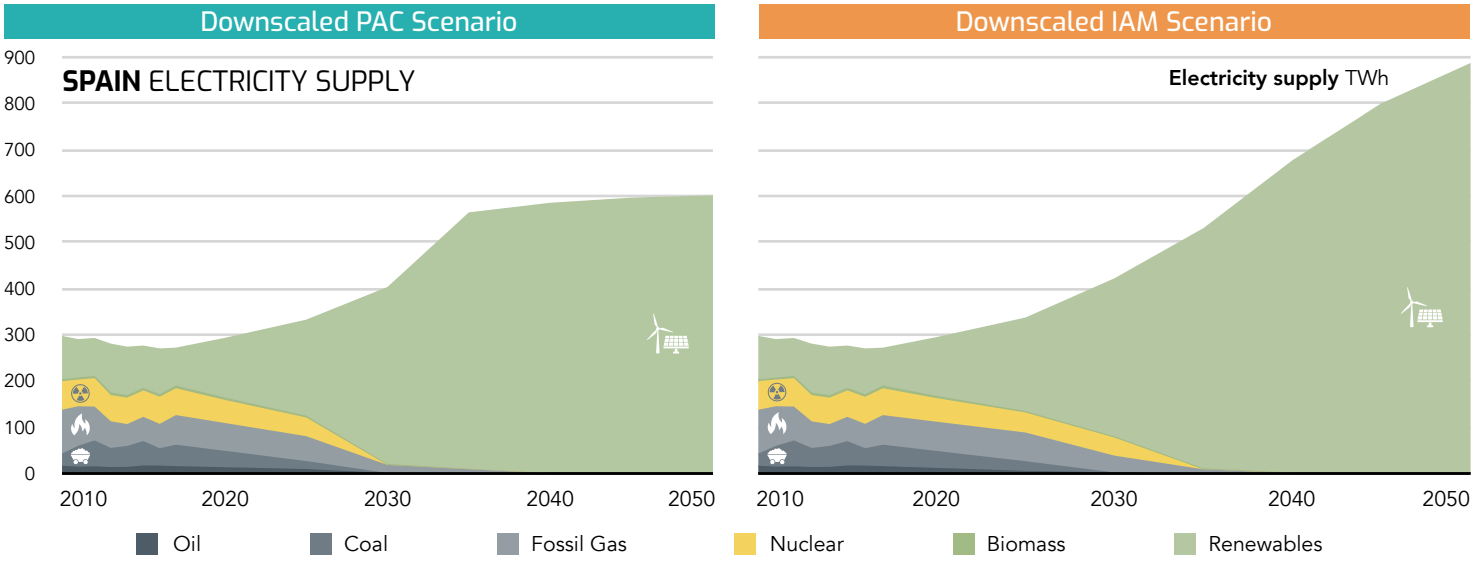
Sectoral decarbonisation: Power



1.5°C Compatible 2030 power sector fuel mix*

	Renewables incl. biomass	Coal	Fossil gas	Nuclear
2017 [5]	32%	17%	23%	21%
2030	82–95% IAM PAC	0%	5–9% PAC IAM	0–9% PAC IAM

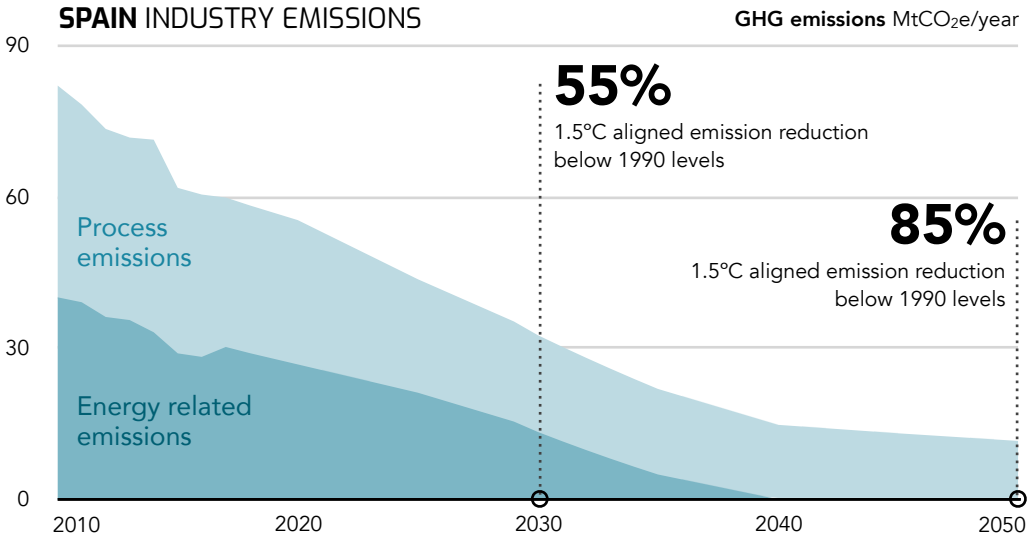
*No detailed wholesale electricity market modelling was undertaken for this assessment



Towards a fully decarbonised power sector

In both downscaled 1.5°C compatible scenarios, remaining coal consumption in Spain's power sector steadily declines and is phased out by 2030, in line with the government's announced 2030 phase out date that is yet to be formally adopted.[1] There is no increase in gas generation in either scenario and it is phased out of the system by around 2035, when the system is fully decarbonised. The expected increase in total electricity demand due to widespread electrification across the economy is met exclusively with renewable sources, with a doubling in total electricity demand by 2035 in both scenarios. Nuclear power is phased out between 2030-2035, in line with the government's 2035 phase out date.

Sectoral decarbonisation: Industry



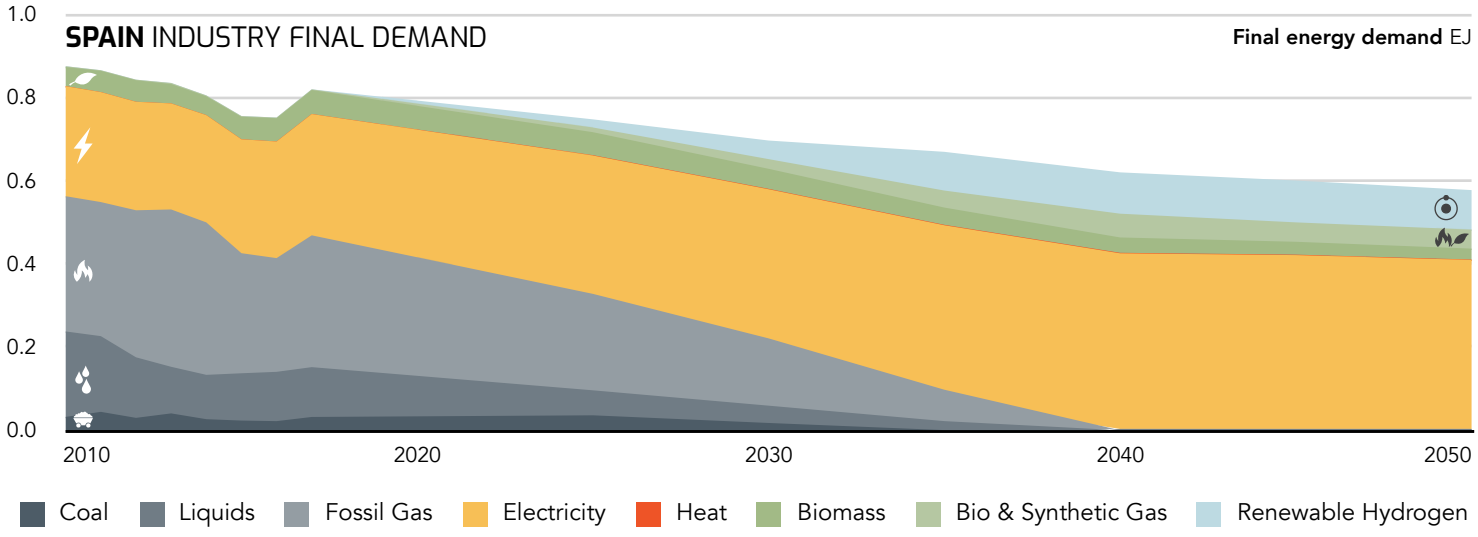
Emissions from industry decline significantly until 2040 in the pathway downscaled from the PAC scenario, whereby energy-related emissions reach zero and further reductions occur more gradually. This is due to the nature of these residual (process) emissions that are harder to mitigate than those from fuel combustion.

It was not possible to downscale the chosen IAM scenario due to a misalignment of scenario and historical energy data.

1.5°C Compatible 2030 industry sector final energy mix

	Electricity	Coal	Fossil gas	Renewable Hydrogen
2017 [5]	36%	4%	39%	0%
2030	**52%**	**3%**	**25%**	**6%**

Downscaled PAC Scenario



Towards a fully decarbonised industry sector

A halving of industry coal demand in Spain between 1990 and 2000 was followed by a steady decline, with mostly natural gas and oil combustion remaining in 2019, making up 57% of total industry energy use.[5] The remaining coal demand must be phased out between 2030 and 2035, while oil and natural gas consumption would need to be eliminated by 2040 to ensure Spain's industry sector is on a 1.5°C compatible trajectory.

Closing the Ambition Gap

Key characteristics of Spain's 1.5°C compatible pathways

	Historical	1.5°C compatible benchmarks		Country targets	
	2017	2030	2050	2030	2050
Total GHG excl. LULUCF	344 $MtCO_2e/yr$	111–173 $MtCO_2e/yr$	24–28 $MtCO_2e/yr$	223 $MtCO_2e/yr$	29 $MtCO_2e/yr$
	18 % above 1990	41–62 % below 1990	90–92 % below 1990	23 % below 1990	90 % below 1990
Emissions intensity of power generation*	250 gCO_2/kWh	15-31 gCO_2/kWh	0 gCO_2/kWh		
Share of renewable power	32 %	82–95 %	100 %	74 %	100 %
Share of unabated fossil fuel in power	47 %	5–9 %	0 %		
Share of nuclear power	21 %	0–9 %	0 %		
Industry electrification rate	36 %	52 %	71 %		

* Does not include upstream emissions

Raising Ambition

A recent change of direction on climate policy, with the adoption of ambitious 2030 and 2050 renewable generation targets and a commitment to reach net zero emissions by 2050, is a welcome development[1]. However, Spain's 2030 emissions target remains well short of what is required to place Spain on a 1.5°C trajectory suggested by the two downscaled scenarios. Boosting their 2030 renewable generation target even higher to at least 82% would contribute to this, as would committing to phase out fossil gas by around 2035.

Other modelling results

Ecologists in Action: Towards a fair and sustainable energy scenario in 2050[12]

- 65% reduction in total final energy consumption below 2015 level by 2050
- Nuclear phase out by 2030
- Coal phased out of power sector by 2030

View the full report covering the EU27 and the 9 member states below or view the other factsheets in this series

Denmark | France | Germany | Italy | Poland | Portugal | Romania | Spain | Sweden

About the author

Supporting science-based policy to prevent dangerous climate change, enabling sustainable development.

Climate Analytics is a non-profit climate science and policy institute based in Berlin, Germany with offices in New York, USA, Lomé, Togo and Perth, Australia, which brings together interdisciplinary expertise in the scientific and policy aspects of climate change. Our mission is to synthesise and advance scientific knowledge in the area of climate change.

climateanalytics.org

Acknowledgments

We would like to acknowledge the Swedish Postcode Foundation for providing funding for this project.

Climate Action Network (CAN) Europe and AirClim provided ongoing and invaluable coordination support but do not necessarily endorse all findings from this project.

References and Data Sources

1. 'Current policies' are those measures that were in force when governments sent their NECPs to the European Commission. Emission reductions by 2030 on this base are taken from the NECPs.
   Integrated National Energy and Climate Plan (NECP) 2021-2030
   Source: Government of Spain (2020).
   Link: https://ec.europa.eu/energy/sites/ener/files/documents/es_final_necp_main_en.pdf
2. Comparability of Effort
   Source: Climate Action Tracker (2021).
   Link: https://climateactiontracker.org/methodology/comparability-of-effort/
3. 1.5°C Pathways for Europe: Achieving the highest plausible climate ambition
   Source: Climate Analytics (2021)
   Link:
4. National Inventory Report - Spain
   Source: Government of Spain (2021)
   Link: https://unfccc.int/documents/274037
5. World Energy Balances 2020
   Source: International Energy Agency (IEA) (2020).
   Link: https://www.iea.org/data-and-statistics/data-product/world-energy-balances
6. Spain. 2021 Common Reporting Format (CRF) Table
   Source: Government of Spain (2021).
   Link: https://unfccc.int/documents/270987
7. Towards Optimal 1.5° and 2 °C Emission Pathways for Individual Countries: A Finland Case Study
   Source: Sferra, F. et al, *Energy Policy,* (2018).
   Link: https://doi.org/10.1016/j.enpol.2019.04.020
8. Paris Agreement Compatible Scenarios for Energy Infrastructure
   Source: PAC Consortium (2020).
   Link: https://www.pac-scenarios.eu/
9. REMIND
   Source: Potsdam Institute for Climate Impact Research (2020).
   Link: https://www.pik-potsdam.de/en/institute/departments/transformation-pathways/models/remind
10. Potential and costs of carbon dioxide removal by enhanced weathering of rocks
    Source: Strefler, J., Amann, T., Bauer, N., Kriegler, E., Hartmann, J. (2018).
    Link: https://iopscience.iop.org/article/10.1088/1748-9326/aaa9c4
11. Description of the REMIND model (Version 1.6)
    Source: Potsdam Institute for Climate Impact Research (PIK) (2015).
    Link: https://www.pik-potsdam.de/en/institute/departments/transformation-pathways/models/remind/remind16_description_2015_11_30_final
12. Hacia un escenario energético justo y sostenible en 2050
    Ecologistas en acción (2015).
    Link: https://www.ecologistasenaccion.org/31234/hacia-un-escenario-energetico-justo-y-sostenible-en-2050-2/