

Fossil fuel prices and inflation in Spain



Final Report

September
2022

Cambridge Econometrics
Cambridge, UK

info@camecon.com
www.camecon.com

Contact person: Carl Heinemann, ch@camecon.com

Authors: Carl Heinemann, ch@camecon.com
Istvan Heilmann, ih@camecon.com
Iakov Frizis, if@camecon.com

Contributors: Aron Hartvig, adh@camecon.com

Project director: Stijn van Hummelen, svh@camecon.com

Disclaimer

This report has been supported by the European Climate Foundation. Responsibility for the information and views set out in this report lies with the authors. The European Climate Foundation cannot be held responsible for any use which may be made of the information contained or expressed therein.

The analysis presented in this report was conducted in September 2022 with the most recent data available at that time, and the report considers policy announcements until end of September 2022.

Cambridge Econometrics' mission is to provide clear and useful insights, based on rigorous and independent economic analysis, to address the complex challenges facing society.

www.camecon.com

Cambridge Econometrics Limited is owned by a charitable body,
the Cambridge Trust for New Thinking in Economics.

www.neweconomicthinking.org

Key findings

- **Energy prices, including electricity, gas and transport fuels, are responsible for a large share of consumer price inflation in Spain** in the past twelve months, contributing more than a third to the annual inflation rate which stands at 10.7% as of July 2022. In March, electricity prices alone were responsible for 45% of year-on-year inflation but prices have since fallen as a result of government intervention. Between May and July, fossil fuels prices accounted for 19-25% of the overall inflation rate, and electricity prices for 16%.
- **We estimate that the lowest income households will spend around 70% more on energy this year than in 2020, or €550 more.** For almost all households, the share of energy costs in overall household expenditure has increased in all years reported, from 2010 to 2020. Based on energy price inflation and households' energy expenditure change, we estimate that the share of energy costs in total household expenditure has risen from 5.6% in 2020 to 8.8% in 2022 for the lowest income households.
- **In response to rising energy prices, the Spanish government has also intervened heavily in retail markets to shield consumers from price hikes,** by cutting taxes, providing direct cash transfers and reducing the price of public transport. These interventions took effect from April, but Eurostat data shows that households are still faced with significantly higher energy prices compared to a year ago. The total funding allocated to support households is estimated to cost the government over €35bn (equivalent to 2.9% of GDP). The Spanish government has also intervened in wholesale electricity markets, by introducing a price cap on natural gas used in power generation in May 2022. As a result, Spanish electricity prices have since then been significantly lower than in other EU countries. An additional **€3 billion** package of measures to support consumers was passed in October, along with an energy savings plan, but these developments came too late to include in this analysis.
- **Renewables are now much cheaper than fossil fuel-based electricity production, and a further expansion of renewables is likely to lead to lower wholesale electricity price, on average, in the long term and reduce the need for government intervention.** This would also help Spain become less reliant on fossil fuel imports and reduce the need for government intervention to support consumers. Spain already has a relatively high share of renewables and the government is seeking a stronger association of wholesale electricity prices with the low cost of renewables. Spain has partially achieved this with the gas price cap, but this comes at a high cost. In the future, this could be supported if an accelerated deployment of renewables is accompanied by investments in battery storage and pumped hydro to replace gas-fired peak load electricity.
- Increasing the electrification of transport, industry and heating, coupled with an expansion of renewables, can further reduce household and business consumers' exposure to volatile fossil fuel prices, and limit the need for government intervention during times of high fossil fuel prices.

Energy prices and inflation in Spain

This report explores the role of energy prices in recent inflation

The world is experiencing a surge in cost of living and corresponding inflation levels, which can be mostly attributed to supply-side factors.

Soaring prices of fossil fuel-based energy preceded and accompanied this return to inflation in countries across the EU. Many renewable energy sources are now cheaper than fossil fuels in electricity generation, especially for newly built capacity (IRENA, 2022). However, many of these advantages are new and not fully understood across policy and investment landscapes.

The perception of the EU's Climate Law, which sets a target to cut emissions by at least 55% from 1990 levels by 2030, is that it is environmentally motivated. However, the policies supporting this target may also have significant effects on both the level and the volatility of cost of living pressures that arise from the fossil fuel energy complex.

This paper sets out to explore the role of energy prices in inflation in Spain, with a view to understanding the potential for faster energy transition measures to ease inflationary pressures and risks.

Spain is a net energy importer, but import dependency has reduced over time

Spain is a net energy importer if all energy sources and consumption (including electricity) are considered. However, Spain's dependence on imports has decreased over time: net imports accounted for 68% of gross available energy in 2020, a decrease from 2000, when net imports stood at 78% of gross available energy. (Eurostat, 2022: NRG_IND_ID; European Commission, 2022d)

Spain is almost entirely reliant on fossil fuel imports. Fossil fuels still have an important role in Spain's total energy use and the country's demand for oil and natural gas is almost completely (99%) met by import (OECD, 2020). In 2021, a substantial portion of natural gas imports were from Algeria (43%) but the remainder of the supply can be considered well diversified including the U.S. (14%), Nigeria (12%) and Russia (9%) (Statista, 2022). Due to the well-developed LNG infrastructure, LNG shipments more than doubled in July 2022 compared to July 2021 and represented 72% of the total natural gas imports, while gas deliveries through pipelines, mainly from Algeria, dropped by 38% (Cores, 2022: pp. 36-37). In fact, in July 2022, gas imports from Russia were around 140% higher than in July 2021. As a result of Spain's reliance on energy imports, domestic energy prices are influenced by global market prices for oil and gas.

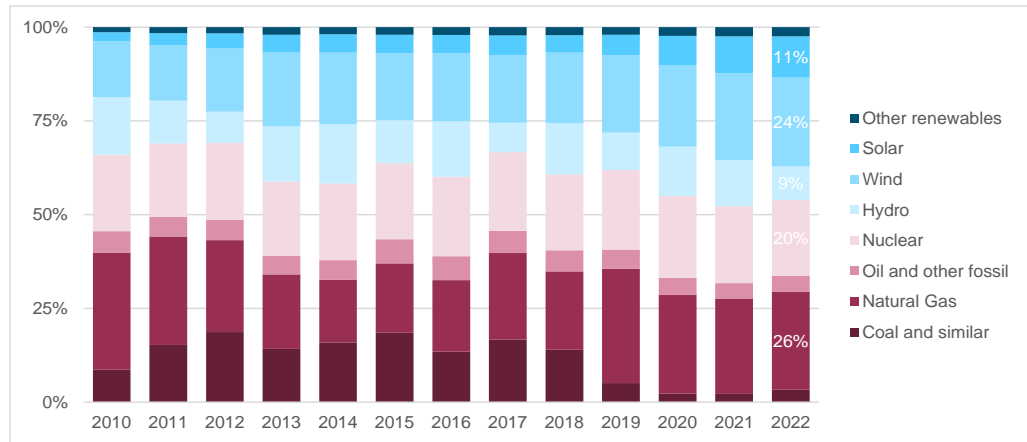
Spain's electricity production consists of a broad mix of sources

Renewable energy sources make up a large share of the Spanish electricity mix, whilst coal and oil have been almost fully phased out.

Spain's electricity generation consists of a broad mix of sources. Between 2010 and 2015, the share of oil and coal fell from around 25% to 6%, driven primarily by a significant reduction in coal-based electricity production, but natural gas remains a key energy source, contributing just over a quarter of electricity production. The electricity production is now dominated by low-emissions technologies. Wind has been playing an important role for a long time, contributing 21% to overall electricity generation in 2020, whilst the share of solar PVs has also increased rapidly (6% in 2020 up from 3% in 2015). Furthermore, Spain has been pioneering concentrated solar thermal power generation, which currently represents 2% of its electricity production. Overall, the share of renewable sources in Spain's electricity generation mix had

reached 45% in 2020 and 46% in the first half of 2022, up from 36% in 2015. Figure 1 shows the changes in the share of renewable energy sources in the Spanish electricity mix.

Figure 1 Electricity generation mix, Spain 2010 to 2022 (Jan-May)



Source: IEA (MES_0522)

The cornerstone of Spain’s future energy system is the Climate Change and Energy Transition Law

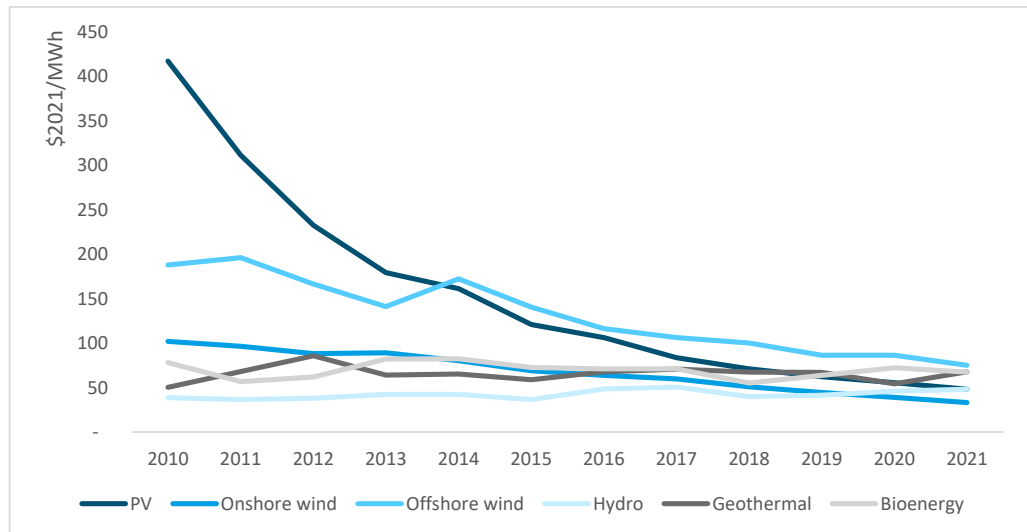
The Spanish climate strategy emphasises a further expansion of renewable energy and energy efficiency. After years of development and debate, Spain’s first major climate law, the Climate Change and Energy Transition Law, came into force in May 2021. The law commits the country to cutting emissions by 23% by 2030, compared with 1990 levels and to achieving climate neutrality by 2050 (IEA, 2022). The law also sets a goal of reaching 74% renewable electricity generation by 2030, 42% renewables in final energy consumption, and reducing primary energy consumption by at least 39.5% through energy efficiency improvements. The goals will be revisited periodically starting from 2023.

Renewables will dominate electricity production in 2030. Spain’s National Energy and Climate Plan foresees a total installed capacity in the electricity sector of 161 GW by 2030, 50 GW of which will be wind energy; 39 GW solar photovoltaic; 27 GW combined gas cycles; 16 GW hydroelectric energy; 9.5 GW pumping; 7 GW solar thermal electric; and 3 GW nuclear.

The cost of renewables has consistently gone down

The lifetime cost of renewables is now below that of fossil fuel-based power generation. The levelized cost of electricity (LCOE) of renewable energy technologies has been decreasing globally, as shown in Figure 2. The largest drop has been observed in the lifetime cost of solar photovoltaic power generation, which has fallen 88%, from \$417 to \$48 per MWh (2021 prices). Similarly, offshore and onshore wind projects’ costs have reduced by 60% and 68%, respectively. At the same time, the LCOE of fossil-fuel based electricity generation has remained largely unchanged until late 2021. Gas-fired power plants’ costs rose sharply in 2022 due to the current hike in natural gas prices, resulting an estimated average LCOE of gas-fired powerplants of \$268 per MWh in Europe. The latest IRENA estimates for the LCOE of renewables are \$25 per MWh for onshore wind (below the world average of \$33 per MWh) and \$48 per MWh for PV (equal to the world average) in Spain (IRENA, 2022).

Figure 2 LCOE of renewable energy sources globally, 2010-2021 (in constant \$2021/MWh)



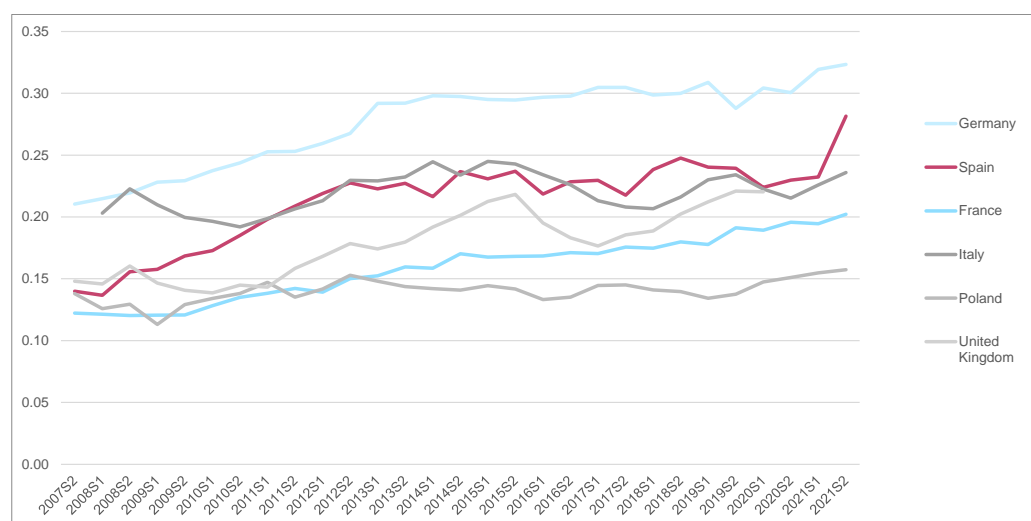
Source: IRENA, 2022

Note: Global weighted average of commissioned projects

Electricity prices have been relatively volatile and high in the last decade

Spanish retail electricity prices rose to the upper end of European peer countries over the last decade. Over the past ten years, electricity prices in Spain have been among the highest of peer countries such as Italy, Germany, France and the UK. This is partly a result of Spanish taxes on retail electricity (which are also relatively high compared to taxes on oil and gas), but the steep increase in late 2021 is primarily a result of the rising natural gas prices, which are key determinants of Spanish wholesale electricity prices. Retail electricity prices increased significantly between 2007 and 2012, and were then relatively constant until late 2022, when prices rose sharply from an average of around €0.23 per kWh in the previous years to around €0.28 in late 2021.

Figure 3 Retail electricity prices in Spain and in selected European countries

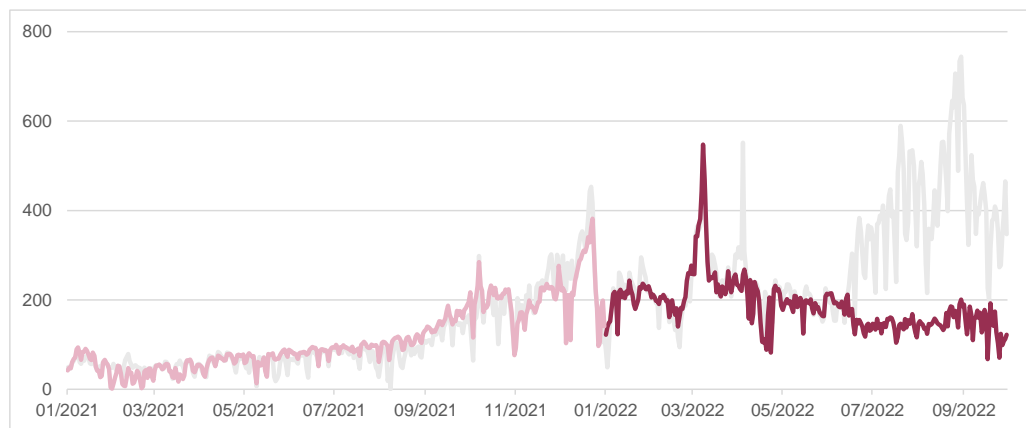


Source: Eurostat dataset: NRG_PC_204

Note: All taxes and levies included; in band DC: consumption is between 2500 and 5000 kWh yearly

Wholesale electricity prices have risen significantly in late 2021, and then spiked in March 2022, with the day ahead price peaking at nearly €550 per MWh on 8 March. In March 2022, the average day-ahead price was €283 per MWh, a historic high, driven by the high prices for natural gas. As a result, the Spanish (and Portuguese) government introduced a price cap on natural gas used in power generation, starting at €40 per MWh in May 2022 and, rising to €70 per MWh at the end of the year (Enerdata 2022). This has significantly lowered and stabilised Spanish wholesale electricity prices compared to other European countries, such as France (see Figure 4), but is expected to cost the Spanish government €6.3bn until its expiry in May 2023 (Enerdata 2022). The measure operates by providing direct grants to electricity producers to bridge the difference between the gas price cap and the market price of natural gas (European Commission, 2022e).

Figure 4 Wholesale day-ahead electricity prices in Spain (red lines) and France for comparison (grey line) in 2022

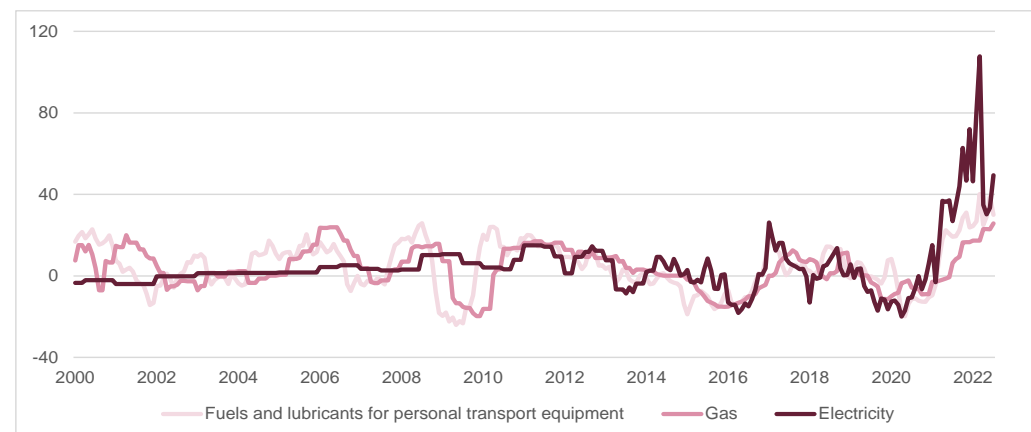


Source: CE analysis of Ember Climate (2022) and Bundesnetzagentur (2022) data

In the last 10 years, Spanish retail electricity prices were more volatile than fossil fuel prices

In Spain, retail electricity prices have been more volatile than fossil fuel prices, but only in the past ten years, as can be seen in Figure 5. The liberalisation of the Spanish electricity market and greater consumer exposure to wholesale prices is said to be one of the reasons¹ (the most recent deregulations took effect in 2013).

Figure 5 Price changes for retail electricity, gas and transport fuels (retail) over the same month in the previous year, percentage points



Source: Eurostat dataset: PRC_HICP_MANR

¹ However, according to the IEA 2021, Spain's retail electricity market remains among the least competitive in Europe.

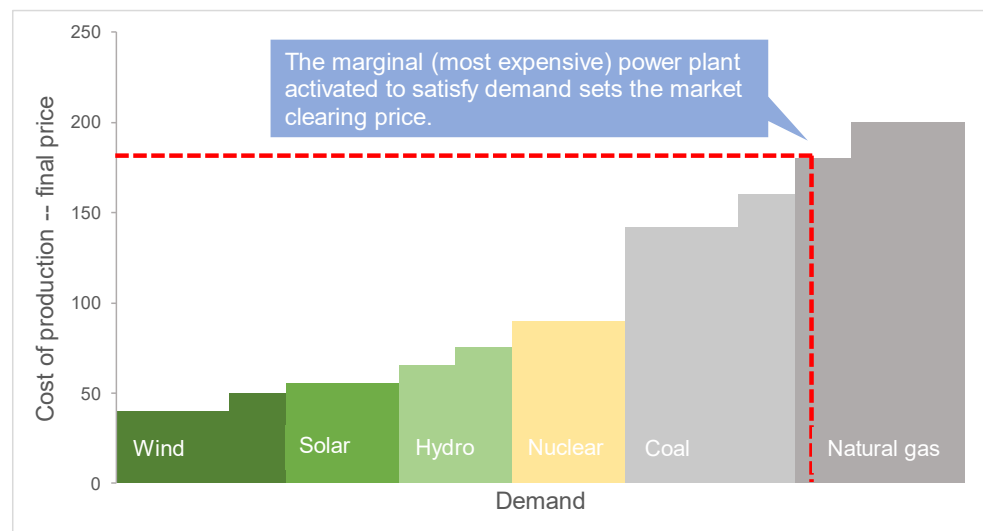
The current increases in wholesale and retail electricity price are connected to the increase of gas prices. Since 2010, retail electricity prices were also more closely correlated with fossil fuel prices. In Spain, baseload power generation is assured by the Spanish nuclear fleet and renewable energy sources. These technologies generate electricity at low prices. However, the wholesale electricity price is usually determined by the last marginal unit of generated electricity, where electricity is supplied in ascending order, based on the marginal generation cost of each unit (see Box 1). During peak times, the last marginal unit of electricity is usually provided by gas-fired power plants, which are affected by the steep rise in natural gas prices since 2021.

Box 1: Electricity price setting in the EU Member States

Key wholesale electricity prices in the EU are based on a marginal price model, set in place by EU legislation. In the electricity market, the power sources with the cheapest operating cost are used first, and power plants that are more expensive to operate are added until total electricity demand in the market is satisfied. This is known as merit order. The last, i.e. the marginal, and therefore most expensive plant activated to satisfy demand sets the price for the whole market. This means that the market clearing price is equal to the marginal price of power production. As a result, wholesale prices can vary significantly during the day, as demand varies at different times of the day and night.

Renewable and nuclear energy sources are usually the cheapest power sources. However, to satisfy demand during peak hours, many countries rely on gas and coal fired plants, which then consequently set the wholesale electricity price. As gas has become more expensive since Russia's invasion of Ukraine, wholesale electricity prices have also soared.

Marginal price models are preferred for their transparency, efficiency and for the incentives they provide to keep generation costs at the lowest possible. As can be seen in the illustration below, operators of renewable power sources can achieve revenues much higher than their marginal costs, which incentivises investment in renewables (European Commission 2022b).



Unique characteristics of the Spanish electricity market also affect retail electricity prices. In Spain, a large share of households (40%) pays for electricity through a variable tariff which changes daily, based on the regulated market prices which are strongly correlated with wholesale prices.² The interconnectivity capacity with France is weak and Spain failed to reach the target of a 10% cross-border interconnection rate by 2020 and is at risk of missing the 15% target by 2030. As a result, the Iberian market between Portugal and Spain, which are well-connected, functions like an island in the European energy market (IEA, 2021: p. 37; European Commission, 2022a). These characteristics contribute to the volatility of Spanish retail electricity prices (Caixa Bank Research, 2022).

Table 1 analyses the price volatility of electricity, gas, and transportation fuels (primary petrol and diesel) in greater detail. Price growth and volatility of all types of energy sources have exceeded overall general inflation in the past 27 years.

Table 1 Standard deviation and average monthly price change for electricity, gas and fuels.

	1995-2021:M7		2021:M8-2022:M7	
	Standard deviation	Average monthly price change (%)	Standard deviation	Average monthly price change (%)
Electricity	2.89	0.20	14.07	4.32
Gas	2.29	0.24	2.07	1.94
Fuels and lubricants for transport	2.65	0.31	6.69	2.43
All items	0.71	0.17	1.23	0.78

Source: Eurostat dataset: PRC_HICP_MMOR

Note: Fuels and lubricants for personal transport equipment category is driven by price change of diesel and petrol. This category has been chosen due to its better data availability

Fuel and electricity prices both have risen sharply in recent history

In the last year, volatility and average price growth accelerated dramatically. In the period of 1995-2021, the average monthly change in retail electricity prices was only slightly above the general price level change. Meanwhile, petrol and diesel prices outpaced general inflation by a factor of two. The volatility of all energy sources was roughly three times higher than that of the general inflation rate until mid-2021. Since then, however, price growth for all energy source has been exceptionally high.

The current energy price hikes are strongly connected to global developments. Since January 2020, energy prices have increased more than at any other time in the past 25 years. Spanish electricity prices have risen by over 100% (see Table 2), whilst fossil fuel prices' rise has been also sharp, with petrol prices up 19%, diesel up 30%, and gas up 27%. The increase is driven by an uptick in global demand after the end of Covid-related lockdowns, the weakening Euro against the US dollar, and, more importantly, reduced supply of natural gas following Russia's invasion of Ukraine in February 2022.

² For comparison, Portugal has a similar power generation mix as Spain, but only 20% of households pay variable tariffs which is announced by the market regulator and more or less fixed for a quarter. As a result, prices are less volatile.

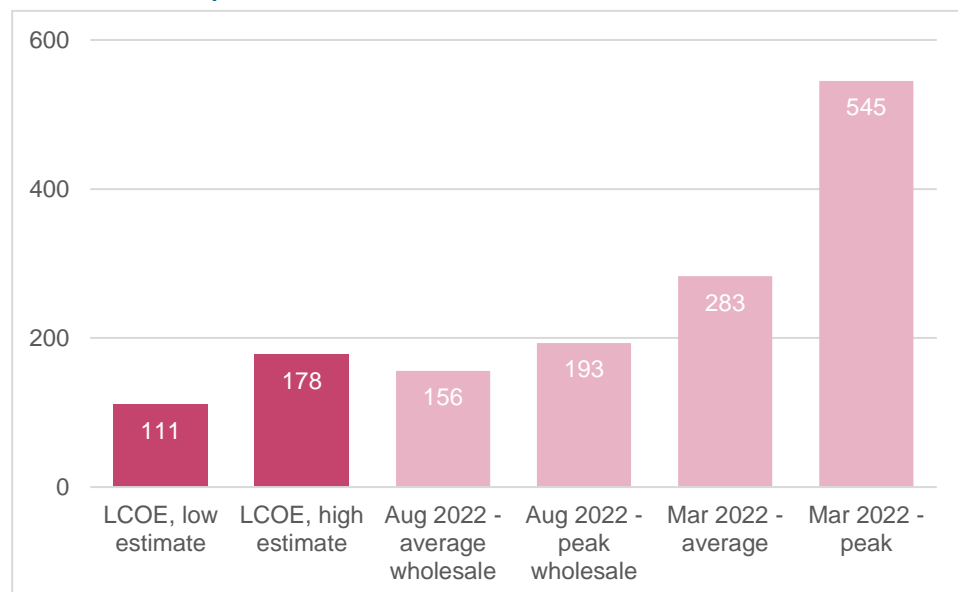
Table 2 Recent change in retail electricity, gas, petrol and diesel prices in Spain

As of September 2022, Change since:	January 2022 (last 6m)	September 2021 (last 12m)	September 2020 (last 24m)	January 2020 (last 30m)
Electricity	17.7%	60.5%	116.2%	114.0%
Gas	19.4%	24.7%	35.0%	26.6%
Diesel	19.4%	26.5%	49.9%	30.4%
Petrol	5.6%	9.5%	32.6%	19.4%
All items (overall inflation)	6.0%	10.3%	13.8%	12.0%

Source: Eurostat dataset: PRC_HICP_MMOR

We estimate that Spanish electricity prices were 60% above production costs in March, but have fallen closer to parity since then

In early 2022, wholesale electricity prices were far above estimated electricity generation costs in Spain. Based on the energy mix in the six months to May 2022 and data on the levelized cost of electricity from IRENA and the World Bank (Timilsina, 2020), we estimate current electricity generation costs in Spain across technologies to be between €111 and €178 per MWh, factoring in current gas prices. The average wholesale price (day ahead) of electricity in Spain in August this year was €155 per MWh, with a peak of €193 on 31 August, much lower than the peak day ahead price of €545 per MWh on 8 March 2022 (CE analysis of OMIE (2022) data). During the price spikes in March, wholesale electricity prices were at least 60% higher than average electricity generation costs across all technologies but have since fallen to levels that are closer to production costs, although still likely higher. Note that estimates of electricity generation costs are indicative only, as they depend on a large range of factors, such as oil and gas prices for fossil fuel-based power generation, lifetime of power plants, and the cost of capital faced by investors.

Figure 6 Estimated average production cost of Spanish electricity compared to recent wholesale prices

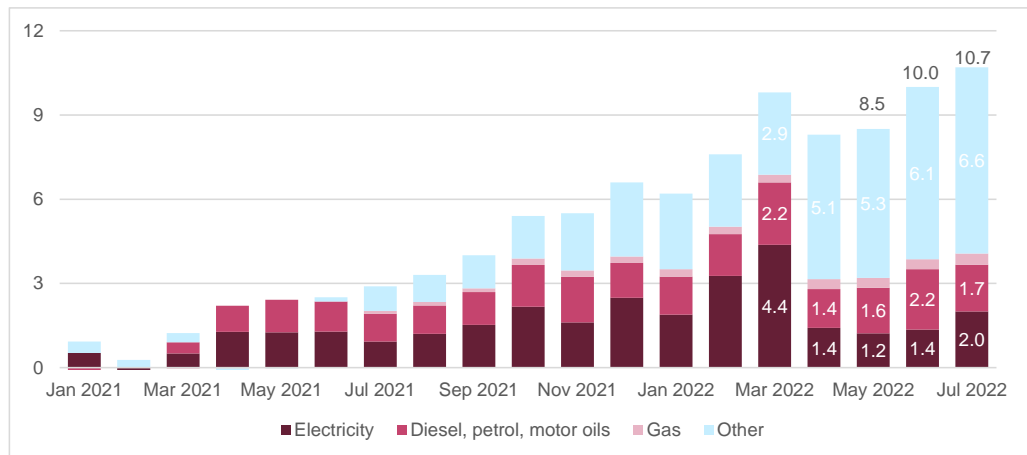
Sources: LCOE: IRENA/World Bank (Timilsina, 2020) (low estimate), Cambridge Econometrics E3ME and IRENA data (high estimate); Wholesale electricity prices (spot) in Spain: OMIE

Energy prices are key drivers of the recent consumer price inflation

Currently, fossil fuels are a major driver of consumer price inflation in Spain. Retail energy and transport fuel prices are a component of the consumer prices index (CPI), and their weights account for around 10% of the overall basket of goods and services included in the CPI (gas and fuels account for around 7% and electricity for around 3%). Recently, however, they have had a much higher contribution to overall inflation. Fossil fuels alone (transport fuels and gas) accounted for approximately 23% of overall year-on-year inflation in May, 25% in June 2022, in 19% in July 2022 (Figure 7).

Electricity prices also had a significant effect on CPI inflation, most notably due to the price hikes in March at the outbreak of the Russia-Ukraine war, at which time electricity alone accounted for 45% of year-on-year inflation.

Figure 7 Contribution of electricity, gas and fuel prices to consumer price inflation in Spain



Source: CE analysis of Eurostat dataset: PRC_HICP_MANR

Various government interventions have reduced electricity prices significantly in the following months, and between May and July, electricity prices contributed around 16% to the annual inflation rate.

Poor households are most affected because they spend a higher share of their incomes on energy

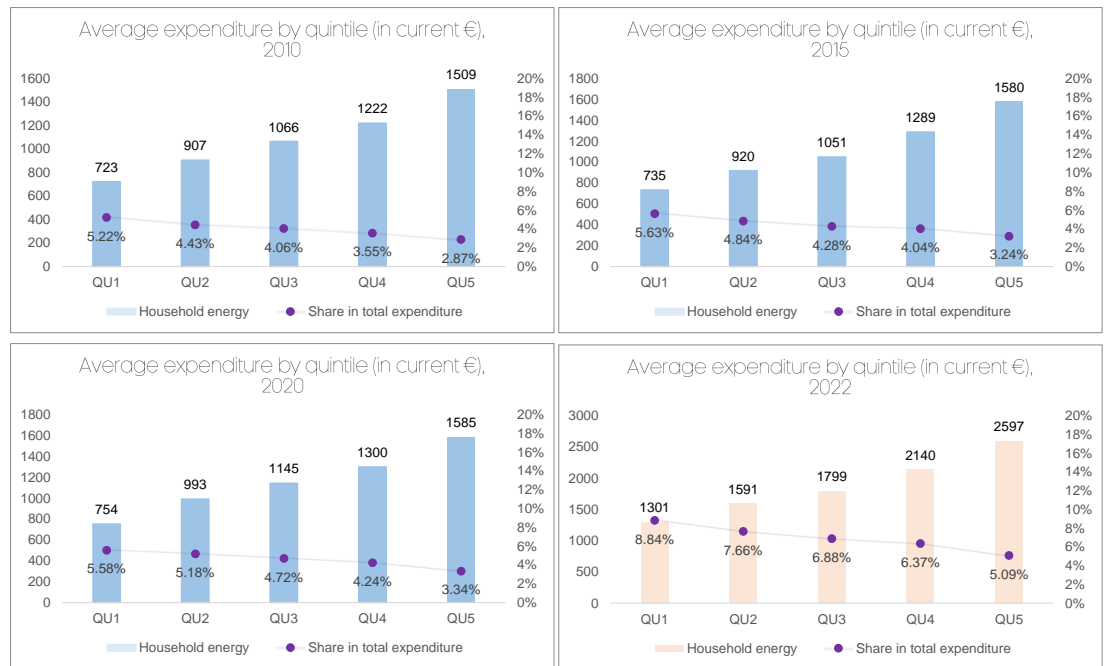
Low-income households spend a larger share of their income on energy than richer households. For most households, expenditure on energy as a share of total household spending increased slightly between 2010 until 2020. Whilst poorer households spend less on energy (and everything else) than wealthier ones, the proportion of total living expenditure on energy is higher, as can be seen in Figure 8.

The share of household expenditure on energy is estimated to have risen substantially since 2020. In 2020, despite the drop of fossil fuel prices, household expenditure on energy rose, reaching 5.6% for households in the bottom 20% of the income distribution. We estimate that household expenditure on energy increased substantially in 2022, as retail gas and electricity prices had increased by 96.4% in August 2022 compared to August 2020, whilst the overall price level had increased by 14.1% over the same time period.

We estimate that an average household in the bottom 20% of the income distribution will spend 8.8% of overall living expenditure on energy in 2022, or around €550 more than in 2020. In other words, a household in the bottom 20% of the income distribution now spends around 72% more on household energy than in 2020, and over 73% more than the richest households relative to their overall living expenses. Households in the top

quintile are estimated to spend €1,012 more on energy in 2022, an increase to 5.09% of total household expenditure, up from 3.3% in 2020.

Figure 8 Household incomes by quintile and expenditure on household energy as a share of total household expenditure



Sources: Eurostat dataset: PRC_HICP_MANR, HBS_STR_T223;
 INE: Household Budget Survey - Average expenditure by household, average expenditure by person and expenditure distribution (vertical and horizontal percentages) by expenditure group and expenditure quintile
 Note: 2022: CE's own estimate, based on energy price inflation and average expenditure growth

Spain is taking measures to address the energy price increases in 2022

To mitigate the impact of high electricity and fossil fuel prices on households and businesses, the Spanish government has introduced a range of measures. The first package, the War Response Action Plan, approved on 29 March 2022, consisted of measures to shield the Spanish economy from the impact of the conflict and a surge in inflation, such as:

- 20-cent per litre cut of fuel prices, of which 15 cents are financed by the government and the rest is covered by the oil companies;
- An increase of the minimum living wage by 15% to support the most vulnerable groups;
- Tax cuts applicable to household electricity bills: VAT cut from 21% to 10%, and then to 5% (announced in June 2022), excise duty on electricity cut from 4.11% to 0.5%, and a suspension of the tax on the value of electric energy production (Caixa Bank Research, 2022).

Approaching the expiration of the measures introduced by the War Response Action Plan, a new anti-crisis package was approved on 25 June 2022. The new package extended the existing measures until the end of the year and introduced several new measures, such as:

- Direct aid of €200 to workers, the self-employed and the unemployed with incomes below €14,000 gross per year to deal with rising living costs;

- A new tax on large energy companies with a turnover above €1bn will come into force in 2023 with the aim to raise €2 billion each year;
- A 50% reduction on public transport tickets.

Estimates by think tank Bruegel suggest that the total cost of measures announced as of September 2022 add up to over €35bn euros, or 2.9% of Spain's GDP.

A further package of measures worth €3bn was announced on 13 October, consisting mainly of expanded social electricity and gas tariffs (La Moncloa, 2022). The Spanish government is also consulting on a reform of electricity tariffs (S&P Global, 2022).

Discussions about EU-wide actions and the future energy system are ongoing

Spain's price cap for natural-gas used in power generation has effectively reduced wholesale electricity prices. On 31 May 2022, the European Commission approved a €6.3 billion intervention for Spain and a €2.1 billion measure for Portugal to reduce the wholesale electricity prices in the Iberian market (MIBEL) by limiting the cost of natural gas based power generation. The measure has effectively reduced wholesale prices, but comes at a high cost for the government. It has not been decided if the measure will be extended after May 2023.

The European Commission and other EU countries are also developing measures to address high energy prices. Other EU countries have made similar interventions, and there is a debate in Europe about how the link between electricity and gas prices can be weakened in European electricity markets, where peak load capacity is typically gas-based (Zakeri et al., 2022; Ember Climate, 2021). In fact, Zakeri et al. (2022) find that between 2015 and 2019, fossil fuel prices have determined European wholesale electricity prices 66% of the time. As a result of the gas price shooting up, electricity prices have also risen sharply in the past 12 months, despite the increasing share of renewables in the generation mix (Ember Climate, 2021). In the long term, to reduce electricity prices sustainably, gas-fired peak load capacity could be replaced by stored excess power from renewables using battery storage and pumped hydro (see, for example, World Economic Forum, 2022).

In the EU, member states have agreed to a series of short-term EU-wide emergency measures to reduce consumer bills. On 14 September 2022 the European Commission proposed a reduction in electricity consumption, a tax on energy providers' excess profits, as well as a 'revenue cap' on producers of non-marginal electricity (renewables, nuclear, lignite). Revenues from the cap and the tax would be used to reduce consumer bills. The measures were agreed on 30 September and include a revenue per MWh capped at €180 per MWh for producers with low marginal costs, a solidarity levy for the fossil fuel sector, and binding targets to reduce peak-time energy demand by 5% (European Council, 2022).

Considering the historical volatility of global fossil fuel prices and their impact on economies when their prices are high, a further expansion of renewables appears the right policy choice. Boosting the share of renewables increases energy independence, reduces the exposure of domestic consumers to global market prices, and has the potential bring down electricity prices in the long run (IRENA, 2022). Delivering the projects already underway to improve interconnection with the French energy grid would help stabilise the Spanish energy system and boost energy security as the share of

renewables increases further. Increasing the electrification of transport, industry and heating, coupled with an expansion of renewables, can further reduce household and business consumers' exposure to volatile fossil fuel prices, and limit the need for government intervention during times of high energy prices. This could be supported by reforming Spanish energy taxation, ensuring carbon costs are appropriately reflected in retail energy prices, which would support the uptake of clean fuels and power sources (IEA, 2021).

Conclusions

Fossil fuels are clearly linked to the current cost of living pressures in Spain and are making an outsized contribution to recent spikes in inflation. These pressures are present across Europe, where the vast majority of fossil fuels is imported and prices are dependent on global markets.

The potential of renewable energy to alleviate cost pressures through lower consumer prices in transport, heating, and electricity can be hard to identify due to market structures and policy provisions. For example, the electricity market design based on marginal pricing means natural gas or coal prices often affect wholesale electricity prices. This means that rising fossil fuel prices also push electricity prices, especially during demand peaks. Energy cost subsidies to householders and businesses are also prevalent in EU countries' responses to the crisis and intermediate price signals to householders, businesses and investors.

Despite these confounding factors, there are clear signs that decarbonising energy systems could moderate the contribution of energy prices to consumer price inflation and volatility in the long run. Ramping up the share of renewables in electricity production should eventually affect wholesale prices, if total electricity demand can more often be satisfied with renewables sources alone. Likewise, expanding the use of renewables in household heating and transport reduces consumer exposure to fossil fuel price volatility in international markets.

References

- Beyond Coal (2021). Overview: National coal phase-out announcements in Europe (Status 22 March 2021). Available at: <https://beyond-coal.eu/wp-content/uploads/2021/03/Overview-of-national-coal-phase-out-announcements-Europe-Beyond-Coal-22-March-2021.pdf> – Accessed on 23 September 2022.
- Bruegel (2022). National fiscal policy responses to the energy crisis. Dataset. Available at: <https://www.bruegel.org/dataset/national-policies-shield-consumers-rising-energy-prices> - accessed on 19 October 2022.
- Bundesnetzagentur (2022). Strommarktdaten (SMARD). Dataset. Available at: <https://www.smard.de/en/downloadcenter/download-market-data> - accessed on 12 September 2022.
- Caixa Bank Research (2022). The Iberian electricity market and the price rally in Spain. Available at: <https://www.caixabankresearch.com/en/economics-markets/commodities/iberian-electricity-market-and-price-rally-spain> – accessed on 4 October 2022.
- Cores (2022). Boletín Estadístico de Hidrocarburos, 296, July 2022. Available at: <https://www.cores.es/sites/default/files/archivos/publicaciones/boletin-est-hidrocarburos-296-julio-2022.pdf> – accessed on 4 October 2022.
- Ember Climate (EMBER) (2021). Soaring fossil gas costs responsible for EU electricity price increase. Available at: <https://ember-climate.org/insights/research/soaring-fossil-gas-costs-responsible-for-eu-electricity-price-increase/> – accessed on 4 October 2022.
- Ember Climate (2022). European wholesale electricity prices data. Dataset (daily data). Available at: <https://ember-climate.org/data-catalogue/european-wholesale-electricity-price-data/> - accessed on 4 October 2022.
- Enerdata (2022). The EC approves a gas price cap for power production in Spain and Portugal. News article. 13 June 2022. Available at: <https://www.enerdata.net/publications/daily-energy-news/ec-approves-gas-price-cap-power-production-spain-and-portugal.html> - accessed on 13 September 2022.
- European Commission (2022a): Electricity interconnection targets. Available at: https://energy.ec.europa.eu/topics/infrastructure/electricity-interconnection-targets_en – accessed on 4 October 2022.
- European Commission (2022b). Electricity market design. Article. Available at: https://energy.ec.europa.eu/topics/markets-and-consumers/market-legislation/electricity-market-design_en – accessed 27 September 2022.
- European Commission (2022c). EU energy prices. EU response to the surge in energy prices and implementation of the REPowerEU plan. Available at: https://energy.ec.europa.eu/topics/markets-and-consumers/eu-energy-prices_en - accessed on 13 September 2022.
- European Commission (2022d): From where do we import energy? Available at: <https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2c.html> – accessed on 4 October 2022.

European Commission (2022e). State aid: Commission approves Spanish and Portuguese measure to lower electricity prices amid energy crisis. Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_3550 – accessed on 4 October 2022.

European Council, 2022. Council agrees on emergency measures to reduce energy prices. Press release. 30 September 2022. Available at: <https://www.consilium.europa.eu/en/press/press-releases/2022/09/30/council-agrees-on-emergency-measures-to-reduce-energy-prices/> - accessed 7 October 2022.

Eurostat (2022). Databases NRG_IND_ID, NRG_PC_204, PRC_HICP_MANR, HBS_STR_T223, PRC_HICP_MMOR, latest available releases. Available at: <https://ec.europa.eu/eurostat/data/database>

INE (2022): Household Budget Survey - Average expenditure by household, average expenditure by person and expenditure distribution (vertical and horizontal percentages) by expenditure group and expenditure quintile.

International Energy Agency (IEA) (2021). Spain 2021. Energy Policy Review.

International Energy Agency (IEA) (2022). Climate change and energy transition law. Available at: <https://www.iea.org/policies/13323-climate-change-and-energy-transition-law> - accessed on 4 October 2022.

International Renewable Energy Agency (IRENA) (2022). Renewable Power Generation Costs in 2021, International Renewable Energy Agency, Abu Dhabi.

La Moncloa (2022). Pedro Sánchez announces new package of economic and social measures to tackle the energy crisis. News article, 13 October 2022. Available at: https://www.lamoncloa.gob.es/lang/en/presidente/news/Paginas/2022/20221013_appearance.aspx - accessed 19 October 2022.

OMIE (2022). Market Results Data, Day Ahead Prices. Available at: <https://www.omie.es/en/market-results/daily/daily-market/daily-hourly-price> - accessed 30 September 2022.

Organisation for Economic Cooperation and Development (OECD) (2020). Fossil Fuels Support: Spain. Country Brief. June 2020. Available at: <https://www.oecd.org/fossil-fuels/countrydata/> – accessed on 2 September 2022.

Statista (2022). Volume of natural gas imported by Spain in 2021, by country of origin. Available at: [Spain: natural gas imports by country of origin | Statista](https://www.statista.com/statistics/1111111/spain-natural-gas-imports-by-country-of-origin/). – accessed on 4 October 2022.

S&P Global (2022). Spain set to overhaul consumer power price mechanism to reduce volatility. News article, 6 October 2022. Available at: <https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/electric-power/100622-spain-set-to-overhaul-consumer-power-price-mechanism-to-reduce-volatility> - accessed 19 October 2022.

Timilsina, G. R. (2020). Demystifying the Costs of Electricity Generation Technologies. World Bank Policy Research Working Paper, WPS 9303. World Bank Washington, DC.

Zakeri, B., Staffell, I., Dodds, P., Grubb, M., Ekins, P., Jääskeläinen, J., (...) & Castagneto-Gissey, G. (2022). Energy Transitions in Europe—Role of Natural Gas in Electricity Prices. Available at SSRN.