

How natural gas demand has evolved in 2022-2023

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Rationale

In view of the energy emergency owing to the war in Ukraine, this article analyses how natural gas consumption by households, firms and the electricity sector evolved in 2022 and early 2023, to identify whether the changes are merely conjunctural or structural in nature.

Takeaways

- Last year was much warmer than usual. This explained households' lower demand for gas in the first half of 2022, but it was not sufficient to warrant the larger fall in demand in the second half. During the first four months of 2023 the typical temperature-related consumption pattern was restored.
- Firms' demand for gas has been lower than usual since April 2022, including in the first four months of 2023. This lower consumption may partly be on account of energy efficiency improvements and investments in renewables made by firms.
- By contrast, in 2022 the electricity sector posted its highest demand for natural gas in recent years, owing to low hydropower and cogeneration output and, especially, to Spanish electricity exports for conjunctural reasons.

Keywords

Natural gas prices, electricity exports, measures.

JEL classification

L00, M21, Q49.

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Introduction

International natural gas prices were very low in 2020, owing to the slowdown in economic activity as a result of the pandemic. However, once activity picked up again, natural gas prices on international markets started to rise. This was abetted by the geopolitical tensions that culminated, in February 2022, in the war in Ukraine, at which point there began an unprecedented escalation in natural gas prices.

Initially, this increase in natural gas prices was due to a faster than expected recovery in the global economy, especially in Asia, while by contrast, investments in gas fields had been falling in recent years in light of the prospect of gas being replaced by less polluting energy sources.¹ This was compounded by the low level of gas reserves in Europe since the summer of 2021, owing to high demand the previous winter as a result of the low temperatures and to the decline in supply from the Russian gas company Gazprom from spring 2021, which drove up European gas demand on the international markets. The problem heightened in 2022 with the onset of the war in Ukraine in February and the subsequent cut in Russian gas supplies through the Nord Stream pipeline in September which suggested that Russia was trying to use energy as a political weapon. Gas supplies have declined ever since the Russian invasion of Ukraine. In this setting, and in view of the risk of total supply cuts that could lead to gas shortages in the winter of 2022-2023, the European Council agreed, among other measures, on a voluntary reduction in demand.

Since late 2022 natural gas prices have moderated, thanks to more favourable weather conditions in Europe and lower demand in China owing to its zero-COVID policy, although prices are still slightly higher than in the pre-pandemic period.

In the specific case of Spain, these international gas price patterns were compounded by the closure, in late 2021, of one of the two Algerian gas pipelines, specifically the Maghreb-Europe pipeline that passed through Morocco.² This closure made it necessary to increase purchases of liquefied natural gas (LNG),³ which is much more expensive than natural gas because, for storage purposes, it must be liquefied, transported in LNG carriers and then subsequently returned to a gaseous state in order to be carried through distribution pipelines.

As a consequence of all the above, the Iberian gas market (MIBGAS) price for Spain⁴ rose from slightly more than €19/MWh, on average, between 2016 (the year in which the index was created) and 2019, to well over €200/MWh on several occasions in 2022, peaking at an all-time high of €225/MWh on 29 August (see Chart 1). Meanwhile, closing prices on the Title Transfer Facility (TTF) virtual gas market based in the Netherlands, the benchmark for European gas prices, have

1 According to the *International Energy Agency (2020)*, global investment in oil and gas fell by 32% between 2014 and 2019.

2 The supply of natural gas from Algeria through the Maghreb-Europe pipeline was discontinued on 31 October 2021.

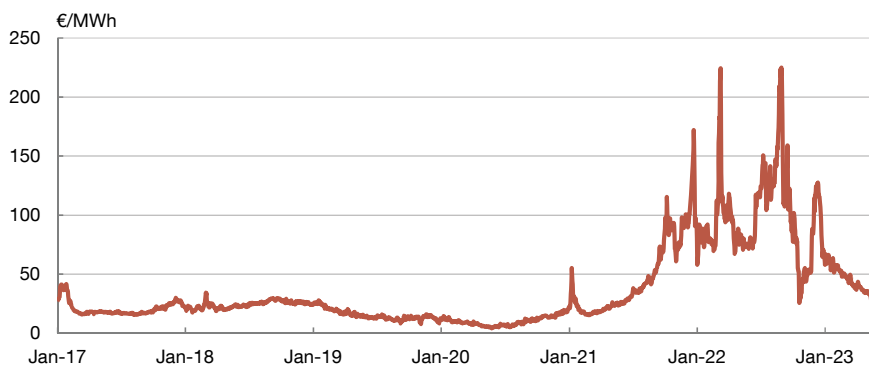
3 In 2022, 72% of all Spain's gas imports were in the form of LNG, compared with 58% in 2019 (*CORES, 2023*).

4 The weighted average price of all gas transactions on MIBGAS for the same day across all trading sessions for Spain.

Chart 1

Spanish wholesale natural gas prices

1.a MIBGAS for Spain



SOURCE: MIBGAS.

been higher than MIBGAS prices since spring 2022, and in summer 2022 were more than €100/MWh higher than the price for Spain. However, in 2023 so far, prices have fallen significantly, with the latest prices on both markets standing at around €30/MWh. These wholesale price developments are passed through in part to retail prices, depending on the taxes and fixed charges paid by agents and the type of contract they have with retailers.

In this setting, this article analyses the demand response of Spanish households, firms and the electricity sector over the last 18 months. To this end, monthly temperature data and monthly data on households' and firms' demand for natural gas are used to compare the recent developments with those of the period 2017 to 2021. As monthly natural gas price data are not available, it is not possible to estimate a function of demand that includes retail gas prices. However, it is possible to compare temperature-adjusted half-yearly demand with how prices have evolved over the last 18 months. This will provide clues as to how easy it is for the different agents to replace this source of energy.

The next three sections describe how demand for natural gas has evolved among households and SMEs, among all other firms and in the electricity sector, respectively. The article ends with some brief conclusions.

Households' and SMEs' natural gas demand

Household demand for natural gas has a marked seasonal pattern, linked to its use for heating and, therefore, to climate conditions. Natural gas is the most commonly used fuel to heat main residences in Spain (40%), followed at some distance by electricity (34%).⁵

⁵ Of the 18.8 million main residences in Spain in 2021, 15.2 million had heating systems and 6.1 million of these were natural gas heating systems. In other words, one-third of all main residences have natural gas heating (INE, 2023a).

Households and SMEs can purchase natural gas on the regulated market or the free market. On the free market, consumers negotiate the price with a retailer, whereas on the regulated market the regulated rate for small consumers (TUR, by its Spanish name) applies.⁶ According to the latest data available (for 2022 Q1), 19% of households had opted for this regulated rate (CNMC, 2023),⁷ which is updated quarterly, taking into account changes in the cost of natural gas.⁸ In September 2021, as a measure to protect households from the rise in natural gas prices, the impact of this increase on the formula used to calculate the regulated rate was capped.⁹ Subsequently, in September 2022, the VAT rate on all natural gas consumption was reduced from 21% to 5% up to the end of 2023¹⁰ and, in October 2022, a special regulated rate was introduced for home-owner associations with natural gas central heating systems, which until then had not been eligible for the regulated rate as their consumption exceeded the maximum limit. To encourage energy saving, the new regulated rate for home-owner association central heating systems applies only to consumption that is equal to or less than average consumption in the last five years; all consumption over that limit is subject to a surcharge of 25%. In addition, in order for home-owner associations to be eligible for the new rate, individual central heating meters must be installed. According to the National Statistics Institute (INE) data available, 6.6% of dwellings in Spain have home-owner association natural gas central heating, while 23.4% have individual natural gas heating (INE, 2010).

As a result of all the above, the increase in natural gas prices borne by households¹¹ was much lower than the increase in the MIBGAS price. According to Eurostat, in 2022 H1 the price paid by the average Spanish household was 29% higher than the average price paid in the same half-year period in the years 2017 to 2021, whereas the average price paid by Spanish households in 2022 H2 was 66% higher. The MIBGAS price, meanwhile, was 396% and 267% higher, respectively. Although Eurostat has not yet published figures for 2023, the changes observed in the consumer price index for natural gas and town gas¹² suggest that prices moderated in the opening months of the year. In any event, the increase in energy prices over the last two years has meant that the percentage of households reporting that they cannot heat their home to an appropriate temperature increased by six percentage points (6 pp) between 2020 and 2022.¹³

6 This is a regulated tariff available to any consumer connected to the natural gas distribution network whose annual consumption is less than 50,000 kWh.

7 The measures adopted to contain the increase in the regulated rate and the introduction of the new regulated rate for home-owner associations appear to have encouraged consumers to switch from the free market to the regulated rate, thus increasing its share.

8 The regulated rate includes the cost of natural gas, network charges, marketing costs and supply security costs. The cost of natural gas amounts to around 30% of the total rate.

9 Royal Decree-Law (RDL) 17/2021 of 14 September 2021 capped the increase in the cost of natural gas at 35% for the 1 October 2021 review and at 15% for the 1 January 2022 review, in both cases compared with the costs applied in the regulated rate in the preceding quarter. Subsequently, the 15% cap on the increase in the wholesale natural gas price was successively extended up to the 1 October 2023 review (RDL 6/2022 of 29 March 2022, RDL 11/2022 of 25 June 2022 and RDL 18/2022 of 18 October 2022).

10 Up to 31 December 2022 under RDL 17/2022 of 20 September 2022, and subsequently to 31 December 2023 under RDL 20/2022 of 27 December 2022.

11 There are no specific data available on prices paid by SMEs, although one would not expect them to be very different from those paid by households.

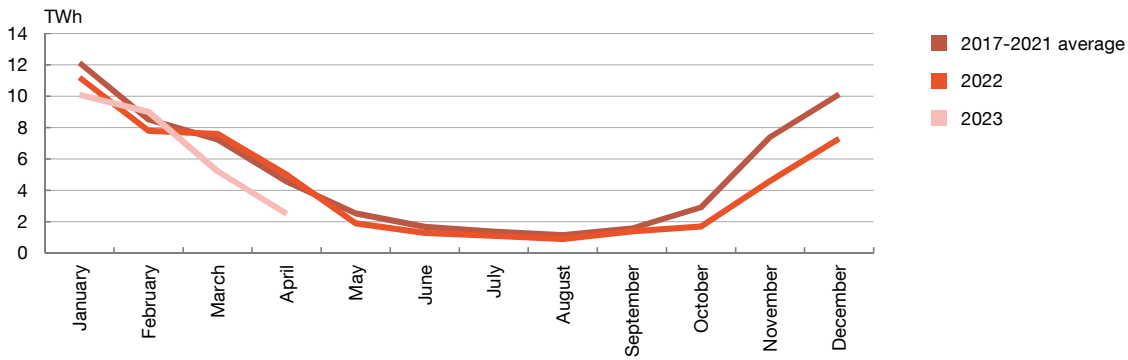
12 This index was much lower in March and, especially, in April than in January 2023 (-11%), but it is not possible to calculate the fall compared with the same period in the years 2017 to 2021 because of the methodological change to the CPI in January 2023 when, for the first time, free market prices were included in the index rather than only the regulated rate, as previously.

13 In 2022, 17.1% of Spanish households could not heat their home to an appropriate temperature, up from 14.3% in 2021 and from 10.9% in 2020 (INE, 2023b).

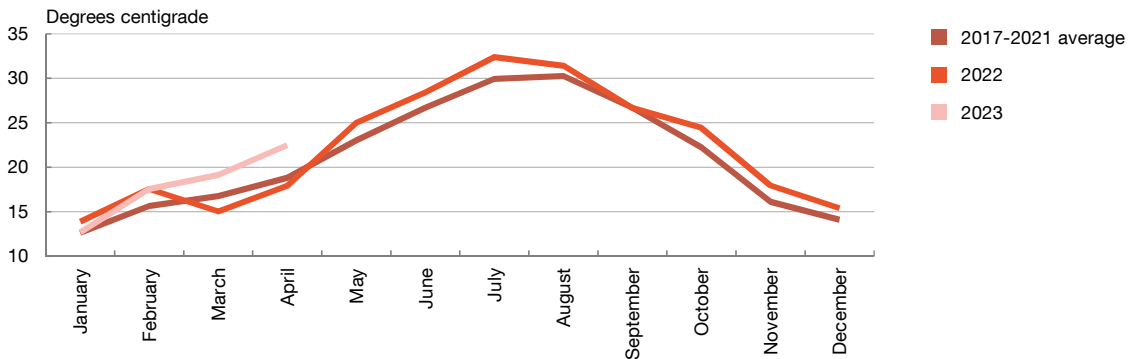
Chart 2

Households' and SMEs' natural gas demand and maximum temperatures

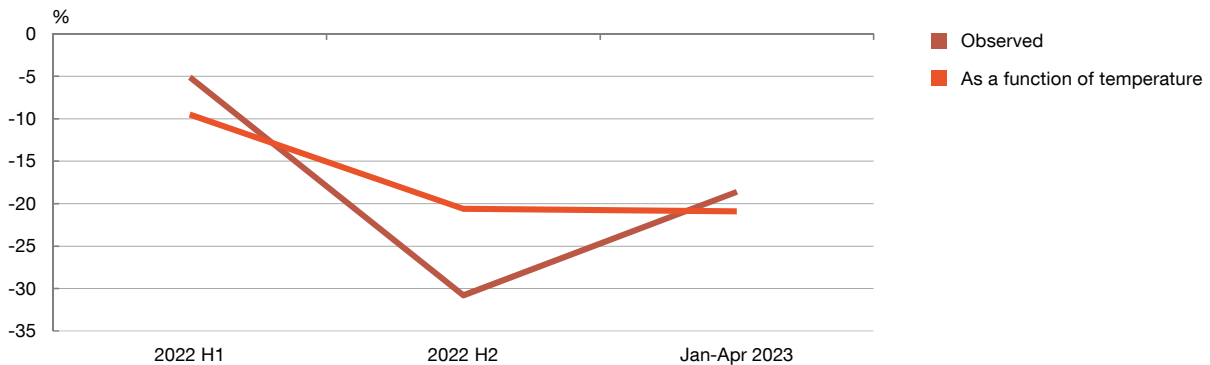
2.a Households' and SMEs' demand for natural gas



2.b Monthly average of maximum daily temperatures



2.c Households' and SMEs' demand for natural gas, change compared with 2017-2021 average



SOURCE: Banco de España, drawing on AEMET and Enagás data.

If the demand for gas of households and SMEs¹⁴ is compared with the average for the same period of the years 2017 to 2021, demand was 5.1% lower in 2022 H1 and 30.8% lower in 2022 H2, while in the first four months of 2023 it was 19% lower (see Chart 2.a). However, taking into

14 The data published by Enagás, which are those used here, do not allow for a distinction to be drawn between households and SMEs.

account that 2022 and the first four months of 2023 were warmer than usual (see Chart 2.b), it is possible that the decline in demand for natural gas observed in 2022 H1 and the first four months of 2023 may be largely explained by the relatively high temperatures. To verify this hypothesis, a model is estimated in which households' and SMEs' monthly natural gas demand is a function of the monthly average of maximum daily temperatures.¹⁵ The values for 2022 H1 and the first four months of 2023 estimated by the model are, in effect, close to the values observed (see Chart 2.c). However, up to one-third (some 10 pp) of the percentage difference in gas consumption in 2022 H2 compared with the 2017–2021 average could be attributable to other factors, including the sharp increase in retail prices.

Firms' natural gas demand¹⁶

Firms' natural gas supply contracts are mostly fixed-rate (30%) or indexed (28%), although a non-negligible proportion have regulated rate (TUR) contracts (22%), while the remainder have other types of contracts (INE, 2023c). However, gas supply contracts in industry are mostly indexed (42%), especially in gas-intensive industries (49%). In Europe contracts are generally TTF-indexed, whereas in Spain both TTF and MIBGAS are used. There is no information available on the percentage of Spanish contracts indexed to each price, but the fact that gas prices have risen more sharply on the TTF could have led to the renegotiation of some contracts, switching from TTF to MIBGAS-indexed prices.

This range of possible contract options dilutes the importance of the MIBGAS price for calculating the increase in natural gas prices borne by Spanish firms. Drawing on Eurostat statistics, it is estimated that the prices paid by Spanish firms overall rose by around 200% in 2022 H1 and by 250% in 2022 H2, in both cases compared with the average price for the same half-year period in the years 2017 to 2021. In the opening months of 2023 (for which there were still no Eurostat data available at the time of preparation of this article) prices are expected to have fallen notably, in line with the MIBGAS price which was only 151% higher than the average of the same periods in the years 2017 to 2021, having been 267% higher in 2022 H2.

At the same time, demand for gas among firms (excluding SMEs) fell by 8% in 2022 H1, by 34% in 2022 H2 and by 19% in the first four months of 2023, in each case relative to the average for the same period in the years 2017 to 2021 (see Chart 3.a).

Chart 3.b, which depicts natural gas consumption by the most gas-intensive productive sectors (excluding the electricity sector), shows that the scale of the response was highly uneven. The refining industry posted the largest proportional drop in demand for gas: 30% in 2022 H1, 57% in 2022 H2 and 52% from January to April 2023, in all cases compared with the average for the same period in the years 2017 to 2021. The next largest proportional declines were seen in the

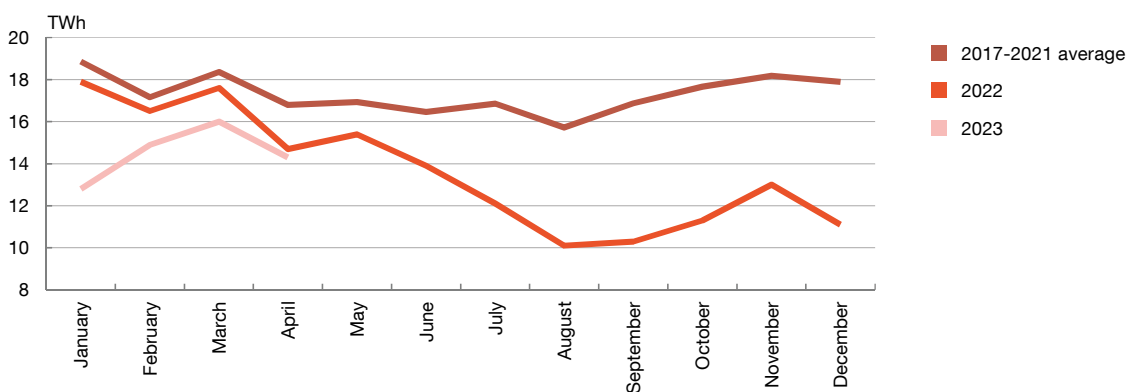
¹⁵ To allow for possible non-linearities in the relationship between natural gas consumption and temperatures, the model includes the square of the monthly variable of maximum daily temperatures as a determinant variable of that consumption. The results would be similar if minimum rather than maximum temperatures were used.

¹⁶ Excluding SMEs, which are analysed together with households in the previous section.

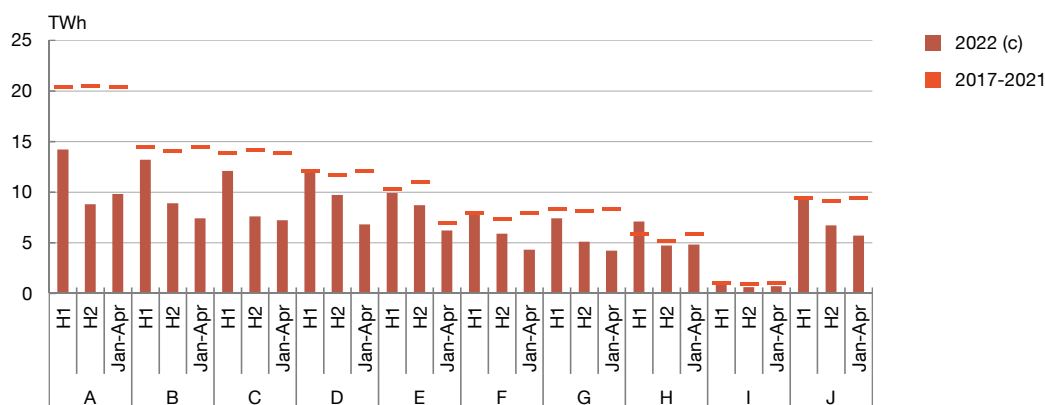
Chart 3

Firms' natural gas demand and response to its increase in price

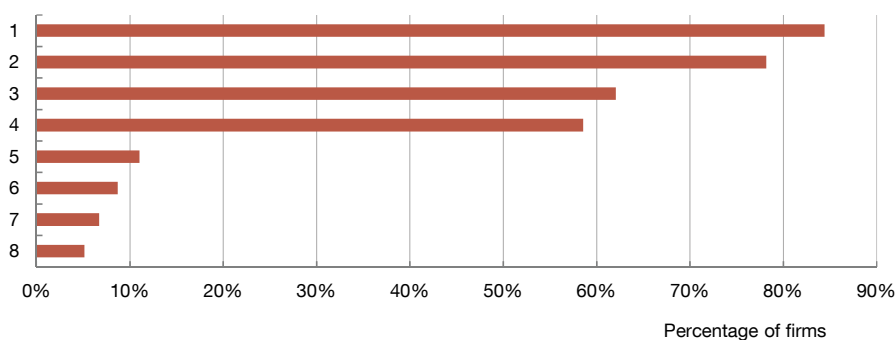
3.a Firms' demand for natural gas (a)



3.b Large gas consumers' demand for natural gas (b)



3.c Response to the energy crisis of firms whose principal energy source is gas (d)



SOURCES: Eurostat, Enagás and EBAE 2023 Q1 (Módulo sobre impacto de la crisis energética).

a Excluding SMEs and the electricity sector.

b The letters denote as follows: A: Refining; B: Chemicals/Pharmaceuticals; C: Cogeneration; D: Construction; E: Agrifood; F: Basic metals; G: Paper; H: Services; I: Textiles; and J: Other industries.

c 2023 for the period January-April.

d The numbers denote as follows: 1: renegotiation of energy supply contracts (including changes in duration, rates, etc.); 2: changes to improve energy efficiency (reducing energy consumption per unit of output); 3: changes in selling prices to reflect higher costs; 4: investment in renewables; 5: temporary production stoppages; 6: changes in supply of products (narrower product range or more focus on higher profit margin products); 7: switch from domestic to international suppliers; and 8: switch from own production to imported inputs.



cogeneration,¹⁷ paper and chemical/pharmaceutical industries. At the other hand of the scale are firms in the services industries, whose natural gas demand rose by 20% in 2022 H1 and then fell by 10% in 2022 H2 and by 34% in the first four months of 2023.

To shed more light on firms' response to the energy crisis, data from a specific module of the February 2023 Banco de España Business Activity Survey (EBAE) are used (see Chart 3.c). According to this survey, the main response of firms whose principal energy source is natural gas was to renegotiate their contracts (84% of firms). Apart from passing through their higher fuel costs to their final prices (62%), other measures adopted that may be considered structural included improving energy efficiency (78%) and investing in renewables (59%), which would suggest a structural reduction in demand for gas per unit of output. Other more short-term measures, such as production shutdowns (11%) or replacing production with imported inputs (5%), were less common. In consequence, although part of the decline in demand observed in recent months could be reversed as natural gas prices return to more moderate levels, demand is not expected to return to its pre-energy crisis levels.

Electricity sector natural gas demand

Natural gas is the fuel used to generate electricity in combined-cycle power plants.¹⁸ The electricity sector's demand for natural gas depends not so much on its price as on the thermal gap, which is that portion of domestic and foreign demand for electricity not covered by other technologies. As a result, in contrast to that of households and firms, the electricity sector's demand for natural gas increased in 2022, to reach its highest level since 2010. It rose by 71% in 2022 H1, by 55% in 2022 H2 and by 39% in the first four months of 2023, in each case with respect to the average demand over the same period of 2017 to 2021 (see Chart 4).

A combination of three factors was responsible for such a significant rise in the electricity sector's demand for natural gas: low hydropower output due to drought; low cogeneration owing to high natural gas prices, which led to a shutdown of cogeneration industries; and high electricity exports due to French nuclear shutdowns and the fact that Spanish wholesale prices were lower than French ones as a result of the temporary adjustment of production costs in the electricity market, known colloquially as the "Iberian mechanism". In place since 15 June 2022, this mechanism limits the influence of the price of natural gas on the wholesale electricity market.¹⁹

17 Cogeneration refers to the use of a single fuel source, generally natural gas, for the simultaneous production of electricity and thermal energy that can be used for other purposes. It does not include combined-cycle power plants that generate only electricity and are analysed in the following section.

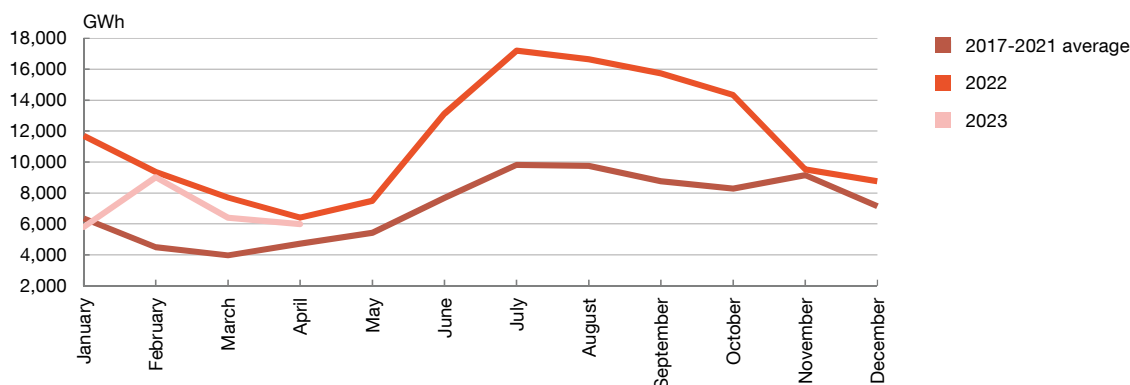
18 Combined-cycle power plants convert the thermal energy of their fuel into electricity by means of two thermodynamic cycles, and they generally use natural gas in the first one.

19 RDL 10/2022 of 13 May 2022, as extended by RDL 3/2023 of 28 March 2023, capped the price at which gas-fired power plants could bid on the wholesale electricity market or pool at €40/MWh for six months. During the first three months of 2023 this price was increased by €5/MWh per month, while currently a linear increase is being applied, from €55/MWh in March to €65/MWh in December 2023. To avoid losses for those utilities that use gas to generate electricity, they are compensated for the difference between the price cap and the true cost, which is paid by Spanish consumers with contracts linked to the pool and by those renewing their contracts from 26 April 2022 onwards. This compensation was not initially available for cogeneration, this being the reason for the shutdown in this industry, but RDL 17/2022 of 20 September 2022 changed this situation.

Chart 4

Electricity sector's natural gas demand

4.a Electricity sector's demand for natural gas



SOURCE: Enagás.



The easing of natural gas prices in recent months has meant that the Iberian mechanism has not actually been applied since late February 2023.

In 2022, hydropower generation declined by 35%, relative to its average level over the period 2017-2021, while cogeneration was down by 37%, so that the thermal gap to be filled by combined-cycle power plants widened. Spain ceased to be a net importer of electricity from late 2021 and in 2022 its net exports reached an all-time high, equivalent to 7% of that year's entire domestic electricity production. Net exports accounted for 29% of the electricity sector's total demand for natural gas in 2022 and for 52% in the first four months of 2023. Thus, disregarding exports, the electricity sector's demand for natural gas increased by 42% in 2022 H1 (rather than 71%) and by 5.6% in H2 (rather than 55%), and fell by 34% in January-April 2023 (as compared with the observed increase of 39%), in each case with respect to the average level for the same period of the years 2017 to 2021.

Conclusions

The foregoing analysis highlights the heterogeneity of the demand response to the escalation in prices and the energy emergency owing to the war in Ukraine. Thanks to government measures, households faced a smaller price increase than other sectors. The decline in demand in 2022 H1 and in the first four months of 2023 can be entirely explained by warmer than normal temperatures, while a third (10 pp) of the percentage fall in demand in 2022 H2 is not explained by temperature and could be related to the significant increase in prices.

This pattern of a greater decline in the demand for natural gas in 2022 H2 is also discerned in industry, which faced rises in natural gas prices to more than twice their level in the period 2017-

2021. Developments vary from one sector to another. Proportionately, the largest decrease in demand for natural gas was in refining, followed by cogeneration, paper and chemicals/pharmaceuticals. Some of the actions taken by firms in this period, such as energy efficiency improvements and investment in renewables, would suggest that part of the decline in demand may be structural.

Unlike households and firms, the electricity sector increased its demand for natural gas in 2022, owing to the decline in hydropower and cogeneration output and an unprecedented increase in net exports.

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