

Fossil fuel prices and inflation in France



Final Report

September
2022

Cambridge Econometrics
Cambridge, UK

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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

- **Fossil fuels are key drivers of recent consumer price inflation in France. In May and June 2022, fossil fuels alone (transport fuels and gas) accounted for nearly 40% of France's annual rate of inflation.** This is despite the fact that fuels and electricity only account for around 10% of the overall basket of goods and services included in the French consumer price index. Between August 2020 and August 2022, household energy prices increased by 37%, whilst the overall price level increased by 9.2%.
- **We estimate that the increase in household energy prices make an average French household €410 worse off in 2022 compared to 2020, mostly due to higher gas prices.** Across the income distribution, spending on energy as a share of total living cost has risen significantly. We estimate that the poorest households in France now spend around a third more on energy than in 2020.
- **The French government has intervened heavily in retail markets to protect consumers and businesses from high energy prices.** The measures so far include price caps on electricity and gas, a petrol subsidy and cheaper energy sales from state-controlled EDF to competing retail suppliers. These measures are forecast to cost over €71 billion, equivalent to 2.9% of France's GDP.
- **Renewables are now much cheaper than fossil fuel-based electricity production, and their cost is forecast to fall further.** The lifetime cost of new wind and solar PV projects in France is now lower than ever, with costs per MWh only about a fifth of that of natural-gas based electricity generation, according to IRENA.
- **A further expansion of renewables therefore appears the right policy choice to increase energy independence, reduce the exposure of domestic consumers to global market prices, and bring down electricity prices in the long run.** The rapid deployment of renewables is particularly important to diversify France's power mix alongside nuclear. 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 France

This report explores the role of energy prices in recent inflation

The world is experiencing a surge in the 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 France, with a view to understanding the potential for faster energy transition measures to ease inflationary pressures and risks.

France is a net energy importer

France is a net energy importer, even though the country has reduced its energy dependence in recent years - from 51% of gross available energy in 2000 down to 45% of gross available energy in 2020. France's import reliance is primarily associated to fossil fuels. Aside from a limited domestic supply of oil and natural gas production (OECD, 2020), France historically imported most of the natural gas used in industry and consumption from outside the European Union – Norway (36%), Russia (17%), Algeria (8%), Nigeria (7.5%). The Netherlands (7.5%) is currently the only EU Member State through which France imports gas.

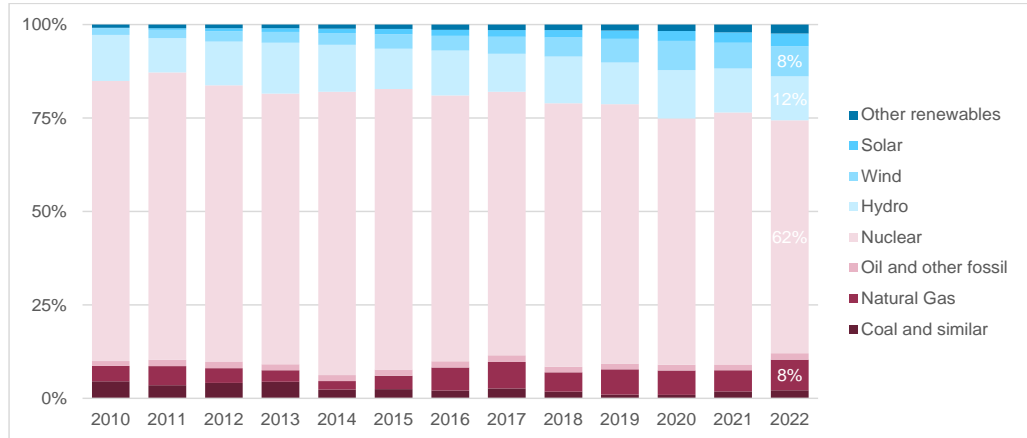
During the second half of 2022, France lost its place as the largest European net exporter of electricity as structural problems associated with the nuclear fleet of the country resulted in a 50% drop in power exports (Rocha, 2022). Since 2015, the share of nuclear in the country's electricity mix has been decreasing – from 75% of electricity generation in 2015, to 66% in 2020 and to 62% in the first half of 2022 (IEA, 2022) (see also Figure 1). The cost of French electricity generation can vary with changes in international commodity markets as France needs uranium to fuel its nuclear fleet, which the country imports from Niger and Canada (OECD, 2020).

Renewables have a limited contribution to electricity generation in France

The share of wind and solar PV in total electricity generation remain well below that of European peers.¹ France has the least carbon emitting power grid among large economies (Zakeri, et al., 2022) thanks to the extensive use of nuclear power. The low carbon emission profile of France is also supported by a growing share of renewables. The share of fossil fuels in French power generation is only around 10%. To offset the drop in nuclear output in 2022, France has however increased the use of natural gas in electricity production. Natural gas accounted for 8.2% of all electricity generation in the first five months of 2022, up from an average of 6.0% between 2018 and 2021.

¹ Germany and Spain report shares of solar PV and wind that are more than twice as high as in France.

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



Source: IEA (MES_0522)

Between 2015 and the first semester of 2022, the share of renewables in France increased significantly, from 15% to 26% of the electricity generation mix (Figure 1). Wind power and solar PV are the main contributors to the recent growth of renewables in France and in the first five months of 2022 accounted for 8.1% and 3.4% of electricity production respectively. Electricity generation from renewable sources has partly offset the decreasing electricity output of the French nuclear fleet. In line with France’s green transition commitments, the reliance on fossil fuels is likely to decrease further in the coming years.

France has ambitious plans for the energy transition, but implementation has been delayed

The French strategy for reaching net zero emissions by 2050 relies on a mix of strictly defined carbon budgets and supporting investment programmes. The ‘Strategie Nationale Bas-Carbone’ (SNBC) is currently the cornerstone of climate and energy policy. The SNBC sets the short and medium term objectives to achieve carbon neutrality by 2050 (Ministère de la Transition écologique et de la Cohésion des territoires & Ministère de la Transition énergétique, 2022a). The ‘Programmation Pluriannuelle de l’énergie’ (PPE) 2019-2028 is a policy steering tool which establishes government priorities in transforming the energy sector. Objectives are set in the form of energy production capacities for renewable and reusable energies (Ministère de la Transition écologique, 2021). This is complemented by the ‘France Relance’ plan, France’s recovery and resilience plan, which outlines 20 reforms and 71 investments to be completed by 2026. The plan mobilises €39.4 billion, 46% of which will be channelled into climate objectives, with a focus on building renovation, sustainable transport and decarbonisation of industrial processes (Ministère de l’Économie et des Finances, 2022; European Commission, 2022a).

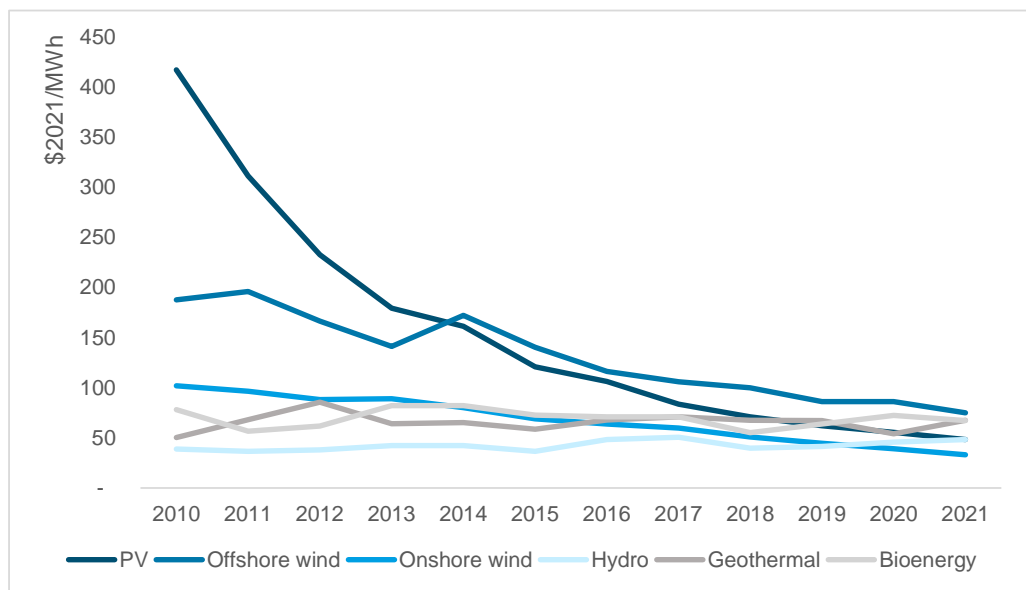
France is poised to miss the 2030 and 2035 targets for the transformation of its electricity generation mix. By 2030, France aims to increase production from renewables to 40% of its electricity mix, and by 2035 to reduce the share of nuclear in power generation to 50% - according to the latest PPE (IEA, 2021; EDF ENR 2022). Given the slow progress in the installation of new renewable capacity, France could miss interim targets for solar PV (i.e., increase capacity to 20 GW in 2023) and wind power capacity (i.e., increase capacity to reach 24.6 GW onshore and 5 GW offshore in 2023) (IEA, 2021; EDF ENR 2022). France also aimed to close all remaining coal-

fired power plants by 2022 (IEA, 2021). However, the Russian invasion of Ukraine and the resulting energy security challenges prompted the French government to consider reactivating coal plants (France24, 2022).

The cost of renewables has consistently gone down

The cost of renewable electricity technologies has fallen dramatically over time. 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 fell by 88% between 2010 and 2021, from \$417 to \$48 per MWh (2021 prices). Similarly, the costs of offshore and onshore wind projects have decreased by 60% and 68%, respectively.

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



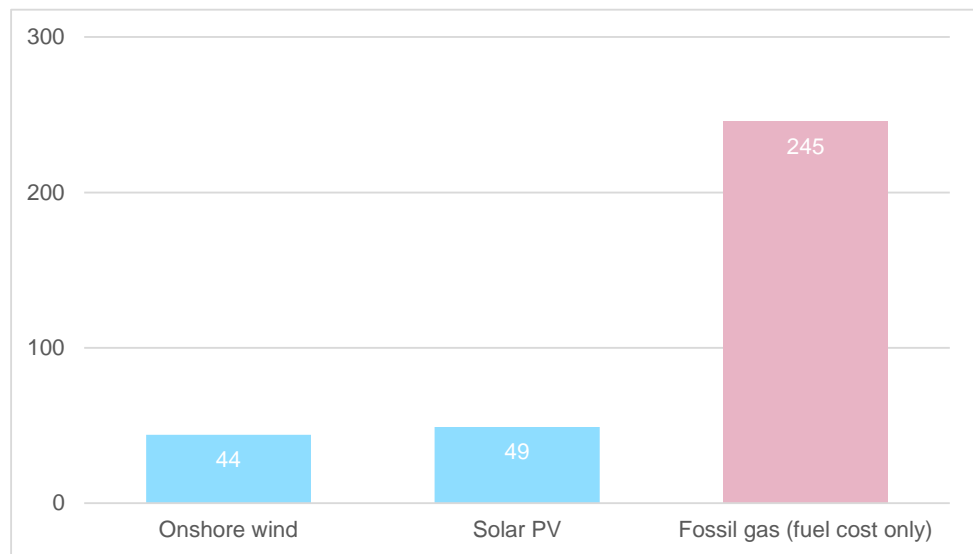
Source: IRENA 2022

Note: Global weighted average of commissioned projects

Despite their cost advantage, the deployment of renewables has been slow in France

The cost of fossil-fuel based electricity generation has risen sharply in the first half of 2022, making renewables even more competitive. Running costs of gas-fired plants rose sharply in 2022 due to the current hike in natural gas prices, with fuel-only costs estimated at \$245 per MWh in France in 2021 prices (IRENA 2022), as shown in Figure 4. The cost of natural gas per MWh is currently about five times higher than the estimated lifetime cost per MWh (LCOE) of new onshore wind projects in France (\$44 per MWh) and new solar PV projects commissioned in France in 2021 (\$49 per MWh) (ibid). Despite this, the deployment of renewable energy generation capacity has been slower in France than in other EU countries.

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

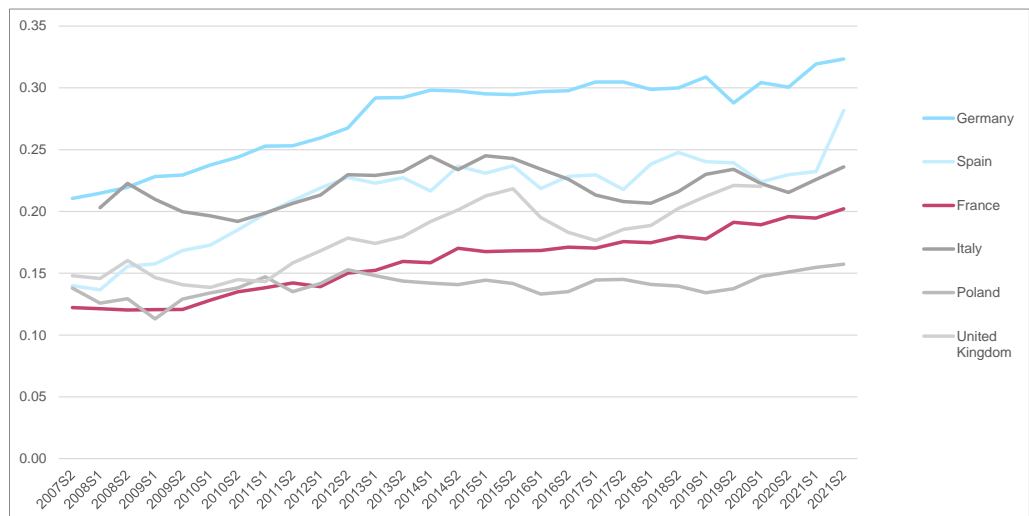


Source: IRENA (2022)

France has historically had lower household electricity prices compared to European peers

Until 2021, France had lower household electricity prices than its European peers. The large French nuclear fleet coupled with an energy market dominated by a state-controlled and former monopoly firm (EDF) has contributed to French households facing lower energy bills compared to their peers. This is related to the fact that France relies on subsidies and direct price controls to ensure affordable electricity (as well as affordable household gas). In European electricity markets, electricity producers typically sell electricity to energy suppliers that then provide electricity to household and business consumers. In France, the main difference to other market-based systems is that the state-owned producer, EDF, sells a large part of its production at a discount (Ouest France, 2022). Since 2019, however, prices have come closer to those in neighbouring countries, as shown in Figure 4.

Figure 4 Retail electricity prices in France and major European countries



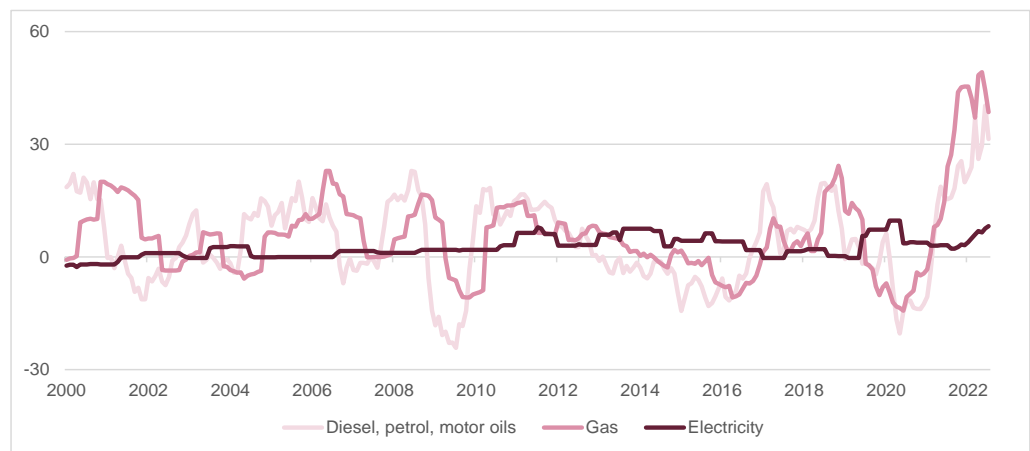
Source: Eurostat, NRG_PC_204

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

Fuel prices have been more volatile and have risen faster than electricity prices in France

Retail fuel and gas prices in France have been more volatile than retail electricity prices. Figure 5 shows annual price changes for retail electricity (dark red line), gas and liquid transport fuels (pink lines) in each month. The evolution of retail electricity prices in France has been much smoother over the last decade compared to retail fossil fuel and gas prices, which are characterised by much greater price swings. While there are some step changes in the annual change in electricity prices around 2004, 2012, 2014, 2020 and 2022, the magnitude of the price change is miniscule compared to that of fossil fuels. This means that household and business consumers have historically been able to estimate their electricity bills with much greater certainty than their expenditure on fossil fuels.

Figure 5 Price changes for electricity, gas and transport fuels over the same month in the past year, percentage points



Source: Eurostat, PRC_HICP_MANR

Table 1 analyses price growth and volatility for all major household energy sources in greater detail, based on Eurostat data from 1995 until today. Price growth and volatility of all energy sources exceeded price inflation of the overall consumption basket in France over the past 27 years. The standard deviation of the price change of gas and transport fuels has historically been much higher than that of retail electricity, indicating that consumers have been exposed to larger retail price volatility in fossil fuels, which are driven by global market prices, than for electricity, the prices of which are determined on domestic markets regulated by the French government and the European Commission.

The average monthly change of gas prices and ‘fuels and lubricants for transport’ prices (95% of which is petrol and diesel) is close to double that of the electricity price in the period 1995-2021. This shows that retail fossil fuel prices have also risen faster than retail electricity prices over that time period. The evolution of retail electricity prices has been much closer to that of the consumer price index overall.

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	0.70	0.14	0.72	0.65
Gas	1.80	0.33	3.33	2.8
Fuels and lubricants for transport	2.36	0.26	5.89	2.44
All items	0.33	0.12	0.44	0.55

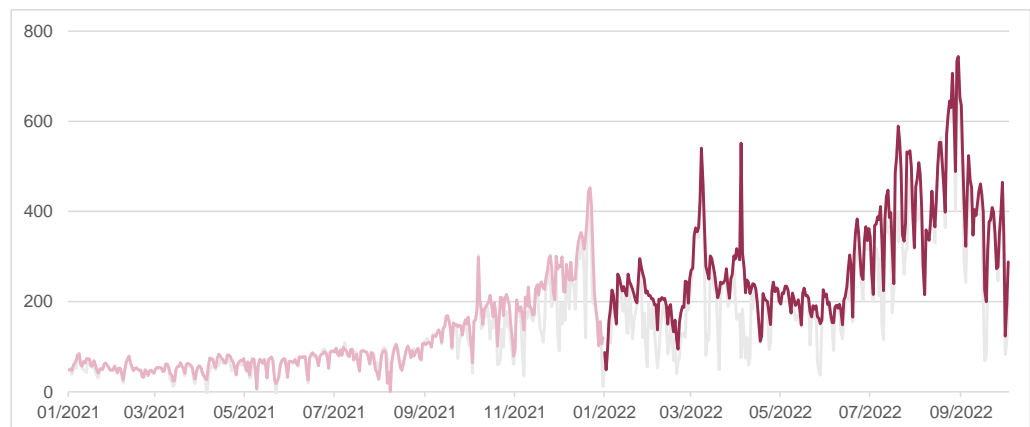
Note(s): Fuels and lubricants for personal transport equipment category is driven by price change of diesel and petrol. This category has been chosen due to its better data availability

Source(s): Eurostat. PRC_HICP_MMOR

In 2022, French wholesale electricity prices have risen above those in peer countries

Since 2021, French wholesale prices have surpassed prices on the German market, which historically had higher wholesale energy prices, as shown in Figure 6. France’s wholesale electricity day-ahead price averaged €401 per MWh in July 2022 and €492 in August, with a daily peak of €744 on 30 August (Bundesnetzagentur, 2022). This is likely linked to increased imports of more expensive electricity from neighbouring countries, mainly Germany, to offset the lower than usual nuclear electricity production (Crellin & Eckert, 2022), and an uptick in expensive natural gas-based electricity generation, the share of which rose from 5.7% of all electricity production in 2021 to 8.2% in the first five months of 2022. Until now, the recent hike in wholesale electricity prices has only had a very limited impact on household electricity bills as a result of government intervention.

Figure 6 Wholesale electricity prices (day-ahead) in 2021 and 2022 in France (red lines) and Germany for comparison (grey line).



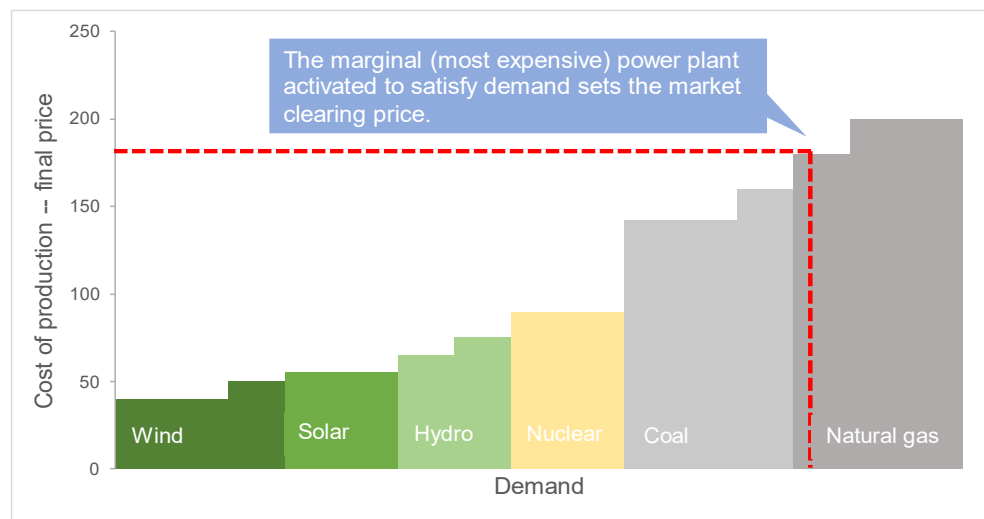
Source: CE analysis of Bundesnetzagentur (2022) data.

Box 1: Electricity price setting in the EU Member States

Key wholesale electricity prices in the EU are based on a marginal price model, established 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).



All household energy prices have risen sharply in recent history

All household energy prices have increased over the past twelve months, but fossil fuel prices have risen particularly sharply, and have also been more volatile than electricity prices. In fact, since January 2020, energy prices have increased faster than at any point in the last 25 years. Table 2 shows the increase in retail prices for electricity, gas and transport fuels over the past 6, 12, 24 and 30 months, as of July 2022. Since January 2020, retail fossil fuel prices have risen more sharply than retail electricity prices, with petrol prices up 17%, diesel up 26% and gas up 54%, whilst electricity prices have risen by 14%.

The increase is driven by an uptick in global demand after the end of Covid-related lockdowns and geo-political uncertainties as a result of Russia’s invasion of Ukraine in February 2022, but also exacerbated by the recent weakening of the euro against the US dollar (European Commission, 2022c; ING, 2022).

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

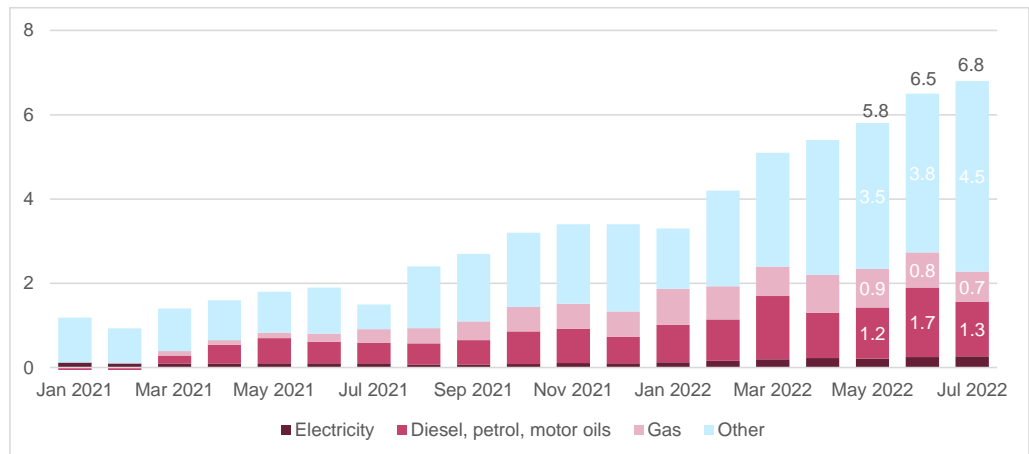
As of July 2022, Change since:	January 2022 (last 6m)	August 2021 (last 12m)	August 2020 (last 24m)	January 2020 (last 30m)
Electricity	6.8%	7.6%	9.8%	14.0%
Gas	11.2%	34.6%	71.0%	54.4%
Diesel	21.3%	29.4%	49.0%	25.8%
Petrol	10.1%	13.5%	33.8%	17.1%
All items (overall inflation)	5.8%	6.7%	9.2%	9.4%

Source: Eurostat, PRC_HICP_MMOR

Energy prices are key drivers of consumer price inflation

Retail energy prices are key drivers of consumer prices inflation in the first half of 2022. Household energy accounts for roughly 10% of the overall basket of goods and services included in the consumer price index. Gas and transport fuels account for around 7% and electricity for around 3%. Due to their recent increases, retail energy prices exerted high inflationary pressure on the overall consumer price index. Fossil fuels alone (transport fuels and gas) accounted for nearly 40% of overall year-on-year inflation in May and June 2022 (Figure 7). This fell to 30% in July 2022 as a result of a declining oil price. Overall, over the past two years, Eurostat CPI data shows that household energy prices increased by 37% from August 2020 to August 2022, whilst the overall price level increased by 9.2%.

Figure 7 Contribution of electricity, gas and fuel prices to consumer price inflation in France, in % points



Source: Eurostat, PRC_HICP_MANR

France currently has one of the lowest inflation rates among European countries, largely due to the much smaller increases in retail electricity and gas prices. Among key energy sources, retail electricity prices contributed the least to the overall increase in household energy prices as a result of the French government capping electricity price changes at 4%. The

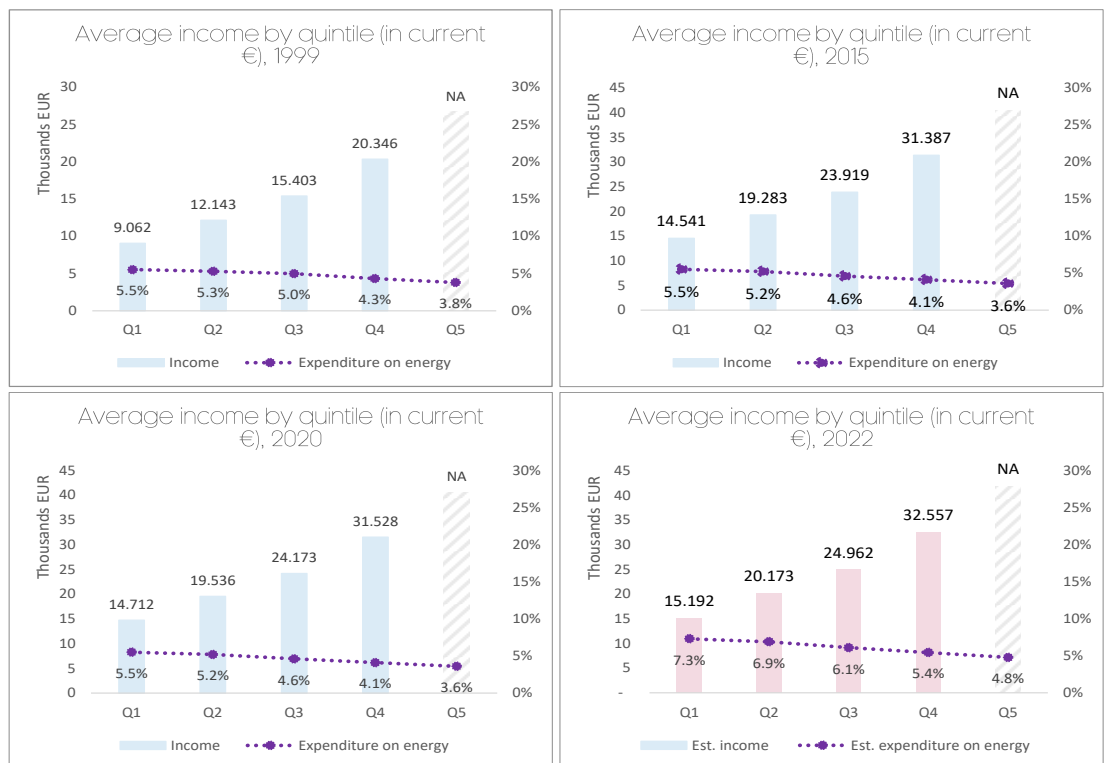
contribution of gas prices to the overall rate of CPI inflation has also been smaller than in other countries, as a result of the French government freezing gas prices at October 2021 levels. These price controls are likely to be a key reason for France’s lower level of consumer price inflation in 2022 compared to European peers such as Spain and Germany.

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

Historically, household expenditure on energy in France has remained largely stable, until recently. French household expenditure on energy is mainly comprised of the cost of household gas and electricity, the latter produced predominantly by nuclear power. The historical stability of electricity prices has benefitted all households across the income distribution. Recently, however, expenditure on energy has risen significantly.

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 Figure 8. In 2020, an average French household in the bottom 20% of the income distribution spent 5.5% of living expenditure on household energy, with very little change over the past 25 years. Based on Eurostat data, we estimate that such a household now spends about 7.3% of total living expenditure on energy. This is about a third more than in 2020, equal to roughly €300 more per year, and despite the government’s price caps on electricity and gas.

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



Sources: Eurostat: lc_lci_r2_a, prc_hicp_manr, hbs_str_t223, ilc_di01
 Note: Income in the fifth quintile (Q5) is not publicly available; 2022: CE’s own estimate, based on energy price inflation and wage growth

We estimate that an average French household (in the third quintile of the income distribution) now spends approx. €410 more on energy per year in 2022 compared to 2020 as a result of higher energy prices alone. Based on energy price inflation and wage growth in France, we estimate that the share of energy in total living expenditure has risen from 4.6% in 2020 to 6.1% in 2022 for households in the middle 20% of the income distribution.

France has introduced measures to address the recent energy price increases

The French government has introduced a number of measures to tackle the rising cost of energy for households and businesses in response to the recent increases in fossil fuel prices, most notably price caps on retail gas and electricity prices. The measures introduced by the French government since autumn 2021 include (see Bruegel, 2022):

- A price cap for domestic gas has been freezing gas prices at October 2021 levels and was originally scheduled to end in the spring 2022, but then extended until the end of 2022 (Guinochet, 2022).
- A second price cap was introduced for domestic electricity prices, also since October 2021, limiting price increases in 2022 to 4%, which is expected to cost the government €24bn (Guinochet, 2022).
- A reduction of the electricity tax from €22.50 per MWh to €1 for households and €0.50 for businesses.
- An obligation of EDF to sell more nuclear electricity to competing suppliers at an adjusted price of €46.2 per MWh, versus €42 per MWh.
- Complete nationalisation of EDF for around €10bn in response to mounting debt in the company, and increased investment in the maintenance of the existing nuclear fleet (€50bn).
- The French government also published an energy demand reduction plan in July 2022, called 'Plan sobriété énergétique', with the aim of reducing energy consumption by 10% over the next two years (Ministère de la Transition Ecologique, 2022b).
- Petrol prices are subsidised by €0.30 per litre from September 2022.

Taken together, the measures announced so far to support households and businesses in the energy crisis are expected to cost French taxpayers over €71bn, or 2.9% of French GDP (Bruegel, 2022).

Discussions about EU-wide actions and the future energy system 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) find that between 2015 and 2019, fossil fuel prices have determined European wholesale 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. 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, 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, 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 cap of €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 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 France to counterbalance the falling share of nuclear power output in France, as the fleet of nuclear reactors is ageing and problems and disruptions become more frequent. 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 France 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 prices often affect wholesale electricity prices. This means that rising fossil fuel prices also push up electricity prices, especially during demand peaks. In France, recent wholesale prices were also been affected by increased electricity imports from neighbours. 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 renewable 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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