North Ayrshire Council

Local Heat and Energy Efficiency Strategy 2024-29 Appendix document

North Ayrshire Council
Comhairle Siorrachd Àir a Tuath

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Appendix A Analysis by Intermediate Zone

In this section the data is analysed by Intermediate Zone. This analysis informed the decision to use Localities as Strategic Zones and Data Zones as Delivery Areas. This section is therefore included for information only and is reported according to LHEES guidance.

Domestic Energy Efficiency

The Home Analytics tool calculates a weighted energy efficiency score, which takes the frequency of 3 metrics, (low loft insulation thickness, a lack of wall insulation and a lack of double / triple-glazing) across the building stock in a zone, and weights them (by default, each is equally weighted) and then sums the 3 values to get a total energy efficiency score. A high score equates to poor energy efficiency in aggregate across the zone.

Table 21 ranks the top 12 intermediate zones on overall weighted score for energy efficiency. The maximum possible score (i.e., if every home in the zone had no loft or wall insulation and single glazing) is 100. It is also notable that the handful of zones with high scores (Figure 56, which shows each Zone's total weighted score and indicates, by colour intensity, the number of properties in that Zone) are considerably higher than the average weighted score of all zones.

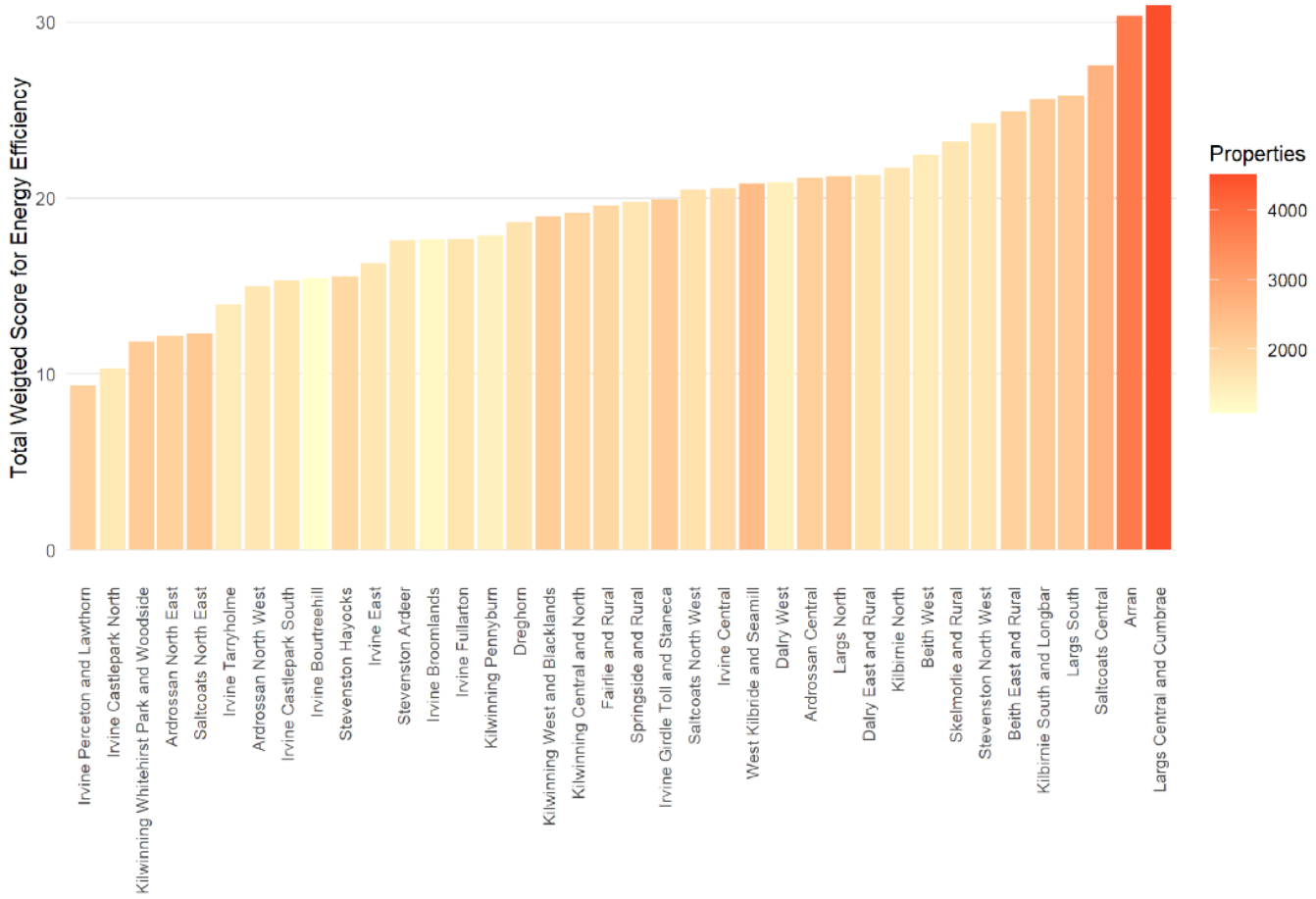
Wall insulation applies to more properties than other interventions with the number of houses requiring walls to be insulated ranging from 49% to 72% in these 12 zones (compare to 5 % to 21 % for loft insulation).

Table 21: Domestic Energy Efficiency – IZ Ranking by Highest Weighted Score.

Zones with highest total weighted score		Total weighted score	Number of potential interventions identified	Number of properties in zone
1	Largs Central and Cumbrae	31	4,201	4,501
2	Arran	30	3,453	3,778
3	Saltcoats Central	28	2,238	2,699
4	Largs South	26	1,707	2,193
5	Kilbirnie South and Longbar	26	1,683	2,177
6	Beith East and Rural	25	1,525	2,030
7	Stevenston North West	24	1,163	1,590
8	Skelmorlie and Rural	23	1,143	1,632
9	Beith West	22	1,020	1,502
10	Kilbirnie North	22	1,065	1,626
11	Dalry East and Rural	21	1,071	1,665
12	Largs North	21	1,412	2,206

There are a total of 38 zones. A further 4 zones have a score of 21.

Figure 56: Weighted Energy Efficiency Scores by IZ



Domestic Fuel Poverty

The Home Analytics tool was used to calculate a weighted fuel poverty score, which takes the frequency of 5 metrics, (low loft insulation thickness, a lack of wall insulation, a lack of double / triple-glazing, number of households in fuel poverty and the number of households in extreme poverty) across the building stock in a zone and weights them (by default, the construction parameters are weighted 16.7%, with fuel poverty at 50% and extreme poverty effectively removed by a weighting of zero) and then sums the 5 values to get a total fuel poverty score. A high score equates to extensive fuel poverty as a result of poor energy efficiency across the zone.

An alternative weighting using extreme fuel poverty at 50% weighting was used for comparison and it was found that none of the top 10 zones changed by more than one ranking place.

This measure is intended to highlight homes where energy efficiency improvements could reduce fuel poverty and is not an outright measure of fuel poverty.

The 12 zones with the highest weighted score are shown in Table 22. As with energy efficiency, there are a few zones which standout as having significantly greater potential for energy efficiency to reduce fuel poverty (Figure 57).

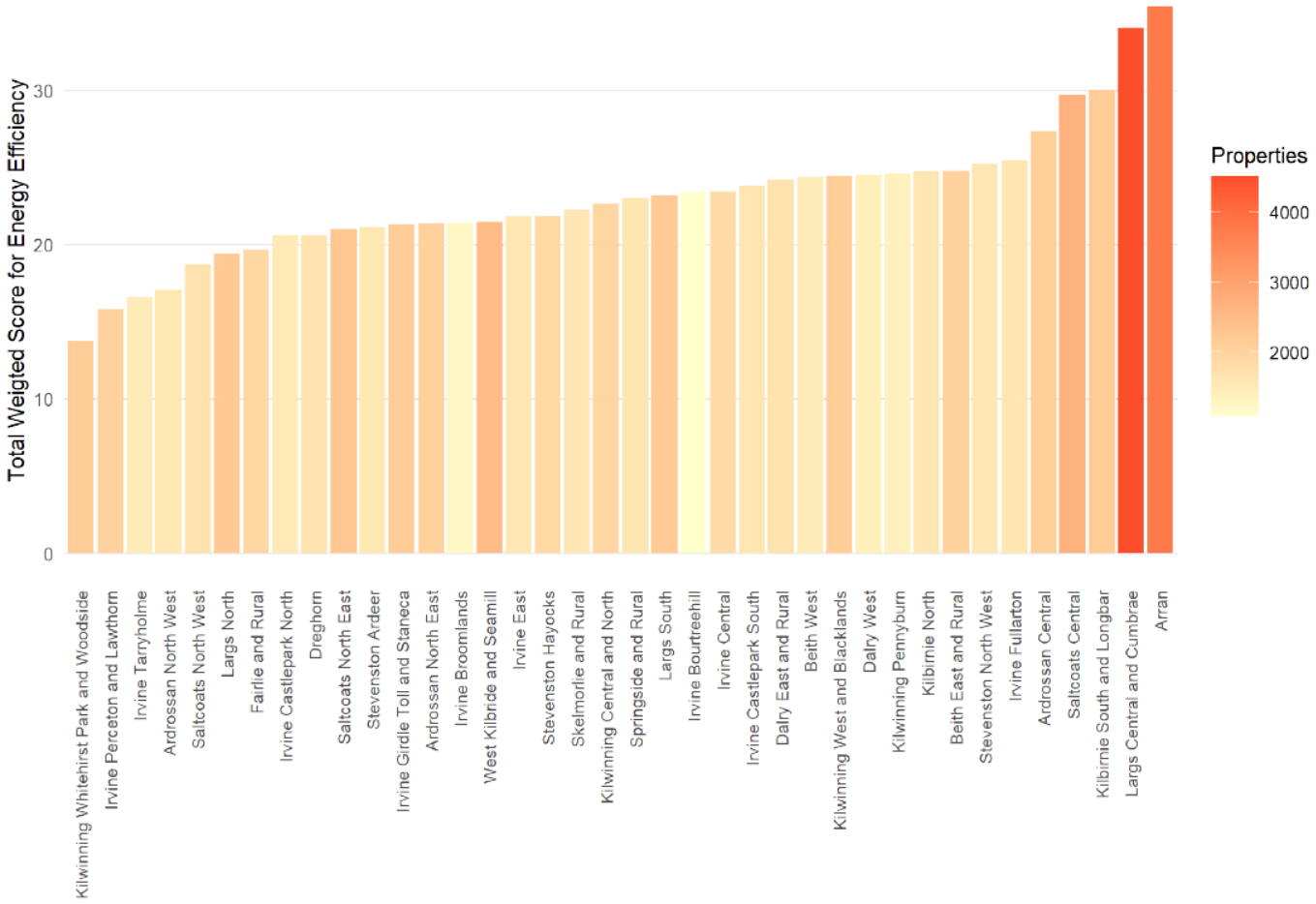
It is worth noting the limitations of this methodology to determine energy efficiency as a driver for fuel poverty. It provides average figures for an area which may not allow areas of highest risk to be identified if there are lower risk properties in the same area. Further analysis is included in the Section 11.

Table 22: Domestic Fuel Poverty Resulting from Poor Energy Efficiency – IZ Ranking by Highest Score(Default Weightings)

Zones with highest total weighted score		Total weighted score	Number of properties in zone
1	Arran	35	3,778
2	Largs Central and Cumbrae	34	4,501
3	Kilbirnie South and Longbar	30	2,177
4	Saltcoats Central	30	2,699
5	Ardrossan Central	27	2,084
6	Irvine Fullarton	25	1,637
7	Stevenston North West	25	1,590
8	Beith East and Rural	25	2,030
9	Kilbirnie North	25	1,626
10	Kilwinning Pennyburn	25	1,373
11	Dalry West	25	1,421
12	Kilwinning West and Blacklands	24	2,126

There are a total of 38 zones. A further 3 zones have a score of 24.

Figure 57: Weighted Scores for Fuel Poverty Resulting From Poor Energy Efficiency by IZ



Domestic Buildings and the Gas Grid

Being on or off the existing gas grid are Considerations within the LHEES process. The Home Analytics Data shows which type of heating fuel is used, including mains gas. Of the properties which do not use mains gas for heating (considered to be off-gas), there are more properties using direct electrical heating than boilers.

Table 23 details the heating systems associated with domestic properties on and off the gas grid. Almost all the on-grid homes have boilers and, physical situation aside, are likely to be able to be connected to heat networks or heat pumps. However, given the energy efficiency status and age of the housing stock (Figure 8), it is likely that interventions to reduce heat losses and adjust heating systems to operate at lower temperatures will be required to allow heat pump installations to operate effectively in places where there are unlikely to be heat networks.

Table 23: Domestic Heating Systems On and Off the Gas Grid

Heating System	On Grid Count	On Grid Percentage	Off Grid Count	Off Grid Percentage
Communal	563	1%	145	1 %
Heat pump	87	<1%	524	5 %
Boiler	59,990	96%	3,841	38 %
Room heater	602	1%	1,177	12 %
Storage heater	1,004	2%	4,382	43 %
Other or none	208	<1%	127	1 %

Communal heating systems refer to a heating system which provides heat to multiple properties within the same building.

Appendix B Analysis by DataZone

Domestic Energy Efficiency

This section allows initial targeting data zones for loft, window, and wall energy efficiency measure improvements. Due to the large number of data zones, the top third of zones are listed here for each consideration. Wall insulation has the largest number of potential interventions. Taking into account other LHEES considerations such as conservation areas and listed buildings will help identify how appropriate measures may by, but a case-by-case suitability check is still required. A reasonable number of dwellings could still have loft insulation and glazing upgrades to improve their energy efficiency.

The ranked Total Weighted Scores for energy efficiency are given for all Data Zones in Table 24.

Table 24: Energy Efficiency in Data Zones

Data Zone	0-99 mm Loft Insulation	Single Glazed windows	Uninsulated (all construction types) Walls	Number of potential interventions identified	Total Weighted Score	Ranking
Northern and Irvine Valley Rural – 05	50%	0%	100%	3	50	1
Arran – 04	39%	12%	73%	491	41	2
Irvine Central – 03	19%	28%	65%	519	37	3
Largs Central and Cumbrae – 06	18%	8%	85%	1339	37	4
Stevenston North West – 02	27%	7%	75%	238	36	5
Largs Central and Cumbrae – 07	24%	9%	76%	763	36	6
Arran – 06	24%	8%	75%	569	36	7
Saltcoats Central – 05	21%	9%	76%	744	35	8
Largs Central and Cumbrae – 05	15%	14%	74%	861	34	9
Arran – 03	25%	6%	70%	423	34	10
Saltcoats North West – 05	27%	7%	62%	422	32	11
Largs Central and Cumbrae – 04	10%	6%	80%	704	32	12
Kilwinning Pennyburn – 02	27%	1%	67%	280	32	13
Ardrossan Central – 03	5%	24%	65%	500	31	14
Beith East and Rural – 01	22%	15%	57%	385	31	15
Skelmorlie and Rural – 01	17%	10%	66%	361	31	16
Dalry East and Rural – 01	15%	5%	72%	228	31	17
Saltcoats Central – 03	14%	15%	62%	519	30	18
Saltcoats Central – 04	13%	13%	63%	612	30	19
Arran – 02	21%	6%	61%	536	29	20
Arran - 07	13%	11%	63%	563	29	21
Largs South – 02	7%	6%	75%	585	29	22
Skelmorlie and Rural – 04	12%	12%	62%	315	29	23

Data Zone	0-99 mm Loft Insulation	Single Glazed windows	Uninsulated (all construction types) Walls	Number of potential interventions identified	Total Weighted Score	Ranking
Saltcoats North West – 06	15%	10%	62%	325	29	24
West Kilbride and Seamill - 03	13%	7%	66%	409	29	25
Kilbirnie South and Longbar - 05	14%	9%	63%	501	28	26
Springside and Rural - 02	13%	24%	48%	235	28	27
Beith East and Rural - 05	16%	5%	64%	457	28	28
Fairlie and Rural - 03	8%	5%	69%	337	28	29
Largs North - 01	16%	6%	61%	505	27	30
Kilbirnie South and Longbar - 01	14%	14%	54%	394	27	31
Stevenston Ardeer - 04	14%	8%	58%	280	27	32
Kilbirnie South and Longbar - 02	7%	38%	37%	330	27	33
Arran - 01	14%	6%	60%	612	27	34
Beith East and Rural - 02	8%	5%	66%	227	26	35
Dreghorn - 04	21%	11%	45%	239	26	36
Irvine Girdle Toll and Staneca - 05	2%	8%	68%	288	26	37
Dalry East and Rural - 03	8%	7%	63%	284	26	38
Fairlie and Rural - 04	8%	8%	62%	331	26	39
Springside and Rural - 05	18%	3%	56%	275	26	40
Largs Central and Cumbrae - 03	12%	8%	57%	218	25	41
Kilbirnie North - 03	16%	22%	38%	229	25	42
Beith West - 03	11%	9%	56%	222	25	43
Largs South - 03	14%	6%	55%	329	25	44
Irvine Girdle Toll and Staneca - 06	10%	7%	58%	182	25	45
Largs North - 05	5%	2%	68%	363	25	46
Dreghorn - 03	11%	3%	60%	282	25	47
Beith West - 02	1%	5%	69%	293	25	48
Kilbirnie North - 04	15%	9%	50%	306	25	49
Stevenston North West - 03	10%	13%	51%	226	25	50
Fairlie and Rural - 02	10%	5%	60%	240	24	51
West Kilbride and Seamill - 02	7%	7%	58%	384	24	52
Largs South - 04	15%	5%	53%	257	24	53
Largs South - 05	11%	12%	49%	193	24	54
Stevenston North West - 04	10%	10%	51%	311	24	55
Largs South - 01	7%	4%	59%	323	23	56
Kilwinning Central and	9%	15%	46%	384	23	57

Data Zone	0-99 mm Loft Insulation	Single Glazed windows	Uninsulated (all construction types) Walls	Number of potential interventions identified	Total Weighted Score	Ranking
North – 01						
Irvine Fullarton - 01	6%	20%	43%	230	23	58
West Kilbride and Seamill - 04	11%	4%	53%	378	23	59
Irvine Girdle Toll and Staneca - 04	4%	5%	60%	275	23	60
Beith West - 04	5%	9%	56%	260	23	61
Largs North - 02	12%	7%	50%	227	23	62

Domestic Fuel Poverty

The ranked Total Weighted Scores for fuel poverty resulting from poor energy efficiency are given for all Data Zones in Table 25.

Table 25: Fuel Poverty Weighted Scores in Data Zones

Data Zone	0-99mm Loft insulation	Single glazed windows	Uninsulated Walls (all construction types	Households in fuel poverty (fuel bill >10% of income after housing	Households in extreme fuel poverty (fuel bill >20% of income after housing)	Total Weighted Score
Largs Central and Cumbrae - 06	18%	8%	85%	56%	59%	46
Arran - 04	39%	12%	73%	46%	62%	43
Largs Central and Cumbrae - 07	24%	9%	76%	43%	58%	39
Northern and Irvine Valley Rural - 05	50%	0%	100%	21%	0%	35
Arran - 07	13%	11%	63%	41%	47%	35
Arran - 06	24%	8%	75%	34%	39%	35
Arran - 03	25%	6%	70%	35%	41%	34
Ardrossan Central - 03	5%	24%	65%	37%	18%	34
Arran - 02	21%	6%	61%	38%	42%	33
Arran - 01	14%	6%	60%	40%	48%	33
Arran - 05	12%	8%	40%	46%	47%	33
Largs Central and Cumbrae - 05	15%	14%	74%	31%	18%	32
Kilwinning Pennyburn - 02	27%	1%	67%	33%	15%	32
Kilbirnie South and Longbar - 02	7%	38%	37%	38%	16%	32
Saltcoats Central - 04	13%	13%	63%	35%	19%	32
Kilbirnie South and Longbar - 03	4%	31%	33%	41%	22%	32

Data Zone	0-99mm Loft insulation	Single glazed windows	Uninsulated Walls (all construction types	Households in fuel poverty (fuel bill >10% of income after housing	Households in extreme fuel poverty (fuel bill >20% of income after housing)	Total Weighted Score
Largs Central and Cumbrae - 04	10%	6%	80%	32%	17%	32
Saltcoats Central - 03	14%	15%	62%	34%	15%	32
Irvine Central - 03	19%	28%	65%	27%	10%	32
Saltcoats Central - 05	21%	9%	76%	28%	9%	31
Kilbirnie South and Longbar - 01	14%	14%	54%	35%	13%	31
Beith East and Rural - 01	22%	15%	57%	31%	12%	31
Kilbirnie North - 03	16%	22%	38%	35%	16%	30
Stevenston North West - 02	27%	7%	75%	25%	8%	30
Springside and Rural - 02	13%	24%	48%	32%	12%	30
Kilbirnie South and Longbar - 05	14%	9%	63%	32%	11%	30
Kilwinning West and Blacklands - 04	6%	30%	31%	35%	16%	29
Dalry West - 02	7%	2%	58%	35%	10%	28
Irvine Fullarton - 02	4%	8%	31%	42%	29%	28
Kilwinning Central and North - 01	9%	15%	46%	33%	12%	28
Irvine Castlepark South - 01	7%	29%	26%	35%	19%	28
Stevenston North West - 04	10%	10%	51%	33%	15%	28
Beith West - 04	5%	9%	56%	33%	14%	28
Skelmorlie and Rural - 01	17%	10%	66%	25%	8%	27
Dreghorn - 04	21%	11%	45%	29%	10%	27
Ardrossan Central - 02	4%	17%	32%	37%	20%	27
Ardrossan North East - 04	6%	17%	30%	37%	16%	27
Saltcoats Central - 02	5%	8%	43%	36%	19%	27
Springside and Rural - 03	8%	12%	38%	35%	15%	27

Data Zone	0-99mm Loft insulation	Single glazed windows	Uninsulated Walls (all construction types	Households in fuel poverty (fuel bill >10% of income after housing	Households in extreme fuel poverty (fuel bill >20% of income after housing)	Total Weighted Score
Stevenston Ardeer - 04	14%	8%	58%	27%	6%	27
Stevenston Ardeer - 03	10%	8%	50%	31%	15%	27
West Kilbride and Seamill - 03	13%	7%	66%	25%	5%	26
Dalry East and Rural - 01	15%	5%	72%	23%	4%	26
Kilbirnie North - 04	15%	9%	50%	29%	10%	26
Kilbirnie North - 02	4%	21%	34%	33%	11%	26
Saltcoats North West - 05	27%	7%	62%	21%	2%	26
Dalry East and Rural - 04	10%	3%	51%	31%	11%	26
Irvine Central - 01	13%	5%	47%	31%	11%	26
Skelmorlie and Rural - 03	7%	4%	52%	32%	10%	26
Dalry West - 03	9%	28%	21%	33%	11%	26
Irvine Fullarton - 03	6%	7%	42%	34%	13%	26
Largs South - 02	7%	6%	75%	23%	3%	26
Beith East and Rural - 05	16%	5%	64%	24%	7%	26
Irvine Bourtreehill - 01	5%	4%	42%	34%	12%	25
Irvine Fullarton - 01	6%	20%	43%	28%	13%	25
Beith East and Rural - 02	8%	5%	66%	25%	6%	25
Fairlie and Rural - 04	8%	8%	62%	25%	6%	25
Kilbirnie South and Longbar - 04	7%	2%	54%	30%	8%	25
Stevenston North West - 03	10%	13%	51%	26%	10%	25
Largs South - 05	11%	12%	49%	27%	7%	25
Irvine Bourtreehill - 03	8%	2%	41%	33%	15%	25
Kilwinning West and Blacklands - 03	13%	2%	50%	29%	7%	25

Conservation Areas

The delivery area maps of conservation areas show a high concentration in Cumbrae as well as in some urban centres such as Irvine. See Figure 58, Figure 59 and Figure 60. Delivery areas with significant properties in conservation areas indicates that there will be more properties in that area with additional planning requirements. Buildings within conservation areas may face an increased cost for installation of energy efficiency measures or heat pumps and may even be prevented from installing glazing upgrades and external wall insulation.

Figure 58: Map of Buildings in Conservation Areas – Data Zone Level

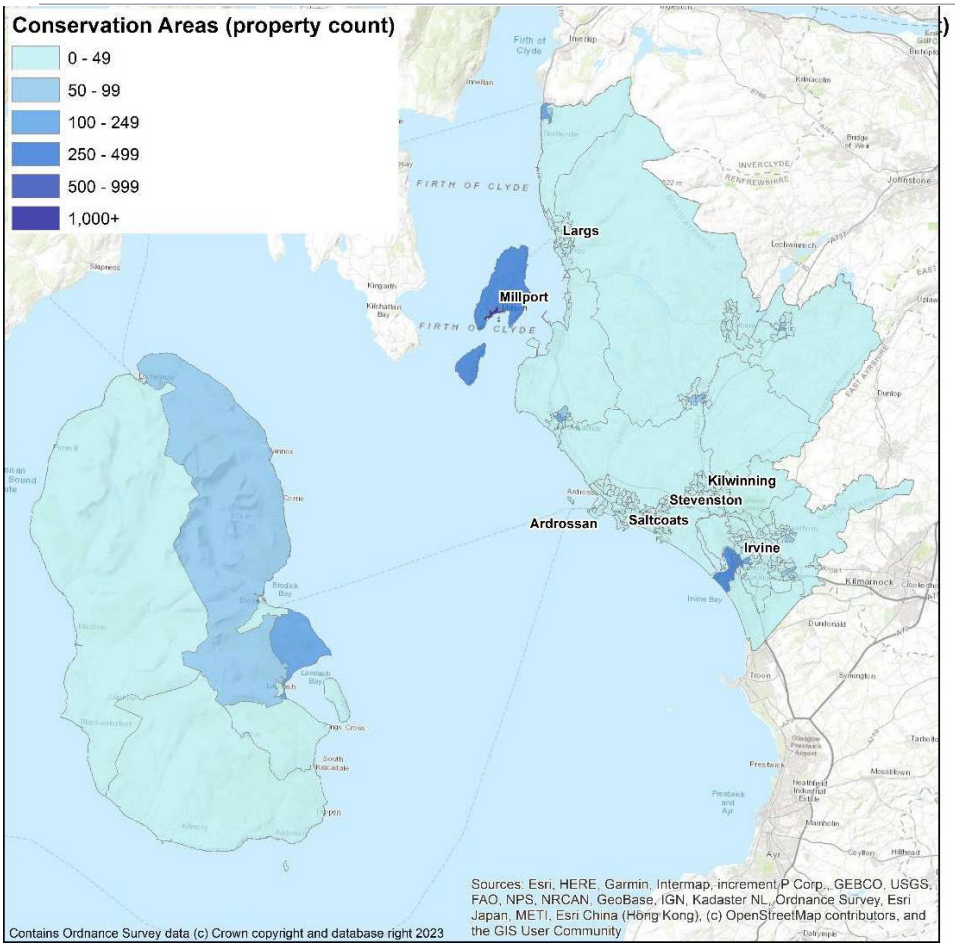


Figure 59: Map of Buildings in Conservation Areas – Data Zone Level: Detail 1

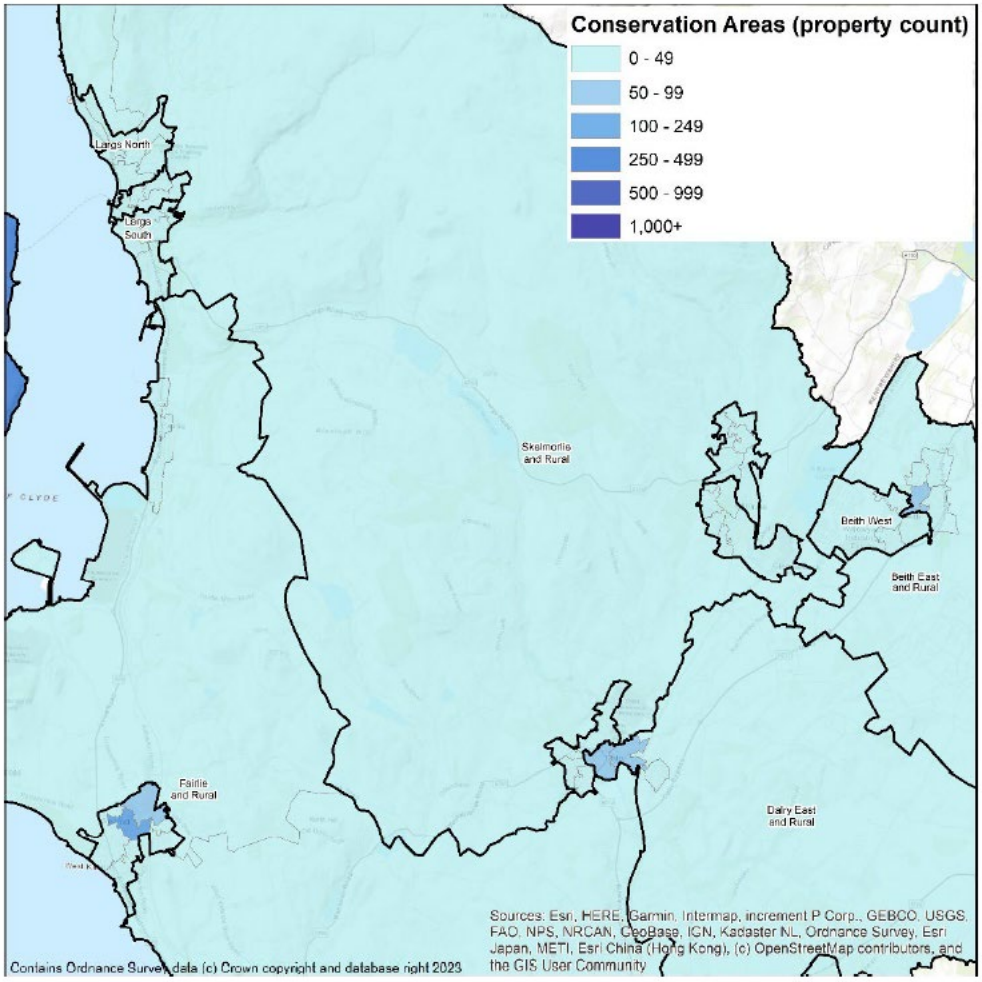
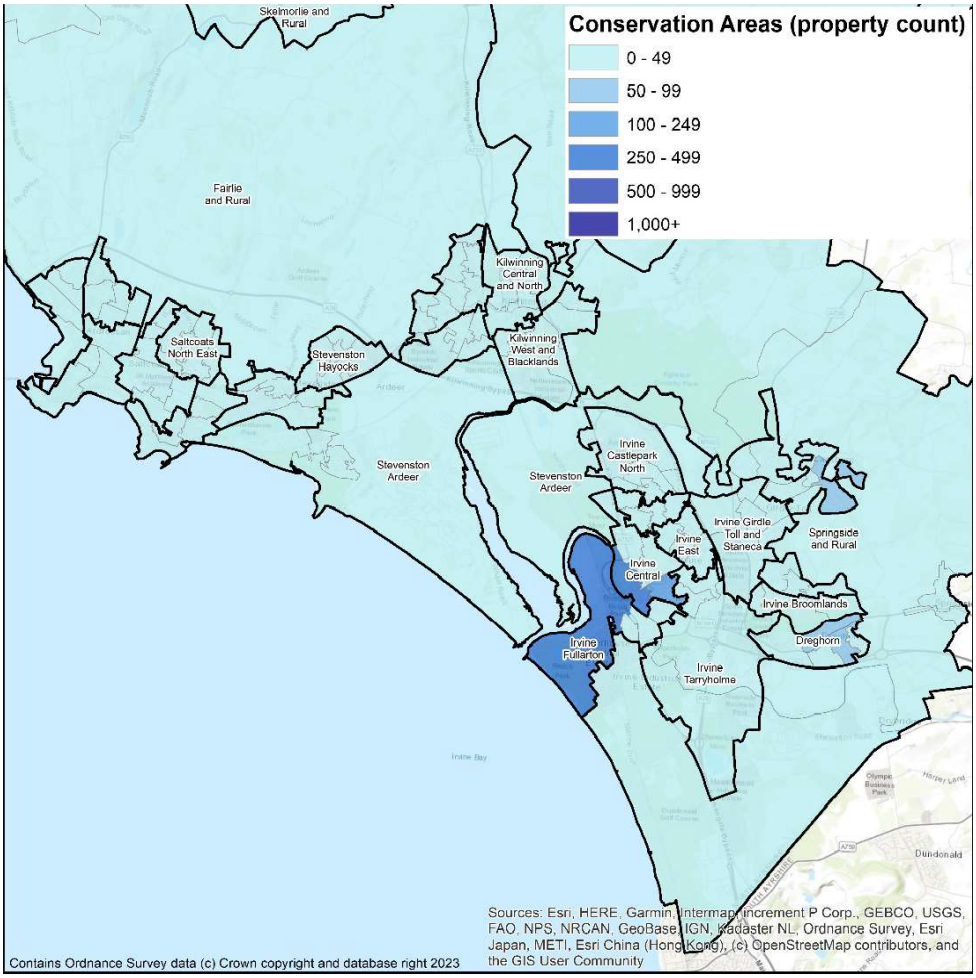


Figure 60: Map of Buildings in Conservation Areas – Data Zone Level: Detail 2



The data zones which contain the highest number of properties within conservation areas, are shown in Figure 61 and Table 27. There are only 26 zones which have conservation areas. There is evidently a large number in Cumbrae as well as Irvine. There is a moderate amount in other areas such as Arran, Skelmorlie and Rural and West Kilbride and Seamill.

Figure 61: Histogram of Properties in Conservation Area – Data Zone Level

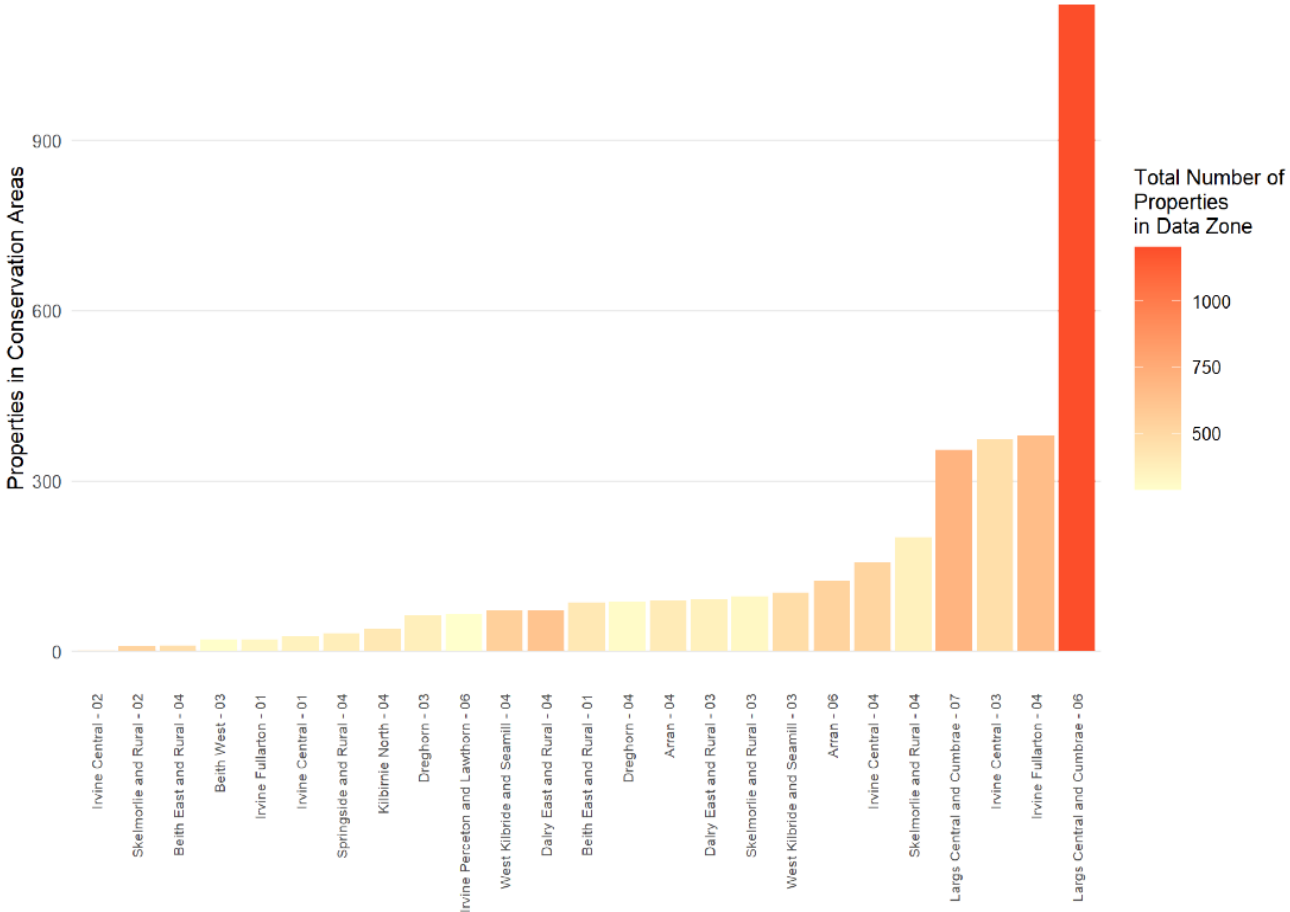


Table 26: Conservation areas – Data zones

Ranking	Zones with highest count of properties located within a conservation area	Number of properties within a conservation area
1	Largs Central and Cumbrae - 06	1,139
2	Irvine Fullarton - 04	379
3	Irvine Central - 03	373
4	Largs Central and Cumbrae - 07	354
5	Skelmorlie and Rural - 04	201
6	Irvine Central - 04	156
7	Arran - 06	124
8	West Kilbride and Seamill - 03	103
9	Skelmorlie and Rural - 03	97
10	Dalry East and Rural - 03	91
11	Arran - 04	89
12	Dreghorn - 04	87
13	Beith East and Rural - 01	86
14	Dalry East and Rural - 04	72
15	West Kilbride and Seamill - 04	72
16	Irvine Perceton and Lawthorn - 06	65
17	Dreghorn - 03	63
18	Kilbirnie North - 04	40
19	Springside and Rural - 04	31
20	Irvine Central - 01	27
21	Irvine Fullarton - 01	21
22	Beith West - 03	21
23	Beith East and Rural - 04	10
24	Skelmorlie and Rural - 02	8
25	Irvine Central - 02	2

It will be important therefore to consider the boundaries of the conservation areas as part of building level analysis. This analysis is based at data zone level. It may be more useful to determine if individual buildings are in conservation areas as the boundaries of these zones do not always align with data zones and this will result in more accurate determination of actions for each delivery area. The more detailed next steps for interventions within conservations areas will require a specialised working group that can highlight more detailed

conservation area boundaries, building locations and building suitability to interventions depending on conservation area requirements.

Listed Buildings

The dispersion of listed buildings by each delivery area is shown in Figure 62, Figure 63, Figure 64 and Figure 65. There are higher concentrations of these properties on Arran and Cumbrae as well as in urban areas such as Ardrossan and Irvine. However, there are listed properties throughout much of the authority area. Therefore, interventions to target listed buildings are not going to be confined to specific geographical areas and it is important to consider the listed buildings as part of planning of interventions in all areas. As with conservation areas, using individual property records will be important to determine the number of listed buildings in an area where an intervention is planned. Listed buildings will present unique challenges with retrofitting building energy efficiency measures as well as any potential renewable heat implementation project. This will potentially require additional costs and planning permissions. This issue should be considered when delivery areas are identified.

Figure 62: Map of Listed Buildings – Data Zone Level

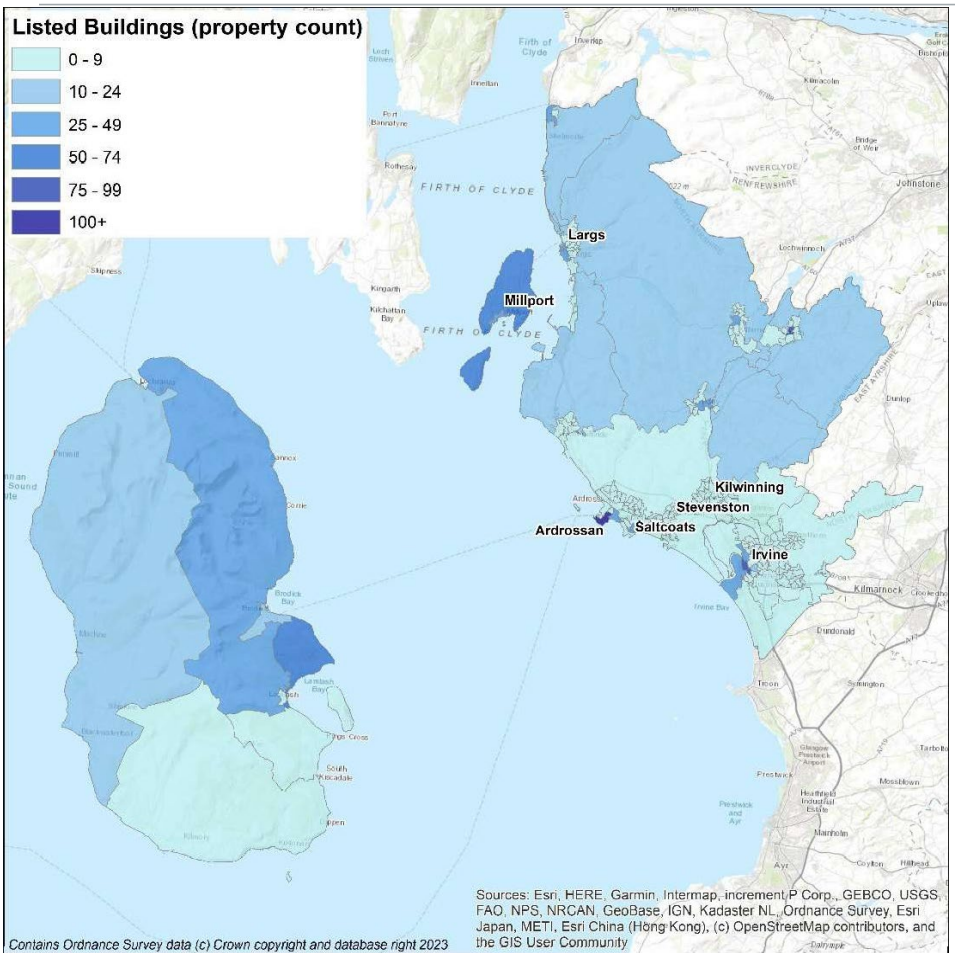


Figure 63: Map of Listed Buildings – Data Zone Level: Detail 1

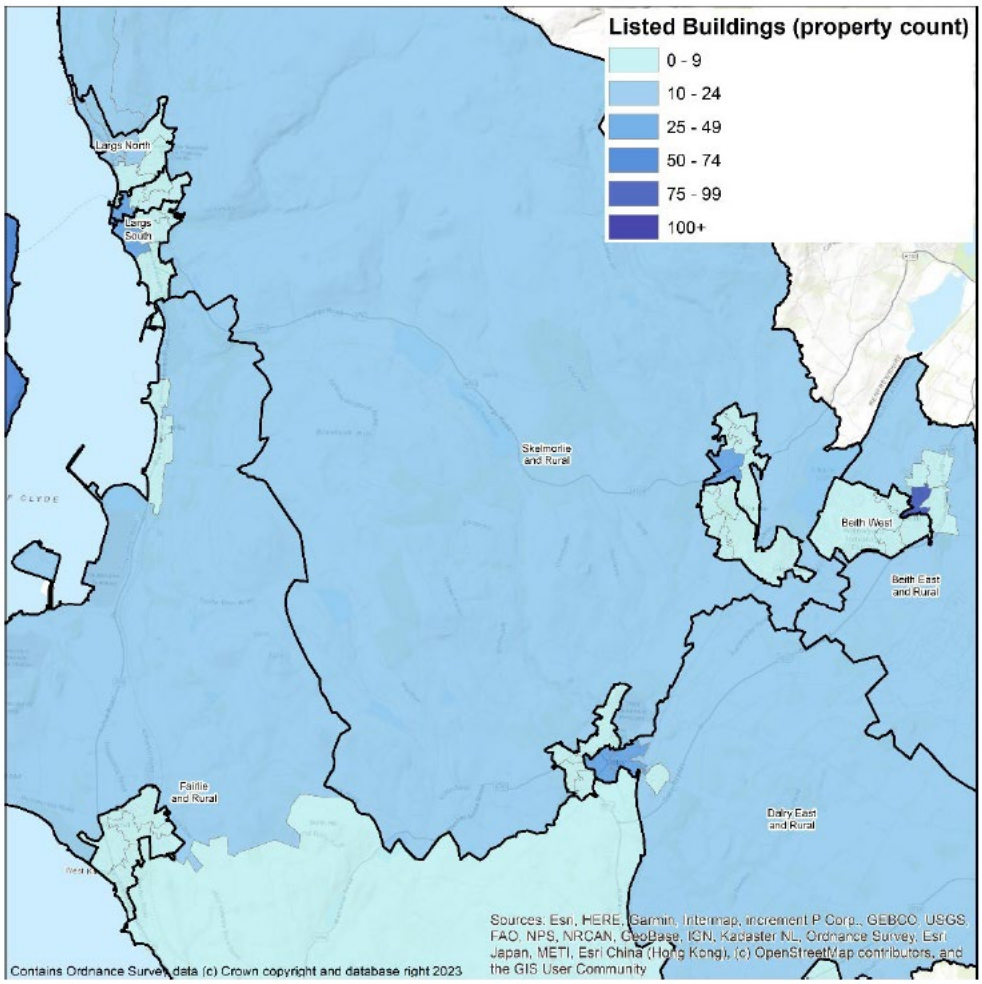


Figure 64: Map of Listed Buildings – Data Zone Level Detail 2

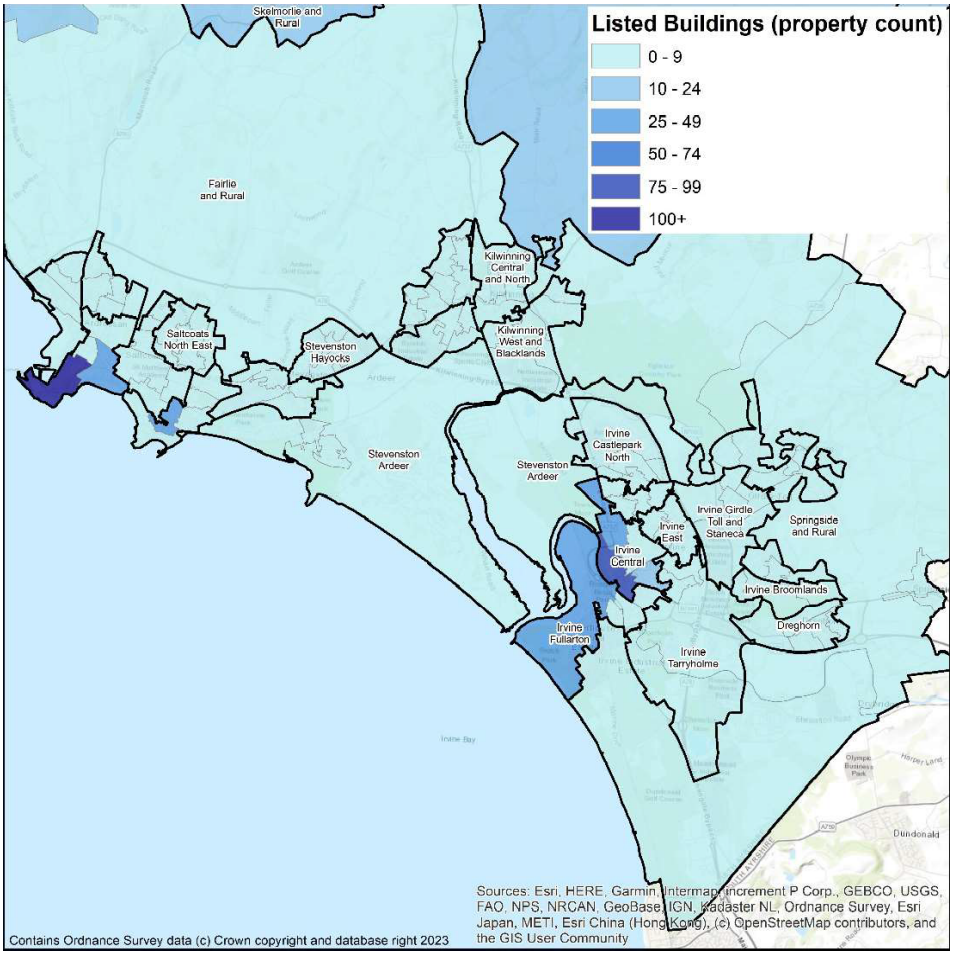


Figure 65: Histogram of Number of Listed Properties: Data Zone Level

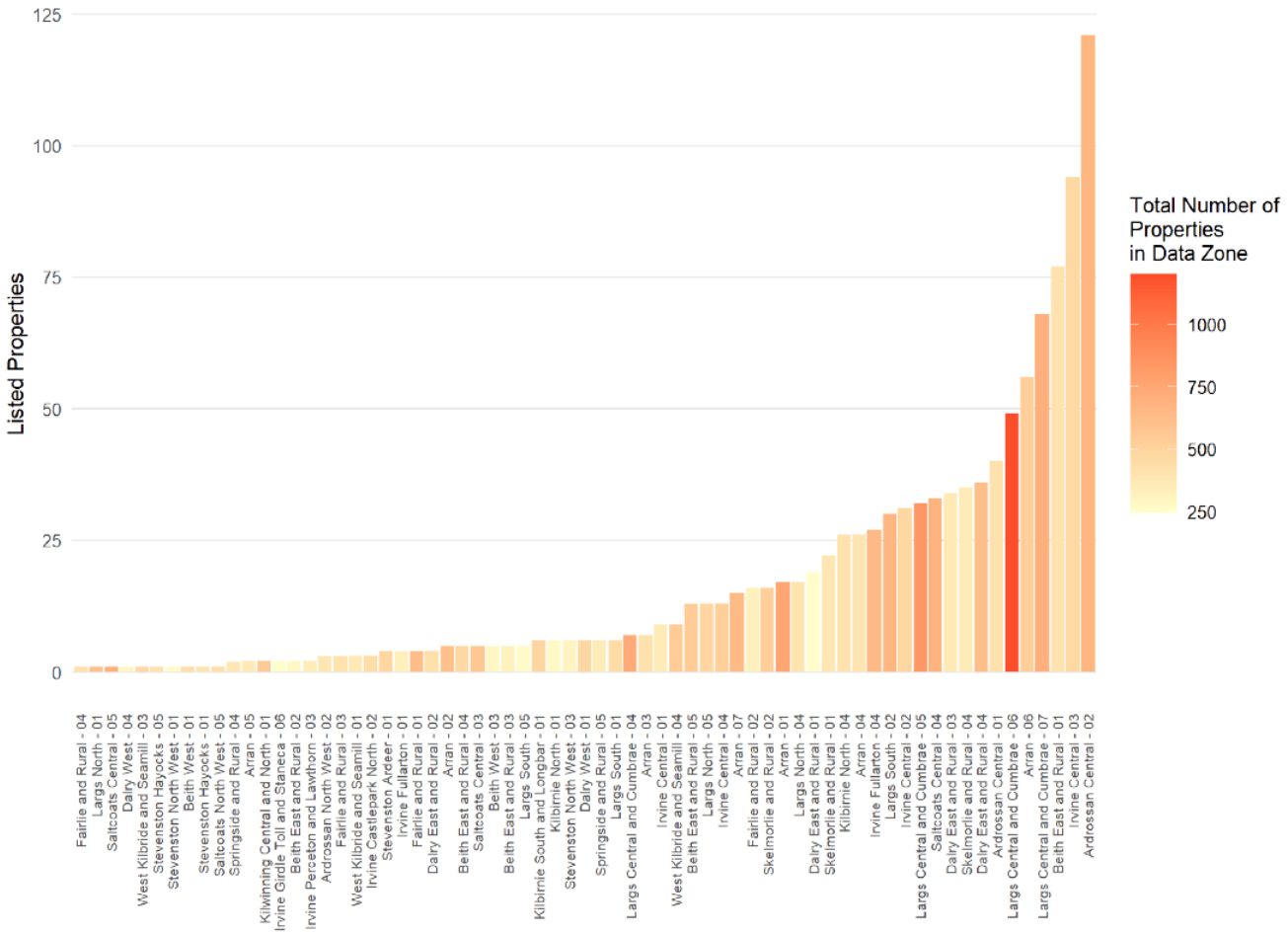


Figure 65 and Table 27 show all the data zones containing listed buildings, ranked by the highest number of listed buildings in each zone. 67 out of the 187 data zones that have listed buildings in, therefore, no short listing is required at this stage. Instead, the overlap of other considerations is deemed more important for prioritising areas. Consideration could be given to grouping hard to treat buildings including conservation areas, listed buildings and traditional building types as there will be commonalities in the challenges, solutions and stakeholders involved. A working group can help to focus on the specific challenges that arise from energy efficiency measures and decarbonisation of listed buildings.

Table 27: Number of Properties with Listed Status per Data Zone

Ranking	Zones with highest count of mixed tenure buildings	Number of mixed tenure buildings
1	Largs Central and Cumbrae - 05	528
2	Largs Central and Cumbrae - 06	454
3	Largs Central and Cumbrae - 04	439
4	Saltcoats Central - 04	418
5	Ardrossan Central - 03	353
6	Irvine Fullarton - 04	317
7	Ardrossan Central - 02	315
8	Saltcoats Central - 05	305
9	Irvine Fullarton - 02	288
10	Largs South - 02	238
11	Irvine Central - 03	229
12	Saltcoats Central - 03	229
13	Largs North - 01	224
14	Irvine Central - 04	204
15	Dalry East and Rural - 04	175
16	Saltcoats North West - 05	171
17	Kilbirnie South and Longbar - 05	170
18	Largs South - 04	164
19	Ardrossan North West - 01	157
20	Skelmorlie and Rural - 02	155
21	Saltcoats Central - 02	142
22	Largs North - 05	138
23	Stevenston Ardeer - 04	137
24	Irvine Fullarton - 01	137
25	Irvine Castlepark South - 04	132
26	Kilwinning Central and North - 01	131
27	Kilwinning Central and North - 02	128
28	West Kilbride and Seamill - 03	126
29	Kilbirnie South and Longbar - 01	123
30	Ardrossan Central – 01	113
31	Irvine East - 01	112
32	Kilbirnie North - 05	111

Ranking	Zones with highest count of mixed tenure buildings	Number of mixed tenure buildings
33	Beith East and Rural - 01	109
34	Kilwinning West and Blacklands - 03	107
35	Largs South - 03	106
36	Kilbirnie North - 04	105
37	Stevenston Hayocks - 01	105
38	Irvine Castlepark North - 05	101
39	Irvine East - 04	98
40	Stevenston North West - 04	97
41	Irvine Castlepark South - 01	96
42	Ardrossan North East - 04	95
43	West Kilbride and Seamill - 04	93
44	Fairlie and Rural - 01	90
45	Stevenston Hayocks - 03	87
46	Stevenston North West - 03	78
47	Fairlie and Rural - 04	77
48	Kilwinning West and Blacklands - 04	77
49	Irvine Tarryholme - 04	76
50	Beith West - 04	72
51	Ardrossan Central - 04	71
52	Dreghorn - 03	66
53	Kilwinning West and Blacklands - 02	64
54	Dalry West - 01	63
55	Largs Central and Cumbrae - 07	63
56	Irvine Central - 02	61
57	Irvine Fullarton - 03	60
58	Saltcoats North West - 06	57
59	Irvine Castlepark North - 03	56
60	Largs Central and Cumbrae - 03	55
61	Irvine Central - 01	55
62	Stevenston North West - 01	54

Mixed Tenure and Use

Table 28 provides the distribution of the mixed tenure mixed use properties when viewed at data zone level.

Table 28: Number of Mixed Tenure Buildings: Top Third of Data Zones

Ranking	Zones with highest count of mixed tenure buildings	Number of mixed tenure buildings
1	Largs Central and Cumbrae - 05	528
2	Largs Central and Cumbrae - 06	454
3	Largs Central and Cumbrae - 04	439
4	Saltcoats Central - 04	418
5	Ardrossan Central - 03	353
6	Irvine Fullarton - 04	317
7	Ardrossan Central - 02	315
8	Saltcoats Central - 05	305
9	Irvine Fullarton - 02	288
10	Largs South - 02	238
11	Irvine Central - 03	229
12	Saltcoats Central - 03	229
13	Largs North - 01	224
14	Irvine Central - 04	204
15	Dalry East and Rural - 04	175
16	Saltcoats North West - 05	171
17	Kilbirnie South and Longbar - 05	170
18	Largs South - 04	164
19	Ardrossan North West - 01	157
20	Skelmorlie and Rural - 02	155
21	Saltcoats Central - 02	142
22	Largs North - 05	138
23	Stevenston Ardeer - 04	137
24	Irvine Fullarton - 01	137
25	Irvine Castlepark South - 04	132
26	Kilwinning Central and North - 01	131
27	Kilwinning Central and North - 02	128
28	West Kilbride and Seamill - 03	126
29	Kilbirnie South and Longbar - 01	123

Ranking	Zones with highest count of mixed tenure buildings	Number of mixed tenure buildings
30	Ardrossan Central - 01	113
31	Irvine East - 01	112
32	Kilbirnie North - 05	111
33	Beith East and Rural - 01	109
34	Kilwinning West and Blacklands - 03	107
35	Largs South - 03	106
36	Kilbirnie North - 04	105
37	Stevenston Hayocks - 01	105
38	Irvine Castlepark North - 05	101
39	Irvine East - 04	98
40	Stevenston North West - 04	97
41	Irvine Castlepark South - 01	96
42	Ardrossan North East - 04	95
43	West Kilbride and Seamill - 04	93
44	Fairlie and Rural - 01	90
45	Stevenston Hayocks - 03	87
46	Stevenston North West - 03	78
47	Fairlie and Rural - 04	77
48	Kilwinning West and Blacklands - 04	77
49	Irvine Tarryholme - 04	76
50	Beith West - 04	72
51	Ardrossan Central - 04	71
52	Dreghorn - 03	66
53	Kilwinning West and Blacklands - 02	64
54	Dalry West - 01	63
55	Largs Central and Cumbrae - 07	63
56	Irvine Central - 02	61
57	Irvine Fullarton - 03	60
58	Saltcoats North West - 06	57
59	Irvine Castlepark North - 03	56
60	Largs Central and Cumbrae - 03	55
61	Irvine Central - 01	55
62	Stevenston North West - 01	54

Appendix B provides the distribution of the mixed tenure mixed use properties when viewed at data zone level. The enhanced maps, see Figure 66, Figure 67 and Figure 68, clearly show a greater concentration of these properties in urban areas. Therefore, when considering interventions for this type of property it will be important to use higher resolution data than strategy zone. More detailed analysis would be warranted to identify interventions likely to be suitable for these buildings alongside the other attributes present in similar LHEES focus areas, such as mixed tenure, conservation areas and listed buildings.

Identifying the tenure and use of a building will determine the funding opportunities and aid in determining the complexity of future implementation works. A working group for these types of properties may be useful as different stakeholders in each building will have varying levels of engagement with the proposed interventions.

Figure 66: Map of Mixed Tenure/Mixed Use Properties – Data Zone Level

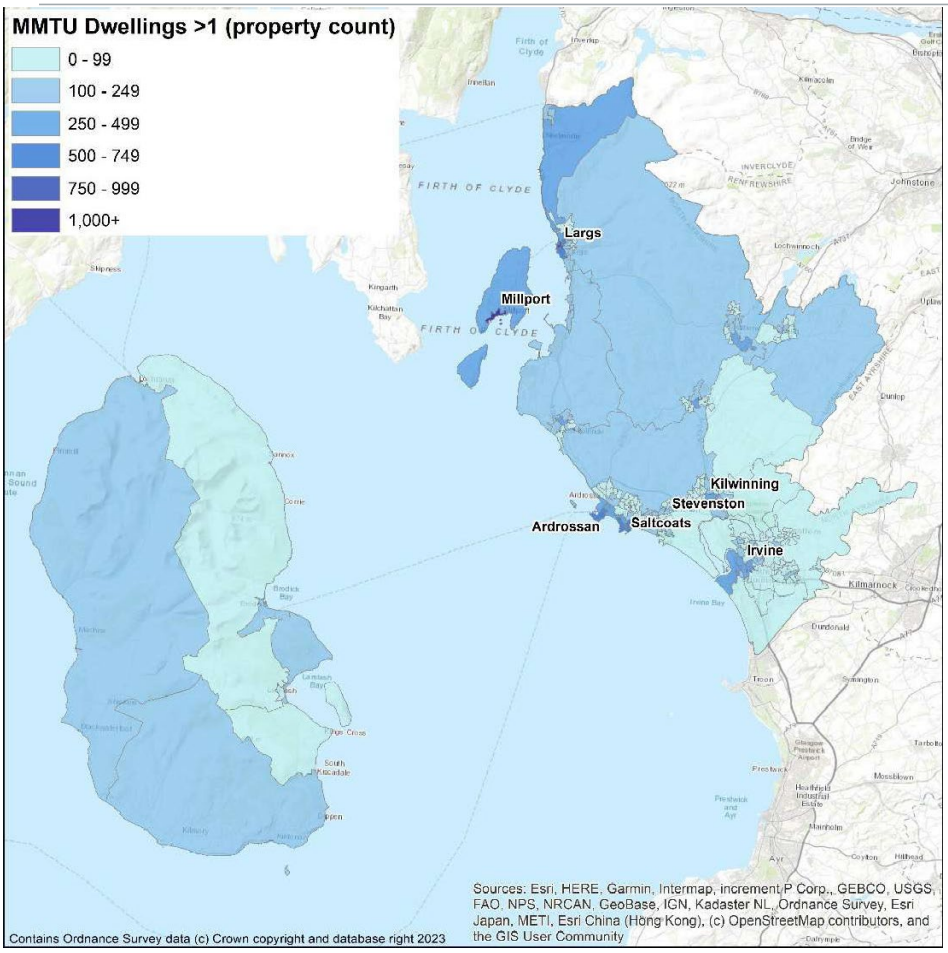


Figure 67: Map of Mixed Tenure/Mixed Use Properties – Data Zone Level: Detail 1

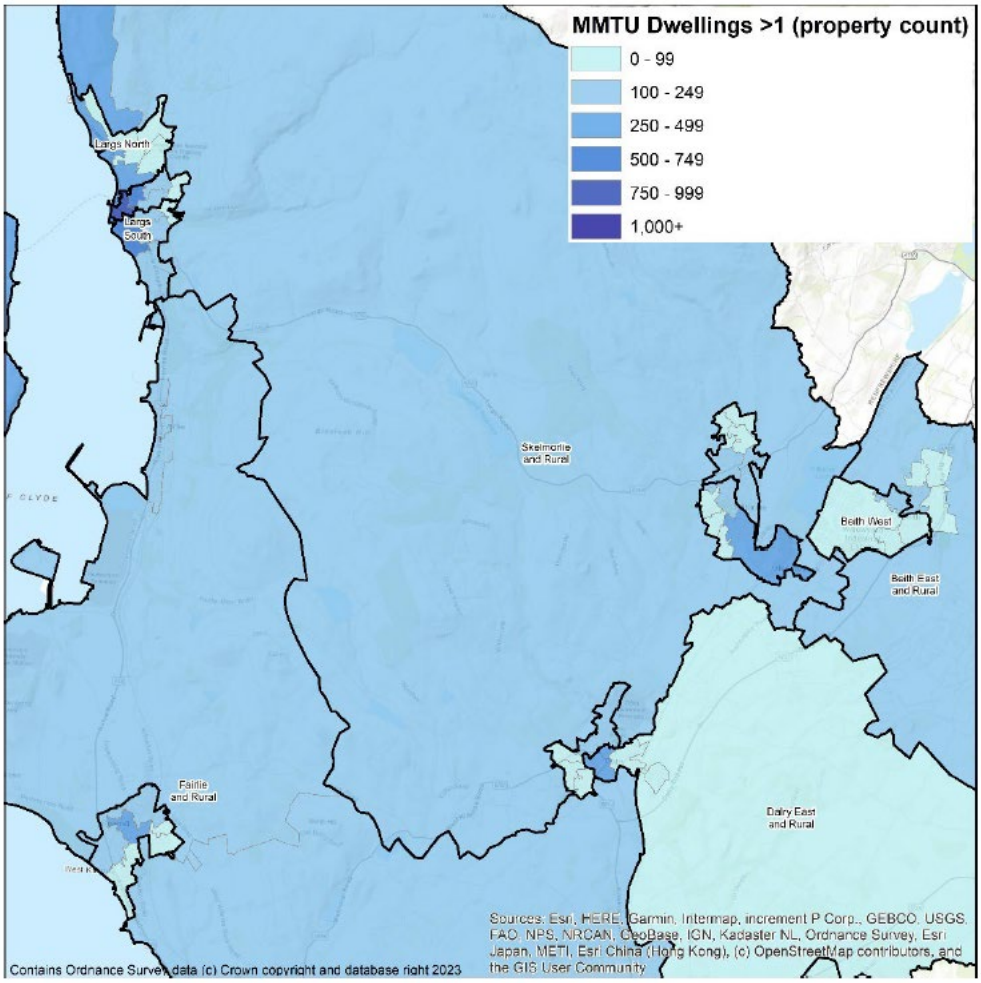
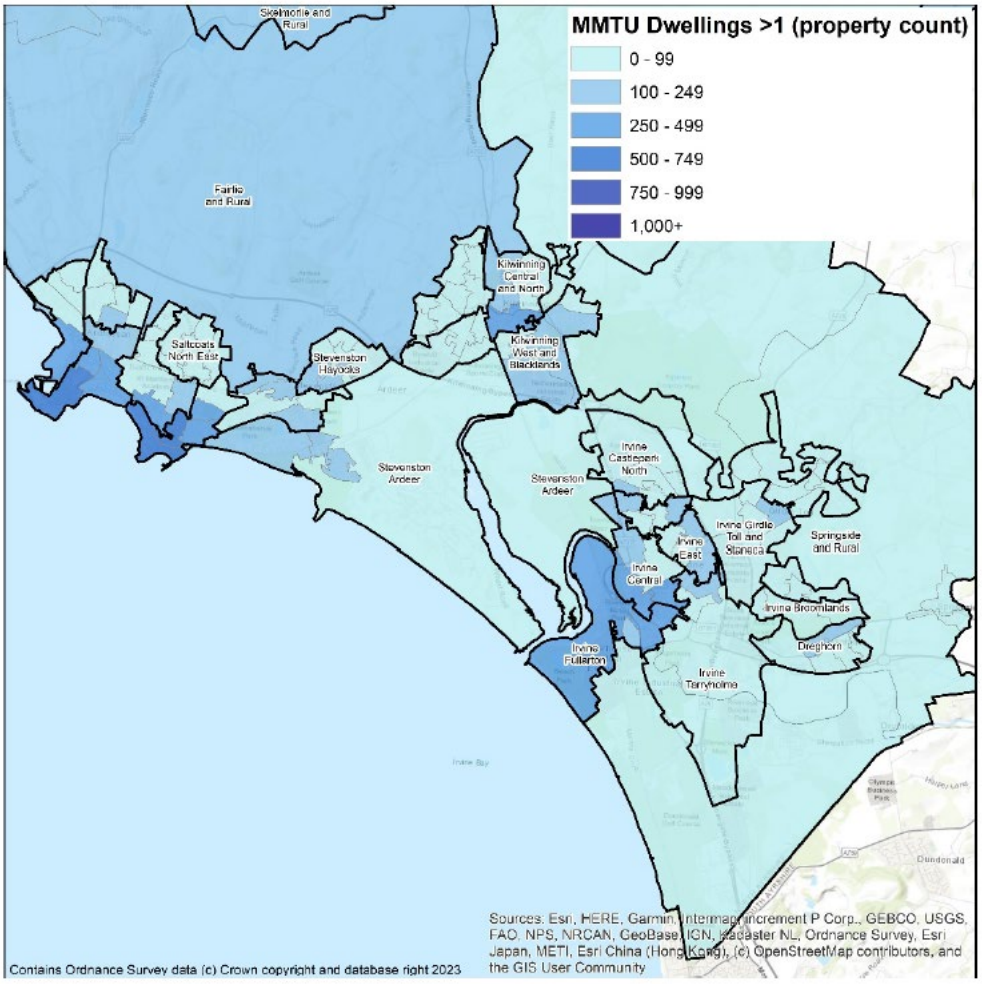


Figure 68: Map of Mixed Tenure/Mixed Use Properties – Data Zone Level: Detail 2



Multiple Considerations

As this report has reviewed the different Considerations and highlighted potential delivery areas when looking for each Consideration, there may be a mismatch between which areas should be targeted first depending on priorities. To help identify which data zones should form the initial delivery Table 29 shows the different considerations for the data zones that are ranked by energy efficiency as a driver for fuel poverty.

The green highlighted cells in Table 29 show the data zones that are in the top third for other LHEES considerations and SIMD. All the data zones with buildings in conservation areas appear in the top third of energy efficiency as a driver for fuel poverty zones. Overall, this shows a high correlation between Considerations.

This information is used to help with prioritisation of data zones.

Table 29: Consideration Ranking Comparison for the Energy Efficiency as a Driver for Fuel Poverty Top Third Data Zones

Data Zone – Ranked by energy efficiency as a driver for fuel poverty	Energy efficiency - rank	Mixed tenure - rank	Homes with >1 dwelling - rank	Listed homes grades A-C - rank	Homes in cons, area - rank	SIMD
Largs Central and Cumbrae - 06	4	2	1	6	1	2
Arran - 04	2	135	107	16	11	7
Largs Central and Cumbrae - 07	6	55	13	4	4	5
Northern and Irvine Valley Rural - 05	1	154	171	68	26	8
Arran - 07	21	108	64	24	26	8
Arran - 06	7	140	70	5	7	8
Arran - 03	10	134	90	30	26	8
Ardrossan Central - 03	14	5	9	68	26	1
Arran - 02	20	122	67	43	26	5
Arran - 01	34	107	69	21	26	7
Arran - 05	87	149	103	56	26	6
Largs Central and Cumbrae - 05	9	1	2	12	26	2
Kilwinning Pennyburn - 02	13	154	171	68	26	2
Kilbirnie South and Longbar - 02	33	154	154	68	26	2
Saltcoats Central - 04	19	4	4	11	26	1
Kilbirnie South and Longbar - 03	65	154	160	68	26	2
Largs Central and Cumbrae - 04	12	3	3	31	26	1
Saltcoats Central - 03	18	12	8	41	26	1
Irvine Central - 03	3	11	16	2	3	1
Saltcoats Central - 05	8	8	6	65	26	2

Data Zone – Ranked by energy efficiency as a driver for fuel poverty	Energy efficiency - rank	Mixed tenure - rank	Homes with >1 dwelling - rank	Listed homes grades A-C - rank	Homes in cons, area - rank	SIMD
Kilbirnie South and Longbar - 01	31	29	29	37	26	1
Beith East and Rural – 01	15	33	27	3	13	4
Kilbirnie North - 03	42	154	171	68	26	2
Stevenston North West - 02	5	69	82	68	26	4
Springside and Rural - 02	27	117	111	68	26	3
Kilbirnie South and Longbar - 05	26	17	15	68	26	3
Kilwinning West and Blacklands - 04	67	48	38	68	26	1
Dalry West - 02	68	146	152	68	26	1
Irvine Fullarton - 02	145	9	11	68	26	1
Kilwinning Central and North - 01	57	26	18	55	26	1
Irvine Castlepark South - 01	84	41	63	68	26	1
Stevenston North West - 04	55	40	37	68	26	1
Beith West - 04	61	50	47	68	26	2
Skelmorlie and Rural - 01	16	105	67	18	26	5
Dreghorn - 04	36	78	81	68	12	3
Ardrossan Central - 02	116	7	5	1	26	1
Ardrossan North East - 04	115	42	52	68	26	2
Saltcoats Central - 02	105	21	21	68	26	1
Springside and Rural - 03	93	92	80	68	26	1
Stevenston Ardeer - 04	32	23	48	68	26	2
Stevenston Ardeer - 03	66	76	66	68	26	1
West Kilbride and Seamill - 03	25	28	23	63	8	5
Dalry East and Rural - 01	17	147	120	19	26	8
Kilbirnie North - 04	49	36	38	17	18	3
Kilbirnie North - 02	96	154	128	68	26	2
Saltcoats North West - 05	11	16	24	58	26	3
Dalry East and Rural - 04	77	15	11	8	14	1
Irvine Central - 01	70	61	96	29	20	1
Skelmorlie and Rural - 03	79	74	60	68	9	5
Dalry West - 03	98	113	145	68	26	4
Irvine Fullarton - 03	108	57	72	68	26	1
Largs South - 02	22	10	7	14	26	7
Beith East and Rural - 05	28	89	56	27	26	6
Irvine Bourtreehill - 01	123	71	106	68	26	1

Data Zone – Ranked by energy efficiency as a driver for fuel poverty	Energy efficiency - rank	Mixed tenure - rank	Homes with >1 dwelling - rank	Listed homes grades A-C - rank	Homes in cons, area - rank	SIMD
Irvine Fullarton - 01	58	24	26	46	21	1
Beith East and Rural – 02	35	99	116	53	26	5
Fairlie and Rural - 04	39	47	42	67	26	4
Kilbirnie South and Longbar - 04	80	125	123	68	26	3
Stevenston North West - 03	50	46	45	35	26	2
Largs South - 05	54	143	131	38	26	8
Irvine Bourtreehill - 03	125	154	166	68	26	2
Kilwinning West and Blacklands - 03	72	34	31	68	26	2

Appendix C Off-gas Grid and On-gas Grid

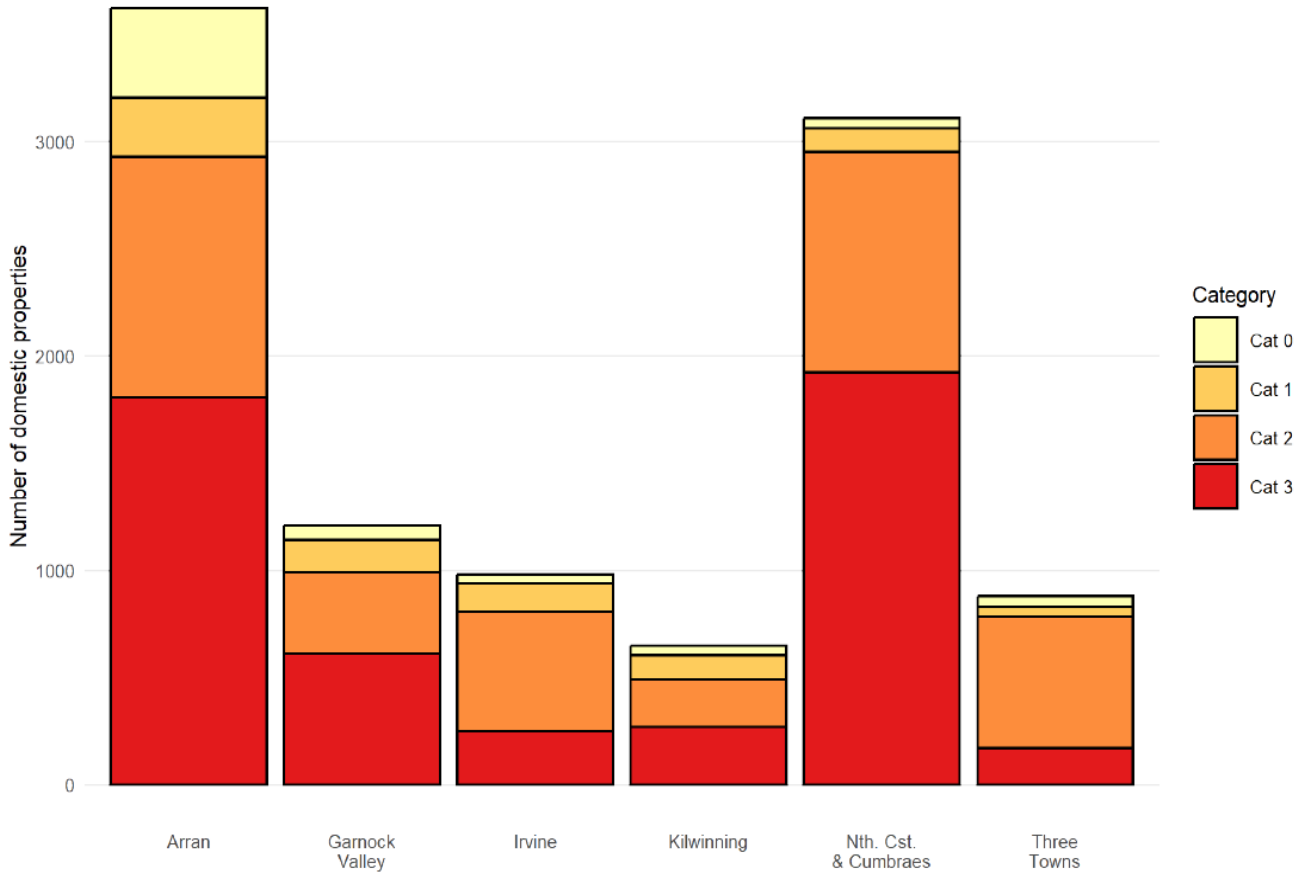
The Domestic Baseline Tool outlines a method of categorising properties based on their suitability for heat pumps. While this report uses an alternative methodology as set out in section 8.8.3, this appendix sets out the findings of the methodology set out in the Baseline Tool.

Off-gas grid

The Domestic Baseline Tool categorises individual properties according to how difficult it will be to transition each property to a low carbon heat source. This is based on several factors including, for example, the existing heating system, listed status and the existing fabric. The methodology considers that Category 0 properties are already low carbon, Category 1 properties are ready to make use of a heat pump with minimal changes to the existing building and Category 2 properties could transition with modest changes. Category 3 properties may require such substantial changes that other electrical or biomass heat sources may be more suitable. This methodology predates the trials which have informed the rest of the analysis in this Strategy and is included for completeness.

Figure 69 shows that most off-grid properties sit in Categories 2 and 3, meaning that there is a potential challenge to convert these to efficient heat-pump systems.

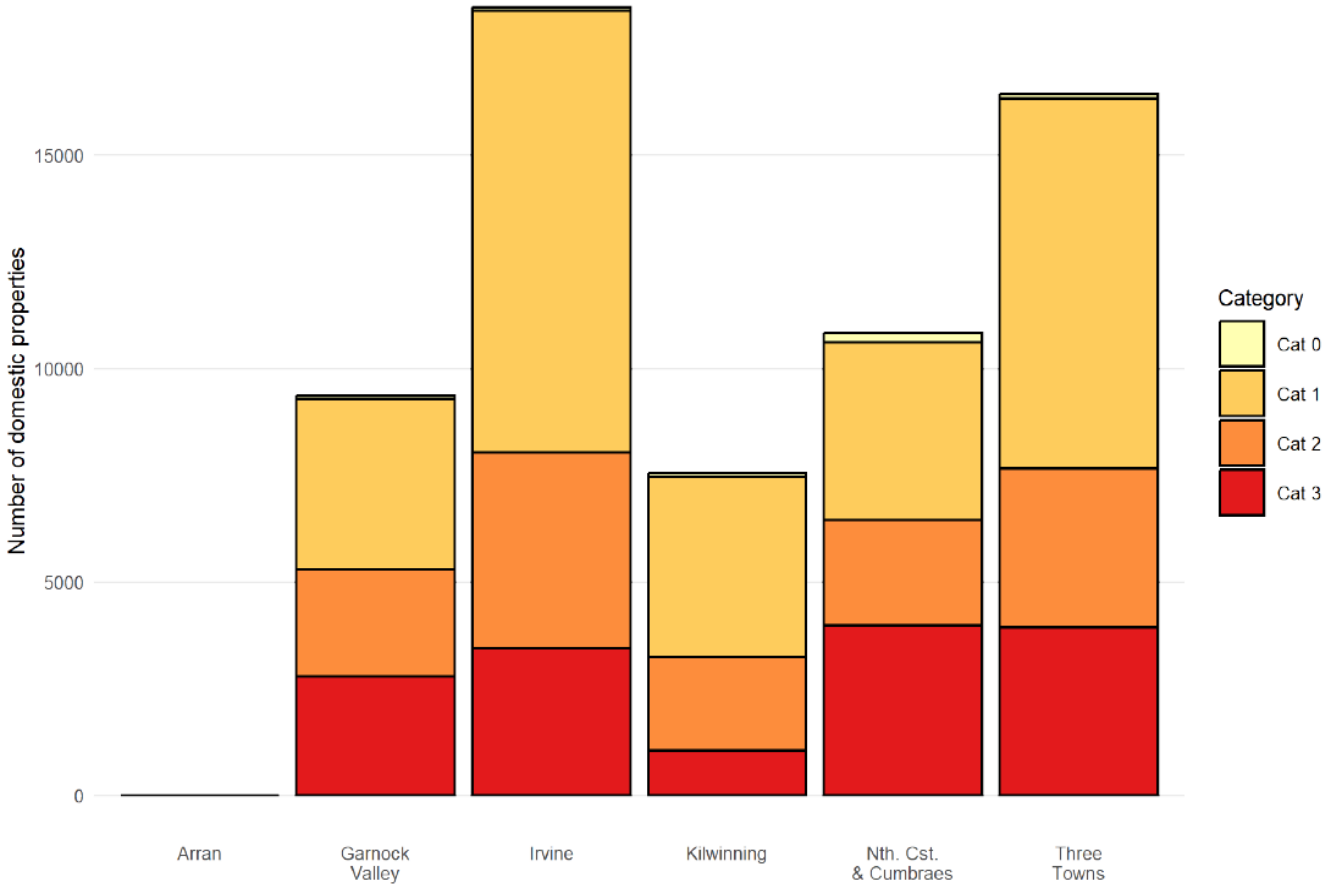
Figure 69: Heat Transition Categories for Off-Gas Grid Domestic Properties



On-gas grid

On-gas grid buildings are similarly categorised by the Domestic Baseline Tool although it might be expected that more on-grid properties will find themselves in areas with heat networks and a connection to these rather than heat pumps might be likely. Most properties are in Categories 1 and 2 and so lend themselves to transition to heat pumps.

Figure 70: Heat Transition Categories for On-Gas Grid Domestic Properties

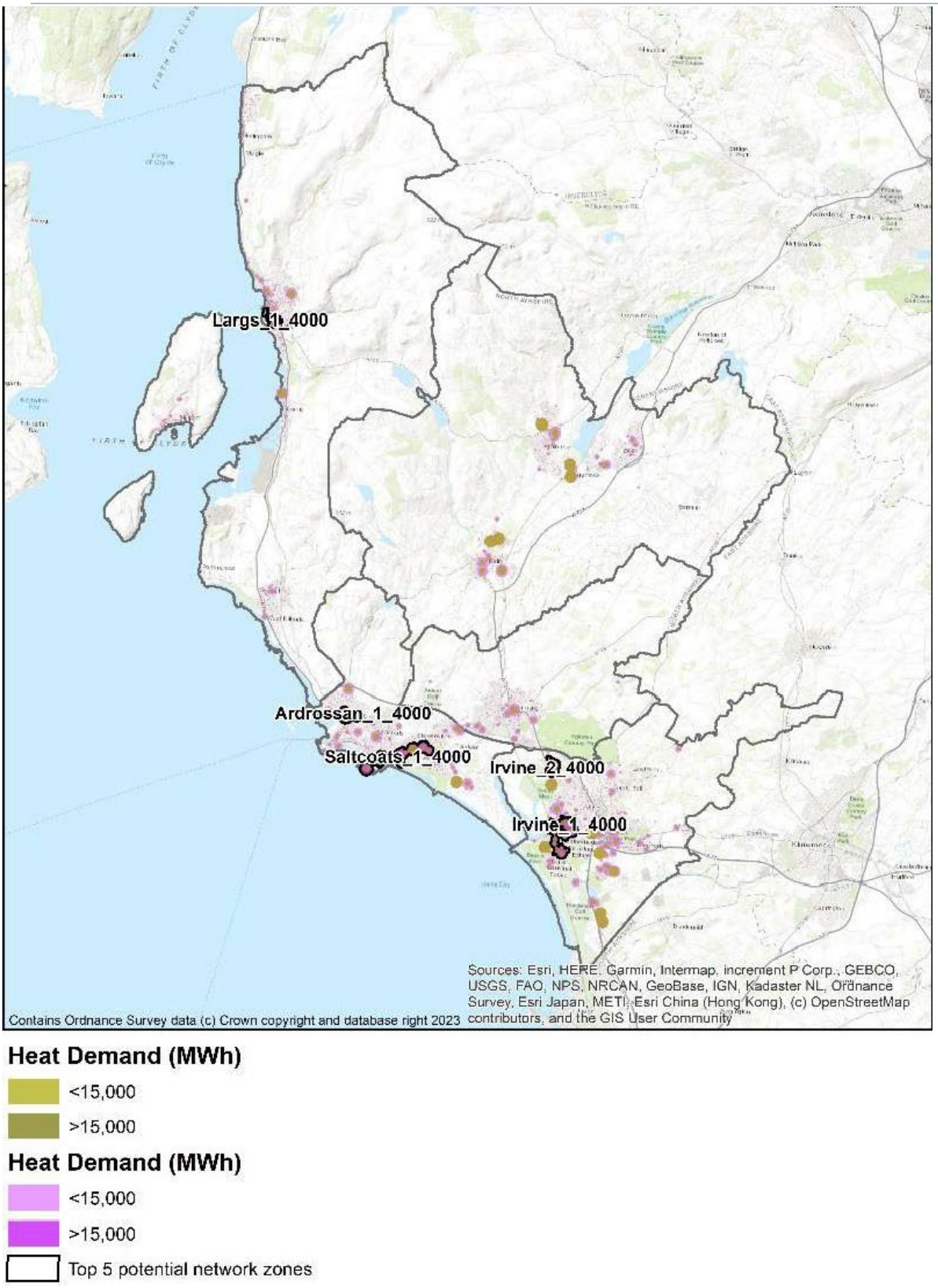


Appendix D Heat Networks

Heat Network Zone Maps

The areas which were found to be viable heat network zones are shown in the following maps.

Figure 71: Authority-wide Plan of Potential Heat Network Zones



Irvine

Figure 72: Irvine Heat Network Opportunity – 4,000 kWh/m/year

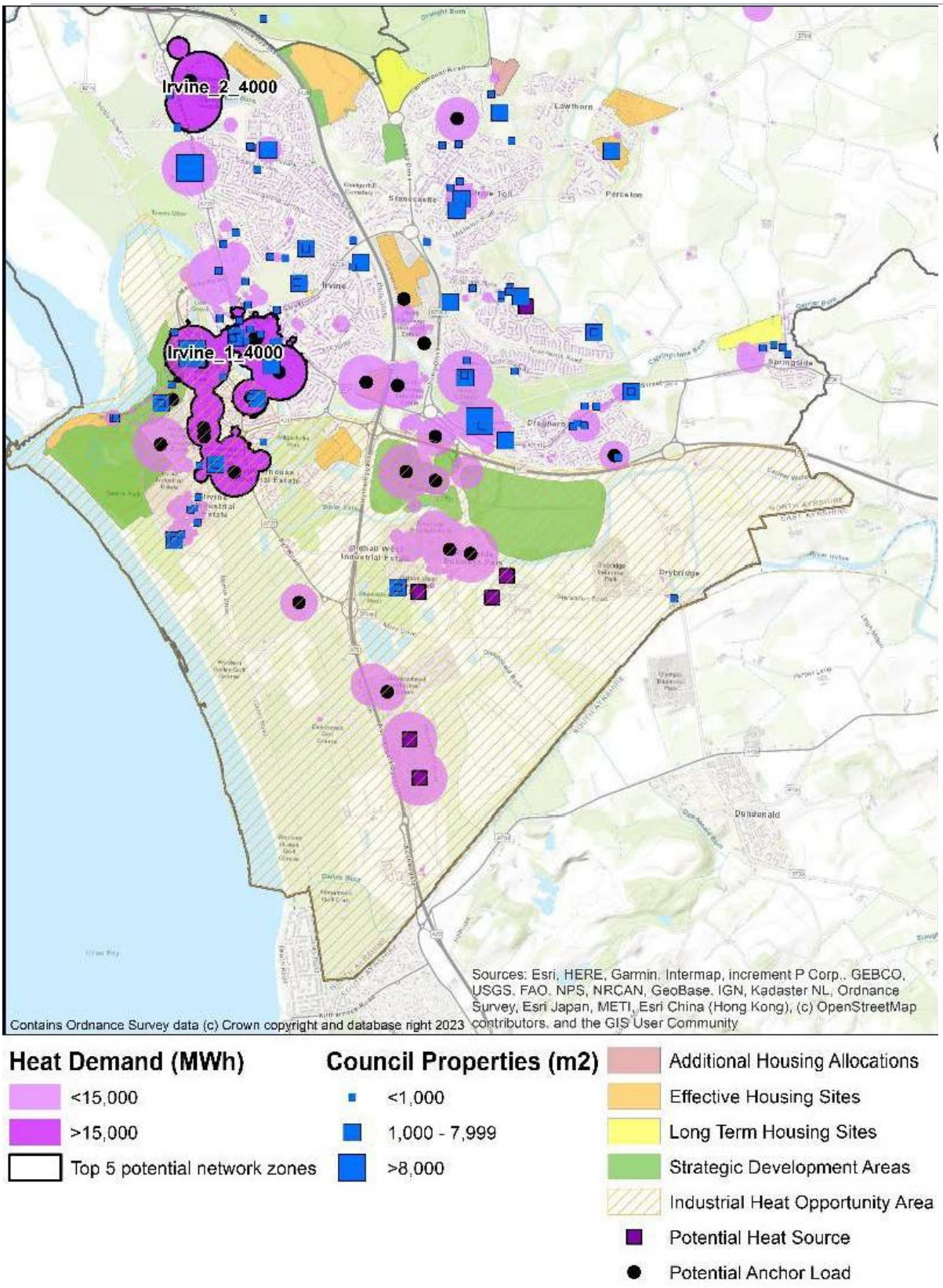


Figure 73: Irvine Heat Network Opportunity – 8,000 kWh/m/year

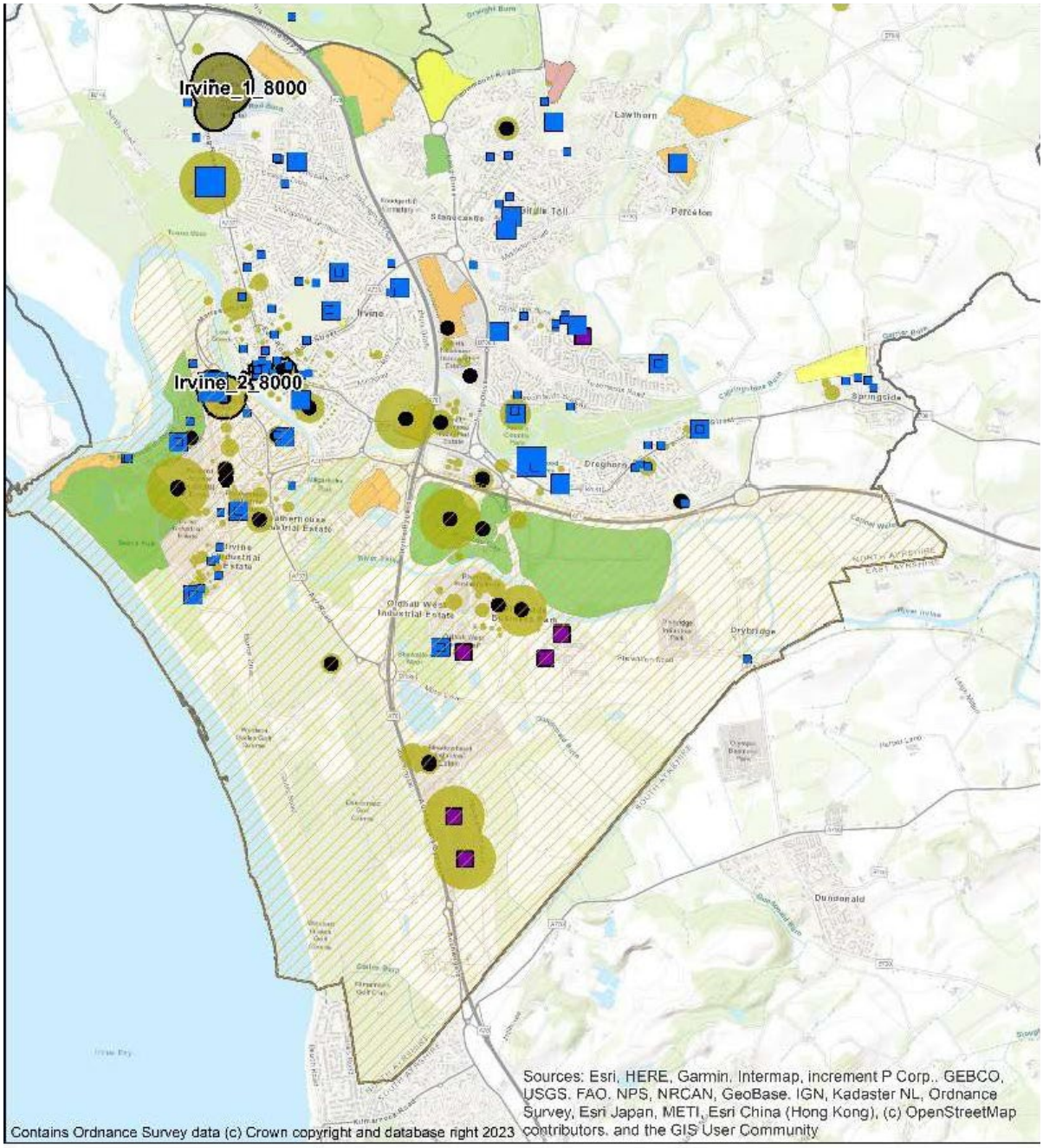
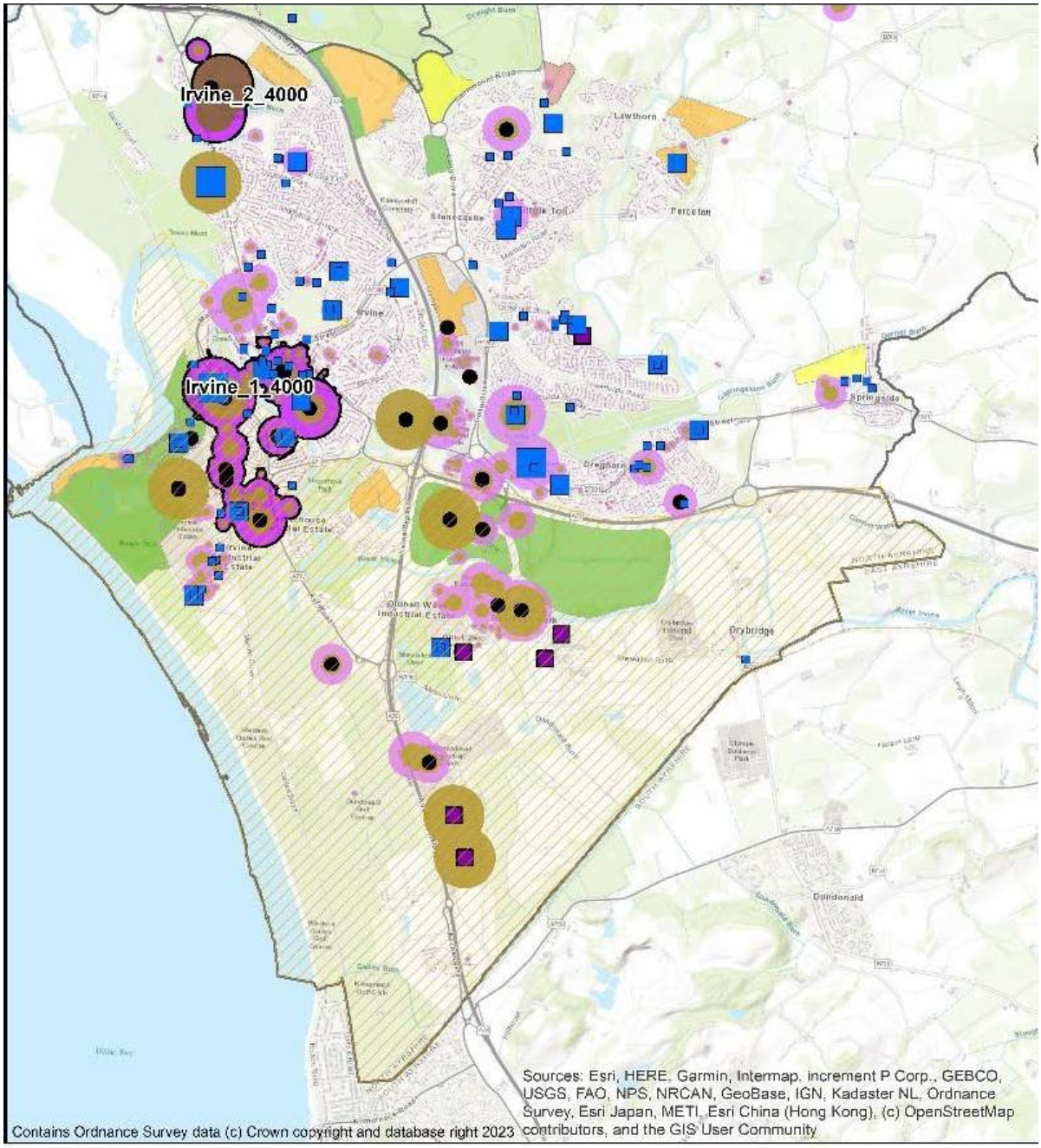


Figure 74: Irvine Heat Network Opportunity – Combined Heat Demand Density Criteria



Three Towns

Figure 75: Ardrossan Saltcoats and Stevenston Heat Network Area – 4,000 kWh/m/year

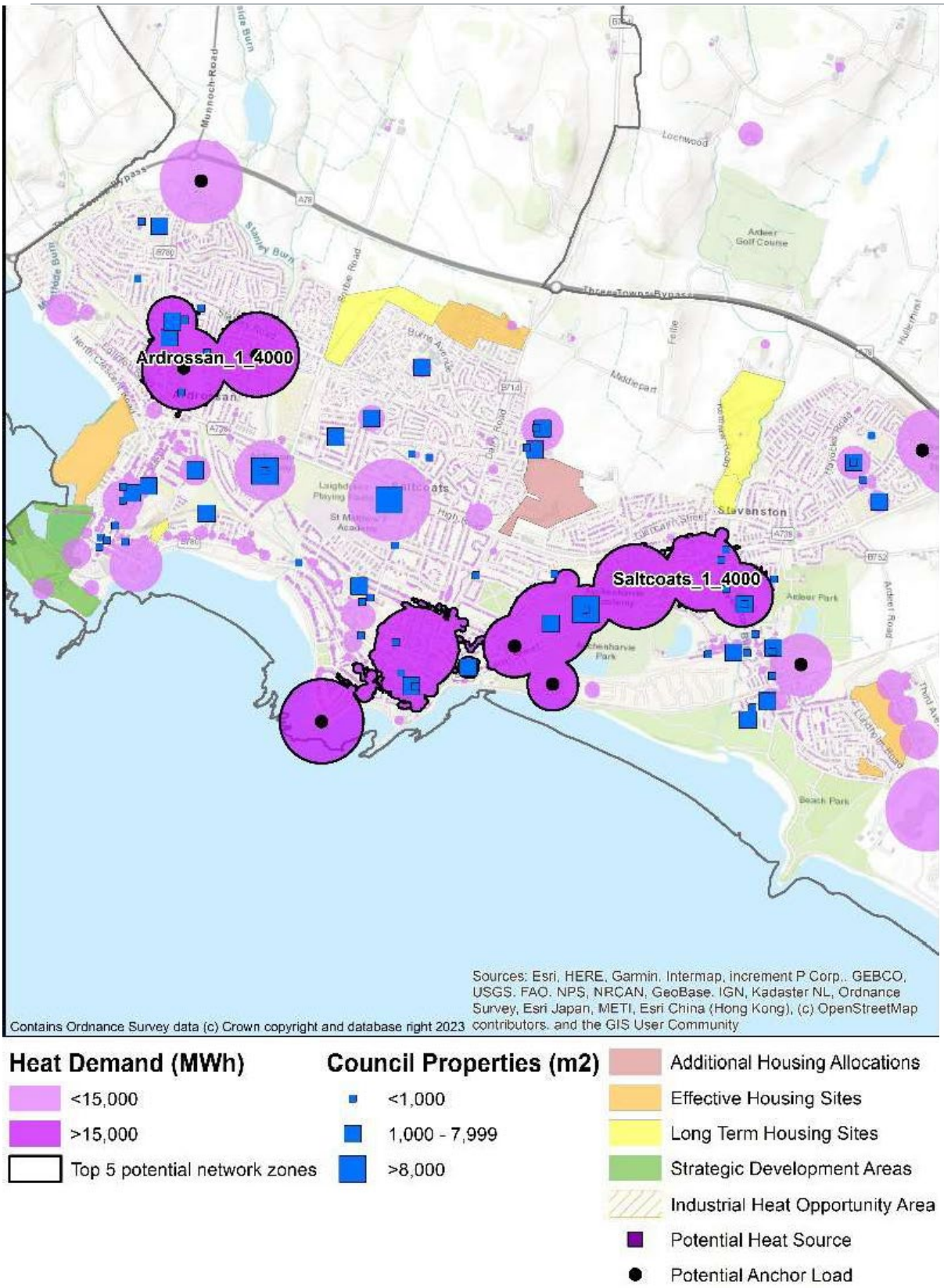


Figure 76: Ardrossan, Saltcoats and Stevenston Heat Network Area – 8,000 kWh/m/year

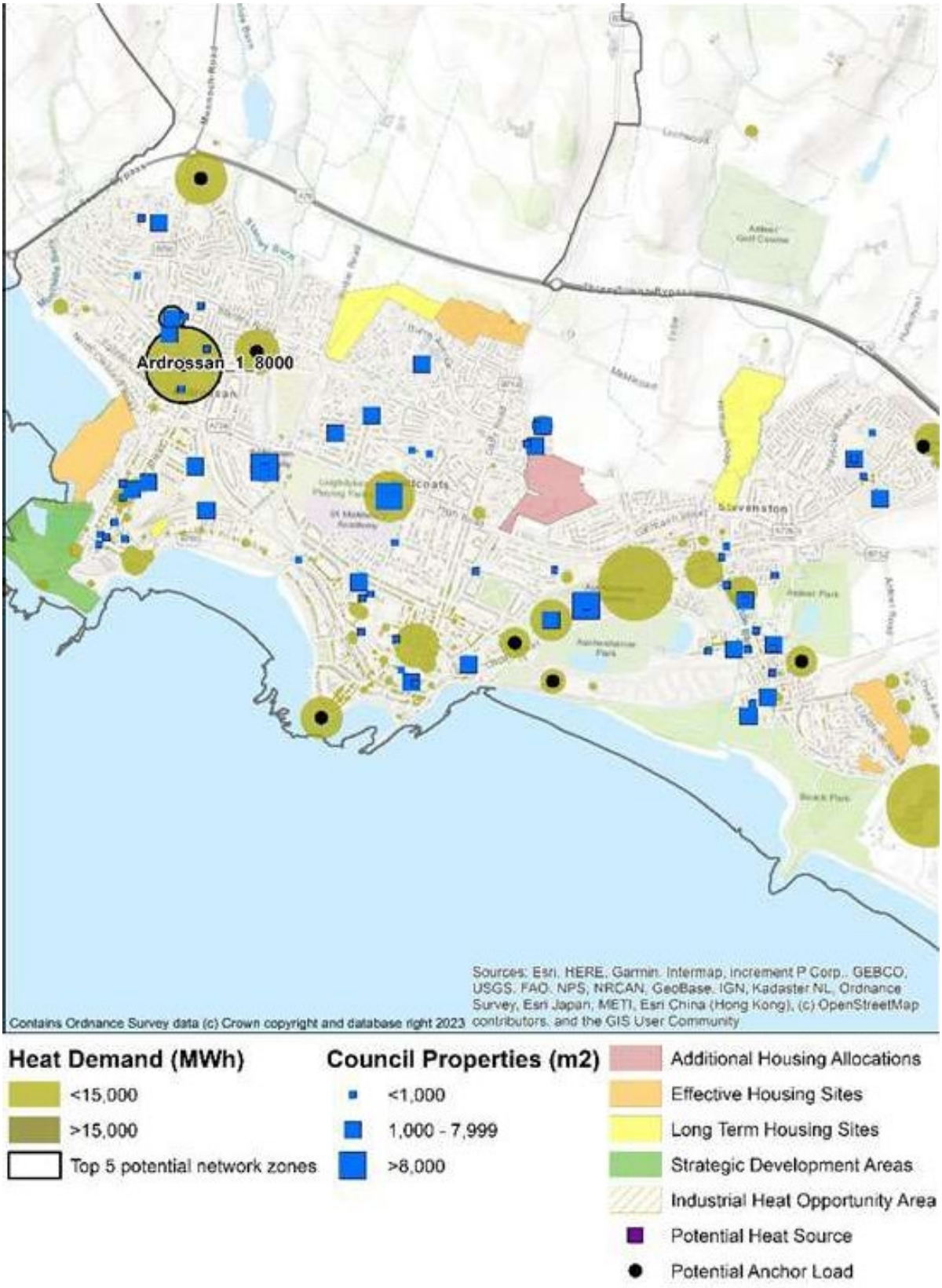
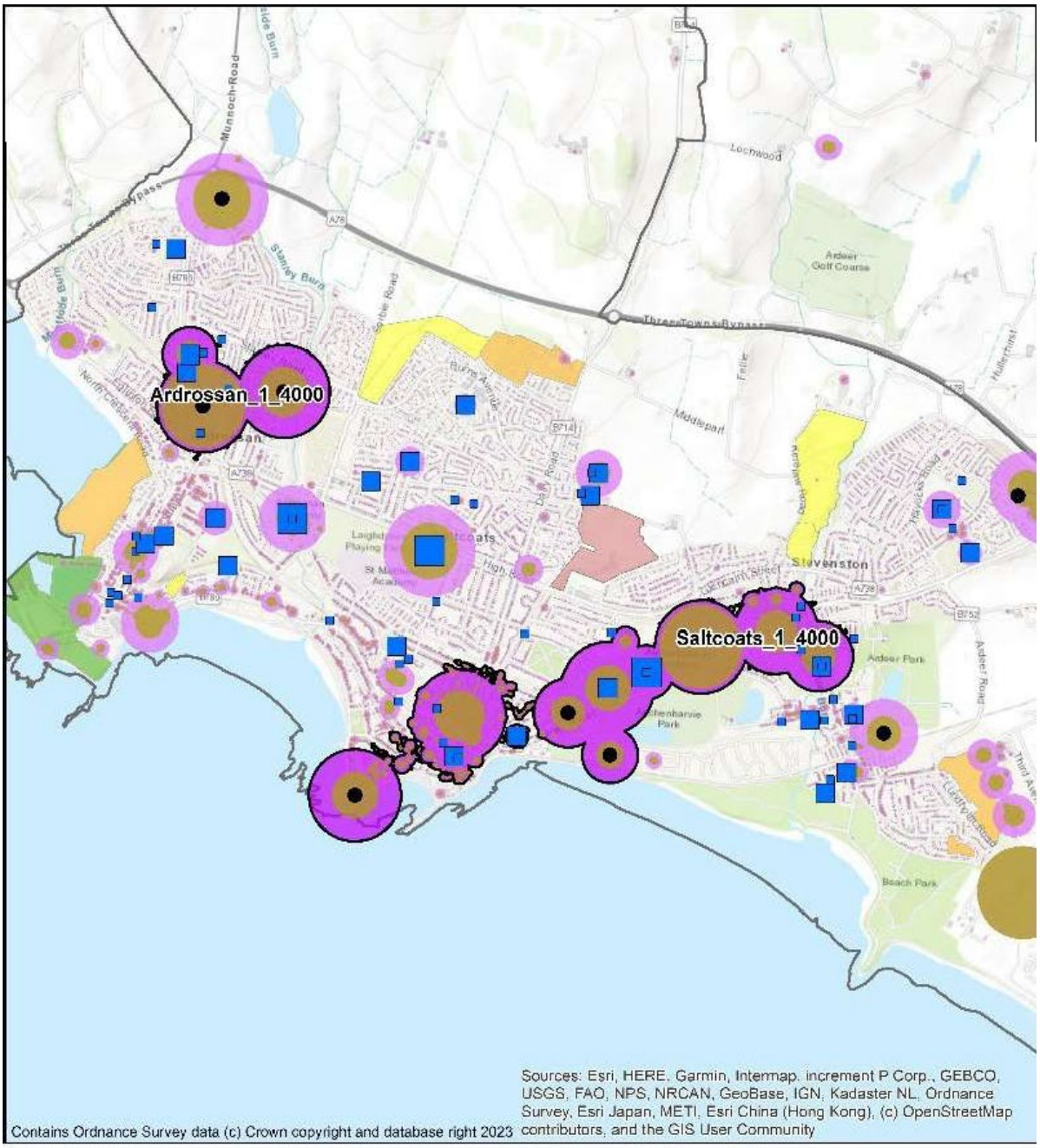


Figure 77: Ardrossan, Saltcoats and Stevenston Heat Network Area – Combined Heat Demand Density Criteria



Appendix E Heat Pump Suitability

The following maps plot the locations of properties which are currently or could be suitable for heat pump installations.

Figure 78: Heat Pump Suitability Irvine (East)

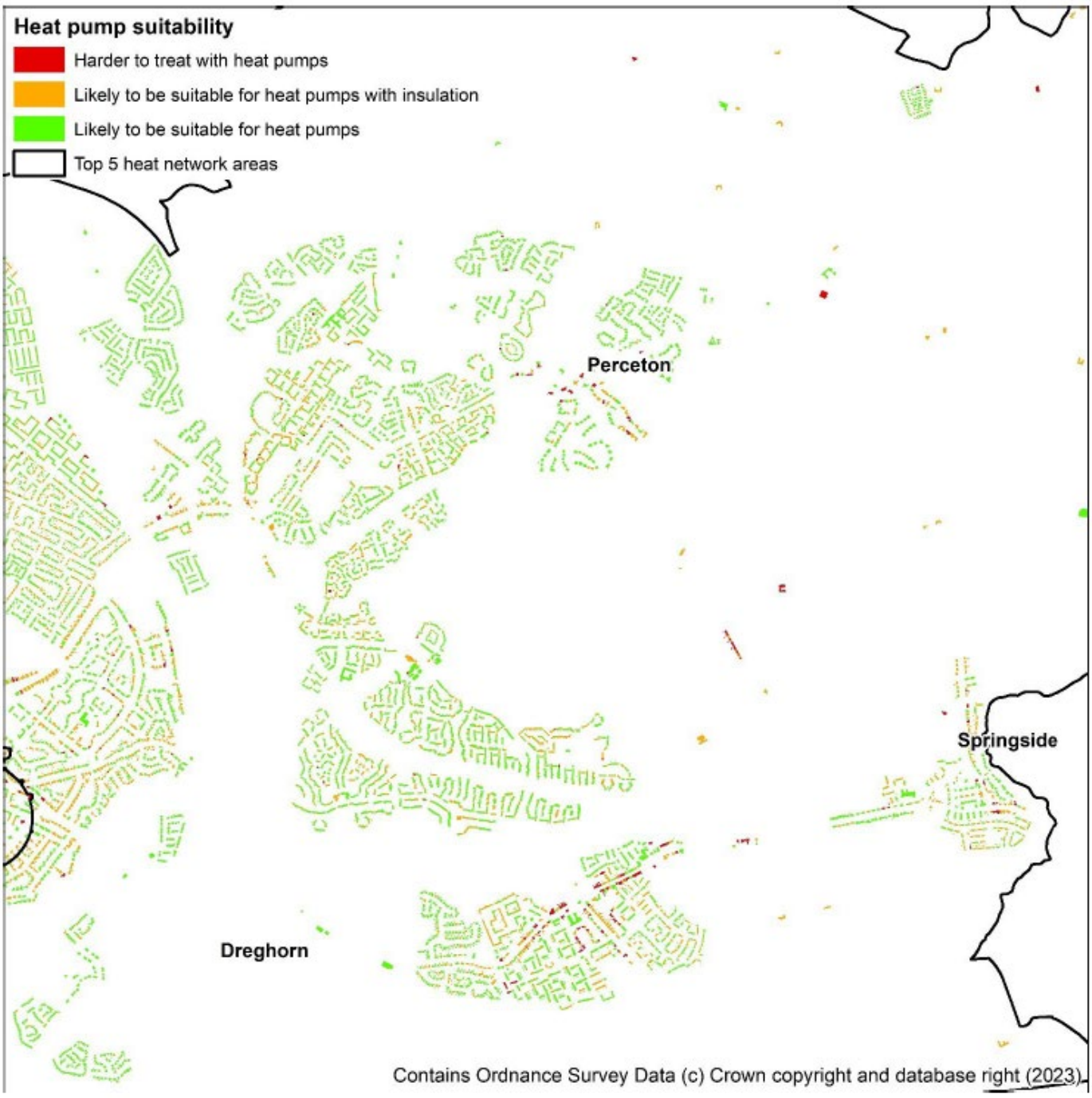


Figure 79: Heat Pump Suitability Irvine (Central)

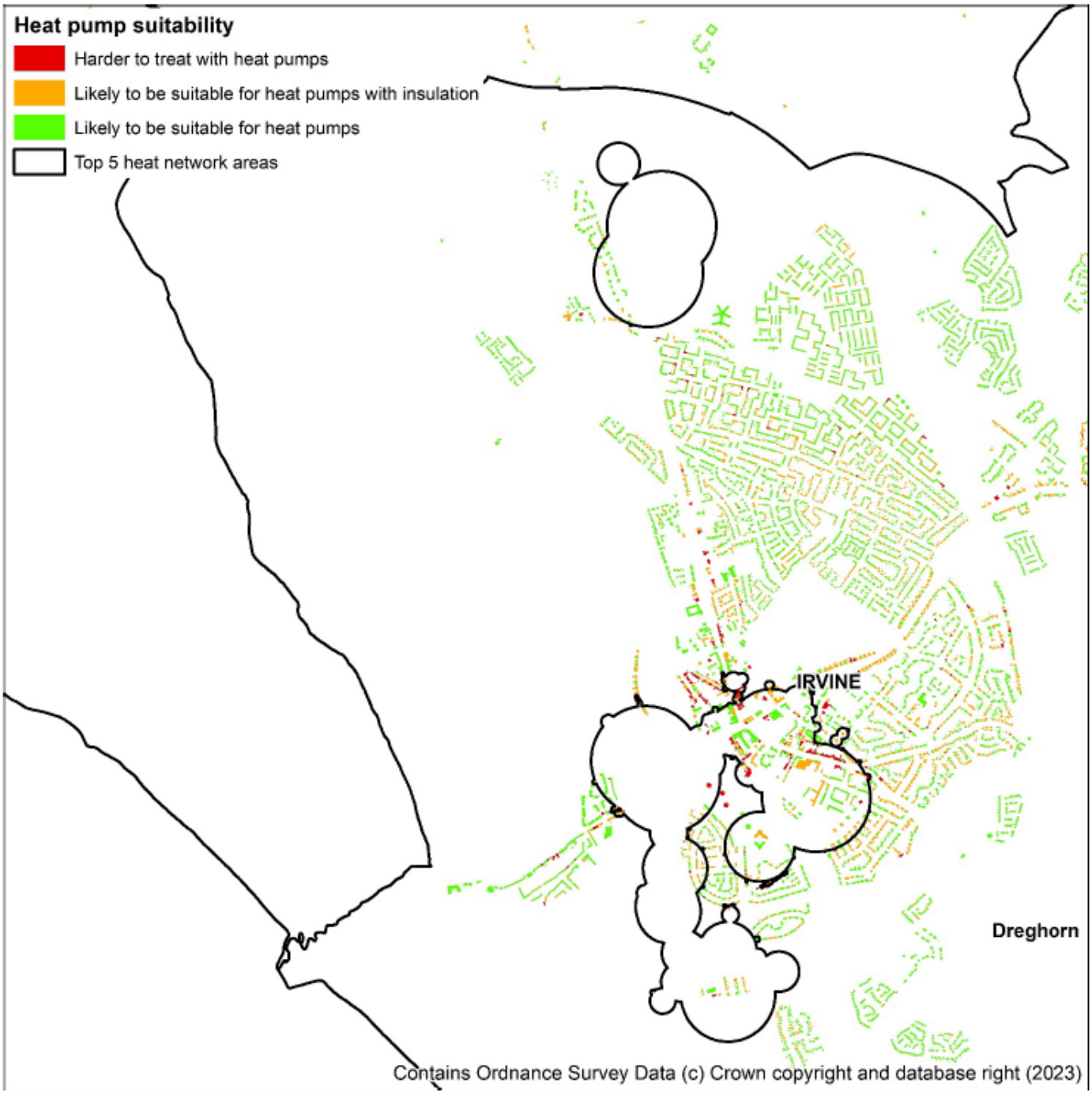


Figure 80: Heat Pump Suitability Kilwinning

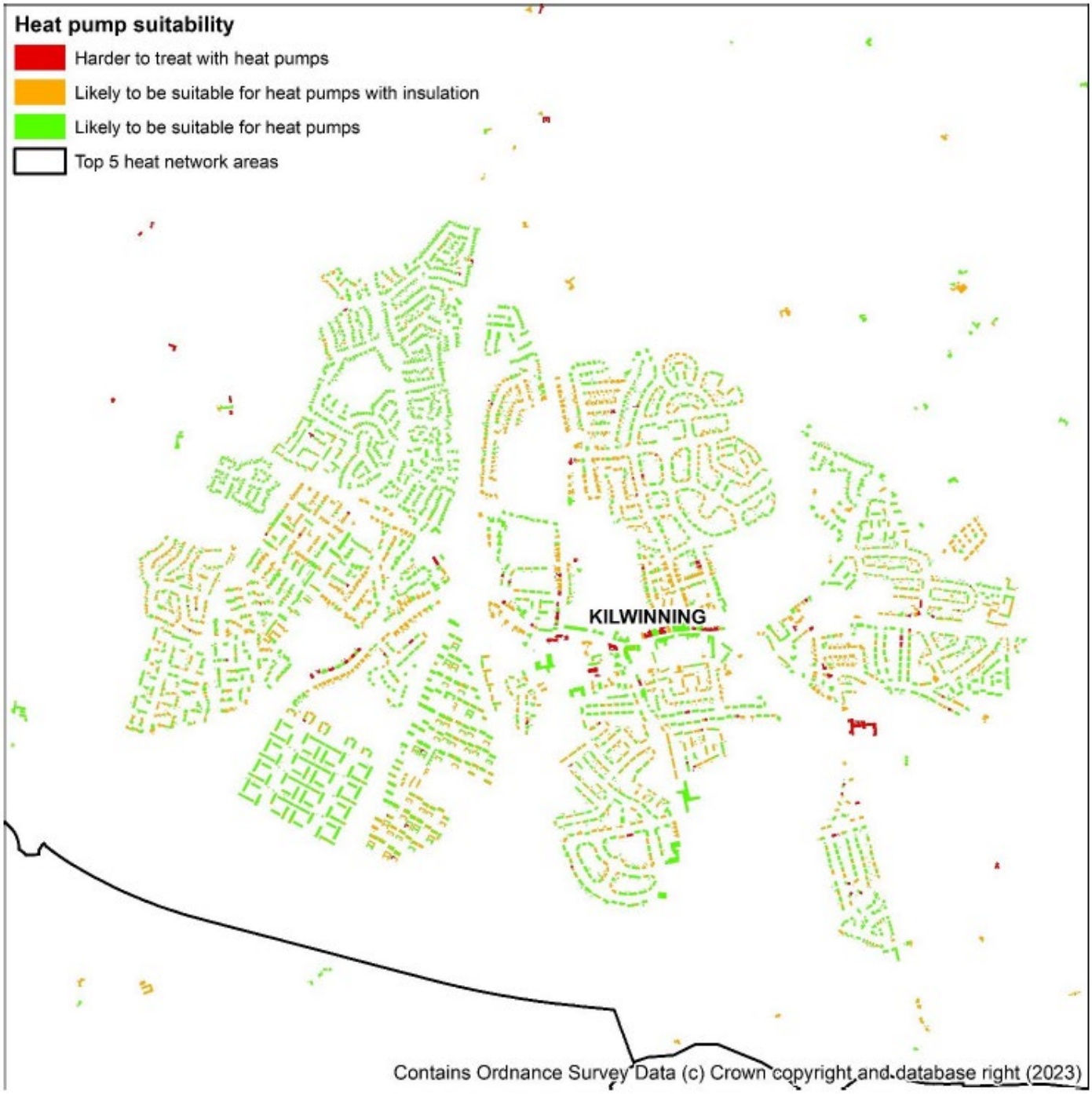


Figure 81: Heat Pump Suitability Three Towns

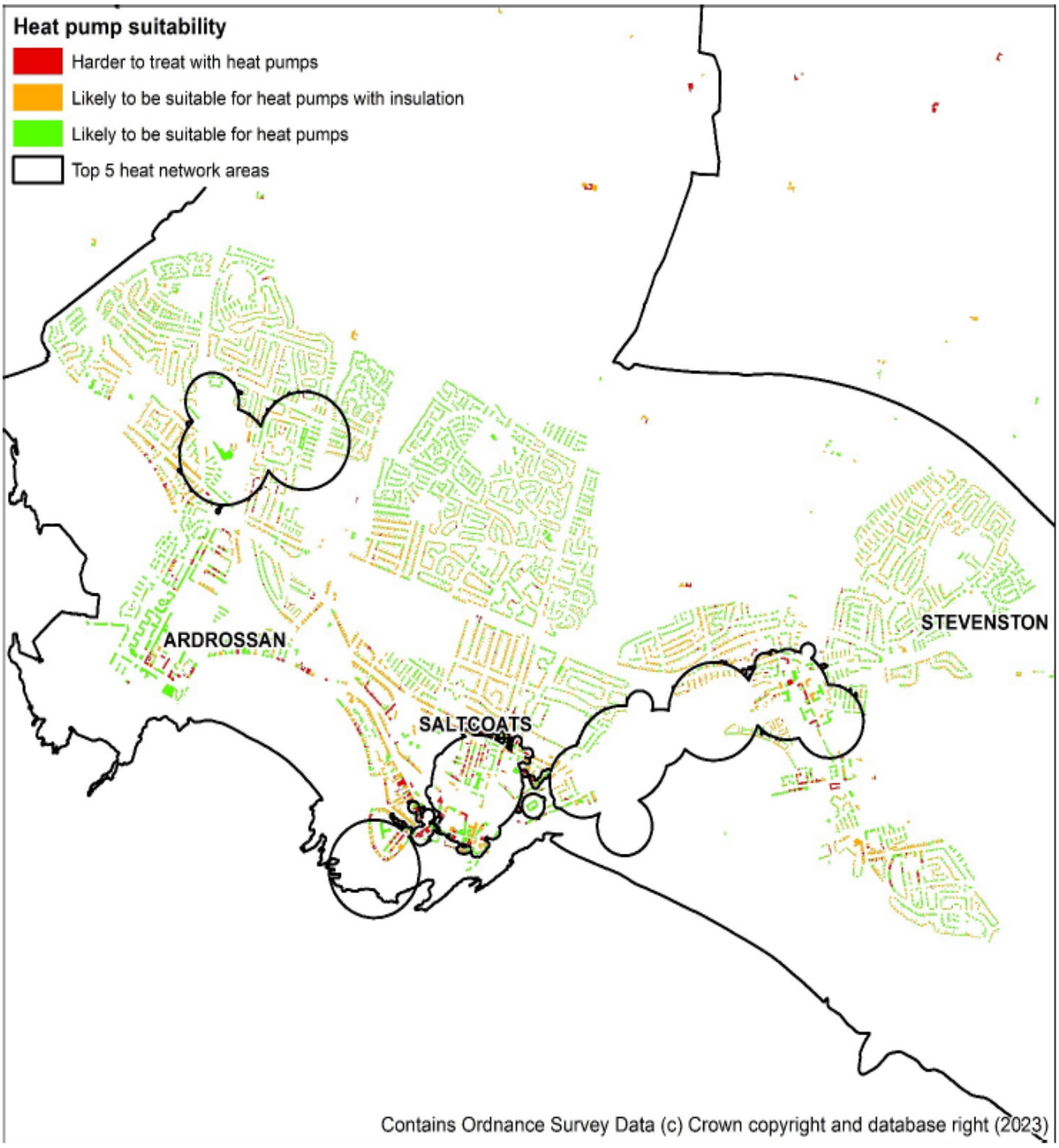


Figure 82: Heat Pump Suitability Beith

Figure 83: Heat Pump Suitability Dalry

Figure 84: Heat Pump Suitability Kilbirnie

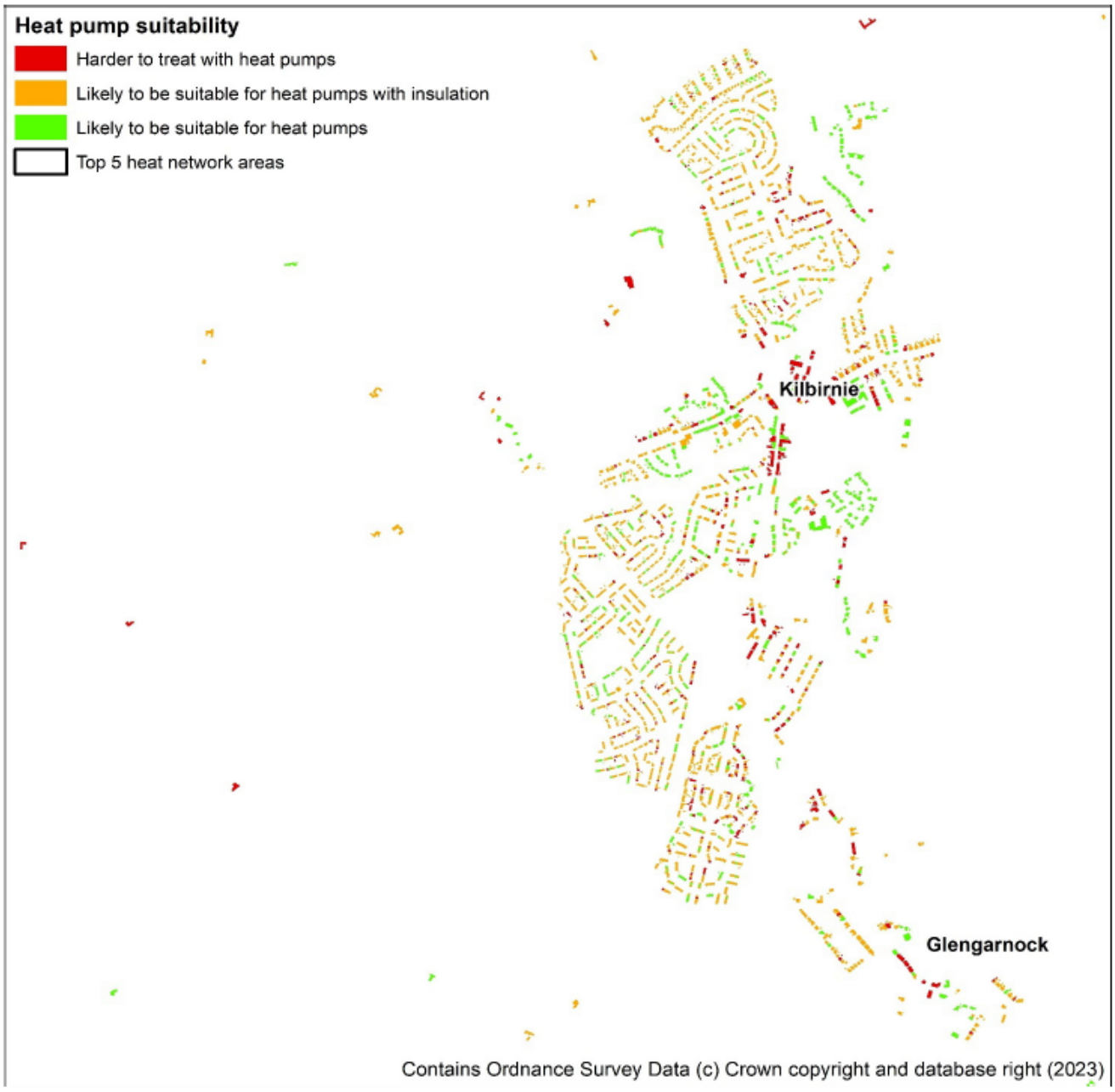


Figure 85: Heat Pump Suitability Fairlie

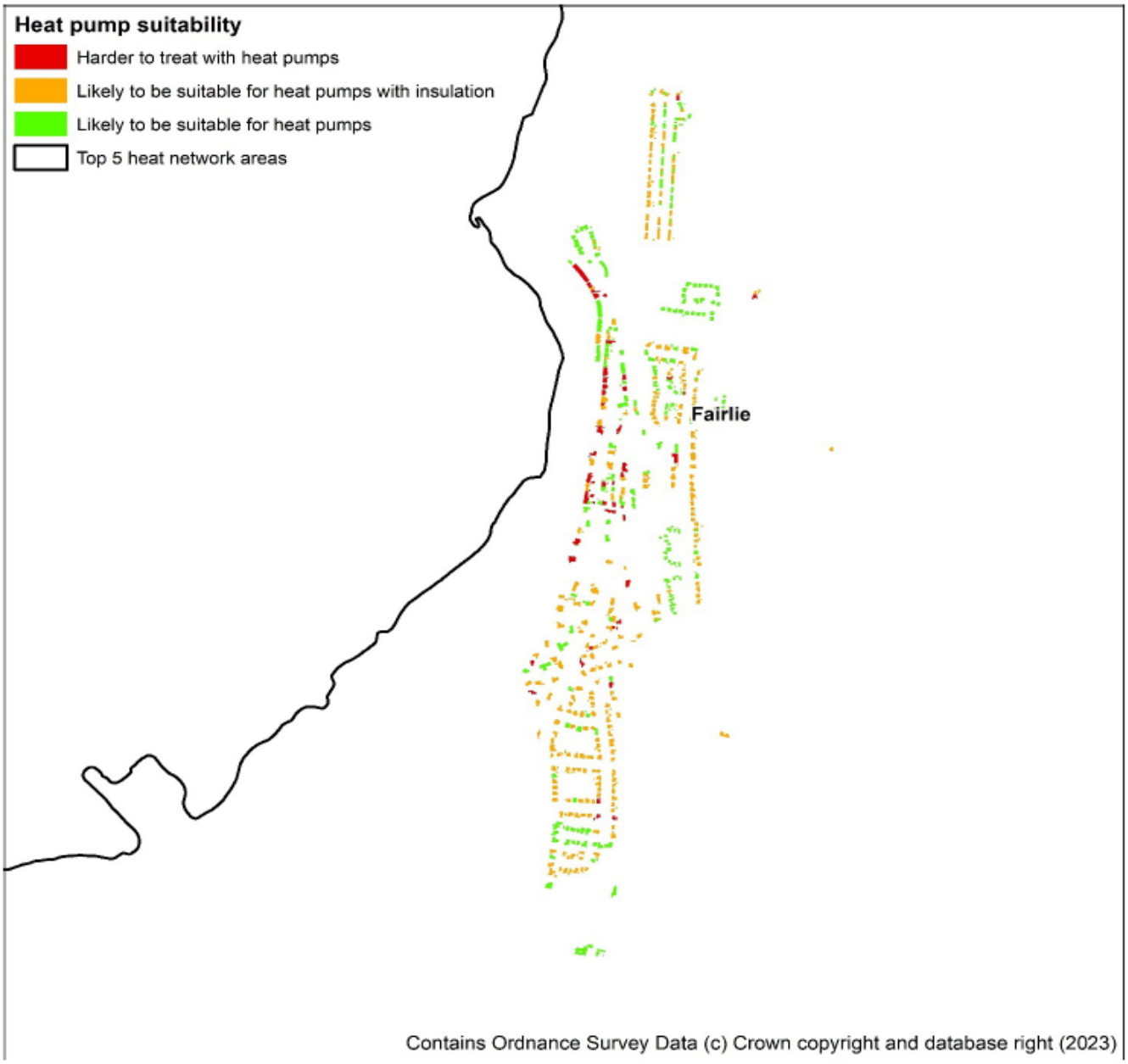


Figure 86:: Heat Pump Suitability Skelmorlie

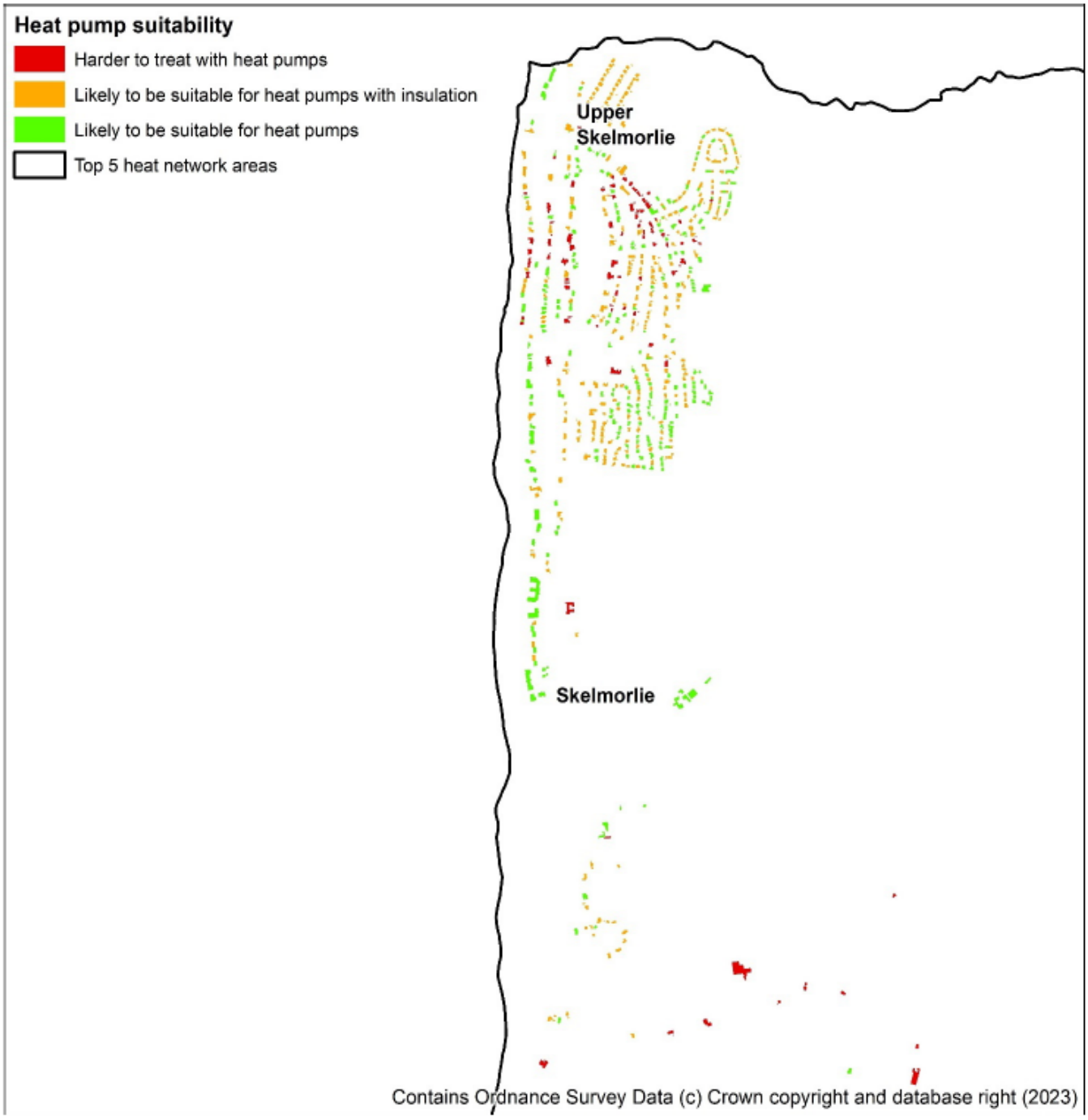


Figure 87: Heat Pump Suitability Largs

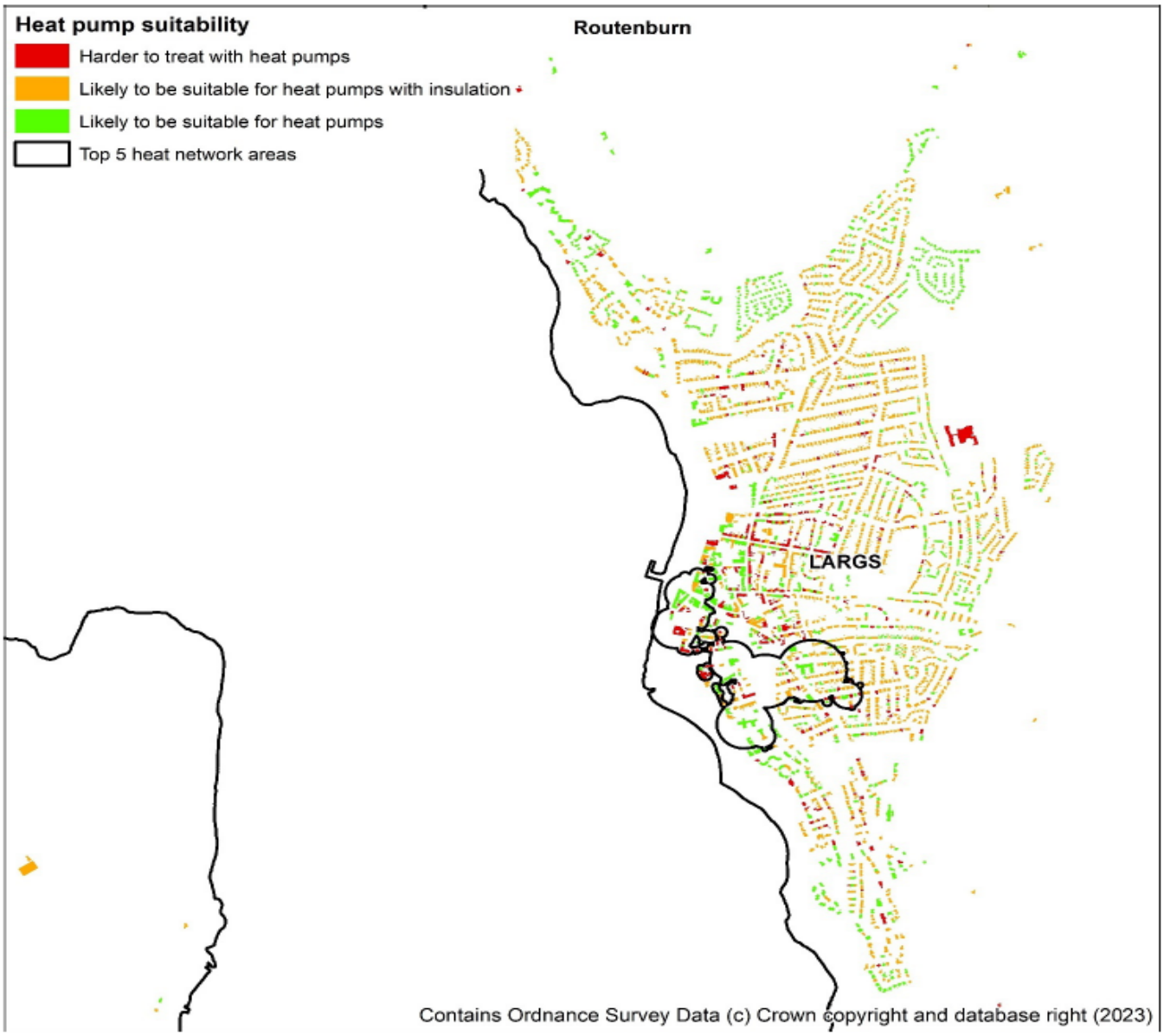


Figure 88: Heat Pump Suitability Millport

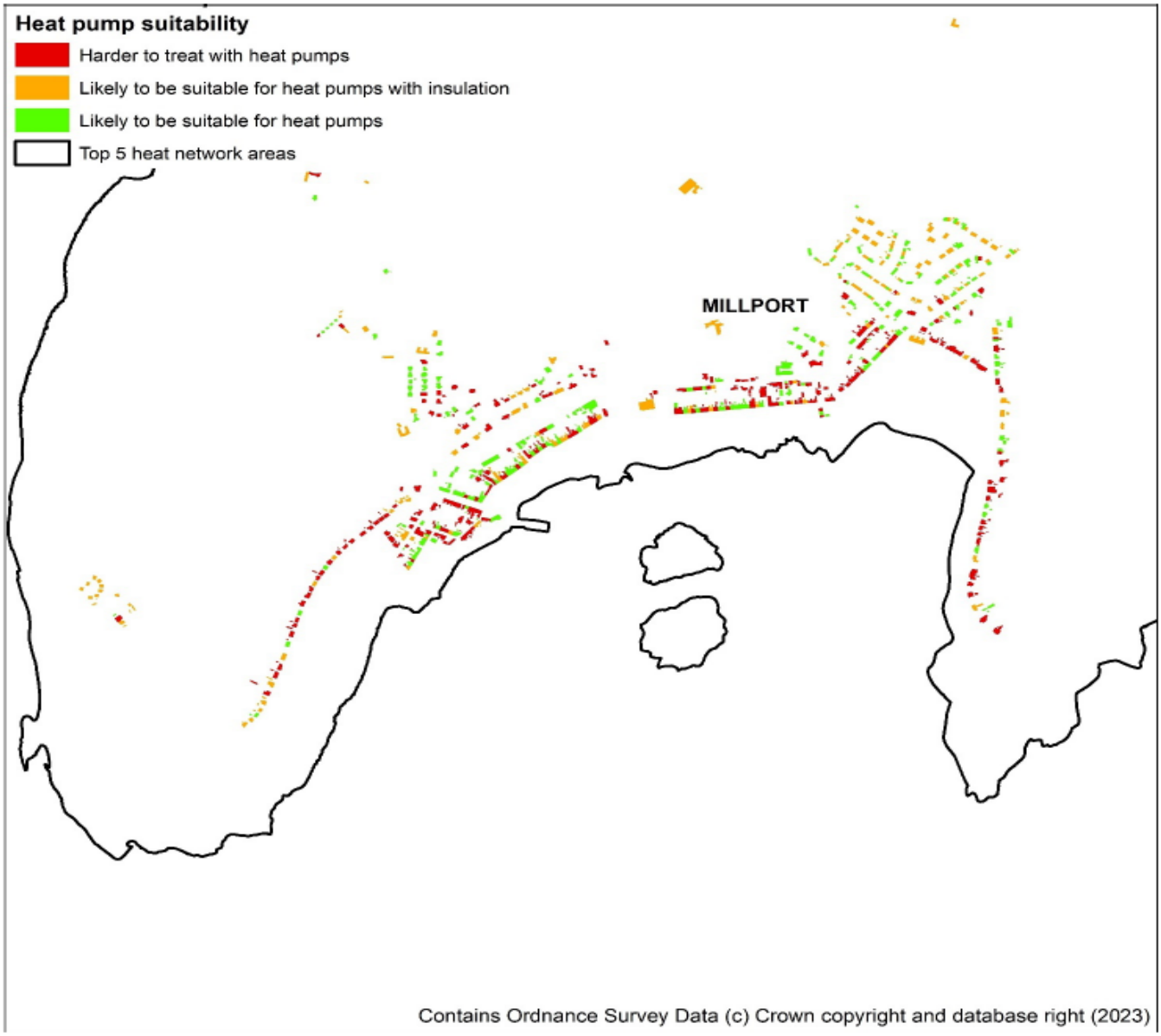


Figure 89: Heat Pump Suitability West Kilbride

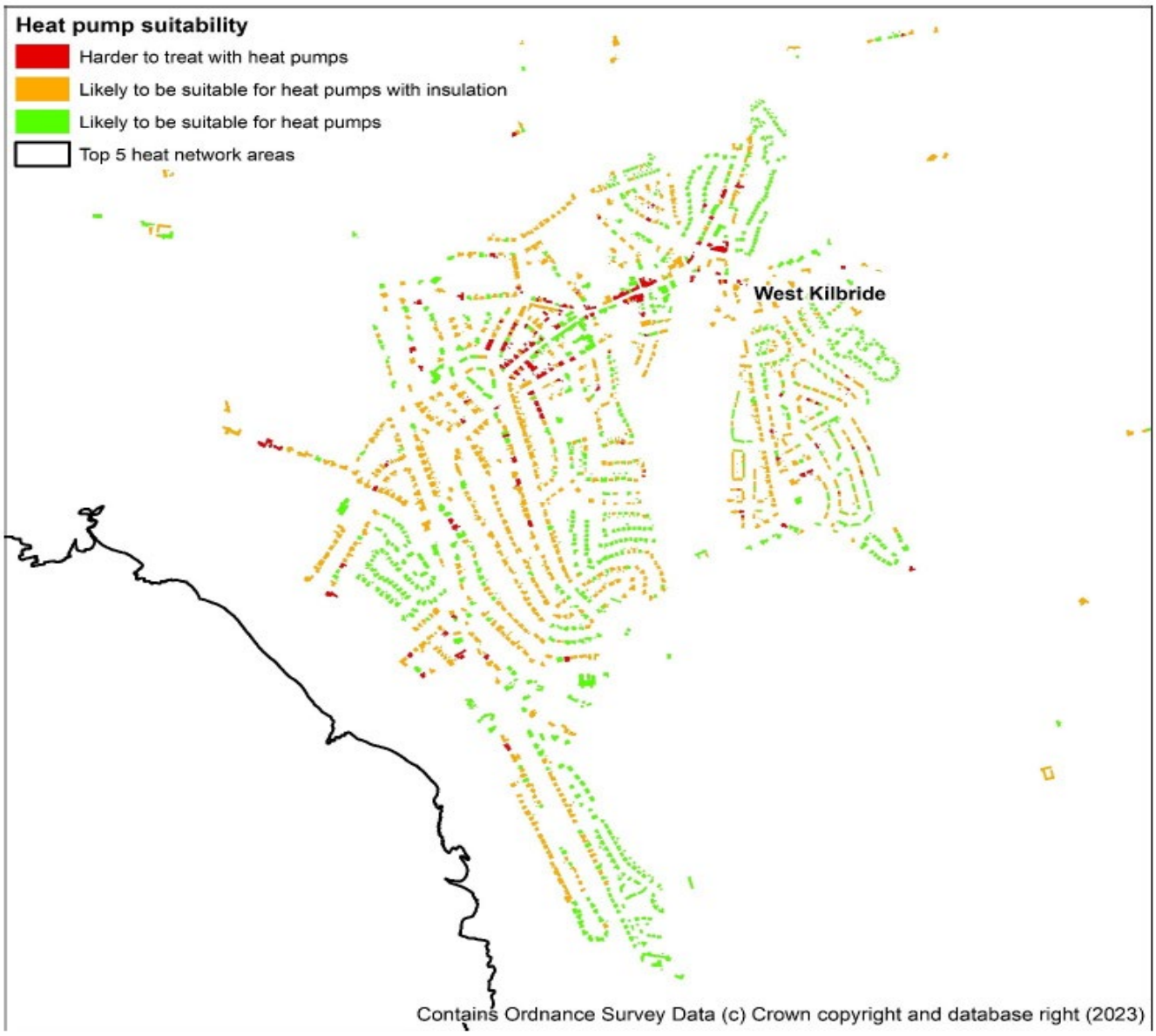


Figure 90: Heat Pump Suitability Arran (Whiting Bay)

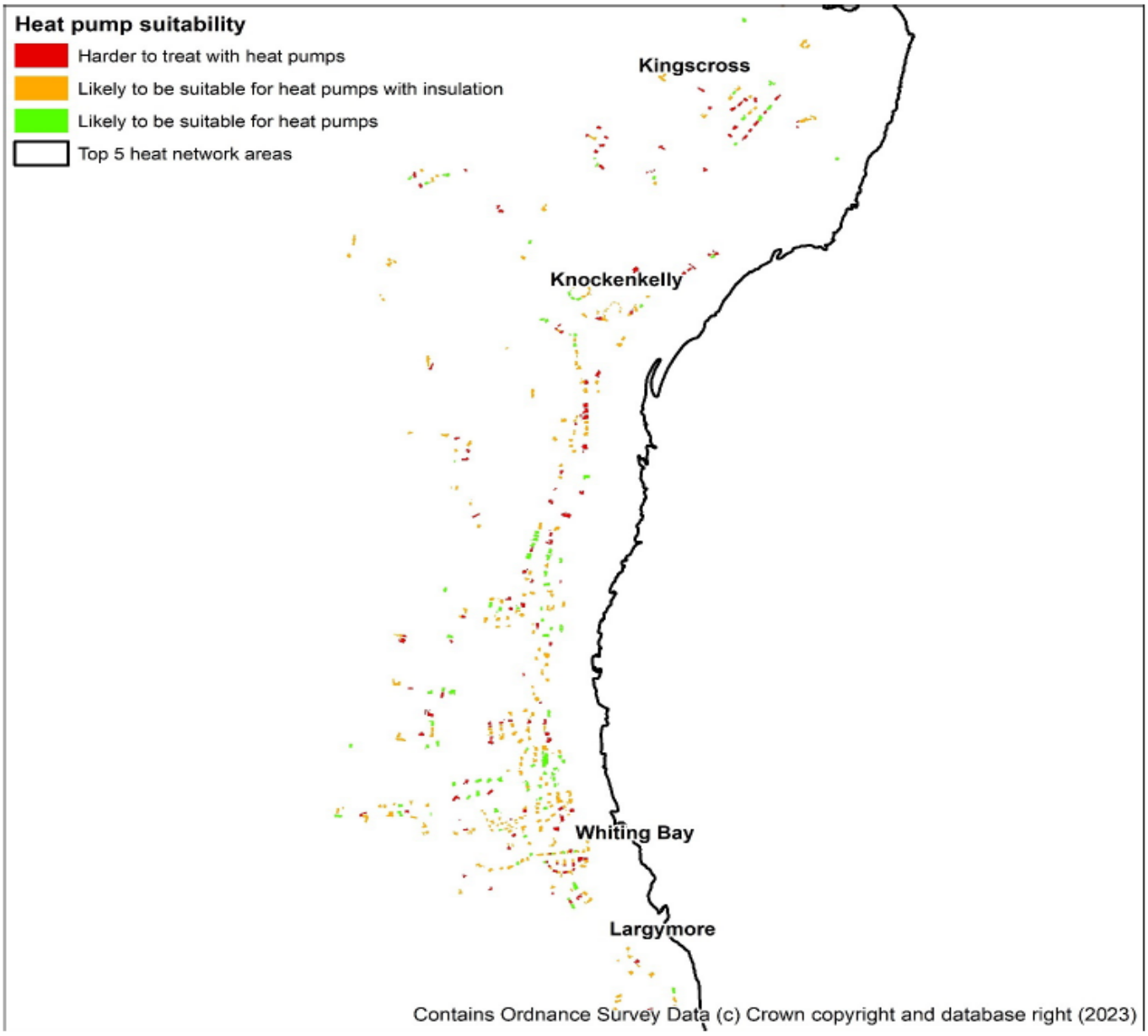


Figure 91: Heat Pump Suitability Arran (Lamlash)

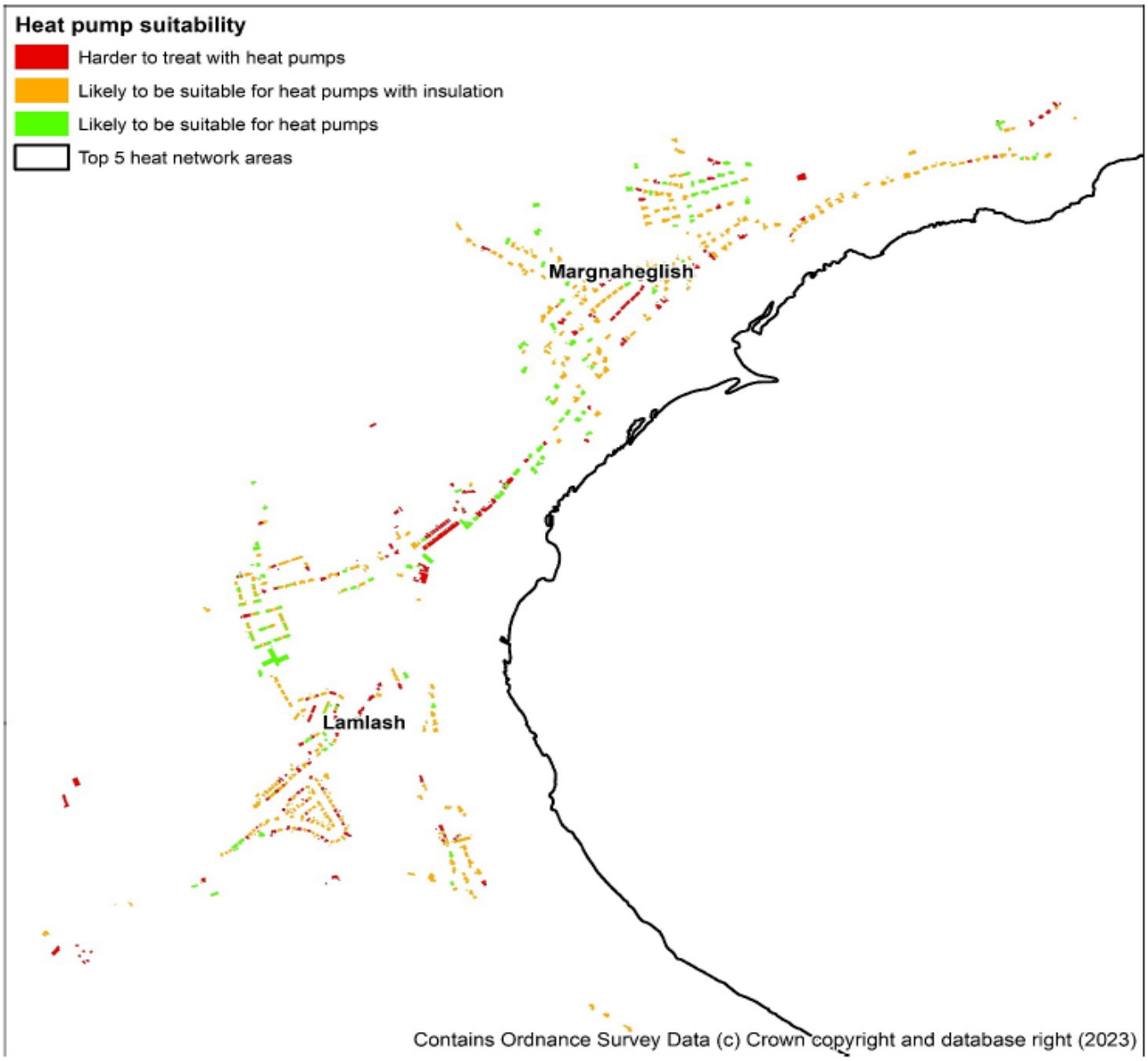
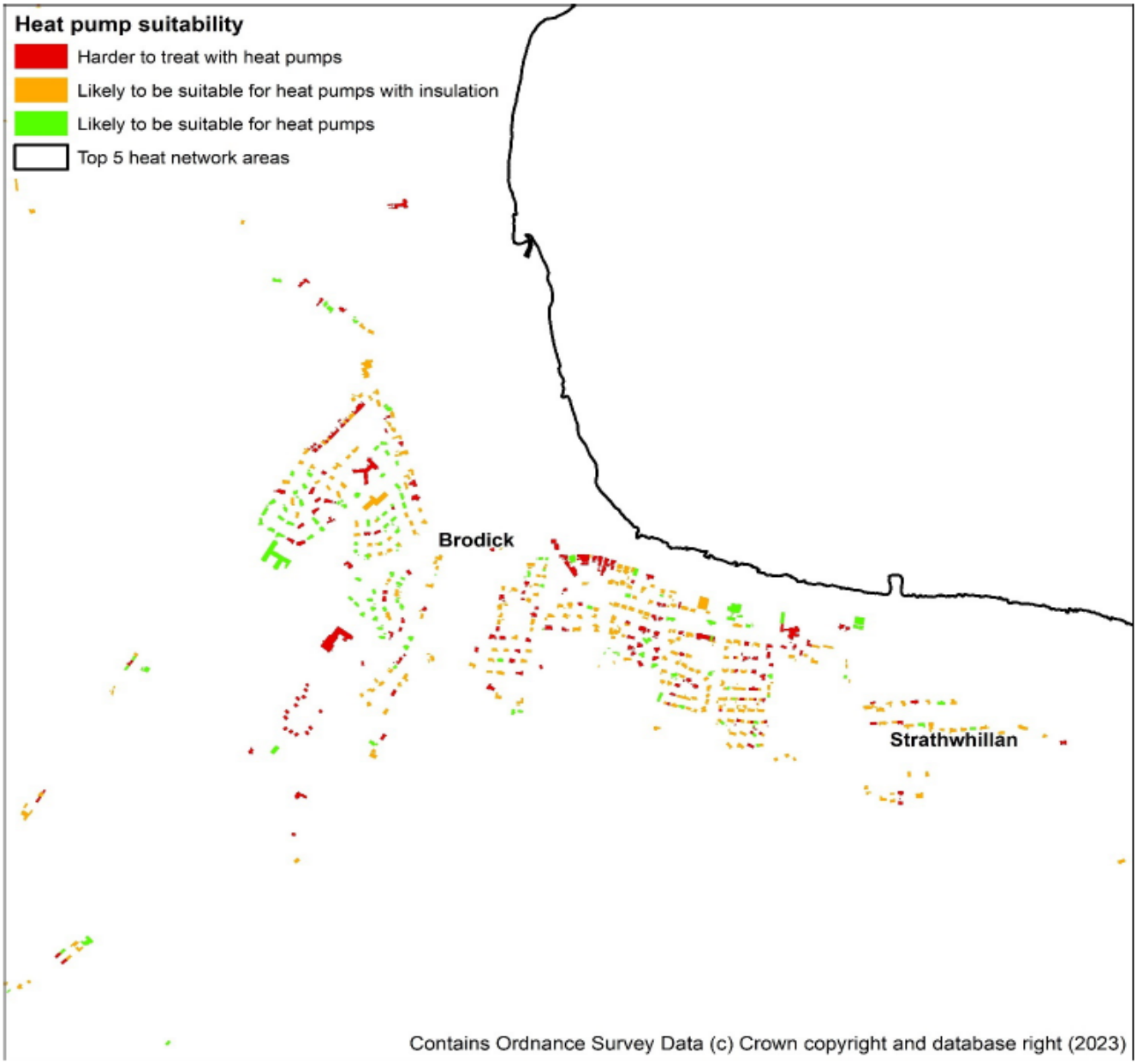


Figure 92: Heat Pump Suitability Arran (Brodick)



Appendix F Default Indicators

The LHEES Methodology utilises weightings in order to calculate the Total Weighted Scores for Energy Efficiency and Fuel Poverty Resulting from Poor Energy Efficiency. Description and default values are given in Table 30.

Table 30: Default Indicators

Theme	Indicator	Criteria	Weighting	Description	Data source if known
Building energy efficiency	Loft insulation	<100mm (prediction) (Yes)	33.33%	Binary identifier. Used to identify properties with a low energy efficiency, properties with no or minimal loft insulation.	Home Analytics
Building energy efficiency	Single glazed windows	Binary (Yes)	33.33%	Binary identifier. Used to identify properties with a low energy efficiency, properties with single glazed windows.	Home Analytics
Building energy efficiency	Wall insulation prediction (all construction types)	Binary (Uninsulated)	33.33%	Binary identifier. Used to identify properties with a low energy efficiency, properties with uninsulated walls.	Home Analytics
Additional example Indicators that could be used to support Delivery Level Area identification as part of LHEES Stage 4 and Delivery Plan	Tenure type	User defined		Four types; housing association, owner/ occupier, private rented, local authority. User can filter by interest.	Home Analytics
Additional example Indicators that could be used to support Delivery Level Area identification as part of LHEES Stage 4 and Delivery Plan	Building age	User defined		Defined in age brackets; Pre 1919, 1919-1949, 1950-1983, 1984-1991, 1992-2002, Post-2002. User can filter by interest.	Home Analytics
Additional example Indicators that could be used to support Delivery Level Area identification as part of LHEES Stage 4 and Delivery Plan	Non-traditional build design type	Solid wall (binary)		User can filter by interest.	Home Analytics
Additional example Indicators that could be used to support Delivery	EPC Rating	E, F or G		User can filter by interest.	Home Analytics

Theme	Indicator	Criteria	Weighting	Description	Data source if known
Level Area identification as part of LHEES Stage 4 and Delivery Plan					
Indicators of fuel poverty	Probability of fuel poverty	% likelihood	50%	50% is default but set to 0% if extreme fuel poverty is to be analysed.	Home Analytics
Indicators of fuel poverty	Probability of extreme fuel poverty	% likelihood	0%	0% is a default Weighting applied. User can adjust balance by selecting 0% or 50% to switch analysis focus between fuel poverty or extreme fuel poverty.	Home Analytics
Building energy efficiency	Loft insulation	<100mm (prediction) (Yes)	16.67%	Poor energy efficiency Indicators sum to 50% of overall Weighting, each have an equal Weighting.	Home Analytics
Building energy efficiency	Single glazed windows	Binary (Yes)	16.67%	Poor energy efficiency Indicators sum to 50% of overall Weighting, each have an equal Weighting.	Home Analytics
Building energy efficiency	Wall insulation prediction (all construction types)	Binary (Uninsulated)	16.67%	Poor energy efficiency Indicators sum to 50% of overall Weighting, each have an equal Weighting.	Home Analytics
Additional example Indicators that could be used to support Delivery Level Area identification as part of LHEES Stage 4 and Delivery Plan	Tenure type	User defined	N/A	Four types; housing association, owner/ occupier, private rented, local authority. User can filter by interest.	Home Analytics
Additional example Indicators that could be used to support Delivery Level Area identification as part of LHEES Stage 4 and Delivery Plan	Building age	User defined	N/A	Defined in age brackets; Pre 1919, 1919-1949, 1950-1983, 1984-1991, 1992-2002, Post-2002. User can filter by interest.	Home Analytics
Additional example Indicators that could be used to support Delivery Level Area identification as part of LHEES Stage 4 and Delivery Plan	Non-traditional build design type	Solid wall (binary)	N/A	User can filter by interest.	Home Analytics
Additional example Indicators that could be used to support Delivery Level Area identification as part of LHEES Stage 4 and Delivery Plan	EPC Rating	E, F or G	N/A	User can filter by interest.	Home Analytics

Appendix G Intervention Details

On- and Off-gas Grid

Table 31: Off-Gas Grid

Intervention	1
Action Summary	1.1 Survey properties with missing data.
Action Summary	1.2 Install low carbon heating in off-gas grid buildings.
LHEES Consideration	1 Off-gas grid.
Background	Properties off the gas grid are deemed as one of the priorities for decarbonisation as they likely have higher associated heating emissions than those on the gas grid. In addition fuel poverty may also be more prevalent in off-gas grid home as alternatives such as LPG or oil tends to be more expensive than gas. The islands in North Ayrshire Council have all their properties which are off-gas and are very remote.
Action Champion	To be decided by North Ayrshire Council.
Internal Stakeholders	Housing, Energy and Sustainability, Property Management & Investment, and Planning.
External Stakeholders	Tenants, Homeowners, Housing Associations, Suppliers/ Installers
Property Numbers	Arran – 3,778
Property Numbers	Garnock Valley – 1,207
Property Numbers	Irvine – 980
Property Numbers	Kilwinning – 649
Property Numbers	North Coast and Cumbraes -3,108
Property Numbers	Three Towns - 880
Technical Considerations	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	No specific requirements for off-gas grid.
Economic Considerations	Access to very rural locations, important to group multiple rural dwellings at the same time.
Prioritisation	Prioritised by data zone SIMD to cover multiple properties in the same locale to maximise installation time efficiency.
External Funding Opportunities	
Internal Funding Allocation	To be decided by NAC. From which budget, in which year, how much per year?
Links to existing projects	NAC, is it already being done?
Time	2030 deadline to allow for 75% reduction in emissions. Average of 1,741 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions, budget etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is sufficient.
Monitoring and evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “off-gas grid” section is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for tother actions.

Table 32: On-Gas Grid

Intervention	2
Action Summary	2.1Survey properties with missing data.
Action Summary	2.2 Install low carbon heating in on-gas grid buildings
LHEES Considerations	2 On-gas grid.
Background	Although properties on-gas grid need to be decarbonised to reach 2045 net zero targets. On-gas fuel costs are likely lower than those off-gas, and on-gas is also likely lower emissions. Therefore on-gas grid is a lower priority than the other considerations.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing, Energy and Sustainability, Property Management & Investment, and Planning.
External Stakeholders	Tenants, Homeowners, Housing Associations, Suppliers/ Installers.
Property Numbers	Arran – 0
Property Numbers	Garnock Valley – 9,443
Property Numbers	Irvine – 18,551
Property Numbers	Kilwinning -7,589
Property Numbers	North Coast and Cumbraes – 10,936
Property Numbers	Three Towns – 16,503
Technical Considerations	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	No specific requirements for on-gas grid.
Economic Considerations	Without optimised heat pump control and suitable tariff selection there is little economic benefit other than removing gas standing charge, if other gas uses can be removed.
Prioritisation	On-gas grid is the lowest priority of all the considerations. Prioritised by data zone SIMD to cover multiple properties in the same locale to maximise installation time efficiency.
External Funding Opportunities	
Internal Funding Allocation	To be decided by NAC. From which budget, in which year, how much per year?
Links to existing projects	NAC, is it already being done?
Time	2045 deadline to achieve net zero target. Average of 3,008 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions, budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is sufficient.
Monitoring and evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “off-gas grid” section is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Local Authority Interventions

Table 33: LA – Wall Insulation

Intervention	3
Action Summary	3.1 Investigate if wall insulation can be added.
Action Summary	3.2 Add wall insulation where feasible.
LHEES Consideration	4 Poor building energy efficiency.
LHEES Consideration	5 Fuel poverty resulting from poor building energy efficiency.
Background	Wall insulation is important in reducing heat loss from the largest surface of buildings and hence heat demand and bills. NAC building stock data details if the buildings have any type of wall insulation. In many properties there is no wall insulation, which depending on the type of wall insulation and the feasibility can be economically reasonable and technically effective. There is an opportunity to reduce heat demand by retrofitting all properties to install wall insulation
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing, Energy and Sustainability, Property Management & Investment, and Planning.
External Stakeholders	NAC tenants, Suppliers/ Installers.
Property Numbers	Arran – 15
Property Numbers	Garnock Valley – 588
Property Numbers	Irvine – 956
Property Numbers	Kilwinning – 361
Property Numbers	North Coast and Cumbraes – 258
Property Numbers	Three Towns - 964
Technical onsiderations	Cavity wall presence and width, internal space, external space, wind driven rain.
Skills Considerations	This is an established practice with a mature skill set that is well established.
Economic Considerations	If done correctly and only for suitable buildings, the insulation should be long term. If inappropriate application or installation, this may cause damp leading to further costs.
Prioritisation	The priority will be vacant properties during transition between tenants. Next, the properties will be prioritised by data zone SIMD to cover multiple properties, and the same type of wall insulation, in the same locale to maximise installation time efficiency.
External Funding Opportunities	
Internal Funding Allocation	To be decided by NAC. From which budget, in which year, how much per year?
Links to existing projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 196 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions
Monitoring and evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “wall insulation” section is updated after each batch of inspections. The action champion shall report back to the LHEES Team with lessons learned for other actions.

Table 34: LA - Windows

Intervention	4
Action Summary	4.1 Survey properties with single glazing
Action Summary	4.2 Upgrade windows to double glazing
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Single glazed windows loose significantly more heat than double glazed windows and increase bills. NAC building stock data details if buildings still have single glazed windows. This is still common in many of NAC properties, which for many cases can be easily upgraded with economic benefits. This opportunity reduces heat demand by retrofitting double glazed windows.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing, Energy and Sustainability, Property Management & Investment, and Planning.
External Stakeholders	NAC tenants, Suppliers/ Installers.
Property Numbers	Arran - 4
Property Numbers	Garnock Valley – 467
Property Numbers	Irvine – 447
Property Numbers	Kilwinning – 215
Property Numbers	North Coast and Cumbraes – 51
Property Numbers	Three Towns - 527
Technical Considerations	This is an established technology with several vendors and no supply bottlenecks.
Skills Considerations	This is an established practice with no specific skills requirement.
Economic Considerations	The 20 plus year lifespan of double-glazed windows can be a cost-effective way of reducing fuel bills.
Prioritisation	The priority will be vacant properties during transition between tenants. ext, the properties will be prioritised by data zone SIMD to cover multiple properties in the same locale to maximise installation time efficiency
External Funding Opportunities	
Internal Funding Allocation	To be decided by NAC. From which budget, in which year, how much per year?
Links to Existing projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 107 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “glazing” section is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 35: LA – Loft Insulation

Intervention	5
Action Summary	5.1 Survey properties with missing data.
Action Summary	5.2 Upgrade all insulation to over 250 mm glass wool (or equivalent).
LHEES Consideration	4 Poor building energy efficiency.
LHEES Consideration	5 Fuel poverty resulting from poor building energy efficiency.
Background	Loft insulation is important in reducing heat loss and hence heat demand and bills. NAC's building stock data details the depth of insulation in the lofts of most properties. In many properties, this is less than 250mm, which is considered economically reasonable and technically effective. There is an opportunity to reduce heat demand by retrofitting all properties to take the insulation up to over 250mm mineral wool (or equivalent).
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing, Energy and Sustainability, Property Management & Investment, and Planning.
External Stakeholders	NAC tenants, Suppliers/ Installers.
Property Numbers	Arran - 37
Property numbers	Garnock Valley – 412
Property numbers	Irvine – 857
Property numbers	Kilwinning – 361
Property numbers	North Coast and Cumbraes - 167
Property numbers	Three Towns – 815
Technical Considerations	This is an established technology with several vendors and no supply bottlenecks.
Skills Considerations	This is an established practice with no specific skills requirement.
Economic Considerations	This is a low-cost investment with a lifespan exceeding that of the building.
Prioritisation	The priority will be vacant properties during transition between tenants. Next, the properties will be prioritised by data zone SIMD to cover multiple properties in the same locale to maximise installation time efficiency.
External Funding Opportunities	
Internal Funding Allocation	To be decided by NAC. From which budget, in which year, how much per year?
Links to existing projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 166 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	
Monitoring and evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "loft insulation thickness" is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 36: LA – Electric to Heat Pumps

Intervention	6
Action Summary	6.1 Survey properties for wet heating system installation requirements
Action Summary	6.2 Install more efficient electrified heating system e.g., ASHP
LHEES Consideration	4 Poor building energy efficiency.
LHEES Consideration	5 Fuel poverty resulting from poor building energy efficiency.
Background	Although dwellings with electric heating may already be decarbonised their other benefits from moving away from traditional direct electric heating systems. More efficient systems can reduce fuel demand and fuel bills. They can also reduce grid constraints, which can allow for more ASHP to be installed in that area. For medium to large demand dwellings and those with wet heating systems already installed an ASHP is the likely most sensible options. For lower demand dwellings and those without wet heating systems, other more modern direct electrified heating systems that couple with thermal storage and utilise modern time of use tariffs can reduce bills compared to traditional direct electrified heating without as much capital investment as an ASHP.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing, Energy and Sustainability, Property Management & Investment, and Planning.
External Stakeholders	NAC tenants, Suppliers/ Installers.
Property Numbers	Arran – 32
Property Numbers	Garnock Valley – 105
Property Numbers	Irvine – 323
Property Numbers	Kilwinning – 62
Property Numbers	North Coast and Cumbraes – 65
Property Numbers	Three Towns - 232
Technical Considerations	ASHP suitability, wet radiator sizing to suit heat demand. Modern direct electrified heating system with thermal storage and smart meter use.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	Compared to traditional direct electric heating systems the modern electrified heating should be cost effective over their lifetime.
Prioritisation	The priority will be vacant properties during transition between tenants. Next, the properties will be prioritised by data zone SIMD to cover multiple properties in the same locale to maximise installation time efficiency.
External Funding Opportunities	
Internal Funding Allocation	To be decided by NAC. From which budget, in which year, how much per year?
Links to existing projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 51 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “heating system” is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 37: LA – Oil/LPG to Heat Pumps

Intervention	7
Action Summary	7.1 Install ASHP
LHEES Consideration	4 Poor building energy efficiency.
LHEES Consideration	5 Fuel poverty resulting from poor building energy efficiency.
Background	Properties with oil/ LPG (which likely link to off-gas grid) are deemed as one of the priorities for decarbonisation as they likely have higher associated heating emissions than those on the gas grid. In addition, fuel poverty may also be more prevalent in oil/LPG homes as the fuel tends to be more expensive than gas.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing, Energy and Sustainability, Property Management. & Investment, and Planning.
External Stakeholders	NAC tenants, Suppliers/ Installers.
Property Numbers	Arran – 10
Property Numbers	Garnock Valley – 9
Property Numbers	Irvine – 6
Property Numbers	Kilwinning – 12
Property Numbers	North Coast and Cumbraes – 0
Property Numbers	Three Towns – 2
Technical Considerations	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	ASHP are typically more cost effective over their lifetime than oil/ LPG heating.
Prioritisation	The priority will be vacant properties during transition between tenants. Next, the properties will be prioritised by data zone SIMD to cover multiple properties in the same locale to maximise installation time efficiency.
External funding opportunities	
Internal Funding Allocation	To be decided by NAC. From which budget, in which year, how much per year?
Links to existing projects	NAC, is it already being done?
Time	2030 deadline to allow for 75% reduction in emissions. Average of 6 dwelling each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “heating system” is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 38: LA – Gas to Heat Pumps

Intervention	8
Action Summary	8.1 Install ASHP
Action Summary	8.2 Install electric cooker
LHEES Consideration	4 Poor building energy efficiency.
LHEES Consideration	5 Fuel poverty resulting from poor building energy efficiency.
Background	Properties on-gas grid need to be decarbonised to reach 2045 net zero targets. On-gas fuel costs are likely lower than those off-gas grid, and on-gas is also likely lower emissions. Therefore on-gas grid is a lower priority than the other considerations.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing, Energy and Sustainability, Property Management & Investment, and Planning.
External Stakeholders	NAC tenants, Suppliers/ Installers.
Property Numbers	Arran - 0
Property Numbers	Garnock Valley – 1,862
Property Numbers	Irvine – 2,984
Property Numbers	Kilwinning – 1,217
Property Numbers	North Coast and Cumbraes - 667
Property Numbers	Three Towns – 3,426
Technical Consideration	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	Without optimised heat pump control and suitable tariff selection there is little economic benefit other than removing gas standing charge, if other gas uses can be removed.
Prioritisation	The priority will be vacant properties during transition between tenants. Next, the properties will be prioritised by data zone SIMD to cover multiple properties in the same locale to maximise installation time efficiency.
External Funding Opportunities	
Internal Funding Allocation	To be decided by NAC. From which budget, in which year, how much per year?
Links to existing projects	NAC, is it already being done?
Time	2045 deadline to achieve net zero target. Average of 486 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “heating system” is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 39: LA – Solid/Biomass to Heat Pumps

Intervention	9
Action Summary	9.1 Survey for requirement for wet heating system
Action Summary	9.2 Install ASHP
LHEES Consideration	4 Poor building energy efficiency.
LHEES Consideration	5 Fuel poverty resulting from poor building energy efficiency.
Background	Properties with solid fuel (which likely link to off-gas grid) are deemed as one of the priorities for decarbonization as they likely have higher associated heating emissions than those on the gas grid. In addition, fuel poverty may also be more prevalent in solid homes as the fuel may be more expensive than gas
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing, Energy and Sustainability, Property Management & Investment, and Planning.
External Stakeholders	NAC tenants, Suppliers/ Installers.
Property Numbers	Arran – 1
Property Numbers	Garnock Valley – 0
Property Numbers	Irvine – 0
Property Numbers	Kilwinning – 3
Property Numbers	North Coast and Cumbraes – 1
Property Numbers	Three Towns - 1
Technical Considerations	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	ASHP are typically more cost effective over their lifetime than solid/ biomass heating.
Prioritisation	The priority will be vacant properties during transition between tenants. Next, the properties will be prioritised by data zone SIMD to cover multiple properties in the same locale to maximise installation time efficiency.
External Funding Opportunities	
Internal Funding Allocation	To be decided by NAC. From which budget, in which year, how much per year?
Links to existing projects	NAC, is it already being done?
Time	2030 deadline to allow for 75% reduction in emissions. Average of dwelling each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “heating system” is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Housing Association Interventions

Table 40: HA – Wall Insulation

Intervention	10
Action Summary	Working group to liaise with housing associations.
LHEES Consideration	4 Poor building energy efficiency.
LHEES Consideration	5 Fuel poverty resulting from poor building energy efficiency.
Background	Wall insulation is important in reducing heat loss from the largest surface of buildings and hence heat demand and bills. Home analytics data details if the buildings have any type of wall insulation. In many properties there is no wall insulation, which depending on the type of wall insulation and the feasibility can be economically reasonable and technically effective. There is an opportunity to reduce heat demand by retrofitting all properties to install wall insulation.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Housing associations, tenants, suppliers/ installers.
Property Numbers	Arran – 43
Property Numbers	Garnock Valley – 41
Property Numbers	Irvine – 181
Property Numbers	Kilwinning – 227
Property Numbers	North Coast and Cumbraes – 38
Property Numbers	Three Towns - 215
Technical Considerations	Cavity wall presence and width, internal space, external space, wind driven rain.
Skills Considerations	This is an established practice with no specific skills requirement.
Economic Considerations	If done correctly and only for suitable buildings, the insulation should be long term. If inappropriate application or installation, this may cause damp leading to further costs.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific housing association engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for home associations.
Links to Existing Projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 47 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	
Monitoring and evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “wall insulation” section is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 41: HA - Windows

Intervention	11
Action Summary	Working group to liaise with housing associations.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Single glazed windows loose significantly more heat than double glazed windows and increase bills. Home analytics data details if buildings still have single glazed windows. This is still common in many properties, which for many cases can be easily upgraded with economic benefits. This opportunity reduces heat demand by retrofitting double glazed windows.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Housing associations, tenants, suppliers/ installers.
Property Numbers	Arran – 17
Property Numbers	Garnock Valley – 15
Property Numbers	Irvine – 100
Property Numbers	Kilwinning – 35
Property Numbers	North Coast and Cumbraes – 3
Property Numbers	Three Towns - 82
Technical Considerations	This is an established technology with several vendors and no supply bottlenecks.
Skills Considerations	This is an established practice with no specific skills requirement.
Economic Considerations	The 20 plus year lifespan of double-glazed windows can be a cost-effective way of reducing fuel bills.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific housing association engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for home associations.
Links to Existing projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 16 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “glazing” section is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 42: HA – Loft Insulation

Intervention	12
Action Summary	Working group to liaise with housing associations.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Loft insulation is important in reducing heat loss and hence heat demand and bills. Home analytics data details the depth of insulation in the lofts of most properties. In many properties, this is less than 250mm, which is considered economically reasonable and technically effective. There is an opportunity to reduce heat demand by retrofitting all properties to take the insulation up to over 250mm mineral wool (or equivalent).
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Housing associations, tenants, suppliers/ installers.
Property Numbers	Arran - 211
Property Numbers	Garnock Valley – 69
Property Numbers	Irvine – 639
Property Numbers	Kilwinning – 333
Property Numbers	North Coast and Cumbraes – 42
Property Numbers	Three Towns - 294
Technical Considerations	This is an established technology with several vendors and no supply bottlenecks.
Skills Considerations	This is an established practice with no specific skills requirement.
Economic Considerations	This is a low-cost investment with a lifespan exceeding that of the building.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific housing association engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for home associations.
Links to Existing Projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 99 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “loft insulation thickness” is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 43: HA – Electric to Heat Pumps

Intervention	13
Action Summary	Working group to liaise with housing associations.
LHEES Consideration	4 Poor building energy efficiency.
LHEES Consideration	5 Fuel poverty resulting from poor building energy efficiency.
Background	Although dwellings with electric heating may already be decarbonised their other benefits from moving away from traditional direct electric heating systems. More efficient systems can reduce fuel demand and fuel bills. They can also reduce grid constraints, which can allow for more ASHP to be installed in that area. For medium to large demand dwellings and those with wet heating systems already installed an ASHP is the likely most sensible options. For lower dwellings and those without wet heating systems other more modern direct electrified heating systems that couple with thermal storage and utilise modern time of use tariffs can reduce bills compared to traditional direct electrified heating without as much capital investment as an ASHP..
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Housing associations, tenants, suppliers/ installers.
Property Numbers	Arran – 354
Property Numbers	Garnock Valley – 4
Property Numbers	Irvine – 23
Property Numbers	Kilwinning – 10
Property Numbers	North Coast and Cumbraes – 64
Property Numbers	Three Towns - 56
Technical Considerations	ASHP suitability, wet radiator sizing to suit heat demand. Modern direct electrified heating system with thermal storage and smart meter use.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	Compared to traditional direct electric heating systems the modern electrified heating should be cost effective over their lifetime.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific housing association engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for home associations.
Links to Existing Projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 32 dwelling each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "heating system" is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 44: HA – Oil/LPG to Heat Pumps

Intervention	14
Action Summary	Working group to liaise with housing associations.
LHEES Consideration	4 Poor building energy efficiency.
LHEES Consideration	5 Fuel poverty resulting from poor building energy efficiency.
Background	Properties with oil/ LPG (which likely link to off-gas grid) are deemed as one of the priorities for decarbonisation as they likely have higher associated heating emissions than those on the gas grid. In addition, fuel poverty may also be more prevalent in oil/ LPG homes as the fuel tends to be more expensive than gas.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Housing associations, tenants, suppliers/ installers.
Property Numbers	Arran – 4
Property Numbers	Garnock Valley – 3
Property Numbers	Irvine – 5
Property Numbers	Kilwinning – 2
Property Numbers	North Coast and Cumbraes – 1
Property Numbers	Three Towns - 2
Technical Considerations	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	ASHP are typically more cost effective over their lifetime than oil/ LPG heating.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific housing association engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for home associations.
Links to Existing Projects	NAC, is it already being done?
Time	2030 deadline to allow for 75% reduction in emissions. Average 3 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “heating system” is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 45: HA – Gas to Heat Pumps

Intervention	15
Action Summary	Working group to liaise with housing associations.
LHEES Consideration	4 Poor building energy efficiency.
LHEES Consideration	5 Fuel poverty resulting from poor building energy efficiency.
Background	Although properties on-gas grid need to be decarbonised to reach 2045 net zero targets. On-gas fuel costs are likely lower than those off-gas grid, and on-gas is also likely lower emissions. Therefore on-gas grid is a lower priority than the other considerations.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Housing associations, tenants, suppliers/ installers.
Property Numbers	Arran – 0
Property Numbers	Garnock Valley – 239
Property Numbers	Irvine – 1,342
Property Numbers	Kilwinning – 674
Property Numbers	North Coast and Cumbraes – 110
Property Numbers	Three Towns - 979
Technical Considerations	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	Without optimised heat pump control and suitable tariff selection there is little economic benefit other than removing gas standing charge, if other gas uses can be removed.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific housing association engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for home associations.
Links to Existing Projects	NAC, is it already being done?
Time	2045 deadline to achieve net zero target. Average of 159 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “heating system” is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 46: HA – Solid/Biomass to Heat Pumps

Intervention	16
Action Summary	Working group to liaise with housing associations.
LHEES Consideration	4 Poor building energy efficiency.
LHEES Consideration	5 Fuel poverty resulting from poor building energy efficiency.
Background	Properties with solid (which likely link to off-gas grid) are deemed as one of the priorities for decarbonisation as they likely have higher associated heating emissions than those on the gas grid. Which can lead to health concerns for tenants. In addition, fuel poverty may also be more prevalent in solid homes as the fuel can be more expensive than gas.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Housing associations, tenants, suppliers/ installers.
Property Numbers	Arran – 2
Property Numbers	Garnock Valley – 0
Property Numbers	Irvine – 1
Property Numbers	Kilwinning – 0
Property Numbers	North Coast and Cumbraes – 0
Property Numbers	Three Towns – 1
Technical Considerations	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	ASHP are typically more cost effective over their lifetime than solid/ biomass heating.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific housing association engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for home associations.
Links to Existing Projects	NAC, is it already being done?
Time	2030 deadline to allow for 75% reduction in emissions. Average of 1 dwelling each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the “heating system” is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Owner Occupied Interventions

Table 47: OO – Wall Insulation

Intervention	17
Action Summary	Working group to improve public awareness for owner occupiers.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Wall insulation is important in reducing heat loss from the largest surface of buildings and hence heat demand and bills. Home analytics data details if the buildings have any type of wall insulation. In many properties there is no wall insulation, which depending on the type of wall insulation and the feasibility can be economically reasonable and technically effective. There is opportunity to reduce heat demand by retrofitting all properties to install wall insulation.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development.
External Stakeholders	Owner occupiers, suppliers/ installers.
Property Numbers	Arran – 1,948
Property Numbers	Garnock Valley – 3,863
Property Numbers	Irvine – 4,463
Property Numbers	Kilwinning – 2,098
Property Numbers	North Coast and Cumbraes – 6,474
Property Numbers	Three Towns – 4,397
Technical Considerations	Cavity wall presence and width, internal space, external space, wind driven rain.
Skills Considerations	This is an established practice with no specific skills requirement.
Economic Considerations	If done correctly and only for suitable buildings, the insulation should be long term. If inappropriate application or installation, this may cause damp leading to further costs.
Prioritisation	There is little control or prioritisation in owner occupied interventions, instead it is dependent on the owner's level of engagement.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for owner occupied buildings.
Links to Existing Projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 1,453 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "wall insulation" section is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 48: OO - Windows

Intervention	18
Action Summary	Working group to improve public awareness for owner occupiers.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Single glazed windows loose significantly more heat than double glazed windows and increase bills. Home analytics data details if buildings still have single glazed windows. This is still common in many properties, which for many cases can be easily upgraded with economic benefits. This opportunity reduces heat demand by retrofitting double glazed windows.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development.
External Stakeholders	Owner occupiers, suppliers/ installers.
Property Numbers	Arran – 242
Property Numbers	Garnock Valley – 685
Property Numbers	Irvine – 821
Property Numbers	Kilwinning – 241
Property Numbers	North Coast and Cumbraes – 669
Property Numbers	Three Towns – 647
Technical Considerations	This is an established technology with several vendors and no supply bottlenecks.
Skills Considerations	This is an established practice with no specific skills requirement.
Economic Considerations	The 20 plus year lifespan of double-glazed windows can be a cost-effective way of reducing fuel bills.
Prioritisation	There is little control or prioritisation in owner occupied interventions, instead it is dependent on the owner's level of engagement.
External Funding	
Internal Funding Allocation	No NAC internal funding for owner occupied buildings.
Links to Existing Projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 207 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "glazing" section is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 49: OO – Loft Insulation

Intervention	19
Action Summary	Working group to improve public awareness for owner occupiers.
LHEES Consideration	4 Poor building energy efficiency.
LHEES Consideration	5 Fuel poverty resulting from poor building energy efficiency.
Background	Loft insulation is important in reducing heat loss and hence heat demand and bills. Home analytics data details the depth of insulation in the lofts of most properties. In many properties, this is less than 250mm, which is considered economically reasonable and technically effective. There is an opportunity to reduce heat demand by retrofitting all properties to take the insulation up to over 250mm mineral wool (or equivalent).
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development.
External Stakeholders	Owner occupiers, suppliers/ installers.
Property Numbers	Arran – 1,741
Property Numbers	Garnock Valley- 3,075
Property Numbers	Irvine – 4,715
Property Numbers	Kilwinning – 2,297
Property Numbers	North Coast and Cumbraes – 4,598
Property Numbers	Three Towns – 3,945
Technical Considerations	This is an established technology with several vendors and no supply bottlenecks.
Skills Considerations	This is an established practice with no specific skills requirement.
Economic Considerations	This is a low-cost investment with a lifespan exceeding that of the building.
Prioritisation	There is little control or prioritisation in owner occupied interventions, instead it is dependent on the owner's level of engagement.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for owner occupied buildings.
Links to existing projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 1,273 dwellings each year from 2024.
Action Plan.	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "loft insulation thickness" is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 50: OO – Electric to Heat Pumps

Intervention	20
Action Summary	Working group to improve public awareness for owner occupiers.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Although dwellings with electric heating may already be decarbonised their other benefits from moving away from traditional direct electric heating systems. More efficient systems can reduce fuel demand and fuel bills. They can also reduce grid constraints, which can allow for more ASHP to be installed in that area. For medium to large demand dwellings and those with wet heating systems already installed an ASHP is the likely most sensible options. For lower demand dwellings and those without wet heating systems, other more modern direct electrified heating systems that couple with thermal storage and utilise modern time of use tariffs can reduce bills compared to traditional direct electrified heating without as much capital investment as an ASHP.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development.
External Stakeholders	Owner occupiers, suppliers/ installers.
Property Numbers	Arran – 1,351
Property Numbers	Garnock Valley – 385
Property Numbers	Irvine – 454
Property Numbers	Kilwinning – 195
Property Numbers	North Coast and Cumbraes – 2,187
Property Numbers	Three Towns - 535
Technical Considerations	ASHP suitability, wet radiator sizing to suit heat demand. Modern direct electrified heating system with thermal storage and smart meter use. If the Arran dwellings that are electrically heated are mainly summer holiday homes, the real-world lower heat demand may mean heat pumps are not viable.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	Compared to traditional direct electric heating systems the modern electrified heating should be cost effective over their lifetime.
Prioritisation	There is little control or prioritisation in owner occupied interventions, instead it is dependent on the owner's level of engagement.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for owner occupied buildings.
Links to Existing Projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 319 dwellings from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "heating system" is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 51: OO – Oil/LPG to Heat Pumps

Intervention	21
Action Summary	Working group to improve public awareness for owner occupiers.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Properties with oil/ LPG (which likely link to off-gas grid) are deemed as one of the priorities for decarbonisation as they likely have higher associated heating emissions than those on the gas grid. In addition, fuel poverty may also be more prevalent in oil/ LPG homes as the fuel tends to be more expensive than gas.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development.
External Stakeholders	Owner occupiers, suppliers/ installers.
Property Numbers	Arran – 971
Property Numbers	Garnock Valley – 554
Property Numbers	Irvine – 231
Property Numbers	Kilwinning – 306
Property Numbers	North Coast – 498
Property Numbers	Three Towns - 81
Technical Considerations	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	ASHP are typically more cost effective over their lifetime than oil/ LPG heating.
Prioritisation	There is little control or prioritisation in owner occupied interventions, instead it is dependent on the owner's level of engagement.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for owner occupied buildings.
Links to Existing Projects	NAC, is it already being done?
Time	2030 deadline to allow for 75% reduction in emissions. Average of 440 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "heating system" is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 52: OO – Gas to Heat Pumps

Intervention	22
Action Summary	Working group to improve public awareness for owner occupiers.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Although properties on-gas grid need to be decarbonised to reach 2045 net zero targets. On-gas fuel costs are likely lower than those off-gas grid, and on-gas is also likely lower emissions. Therefore on-gas grid is a lower priority than the other considerations.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development.
External Stakeholders	Owner occupiers, suppliers/ installers.
Property Numbers	Arran – 0
Property Numbers	Garnock Valley – 6,188
Property Numbers	Irvine – 11,904
Property Numbers	Kilwinning – 4,939
Property Numbers	North Coast and Cumbraes – 8,202
Property Numbers	Three Towns – 9,679
Technical Considerations	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	Without optimised heat pump control and suitable tariff selection there is little economic benefit other than removing gas standing charge, if other gas uses can be removed.
Prioritisation	There is little control or prioritisation in owner occupied interventions, instead it is dependent on the owner's level of engagement.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for owner occupied buildings.
Links to Existing Projects	NAC, is it already being done?
Time	2045 deadline to achieve net zero target. Average of 1,948 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "heating system" is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 53: OO – Solid/Biomass to Heat Pumps

Intervention	23
Action Summary	Working group to improve public awareness for owner occupiers.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Properties with solid (which likely link to off-gas grid) are deemed as one of the priorities for decarbonisation as they likely have higher associated heating emissions than those on the gas grid. Which can lead to health concerns for tenants. In addition, fuel poverty may also be more prevalent in solid homes as the fuel can be more expensive than gas.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development.
External Stakeholders	Owner occupiers, suppliers/ installers.
Property Numbers	Arran – 114
Property Numbers	Garnock Valley – 92
Property Numbers	Irvine – 25
Property Numbers	Kilwinning – 26
Property Numbers	North Coast and Cumbraes – 64
Property Numbers	Three Towns - 34
Technical Considerations	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	ASHP are typically more cost effective over their lifetime than solid/ biomass heating.
Prioritisation	There is little control or prioritisation in owner occupied interventions, instead it is dependent on the owner's level of engagement.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for owner occupied buildings.
Links to Existing Projects	NAC, is it already being done?
Time	2030 deadline to allow for 75% reduction in emissions. Average of 59 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "heating system" is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Privately Rented Interventions

Table 54: PR – Wall Insulation

Intervention	24
Action Summary	Working group to liaise with larger private landlords and improve public awareness for smaller landlords.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Wall insulation is important in reducing heat loss from the largest surface of buildings and hence heat demand and bills. Home analytics data details if the buildings have any type of wall insulation. In many properties there is no wall insulation, which depending on the type of wall insulation and the feasibility can be economically reasonable and technically effective. There is an opportunity to reduce heat demand by retrofitting all properties to install wall insulation.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Private landlords, tenants, suppliers/ installers.
Property Numbers	Arran – 332
Property Numbers	Garnock Valley – 642
Property Numbers	Irvine – 994
Property Numbers	Kilwinning – 335
Property Numbers	North Coast and Cumbraes – 1,474
Property Numbers	Three Towns – 1,248
Technical Considerations	Cavity wall presence and width, internal space, external space, wind driven rain.
Skills Considerations	This is an established practice with no specific skills requirement.
Economic Considerations	If done correctly and only for suitable buildings, the insulation should be long term. If inappropriate application or installation, this may cause damp leading to further costs.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific landlords' engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for privately rented buildings.
Links to Existing Projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 314 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "wall insulation" section is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 55: PR – Windows

Intervention	25
Action Summary	Working group to liaise with larger private landlords and improve public awareness for smaller landlords.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Single glazed windows loose significantly more heat than double glazed windows and increase bills. Home analytics data details if buildings still have single glazed windows. This is still common in many properties, which for many cases can be easily upgraded with economic benefits. This opportunity reduces heat demand by retrofitting double glazed windows.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Private landlords, tenants, suppliers/ installers.
Property Numbers	Arran – 58
Property Numbers	Garnock Valley – 166
Property Numbers	Irvine – 217
Property Numbers	Kilwinning – 41
Property Numbers	North Coast and Cumbraes – 153
Property Numbers	Three Towns - 284
Technical Considerations	This is an established technology with several vendors and no supply bottlenecks.
Skills Considerations	This is an established practice with no specific skills requirement.
Economic Considerations	The 20 plus year lifespan of double-glazed windows can be a cost-effective way of reducing fuel bills.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific landlords' engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for privately rented buildings.
Links to Existing Projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 57 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property Database and ensure that the "glazing" section is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 56: PR – Loft Insulation

Intervention	26
Action Summary	Working group to liaise with larger private landlords and improve public awareness for smaller landlords.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Loft insulation is important in reducing heat loss and hence heat demand and bills. Home analytics data details the depth of insulation in the lofts of most properties. In many properties, this is less than 250mm, which is considered economically reasonable and technically effective. There is an opportunity to reduce heat demand by retrofitting all properties to take the insulation up to over 250mm mineral wool (or equivalent).
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Private landlords, tenants, suppliers/ installers.
Property Numbers	Arran – 332
Property Numbers	Garnock Valley – 424
Property Numbers	Irvine – 855
Property Numbers	Kilwinning – 295
Property Numbers	North Coast and Cumbraes – 781
Property Numbers	Three Towns - 764
Technical Considerations	This is an established technology with several vendors and no supply bottlenecks.
Skills Considerations	This is an established practice with no specific skills requirement.
Economic Considerations	This is a low-cost investment with a lifespan exceeding that of the building.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific landlords' engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for privately rented buildings.
Links to Existing Projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 216 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "loft insulation thickness" is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 57: PR – Electric to Heat Pumps

Intervention	27
Action Summary	Working group to liaise with larger private landlords and improve public awareness for smaller landlords.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Although dwellings with electric heating may already be decarbonised their other benefits from moving away from traditional direct electric heating systems. More efficient systems can reduce fuel demand and fuel bills. They can also reduce grid constraints, which can allow for more ASHP to be installed in that area. For medium to large demand dwellings and those with wet heating systems already installed an ASHP is the likely most sensible options. For lower demand dwellings and those without wet heating systems, other more modern direct electrified heating systems that couple with thermal storage and utilize modern time of use tariffs can reduce bills compared to traditional direct electrified heating without as much capital investment as an ASHP.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Private landlords, tenants, suppliers/ installers.
Property Numbers	Arran – 291
Property Numbers	Garnock Valley – 72
Property Numbers	Irvine – 155
Property Numbers	Kilwinning – 28
Property Numbers	North Coast and Cumbraes – 546
Property Numbers	Three Towns - 237
Technical Considerations	ASHP suitability, wet radiator sizing to suit heat demand. Modern direct electrified heating system with thermal storage and smart meter use.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	Compared to traditional direct electric heating systems the modern electrified heating should be cost effective over their lifetime.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific landlords' engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for privately rented buildings.
Links to Existing Projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 83 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "heating system" is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 58: PR – Oil/LPG to Heat Pumps

Intervention	28
Action Summary	Working group to liaise with larger private landlords and improve public awareness for smaller landlords.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Properties with oil/ LPG (which likely link to off-gas grid) are deemed as one of the priorities for decarbonisation as they likely have higher associated heating emissions than those on the gas grid. In addition, fuel poverty may also be more prevalent in oil/ LPG homes as the fuel tends to be more expensive than gas.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Private landlords, tenants, suppliers/ installers.
Property Numbers	Arran – 133
Property Numbers	Garnock Valley – 61
Property Numbers	Irvine – 37
Property Numbers	Kilwinning – 52
Property Numbers	North Coast and Cumbraes – 126
Property Numbers	Three Towns - 16
Technical Considerations	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	ASHP are typically more cost effective over their lifetime than oil/ LPG heating.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific landlords' engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for privately rented buildings.
Links to Existing Projects	NAC, is it already being done?
Time	2030 deadline to allow for 75% reduction in emissions. Average of 71 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "heating system" is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 59: PR – Gas to Heat Pumps

Intervention	29
Action summary	Working group to liaise with larger private landlords and improve public awareness for smaller landlords.
LHEES Consideration	4 Poor building energy efficiency.
LHEES Consideration	5 Fuel poverty resulting from poor building energy efficiency.
Background	Although properties on-gas grid need to be decarbonised to reach 2045 net zero targets. On-gas fuel costs are likely lower than those off-gas grid, and on-gas is also likely lower emissions. Therefore on-gas grid is a lower priority than the other considerations.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Private landlords, tenants, suppliers/ installers.
Property Numbers	Arran – 0
Property Numbers	Garnock Valley – 906
Property Numbers	Irvine – 1,880
Property Numbers	Kilwinning – 561
Property Numbers	North Coast and Cumbraes – 1,277
Property Numbers	Three Towns – 1,953
Technical Considerations	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	Without optimised heat pump control and suitable tariff selection there is little economic benefit other than removing gas standing charge, if other gas uses can be removed.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific landlords' engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for privately rented buildings.
Links to Existing Projects	NAC, is it already being done?
Time	2045 deadline to achieve net zero target. Average of 313 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property. Database and ensure that the "heating system" is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Table 60: PR – Solid/Biomass to Heat Pumps

Intervention	30
Action Summary	Working group to liaise with larger private landlords and improve public awareness for smaller landlords.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Properties with solid (which likely link to off-gas grid) are deemed as one of the priorities for decarbonisation as they likely have higher associated heating emissions than those on the gas grid. Which can lead to health concerns for tenants. In addition, fuel poverty may also be more prevalent in solid homes as the fuel can be more expensive than gas.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Private landlords, tenants, suppliers/ installers.
Property Numbers	Arran – 10
Property Numbers	Garnock Valley – 6
Property Numbers	Irvine – 3
Property Numbers	Kilwinning – 0
Property Numbers	North Coast and Cumbraes – 10
Property Numbers	Three Towns - 2
Technical Considerations	ASHP suitability, radiator sizing to suit heat demand.
Skills Considerations	ASHP are a developing technology in the UK, the increased demand may cause installer and supply chain constraints.
Economic Considerations	ASHP are typically more cost effective over their lifetime than solid/ biomass heating.
Prioritisation	The priority should be vacant properties during transition between tenants. Although is highly each on specific landlords' engagement levels.
External Funding Opportunities	
Internal Funding Allocation	No NAC internal funding for privately rented buildings.
Links to Existing Projects	NAC, is it already being done?
Time	2030 deadline to allow for 75% reduction in emissions. Average of 5 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	Strategic zone (locality) level data above is currently sufficient. Map if required.
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the "heating system" is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Mixed Tenure/Mixed Use

Table 61: Mixed Tenure/Mixed Use

Intervention	31
Action Summary	Working group to liaise with larger MTMU landlords and improve public awareness for smaller MTMU landlords, to implement a combination of measures in the hard-to-treat buildings.
LHEES Considerations	4 Poor building energy efficiency.
LHEES Considerations	5 Fuel poverty resulting from poor building energy efficiency.
Background	Buildings which have mixed tenure and mixed use have unique challenges due to multiple stakeholders in each building, with potentially different applications for their building and different priorities. MTMU buildings need to have collaborative approach and engagement from all stakeholders in order to help reduce tenants' risk to fuel poverty and in order to decarbonise.
Action Champion	To be decided by NAC.
Internal Stakeholders	Housing Strategy and Development and Business Support and Development.
External Stakeholders	Landlords, tenants, suppliers/ installers.
Property Numbers	Arran – 82
Property Numbers	Garnock Valley – 1,095
Property Numbers	Irvine – 2,368
Property Numbers	Kilwinning – 688
Property Numbers	North Coast and Cumbraes – 3,109
Property Numbers	Three Towns – 3,393
Technical Considerations	Different heating requirements for different areas of the buildings, poses a challenge to come up with a solution to capture all
Skills Considerations	ASHP suitability, radiator sizing to suit heat demand.
Economic Considerations	No specific requirements for off-gas grid.
Prioritisation	The priority should be vacant properties during transition between tenants, which is of a particular challenge when there are multiple tenants. Although is highly each on specific landlords' engagement levels.
External Funding Opportunities	
Internal Funding Allocation	From which budget? In which year? How much per year
Links to Existing Projects	NAC, is it already being done?
Time	2040 to remove fuel poverty as far as reasonably possible. Average of 671 dwellings each year from 2024.
Action Plan	Step by step. Start with enabling actions- budgeting etc. Move onto delivery. Align with other interventions.
Geospatial	
Monitoring and Evaluation	Works should be inspected on completion. The action champion shall maintain the property database and ensure that the database is updated after each batch of inspections. The action champion shall report back to the LHEES team with lessons learned for other actions.

Appendix H Domestic Intervention Costs

Total Domestic Intervention Costs

The capital costs of the interventions and the potential energy savings attributed to the interventions have been estimated. Costs and emissions for each fuel source used in the analysis are based on Department for Energy Security and Net Zero figures. This differs from the data found in SAP and reduced SAP for EPC and Property Energy Analysis Tool (PEAT) calculations as they are not as frequently updated.

Table 62 shows the breakdown of the capital expenditure required per intervention and the effect this intervention has on reducing energy demand across all the NAC building stock. For reference, the baseline heat demand per year for the domestic buildings in NAC is estimated to be 987,000 MWh. This data helps to identify which measures are the most effective way to reduce heating demand, helping both fuel poverty and heat decarbonisation. Loft insulation upgrade is by far the lowest cost method to reduce heating demands. On the other hand, installing external wall insulation on the outside of buildings that already have cavity or internal wall insulation is deemed as the least cost-effective way to reduce heat demand. However, they may be other reasons for doing less cost-effective measures, such as funding streams being allocated only to specific measures or improving the aesthetics of the building with external wall insulation or window upgrades.

Table 62: Summary of Energy Efficiency Interventions Across all Buildings in North Ayrshire

Fabric Measures	Capital Cost (£)	Heat Demand Reduction (kWh/y)	Cost Effectiveness (kWh/y£)	Fuel Savings per Investment Cost (£/£)
Cavity Wall Insulation (CWI)	42,000,000	55,800,000	1.33	0.206
Internal Wall Insulation (IWI)	12,600,000	8,600,000	0.69	0.111
External Wall Insulation (only wall measure)	63,900,000	32,300,000	0.51	0.091
External Wall Insulation (alongside CWI or IWI)	663,300,000	98,900,000	0.15	0.022
All wall insulation measures	**781,700,000**	**195,500,000**	**0.25**	**0.039**
Loft insulation upgrade from <100mm	5,300,000	27,700,000	5.28	0.927
Loft insulation upgrade from 100-250mm	15,500,000	73,800,000	4.76	0.475
Loft insulation upgrade from 250-300mm	23,800,000	103,900,000	4.36	0.193
All loft insulation measures	**44,600,000**	**205,400,000**	**4.61**	**0.377**
All Single to Double Glazing upgrade	**30,300,000**	**8,700,000**	**0.29**	**0.048**

Fabric Measures	Capital Cost (£)	Heat Demand Reduction (kWh/y)	Cost Effectiveness (kWh/y£)	Fuel Savings per Investment Cost (£/£)
Cylinder insulation upgrade from <50mm	12,500,000	17,700,000	1.41	0.219
Cylinder insulation upgrade from 50-80mm	4,200,000	2,900,000	0.69	0.115
All cylinder insulation measures	**16,800,000**	**20,600,000**	**1.23**	**0.193**
All Measures	**873,400,000**	**430,300,000**	**0.49**	**0.060**

Table 63 the total investment cost across the area from replacing the current heating systems with heat pumps is shown. The return on investment from the reduction in annual fuel costs compared to the cost of installing the heat pump highlights how cost-effective heat pumps can be at reducing fuel poverty. This is particularly the case for buildings currently heated from direct electric, LPG, or Oil. Although the fuel savings from gas boilers switching to heat pumps is still as effective as external wall insulation on buildings that have already have cavity or internal wall insulation. Although the cost of solid fuels may be lower than that of heat pumps, the improvement in air quality from switching away from burning coal may be worthwhile for the residents alongside the decarbonisation benefits.

Total costs are estimated using the cost of individual heat pumps, although some of these may be communal heat pump systems. Of the heat pump suitable dwellings around 18,000 are flats, and 1,300 are flats that are smaller than 60m². These small flats are the ones which may benefit the most from communal heat pump systems as they may struggle to have space for hot water cylinders or equivalent thermal storage that is required alongside an individual heat pump. The Home Analytics dataset does not specifically state if properties currently have a hot water cylinder, if this data becomes available it can be used to further filter down the small flats by ones that don’t already have a cylinder to highlight the more challenging properties for individual heat pumps.

Table 63: Summary of Heating Systems Changes Across all North Ayrshire

Heating System	Number of Buildings	Heat Pump Buildings	Cost of Heat Pump Installation (£)	Fuel Savings per Investment Cost (£/£)
Biomass	181	N/A	0	0
LPG	667	606	5,200,000	0.120
Main Gas	61,043	56,476	480,000,000	0.025
No Fuel listed	383	276	2,300,000	-
Oil	2,457	2,066	17,600,000	0.172
Solid	215	141	1,200,000	-0.057
Unknown	349	349	3,000,000	-
Direct electric	7,766	5,975	50,800,000	0.251
Heat pump	566	N/A	0	-
All Heating Systems	**73,627**	**65,889**	**560,100,000**	**0.050**

Table 64 shows all the fabric measures for the dwellings that are owned by the Council. These are all the measures that North Ayrshire Council have direct influence over. The scale of the investment required to implement all the energy efficiency measures, let alone changing the heating source, is far beyond what is achievable for the Council, emphasising the important of further specific targeting of measures.

Table 64: Summary of Interventions Across Local Authority Owned Buildings

Measure	Capital Cost (£)	Heat Demand Reduction (kWh/y)
Cavity Wall Insulation (CWI)	5,500,000	7,800,000
Internal Wall Insulation (IWI)	1,300,000	1,000,000
External Wall Insulation (only wall measure)	3,900,000	1,700,000
External Wall Insulation (alongside CWI or IWI)	87,600,000	11,200,000
All wall insulation measures	**98,300,000**	**21,700,000**
Loft insulation upgrade from <100mm	500,000	2,200,000
Loft insulation upgrade from 100-250mm	1,600,000	4,700,000
Loft insulation upgrade from 250-300mm	3,400,000	4,200,000
All loft insulation measures	**5,600,000**	**11,100,000**
All Single to Double Glazing upgrade	**6,900,000**	**1,700,000**
Cylinder insulation upgrade from <50mm	1,900,000	2,600,000

Measure	Capital Cost (£)	Heat Demand Reduction (kWh/y)
Cylinder insulation upgrade from 50-80mm	600,000	400,000
All cylinder insulation measures	**2,500,000**	**3,000,000**
All Measures	**113,200,000**	**37,400,000**

Top Third of Data Zones Intervention Costs

Table 65 shows the interventions for the top third of data zones as ordered by energy efficiency as a driver for fuel poverty, for all domestic buildings in North Ayrshire.

Table 65: Interventions for the Top Third of Data Zones, by Energy Efficiency as a Driver for Fuel Poverty

Measure	Capital Cost (£)	Heat Demand Reduction (kWh/y)
Cavity Wall Insulation (CWI)	12,800,000	18,300,000
Internal Wall Insulation (IWI)	4,500,000	3,200,000
External Wall Insulation (only wall measure)	35,100,000	18,100,000
External Wall Insulation (alongside CWI or IWI)	162,900,000	25,300,000
All wall insulation measures	**215,200,000**	**64,900,000**
Loft insulation upgrade from <100mm	2,800,000	15,400,000
Loft insulation upgrade from 100-250mm	4,900,000	15,400,000
Loft insulation upgrade from 250-300mm	6,700,000	9,300,000
All loft insulation measures	**14,400,000**	**40,100,000**
All Single to Double Glazing upgrade	**14,800,000**	**4,300,000**
Cylinder insulation upgrade from <50mm	4,600,000	6,400,000
Cylinder insulation upgrade from 50-80mm	1,700,000	1,200,000
All cylinder insulation measures	**6,300,000**	**7,600,000**
All Measures	**250,700,000**	**116,900,000**

Local Authority Properties in the Top Third of Data Zones - Affordable Interventions

The interventions in Table 66, are for LA owned buildings which are located in the top third of data zones by fuel poverty, are now at a value which is more realistic for North Ayrshire Council to be able to have an impact on and in the areas where they should have the largest impact in helping reduce fuel poverty. This is a total of 4,717 properties, out of the 73,000 properties in the area.

As adding external wall insulation into buildings that already have cavity or internal wall insulation is a less cost-effective way of reducing heat demand, it is a lower priority intervention and therefore excluded from the recommendations and the total values. If there are specific funding streams that are only available for EWI, or this brings other non LHEES benefits this intervention may still be implemented.

Table 66: Interventions for the Top Third of Data Zones, by Energy Efficiency as a Driver for Fuel Poverty, for LA-Owned Properties

Measure	Capital Cost (£)	Heat Demand Reduction (kWh/y)
Cavity Wall Insulation (CWI)	1,900,000	2,800,000
Internal Wall Insulation (IWI)	400,000	300,000
External Wall Insulation (only wall measure (EWI))	800,000	200,000
All wall insulation measures (excluding EWI alongside CWI or IWI)	**3,100,000**	**3,300,000**
Loft insulation upgrade from <100mm	90,000	400,000
Loft insulation upgrade from 100-250mm	500,000	1,400,000
Loft insulation upgrade from 250-300mm	1,200,000	1,500,000
All loft insulation measures	**1,800,000**	**3,200,000**
All Single to Double Glazing upgrade	**3,800,000**	**800,000**
Cylinder insulation upgrade from <50mm	800,000	1,000,000
Cylinder insulation upgrade from 50-80mm	300,000	200,000
All cylinder insulation measures	**1,100,000**	**1,200,000**
All Measures (excluding EWI alongside CWI or IWI)	**9,800,000**	**8,600,000**

In addition to the energy efficiency measures, and estimated costs, across the top third of data zones by fuel poverty, Table 67 groups buildings by fuel source.

Table 67: Current Fuel Source in LA-Owned Homes in the Top Third of Data Zones by Fuel Poverty

Main Fuel	Number of Buildings	Heat Pump Suitable	Cost of Heat Pump Installation (£)
Biomass	0	N/A	0
LPG	4	3	25,000
Main Gas	4,129	3,907	33,200,000
No Fuel listed	26	26	220,000
Oil	19	19	160,000
Solid	3	2	17,000
Unknown	0	0	
Electricity (direct electric heating)	502	465	4,000,000
Electricity (heat pump)	34	N/A	0
Total	**4,717**	**4,422**	**37,600,000**

As well as the LA properties that North Ayrshire Council can have a direct influence over, there is also funding allocated which can help the LHEES considerations for other tenancy properties. North Ayrshire Council can help to engage with relevant owners and tenants to utilise the following funding. More information is found in this LHEES Strategy about the funding streams.

- Area Based Scheme - Funding for owner occupied or privately rented properties that are Council Tax bands A-C can help with insulation and double-glazing installations in addition to the adoption of renewable technologies.
- Warmer Homes Scotland - Funding for homeowners or private sector tenants, to install wall and loft insulation as well as renewables to bring their home up to tolerable living standards.
- Home Energy Scotland Loan - For homeowners to install glazing and renewable systems.
- Home Energy Scotland Private Rented Sector Landlord Loan – To help private rented sector landlords to install insulation, glazing and renewables.
- ECO3 Home Heating Cost Reduction Obligation – For people who qualify for Warm Home Discount and other means tested eligibility to have wall or windows installed.
- ECO3 Local Authority Flexibility Scheme – For low income and those vulnerable to the cold to have wall or loft insulation or window upgrades.
- Registered Social Landlord Loan – For landlords to install wall insulation or windows.

- Energy Efficiency Business Support – Technical advice, loans, and grants on energy efficiency measures for SME, not for profit organisations and charities.
- Heat Network Fund – A maximum of 50% of the capital cost towards eligible heat networks creation or expansion.

Heat Pumps, the Cost and Carbon Emissions

The cost and emissions of heat is dependent on the quantity of heat demand, the heating system efficiency, and the cost of fuel. These factors can help in reducing fuel poverty and in decarbonisation across North Ayrshire Council. Table 68 shows the cost of fuels used in this analysis, this data is from the UK Government Department for Energy Security and Net Zero 2023 Greenbook.

A simple comparison can be made using the cost of fuel to compare the cost of heat using gas boilers compared to heat pumps. For a gas cost of 0.103 £/kWh, with an 80% boiler efficiency this equates to 0.129 £/kWh of heat. Compared to a flat rate electricity cost of 0.34 £/kWh, as long as a heat pump can operate at a minimum COP of 2.64, then the heat pump will be lower cost to operate. As mentioned, the UK Government has set a requirement for heat pumps to be designed to operate at a COP of greater than 2.8 to be eligible for funding[34], implying that with the current cost of gas and electricity heat pumps should always reduce fuel bills and help reduce fuel poverty compared to gas boilers.

In addition, if switching to heat pumps means a building no longer requires gas, by not requiring gas for cooking or a fireplace, then there will be further benefits by not having to pay a gas standing charge.

For heat pumps to be effective measures they should be achieving a COP of 3 or greater, higher values have been achievable in trials with good practise. The Council need to ensure the role out of heat pumps in our properties comes with a good experience and high operating efficiencies, then importantly this information needs to be disseminated across the area.

Using a COP for heat pumps of 3.0 for the analysis, with this heat pump efficiency, compared to direct electric heating which operates close to 100% efficient, a heat pump should reduce fuel bills by a factor of three. This assumes a flat rate tariff, whereas for tariffs with lower night-time rate this difference will be reduced. Although a heat pump can still utilise low night rates direct electric can be more flexible at using the lower rate. Overall heat pump will be a significant benefit in reducing fuel poverty in homes with direct electric heating, which are likely the homes that currently have the highest cost of heat.

[34] Boiler Upgrade Scheme (BUS) - Installers | Ofgem

Table 68: Cost of Fuels Used for this Analysis.

Fuel	Cost (£/kWh)
Biomass	0.08
Solid	0.0665
Electricity	0.34 (flat rate)
LPG	0.155
Mains Gas	0.103
Oil	0.155

Table 69 shows the total annual cost and emissions from heating all the buildings in North Ayrshire Council. Heat pumps use a COP of 3, direct electric heating uses an efficiency of 100%, and boilers use an efficiency based on the boiler efficiency from their EPC in the Home Analytics dataset. Note that the annual CO_2 emissions are based on 2023 grid carbon factors and that, by 2035, the grid is predicted to be carbon neutral. This means that the CO_2 emissions will be zero for all heat pumps or electric heating systems.

Table 69: Annual Cost and Emissions of Heating, in Heat Pump Suitable Properties

Scenario	Annual Cost of Heat (£)	Annual Emissions (tCO2e)
Current Scenario	134,300,000	210,000
Current heating system, with all energy efficiency measures, excluding EWI on buildings with CWI or IWI	101,100,000	160,000
Transition to heat pumps in suitable properties, with all energy efficiency measures, excluding EWI on buildings with CWI or IWI	73,200,000	42,000

Although this analysis uses heat pumps operating at a COP of 3.0, the COP can be improved upon by reducing the flow temperature of the heat pump, resulting in lower cost of heating. Increasing to larger radiators with more thermal power, or convection radiators, allows the buildings heat demand to be met with a lower flow rate. It is recommended for North Ayrshire Council to trial different radiator packages, to find the optimum trade off from more expensive larger/more powerful radiators against the reduced operational cost from lower flow temperatures. The EPC recognises the benefit of lower flow temperature heat pump systems and improves the score.

The results in Table 69 use a flat rate tariff for simplicity of calculations and to allow for a worst-case low level of consumer engagement with the heating system. If users are more engaged or allow intelligent control systems for the heat pumps to interact with the modern array of tariffs available, there can be significant further benefits for the user, including cost savings, associated emissions reduction and reduction in electrical network demand. These

dynamic or variable time of use tariffs reward consumers who shift their demand to off-peak times balancing the renewable energy supply and demands. Heat pumps can use these times of low cost and low emissions electricity to charge hot water cylinders, they can also be used to maintain a level of temperature in the building, which also has the benefit of reducing the peak heat demand and allowing further lower flow temperatures.

With the current associate emissions from electricity generation, installation of heat pumps makes a significantly larger reduction to heating associated emissions in North Ayrshire than the energy efficiency measures. As the electricity emissions reduce towards the 2035 prediction of 0 gCO_2e/kWh the benefit of heat pumps on emissions reduction increases.