

Fossil fuel prices and inflation in Italy



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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.

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Key findings

- **Energy prices have been a key driver of recent Italian consumer price inflation. Fossil fuels alone were responsible for roughly 30% of Italy's annual rate of inflation this Spring.** Unlike in other European countries, retail electricity prices have outpaced other energy prices in Italy and were 112% higher in July 2022 than in August 2020. Over the same time period, retail petrol prices were up 14%, diesel up 22%, and natural gas up 42%.
- **We estimate that before government support, an average Italian household will be spending around €1,400 more on energy and fuel bills this year than in 2020.** Low income households are worse affected by the increasing energy prices: we estimate that households in the lowest income quintile now spend about 50% more on energy than in 2020.
- **In response to the high energy prices, the Italian government has taken a variety of measures to support households, which are forecast to cost over €59bn,** equivalent to 3.3% of Italian GDP. Italy's support packages consist mainly of tax cuts on energy and direct cash transfers to low and middle income households.
- **Renewables are now much cheaper than fossil fuel-based electricity production and their cost is forecast to fall further.** Recent IRENA estimates show that the lifetime cost per MWh of new installed solar PV and onshore wind power in Italy is now at least five times lower than the fuel-only cost of gas-fired power generation per MWh. At the same time, the cost of fossil fuels is likely to remain volatile and dependent on global market prices. Despite this, installation of new wind and solar PV capacity has been slower in Italy since the mid-2010 years compared to other European countries.
- **Accelerating the deployment of renewables appears the policy choice to increase energy independence, reduce the exposure of domestic consumers to volatile global fossil fuel prices, and bring down electricity prices in the long run.** A higher share of renewables means lower average electricity production costs, which is key for Italy, where the electricity system is extremely reliant on natural gas, and where wholesale electricity has therefore skyrocketed in recent months. 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. Scenarios for the future energy system also envisage the current gas-fired peak load capacity to be replaced by battery storage, green hydrogen and pumped hydro. This would uncouple wholesale electricity markets from global fossil fuel prices.

Energy prices and inflation in Italy

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 Italy, with a view to understanding the potential for faster energy transition measures to ease inflationary pressures and risks.

Italy is a net energy importer

Italy is a net energy importer. Net imports accounted for 74% of gross available energy in 2020, 13 percentage points lower than in 2000 (Eurostat, 2022a). Italy is a net importer of fossil fuels, with very little own production of oil and natural gas and no coal production. Oil imports account for over 90% of Italy's crude oil use and over 93% of Italy's natural gas supply is imported (Eurostat, 2022a). Historically, most of Italy's gas imports are from Algeria and the Russian Federation. Key domestic energy sources are renewables and small-scale domestic natural gas and oil production. As a result of Italy's reliance on energy imports, domestic energy prices are highly dependent on global market prices for oil and gas.

Electricity production in Italy is highly dependent on imported natural gas

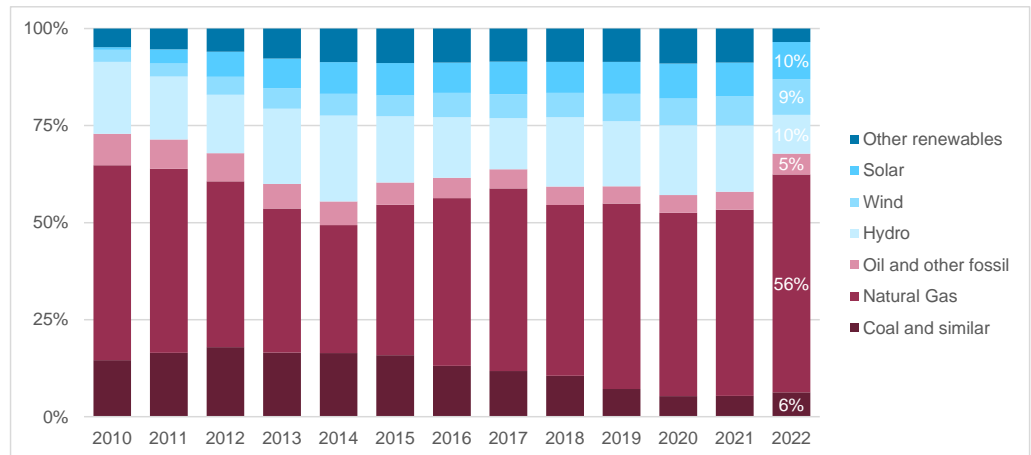
Electricity production in Italy is dominated by natural gas. In 2010, natural gas accounted for 50% of all electricity production. As shown in Figure 1, the share of natural gas fell to 33% in 2014, but then rose again, reaching 48% in 2021, and 56% in the first half of 2022 (IEA, 2022). The high share of gas in the first half of 2022 is a result of the severe drought which has affected Italy since the beginning of the year and resulted in a 40% drop in hydropower production, which reached a 50-year low (JRC, 2022). In mid-March of 2022, the stored energy value in Italy's hydropower reservoirs was at 28.2% of total storage capacity, 2.2 percentage points lower than the previously observed historical low. Hydropower is still Italy's most important source of renewables and has accounted for 17% of Italy's electricity production between 2010 and 2022.

This shortfall was substituted by natural gas, contributing to higher wholesale electricity prices in Italy during 2022 (IEA, 2022). Between 2015 and 2022, share of oil and coal in Italy dropped from 22% to 12%. This reduction is primarily due to a significant decrease in coal-based electricity production (IEA, 2022).

The renewable capacities of Italy have been expanding in recent years.

The share of renewable sources in the electricity generation mix has grown from 27% in 2010 to 42% in 2021. After a rapid expansion in wind and solar capacity in the early 2010 years, the pace of the deployment of renewables has slowed down markedly, as can be seen in Figure 1. Wind power currently accounts for 9% of Italy’s electricity generation, while solar and hydro each account for around 10%.

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



Source: IEA (MES_0522)

Italy aims to increase the share of renewables in total energy consumption, but progress has been slow

Italy aims to increase the share of renewables in total energy consumption in the coming years, and has recently increased its ambitions. Italy’s original National Energy and Climate Plan (NECP) set targets to increase the share of renewables in electricity generation to 55% by 2030, and to 30% in total energy consumption, which is less ambitious than the latest targets of European peer countries. Germany, Spain and Austria all aim to increase the share of renewables in electricity production to 75% or more by 2030 (Ember Climate, 2021a).

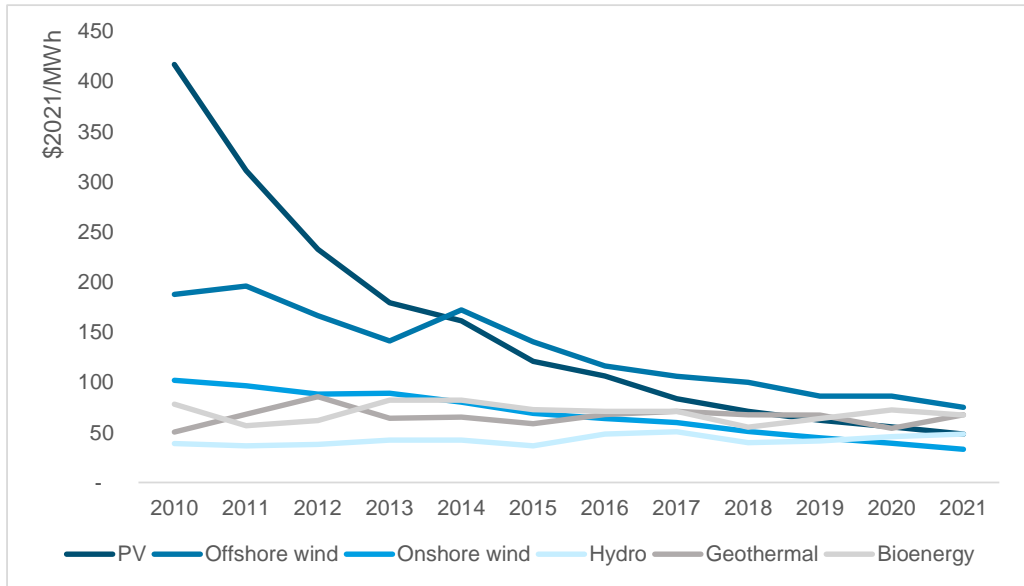
In early 2022, Italy adopted a new Plan for the Ecological Transition (PTE) which features a revised target of 70% renewables in electricity production by 2030 and between 95% and 100% by 2050 (ASVIS 2022; Ember Climate 2022). The plans foresee the installation of 65-70 GW of renewable energy, predominantly wind and solar, over the next decade. These targets are still slightly less ambitious than peer countries such as Germany and could be difficult to achieve considering the slow installation of new wind and solar capacity in recent years (Ember Climate 2021b). In May 2022, Italy further agreed with the G7 environment and energy ministers to aim for a “predominantly” decarbonised electricity sector by 2035 (Clean Energy Wire, 2022). However, as pointed out above, the installation of new wind and solar PV capacity has lagged behind other countries such as Spain and Germany.

The cost of renewables has consistently gone down

The levelized cost of electricity (LCOE) of renewable energy technologies has been falling globally. The levelized cost of electricity (LCOE), i.e. the lifetime cost per MWh, of renewable energy technologies has been falling, as shown in Figure 2. The largest drop has been observed in the lifetime cost of solar photovoltaic power generation, which has fallen by 88% between 2010 and 2021, from a global average of \$417 to \$48 per MWh (2021 prices). Similarly, the costs of offshore and onshore wind projects have

decreased by 60% and 68% respectively. Despite this, the deployment of renewable energy generation capacity has slowed down since around 2015.

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

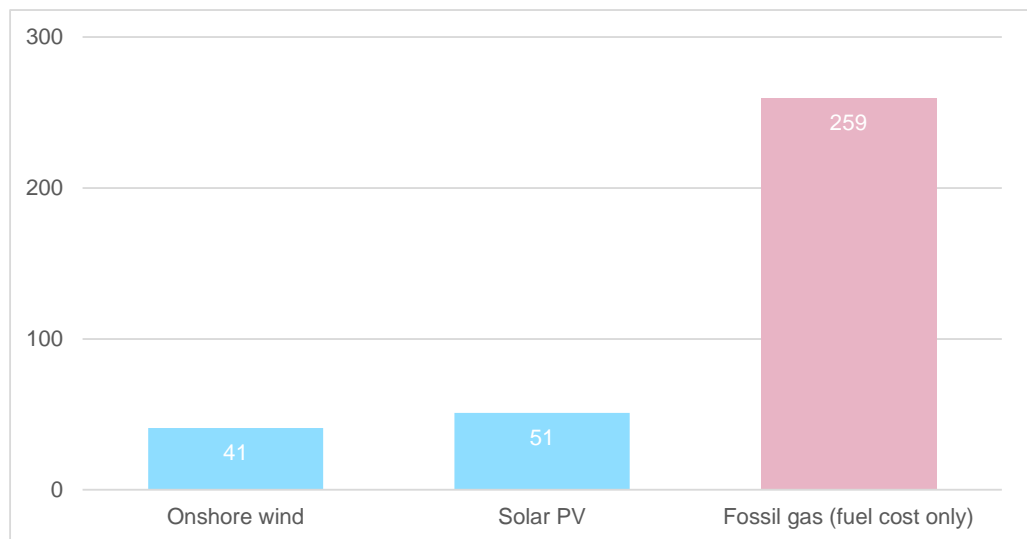


Source: IRENA 2022

Note: Global weighted average of commissioned projects

The cost of fuel for gas-fired power plants in Italy is more than twice the lifetime cost of new onshore wind and solar PV projects. In 2022, the cost of fuel for gas-fired power plants was close to three times that of solar PV projects commissioned in 2021 in Italy, as can be seen in Figure 3 (IRENA, 2022). This stark contrast is the result of a global downward trend in the lifetime costs of renewables, coupled with recent geopolitical tensions associated with fossil fuel producing countries (European Commission, 2022).

Figure 3 Lifetime cost (LCOE) per MWh of new onshore wind and solar PV projects commissioned in Italy in 2021; fuel-only cost of gas-fired power plants in Italy in 2022; all in 2021 USD



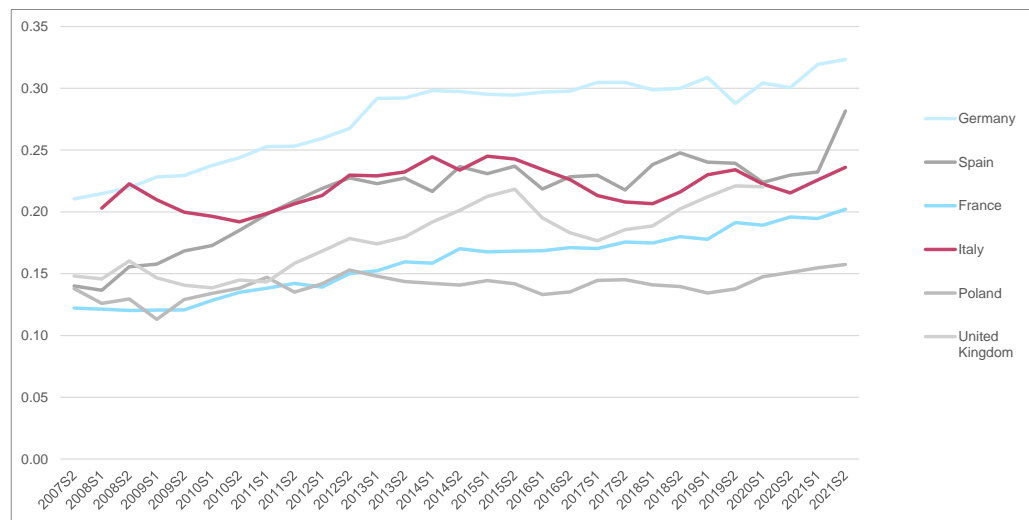
The LCOE of fossil fuel has risen sharply since the Russian invasion of Ukraine, making renewable energy sources even more competitive. The LCOE of fossil-fuel based electricity sources had remained largely unchanged over the past decade, but then rose sharply as a result of fuel price hikes in

the context of Russia’s invasion of Ukraine. The estimated fuel-only cost of gas-based power generation in Italy is currently estimated at \$259 per MWh (IRENA, 2022). This is five to six times higher than the latest IRENA estimates of the LCOE of new onshore wind (\$41 per MWh) and new solar PV (\$51 per MWh) in Italy, as shown in Figure 3 (ibid.). This underlines the benefits Italy could draw from accelerating the deployment of renewables and reducing its reliance on expensive natural gas.

Electricity prices have been relatively stable in the last decade

Until 2019, retail electricity prices were slightly higher in Italy compared to European peers such as France and the UK. Retail electricity prices in Italy have fluctuated in the range between €0.20 per kWh and €0.25 per kWh over the 10 years to 2021, slightly higher than in France, the UK and Poland, but lower than in Germany as shown in Figure 4. Spain’s retail electricity prices overtook Italy’s in 2016. The Italian retail electricity market is competitive, with a large number of small suppliers, and a relatively low market share of the biggest players when compared to other EU countries (Eurostat, 2022b).

Figure 4 Retail electricity prices, bi-monthly, in Italy and other European countries



Source: Eurostat, NRG_PC_204

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

Fuel prices have been more volatile than electricity prices

Price growth and volatility of all types of energy sources have exceeded overall inflation in the past 27 years. Table 1 analyses the retail price volatility of electricity, gas, and transportation fuels (primarily petrol and diesel) in greater detail. Price growth and volatility of all types of energy sources have exceeded overall inflation in the past 27 years, with gas and liquid fossil fuel prices rising slightly faster than electricity prices until mid-2021, as can be seen from the figures for standard deviation (indicating volatility) and average monthly change in Table 1.

Historically, retail electricity prices in Italy have been less volatile than other key energy prices, but the difference is relatively small given the country’s reliance on fossil fuels for electricity production. Average monthly price growth of retail electricity, gas and transport fuels is almost identical in the period of 1995-2021 and only slightly over the general inflation rate. Gas and liquid fossil fuels had a slightly greater volatility than electricity prices, as can be seen from the standard deviation figures in Table 1. This

shows that consumers were exposed to slightly larger price swings from gas and petrol and diesel than for electricity between 1995 and 2021.

Looking at the most recent 12 months, this pattern was reversed, with electricity prices rising faster than fossil fuel prices, as well as much higher price volatility than in the previous 25-years (see standard deviation figures in Table 1).

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	1.61	0.18	7.61	5.50
Gas	1.95	0.22	6.78	3.08
Fuels and lubricants for transport	2.00	0.22	4.50	2.06
All items	0.81	0.14	0.80	0.69

Note(s): 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

Source(s): Eurostat. PRC_HICP_MMOR

Fuel prices have risen sharply in recent history, driving up electricity prices as well

Energy prices in Italy have increased more than at any other time in the past 25 years. Since January 2020, energy prices have increased more than at any other time in the past 25 years. Fossil fuel prices have risen more sharply than electricity, with petrol prices up 14%, diesel up 22%, and gas up 42%, whilst electricity prices have risen sharply, by 112% (see Table).

Table 2 Recent change in household electricity, gas, petrol and diesel prices in Italy

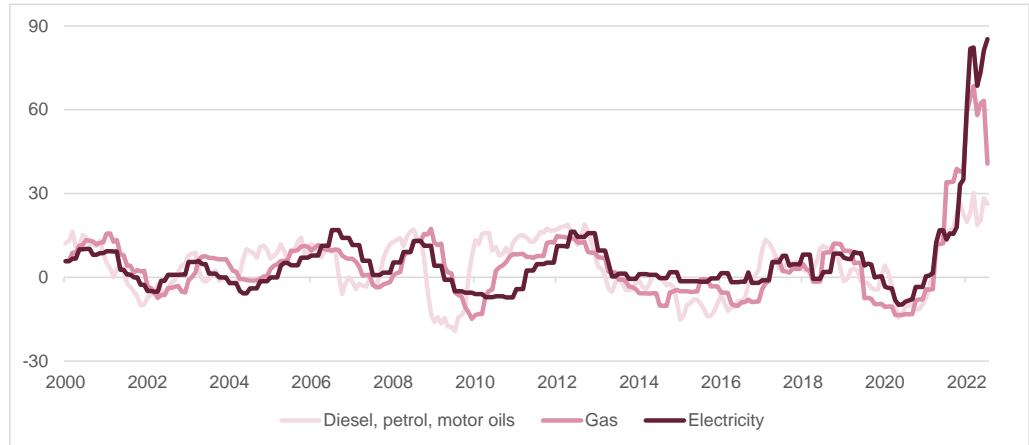
<i>As of July 2022, Change since:</i>	January 2022 (last 6m)	August 2021 (last 12m)	August 2020 (last 24m)	January 2020 (last 30m)
Electricity	62.6%	102.5%	134.4%	111.9%
Gas	25.1%	37.5%	48.4%	41.8%
Diesel	12.2%	18.3%	38.7%	22.1%
Petrol	4.3%	8.8%	28.0%	14.3%
All items (overall inflation)	5.6%	9.2%	12.1%	9.9%

Source: Eurostat, PRC_HICP_MMOR

Electricity and gas prices have risen faster than those of transport fuels in 2022. Figure 5 shows the monthly change in electricity and fuel prices (petrol and diesel) over the last 22 years. Transport fuels, natural gas and electricity prices followed similar patterns over the past 20 years, but electricity and gas prices rose faster than that of transport fuels in 2022. The reliance on gas has contributed to the recent persistence of high wholesale electricity prices in Italy. The sharp rise of natural gas prices, together with the abrupt fall of the contribution of hydro power to electricity generation have resulted in higher monthly average prices than in other major European countries such as Germany (see Figure 5).

Throughout Europe, natural gas prices play a role in wholesale electricity price formation (Zakeri et al, 2022) but, in Italy, the importance of gas prices in driving wholesale are likely to play a greater role than in other markets, given the much higher share of natural gas in electricity production than in peer countries such as Germany or Spain. Box 1 provides further information about price formation on European wholesale electricity markets.

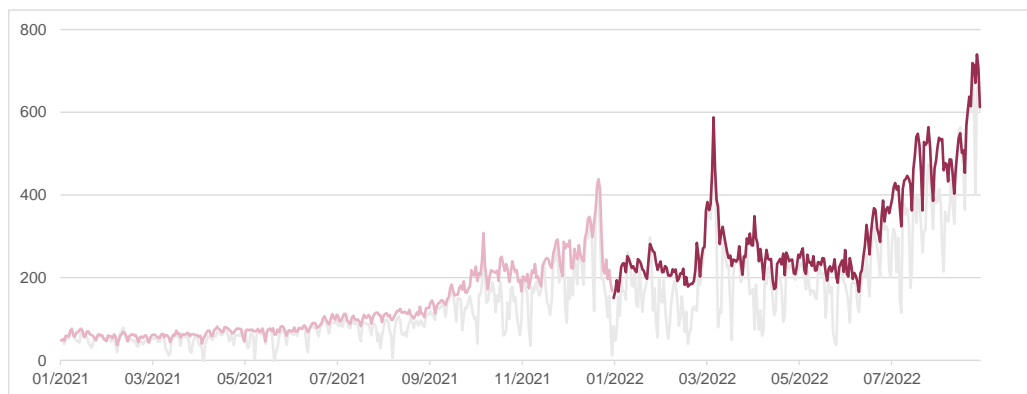
Figure 5 Monthly change in electricity, gas and fossil fuel retail prices



Source: Eurostat, PRC_HICP_MMOR

Wholesale electricity prices have risen sharply in 2022 and have been pushing retail prices as a result. In March 2022, wholesale day-ahead electricity prices reached a peak of €543 per MWh. Following the March spike, prices stayed mostly in the range between €200 and €300 per MWh (higher than in other European countries such as Germany as can be seen in Figure 6) but then rose sharply again from mid-June to reach a peak of €740 per MWh in August. Throughout the first half of 2022, Italian wholesale electricity prices mostly remained above €200 per MWh, about twice as high as in the first half of 2021, as can be seen in Figure 6. This rise is a result of the dry summer and low levels of hydro power generation, which increased Italy’s already high exposure to natural gas prices which have risen sharply since Russia’s invasion of Ukraine.

Figure 6 Wholesale day-ahead electricity prices in Italy (red lines) and Germany (grey lines) for comparison. CE analysis of GME (2022) and Bundesnetzagentur (2022) data.

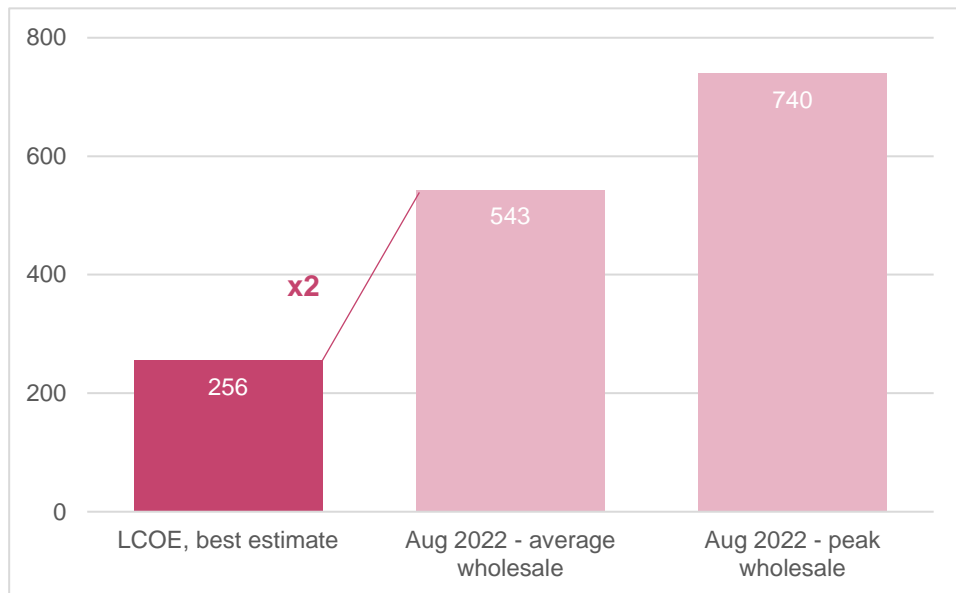


Italian wholesale electricity prices are estimated to be at least twice as high as production costs in August 2022

Italian wholesale prices were around two times as high as estimated energy production costs. We estimate current electricity generation costs in Italy across technologies to be in the region of €260 per MWh, based on Italy’s electricity mix in the five months to May 2022 and data on the levelized cost of electricity from IRENA and the World Bank, factoring in the recent high gas and carbon prices. These figures are indicative only as estimates of the levelized cost of electricity are inherently uncertain. They depend on a range of assumptions such as future carbon and fuel prices and the weighted average cost of capital of the upfront investment.

Whilst this estimate looks high when compared to historical wholesale prices in Italy, the difference in recent wholesale prices is striking as can be seen in Figure 7: Average day ahead wholesale prices in Italy in August this year were €543 per MWh, peaking at €740 on 29 August (Gestore Mercati Elettrici, 2022).

Figure 7 Wholesale electricity prices in Italy in August 2022; Indicative CE estimates of electricity generation costs, weighted across all power generation technologies ; in € per MWh



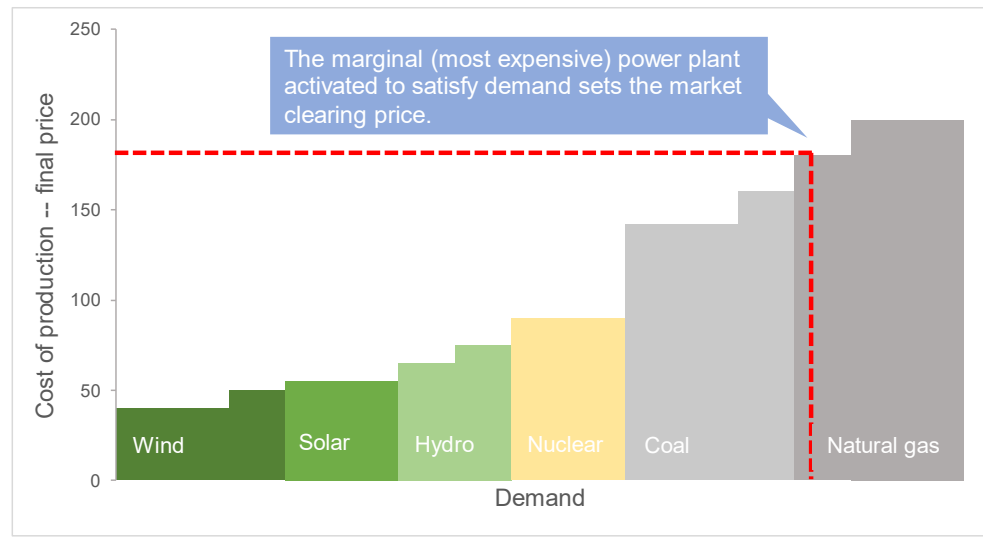
Source: Indicative LCOE: CE calculation based on IRENA/World Bank data (assumes a gas cost of \$259 per MWh and a carbon price of €80); Wholesale electricity prices (day ahead) in Italy: Gestore Mercati Elettrici (2022)

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, then 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 2022).

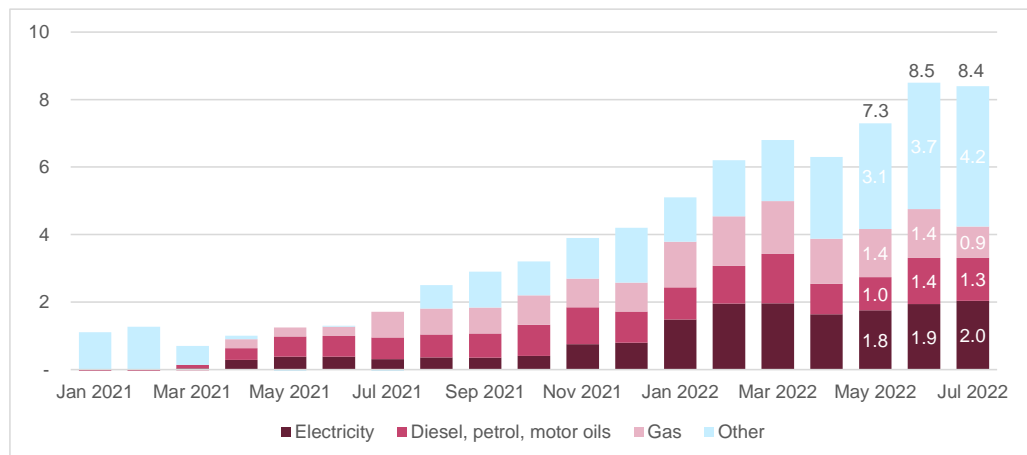


Energy prices are key drivers of the recent consumer price inflation

In 2022, retail energy prices were a key driver of consumer price inflation in Italy. Retail energy 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 Italian CPI. Household gas and transport fuels account for around 7.5% and electricity for around 2.5%. Recently, energy prices had a much higher contribution to overall inflation than these weightings suggest. In January, February and March, fossil fuels alone accounted for over 40% of the annual rate of inflation in Italy but their contribution has fallen to around 30% in the most recent three months (May to July) (Figure 8). This is a result of government intervention as well as a falling oil price in July.

Electricity prices were the greatest single driver of retail energy price inflation in Italy over the past 12 months, as a result of Italy’s reliance on natural gas in electricity generation. However, taken together, retail prices for gas and transport fuel still contributed more to Italy’s annual rate of inflation than retail electricity prices throughout the first half of 2022. In other European countries such as Germany, Poland and France, retail electricity prices contributed much less to the annual rate of inflation, partly due to the lower reliance on natural gas for electricity production in these countries.

Figure 8 Contribution of electricity, gas and fuel prices to consumer price inflation in Italy, in % points



Source: Eurostat, PRC_HICP_MANR

Before the Covid-19 pandemic, household spending on energy had been relatively stable

Household expenditure on energy as a share of total living costs has been relatively stable historically. Data from Italy’s national statistics office, Istat, shows that expenditure on energy in average households remained in the region of 10.5% of total living costs between 2014 and 2019, and then dropped to 9.8% during 2020, the first year of the pandemic. This was as a result of a collapse in fossil fuel prices and reduced demand for transport during the lockdowns, as can be seen in the top two plots of Figure 9. Since the second half of 2021, fuel prices have risen sharply in Italy, with a considerable impact on household budgets. As of August 2022, the annual rate of inflation reached 102.9% for electricity, 59.1% for gas and 14.1% for transportation fuels, whilst Italy’s overall inflation rate stood at 9.1%. As a result, household spending on energy has also risen sharply.

Poor households spend a higher share of living expenditure on energy

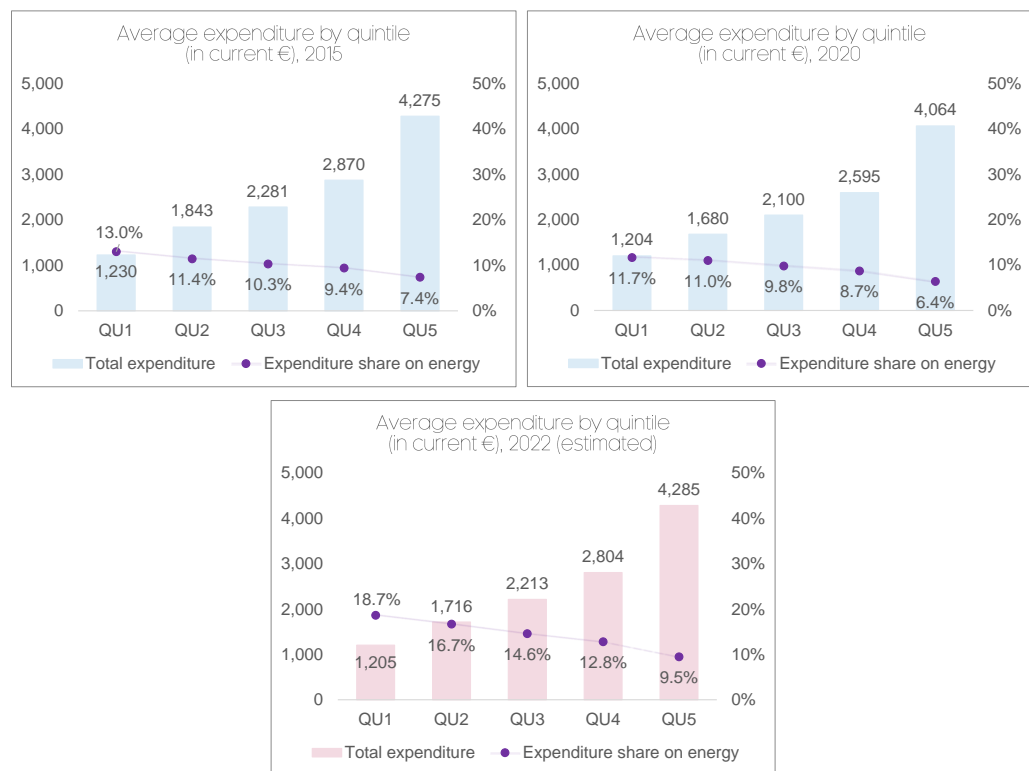
Lower income and vulnerable households spend a larger proportion of their income on energy consumption. Whilst poorer households spend less on energy (and everything else) than richer households, they spend a larger proportion of their incomes on energy bills as can be seen in all three years reported in Figure 9.

We estimate that an average household in the bottom quintile of the income distribution now spends 50% more on energy than in 2020.

Based on Eurostat data, we estimate that an average household in the bottom quintile is spending roughly €1,000 more on energy in 2022 compared to 2020, and that spending on energy now accounts for nearly 19% of total living expenditure. In other words, low income households now spend around 50% more on energy than in 2020 and over 50% more than the richest households relative to their overall living cost.

Expenditure on energy for higher income households (fifth quintile) in 2022 is estimated to increase by around €1,750 per year, to 9.5% of total living expenditure, up from 6.4% in 2020. Our calculations show that an average household (in the third quintile of the income distribution) is approximately €1,400 worse off in 2022 compared to 2020 as a result of household energy prices alone.

Figure 9 Household expenditure by quintile and share of energy in total household expenditure



Sources: Eurostat : prc_hicp_manr; I.Stat: Consumption expenditure – Expenditure quantiles

Note: Energy represents household energy (CP045 – primary electricity and gas) and transportation fuels (CP0722 – primary petrol and diesel); 2022: CE’s own estimate, based on energy price inflation and average expenditure growth

Italy is taking measures to address the energy price increases since autumn 2021

The Italian government has taken a number of measures to protect households and businesses from the high energy prices. Government interventions to offset the significant increase in retail energy prices began in September 2021 and have since been extended multiple times. These measures include (Bruegel, 2022):

- A reduction in VAT on gas for households and businesses. The measure originally applied for the last quarter of 2021 but has been extended three times since then, in December 2021 and in April and June 2022;
- Elimination of system charges for household and micro-business electricity users, benefitting around 6 million small businesses and around 29 million domestic customers;
- A 'social bonus' discount on energy bills for certain disadvantaged groups has been enlarged and freezes gas and electricity prices for 5.2 million households at summer 2021 prices;
- An increase in corporation tax applicable to energy suppliers;
- A €200 cash payment for all workers and pensioners with gross income below €35,000, as well as an income tax discount for this group, plus an additional €150 payment announced in September 2022 for those with gross incomes below €20,000;
- Reduced taxes on petrol, as well as various measures to support businesses and incentivise energy efficiency.

Despite the significant interventions, considering the estimates presented above, these measures are unlikely to fully offset the increased energy prices faced by households. These measures are currently estimated to cost the Italian government more than €59bn, or 3.3% of GDP (Bruegel, 2022).

Discussions about EU-wide actions are ongoing

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; see also Box 1). In fact, Zakeri et al. (2022) found that between 2015 and 2019, fossil fuel prices determined European wholesale prices 66% of the time. This figure is likely to be higher for Italy, where gas has an extraordinarily large share in total electricity generation, and gas-fired power plants are, therefore, setting wholesale prices most of the time. In the long term, in order to reduce electricity prices sustainably, gas-fired peak load capacity could be replaced by stored excess power from renewables using battery storage, green hydrogen 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 and 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 inframarginal producers, 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 to be 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). Renewables will be important in Italy to counterbalance the falling share of hydro power output in Italy, especially if the climatic challenges experienced in 2022 become more frequent in the future. 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.

Conclusions

Fossil fuels are clearly linked to the current cost of living pressures in Italy and are making an outsized contribution to recent spikes in inflation. These pressures are present across Europe, where the vast majority of fossil fuels are 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 prices affect wholesale electricity prices at almost all times of the day in Italy. This means that rising fossil fuel prices also push up electricity prices, especially during demand peaks. Energy cost subsidies to households 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.

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