



Fuel Poverty in Glasgow: a snapshot

submitted as part of the
Data Science course at Code Division
2022

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1. Introduction

Back in December 2021 trade body Energy UK warned of rising energy prices that would hurt the economy with domestic bills increasing by 45-50% due to the rise of wholesale price of gas following a very cold winter in 2020/2021, and a windless summer in 2021 that resulted in an inability to generate wind energy [1]. While across Europe measures were taken to minimise the knock-on impact that this would bring to domestic bills, in the UK the Treasury was not intervening.

In the UK, consumers are shielded from sudden rises in energy prices by limiting the amount that energy firms can charge customers. This amount is set by the energy regulator Ofgem and is called the price cap. The price cap is revised and changed every six months, once in April and then in October. Despite the gas price increase, energy firms seem to have been providing gas at a loss due to the cap [1]. This, in turn, resulted in various firms remaining out of pocket and ultimately going bust. Thus, to avoid a collapse of the energy industry, a price cap rise was announced that has affected everyone except those on a fixed deal. The rise did not only affect electricity bills, since about a third of the electricity in the UK is generated by gas, but also the eco tariffs due to them being partly outsourced from the National Grid, some of which is generated from gas [2].

At the time of writing this report the cost of gas and electricity for a typical household has risen almost by 54% bringing energy bills to nearly £2000. Before the cap rise, it was estimated that around 4 million households were experiencing financial difficulties due to increasing energy bills. It is now expected that the number of fuel poor households has gone up to 6.3 million after April's cap rise, equating to 30% of homes struggling to pay for electricity and gas bills. After October's cap rise it is expected that this number would go up again to 8.5 million, with pensioners and people in local authority housing being hit hardest [3]. With food prices rising and higher tax bills too, more households are left to decide whether they eat or keep warm.

1.1 What is fuel poverty?

Fuel poverty or being fuel poor is where a household spends a high proportion of the household income on energy to keep it warm, bringing their residual income below the poverty threshold.

In the UK, fuel poverty is a devolved area and as such is defined, measured and tackled differently in each nation (Figure 1).

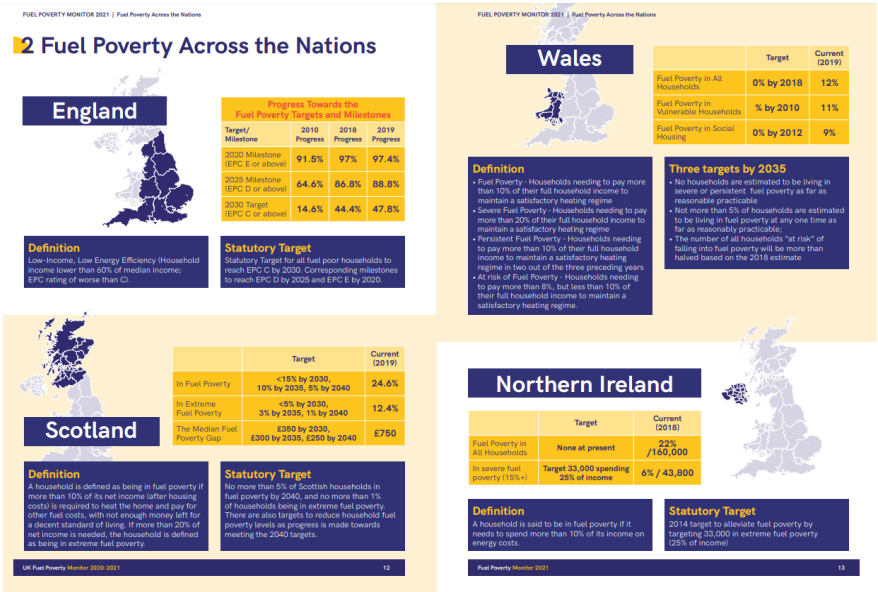


Figure 1: Fuel Poverty Across the Nations (taken from UK Fuel Monitor 2021) [4]

Fuel poverty is affected by three key factors: a household’s income, their fuel costs, and their energy consumption, which in turn can be affected by the energy efficiency of the home [5].

In Scotland, a household is defined as being in fuel poverty when more than 10% of its net income is required to keep their homes heated (i.e. pay for energy bills and other fuel costs) while maintaining an adequate standard of living. If more than 20% of net income is needed, the household is defined as being in extreme fuel poverty [4].

Despite the (Scottish) government’s efforts to eliminate fuel poverty by 2016 over a quarter of households were still living in fuel poverty by then. Hence, fuel poverty needed a new definition and ways of tackling it that takes into consideration people’s income and cost of living rather

than the size of the dwelling only. This resulted in the passing of the Fuel Poverty Act in June 2019 [6].

1.2 Scottish Government Strategy

Since the introduction of the Fuel Poverty Act in 2019, the Scottish Government set out a strategy for tackling fuel poverty. By 2040, the target is to have no household in fuel poverty, however where circumstances are beyond the control of the government, no more than 5% should be in fuel poverty and 1% in extreme fuel poverty.

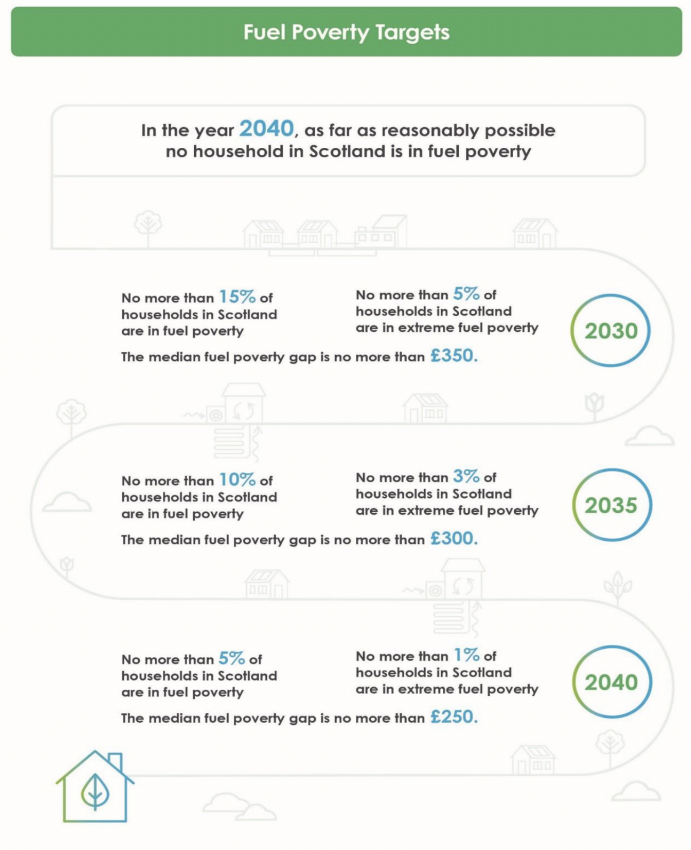


Figure 2: Fuel Poverty Targets (taken from Tackling fuel poverty in Scotland: a strategic approach, published Dec 2021) [7].

This strategy builds on previous schemes to provide help to those in financial need and making improvements to their homes to make them warmer and healthier to live in.

The four drivers of fuel poverty identified by the Scottish Government strategy are:

- poor energy efficiency of the home
- low household income
- high energy prices
- how energy is used in the home

The strategy sets out ways to monitor and inform policies for the Scottish Government through the Scottish Fuel Poverty Advisory Panel which meets regularly with the Scottish Fuel Poverty Partnership Forum, a collection of 26 relevant public and private sector organisations such as Citizens Advice Scotland, NHS Health Scotland and Energy Action Scotland. Energy providers are also part of the partner forum along with other charities such as Age Scotland, Child Poverty Action group and Shelter. A full list can be found [here](#).

Along with this strategy, the Scottish government has published a document for Housing to 2040, setting out the requirements for housing standards to improve living conditions throughout Scotland regardless of the tenure of the property [8].

The Scottish Government wants to improve the energy efficiency of all Scottish homes to the equivalent of an Energy Performance Certificate (EPC) C by 2033. While we still rely on fossil fuels such as gas for home heating, the current climate crisis has highlighted the importance of moving towards net-zero carbon emissions, currently estimated to be up to £6 billion to achieve this [9].

Therefore, despite the huge upfront cost to improve energy efficiency and achieve net-zero carbon emissions, improving living conditions and reducing the impact on the environment would have a beneficial effect on the health of the nation, ultimately relieving strain on the NHS and saving millions of pounds year-on-year.

1.2.1 Energy Efficiency Rating

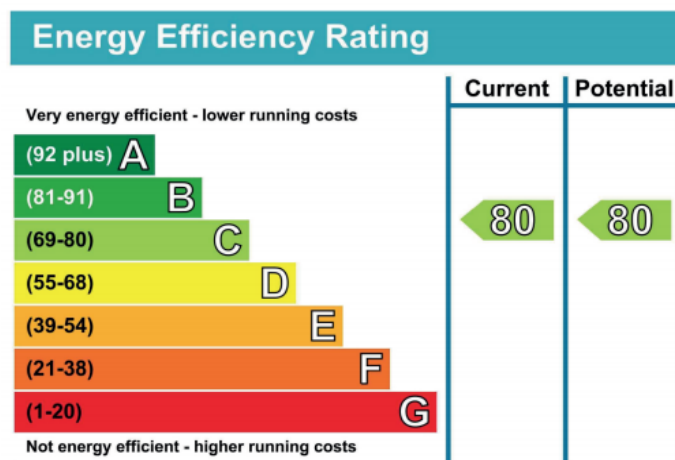


Figure 3. Energy Performance Certificates, or EPCs, are legally required when buying or renting a home and tell you how energy efficient a property is, from A (very efficient) to G (very inefficient). The average energy efficiency rating of most of the UK's housing stock sits in band D – meaning there's generally room for improvement. The certificate gives an indication of how much the home will likely cost to run now, and how much could potentially be saved with some home improvements.

New energy efficiency certificates are recorded when a property is built, sold or rented out. For landlords or owners, there is a large fine (minimum of £500 up to £5,000, calculated as 12.5% of the value of the property) if an assessment is not conducted at these transition times. When the regulations are updated in 2025, the penalty for not having a valid EPC of 'C' or above will be raised to £30,000.

The Energy Efficiency Standard for Social Housing (ESSH) policy aims to improve the energy efficiency of social housing in Scotland [10]. Before the pandemic, North Glasgow Housing Association Limited had planned to do upgrade work on 447 properties to bring them up to initial ESSH levels of energy efficiency, this was in 2018-2019. They actually achieved double that and had improved 1,101 properties [11].

A second milestone was set for the ESSH, aiming for *'all social housing to meet, or can be treated as meeting, EPC Band B (Energy Efficiency rating), or is as energy efficient as practically possible, by the end of December 2032 and within the limits of cost, technology and necessary consent'* [10].

1.3 Fuel Poverty and Health

Poor-quality housing has been previously linked to poor physical health and wellbeing. Links to cardiovascular, respiratory and mental health problems are only a few of the many issues people living in cold homes endure. In Scotland, cold homes account for some of the thousands of Excess Winter Deaths (EWD) annually [\[12\]](#).

Fuel poor households in which their members spend a high proportion of time in the home can be disproportionately affected by this. Older people and other vulnerable groups are particularly affected by fuel poverty and the illnesses that come with it such as diabetic complications, peptic ulcer disease, osteoarthritis and hip fractures to mention just a few [\[13\]](#). According to previous research studies, ill health due to cold homes costs the NHS millions of pounds every year. Thus, the potential for improving health outcomes by improving housing quality has been one of the many recommendations the Scottish government has tried to address over the years [\[14\]](#).

Efforts to engage the health sector by training staff in recognising the signs of fuel poverty in patients and directing them to get appropriate advice and help have been proposed by EAS (Energy Action Scotland) as another way to tackle cold homes and assist households living in fuel poverty in Scotland [\[15\]](#). The Scottish government estimates that the number of fuel poor households counts for about 24.5% of all households in Scotland based on data from 2019 [\[16\]](#). A number that would have increased due to the Covid-19 pandemic.

1.3.1 Fuel Poverty and the COVID-19 Pandemic

In March 2020 consumers were forced to change habits due to the Covid-19 pandemic. Uswitch suggested that the rise in a working from home and homeschooling 'culture' would result in an extra £16 a month on energy per household, a total of £195 a year for those on poor value tariffs. This together with job losses and loss of income due to the furlough scheme strongly suggested that customers may struggle to pay their energy bills [\[17\]](#).

However, an experimental analysis of the impact of the pandemic on fuel poverty showed that a) an increasing unemployment rate to about 13%, and b) the associated loss of income through COVID-19 had the largest impact on fuel poverty rates with an estimated additional 136,000 households in fuel poverty by September 2020. In addition, fuel poverty rates increased due to

increasing use of energy for cooking, lighting, appliances and renewables. While increased space heating only due to staying at home did not [18].

The Covid-19 pandemic may have severely impacted households already in fuel poverty due to the rise in energy bills by the increased energy demand while at home. 61% of Scottish residents claimed to have used more energy in 2020 due to the pandemic, which has resulted in energy bills rising by an average of 15%.

The Energy Saving Trust reported people's concerns about their energy bills post-pandemic, with 70% worried about them going up in the future [19]. As previously mentioned, not being able to pay energy bills may lead to fuel poverty, which will result in a cold home, which in turn may result in poor health. While many factors have contributed to the high number of coronavirus deaths, fuel poverty and housing conditions are likely to have played a key part [20].

1.4 Fuel Poverty in Scotland

As described above, fuel poverty is defined by the Scottish Government as any household spending more than 10% of their net income on energy bills once housing costs have been deducted [21]. In 2019 around 613,000 (24.6%) of all households in Scotland were estimated to be fuel poor, 12.4 % of which were said to be in extreme fuel poverty where 20% or more of their income were spent on fuel [22].

In Scotland, levels of fuel poverty vary with location (Figure 3). The rural highlands and islands in the North of Scotland, where mains gas is lacking, are the worst hit by fuel poverty (31-40%). This is almost three times higher, compared to the lowest area of fuel poverty of 13% in East Renfrewshire. In contrast, Edinburgh shows 21% fuel poverty, while Glasgow City is close to 25%. Off-gas consumers in these parts of the country use electricity, oil or liquid petroleum gas (LPG) for heating their homes at a much higher cost than those in urban, gas mains areas [23].

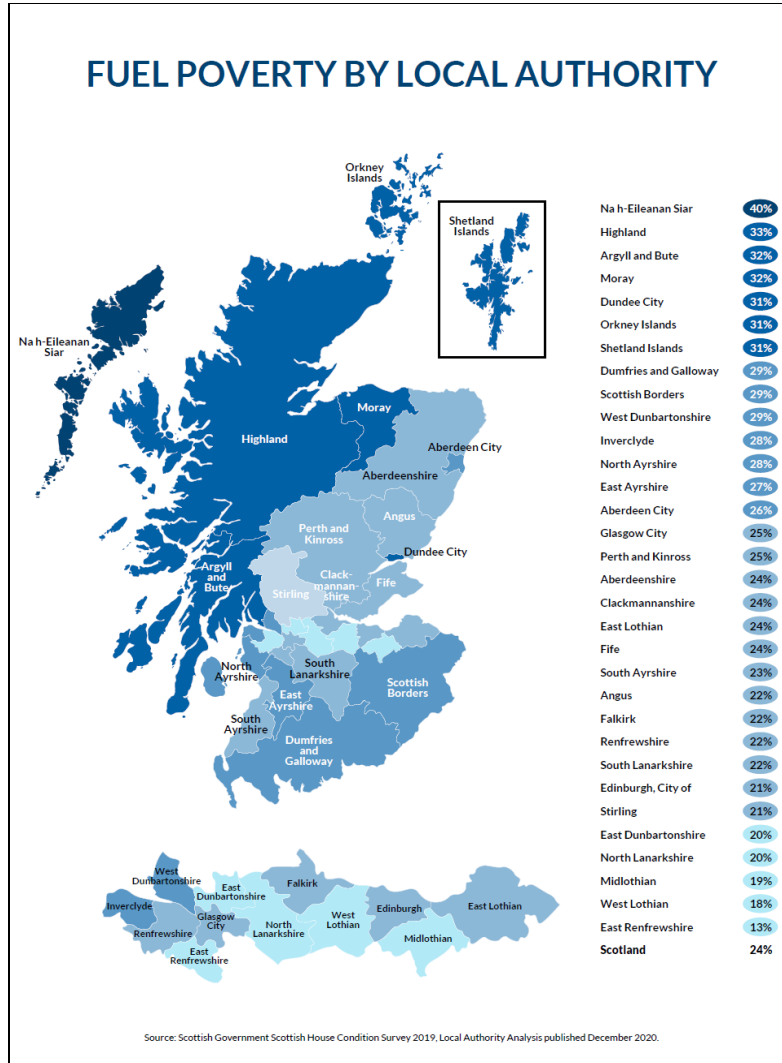
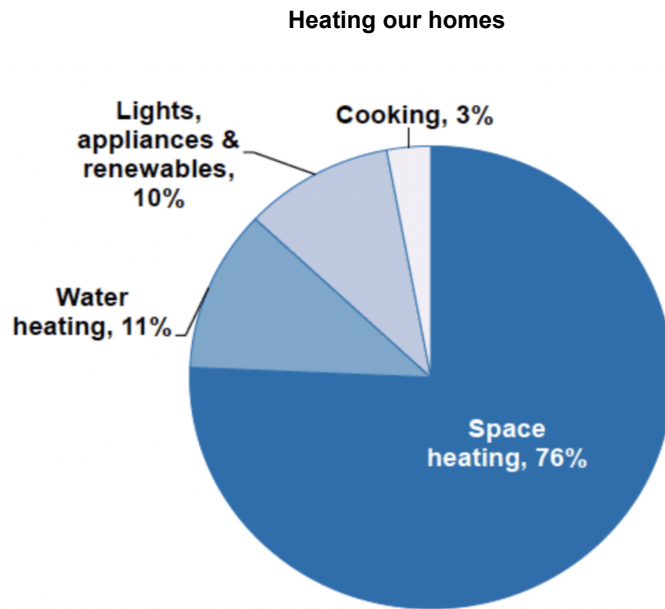


Figure 4: Fuel Poverty in Scotland by Local Authority. Source Scottish Government Scottish House Condition Survey 2019, Local Authority Analysis published in December 2020 [24]

The rise in energy prices will have a great impact on the whole of Scotland, where more and more people will fall into fuel poverty. Speaking to the Scottish Parliament in February 2022 about the impending price cap increase, the Finance Secretary Kate Forbes mentioned that “the additional energy costs alone will (...) result in a total of 874,000 fuel poor households – an increase of 43% on most recent 2019 published statistics – and 593,000 households in extreme fuel poverty” [25].

Modelling done by Energy Action Scotland shows that 57% of people living in the Western Isles are now fuel poor after April’s price cap increase. And the overall percentage for Scotland has risen to 36% [26].



Sample Size: 2,997

Figure 5: Percentage of Mean Household Energy Consumption in Scotland. Most of the energy consumption in Scotland goes into heating a space i.e home (76%). Source Scottish House condition survey 2019 [22].

The Scottish House Condition Survey from 2019 showed that 76% of household energy consumption is used to heat space, i.e. homes (Figure 5). This suggests that if the energy efficiency ratings of homes were low, then most of the energy used to heat them would escape, thus wasting valuable resources and money.

1.4.1 Fuel Poverty in Glasgow

Despite Glasgow being the city with the largest population in Scotland (612,040 inhabitants 2021 [27]) only approximately 25% of the city's households were found to be fuel poor in the period 2017-2019 (Figure 6). This was higher than Scotland (24%) and Edinburgh (21%) but lower than Aberdeen (26%) and Dundee (31%) and did not take into account the impacts of the pandemic or any energy price rises.

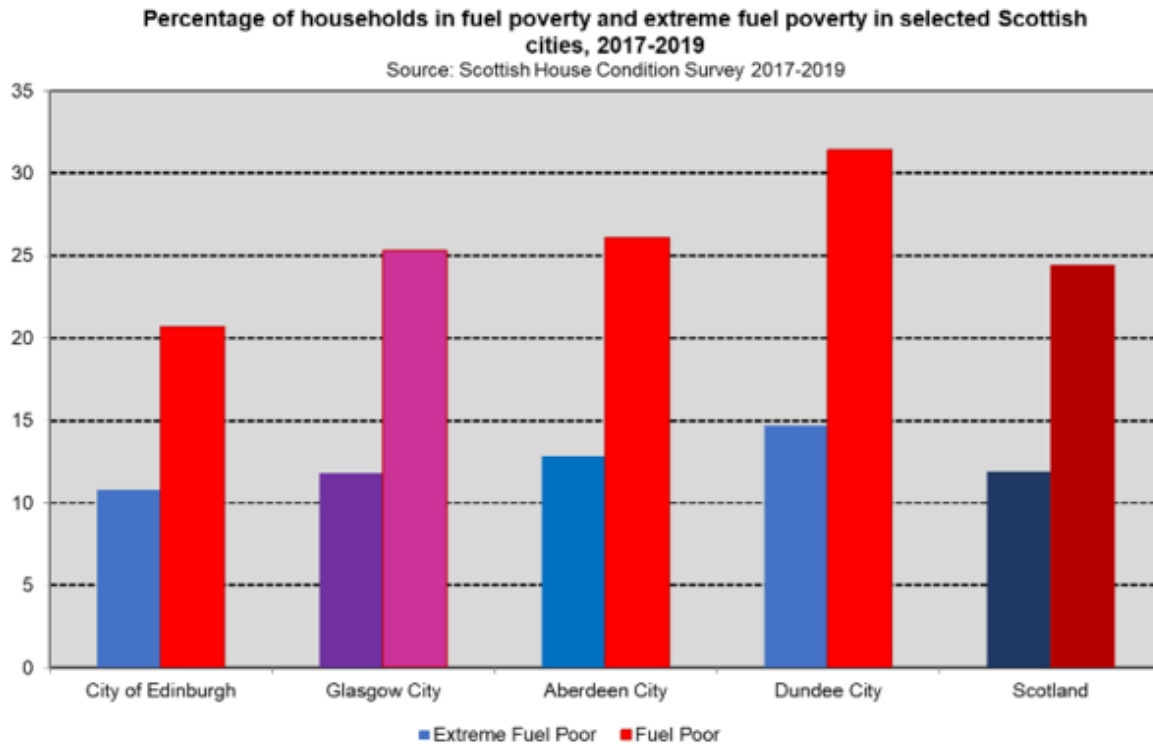


Figure 6: Percentage of households in fuel poverty and extreme fuel poverty for selected Scottish cities. Source [28]

Data on fuel poverty and extreme fuel poverty within Glasgow and Clyde Valley local authorities show that while the highest percentage of fuel poverty in Glasgow appears to be in West Dunbartonshire (29%), with Inverclyde (28%) a close second, the latter had the highest percentage of extreme fuel poverty than all the other local authorities in the area. Trends of fuel poverty and extreme fuel poverty in Glasgow closely follows the trend for Scotland (Figure 7 [29], Figure 8 [30]).

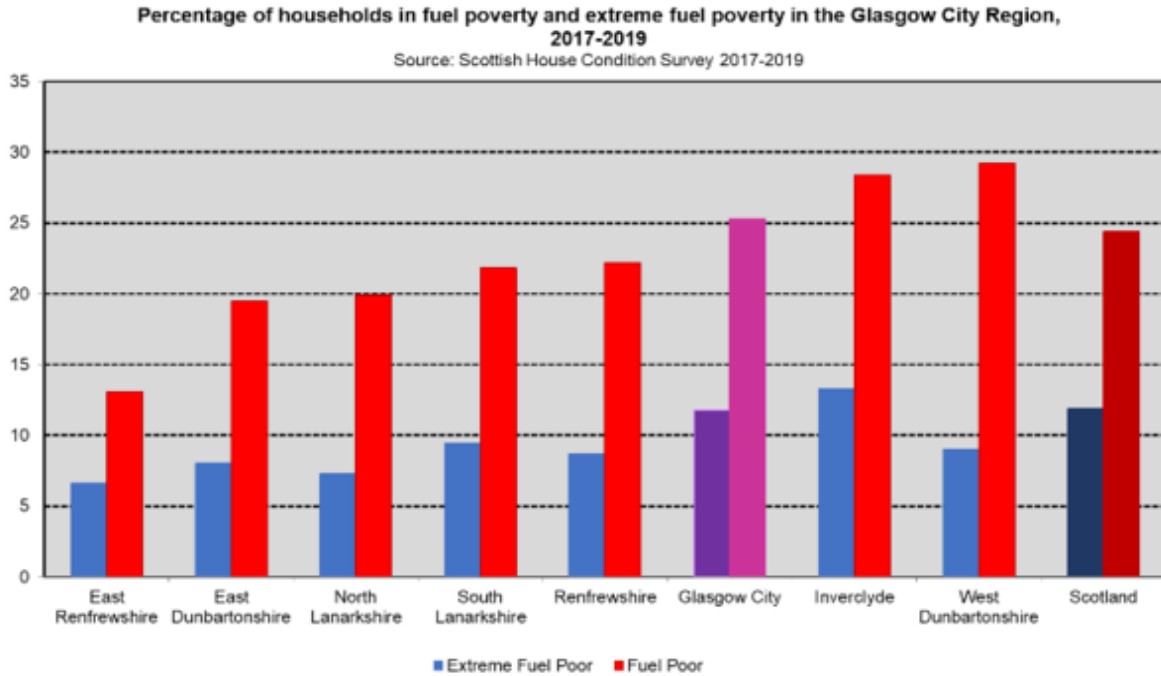


Figure 7: Fuel poverty in Glasgow and Clyde Valley local authorities 2017 - 2019. Source [29]

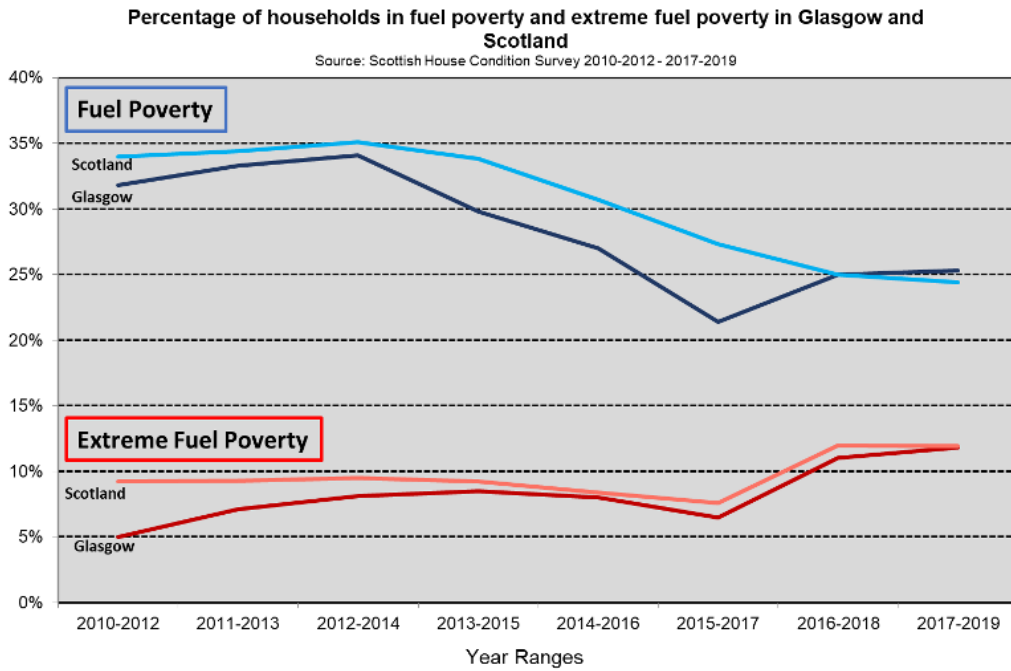


Figure 8: Comparison of fuel poverty in Scotland and Glasgow. Source [30]

1.5. Aim of the report

As part of the Data Science course at Code Division, the aim of this report was initially to explore the factors that influence fuel poverty in Scotland. We were partnered with Clutha Trust, an arts charity based in Glasgow whose interest is 'to advance the arts and culture for public benefit, and to relieve hardship among disadvantaged individuals by running live entertainment events'. Due to the location of the charity's headquarters, the focus of this report was to explore fuel poverty in Glasgow specifically, however this could be expanded to any areas. Although fuel poverty has been extensively looked into before, due to the recent energy price cap rise and its immediate impact on energy bills and cost of living, the report aims to present more recent information on the current status of fuel poverty and its contributing factors.

2. Methodology

2.1 Data sets

Data sets from different sources were chosen for this investigation. The data sets were uploaded into a GitHub repository to which all members of the group had access. This can be found here: <https://github.com/Fuel-Poverty-Project-CD>. A table containing information on data sources and links to storage are attached in the [Appendix](#) of this report.

2.2 Analysis

2.2.1 Tools

Analysis of the different data sets was done using Excel spreadsheets including Pivot Tables and the programming language Python. For analysis and visualisation in Python, the following libraries were used: pandas, plotly.express, plotly.io.

2.2.2 Analysis Process

In order to look at fuel poverty in Scotland, different data sets were used and partly merged where this was necessary. This is explained in more detail in the [Appendix](#). Prescriptive analyses of these data sets were then conducted, whereby the rate of fuel poverty was initially

observed across previous years up to 2021 to then be able to predict the fuel poverty rate in 2022, following the rise of the price cap in October. Graphs were created using different libraries (see 2.2.1) for visualisation.

2.2.3 Statistics

For modelling the relationship between the average energy efficiency and the percentage of income deprived areas across Glasgow, a linear regression was performed.

2.3 Project management

All members of the team had access to all management tools used for the duration of the project. For project management and team collaboration, the Miro application was used (<https://miro.com/app/board/uXjVO-J-XB0=>). For discussions and day to day communications, a specific Slack channel was created called **Fuel Poverty Project**. For collation of resources, a shared Google folder was created called **Data Science Project - Fuel Poverty**. To better manage deadlines, a Gantt chart was created using Excel.

3. Key Findings

In this section, we explain our findings through the analysis of data we collated from various sources. These data sources, links and files can be found in the [Appendix](#).

3.1 Low income earners in the UK are most affected by energy price rises

The Scottish Government defined a household to be in fuel poverty if, after housing costs have been deducted, more than 10% (20% for extreme fuel poverty) of their net income is required to pay for their reasonable fuel needs [\[31\]](#).

With the data collected from different sources (see [Appendix](#) - Weekly average earnings per month for 2000-2022, earnings distribution, Gas and Electricity after April 2022, Electricity up to April 2022) a comparison of average and low net income after housing costs against energy expenditure was conducted.

The fuel poverty situation for those on a lower income, and for whom their weekly energy expenditure maintains them around the fuel poverty line, worsens as shown in figure 8 (orange dotted line). Here, the fuel cap increase of April 2022 has already increased the percentage paid by low net income households up to 14.1%. A second increase in energy prices such as the one expected in October 2022 would increase that percentage up to 18.4% which would result in many more households becoming extremely fuel poor as per the Scottish Government's definition. Figures shown for April 2022 onwards do not include the rising costs for food, rent, council tax, transportation costs and any inflation or world events that could affect prices.

Improving the energy efficiency rating of homes, e.g. by taking them from EPC band E to C, would result in lower energy costs (Figure 9, green dotted line). This could potentially result in the reduction of energy bills for those households by over half, i.e. 56% (see figure 12). However, October 2022's predicted price cap increase would still plunge an estimated 33.9 million people into fuel poverty (Table 1). Of note is that the compulsory standing charges, that energy providers add before the products are even used, will have a knock on effect on fuel poverty and are independent of energy consumption, they have been included in this projection.

These standing charge increases alone will cause many people to struggle to pay their energy bills even if they vastly reduce their energy consumption.

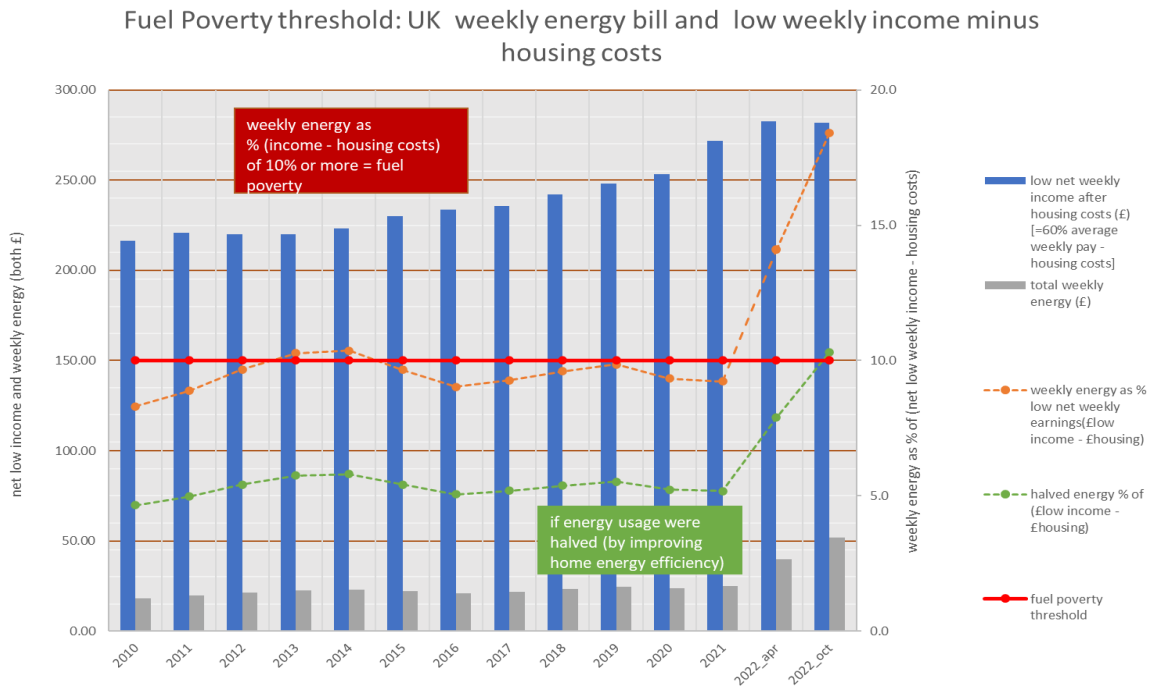


Figure 9: UK weekly energy bills affect low income earners the most. Fuel poverty threshold is defined here as 10% or more of net income after housing costs spent on energy bills (red dotted line). Low income earners will be the most affected group by the increase in energy prices. Those on relatively low income (60% median UK income) are already in fuel poverty following the April 2022 energy cap increase (energy bills are now 14.1% of their income after housing costs). In October 2022, assuming a further energy cap increase of £600, an average energy bill will rise to 18.4% of relatively low income after housing costs. For the purposes of the analysis shown in the chart, it has been assumed that improving energy efficiency would allow the householder to reduce their energy consumption by 50%, all other variables being equal.

However, the actual energy savings may be less than the predicted halving as households may choose to increase the comfortable temperature in their homes due to the reduced costs rather than keeping it switched off. Savings would depend on what temperature they kept in the home before the energy efficiency improvements. [32]

Table 1. Around 23.2 million people in the UK would hit the Scottish Government’s definition of fuel poverty after April 2022’s fuel prices rises.

	% of median income	Energy costs as % income after housing costs	Estimated number of people (million) based on UK income distribution	Comments
Defined as relative low income	60%	14.1%	14.0	
Fuel poverty level income	76%	10.0%	23.2	Even earning 76% of median income will result in fuel poverty at April 22 energy prices
Average income	100% (=median)	7.9%	33.9	

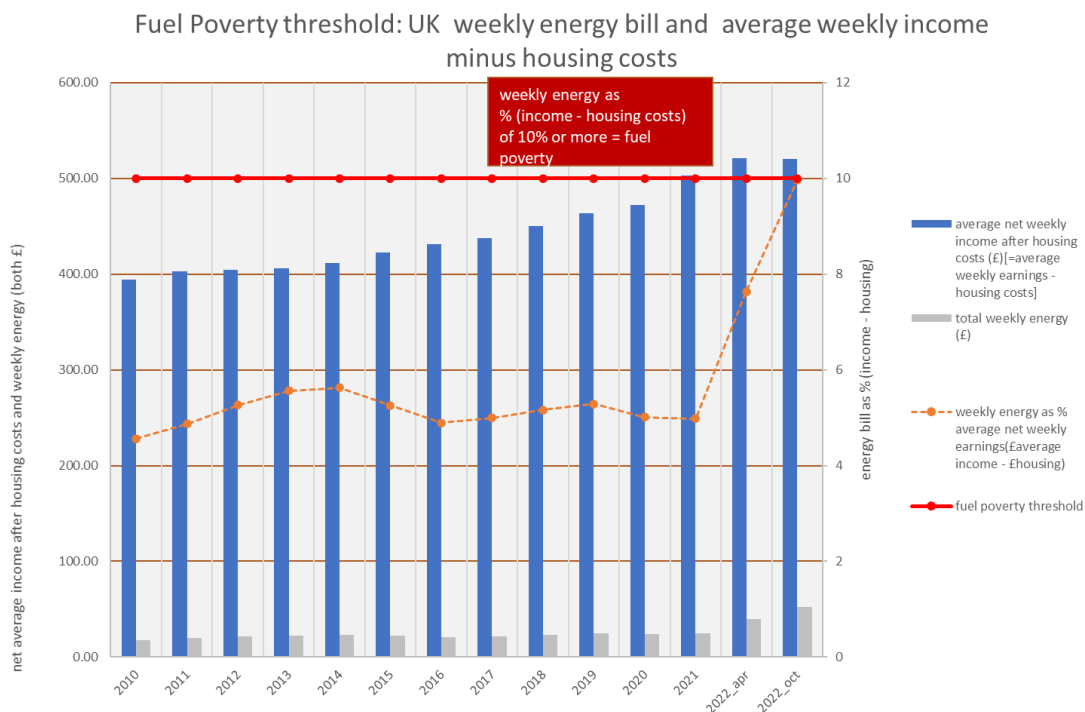


Figure 10: UK weekly energy bill affects the average weekly income earners. Fuel poverty threshold defined here as 10% or more of net income is spent on energy bills (red dotted line). Those on average weekly incomes are at 7.9% of (net income - housing costs) with the April 2022 energy cap increase. In October 2022, assuming a further energy cap increase of £600 for the average usage (12,000kWh gas and 2,900kWh for elec) even those on average income will face energy bills of 10.0% of their net income, tipping even those on average earnings into fuel poverty (using the Scot gov standard).

Figure 10 shows how those earning average wages fare with energy prices rising in the UK. Between 2010 and 2021, the proportion spent on energy bills by average income earners (orange dotted line) was below the fuel poverty threshold set by the Scottish Government (red dotted line). The April 2022 rise in energy prices has increased the percentage households need to spend on energy bills to almost 8% of their net household income and the increase expected in October 2022 will increase spending to 10% in October 2022 (assuming the price cap increase is correct). This would mean that median earning households will be categorised as in fuel poverty by Scotland’s definition. This is the equivalent of 23.3 million people being considered living in fuel poverty in the UK (Table 2).

Table 2. Around 33.9 million people in the UK could hit the Scottish Government’s definition of fuel poverty after October 2022’s fuel prices rises.

	% of median income	Energy costs as % income after housing costs	Estimated number of people (million) based on UK income distribution	Comment
Defined as relative low income	60%	18.4%	14.0	Those on relative low income will have even less money to pay for food etc
Fuel poverty level income	100%	10.0%	33.9	With this proposed rise, even those on average income will be in fuel poverty
Average income	100% (=median)	10.0%	33.9	

Over the last month, for what reasons has your cost of living increased? Adults in Great Britain, 6 to 16 January 2022

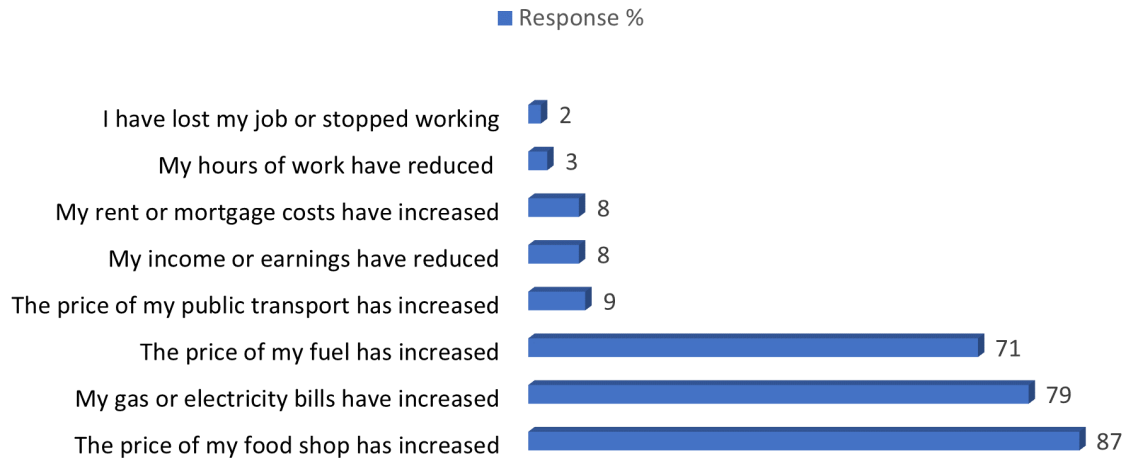


Figure 11: The main contributors to the rise in living costs. A survey conducted by ONS showed that main contributors to the cost of living were found to be food , gas and electricity and fuel. Source [\[33\]](#).

Figure 11 shows the perceptions of people surveyed by the Office for National Statistics, as to why their cost of living was increasing. This data represents responses taken from adults in the UK in January 2022. The main contributors to the rise in the cost of living were found to be food, with 87% of respondents giving their top answer as their cost of living had risen due to the increase in food prices, followed by gas and electricity (79%) then by fuel (71%).

3.2 Energy efficiency of a home has an impact on its energy bills - Glasgow areas

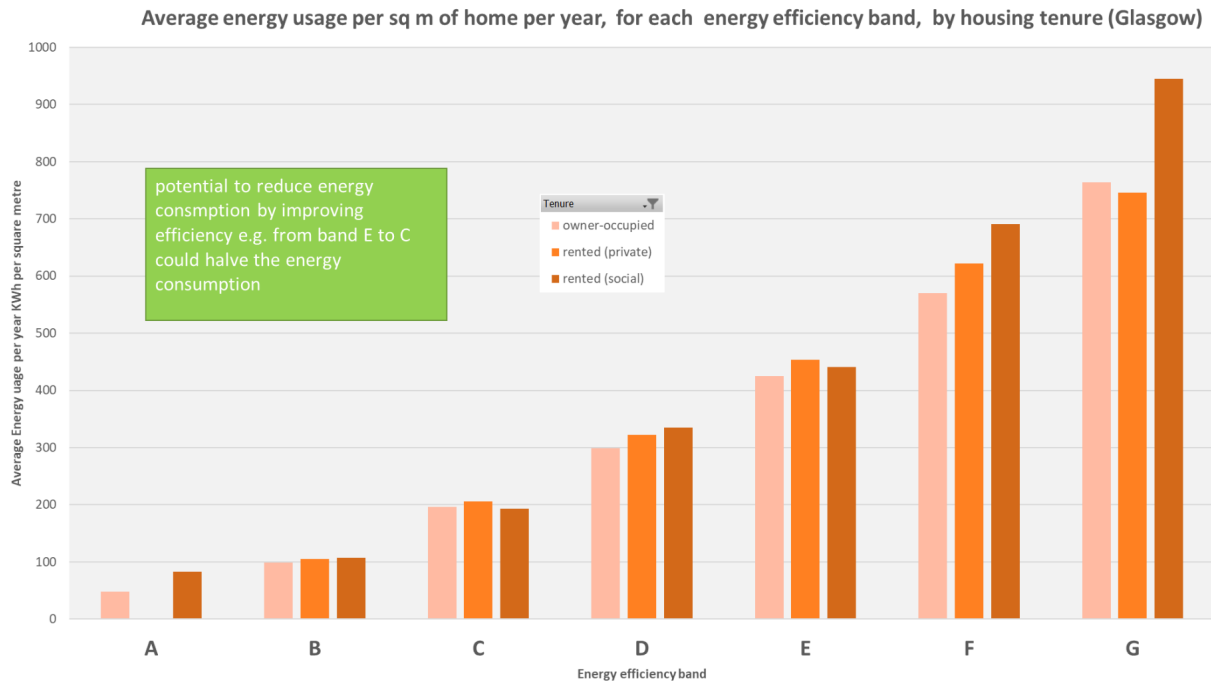


Figure 12: Average energy usage by energy efficiency band and housing tenure in Glasgow. Energy efficiency bands are from A-G where A is the most energy efficient band and as such energy consumption in this category is expected to be low. G is the least energy efficient band, therefore, the energy consumption is expected to be the highest. Average energy usage is per square metre. Housing tenures are rented (private), rented (social) and owner occupied.

As shown in figure 12, if the energy efficiency of a household can be improved by two bands then the resulting energy usage could potentially be halved, as long as previous conditions are the same and no other usage changes occur. Figure 12 shows the average energy usage (per KWh per square metre) against different EPC bands in Glasgow, where A is the most efficient and G the least. If households can improve their energy efficiency from E to C then the consumption of energy would be approximately reduced by half. Looking at social rented housing, the E band uses approximately 430 KWh per m² whereas the same tenure in the C band uses approximately 190 KWh per m². Similarly, can be said for improvements from C to A bands.

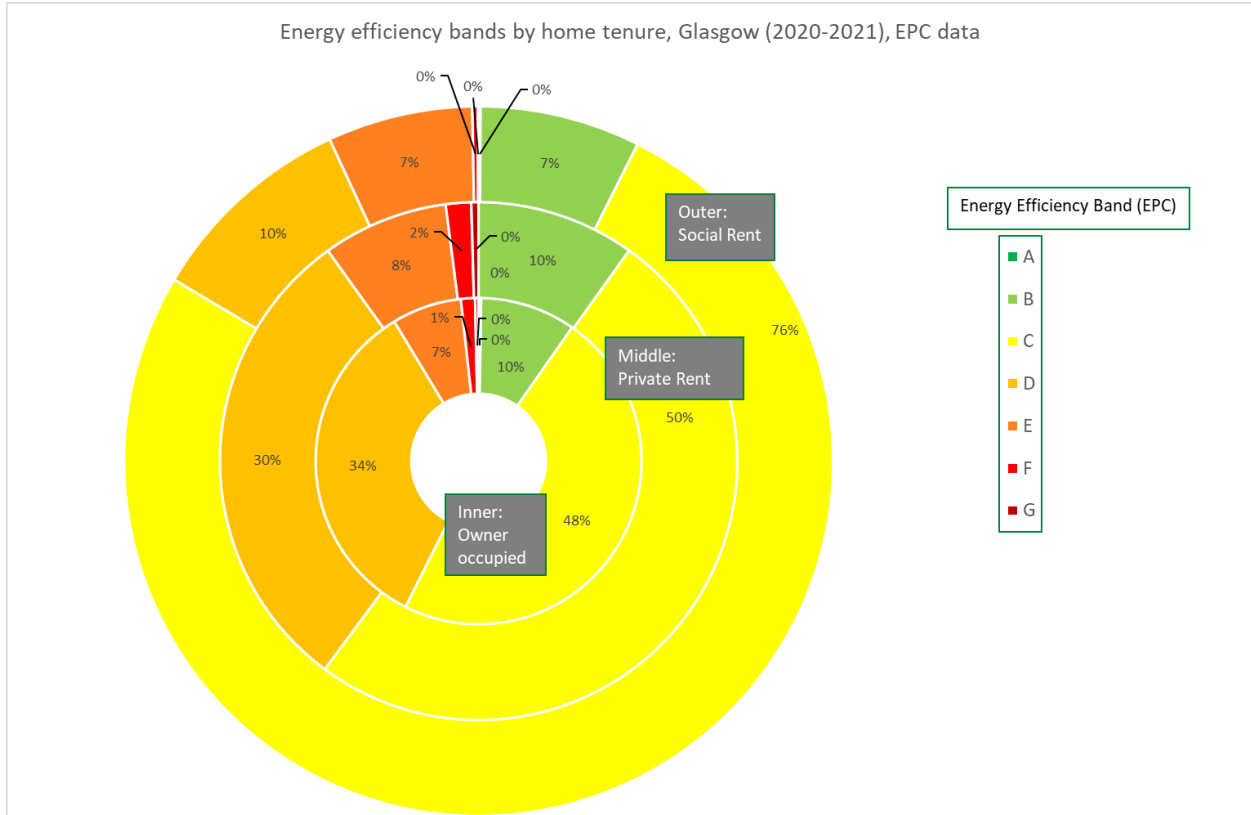


Figure 13: Percentage of the energy efficiency bands for each of the three types of home tenure in Glasgow. The inner circle represents the owner occupied properties, the middle circle represents the private rented properties, and the outer circle represents the social rented housing. Most properties across all three home tenures have an energy efficiency band C (yellow, owner occupied: 48%, private rented: 50%, social rented: 76%).

Analysis done on the percentage of energy efficiency ratings data of Glasgow’s home tenure for the period 2020-2021 shows that across all three types of home tenures (social rented, private rented and owner occupied) most houses are on Band C. Notably, social housing had the highest percentage of homes in Band C (76%) compared to private rented (50%) and owner occupied (48%) (Figure 13). All this suggests that improving home energy efficiency could have a positive impact on energy bills.

Ongoing improvements to social housing in Scotland, under the EESSH policy, are likely to have contributed to this high percentage (76%) of social housing properties in Band C. (Section [1.2.1](#)).

Percentage of Income Deprived Area VS Average Current Energy Efficiency Glasgow (2020-2021)



Figure 14: Relationship between % of people who are income deprived in a given area and average energy efficiency for that area. Data taken from Scottish Index of Multiple Deprivation (SIMD) 2020 and EPC data for all four quarters of 2020. The percentage of income deprived people per postcode area presents as the independent variable (X axis) and average energy efficiency of those areas as the dependent variable (Y axis). Each dot represents a postcode area $Y = \text{intercept} + (\text{slope} * X) \Rightarrow Y = 66.86641 + (0.22139 * X)$.

As a result of the data shown in figures 12 and 13, the relationship between percentage of income deprived areas and average energy efficiency across Glasgow district areas, for the period of 2020-2021, was further investigated. Interestingly, the areas in Glasgow with higher percentages of income deprivation also showed higher energy efficiency, as demonstrated by the positive linear regression seen in Figure 14. The relationship between percentage of income deprived areas and energy efficiency was found to be significant ($p < 0.005$, $r^2 = 0.33$).

3.3 Energy consumption per sqm in areas of high demand and low income deprivation in Glasgow are similar for 2020 - 2021

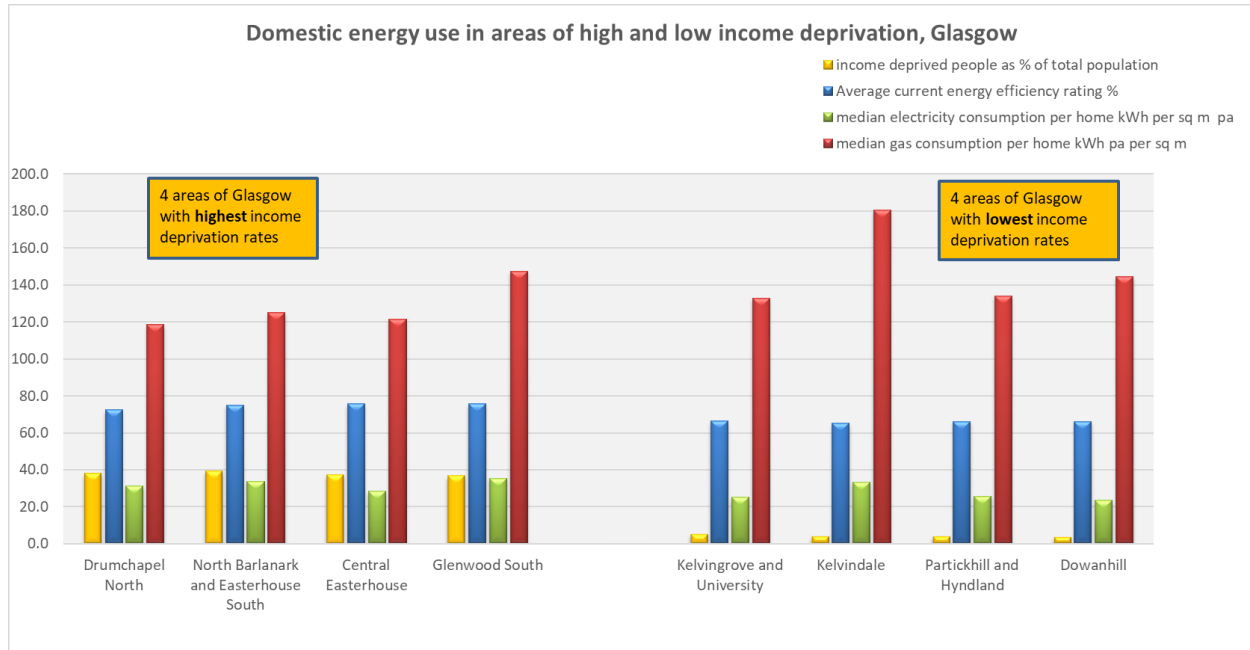


Figure 15. Energy use in areas of high and low income deprivation in Glasgow. Average of the current energy efficiency rating (blue bars) in areas with highest income deprivation rates (yellow bars, left) is slightly higher than in those areas with the lowest income deprivation rates (yellow bars, right). Gas and electricity consumption (red and green bars respectively) in both high and low income areas in Glasgow are very similar.

To look into the energy consumption of both high and low income deprivation areas in Glasgow Energy Performance certificate (EPC) data for 2020 - 2021 was analysed (Figure 15). The four areas on the left (Drumchapel North, North Barlanark & Easterhouse South, Central Easterhouse and Glenwood South) are those with the highest percentage of income deprived people from their total populations (36.9 to 39.0%). The four areas on the right (Dowanhill, Partickhill & Hyndland, Kelvindale and Kelvingrove & University) are those with the smallest percentage of income deprived people in their total population (3.7 to 5.1%). We had assumed areas of high income deprivation would also have low energy efficiency; however, the energy efficiency ratings (72.6% to 75.7%) of the most deprived areas were higher than those of the least deprived areas (65.2% to 66.4%).

Glasgow Districts Median current energy efficiency (2020 Q1-Q4, 2021 Q1-Q2)

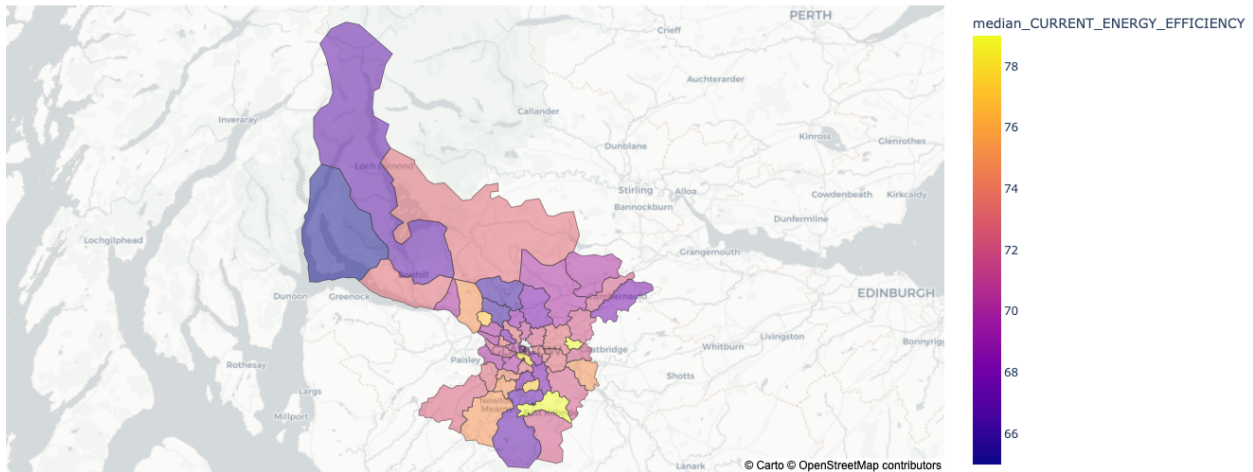


Figure 16: Energy efficiency across Glasgow. The darker colour means the lower median energy efficiency in each Glasgow district area, the lighter colour means the higher median energy efficiency.. Data sample collected for this plot had 60,076 records in Glasgow (2020 Q1-Q4 plus 2021 Q1,Q2)

Analysis done on the current energy consumption in Glasgow (Figure 17) showed that in those areas where energy consumption was high (orange and yellow) the energy efficiency (Figure 16) was low (purple and dark blue). This was somewhat expected since low energy efficiency homes would take longer to heat, with a lot of the energy getting wasted, which in turn would result in higher energy bills.

Glasgow Districts Median Energy Consumption current (2020 Q1-Q4, 2021 Q1-Q2)

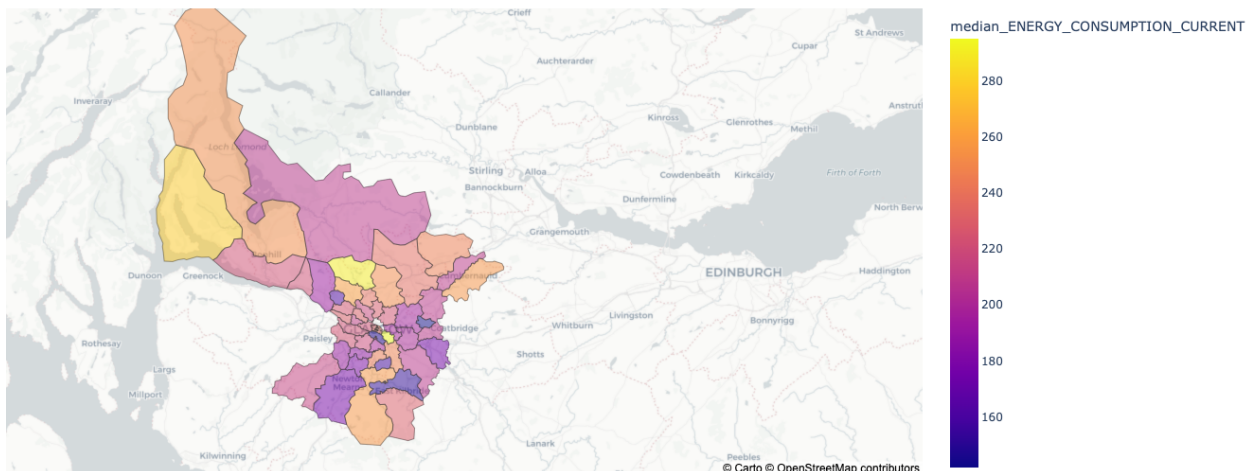


Figure 17: Energy consumption across Glasgow. The darker colour means the lower median energy consumption in each Glasgow district area, the lighter colour means the higher median energy consumption. Data sample collected for this plot had 60,076 records in Glasgow (2020 Q1-Q4 plus 2021 Q1,Q2)

3.4 Areas in Glasgow that would benefit from improved energy efficiency measures

In order to identify the areas in Glasgow that might benefit from improved energy efficiency measures, data on EPC ratings and income population gathered between 2020 and 2021 was analysed. The data was filtered for areas of Glasgow which had $\geq 25\%$ of their population as income deprived and had $\leq 80\%$ energy efficiency ratings. The result shows (Figure 18) that there are a total of 7 Glasgow district areas where the percentage of income deprivation was greater or equal to 25%. These areas had a percentage of energy efficiency less than or equal to 80%. These were G15 (Drumry East, Drumry West, Drumchapel North), G51 (Ibrox East and Cessnock, Govan and Lighthouse), G46 (Carnwadric East, Carnwadric West, Giffnock, Kennishead, Thornliebank, Deaconsbank), G22 (Possil Park, Milton East, Milton West, Milton), G21 (Springburn East and Roystonhill), G40 (Parkhead West and Browfield, Dalmarnock and Bri), G45 (Glenwood North, Glenwood South, Castlemilk). The areas corresponding to postcodes G45 and G22 were found to have the highest percentage of income deprivation (around 30%) and the lowest energy efficiency.

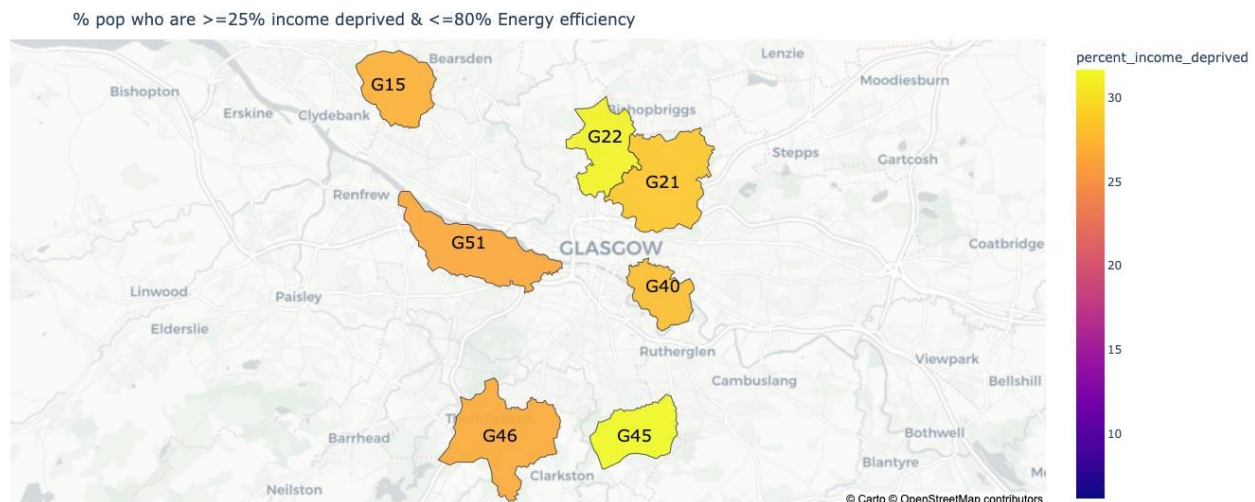


Figure 18: Areas of Glasgow that would benefit from improved energy efficiency measures. Data here shows the percentage of population who are greater or equal to 25% income deprived AND have less than or equal to 80% energy efficiency ratings on their homes (2020-2021 data). Postcodes are **G15** (Drumry East, Drumry West, Drumchapel North, Drumchapel South, Blairdardie East, Blairdardie West, Drumchapel), **G51** (Ibrox East and Cessnock, Govan and Lighthouse, Drumoyne and Shieldhall, Govan, Ibrox), **G46** (Carnwadric East, Carnwadric West, Giffnock, Kennishead, Thornliebank, Deaconsbank) **G22** (Possil Park, Milton East, Milton West, Milton), **G21**(Springburn East and Roystonhill and Blochairn and Provanmill, Petershill, Keppochhill, Cowlairst and Port Dundas, Balornock, Barmulloch, Cowlairst, Royston, Springburn, Sighthill), **G40**(Parkhead West and Barrowfield, Dalmarnock, Bridgeton, Calton and Gallowgate), **G45** (Glenwood North, Glenwood South, Castlemilk)

4. Insights

The following points are interesting insights we've gathered during the course of this project. These are results that struck us as notable and often surprising.

- Due to the April 2022 and possible October 2022 cap rises in energy bills more and more households will inevitably be fuel poor, including those who are currently considered middle income (Figure 10).
- Since the majority of the energy goes into heating a space or home (76%) (Figure 5), making or helping homes to be more energy efficient would have a great impact on energy bills savings, whilst also helping to tackle climate change .
- What was striking about this data, is that the energy consumption per sq metre of a band C home is twice that of a Band B home. Similarly, improving from Band D to B or E to C could result in potentially halving the energy needs (Figure 12).
- 76% of social rented housing in Glasgow are in Band C (energy efficiency rating) which are likely the result of ongoing improvements to social housing in Scotland, under the EESSH policy (Figure 13) .
- Due to mainstream media reporting on poor social housing conditions [34], it was expected that social housing properties would have worse energy efficiency, however from the data we used (2020-21 EPC certs) this was not the case. Most likely this is due to the Social Housing improvements programme (ESSH), part of the Scottish Government strategy on reducing fuel poverty (Figure 13).
- There are seven areas in Glasgow that would benefit from improving home efficiency,
- with **G22** (Possil Park, Milton East, Milton West, Milton, Possilpark) and **G45** (Glenwood North, Glenwood South, Castlemilk) being the ones that would benefit the most (Figure 18).

5. Further Work

Due to time constraints for collecting and analysing data, this report only shows a snapshot of fuel poverty in Glasgow. Therefore, the aim of this section is to provide ideas and suggestions for further work.

- Could power companies do more to help those in need e.g with improved payment schemes? - The impact of the various tariffs would be useful to consider - the report has concentrated on Direct Debit payees only but many of those in Fuel Poverty are also constrained to using Prepaid meters. This can mean that those households are on less favourable tariffs. Credit payments are also often more expensive than Direct Debit. For those employed in “gig economy” jobs, where monthly income is hard to predict, Direct Debit and the preferable rates are out of reach. If we had more information about how people pay for their energy and how much the different payment options cost, prepayment vs Direct Debit vs Credit customers, it would be interesting to know if those in low income households are disadvantaged by the payment methods.
- Is it possible to obtain pandemic and post-pandemic data (2020, 2021)? - Due to the pandemic, the data on typical energy usage, collected by Ofgem, was paused in 2020. Assumptions made about usage do not take into account the changes in our energy uses during lockdown and increased remote working from home since the pandemic, therefore more accurate and up-to-date data would yield more relevant results. In addition, people who worked from home were spending more on utility bills because of the COVID-19 pandemic. We can only imagine that the impact was even harder on lower income households.
- What do the latest energy prices do to the estimated number of households in fuel poverty and extreme poverty? - Scottish Government: "The fuel costs used to estimate the number of households in fuel poverty were based on 2017 fuel prices and do not therefore take account of the recent substantial increase in fuel prices." Tackling Fuel Poverty in Scotland Strategic Approach [\[7\]](#).
- What is the energy efficiency of homes in rural areas of Scotland? Are these areas significantly colder than the urban central belt of Scotland? How can the Scottish Government help homes stay warmer for cheaper? - We considered only Glasgow for this project, which does indeed suffer from high income deprivation and high rates of fuel poverty. However, there are different pressures in remote and rural areas and in fact

these areas have higher levels of fuel poverty (40% in Western Isles and 33% in Highland compared with 25% in Glasgow). Typically, households in these areas do not have access to mains gas which has until now been a cheaper form of heating than electricity. This would merit further investigation and analysis.

- What impact does Energy Efficiency have on fuel poverty in other areas of Scotland? - The EPC dataset is very rich and contains a lot of information per household record. It would be useful to a) expand the analysis of Glasgow households by using data from earlier years b) expand the analysis to other parts of Scotland c) expand the analysis to look at the recommendations for energy efficiencies given for each home.
- What can the Government do to help tackle home energy efficiency across Scotland? - Research, data modelling and analysis, as conducted in this report, could be done to help the Scottish Government identify those homeowners and private rental landlords who need to improve their properties to higher energy efficiency standards. Improving EPC ratings will help reduce their energy consumption and aid towards our goal of tackling climate change. Changes to building regulations for listed buildings may need to be implemented to assist property owners make energy saving improvements. Again, this would reduce energy consumption and help with climate change targets.

6. Conclusion

In this report we have looked into the current fuel poverty situation in Glasgow, and identified the postcode districts that may be the most affected by energy price rises based on a combination of income deprived households and energy deficient homes in these areas. Initially, it was assumed that households in poorer areas would be less energy efficient than in more affluent areas; this was found to be the opposite. A reason for this may be that the government has been investing in improving social housing's energy efficiency since 2010. Because more affluent areas were found to have less energy efficient homes, it has become clearer that both low and high income areas would benefit from further legislation and schemes that would support making homes more energy efficient, not only in Glasgow but nationwide. This would result in warmer homes and the reduction of energy bills which, in turn would have a positive impact on the NHS running costs by improving the health of the nation while helping reach the government's net zero carbon emissions target by 2050. This data only provides a snapshot into the fuel poverty situation in Glasgow for 2020-2021, and therefore, further work is needed to determine the full impact that both April 2022 and October 2022 price cap increases will have on fuel poverty.

Acknowledgements

We would like to thank Frank Duffy and Alan Crossan of Clutha Trust in Glasgow for providing the initial topic for this report, and helping us set on this path of investigation. Many thanks to Dr Jayanthi Santhanam for her mentoring and unwavering support during this project. Thanks to Flavio Garinei, statistics tutor at CodeDivision, for giving us a hand with our statistical analysis. Thanks also go to Marise Nelson, Social Projects & Sector Education Consultant at ScottishPower, for the discussion and interest in this report. For his suggestions regarding the source of data for domestic gas and electricity usage by area and advice to consider the impact of housing tenure, we also thank Dr Nick Bailey, Professor of Urban Studies at the University of Glasgow.

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Appendix

Information	File location of data used	GitHub link	Source
High energy bills & food prices	https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/Higher energy bills and food prices are the main contributors to rising living costs.xlsx	https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/Higher energy bills and food prices are the main contributors to rising living costs.xlsx	https://www.ons.gov.uk/economy/inflationandpriceindices/articles/energypricesandtheireffectonhouseholds/2022-02-01
Domestic Energy Performance Certificate	https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/glasgow all epc meanmedian 2021.xlsx	<ul style="list-style-type: none"> • https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/D_EPC_data_2021_Q2_extract_0721.zip • https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/D_EPC_data_2021_Q1_extract_0721.zip • https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/D_EPC_data_2020_Q4_extract_0721.zip • https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/D_EPC_data_2020_Q3_extract_0721.zip • https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/D_EPC_data_2020_Q2_extract_0721.zip 	https://statistics.gov.scot/data/domestic-energy-performance-certificate

Information	File location of data used	GitHub link	Source
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Weekly Income	https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/178a2593d046630371b882055f525e12ec5eda3f/ONS_Average_weekly_earnings_for_total_pay.xlsx		https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/methodologies/aguidetolabourmarketstatistics#earnings
Weekly average earnings per month for 2000-2022 from:			https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/averageweeklyearningsingreatbritain/april2022
Energy costs: Gas up to Apr 2022		https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/178a2593d046630371b882055f525e12ec5eda3f/UK_domestic_gas_bills.xlsx	https://www.gov.uk/government/statistical-data-sets/annual-domestic-energy-price-statistics
Electricity up to Apr 2022 (average elec bills in UK over time)		https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/178a2593d046630371b882055f525e12ec5eda3f/UK_domestic_electricity.xlsx	https://www.gov.uk/government/statistical-data-sets/annual-domestic-energy-price-statistics

Information	File location of data used	GitHub link	Source
Gas and Electricity after April 2022			https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1064828/quarterly-energy-prices-march-2022.pdf
Earnings distribution	https://github.com/Fuel-Poverty-Project-CD/data-analysis/blob/main/energy_vs_income.xlsx	https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/hbai-summary-results_2021.xlsx	https://www.gov.uk/government/statistics/households-below-average-income-for-financial-years-ending-1995-to-2020
EPC Glasgow	https://github.com/Fuel-Poverty-Project-CD/data-analysis/blob/main/EPC_Glasgow_data_2020_21.xlsx	<ul style="list-style-type: none"> • https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/D_EPC_data_2021_Q2_extract_0721.zip • https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/D_EPC_data_2021_Q1_extract_0721.zip • https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/D_EPC_data_2020_Q4_extract_0721.zip • https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/D_EPC_data_2020_Q3_extract_0721.zip • https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/D_EPC_data_2020_Q2_extract_0721.zip 	https://statistics.gov.scot/data/domestic-energy-performance-certificates

Information	File location of data used	GitHub link	Source
		<p>ob/main/D_EPC_data_2020_Q2_extract_0721.zip</p> <ul style="list-style-type: none"> • https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/D_EPC_data_2020_Q1_extract_0721.zip 	
Opinions and Lifestyle Survey		<p>https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/Higher_energy_bills_and_food_prices_are_the_main_contributors_to_rising_living_costs.xlsx</p>	<p>https://www.ons.gov.uk/economy/inflationandpriceindices/articles/energypricesandtheireffectonhouseholds/2022-02-01</p> <p>https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandwellbeing/bulletins/coronavirusandthesocialimpactongreatbritain/21january2022</p>
Scottish Index of Multiple Deprivation in Glasgow (SIMD) (2020)	<p>https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/glasgow_e_income_deprived.xlsx</p>	<p>https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/simd2020_withinds.csv</p>	<p>https://simd.scot/#/simd2020/BTTTTFTT/11/-4.2530/55.8579/</p>
Data Dictionary		<p>https://github.com/Fuel-Poverty-Project-CD/DataSets/blob/main/SIMD%20MSOA%20EPC%20fields.xlsx</p>	

Acronyms

EESH - Energy Efficiency Standard for Social Housing

EPC - Energy Performance Certificate

MSOA - Middle Super Output Area (for domestic electricity and gas consumption)

NHS - National Health Service

SIMD - Scottish Index of Multiple Deprivation data

ONS - Office for National Statistics