

Fossil fuel prices and inflation in Japan



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Key findings

- **The price of energy from fossil fuels is responsible for a large share of recent consumer price inflation in Japan. Since May 2022, fossil fuels alone (transport fuels, gas and kerosene) accounted for between 16 and 24% of Japan's annual inflation rate, while electricity contributed 25%.** This is even though fuels and electricity only account for around 7% of the overall basket of goods and services included in the Japanese consumer price index. Between September 2021 and August 2022, prices for electricity, gas and kerosene (which is widely used in residential heating) went up by 22%, 20% and 18%, whilst consumer prices overall increased by 3.0%.
- **We estimate that the increase in energy prices (household and transportation) has made an average low income Japanese household nearly 40,000 yen (around \$270) worse off in 2022 compared to 2021.** For all households, spending on energy as a share of living expenditure has risen sharply. We estimate that Japan's poorest households now spend around 18% more on energy than in 2021.
- **The Japanese government has intervened heavily in wholesale petrol, diesel and kerosene markets to lower retail energy prices and has recently proposed a large-scale subsidy package to shield households and businesses from soaring electricity and gas prices.** Measures include subsidies to oil refineries introduced in January 2022, while in October, a 25 trillion yen package (around 4% of Japan's GDP) to lower electricity and gas bills was announced.
- **Renewables are now much cheaper than fossil fuel-based electricity production, and the cost of renewables is forecast to fall further.** The lifetime cost of new wind and solar PV projects in Japan is lower than ever but has remained among the highest globally. However, the cost of gas-fired plants is almost double of the lifetime cost of a new onshore wind farm and more than double that of a new utility-scale solar PV plant, according to recent IRENA estimates. Japan also pays more to import LNG and coal compared to peer economies. Despite these factors, Japan's electricity sector remains heavily dependent on gas (LNG), oil and coal-fired power generation, which has recently led to unprecedented wholesale electricity price hikes.
- **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 to diversify Japan's power mix and reduce dependence on imported fossil fuels is particularly important. This, together with increased electrification of transport, industry, and heating, can 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 Japan's energy system envisage current oil- and gas-fired peak load capacity being replaced with battery storage, green hydrogen, and pumped hydro. This could help decouple wholesale electricity markets from global fossil fuel prices.

Energy prices and inflation in Japan

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

Japan is dependent on fossil fuel imports

Japan is heavily reliant on energy imports, which account for 99% of its oil, natural gas and coal consumption. Following the 2011 earthquake and tsunami, and the resulting Fukushima nuclear disaster, nuclear energy production in Japan fell to zero by 2014. As a result, energy imports increased and in 2014, Japan imported 94% of energy supply. This has left the country highly exposed to volatile global energy prices. The recent gradual reintroduction of nuclear energy, expansion of renewable energy, and energy efficiency gains have reduced dependency on fossil fuel imports. However, in 2019, imports still accounted for 88% of Japan's energy supply (IEA, 2021). Over 99% of Japan's natural gas (in the form of liquefied natural gas, LNG), oil and coal is imported (US EIA, 2020; US EIA, 2019). Although Japan has successfully diversified the sources of its LNG imports, oil imports remain heavily concentrated in a small number of Middle Eastern suppliers (IEA, 2021). Coal imports are mainly from Australia, Indonesia and also Russia (until 2022) (US EIA, 2019). Japan also faces significantly higher coal import prices than other significant coal importers in Asia, such as South Korea and India (METI, 2022b).

Prior to 2011, nuclear energy made up between 25% and 30% of electricity production in Japan (Nuclear World Association, 2022), but that fell to zero after the Fukushima disaster. In the aftermath of the disaster, the Japanese government introduced reforms to liberalise the electricity market and increase the share of renewables (Reuters, 2021). After a decade with very limited nuclear energy production, the government now plans to redeploy more nuclear reactors to boost nuclear's proportion of total primary energy supply to 11% (TPES) by 2030. However, this will require a concerted effort by the industry to reach safety standards and regain social acceptance. To achieve this, the number of active reactors across Japan must increase from 9 to 30 (IEA, 2021).

In early 2021, Japan's electricity grid came under significant pressure as cold weather led to LNG shortages and the highest wholesale electricity prices ever recorded anywhere in the world at the time, hitting the equivalent of \$2,390 per MWh, which caused serious financial problems for many of the small new electricity providers that had entered the market following liberalisation in 2016 (Reuters, 2021).

Japan is aiming to be net-zero by 2050

Japan plans to diversify its renewable energy portfolio. Japan's latest Strategic Energy Plan (the 6th SEP), passed in 2021, sets out targets to reduce GHG emissions by 46% by 2030 (compared to 2013 levels), and to

reach net zero by 2050. The plan aims to diversify energy sources and increase domestic supplies. Specifically, Japan seeks to develop solar PV, wind, geothermal, hydropower, biomass, hydrogen/ammonia, and nuclear energy. In one scenario, production of renewable energy will double by 2030 (from 2019 levels) to 36-38%, more than the previous target of 22-24% (METI, 2021).

Japan plans to develop a major hydrogen industry and is aiming to commercialise it by 2030 (IEA, 2021). The government hopes that widespread adoption of the technology will reduce the cost of supply. It plans to have 800,000 fuel cell vehicles and 1,200 fuel cell buses on Japanese roads by 2030 (Grantham Research Institute, 2021). If this is achieved, hydrogen will make up 1% of Japan's energy mix by 2030 (METI, 2021). This will also help address Japan's structural issues when it comes to decarbonisation: oil currently accounts for 97% of energy use in transportation. Electricity accounts for just 2% of total transport-related energy demand, most of which comes from Japan's large rail network, and the small but growing fleet of electric vehicles (IEA, 2021).

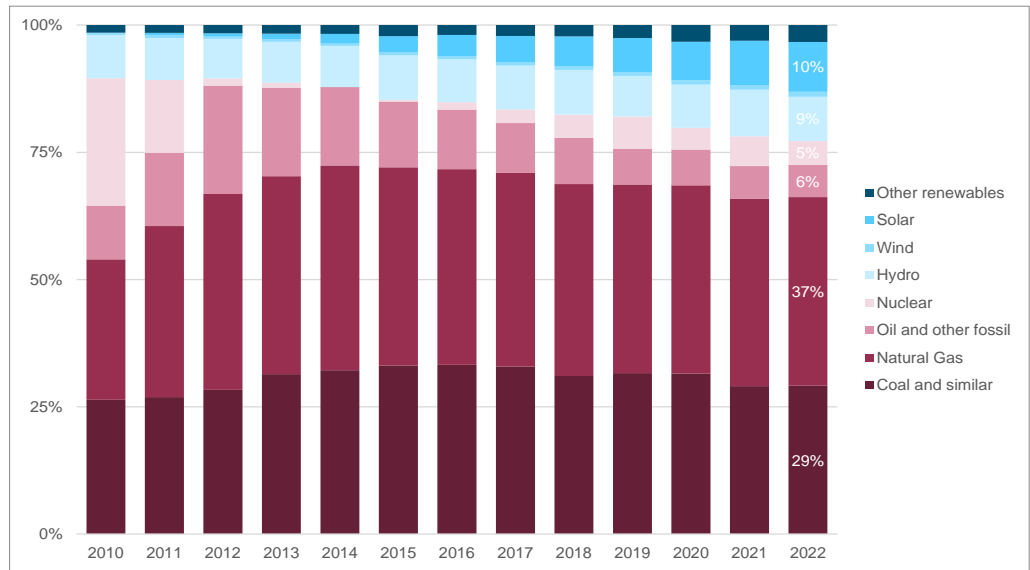
A coal-fired power plants phase out date is uncertain. Japan has promised to shut down all inefficient coal-fired power plants, which would mean shutting down about 100 of the 140 currently in operation, (Reuters, 2020), however, there is currently no plan in place to implement this. Despite Tokyo's target to reach net zero by 2050, and the comparatively high coal import prices, new coal power plants are currently under construction or planned, casting doubt over the achievability of Japan's emission reductions target (Energy Tracker Asia, 2022). The Japanese government sees coal as a transitional energy source (METI, 2022a), but has been criticised for supporting investment in ammonia-coal co-firing R&D (Bloomberg NEF, 2022), and more generally for substantial investments in oil, gas and coal projects (on average \$10bn per year between 2019 and 2021) (Climate Network, 2022).

Japan intends to expand offshore wind capacities in order to meet net-zero targets by 2050. Large scale offshore wind projects are expected to be delivered by 2030 and 2040, with 10 and 30-45 GW installed capacities announced in the Offshore Wind Industry Vision (Power Technology, 2020).

Japan's electricity production is still driven by fossil fuels

There has been a slow but consistent increase in renewable energy in Japan's electricity generation mix, but it remains heavily reliant on fossil fuels. Japan's power generation comes from a broad mix of sources but is strongly dominated by fossil fuels (around 75%) (Figure 1). Solar energy accounted for 10% of electricity generation in the first six months of 2022, up from close to zero in 2010-11 (Figure 1). However, there has been no progress in launching large-scale wind power projects which means that renewable capacities are somewhat dominated by solar. The total share of renewables currently stands at around 20-23%, less than in other advanced economies such as Germany and Spain. As a result, coal and natural gas remain Japan's key sources for electricity generation (with a share of 29 and 37% in 2022, respectively).

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



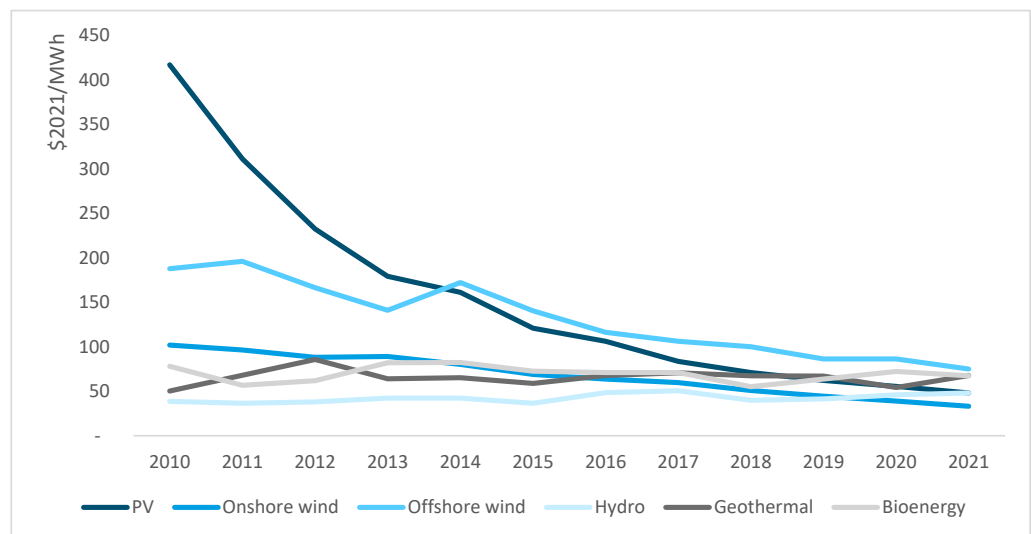
Source: IEA (MES_0522)

Unlike in other advanced economies, oil-fired power plants still play an important part in Japan’s electricity mix, especially in the immediate aftermath of the Fukushima disaster. In 2012, their share jumped to 21%, up from 11% in 2010, to substitute for the reduction in nuclear power generation. Since then, oil for electricity production has decreased, but remains above the level seen in many other developed countries (Figure 1).

The cost of renewables has consistently gone down

The global average lifetime cost per MWh of renewables is now far below that of fossil fuel-based power generation. The levelized cost of electricity (LCOE) of renewable energy technologies has been decreasing globally, as shown in Figure 2. The largest drop has been observed in the lifetime cost of solar photovoltaic power generation, which has fallen 88%, from \$417 to \$48 per MWh (2021 prices). The costs of offshore and onshore wind projects have also reduced, by 60% and 68%, respectively. At the same time, the LCOE of fossil-fuel based electricity generation has remained largely unchanged until late 2021 (IRENA, 2022).

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



Source: IRENA, 2022

Note: Global weighted average of commissioned projects

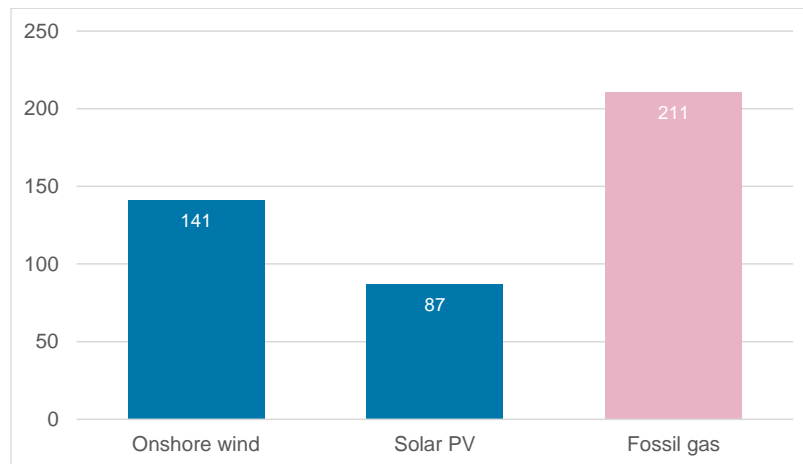
Renewables are far cheaper than natural-gas based power generation.

Installing new renewable capacity remains highly competitive compared to fossil-fuel based alternatives. The fuel-only costs of gas-fired power generation in Japan is estimated at \$210 per MWh as of 2022, roughly 50% higher than the lifetime cost per MWh of new onshore wind, and more than two times as expensive as new solar PV capacity (Figure 3).

However, commissioning new renewable projects in Japan is more expensive than in most other countries. New onshore wind projects commissioned in Japan in 2021 had an average lifetime cost per MWh of \$141 and new utility scale solar PV had a lifetime cost of \$86 per MWh. As of 2021, these costs are the highest and second highest among the major economies for which figures are reported by IRENA, and significantly higher than the global weighted average of \$33 and \$48 per MWh for wind and solar PV.

Japan has seen radically decreasing LCOE costs of electricity from solar PV (which reduced by 80% between 2011 and 2021). Yet unlike in other geographies, the LCOE of Japanese wind energy has not fallen as rapidly. The lifetime cost per MWh of onshore wind power production decreased by 17% between 2010 and 2021 (from \$170 to \$140 per MWh), while the cost of offshore wind power generation has barely changed over the same time period (standing at \$196 per MWh in 2021, slightly up from \$187 per MWh in 2010) (IRENA, 2022).

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



Source: IRENA, 2022

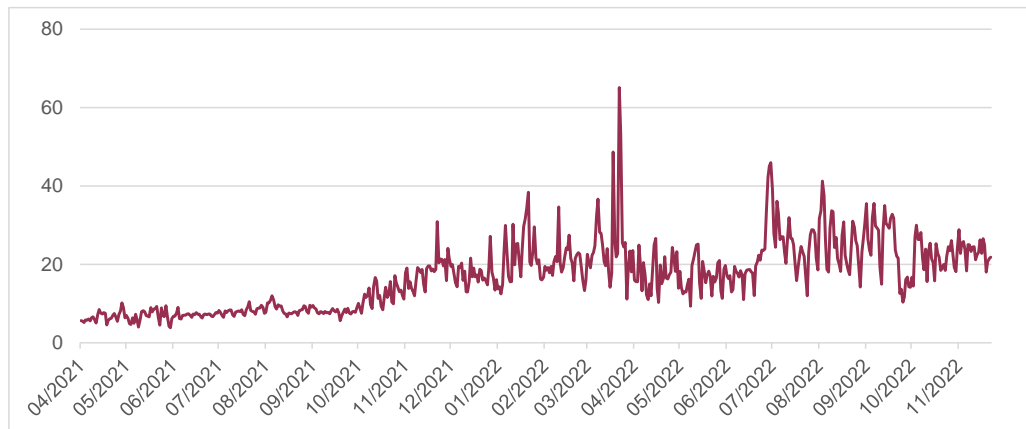
Wholesale electricity prices have risen sharply over the past year

Japanese wholesale electricity prices have risen sharply since autumn 2021, and are on average 64% higher in the current financial year compared to 2021/22 . Data from the Japanese Electric Power Exchange (JEPX) shows that daily prices in the spot market started to rise in the autumn of 2021, reflecting increases in global coal, oil and gas prices, including LNG. Gas-fired power generation accounted for over 35% of Japan’s electricity mix in 2021. Oil and coal-fired power plants accounted for another 35% of Japan’s electricity mix in 2021 and the first half of 2022. Increases in the global prices for these fossil fuels therefore push up wholesale electricity, as the fuel cost of electricity generation increases. As a result, average daily prices peaked at

65,000 JPY per MWh (c.\$460) in March 2022, and after stabilising at around 18,000 JPY per MWh (c.\$127) in the period between April and June, prices rose again in July and August (Figure 4).

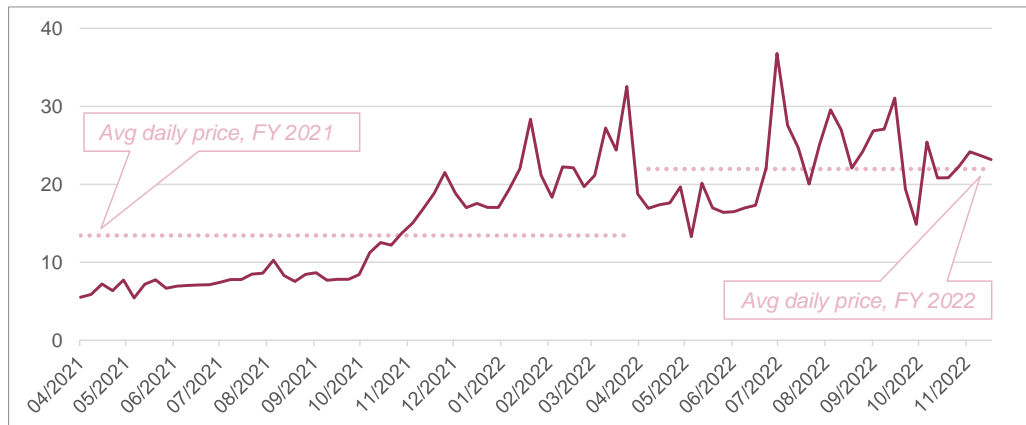
Between 1st August 2022 and 15 November 2022 (latest available data), the average daily spot price was 24,000 JPY per MWh (c.\$170), 128% higher than in the same period in 2021 (10,500 JPY per MWh, or c.\$74). The average spot price of electricity over the whole fiscal year 2021/22 (starting in April 2021) was 13,400 JPY per MWh (\$95), but the average of the current fiscal year stands at 22,000 JPY per MWh (\$155) as of 21 November – that’s around 64% higher (Figure 5).

Figure 4 Daily average wholesale JPEX power price in JPY per kWh, spot market 'system prices' (weighted by transaction volume)



Source: JEPX Trading information data archive (2022)

Figure 5 Weekly average of daily average wholesale JPEX power price in JPY per kWh, spot market 'system prices' (weighted by transaction volume)

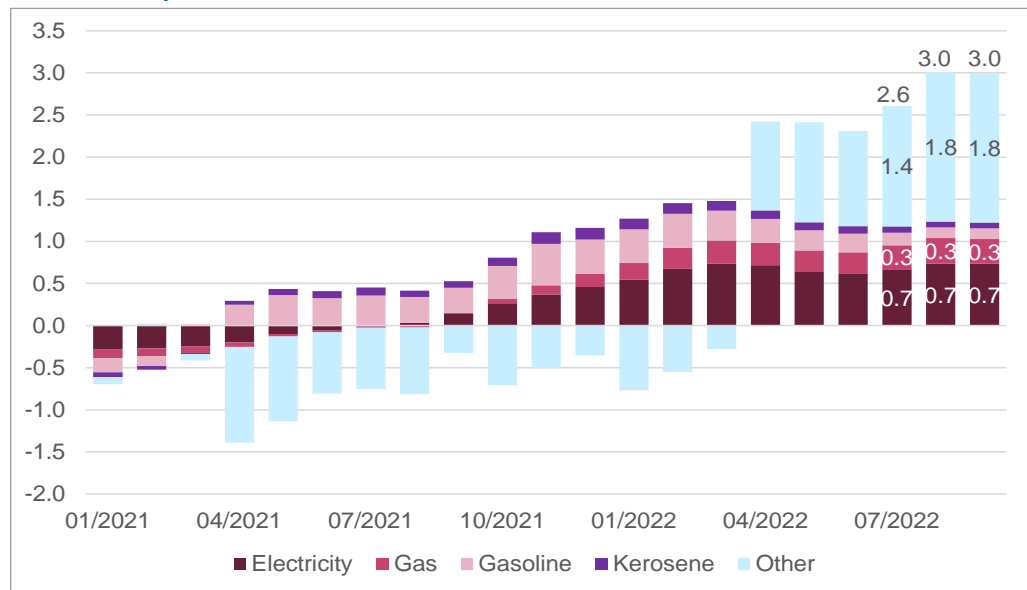


Source: JEPX Trading information data archive (2022)

Energy prices are key drivers of recent consumer price inflation in Japan

Rising energy prices have started to hit households, and energy prices are key drivers of current consumer price inflation in Japan. Retail energy and transport fuel prices are a component of the Japanese consumer price index (CPI), accounting for around 7% of the overall basket of goods and services included. (Gas and fuels account for around 3.7% and electricity for around 3.4%). Recently, however, their contribution to overall inflation was higher. Fossil fuels alone (petrol, kerosene and gas) accounted for approximately 24% of overall year-on-year inflation in May and June 2022, 19% in July, and ca. 16% in August and September 2022 (see Figure 6).

Figure 6 Contribution of electricity, gas, gasoline and kerosene to consumer price inflation in Japan



Source: CE analysis of e-stat (Japan): Consumer Price Index / 2020-Base Consumer Price Index / Monthly Report / Monthly / 2022 September / Table 4-1 / Monthly

It is also important to note that petrol (gasoline) prices significantly exceeded the overall rate of inflation throughout most of 2021, and were a key driving force in the overall CPI. As the result of governmental subsidies for refineries, retail petrol prices fell after January 2022, and now make a smaller contribution to year-on-year inflation.

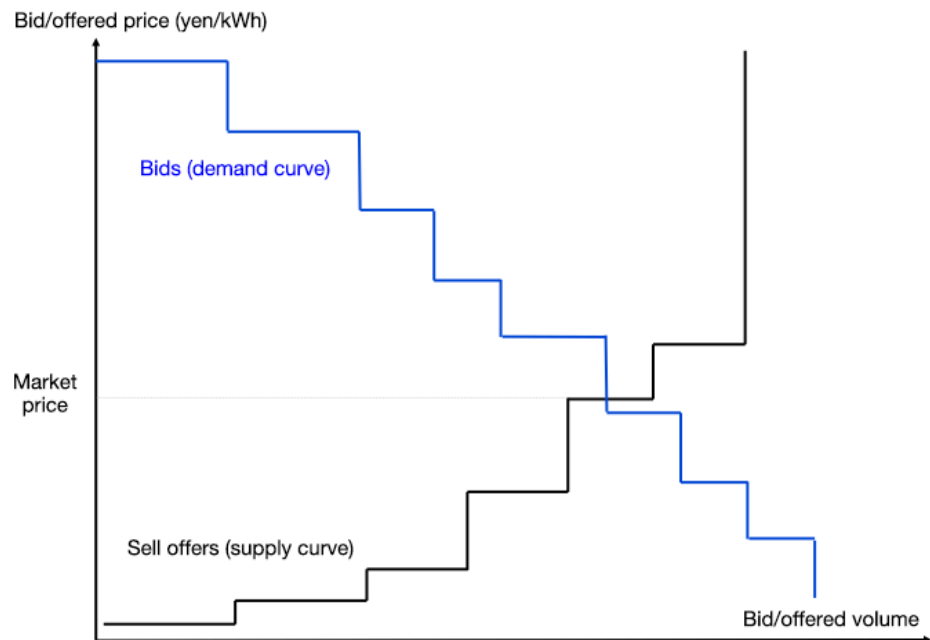
Since late 2021, electricity prices have had a particularly high impact on CPI inflation. Electricity prices started to rise in September 2021, and contributed 0.73 percentage points to Japan’s 3% year-on-year inflation rate this September, as shown in Figure 7. This means that electricity prices alone accounted for roughly 25% of the overall year-on-year change in consumer prices.

Despite rising energy prices and their contribution to overall price increases, the annual rate of inflation is still below 3% and is among the lowest globally. Japan has seen a prolonged period of very low inflation, including deflationary periods, for example, in the first half of 2021 (see Figure 7). The return of overall CPI inflation in 2022 is thought to be due to a combination of a weakening yen against the US dollar, which makes imports more expensive, and higher global energy prices (Foreign Policy, 2022).

Box 1: Wholesale electricity market in Japan

Unlike in most advanced economies, participation in the wholesale electricity market is not obligatory in Japan. The wholesale electricity market was established in 2003, and until 2016, saw only a small fraction of the country’s energy trading. Bilateral transactions were the dominant form of trading. Since 2016, the liquidity of the trade platform (JEPX) has increased, reaching 30% of all retail sales, up from 2% in April 2016 (IEA, 2021).

The largest share at JEPX are the spot market transactions for next-day delivery, and this is broadly similar to European wholesale markets. The pricing method is based on a blind single-price auction system. Single-price auction means that all the buyers (and sellers) send their quotas, as a quantity they would buy (or sell) for a given price, which are sorted in ascending (sell bids) and descending (buy bids) order. These bids define the demand and supply curves. The (single) market price, which determines the quantity, is the intersection of the demand and supply curves. The auction is ‘blind’ as buyers and sellers only know their quotes and the clearing price. This system incentivises electricity producers to improve their efficiency and bring costs down (IEA, 2021; Ito, 2021), whilst also creating transparency. The market equilibrium, as well as bid and offer curves are illustrated in the figure below.



Source: Ito, 2021

Petrol and kerosene prices were more volatile than gas and electricity

Historically, petrol and household kerosene prices have been far more volatile than gas and electricity prices in Japan. Table 1 analyses the price volatility and average monthly change in prices in more detail. In general, the price volatility of all energy sources exceeded that of overall inflation rate by at least a factor of two. Petrol and kerosene prices (the latter still widely used in residential heating in rural areas) were particularly volatile, with standard deviations much higher than those of gas and electricity prices over time as shown in Table 1.

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

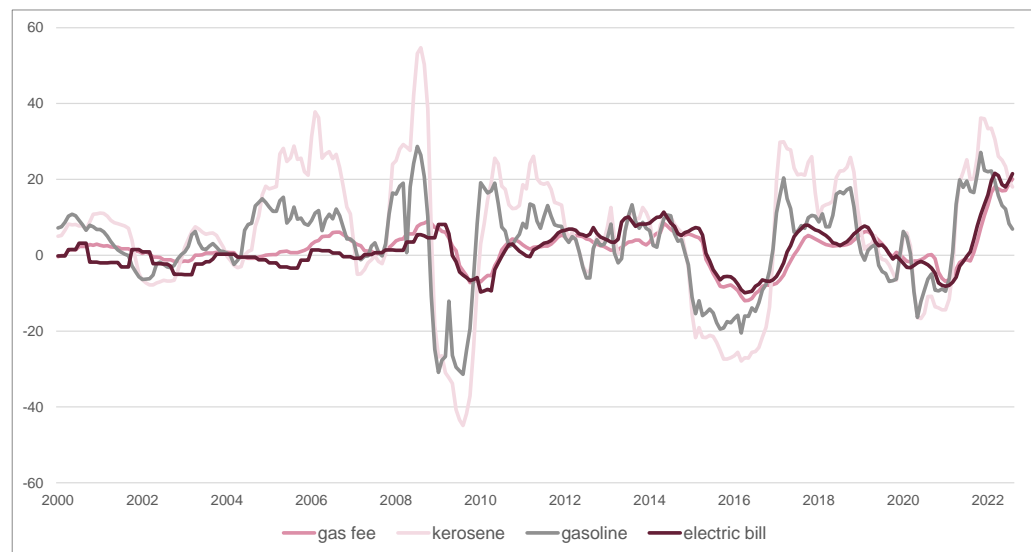
	1995-2021:M8		2021:M9-2022:M8	
	Standard deviation	Average monthly price change (%)	Standard deviation	Average monthly price change (%)
Electricity	0.98	0.03	0.82	1.52
Gas	0.65	0.08	0.93	1.39
Petrol (gasoline)	2.96	0.13	1.91	0.54
Kerosene	3.08	0.29	2.31	1.34
All items	0.32	0.01	0.22	0.23

Source: e-stat (Japan): Consumer Price Index / 2020-Base Consumer Price Index / Monthly Report / Monthly / 2022 August / Table 4-1 / Monthly

Fuel and electricity prices both have risen sharply in recent history

In the last year, energy prices accelerated in Japan, but the changes were moderate compared to other advanced economies. Between 1995 and 2021, the average monthly change in retail electricity and gas prices was only slightly above the average monthly change in the overall consumer prices, which was close to zero. Even though kerosene and petrol prices rose more rapidly, their increase is not high in comparison to the increases in other countries.

Figure 7 Annual rate of change in electricity, gas, kerosene and gasoline retail prices, monthly data



Source: e-stat (Japan): Consumer Price Index / 2020-Base Consumer Price Index / Monthly Report / Monthly / 2022 August / Table 4-1 / Monthly

However, since last autumn, energy prices have risen rapidly. Figure 10 shows Japanese retail electricity and gas prices have strongly correlated in the last few years. This is due to the wholesale electricity pricing method (see Box 1) where gas-fired plants typically provide the marginal units of electricity and set wholesale prices.

The current energy price hikes are strongly connected to global developments. Since last October, electricity and gas prices have risen at a pace have not seen since the oil crisis at the end of the 1970s (see Figure 7 and Figure 10 in the appendix): electricity and gas were up 22% and 20%, respectively. Kerosene and petrol prices have historically been more volatile than gas and electricity prices, and their recent increase (18% and 7% over the past twelve months) has also significantly exceeded the overall rate of inflation. The soaring energy prices are driven by an uptick in global demand after the end of Covid-related lockdowns, by the weakening of the yen against the US dollar and energy market turbulences caused by Russia's invasion of Ukraine. Coal import prices reportedly more than doubled in Japan, and LNG import prices are higher in Japan than in other developed economies such as the UK and the US (METI, 2022b; METI, 2022c; IEA, 2022).

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

As of October 2022, Change since:	January 2022 (last 8m)	September 2021 (last 12m)	September 2020 (last 24m)	January 2020 (last 31m)
Electricity	15%	22%	23%	20%
Gas	13%	20%	18%	18%
Kerosene	7%	18%	42%	24%
Petrol (gasoline)	3%	7%	25%	15%
All items (overall inflation)	3%	3%	3%	2%

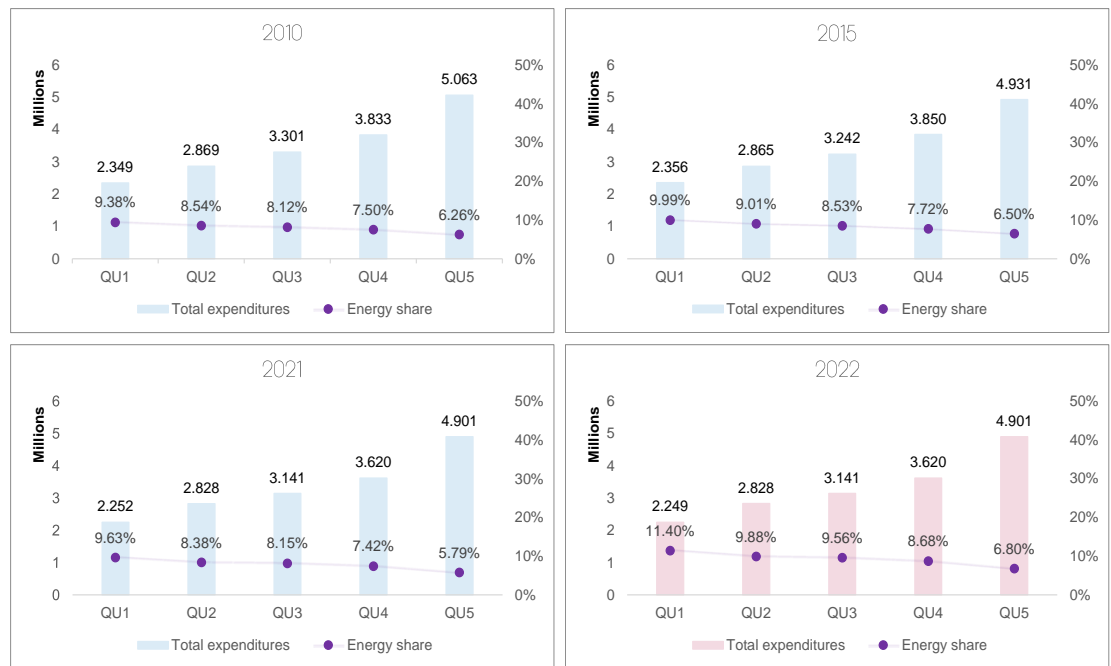
Source: e-stat (Japan): Consumer Price Index / 2020-Base Consumer Price Index / Monthly Report / Monthly / 2022 August / Table 4-1 / Monthly

Poor households spend a higher share of their incomes on energy

Low-income households spend a larger share of their income on energy than richer ones. For most households, expenditure on energy as a share of total household spending remained stable between 2005 and 2021. While poorer households spend less on energy (and everything else) than wealthier ones, the proportion of total living expenditure on energy is higher, as can be seen in Figure 8.

The share of household expenditure on energy is estimated to have risen substantially since 2021. In 2020, the drop in fossil fuel prices did not significantly affect household budgets in Japan, and the share of spending on energy remained virtually unchanged in 2021 across all income groups. Conversely, the current cost-of-living crisis is having a significant impact on household budgets in all income groups. We estimate that household expenditure on energy rose substantially in 2022, as retail gas prices and electricity bills went up by 20% and 21.5% respectively in the twelve months between August 2021 and August 2022. Overall consumer prices only increased by 3.0% in the same period.

Figure 8 Household by quintile and expenditure on household energy and transportation fuels as a share of total expenditures (in current yen)



Sources: e-Stat (Japan): Consumer Price Index / 2020-Base Consumer Price Index / Monthly Report / Monthly / 2022Aug. / Table 4-1 (monthly) and Table 9 (monthly); e-Stat (Japan): Family Income and Expenditure Survey / Income and Expenditure / Two-or-more-person households / Annual Report / Yearly / 2010, 2015, 2021, 2022 / Table 5

Note: Only two-or-more-person households are considered. Based on energy price inflation and on the average growth of expenditures between 2005-2019 (assuming pre-Covid trend)

We estimate the bottom 20% of households by income now spend 11.4% of household expenditure on energy (household energy and transport fuel), 39,700 yen (ca. \$270) more per year compared to 2021. In other words, a household in the bottom 20% by income now spends around 18% more on energy (gas, kerosene, electricity and transport fuels) than in 2021, and over 68% more than the richest households relative to their overall living expenses. Households in the top quintile are estimated to spend around 49,000 yen (around \$335) more per year on energy in 2022, an increase to 6.8% of total household expenditure, up from 5.8% in 2021.

Japan has taken measures to reduce retail energy prices

A subsidy package has been introduced to moderate gasoline and kerosene price increases, and a large-scale proposal is on the table to reduce household electricity and gas bills. Japan’s reliance on fossil fuel imports means that the economy is highly exposed to fluctuations in international energy prices. The yen has fallen 21% against the dollar this year (Financial Times, 2022), prompting the Bank of Japan to make a 5.5 trillion yen (\$33bn) intervention to support the currency (Nikkei Asia, 2022b). The weak yen has exacerbated the issue of rising fuel costs since imports make up such a large part of the primary energy mix. However, the Japanese government is offering 50,000 yen (\$345) in financial support to low-income households (those exempted from paying resident taxes) to help them pay for increasingly expensive electricity, gas and food (Reuters, 2022b).

Due to soaring petrol and kerosene prices, the government also launched a new subsidy package for oil refineries in January 2022, to prevent retail prices from rising too far above the level of 170 yen per litre (S&P Global, 2022; Kyodo News, 2022). The measure is still in place. At the end of October 2022, the government proposed a new plan to shield households from soaring energy prices and inflation not seen in a generation. The proposed package will take effect from January 2023 and is expected to cost between 25 and 29 trillion yen (around \$170-200bn) – roughly equivalent to 4% of Japan's GDP. Among other measures, it aims to reduce household electricity bills by 20%, by setting a subsidy of 7 yen per kWh. Businesses will receive a subsidy of 3.5 yen per kWh. Additionally, city gas bills will be reduced by 30 yen per cubic meter, resulting in a 10% decrease for households (Nikkei Asia, 2022a and 2022c; Enerdata, 2022).

The government also aims to bring back online 17 of the 33 existing nuclear reactors by the summer of 2023. This will reduce the cost of energy both for industry and consumers. However, it is not yet certain if all 17 reactors will come back online, as there are still significant public concern around the safety of nuclear power plants following the Fukushima Nuclear Disaster in 2011 (Financial Times, 2022).

By supporting investment in renewables, Japan could boost energy security and stabilise consumer prices

Considering the historical volatility of global fossil fuel prices and their impact on Japanese households over the past year, the expansion of renewables appears to be the right policy choice. By lowering the share of energy from imported fossil fuels, energy independence would increase, the exposure of domestic consumers to global market prices would also decline and it has the potential to bring down electricity prices in the long run (IRENA, 2022). Therefore, Japan should create a supportive policy environment to incentivize investments in renewable energy, promote energy efficiency and improve the electricity grid to incorporate large-scale renewable energy generation (IEA, 2021). By fostering electrification and green hydrogen-based solutions in the industry and in the transport sector, the high reliance on oil and coal – which are almost entirely imported – could be radically decreased.

Conclusions

Fossil fuels are clearly linked to the increasing cost of living pressures in Japan and are making an outsized contribution to recent spikes in inflation. These pressures are present across developed countries that depend on fossil fuel imports and are exposed to international market prices for oil and natural gas.

The potential of renewable energy to alleviate cost pressures by delivering lower consumer prices for 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 – in Japan, the strong correlation between retail gas and electricity prices is particularly striking, despite a diversified electricity mix. This means that rising fossil fuel prices also push up electricity prices, especially during demand peaks. Significant fossil fuel subsidies to refineries have been in place for months, and large-scale targeted support is being prepared to support households and businesses more directly.

Despite these confounding factors, there are clear signs that decarbonising Japan's energy system 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 increasingly be satisfied by renewable sources alone. Likewise, expanding the use of renewables in household heating – which often use kerosene – and transport reduces consumer exposure to fossil fuel price volatility in international markets.

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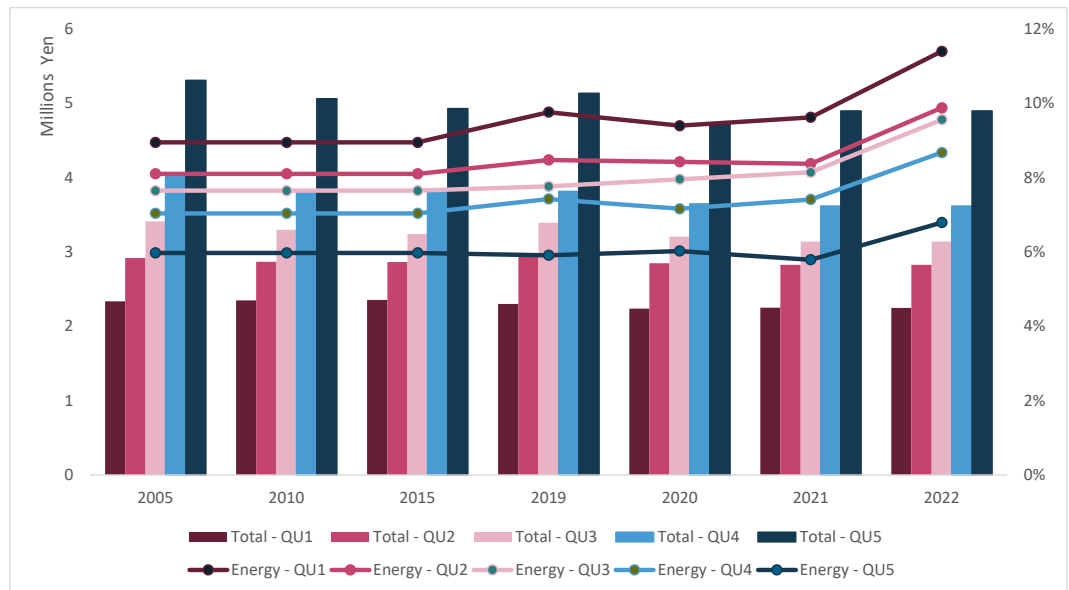
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Appendix

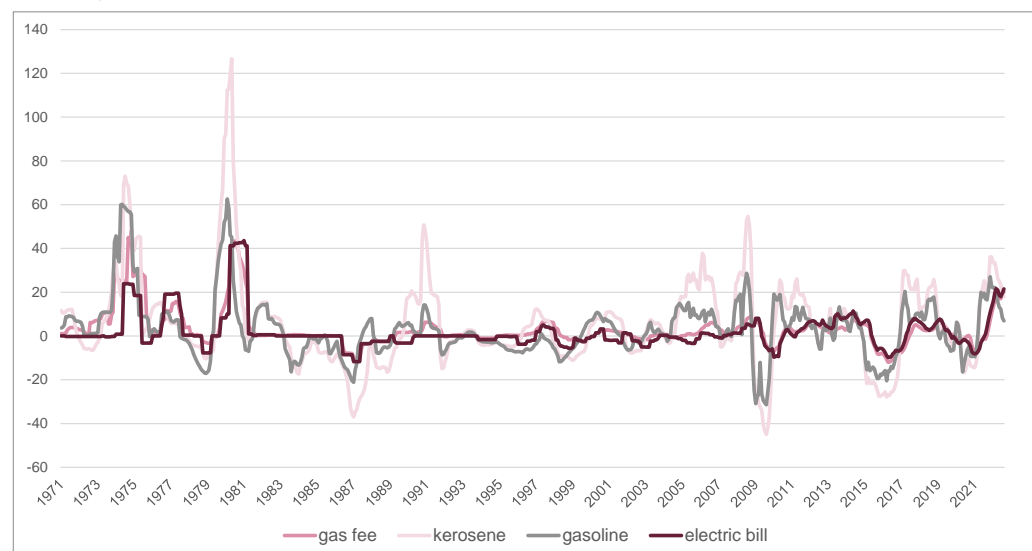
Figure 9 Household by quintile and expenditure on household energy and transportation fuels as a share of total expenditures (in current yen)



Sources: e-Stat (Japan): Consumer Price Index / 2020-Base Consumer Price Index / Monthly Report / Monthly / 2022 Aug. / Table 4-1 (monthly) and Table 9 (monthly); e-Stat (Japan): Family Income and Expenditure Survey / Income and Expenditure / Two-or-more-person households / Annual Report / Yearly / 2005, 2010, 2015, 2019, 2020, 2021, 2022 / Table 5

Note: Only two-or-more-person households are considered.

Figure 10 Annual rate of change in electricity, gas, kerosene and gasoline retail prices, monthly data



Source: e-stat (Japan): Consumer Price Index / 2020-Base Consumer Price Index / Monthly Report / Monthly / 2022 August / Table 4-1 / Monthly