

CUSP 

London Data Dive 2025

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Team 7



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Background

Fuel Poverty:

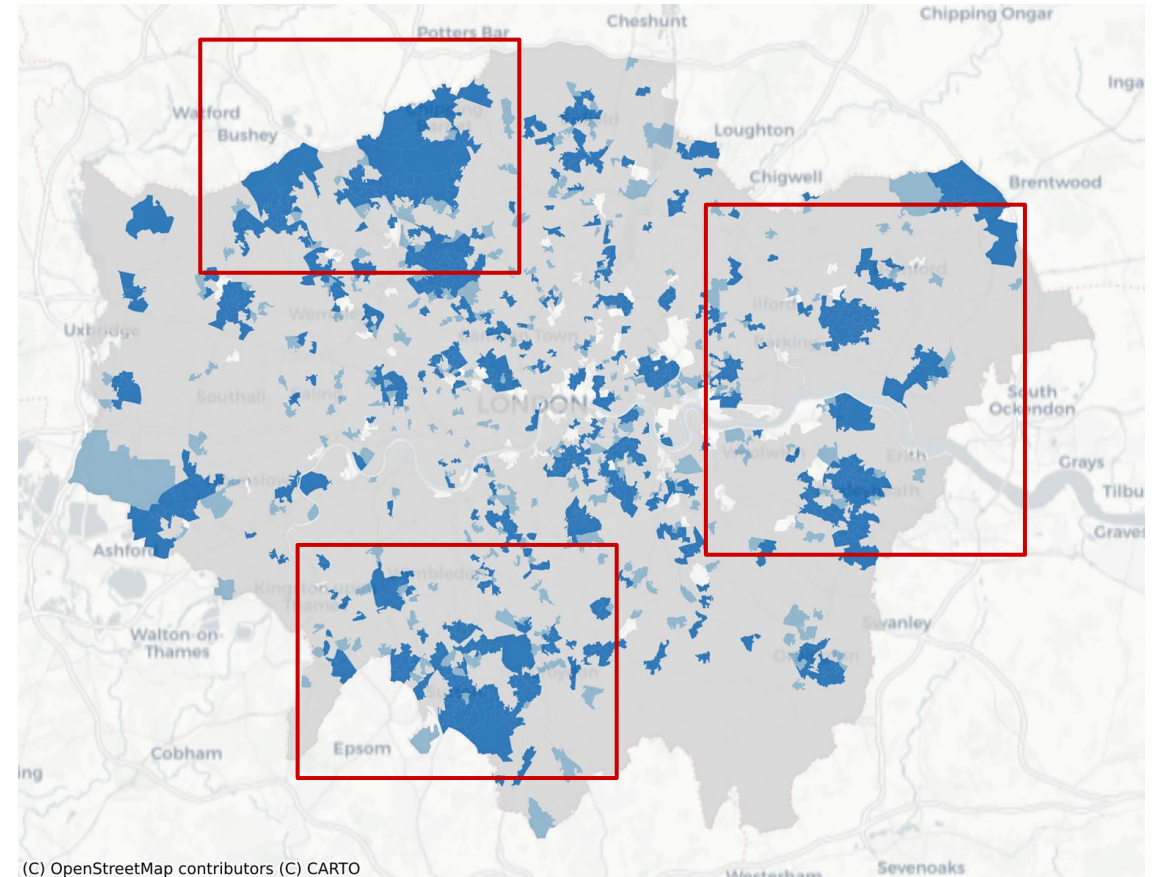
Fuel poverty in England is measured using the Low Income Low Energy Efficiency (LILEE) indicator. Under this indicator, a household is considered to be fuel poor if: they are living in a property with a fuel poverty energy efficiency rating of band D or below and when they spend the required amount to heat their home, they are left with a residual income below the official poverty line. (“Fuel Poverty Statistics,” 2024)

Fuel poverty is a persistent issue in the UK which affects approximately **11%** of households. (Simcock N, Walker G, Day R., 2016)

Research Questions

- a) Are there disparities in energy efficiency ratings and socio-economic factors that could exacerbate fuel poverty in certain areas of London?
- a) How can existing policy gaps be addressed to mitigate regional inequalities in access to affordable heating energy and reduce fuel poverty?

Local Moran's I – Clusters of Fuel Poverty



Moran's I: 0.227, R-Value: 0.001

The Moran's I and Local Moran's I values indicate a clustering pattern of energy poverty, with high-concentration areas (deep blue) primarily located in the northern, eastern, and southern parts of London.



Data Sources

Reference for factors choose:

- *The Home Upgrade Grant (HUG)*
- *The Sustainable Warmth Competition*
- *The Social Housing Decarbonisation Fund*
- *The Energy Company Obligation (ECO)*
- *The Great British Insulation Scheme*
- *Simcock N, Walker G, Day R. Fuel poverty in the UK: Beyond heating[J]. People, Place and Policy, 2016, 10(1): 25-41.*
- *Walker, R., McKenzie, P., Liddell, C., & Morris, C. (2014). Estimating fuel poverty at household level: An integrated approach. Energy and Buildings, 80, 469-479.*

Independent Variables

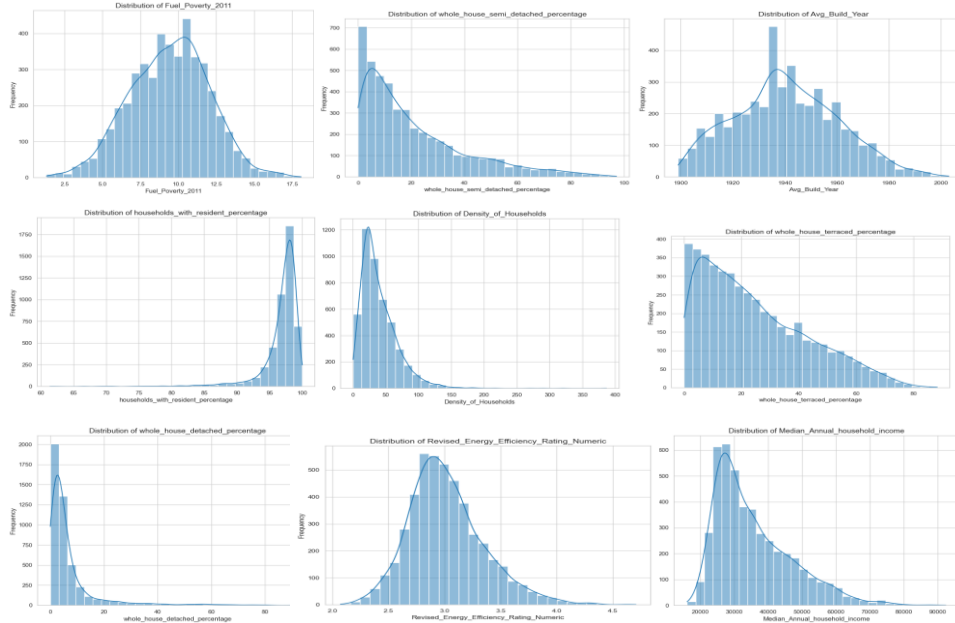
Dependent Variable

Datasets	Study Themes	Key Variables	Scopes	Time
LSOA Atlas - London Datastore	• Household income and housing characteristics	Median Annual household income	Greater London LSOA	2011
		Density of Households		
		Dwelling types		
London Building Stock Model (LBSM)	• Energy efficiency in buildings	Energy Efficiency Rating		2017
Lower Super Output Area (LSOA), Middle Super Output Area (MSOA) and Intermediate Geography Zone (IGZ) electricity and gas estimates - data.gov.uk	• Energy consumption patterns	Mean Electricity Consumption		2011
		Mean Gas Consumption		
Property Build Period - London Datastore	• Housing age and construction period	Average Built Year		2014
Fuel Poverty	• Fuel poverty distribution	Percentage of Households in Fuel Poverty		2011

Variables Selection

The distribution of almost all factors exhibits **skewness**, reflecting the underlying **inequality trends** that exist within London.

Distribution Of Factors

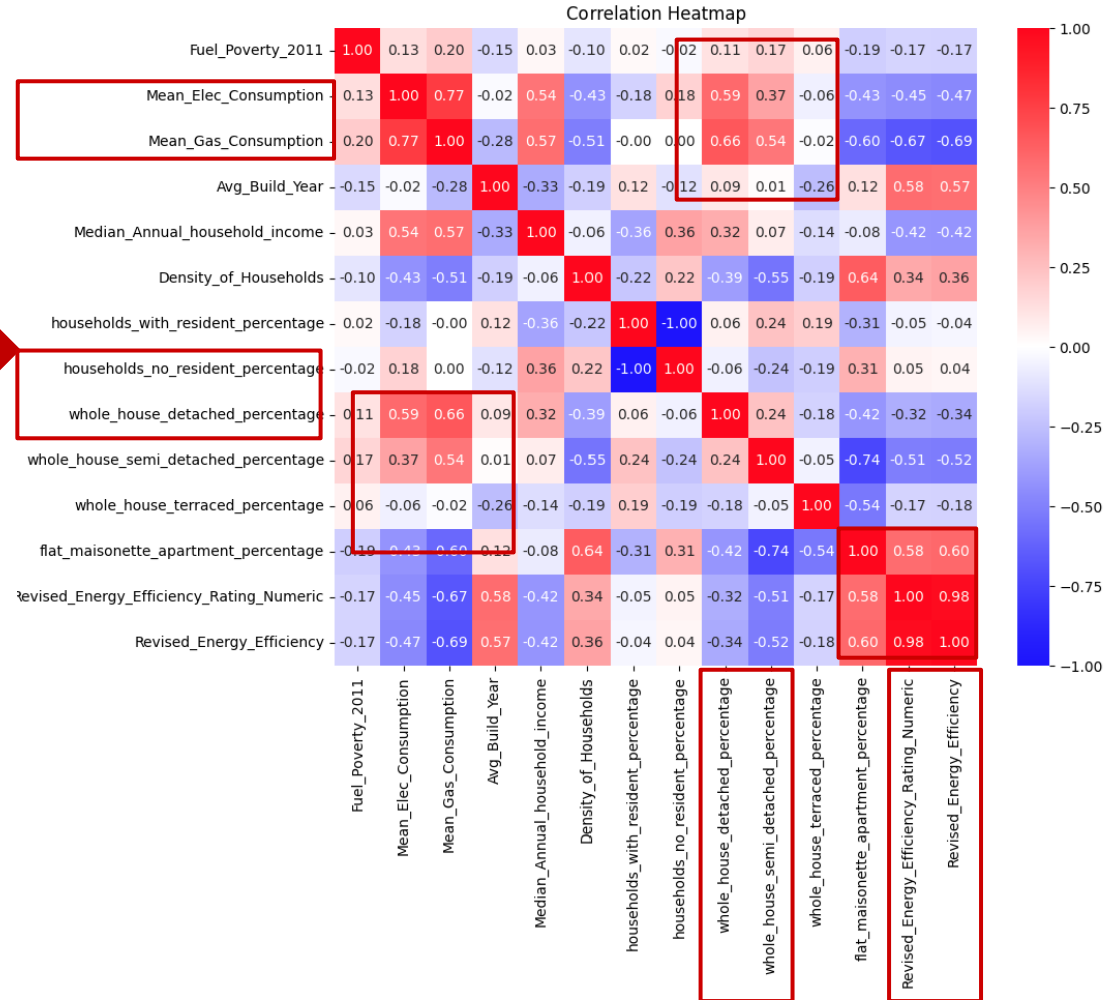


Multiple Linear Regression

$R^2 = 0.075$ not strong enough for evidence

Columns Eliminated due to **high multicollinearity** & **low significance**:

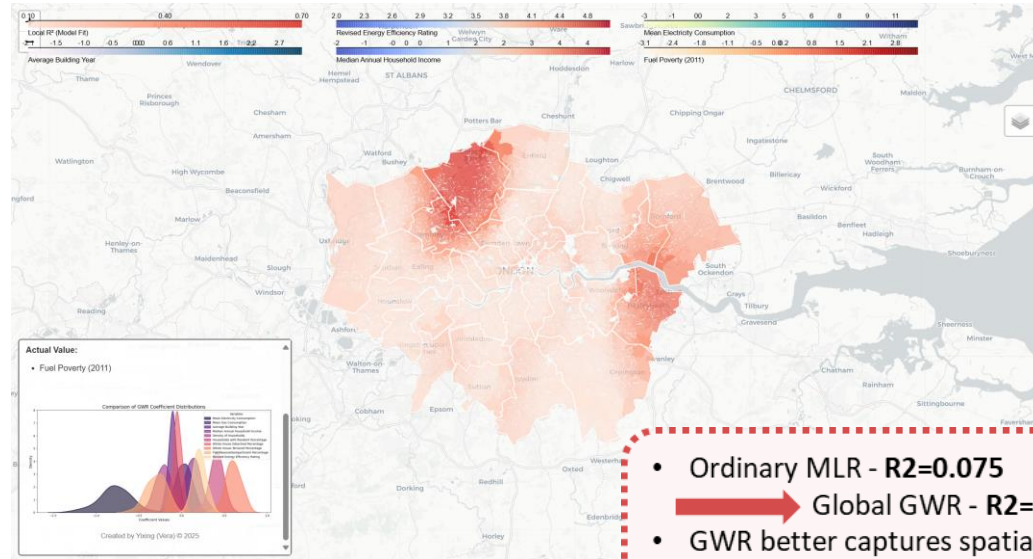
- Households no resident percentage
- Whole house semi-detached percentage



	Variable	VIF
0	const	280.913432
1	Mean_Elec_Consumption	3.269931
2	Mean_Gas_Consumption	6.757232
3	Avg_Build_Year	3.039415
4	Median_Annual_household_income	2.223366
5	Density_of_Households	2.248930
6	households_with_resident_percentage	1.435662
7	whole_house_detached_percentage	2.246637
8	whole_house_terraced_percentage	2.718651
9	flat_maisonette_apartment_percentage	5.455125
10	Revised_Energy_Efficiency_Rating_Numeric	3.533339

VIF TEST

Spatial Variation - in Drivers of Fuel Poverty



- Ordinary MLR - $R^2=0.075$
- Global GWR - $R^2=0.875$
- GWR better captures spatial variation than MLR.

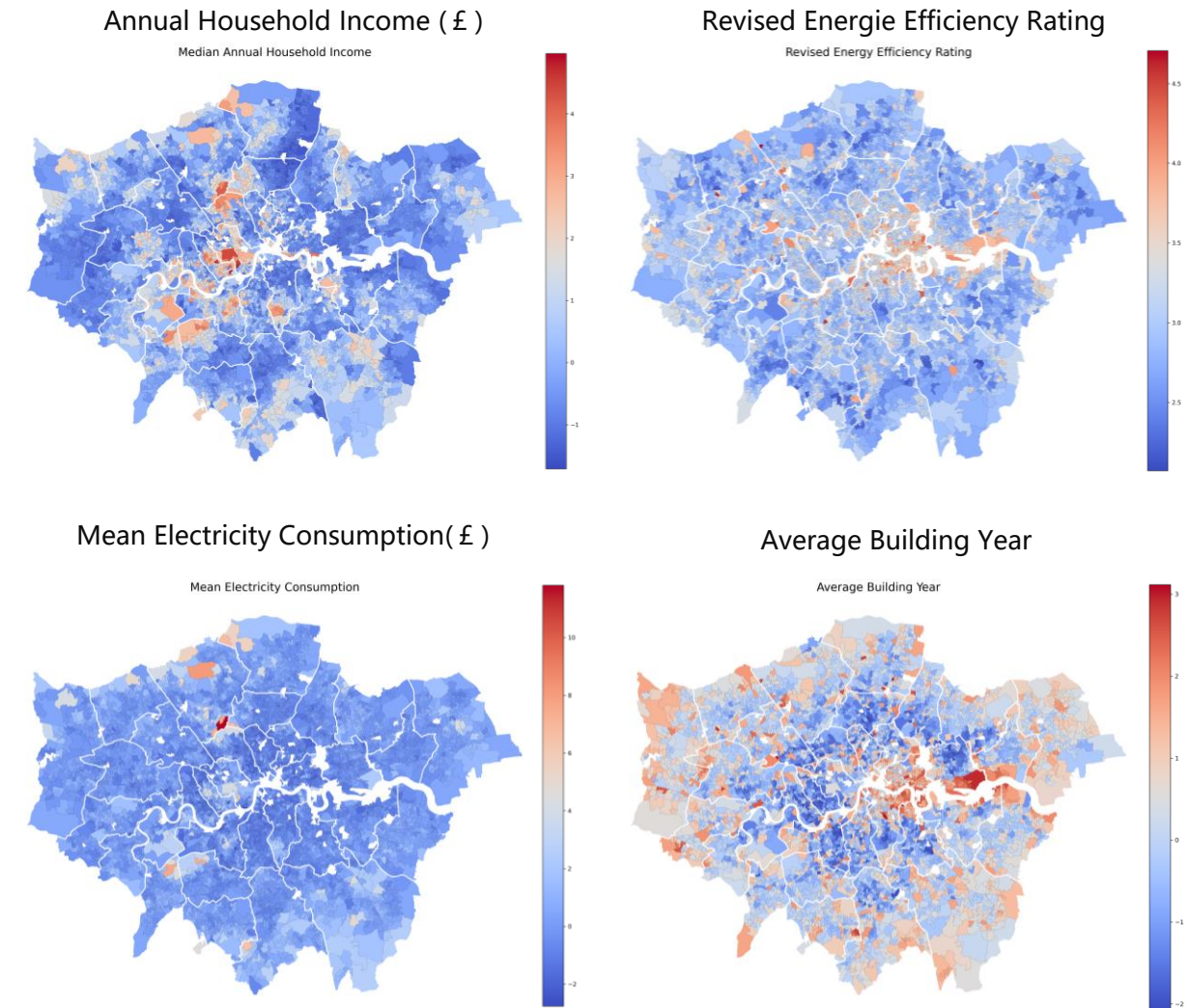
High R^2 Zones:

- Deep red areas - strong relationships / white – other factors are not considered

Significant Variables:

- **Median Annual Household Income:** Higher income reduces fuel poverty
 - low-income areas (e.g., East London) linked to higher fuel poverty.
- **Average Building Year:** Older buildings increase fuel poverty
 - Concentrated in city center and peripheral areas.
- **Mean Electricity Consumption:** Higher consumption linked to fuel poverty.
 - In large-home, high-utility regions (redder zones).
- **Revised Energy Efficiency Rating:** Better ratings reduce fuel poverty
 - Low efficiency in eastern/northern areas linked to higher fuel poverty.

Geographically Weighted Regression (GWR)



Interactive map link for exploring: [Spatial Insights into Fuel Poverty and Associated Factors in Urban Areas \(GWR Results\)](#)

Policy Improvement & Insights

Policies should not adopt a one-size-fits-all approach but should instead be **tailored to the specific characteristics of each area**.

For example, North London may require building quality improvement programs, while South London would benefit more from enhanced financial support for low-income households.

FACTORS	POLICY	PATTERN	BOROUGH
Energy Efficiency	-energy retrofit programs	Eastern and Northern London	TowerHamlet/Newham/Lambeth/Hackney
Electricity Consumption	-income support measures -dynamic pricing mechanisms to reduce peak-hour costs	Haringey, Barnet	Haringey/Richmond/Upminster/Thames/Wandsworth/Barnet
Built Year	-targeted renovation subsidies -public housing renewal initiatives	East London	East London/Islington/Enfield/Redbridge/Hamden/Croydon/Hillingdon
Income	-income support measures	East London	East London/Islington/Enfield/Redbridge/Hamden/Croydon/Hillingdon

Winter Fuel Payment

You could get between £250 and £600 tax-free to help pay your heating bills: if you were born on or before 25 September 1957.

You usually get a Winter Fuel Payment automatically if you get the State Pension or another social security benefit (not Housing Benefit, Council Tax Reduction, Child Benefit or Universal Credit).

The amount you receive includes a 'Pensioner Cost of Living Payment' of £150-£300 in addition to any other cost of living payments you receive.

Find out more about the [Winter Fuel Payment](#) ↗

Limitations & Future Development

- **Biases from data sources:**
 - Lack of differentiation in electricity and gas data for heating purposes
 - Limited coverage of energy sources
- **Variable Definition Limitations:**
 - Lack of quantitative data on building energy transmission infrastructure
- **Temporal Limitations:**
 - Data covers only a specific time period (2011-2017), limiting the generalizability of trend analysis (EPC & Fuel Poverty Data Lag)
- **Model Fit Limitations:**
 - Spatial scale accuracy issues
 - Inconsistent GWR accuracy across regions





Thanks for
your Listening!

References

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- Poortinga, W. (2019). Health and social outcomes of housing policies to alleviate fuel poverty. In *Urban Fuel Poverty* (pp. 239-258). Academic Press.
- Fuel poverty statistics. (2024, February 15). Retrieved from GOV.UK website: <https://www.gov.uk/government/collections/fuel-poverty-statistics#2023-statistics>
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