

Fossil fuel prices and inflation in Türkiye



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info@camecon.com
www.camecon.com

Contact person: Carl Heinemann, ch@camecon.com

Authors: István Heilmann, ih@camecon.com
Carl Heinemann, ch@camecon.com

Contributors: Iakov Frizis, if@camecon.com

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

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The analysis presented in this report was conducted in October 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, including natural gas, are responsible for a large share of consumer price inflation in Türkiye in the past 12 months.** In the last year, energy prices have skyrocketed, with electricity up 102%, gas up 145%, and transport fuels (primary diesel and petrol) up 182%. Since May, fossil fuel prices were responsible for roughly one fifth of Türkiye's overall inflation rate, which currently stands at over 83%. Electricity prices, meanwhile, have accounted for only 3% as a result of state subsidies.
- We estimate that the lowest income households will spend almost twice as much on energy bills this year compared to 2021** (in nominal terms). For almost all households, energy costs as a proportion of overall household expenditure have remained high over the past 25 years (but decreased slightly between 2005 to 2015). We estimate that the share of energy costs in total disposable income has risen from 7.6% in 2021 to 9.3% in 2022 for the lowest income households, meaning they now spend nearly 25% more on energy than last year in real terms.
- Türkiye has introduced targeted measures to shield households from soaring energy prices, at a cost of around \$16bn in 2022 alone.** In order to protect citizens from energy price hikes, generous subsidies to reduce electricity and gas tariffs for many households have been brought in at a cost to government of roughly 300 billion Turkish liras (\$16bn) in 2022 alone. The subsidies will double in 2023, during which parliamentary and presidential elections will be held. The Turkish National Bank has also cut interest rates instead of raising them, which has led to a depreciation of the lira resulting in rising import costs.
- Renewable energy source are now much cheaper in Türkiye than fossil fuels.** The lifetime cost per MWh of new solar PV (\$64) and onshore wind power (\$44) is now less than half the cost per MWh of natural gas-fired power generation (\$128). In the past decade, Türkiye has already made great progress in deploying renewables, increasing their share from roughly a quarter in 2010 to nearly half of all electricity generation in the first half of 2022.
- As fossil fuel prices continue weigh on household budgets, Türkiye could draw strategic benefits from continuing its ambitious energy transition towards renewables.** Continuing and expanding the support for renewables reduces Türkiye's dependence on energy imports, and has the potential to reduce electricity prices in the long run as domestically produced renewables substitute for fossil fuel imports. Coupling further investment in renewables with a rapid electrification of transport and heating also reduces household exposure to volatile global market prices for fossil fuels, and thus limits the need for government interventions in times of high global prices.

Energy prices and inflation in Türkiye

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

Soaring prices of fossil fuel-based energy preceded and accompanied this return to inflation in countries across the world. 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. This paper sets out to explore the role of energy prices in inflation in Turkey, with a view to understanding the potential for faster energy transition measures to ease inflationary pressures and risks.

Türkiye is very reliant on energy imports, but its sources are diversified

Türkiye is a net energy importer if all energy sources and consumption (including electricity) are considered. Energy demand has been growing substantially for decades due to the significant economic growth and general increase of the standard of living: among OECD countries, Türkiye had the fastest growing demand for electricity and natural gas over the past 20 years (Ministry of Foreign Affairs, 2022).

Türkiye is highly reliant on fossil fuel imports. Fossil fuels have an essential role in the Turkish total energy supply: in 2019, more than 80% of total primary energy supply (TPES) was from fossil fuels. Oil, coal and natural gas all have similar shares (29%, 28%, 25%, respectively). As the country has limited domestic fossil fuel resources, it is almost entirely dependent on imports (93% of oil and 99% of gas) (IEA, 2021).

Türkiye has made efforts to diversify its energy imports. For instance, in the early 2000's the vast majority of Türkiye's natural gas supplies came from Russia, but new gas pipelines have since been built connecting the country with Azerbaijan and Iran, new LNG terminals have been developed and gas storage capacities have been expanded. In October 2022, Russia proposed increasing the importance of Türkiye in the European gas market by creating a new gas hub on its territory which would deliver more natural gas through the Balkans to the EU (Reuters, 2022a). Similarly, pipelines and tankers deliver crude oil supplies from Iran, Iraq, Saudi Arabia and Russia. Türkiye also has significant refinery capacity.

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

Renewable energy sources make up a large share of the Turkish electricity mix. Türkiye's electricity generation consists of a broad mix of sources. In the last decade, electricity generation from renewable energy sources, primary from wind, solar and geothermal, has almost tripled. This has been facilitated by favourable climate conditions, expanding demand and a supportive regulatory environment. The later includes feed-in-tariffs offered to renewable power operators and public tendering of larger scale renewable energy projects to crowd-in private investments under the Renewable Energy Resource Areas (YEKA) programme. Installed solar water heating capacity in Türkiye is among highest globally (IEA, 2021).

It is expected that Türkiye's first nuclear power plant will come online in 2023, followed by further reactors scheduled to go live in 2026, with a total capacity of 4.8 GW. Türkiye has been seeking to expand the share of nuclear power further and reach a national target of three power plants with twelve reactors overall. However, construction of the second nuclear power plant has

become uncertain in recent years. Türkiye is also trying to diversify its nuclear power portfolio: Russia, a Franco-Japanese consortium and China with US technology are all involved in planning or building new nuclear plants. (World Nuclear Association, 2022; IEA, 2021)

Türkiye seeks to boost nuclear and renewables but also supports power generation from coal

Türkiye seeks to increase its energy security by strengthening domestic energy production and by developing relevant industries. In order to boost energy security, there has been a push towards coal-fired power generation instead of using natural gas, and domestic lignite mining has been supported, along with the development of renewables and nuclear power. The development of domestic manufacturing of electricity generation technology and measures to promote energy efficiency¹ are the main components of the national energy security programmes (IEA, 2021). Türkiye's stated aim is to become a trading centre of energy in the region and enhance regional and global energy security (Ministry of Foreign Affairs, 2022).

Türkiye has exceeded a goal to install 10 GW of wind power capacity in 2021 (all onshore), and the government plans to install an additional 20 GW of wind power capacity by 2030, supported by developing the domestic wind turbine manufacturing industry. Even though the country has significant potential for offshore wind, estimated at 70-75 GW, to our knowledge, there are currently no concrete projects underway to build any offshore wind farms (Wind Europe, 2021; EV Wind, 2021). Türkiye's first tender for offshore wind was issued in 2018, but subsequently postponed due to a lack of site data among other reasons (OffshoreWind, 2021).

The Turkish government plans to ramp up installed solar PV capacity to 15 GW by 2027, supported by a programme designating so-called Renewable Energy Resource Areas (YEKA) (PV Tech, 2021). Geothermal energy is also contributing to electricity generation, with 1.7 GW of installed capacity in 2021, making Türkiye a global leader in the use of this energy source. Large-scale installation of geothermal generation capacity started in 2006 and further capacity growth is expected, but at a slower pace (Serpen and DiPippo, 2022; Norton Rose Fulbright, 2020).

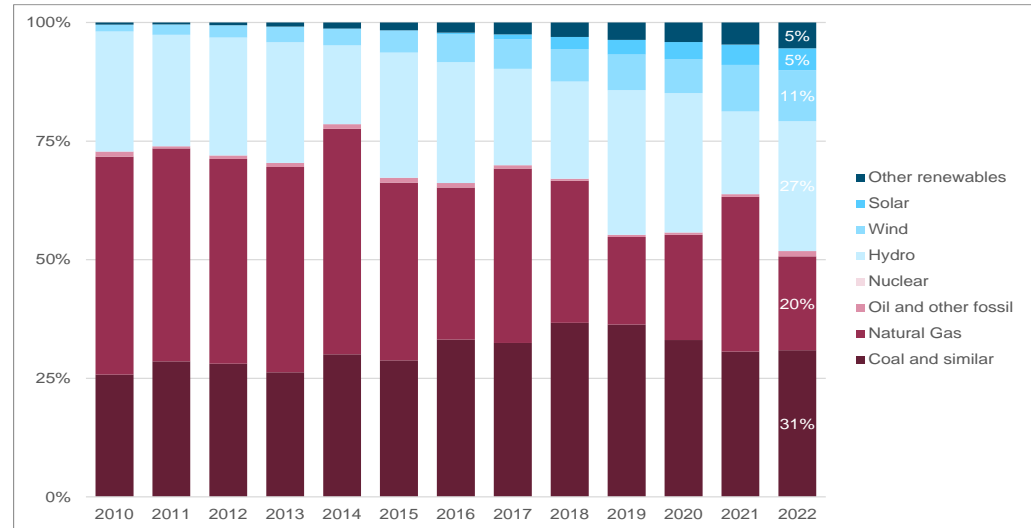
Türkiye has a diverse mix of electricity generation and an increasing share of renewables

There is strong growth in renewable energy deployment, which now account for close to 50% of Türkiye's electricity production. According to IEA data, total electricity production has increased by 56% since 2010, reaching 638 TWh in 2021. Although total electricity production from fossil fuels has increased, the renewable energy sector is expanding much faster. Hydro power is responsible for a large share of electricity production (between 17 and 31%), but the greatest increase in renewable electricity generation came from wind energy, the share of which has grown from 1% to 11% over the past 12 years, and a 10-fold increase in electricity generated. In the last five years, the share of solar PV in total electricity production has also risen significantly, from almost 0 to 5%. The rapid expansion of green energy, which can be seen in Figure 2, is facilitated by favourable geographical and climatic circumstances, supportive government policies and the developing domestic wind turbine industry.

¹ For instance, Turkey's National Energy Efficiency Action Plan has a target of lowering primary energy consumption by 14% between 2017-23.

In recent years, Türkiye has sought to switch from natural gas to coal-fired power generation. Increasing the share of coal and decreasing the importance of natural gas in electricity production is a component of the government’s strategy to diversify Türkiye’s energy imports. There has also been large push on domestic lignite mining and new coal power plant capacity has been added. Simultaneously, switching from gas to coal in electricity generation has been promoted.

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

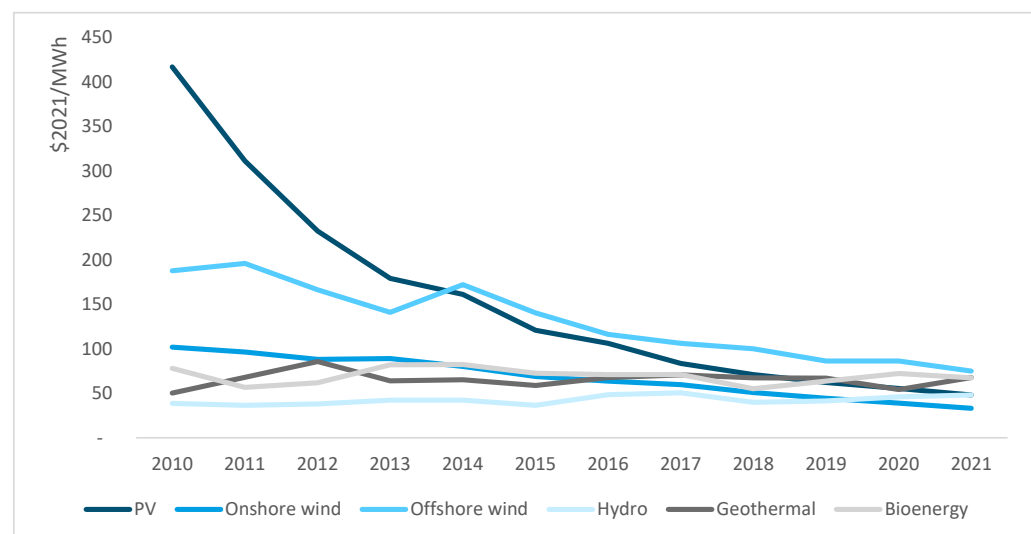


Source: IEA (MES_0522)

The cost of renewables has consistently gone down

The global average 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 by 88% between 2010 and 2021, from \$417 to \$48 per MWh (2021 prices). Similarly, the lifetime cost per MWh of new offshore and onshore wind projects have reduced by 60% and 68%, respectively.

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



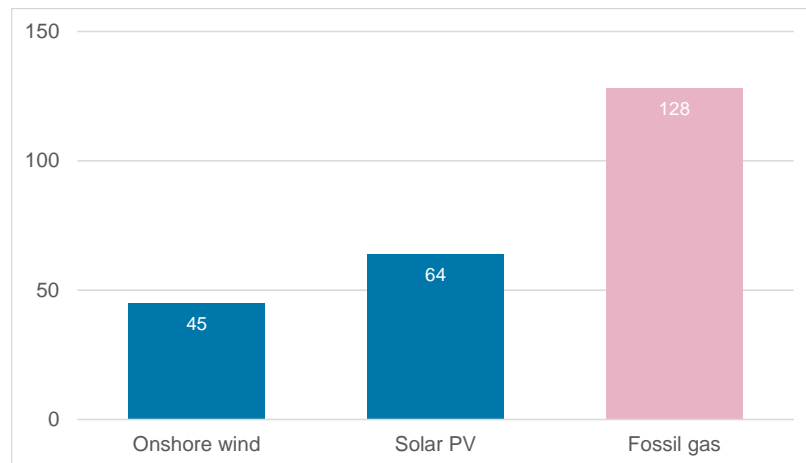
Source: IRENA, 2022

Note: Global weighted average of commissioned projects

At the same time, the LCOE of fossil-fuel based electricity generation has remained largely unchanged (IRENA, 2022). Similar cost reductions for renewables have been observed in Türkiye (Figure 3).

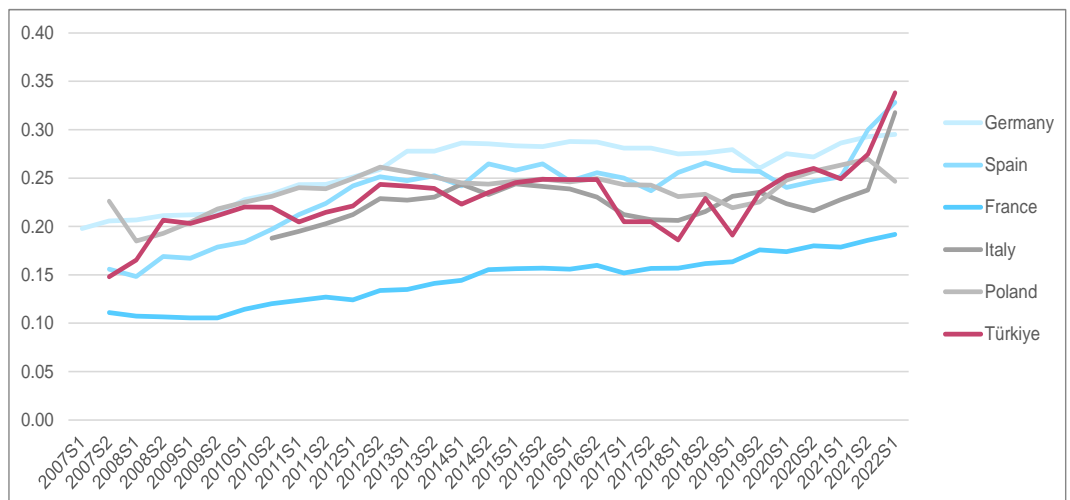
The levelized cost of electricity from renewable sources is now significantly lower than that of natural gas-based electricity generation in Türkiye. The lifetime cost of newly commissioned renewable energy projects in Türkiye slightly exceeds that of other larger economies. New onshore wind projects had a lifetime cost of \$45 per MWh in 2021 and the lifetime cost per MWh of utility scale solar PV projects stood at \$64. These values are higher than the global weighted average of \$33 and \$48 per MWh, but only a fraction of the operating cost of gas-fired power plants, which are estimated to be around \$128 per MWh in 2022 in Türkiye (IRENA, 2022). Türkiye has already benefitted from the falling costs of renewable energy, considering the fast progress made in boosting the share of renewables in electricity production and the lower nominal retail prices for electricity compared to other European countries.

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



Source: IRENA, 2022

Figure 4 Retail electricity prices in Turkey (purple) and selected EU countries, in € per kWh on Purchasing Power Standard (PPS)



Source: Eurostat dataset: NRG_PC_204

Note: All taxes and levies included; consumption band between 2,500 and 5,000 kWh p.a.

Turkish retail electricity prices have recently increased, but nominal prices remain below those in other major economies

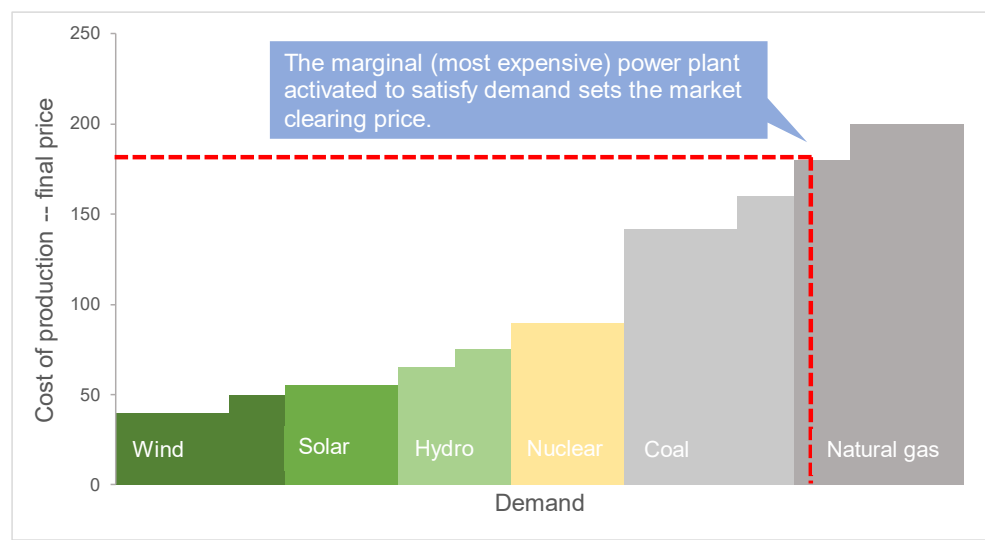
While nominal electricity prices in Türkiye are comparatively low, retail electricity prices in purchasing power standard (PPS) terms have increased rapidly since 2021 and are now among the highest among major European economies. In nominal terms, Turkish retail electricity prices are at the lower end of the range for European countries and have actually decreased in recent years. In PPS terms, however, Turkish retail electricity prices have risen sharply in the second half of 2021 (a 35% increase between the first half of 2021 and the first half of 2022) and are now the highest among other major European economies (Figure 4). The high prices in PPS terms are related to the collapse of the Turkish lira which has lost more than 80% of its value against the euro since 2012.

Box 1: The Turkish wholesale electricity market

Türkiye started liberalising its wholesale electricity market in 2001 by opening the sector to private participants. Most electricity is traded in bilateral agreements, but the share of bilateral transactions has recently fallen, from 66% in 2016 to 57% in 2020 while the spot market, most notably the day-ahead market, has grown to 40% from 27% in the same period. The electricity trading platform is run by EPIAŞ, is the market operator of Istanbul Energy Exchange (PwC and PRT IO, 2021; IEA, 2021).

The Turkish day-ahead electricity market is harmonised with EU electricity markets, with auctions for hourly electricity volumes delivered the next day (PwC and PRT IO, 2021). In this market, to fulfil demand, 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 is satisfied. This is known as merit order pricing. The last, i.e. the marginal, and therefore most expensive plant activated to satisfy demand sets the price for the whole market which is therefore uniform. 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 day.

This means operators of renewable power sources can achieve revenues much higher than their marginal costs, which incentivises investment in renewables (European Commission, 2022). However, it also means that end users do not necessarily benefit from lower electricity prices as the proportion of generation from renewable sources increases.



Turkish energy prices are more volatile than overall consumer prices

Historically, the volatility of retail electricity prices was lower than that of retail prices of key fossil fuels (petrol, diesel and household gas). Table 1 analyses the price volatility and average monthly change of prices in more detail. In general, the price volatility of all key energy sources exceeded that of overall inflation rate by roughly a factor of two. Electricity prices were the least volatile compared to the consumer price index.

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

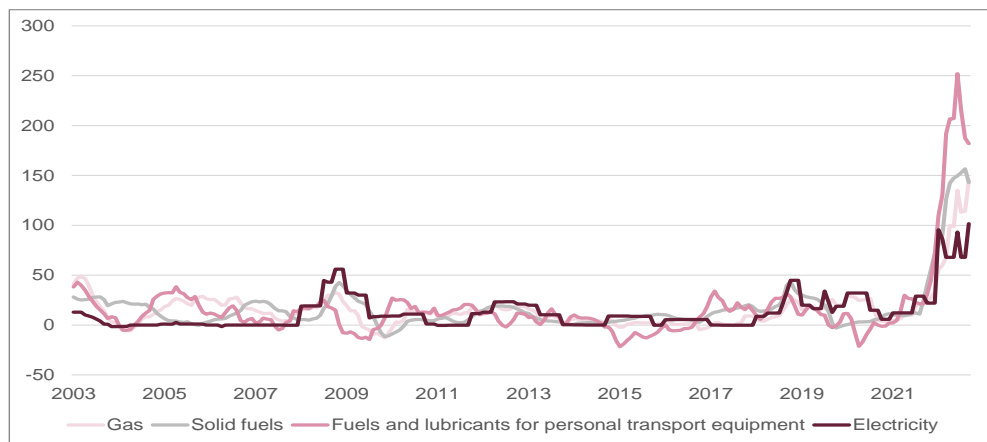
	1996:M2-2021:M8		2021:M9-2022:M9	
	Standard deviation	Average monthly price change (%)	Standard deviation	Average monthly price change (%)
Electricity	3.62	1.79	20.44	6.96
Gas	4.13	2.03	7.81	7.45
Fuels and lubricants for transport	4.55	1.86	11.72	8.94
All items	1.97	1.73	3.73	4.95

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 of key energy sources have accelerated dramatically. In the period between 1996-2021, the average monthly change in retail electricity and fossil fuel prices was only slightly above the general price level change. Since mid-2021, price growth and volatility for all key energy sources has been exceptionally high: the standard deviation of month-on-month price changes doubled for natural gas, more than doubled for transportation fuels and more than quadrupled for electricity prices, compared to the period between 1996-2021.

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



Source: Eurostat dataset: PRC_HICP_MANR

The current energy price hikes are strongly connected to global developments. Since January 2021, energy prices have increased at a pace not seen since the early 2000's. Turkish electricity prices rose by over 160% (see Table 2) in the last 24 months and fossil fuel prices have risen even more sharply, with transportation fuels up 243%, and gas up 195%. In January 2022, tariffs increased by 50% for households with low electricity consumption, and by more than 100% for businesses and households with high electricity consumption. Gas prices increased by 25% and 50% for households and industry, respectively (Enerdata, 2022). The price increases are ultimately driven by soaring fossil fuel prices since Russia's invasion of Ukraine and increasing global demand after the end of Covid-related lockdowns, but have also been heavily exacerbated by the depreciation of the Turkish lira against the US dollar and euro over the past 18 months.

Table 2 Recent change in retail electricity, gas and transportation fuel prices in Türkiye

As of October 2022, Change since:	January 2022 (last 9m)	October 2021 (last 12m)	October 2020 (last 24m)	January 2020 (last 31m)
Electricity	102%	102%	161%	161%
Gas	118%	145%	195%	202%
Fuels and lubricants for transport	88%	182%	243%	229%
All items (overall inflation)	52%	84%	120%	139%

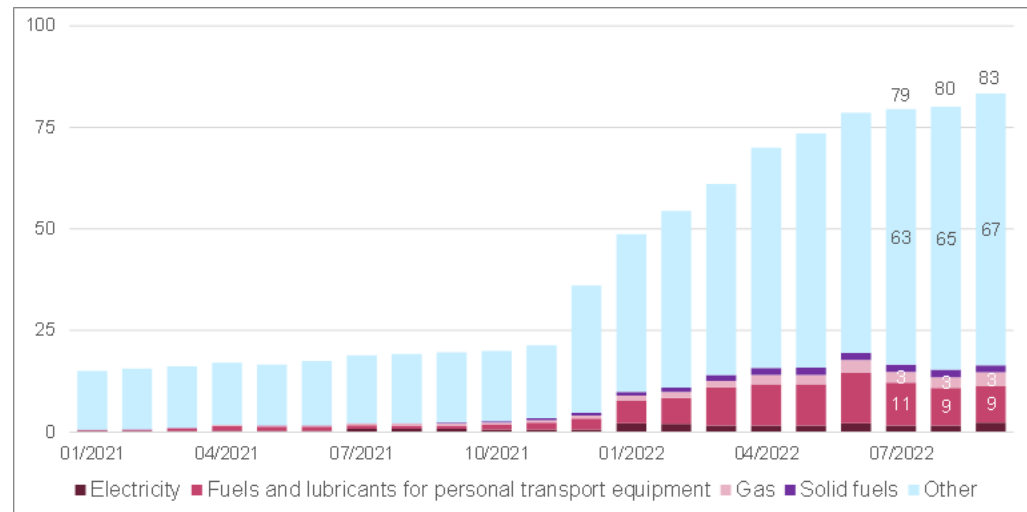
Source: Eurostat dataset: PRC_HICP_MMOR

Fossil fuel prices are important drivers of the recent consumer price inflation

Currently, the contribution of fossil fuels to inflation is outsized. Retail energy and transport fuel prices are a component of the consumer prices index (CPI), and generally 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 been responsible for a much higher proportion of inflation. Fossil fuels alone (transport fuels, primary gasoline and diesel, solid fuels (coal) and gas) accounted for approximately 19% of overall year-on-year inflation in May and July 2022, 22% in June and 17% in August and September (see Figure 6).

Electricity prices have had a moderate effect on CPI inflation. After the jump in January 2022, caused by a significant rise in domestic tariffs, the contribution of electricity prices to the overall rate of inflation remained stable and close to its share in the inflationary basket: around 2-3% since March 2022, down from 4.5% in January. This decrease is due to generous state subsidies which reduced electricity bills.

Figure 6 Contribution of electricity, gas, solid fuels and transport fuel prices to consumer price inflation in Türkiye, percentage points, annual rate of change in each month



Source: CE analysis of Eurostat dataset: PRC_HICP_MANR

Poor households spend a higher share of their incomes on energy

Poorer households spend less on energy (and everything else) than wealthier ones, but they spend a larger proportion of their incomes on energy bills, as can be seen in Figure 7. Only three datapoints on household expenditure on energy are available for Türkiye (2005, 2010, 2015). Between 2005 and 2015, household expenditure on energy (as a share of total expenditure) has fallen in all income groups.

Household spending on energy has risen sharply over the last year. We estimate that over the past year, household energy expenditure has doubled in nominal terms, and is now four times higher than in 2015 for the poorest households. In 2015, poorer households (the bottom 20% by income) spent 8.1% on household energy, which is predominantly electricity, gas and solid fuels (mainly coal). Since then, Eurostat data shows that retail energy prices increased by 88% between 2015 and 2020, and by 144% between mid-2020 and mid-2022.

Fossil fuels drove energy price inflation in Türkiye over the last year, outpacing Türkiye's already high rate of overall consumer price inflation.

The price changes for key energy sources have to be seen in the context of high overall inflation in Türkiye. The consumer price index rose by nearly 94% between 2015 and 2020, and by almost 115% in the last two years, but energy prices increased even more than the CPI overall. The recent hike in retail energy prices is largely driven by fossil fuel prices. The price of gas and solid fuels (mainly coal), more than doubled from August 2021 to August 2022 (increases of 114.2% and 156.6%, respectively). The primary energy source for heating in residential buildings is natural gas, the share of which has been growing sharply since 2000, displacing mainly biomass (wood) and oil, and to a lesser extent also coal (IEA, 2021). Moreover, prices for 'fuels and lubricants for personal transport equipment' (predominantly diesel and petrol) have increased by 187.5%, and are now almost three times as high as a year ago.

Poorer households are more severely affected by soaring energy prices than high income households. For poorer households (the bottom 20% by income), energy costs as a proportion of overall household expenditure remained relatively high (over 8%) in all reported years. Based on energy price inflation and real disposable income growth in Türkiye, we estimate that the share of energy costs in total expenditure stood at 7.6% in 2021, and rose to 9.3% in 2022 for poorer households. This is roughly equivalent to an extra 820 TRY in energy bills in 2022, compared to 2021 for poorer households.² This means that the poorest households now spend c. 95% more on energy in nominal terms than in 2021, and 116% more than richer households (the top 20% by income) relative to their overall living cost. We estimate that an average household is approximately 1,550 TRY worse off per year in 2022 compared to 2021 as a result of higher retail energy prices alone (in current values). These estimates are shown in Figure 7.

Figure 7 Household disposable income by quintile and expenditure on household energy as a share of total disposable income



Sources: Eurostat dataset: PRC_HICP_MANR, HBS_STR_T223

Turkish Statistical Institute: Distribution of annual equivalised household disposable income by quintiles ordered by equivalised household disposable income, 2014-2021

Note: Figures for 2022 are CE's own calculations, based on estimated real wage growth in line with the historical trend.

All years: the share of household energy (CP045) is CE's own estimate, based on energy price inflation and household budget survey (hbs) in 2015.

Due to the high levels of inflation in Turkey, extrapolated figures for 2022 are uncertain and need to be interpreted with caution.

² We do not convert estimates to USD, given the highly volatile Turkish lira and the fact that the Turkish economy has experienced high levels of inflation, as well as high rates of income and expenditure growth in recent years, which make the accurate conversion of annualised expenditure estimates difficult. We project disposable income to 2022 assuming a real growth rate equal to the average annual real household income growth between 2014-2021, and then adjusting the 2022 figure for CPI inflation. The last available data for household energy expenditure from 2015 (Eurostat: HBS_STR_T223) is extrapolated to 2022, using Eurostat CPI data for household energy items. We then calculate the expenditure share in each year.

Türkiye's recent monetary policy has been controversial

Türkiye has taken controversial measures to address high levels of inflation. The conventional strategy to curb high inflation rates is to increase interest rates. However, in the current crisis, the Turkish National Bank has decided to cut interest rates several times since the end of 2021, most recently at the end of September 2022, resulting in a total cut of 5 percentage points in a single year (CNBC, 2022). Turkish CPI inflation reached a 24-year high this August, and the Turkish lira collapsed, dropping by over 50% against the US dollar in the twelve months to August 2022. The main purpose of lowering interest rates is to boost the economy, especially exports and investment (Reuters, 2022b). As a result, Turkish GDP is estimated to have grown by 7.6% in the second quarter of 2022, compared to the second quarter of 2021 (TCMB, 2022b).

The Turkish government has introduced several measures to protect households from the soaring energy prices, and is planning to expand these in 2023, during which parliamentary and presidential elections will be held. In December 2021, the minimum wage was raised by 50% (BBC News, 2021). In early 2022, natural gas and electricity subsidies were announced to help households and businesses with soaring energy costs. Bills jumped again on 1st of January as new tariffs took effect (AP News, 2022). The cost of these subsidies is estimated to reach 300 billion liras (\$16bn) in 2022, equivalent to roughly 2% of GDP, and the size of subsidies is planned to double in 2023 as part of the next budget. The subsidies would result in an 80% reduction in gas prices and a 50% reduction in electricity prices faced by households (Bloomberg, 2022).

Continuing the expansion of renewables could increase Türkiye's energy independence further

Türkiye has made good progress in deploying renewable energy sources and has recently announced a net zero target for 2053, which signals the general direction of travel. However, the policy pathway to achieving this still needs to be worked out and interim targets need to be developed. For now, the country remains reliant on energy imports and is vulnerable to fossil fuel price shocks. Recently, the impact of global fossil fuel price hikes was amplified by the depreciating Turkish lira, and despite large-scale government subsidies, Turkish households are estimated to be significantly worse off this year compared to 2021 as a result of rising energy bills.

Going forward, Türkiye could further increase its energy independence by continuing to ramp up renewable energy capacity and capitalise on its substantial renewables capacity. If coupled with increasing electrification of household heating and cooling, as well as personal transport, such a strategy would also directly reduce the exposure of Turkish households to globally traded and volatile fossil fuels.

Conclusions

Fossil fuel dependence and price hikes are key drivers of the current cost of living pressures in Türkiye and are making an outsized contribution to recent spikes in inflation. These pressures are present across Europe and in many developed countries, 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 or coal prices often affect wholesale electricity prices. This means that rising fossil fuel prices also push up electricity prices, especially during demand peaks. Energy cost subsidies to householders and businesses are then used by Türkiye's government alter prices to householders, businesses and investors.

Despite these confounding factors, there are clear signs that decarbonising energy systems can 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. Higher share of renewable energy sources can significantly reduce Türkiye's dependence on energy imports which would be particularly beneficial during times of currency depreciation and volatility.

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