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Domestic energy consumer archetypes: segmentation profiles

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Executive Summary

Introduction

This report presents eight Scottish energy consumer archetypes. They have been developed following an extensive review of existing segmentation approaches and consultation with stakeholders. This research is described in an accompanying ClimateXChange report – *Domestic energy consumer types – Review of existing segmentation approaches*.

Methodology

The archetypes were produced from a data set that was compiled from the Scottish Housing Condition Survey (2014 - 16) and the Scottish Household Survey (2014 - 16), supplemented with information derived from Ofgem Consumer Segmentation (2017) data. A hierarchical clustering method was then applied using fields within this data set to separate out distinct set of 'clusters' or household archetypes. These archetypes were then categorised using information from the clustering process plus additional information in the combined SHCS/SHS data set.

Archetypes

The resulting archetypes, presented in the main report, serve as a tool that enables users to take a more detailed review of different consumer issues across the energy sector. In particular, it is intended that the archetypes will help enhance understanding of the different experiences and needs of different energy consumers, the different drivers that may exist for households to engage in energy related policies and enable a more considered and nuanced approach to policy design and promotion of energy technologies.

The archetypes are summarised below. All households (and consumers) in Scotland are represented by these groups. The names of the archetypes represent the most typical characteristics, predominant features or average statistics (e.g. household income) across all households in these groups. It should be noted that within groups there exists a degree of variation in these characteristics and statistics, and when considering individual households

within a particular archetype. A more detailed discussion on the main intended uses of the archetypes as well as their limitations is available in Annex A of the main report.

Archetype		Number of hhlds	Average net income	Main rurality	Long-term illness or disability	Energy market engagement
1	**Single low income renters using electricity for heating**	245,000	£18,700	Mixed	42%	8%
2	**Urban very low income single older adults**	289,800	£11,600	Urban	43%	24%
3	**Switched on wealthier couples and families**	597,000	£41,700	Urban	17%	84%
4	**Families or younger couples in urban areas**	418,700	£19,400	Urban	7%	42%
5	**Wealthy rural families**	99,300	£42,400	Rural	21%	55%
6	**Older urban couples who own their homes outright**	320,600	£25,100	Urban	44%	63%
7	**Urban social renters with long term health problems**	285,400	£17,400	Urban	92%	25%
8	**Rural, less affluent older adult households.'**	174,500	£22,800	Rural	30%	30%
All households		**2,430,300**	**£25,100**	**-**	**34%**	**47%**

This research is independent and does not necessarily reflect Scottish Government policy.

Please also note that, while published in late 2020, this research was finalised in 2019.

Contents

Introduction

This report presents eight Scottish energy consumer archetypes. They have been developed following an extensive review of existing segmentation approaches and consultation with stakeholders. This research is described in an accompanying ClimateXChange report – *Domestic energy consumer types – Review of existing segmentation approaches*.

The archetypes are intended to assist Scottish Government and others in more accurately and consistently assessing the implications of energy policy and interventions on different types of consumers and allow targeted interventions and support to suit different groups. An initial, direct use will be in a linked project in which the consumer types developed in this project will provide a framework for a distributional impact assessment of forthcoming changes in energy policy and the energy market. Further guidance on their use is provided in Annex A.

Methodology overview

The archetypes were produced from a data set that was compiled from the Scottish Housing Condition Survey (2014 - 16) and the Scottish Household Survey (2014 - 16). It was also supplemented with information derived from Ofgem Consumer Segmentation (2017) data. A hierarchical clustering method was then applied using fields within this data set to separate out distinct set of 'clusters' or household archetypes. These archetypes were then categorised using information from the clustering process plus additional information in the combined SHCS/SHS data set. Further detail on the method used to produce the archetypes is provided in Annex B.

Key components of each archetype

A summary of the eight household archetypes are provided below in Table 1. As the data illustrates, the archetypes vary in income levels, rurality, whether any person in the households has a long-term illness or disability and the level of engagement in the energy market. The largest archetype represents approximately 600,000 households across Scotland and the smallest archetype represents approximately 100,000 households. Each archetype is presented separately and in more detail in the following sections.

Table 1: Summary of the Scottish Energy Consumer Archetypes

Archetype		Number of hhlds	Average net income	Main rurality	Long-term illness or disability	Energy market engagement
1	**Single low income renters using electricity for heating**	245,000	£18,700	Mixed	42%	8%
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8	**Rural, less affluent older adult households.'**	174,500	£22,800	Rural	30%	30%
All households		**2,430,300**	**£25,100**	**-**	**34%**	**47%**

Archetype names and profiles

The names given to each of the archetypes (in Table 1 and within the remainder of this report) serve to highlight some of the key characteristics of each segment. However, the names themselves should not be considered or used as full definitions; they do not describe all aspects of each archetype or cover the full range of characteristics of consumers represented by each of the groups. The archetypes are outlined in more detail in the sections below, including more detailed descriptions and statistical profiles, and these should be referred to for the full characterisation of each archetype.

Glossary of terms

Term	Definition
Urban	Using the Scottish Government two-fold Urban Rural Classification, urban areas are defined as settlements of 3,000 or more people.[1]
Rural	Using the Scottish Government two-fold Urban Rural Classification, rural areas are defined as settlements of fewer than 3,000 people.
EPC	Energy Performance Certificate. EPCs are a measure of the energy efficiency ratings of homes, with properties rated A the most energy efficient and G the least efficient.[2] Inefficient homes are more expensive to heat, and those on lower incomes living in these homes are more likely to struggle to afford to heat these homes and stay adequately warm in winter.
Income	The average net household income of each household is presented for each of the archetypes below. Several of the archetypes are also described as being 'low income' or 'very low

[1] https://www2.gov.scot/Topics/Statistics/About/Methodology/UrbanRuralClassification
[2] https://www.gov.scot/publications/energy-performance-certificates-introduction/

	income'. For the purposes of this analysis, references to incomes have been used as a way of distinguishing those archetypes which represent households on some of the lowest incomes when compared to other archetypes and the wider population. Being on low incomes is likely to be a significant contributory factor that prevents households being able to participate in emerging energy market developments or certain energy policies, or benefit from newer energy technologies.
Age	Age of households was used as part of the segmentation process. If an age distribution profile of an archetype is more significantly skewed to include more households in particular age bands then this has also been included as a descriptor in the definition of an archetype. However, labelling an archetype as being predominantly comprised of younger adults, as an example, doesn't necessarily infer that all households in that archetype are below a certain age thresholds, but that a high proportion of households will be in the 16-35 age band and that the significant majority will all be under 55. Age profiles are provided in each of the archetype descriptions.
Engagement with the energy market	Households have been assessed for whether they are likely to have had any engagement with energy market in last 12 months. In this analysis, 'engagement' means having compared tariffs, switched tariffs or switched energy supplier.
Fuel poverty and extreme fuel poverty	The fuel poverty data draws on the definition of fuel poverty in Scotland being defined as households that have to spend more than 10% of their disposable income on keeping adequately warm and meeting their energy needs. Households are classified as being in *severe* fuel poverty if these costs exceed 20% of their disposable income.[3] Since the analysis was undertaken a revised definition of fuel poverty has been set out in the Fuel Poverty Act (Targets, Definitions and Strategy) (Scotland) Act 2019.[4] This revised definition has not been included in this research.
SIMD	Scottish Index of Multiple Deprivation. This measures levels of deprivation across seven areas: current income, employment, health, education, skills and training, housing, geographic access and crime.[5] It is intended to identify those areas most in need of government support. SIMD is presented here in 'quintiles' which divides areas in Scotland into five groups with different levels of deprivation.

[3] https://www.gov.scot/publications/scottish-house-condition-survey-2017-key-findings/pages/6/
[4] http://www.legislation.gov.uk/asp/2019/10/enacted
[5] https://www2.gov.scot/Topics/Statistics/SIMD

Modelled fuel bill	The descriptions of archetypes below include an average modelled fuel bill for each group. The modelled fuel bill has been calculated by the Building Research Establishment (BRE) and published in the SHCS. The modelled fuel bill includes the cost of using electricity and other fuels in the home for heating, cooking, lighting and using electrical appliances. It does not include the costs of transport fuels or charging electric vehicles.
Social landlord	The descriptions of archetypes below include a profile of the tenure of housing of each group. The 'social landlord' category includes both local authority and housing association housing.

Archetype 1:
Single, low income renters using electricity for heating

Archetype 1 is predominantly single adult households, on lower than average incomes, with very low engagement in the energy market (just 8% compared or switched tariff in the previous year). A significant number of this group also have a long-term health condition (43%).

These households tend to live in small but inefficient electrically heated homes (storage heaters), mostly renting (private or social rentals) tenements, high-rise flats or terraces. Over 40% live in dwellings rated in EPC bands E, F or G and this group have the highest proportion of people unable to heat their homes in the winter (35%), with half in fuel poverty and 16% in severe fuel poverty.

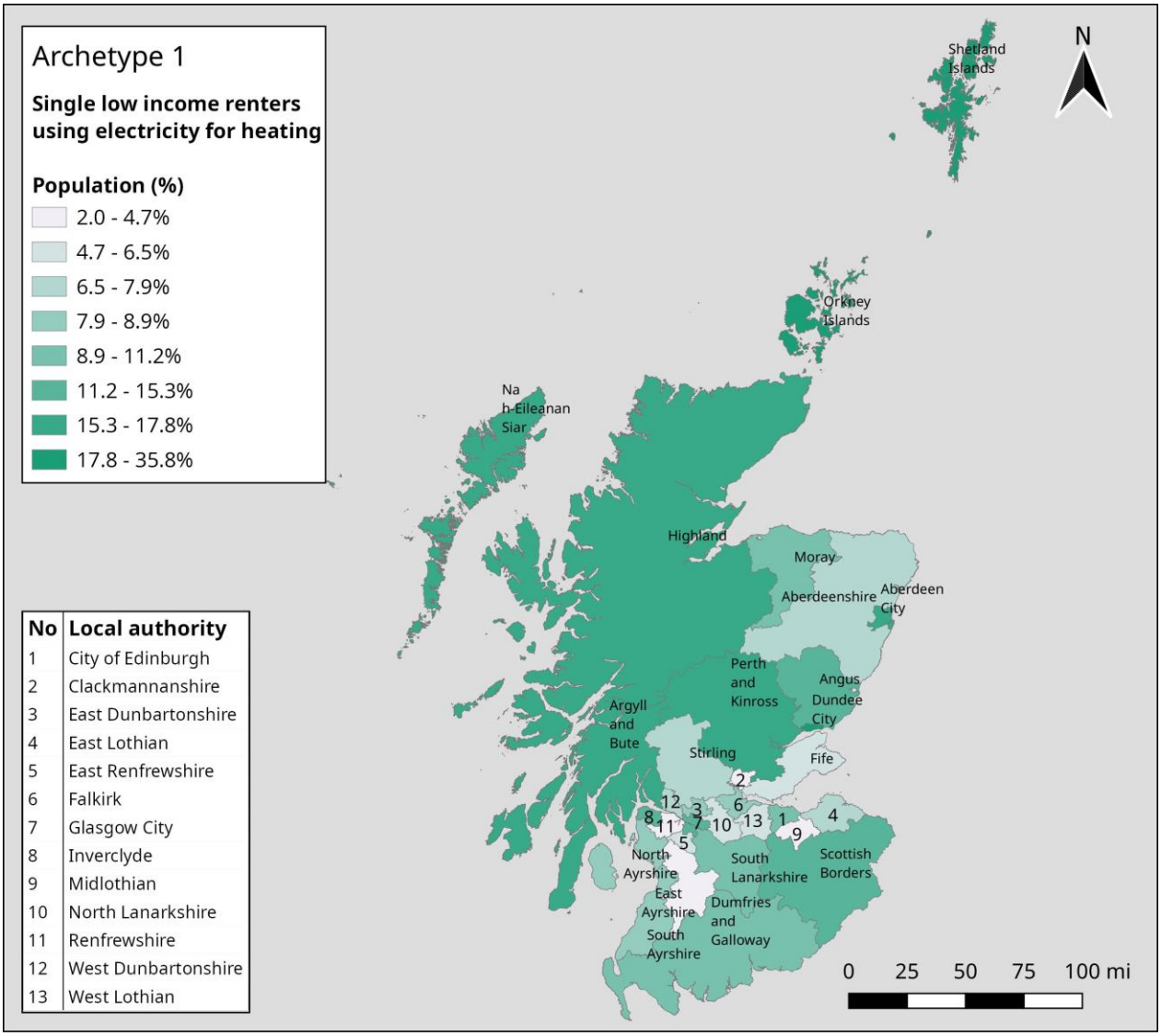
This group comprise significant proportions of rural populations in Shetland, Orkney, the Highlands, and Perth and Kinross, but the majority are located in urban areas including Aberdeen and Dundee.

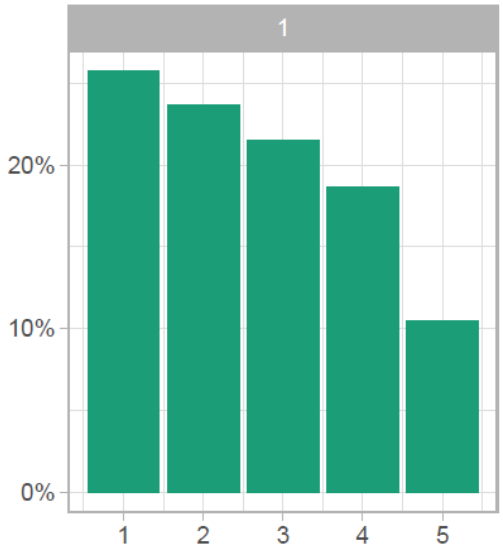
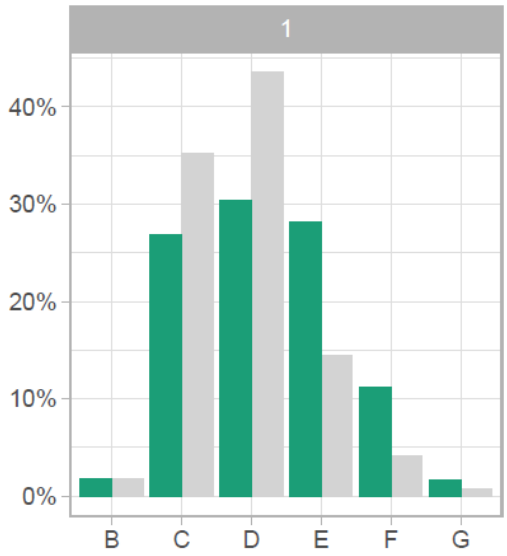
Archetype 1: Key statistics	
Number of households:	245,000
Average income	£18,700
Energy efficiency average SAP rating	56
Modelled fuel bill	£1,710
Proportion of homes in fuel poverty (10% definition)	51% (16% in extreme FP)

Archetype 1: Demographic profile	
Age profile (head of household)	Aged 16 - 35: 24% Aged 36 - 55: 26% Aged 56 - 65: 15% Aged 66 - 75: 17% Aged 75+: 17%
Household type	Single pensioner: 30% Pensioner couple: 8% Single adult working age, no children: 32% Couple working age, no children: 18%
Economic status (head of household)	Employed: 40% Retired: 36%
Proportion with a degree/professional qualification	22%
Tenure	Social landlord: 43% Private rented: 25% Owner occupied: 32%
Main heating fuel of dwelling	Electricity (storage heaters) and some communal systems

Any engagement with energy market in last 12mths	8%	*(GB average = 40%)*
Unable to keep adequately warm in winter*	34%	*(Scotland average = 19%)*
Long term illness or disability	42%	*(Scotland average = 34%)*
Considering buying an EV in the future*	29%	*(Scotland average = 37%)*
Use public transport for main commute	23%	*(Scotland average = 18%)*

Figure 1: Local authority population profile for Archetype 1



SIMD distribution *(1 = area with most deprivation):*	**EPC profile of dwellings** *(light grey profile is for all dwellings in Scotland)*
	

Archetype 2: Urban very low income single older adults

Archetype 2 represents very low income older single adult households living in urban areas experiencing high levels of fuel poverty. Most (two thirds) are female and of pensionable age. Over 40% have a long-term health condition. Housing tenure is mixed; most either own their property outright (46%) or are living socially rented properties (40%). One-third live in the most deprived SIMD neighbourhoods and only a small proportion (14%) have a degree-level qualification.

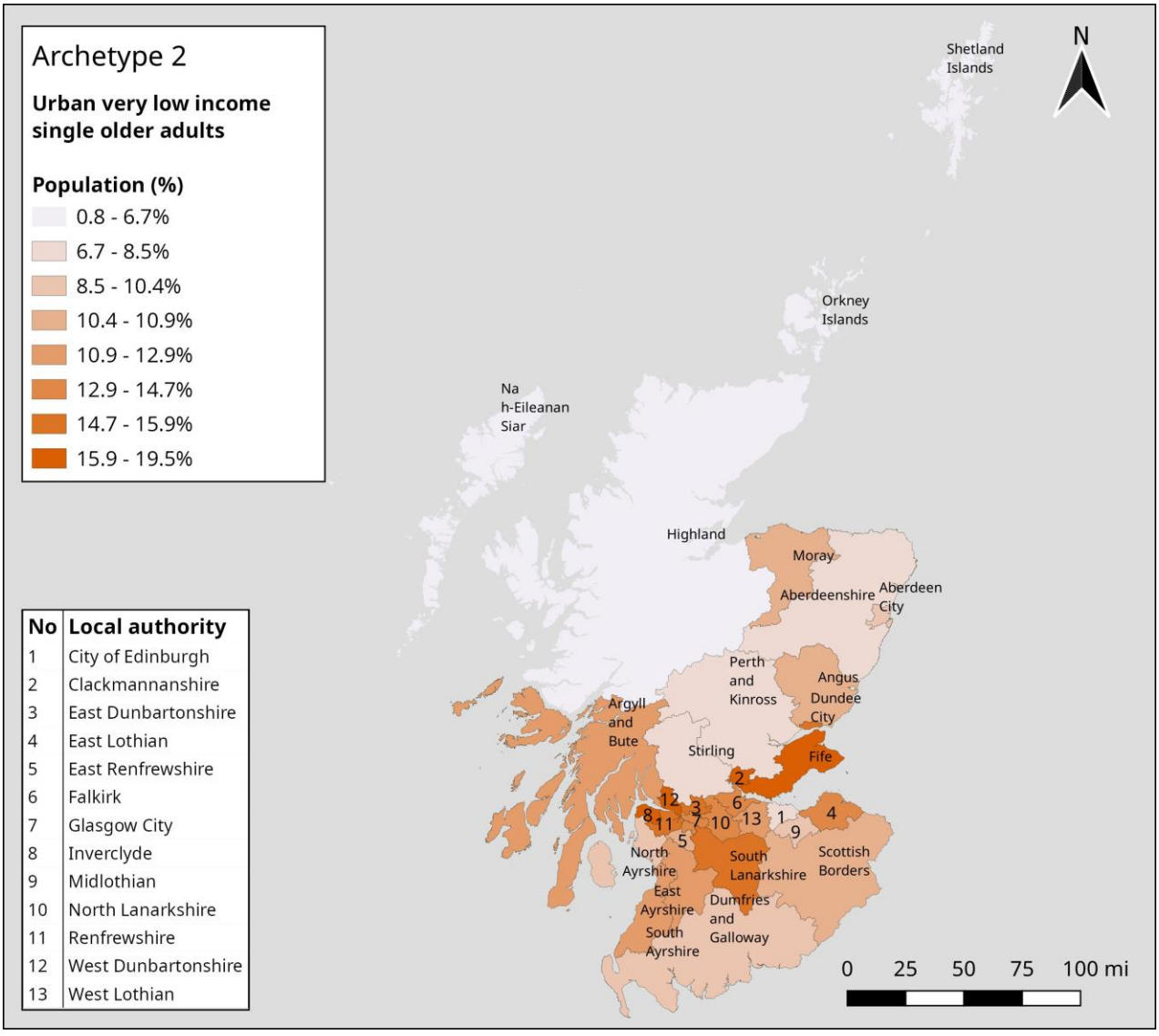
Most heat their homes using mains gas, and these homes are more efficient than average, with most rated D or above. However, the very low incomes of this group mean that two thirds are in fuel poverty and 20% in extreme fuel poverty. However, relatively few report problems keeping warm in winter (17%). There are relatively low levels of engagement with the energy market with less than a quarter having compared or switched tariffs over last year.

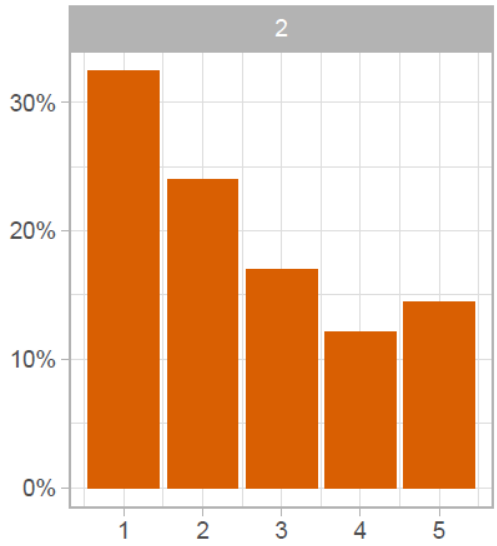
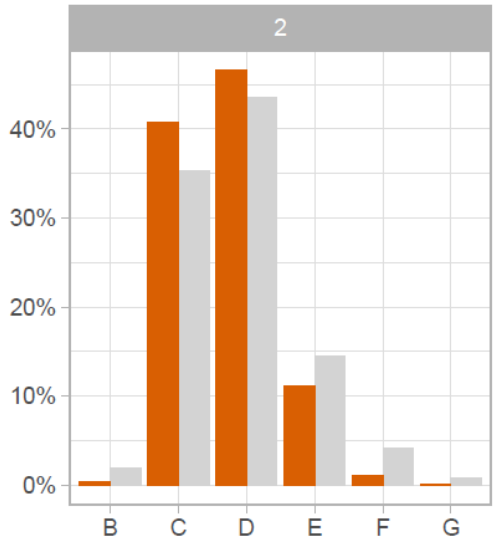
Archetype 2: Key statistics	
Number of households:	290,000
Average income	£11,600
Energy efficiency average SAP rating	64
Modelled fuel bill	£1,290
Proportion of homes in fuel poverty (10% definition)	67% (20% in extreme FP)

Archetype 2: Demographic profile	
Age profile (head of household)	Aged 16 - 35: 5% Aged 36 - 55: 12% Aged 56 - 65: 20% Aged 66 - 75: 32% Aged 75+: 31%
Household type	Single pensioner: 60% Single adult working age, no children: 24%
Economic status (head of household)	Retired: 72% Permanently sick or disabled: 10%
Proportion with a degree/professional qualification	14%
Tenure	Social landlord: 39% Owned outright: 46% Owned with mortgage: 9% Private rented: 6%
Main heating fuel of dwelling	Mains gas
Any engagement with energy market in last 12mths	24% (GB average = 40%)

Unable to keep adequately warm in winter*	17%	(Scotland average = 19%)
Long term illness or disability	42%	(Scotland average = 34%)
Considering buying an EV in the future*	24%	(Scotland average = 37%)
Use public transport for main commute	35%	(Scotland average = 18%)

Figure 2: Local authority population profile for Archetype 2.



SIMD distribution *(1 = area with most deprivation):*	**EPC profile of dwellings** *(light grey profile is for all dwellings in Scotland)*
	

Archetype 3: Switched on wealthier couples and families

Archetype 3 is a group of working age couples and families with both adults in full time employment, making this (on average) the second highest earning archetype; most have an annual net household income over £30,000 and half have a net household income over £40,000.

They are well educated, and have the highest proportion (43%) of people with a degree or equivalent and are the group most likely to consider buying an electric car in the future. Nearly all live in urban areas, in homes they own (paying mortgages), typically in the least deprived areas of cities and towns.

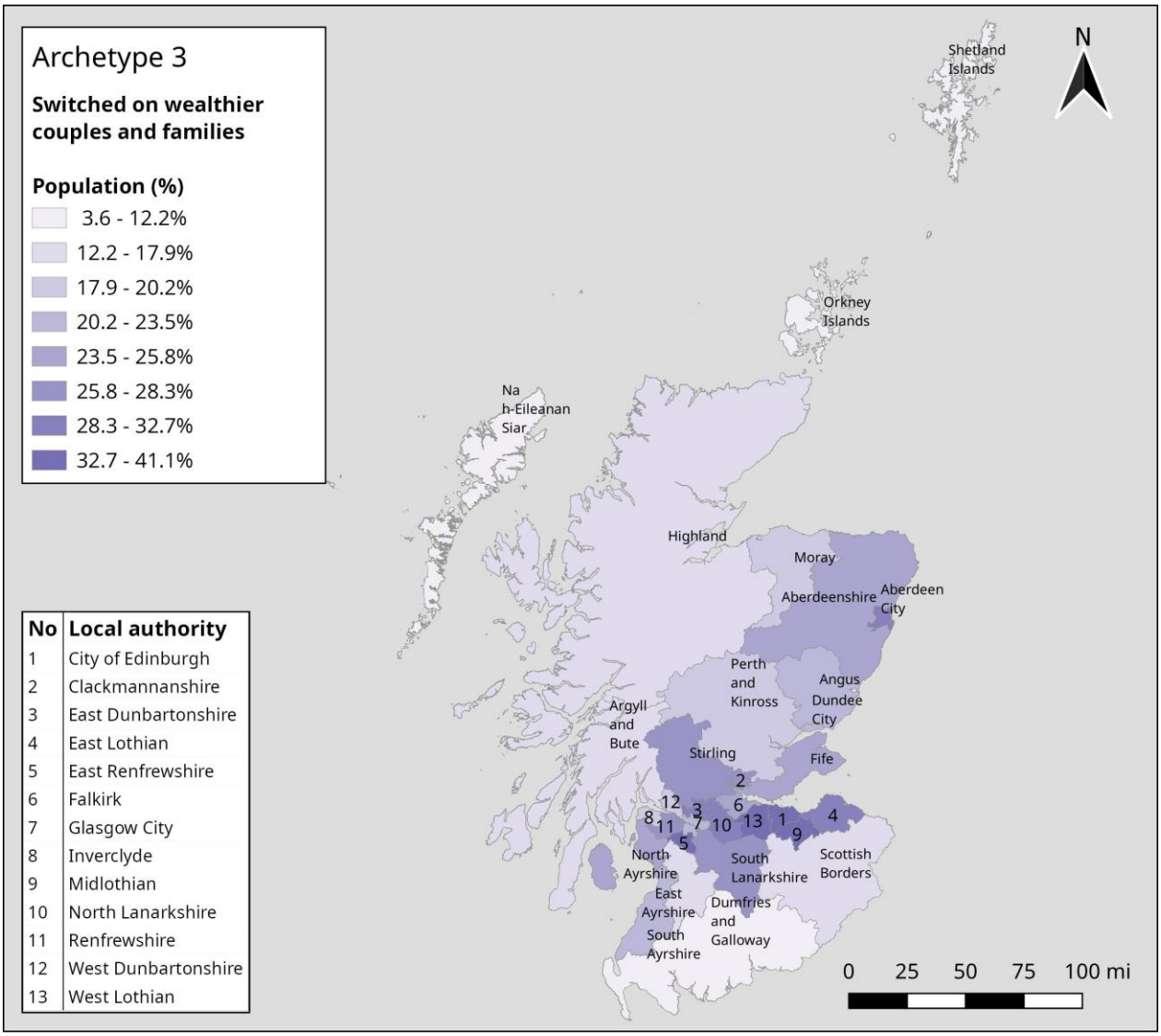
This group experience very low levels of fuel poverty (2%). Nearly all heat their homes using mains gas and their homes –which tend to be detached, semi-detached or terrace houses – are more efficient than average. They are the most engaged in the energy market, with 84% having either compared or switched their tariff in the last 12 months.

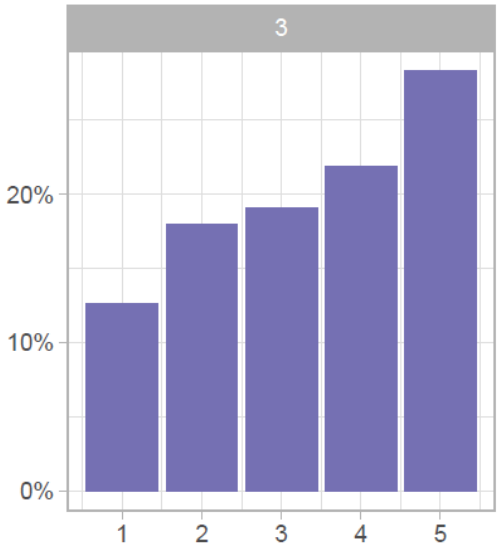
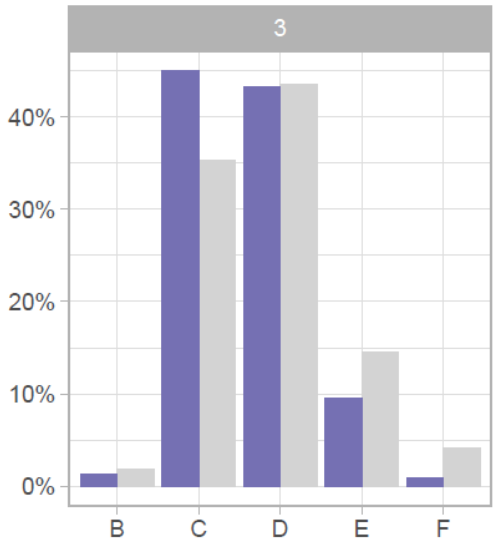
Archetype 3: Key statistics	
Number of households:	597,000
Average income	£41,700
Energy efficiency average SAP rating	66
Modelled fuel bill	£1,710
Proportion of homes in fuel poverty (10% definition)	2%

Archetype 3: Demographic profile		
Age profile (head of household)	Aged 16 - 35: 24% Aged 36 - 55: 61% Aged 56 - 65: 14% Aged 66 - 75: 1% Aged 75+: 0%	
Household type	Couple with children: 47% Couple working age, no children: 44%	
Economic status (head of household)	Employed: 97%	
Proportion with a degree/professional qualification	43%	
Tenure	Owned with mortgage: 70% Owned Outright: 13% Social landlord: 7% Private rented: 10%	
Main heating fuel of dwelling	Mains gas	
Any engagement with energy market in last 12mths	84%	(GB average = 40%)
Unable to keep adequately warm in winter*	15%	(Scotland average = 19%)
Long term illness or disability	17%	(Scotland average = 34%)

Considering buying an EV in the future*	47%	(Scotland average = 37%)
Use public transport for main commute	16%	(Scotland average = 18%)

Figure 3: Local authority population profile for Archetype 3.



SIMD distribution *(1 = area with most deprivation):*	**EPC profile of dwellings** *(light grey profile is for all dwellings in Scotland)*
	

Archetype 4: Families or younger couples in urban areas

Archetype 4 is a group of younger or working age adults or families on low to average incomes (most taking home between £10,000 and £25,000 annually). Nearly half have children in the household and most have an adult (but usually only one adult) in full time employment, although 10% are in full time education.

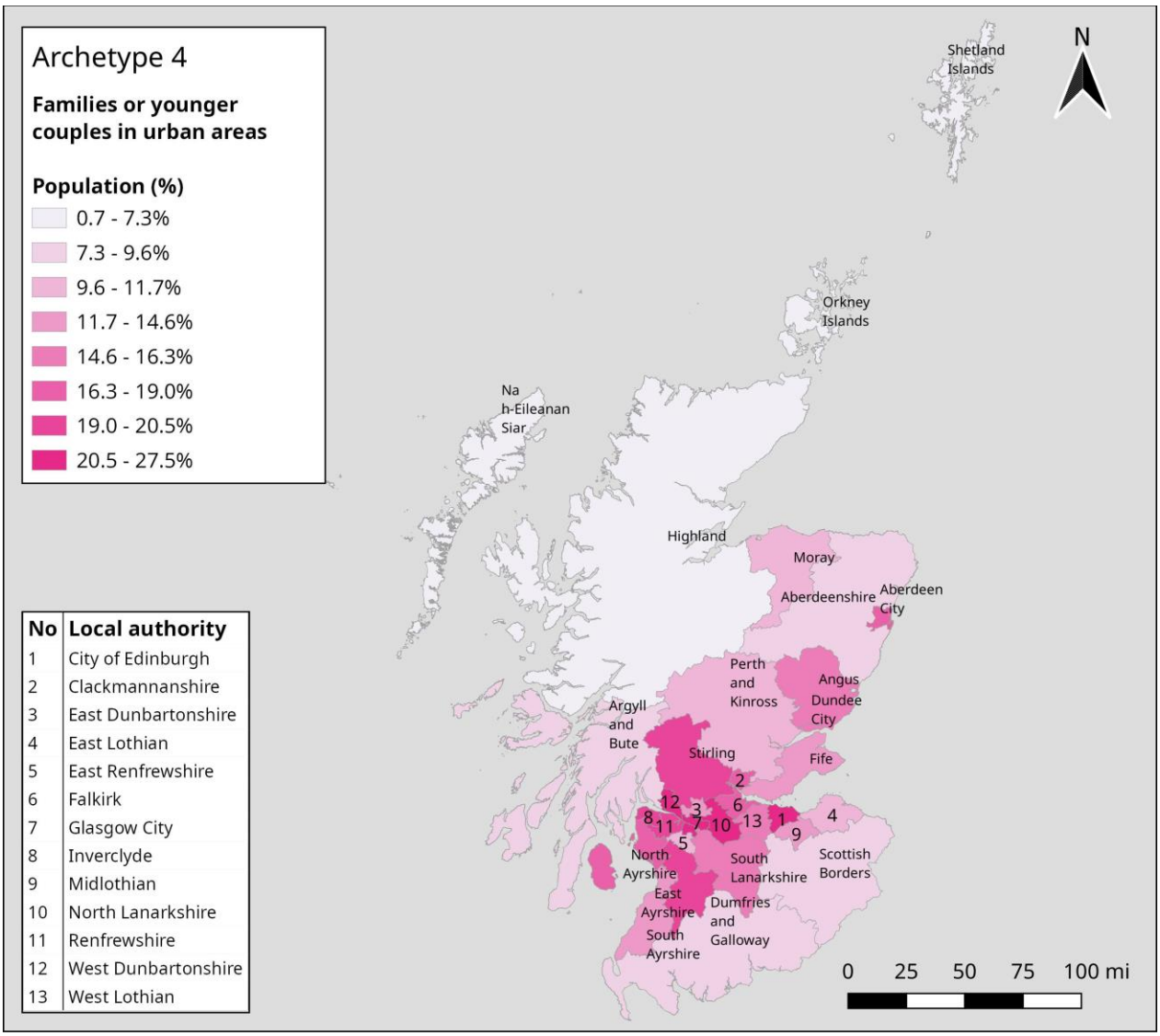
Nearly all live in urban areas, with 30% living in the most deprived SIMD neighbourhoods. Most (60%) are in private or social rented accommodation, although some are on the 'housing ladder'. Typically they live in tenements, 4-in-a-block flats or terraced houses. Their homes are more efficient than average, with low fuel costs. Around 20% are estimated to be in fuel poverty. Despite this, one-fifth report problems keeping their homes warm in winter. They are less engaged with the energy market than average, but around 40% would consider buying an electric car in the future.

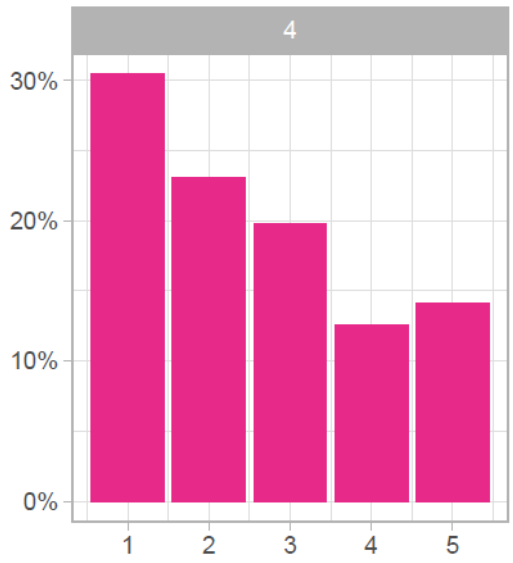
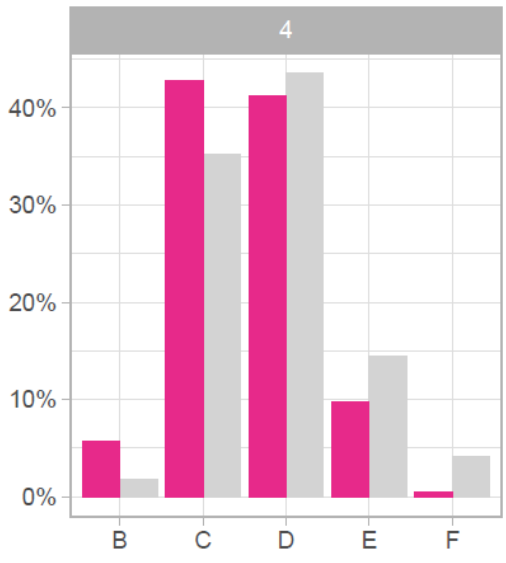
Archetype 4: Key statistics	
Number of households:	419,000
Average income	£19,400
Energy efficiency average SAP rating	67
Modelled fuel bill	£1,280
Proportion of homes in fuel poverty (10% definition)	21%

Archetype 4: Demographic profile		
Age profile (head of household)	Aged 16 - 35: 40% Aged 36 - 55: 45% Aged 56 - 65: 12% Aged 66+: 3%	
Household type	Single adult working age, no children: 40% Couple working age, no children: 26% Lone parent: 16% Couple with children: 13%	
Economic status (head of household)	Employed: 77% In fulltime education: 10%	
Proportion with a degree/professional qualification	29%	
Tenure	Social landlord: 31% Private rented: 30% Owned with mortgage: 31% Owned outright: 8%	
Main heating fuel of dwelling	Mains gas	
Any engagement with energy market in last 12mths	42%	(GB average = 40%)
Unable to keep adequately warm in winter*	21%	(Scotland average = 19%)

Long term illness or disability	7%	(Scotland average = 34%)
Considering buying an EV in the future*	39%	(Scotland average = 37%)
Use public transport for main commute	21%	(Scotland average = 18%)

Figure 4: Local authority population profile for Archetype 4.



SIMD distribution *(1 = area with most deprivation):*	**EPC profile of dwellings** *(light grey profile is for all dwellings in Scotland)*
	

Archetype 5: Wealthy rural families

This group is the highest earning archetype and live in large older rural detached or semi-detached homes, and most (83%) are home owners. The majority of this group have a net annual household income over £30,000, and over half over £40,000. Three quarters of households contain two working adults, with 16% of people being self-employed, the highest proportion of any archetype. Most of the adults (two thirds) in these households are aged between 35 and 55. Over 40% have children in the household.

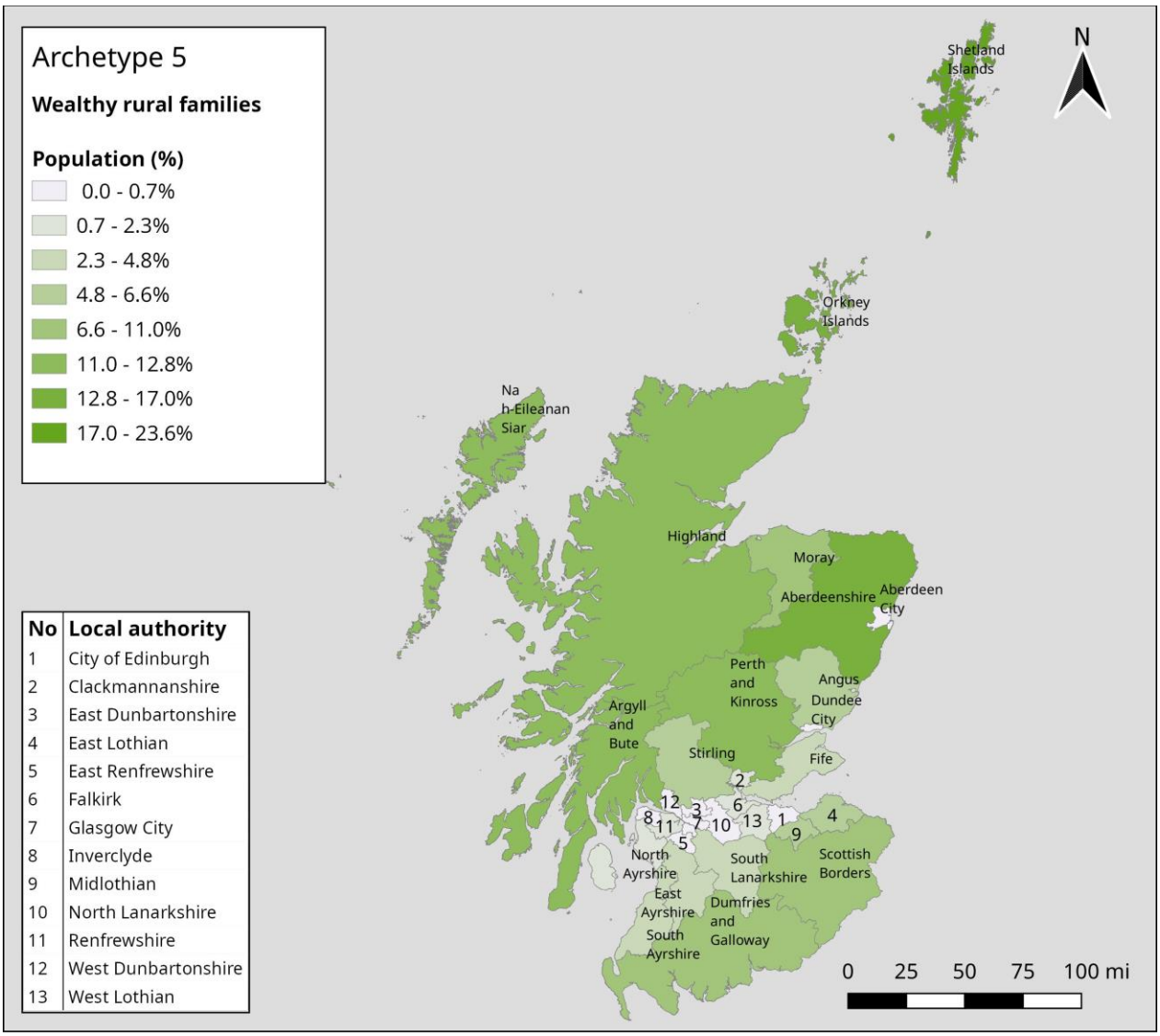
This group typically live in large inefficient older homes (40% were built before 1919). Half live in homes rated E, F or G and most are off the gas grid, using electricity, oil or LPG to heat their homes. As a result, this group have high energy costs. However, high incomes mean fuel poverty levels are low and few report problems keeping their homes warm in winter. They are well educated (41% with a degree or higher) and more engaged in the energy market than most, with over half having compared tariffs in the last year.

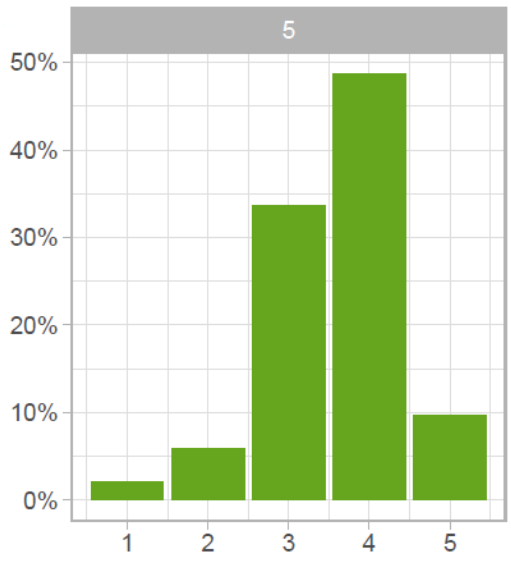
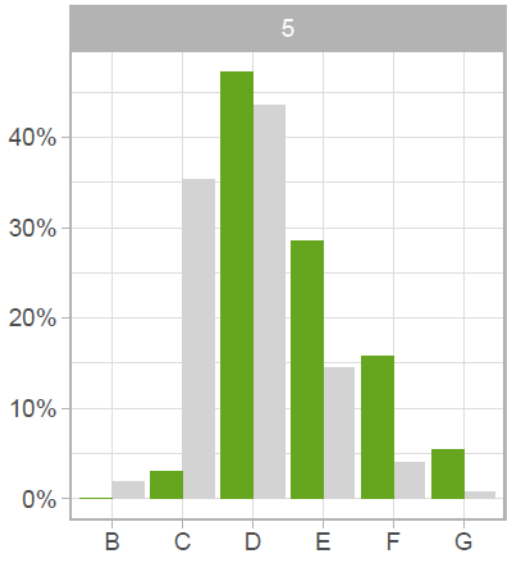
Archetype 5: Key statistics	
Number of households:	99,000
Average income	£42,400
Energy efficiency average SAP rating	51
Modelled fuel bill	£2,530
Proportion of homes in fuel poverty (10% definition)	14%

Archetype 5: Demographic profile		
Age profile (head of household)	Aged 16 - 35: 12% Aged 36 - 55: 67% Aged 56 - 65: 19% Aged 66 - 75: 2% Aged 75+: 1%	
Household type	Couple with children: 41% Couple working age, no children: 44%	
Economic status (head of household)	Employed: 97%	
Proportion with a degree/professional qualification	41%	
Tenure	Owned with mortgage: 66% Owned outright: 18% Social landlord: 1% Private rented: 15%	
Main heating fuel of dwelling	Oil or LPG	
Any engagement with energy market in last 12mths	55%	(GB average = 40%)
Unable to keep adequately warm in winter*	19%	(Scotland average = 19%)

Long term illness or disability	21%	(Scotland average = 34%)
Considering buying an EV in the future*	34%	(Scotland average = 37%)
Use public transport for main commute	9%	(Scotland average = 18%)

Figure 5: Local authority population profile for Archetype 5.



SIMD distribution *(1 = area with most deprivation):*	**EPC profile of dwellings** *(light grey profile is for all dwellings in Scotland)*
	

Archetype 6: Older urban couples who own their homes outright

Archetype 6 represents a set of older working age or retired couples on reasonable incomes, living in urban houses they own outright, in some of the least deprived neighbourhoods. More than 60% are over 65 and two-fifths have long term health conditions. This group have the highest rates of home ownership with nearly 90% owning their detached, semi-detached or terraced houses outright - and thus have low housing costs.

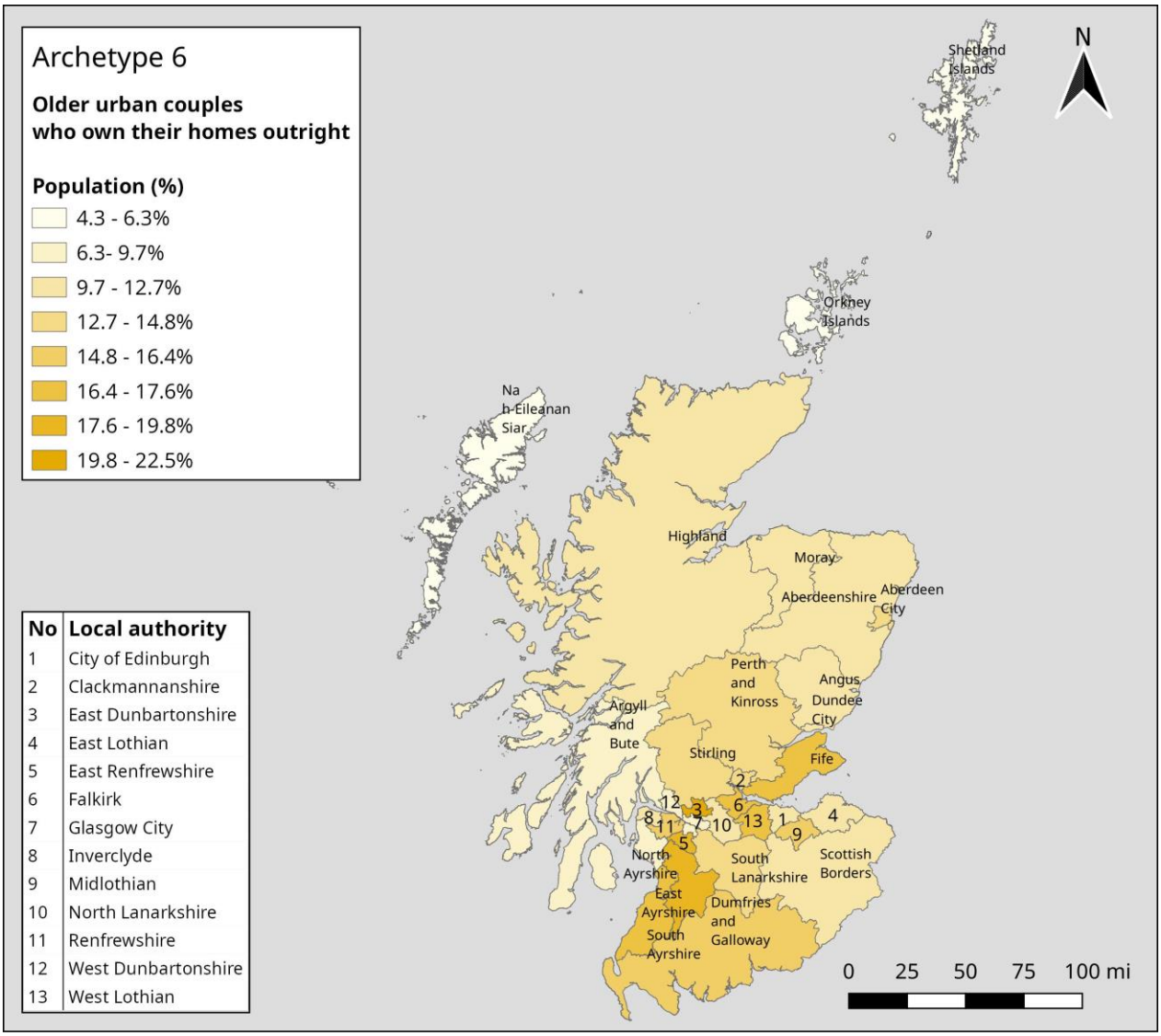
Being mostly urban, homes are typically heated with mains gas and most are rated in EPC bands D or above. However, these homes are generally larger than average and thus have higher heating costs, in turn meaning that they have higher than average rates of fuel poverty. However, this group experience the least problems keeping their home warm in winter. Unlike other largely retired archetypes, they also have high levels of engagement in the energy market, with over 60% having compared or switched tariff in the previous year.

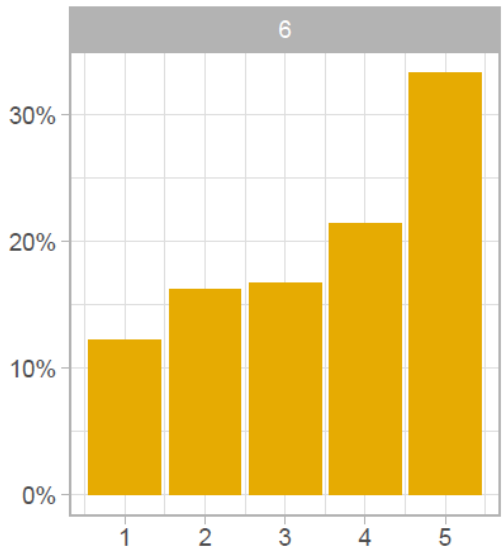
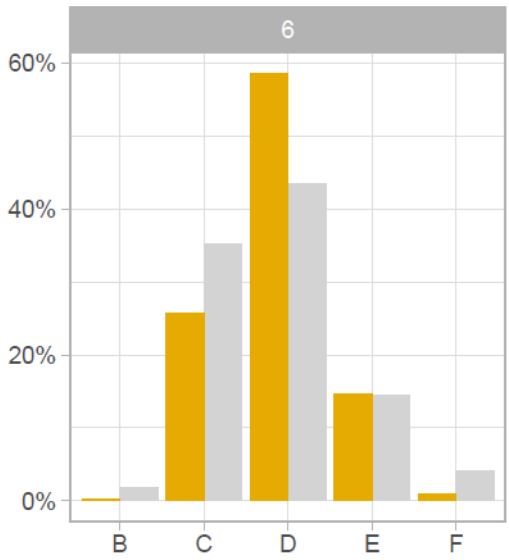
Archetype 6: Key statistics	
Number of households:	321,000
Average income	£25,100
Energy efficiency average SAP rating	63
Modelled fuel bill	£1,760
Proportion of homes in fuel poverty (10% definition)	36%

Archetype 6: Demographic profile		
Age profile (head of household)	Aged 16 - 35: 1% Aged 36 - 55: 9% Aged 56 - 65: 28% Aged 66 - 75: 41% Aged 75+: 22%	
Household type	Pensioner couple: 61% Couple working age, no children: 25%	
Economic status (head of household)	Employed: 27% Retired: 69%	
Proportion with a degree/professional qualification	29%	
Tenure	Owned Outright: 86% Owned with mortgage: 6% Social landlord: 6% Private rented: 2%	
Main heating fuel of dwelling	Mains gas	
Any engagement with energy market in last 12mths	63%	(GB average = 40%)
Unable to keep adequately warm in winter*	11%	(Scotland average = 19%)
Long term illness or disability	44%	(Scotland average = 34%)

Considering buying an EV in the future*	32%	(Scotland average = 37%)
Use public transport for main commute	18%	(Scotland average = 18%)

Figure 6: Local authority population profile for Archetype 6.



SIMD distribution *(1 = area with most deprivation):*	**EPC profile of dwellings** *(light grey profile is for all dwellings in Scotland)*
	

Archetype 7: Urban social renters with long-term health problems

Archetype 7 is a group of working age adults, most of whom are unable to work due to health conditions or pensioners. They predominantly live in social housing in more deprived urban areas. Two thirds are working age but only one-fifth 20% are in work, with over 90% having a long-term health condition. The low levels of employment mean that this group are on lower than average incomes. There are also very low numbers of people with a degree qualification (10%). This group has the lowest rates of home ownership, with over 60% live in social housing and living mostly in flats or terraces. However, some pensioners in the group own their homes outright.

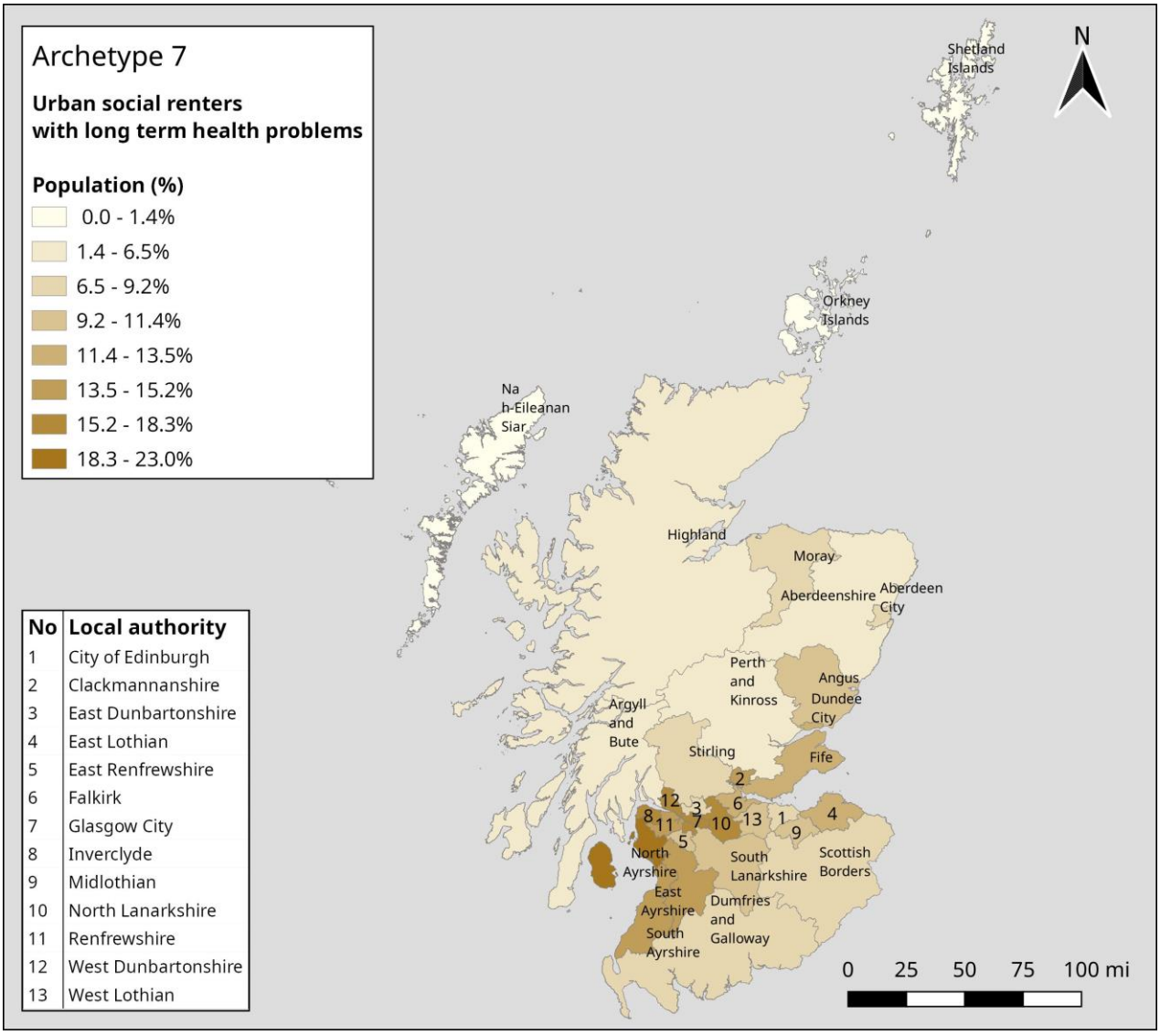
Homes are more efficient that average, with most heated by mains gas, and rates of fuel poverty are lower than average. However, approximately a quarter report problems keeping their homes warm in winter and the group has low levels of engagement with the energy market. This group also has the highest rate of pre-payment meters (PPM), with over 20% using PPMs for electricity, gas or both.

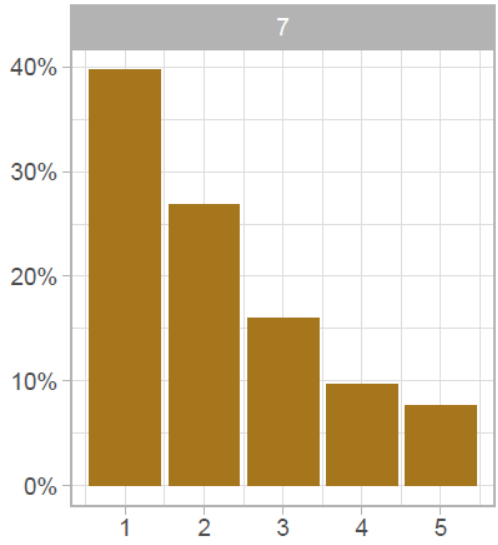
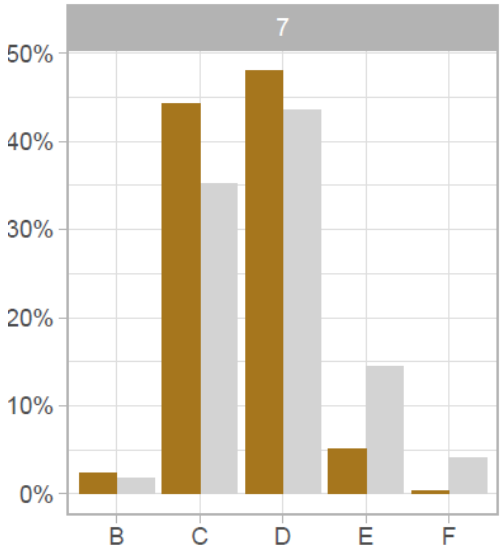
Archetype 7: Key statistics	
Number of households:	285,000
Average income	£17,400
Energy efficiency average SAP rating	67
Modelled fuel bill	£1,230
Proportion of homes in fuel poverty (10% definition)	26%

Archetype 7: Demographic profile		
Age profile (head of household)	Aged 36 - 55: 34% Aged 56 - 65: 22% Aged 66 - 75: 19% Aged 75+: 14%	
Household type	Single adult working age, no children: 26% Couple working age, no children: 21% Single pensioner: 20% Pensioner couple: 15%	
Economic status (head of household)	Retired: 37% Permanently sick or disabled: 27% Employed: 21%	
Proportion with a degree/professional qualification	10%	
Tenure	Social landlord: 63% Owned Outright: 21% Owned with mortgage: 6% Private rented: 9%	
Main heating fuel of dwelling	Mains gas	
Any engagement with energy market in last 12mths	25%	(GB average = 40%)

Unable to keep adequately warm in winter*	24%	(Scotland average = 19%)
Long term illness or disability	92%	(Scotland average = 34%)
Considering buying an EV in the future*	26%	(Scotland average = 37%)
Use public transport for main commute	29%	(Scotland average = 18%)

Figure 7: Local authority population profile for Archetype 7



SIMD distribution *(1 = area with most deprivation):*	**EPC profile of dwellings** *(light grey profile is for all dwellings in Scotland)*
	

Archetype 8: Rural, less affluent older adult households

This archetype is predominantly comprised of older couples, in retirement or towards the end of their careers on low to middle incomes, living in the least efficient rural homes. Over half are over 65 and retired and over 40% have long term health conditions. These are adult-only households whose children have already left home, or whom have never had children.

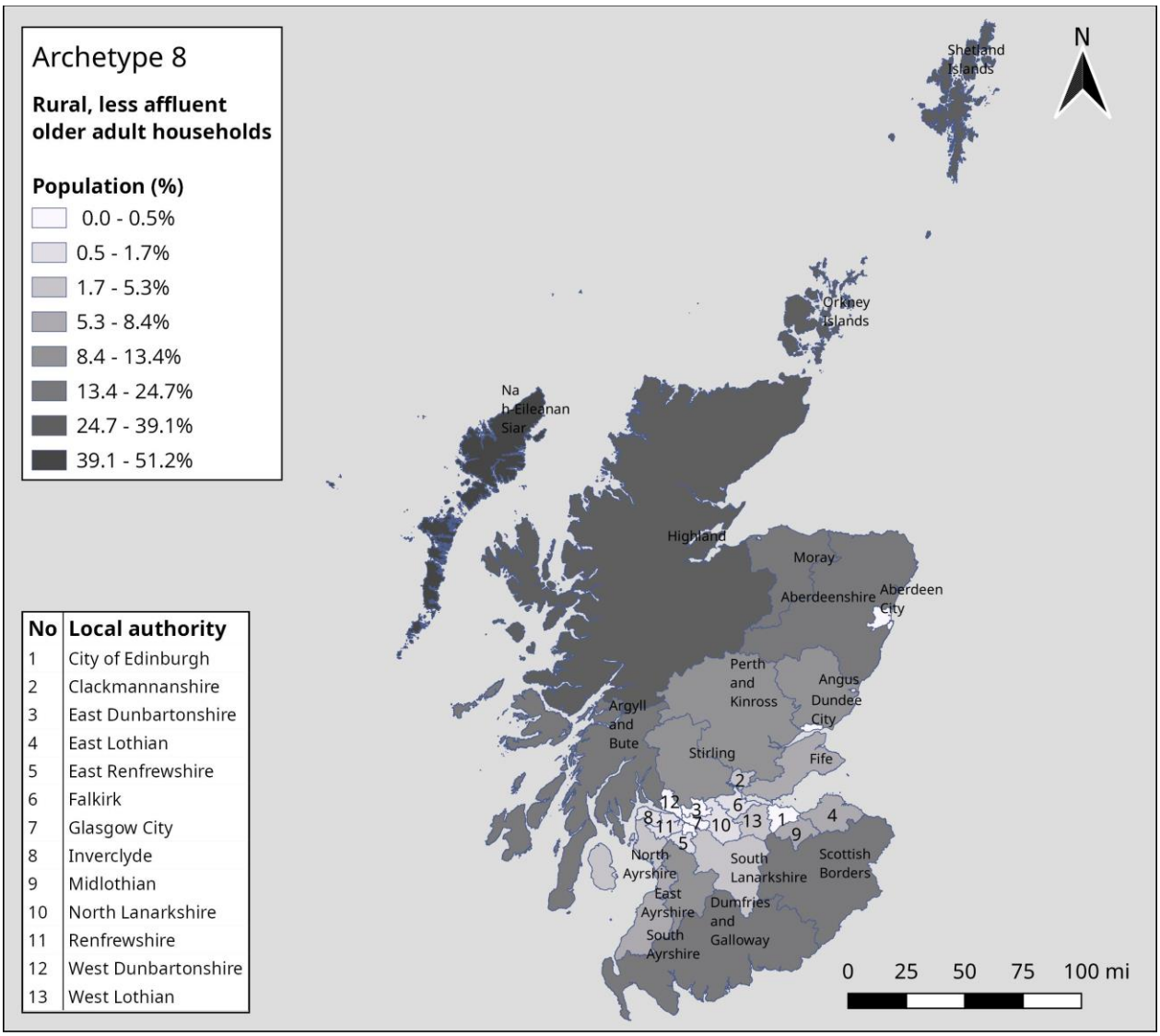
This group have high levels of home ownership, over 70% owning their homes outright, but these homes are some of the least efficient, with 65% rated in EPC bands E, F or G and many built before 1919. Less than a quarter use mains gas, with most heating their homes with oil or LPG. As a result this group suffers from high levels of fuel poverty (60%) with 24% of households in extreme fuel poverty. Levels of engagement in the energy market are low. However, the proportion of households reporting problems keeping their home warm in winter is similar to the national average.

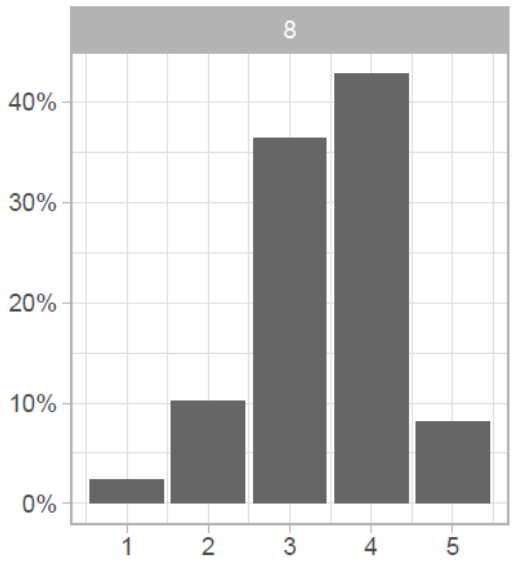
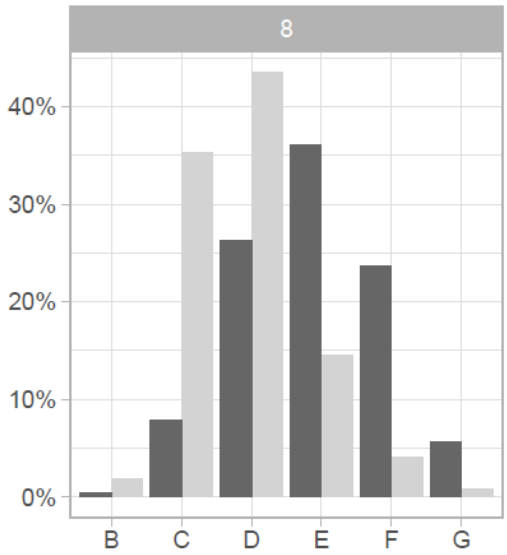
Archetype 8: Key statistics	
Number of households:	175,000
Average income	£22,800
Energy efficiency average SAP rating	47
Modelled fuel bill	£2,490
Proportion of homes in fuel poverty (10% definition)	60%

Archetype 8: Demographic profile		
Age profile (head of household)	Aged 16 - 35: 3% Aged 36 - 55: 19% Aged 56 - 65: 26% Aged 66 - 75: 32% Aged 75+: 20%	
Household type	Pensioner couple: 35% Couple working age, no children: 23% Single adult working age, no children: 14% Single pensioner: 22%	
Economic status (head of household)	Retired: 57% Employed: 37%	
Proportion with a degree/professional qualification	33%	
Tenure	Owned Outright: 72% Owned with mortgage: 7% Private rented: 15% Social landlord: 6%	
Main heating fuel of dwelling	Oil, LPG or coal	
Any engagement with energy market in last 12 mths	30%	(GB average = 40%)
Unable to keep adequately warm in winter*	18%	(Scotland average = 19%)

Long term illness or disability	30%	(Scotland average = 34%)
Considering buying an EV in the future*	28%	(Scotland average = 37%)
Use public transport for main commute	6%	(Scotland average = 18%)

Figure 8: Local authority population profile for Archetype 8



SIMD distribution *(1 = area with most deprivation):*	**EPC profile of dwellings** *(light grey profile is for all dwellings in Scotland)*
	

Annex A: Recommendations for using the consumer archetypes

Table 2: Summary guidelines for using the Scottish Energy Consumer Archetypes

The Scottish Energy Consumer Archetypes should be used to	The Scottish Energy Consumer Archetypes should NOT be used
• Gain a better and more detailed understanding different types of energy consumers across Scotland • Enhance insight regarding the experiences, needs and expectations these groups have in relation to energy • Consider different drivers that may exist across the population to engage in or interact with energy-related policies • Consider how policies may be better designed to reflect different needs, requirements or behaviour of different types of households • Enable a more nuanced approach that caters for different types of energy consumers when promoting the benefits of smarter domestic energy applications and systems	• As a main policy targeting tool or the primary source of information when designing detailed eligibility criteria • To identify distinct or complex vulnerabilities across the population • To simplify the needs of the population to the common characteristics for each archetype • (Or conversely) to assume that all households in each group experience the same situations or necessarily have the same needs.

The archetypes presented in this report have been derived from surveys that include detailed socio-demographic information on population and characteristics of dwellings in Scotland. The key objective of this work was to segment this representative data set into distinct consumer or household archetypes. A concurrent consideration during the analysis was to ensure that households were categorised using characteristics that enable users to recognise and identify different energy consumers in the 'real world'.

The resulting archetypes presented in the main report serve as a tool that enables users to take a more detailed review of different consumer issues across the energy sector. In particular, it is intended that the archetypes will help enhance understanding of the different experiences and needs of different energy consumers, the different drivers that may exist for households to engage in energy related policies, and enable a more considered and nuanced approach to policy design and promotion of energy technologies.

However, it should be recognised that the descriptions of the archetypes presented here represent the most typical characteristics, predominant features or average statistics (e.g. household income) across all households in these groups. Within groups there exists a degree of variation in these characteristics and statistics, and when considering individual households within a particular archetype. Furthermore, segmenting the population into eight archetypes has resulted in group sizes varying between 100,000 and 600,000 households. It should be noted that grouping households together in archetypes of this size will not always

reveal the multitude of vulnerable situations and circumstances that different households can experience.

It is clear that different archetypes presented here have differing levels of certain vulnerabilities (e.g. higher rates of long-term health conditions or being on very low incomes), and that some archetypes are more likely to be disadvantaged than others. However, it was never the objective of this exercise to present a detailed profile of different and multiple vulnerabilities and the extent to which these predominate across the population. This is not done so here and as a result this is not a tool which enables users to examine complex vulnerabilities with relation to energy. It should also be recognised that vulnerabilities can exist in all households and that these vulnerabilities can vary significantly in both magnitude and severity.

The archetypes themselves are intended to be used to understand how different policies may impact on a selection of different types of households and energy consumers. They may be used to investigate existing or proposed policy designs or to help rebalance any policies which have been identified as unintentionally overlooking or disadvantaging certain households. However, for the reasons mentioned above, they are not intended to be used as the main source of information when considering policy design. For example, they are not intended to be used as the main tool to accurately identify or locate vulnerable households or to design detailed eligibility criteria for policies. Once this has been done the archetypes can be used to consider what distributional impacts may have when considering each of these archetypes.

Annex B: Methodology

A process diagram summarising the approach used to derive the archetypes is provided overleaf in Figure 9. Further detail is provided below.

The archetypes were produced from a data set that was compiled from the following surveys:

- Scottish Housing Condition Survey (2014 - 16)
- Scottish Household Survey (2014 - 16)
- Ofgem Consumer Segmentation (2017).

A three year combined dataset of approximately 8,300 records was generated from SHCS survey data from 2014, 2015 and 2016, including a three-year survey weight field. This was supplemented by joining fields from the SHS for the same survey years; every record in the three year SHCS survey was matched to a corresponding SHS record. Alongside this, a reliable energy market engagement model was successfully derived using the Ofgem Consumer Segmentation data and then trained on the combined SHCS/SHS data set to add a field that specified whether households had engaged in the energy market in the last 12 months (by comparing tariffs, switching tariffs or switching energy supplier).

A set of complete fields from this derived dataset were then shortlisted for inclusion in the segmentation approach. This took into account the findings from a review of existing energy segmentation tools and from discussions with key stakeholders (presented in the accompanying ClimateXChange report: *Domestic energy consumer types – Review of existing segmentation approaches*). These findings help shortlist the most significant and important characteristics that should be included when deriving Scottish consumer segments. This information was then cross-referenced with the data set to ensure that fields containing this information were complete and the data was in a suitable format and structure for inclusion in the segmentation approach.

To produce a set of energy consumer archetypes, a hierarchical clustering method was used to separate the households in the SHS/SHCS data set into a distinct set of 'clusters' or archetypes. The clustering was performed in R software using the *hclust* package[6], and using Ward's hierarchical clustering method.[7] This approach was selected as it allows for both categorical and numerical fields to be included in the segmentation and is a method that produces dense clusters of similar sizes (i.e. similar number of households), with fewer outliers. It also allows for different fields to be allocated different weightings to enhance or diminish how significant these are in the clustering.

A guiding principle of the segmentation was to aim to develop between six and eight consumer types. Another key focus was to ensure that across the final consumer types it was possible to identify different vulnerable situations in the population, as well as taking account of the key household characteristics, dwelling details, energy-related information and the geography of Scotland. An iterative process was used to deriving a final set of consumer types, including adding in or removing different fields in the SHCS/SHS data set and applying different weightings to these fields in clustering function. The final list of fields use to generate the set of consumer types and the associated weightings applied are provided in Table 3 below.

[6] https://stat.ethz.ch/R-manual/R-devel/library/stats/html/hclust.html
[7] https://arxiv.org/pdf/1111.6285.pdf

Figure 9: Methodology process diagram for generating Scottish energy consumer archetypes

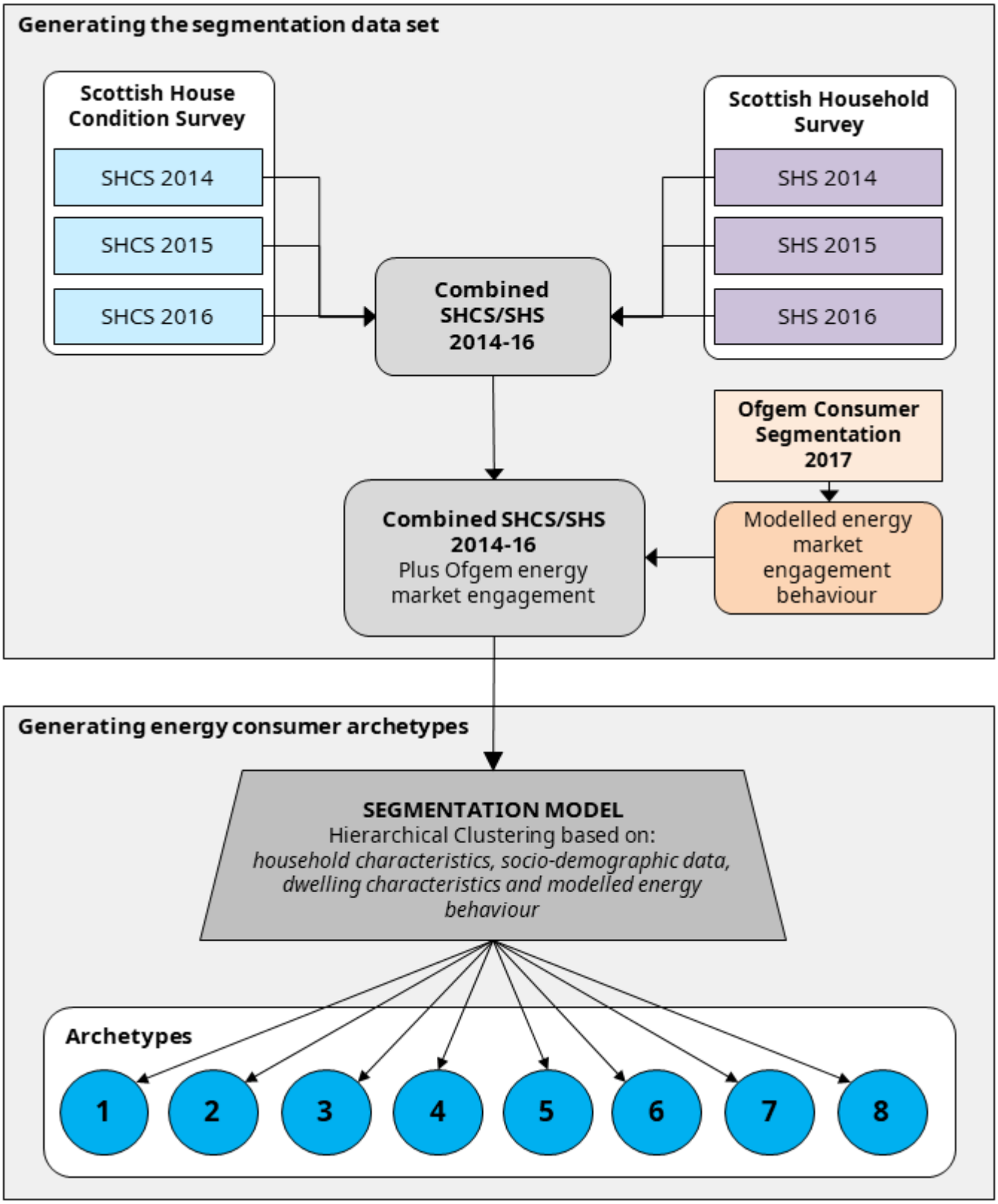


Table 3: Fields and weightings used in the segmentation analysis

Field	Segmentation weighting
Net household income	2.5
Rurality	2.1
EPC band of dwelling	2.0
Long-term health condition or illness in household	2.0
Prepayment meter flag (some missing entries)	2.0
Tenure	2.0
Type of dwelling	2.0
Main heating fuel	1.5
Age of dwelling	1.0
Age of highest earner in household	1.0
Annual energy consumption (BRE)	1.0
Annual fuel costs (BRE)	1.0
Economic status of highest earner in household	1.0
Fuel poverty status of household	1.0
Household working status	1.0
Main heating system	1.0
Number of adults	1.0
Number of children	1.0
Sex of highest earner in household	1.0
Total floor area of dwelling	1.0
Type of household	1.0
Households struggling to stay warm in winter	0.5
Engagement in the energy market in the last 12 months	0.4