



Retrofit Proposal

Prepared for: Georgeham Parish Council

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4th May 2022

Proposal number: 2021-001

EXECUTIVE SUMMARY

Objective

This objective of this proposal is to provide a plan for retrofitting the housing stock in terms of energy efficiency fabric improvements in line with the government's plans for retrofitting all Band D-G properties to Band C standard by 2035. However this "standard" aspiration falls short of what might be achieved, to this end a "higher" aspiration showing what is possible if all Energy Efficiency Measures (EEMs) are adopted.

Scope

This proposal considers:

- Fabric improvements
- Renewables
- CO2e emissions
- Cost/benefit analyses
- Net zero declaration
- Conclusions, Recommendations & Caveats

Net Zero Declaration

Given the government's plans for housing retrofit and grid decarbonisation stipulate 2035, it makes sense to adopt this date for net zero.

Conclusions, Recommendations & Caveats

CONCLUSIONS

40% of the parish's CO2e emissions are from housing.

The majority of the housing stock is owner occupied and 83% are in the least energy efficient bands, the base data does not define whether these are second homes or holiday lets. However, they fall into the "able to pay" category and as such significant improvements over the government's "Standard' aspiration of *all Bands D-G to Band C standard by 2035* can be achieved.

Retrofitting the housing stock & converting to all electric will:

- Reduce energy demand by 31%.
 - Reduce CO2e emissions by 31%
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- With Grid Decarbonisation reduce CO₂e emissions by 83% (Higher aspiration).
- Assist with householders with reduced fuel bills.
- Provide health benefits.

Whole house retrofitting e.g. fabric improvements and renewable technologies planning is essential.

Solar Photovoltaics (PV) could generate 2,689,680 kWh/annum.

The average cost of whole house retrofitting is £23,469.05.

RECOMMENDATIONS

Community engagement events are essential to encourage the “able to pay” market to adopt whole house retrofitting.

Other measures should be adopted to influence the private & social landlords to undertake whole house retrofitting.

A detailed study into Solar PV, battery storage and solar water heating should be undertaken as PV technology has improved where shading is less problematic.

Whole house retrofit planning has the potential to realise economies of scale and reduce costs.

CAVEATS

The base data used for the analysis is predicated on, amongst other sources, Energy Performance Certificates (EPC), it is widely recognised there are problems with EPC data and changes to the applications that produce EPCs (SAP & RdSAP) are being revised. RdSAP is due for re-release in 2023. The data in this report should be regarded as indicative and not absolute. However, “sense” checking of the data has been conducted against other sources to ensure the data are as accurate as possible.

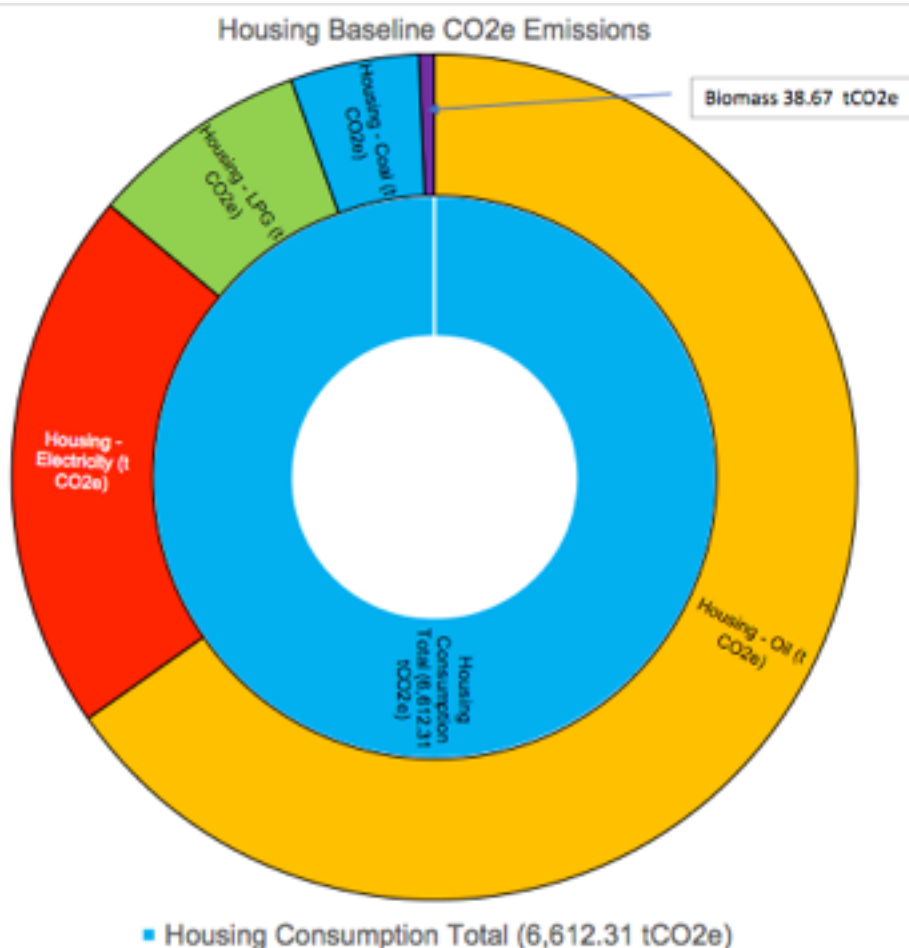
The Energy Efficiency measures (EEM) addressed in the base data are limited and do not include:

- Simple EEMs such as low energy lighting, draught proofing, etc.
- Behavioural changes

Further energy demand and CO₂e emissions reductions can be realised with the inclusion of simple EEMs and behavioural changes.

Housing Stock

Baseline Emissions



Georgeham parish is off the mains gas grid and housing accounts for 6,612.31 tCO₂e per annum and is the highest contributor to the parish's total territorial footprint of 16,394 tCO₂e per annum.

This also equates to 40% of total territorial emissions.

Georgeham

16,394t CO₂e*
total territorial footprint (p.a.)

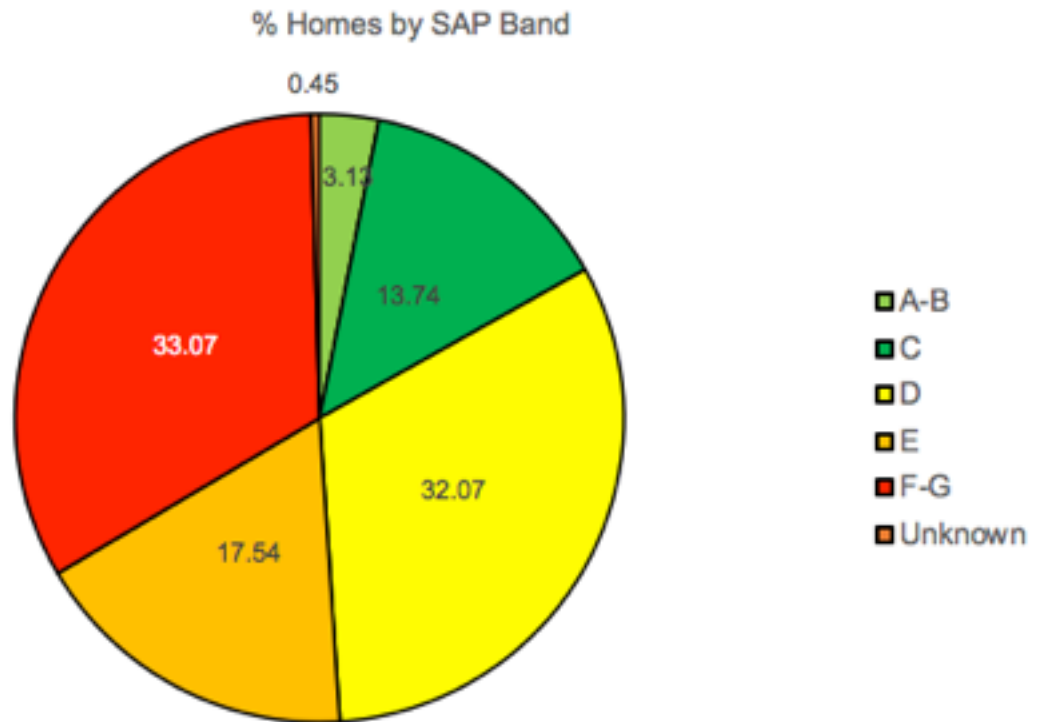
EMISSIONS BREAKDOWN (t CO₂e)



Housing	6,612
Agriculture	3,478
Industrial and commercial	2,968
Road Transport	1,517
Aviation	829
F-gases	428
Shipping	330
Waste management	216
Other Transport	15
Diesel fuelled railways	0

Housing Stock

The following graph shows the types of housing within the parish by SAP Band, detached properties dominate the housing stock.

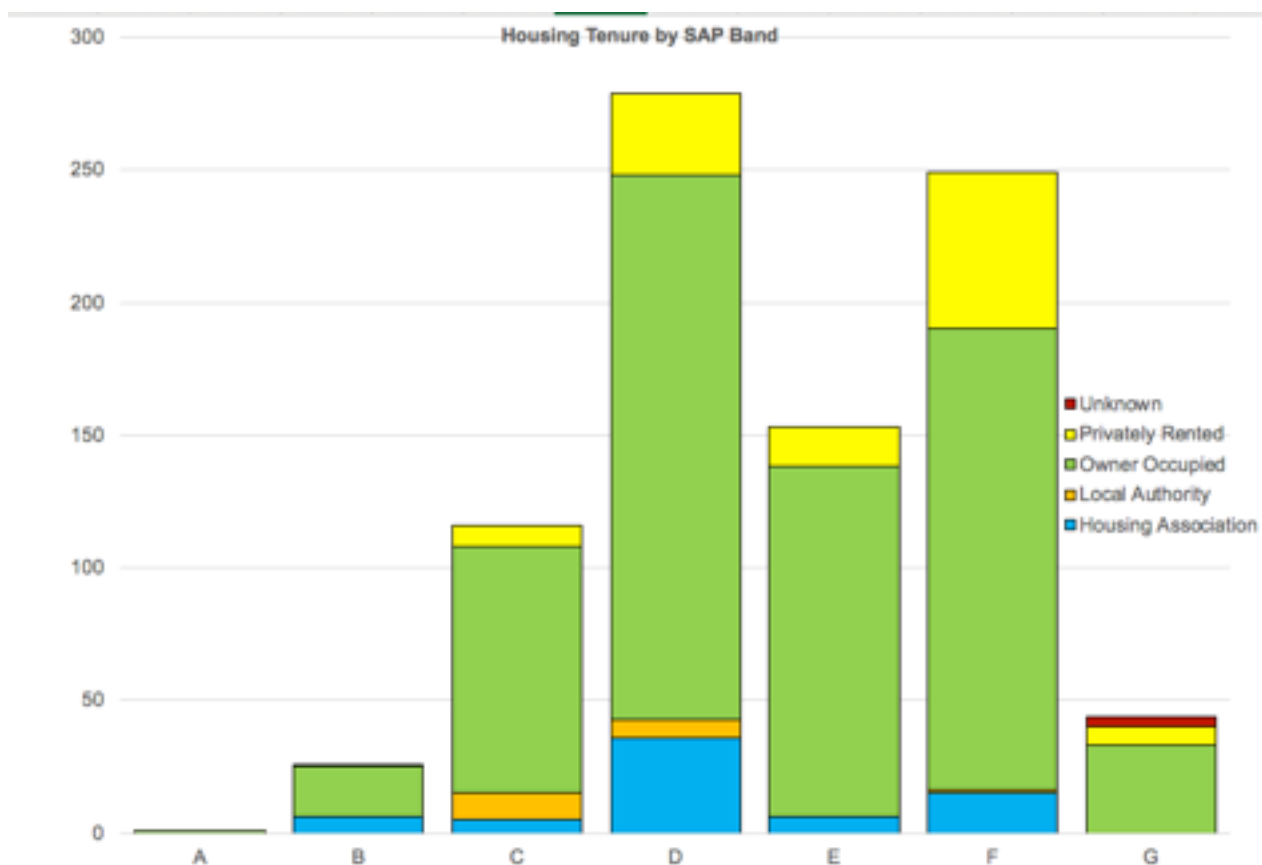


As shown in the above graph:

- Band A-B = 3% of housing stock
- Band C = 14% of housing stock
- Band D = 32% of housing stock
- Band E = 18% of housing stock
- Band F-G = 33% of housing stock
- Unknown = <1% of housing stock

On the basis that SAP Bands D - G reflect Low Energy Efficiency (LEE) housing, 83% of the parish's housing stock is classified LEE.

Housing Stock Tenure

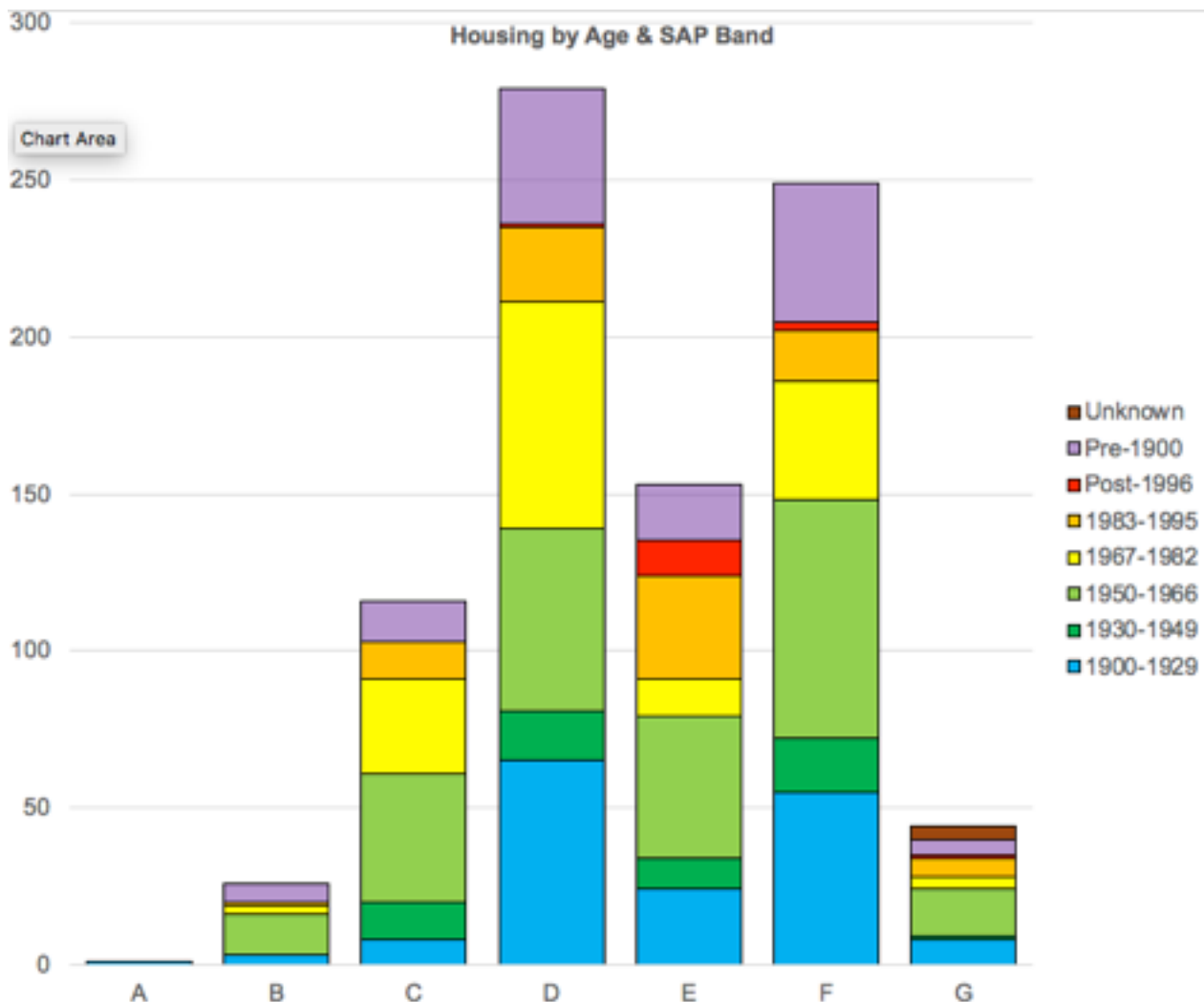


Analysis shows that of the 868 properties within the parish:

- Owner occupied accounts for 657 properties or 75%
- Private rentals account for 127 properties or 15%
- Local authority accounts for 18 properties or 2%
- Housing associations account for 68 properties or 8%
- There are 4 properties where the tenure is unknown.

The HADS data does not specify those owner occupied homes that are second homes or holiday lets.

Housing Stock by Age



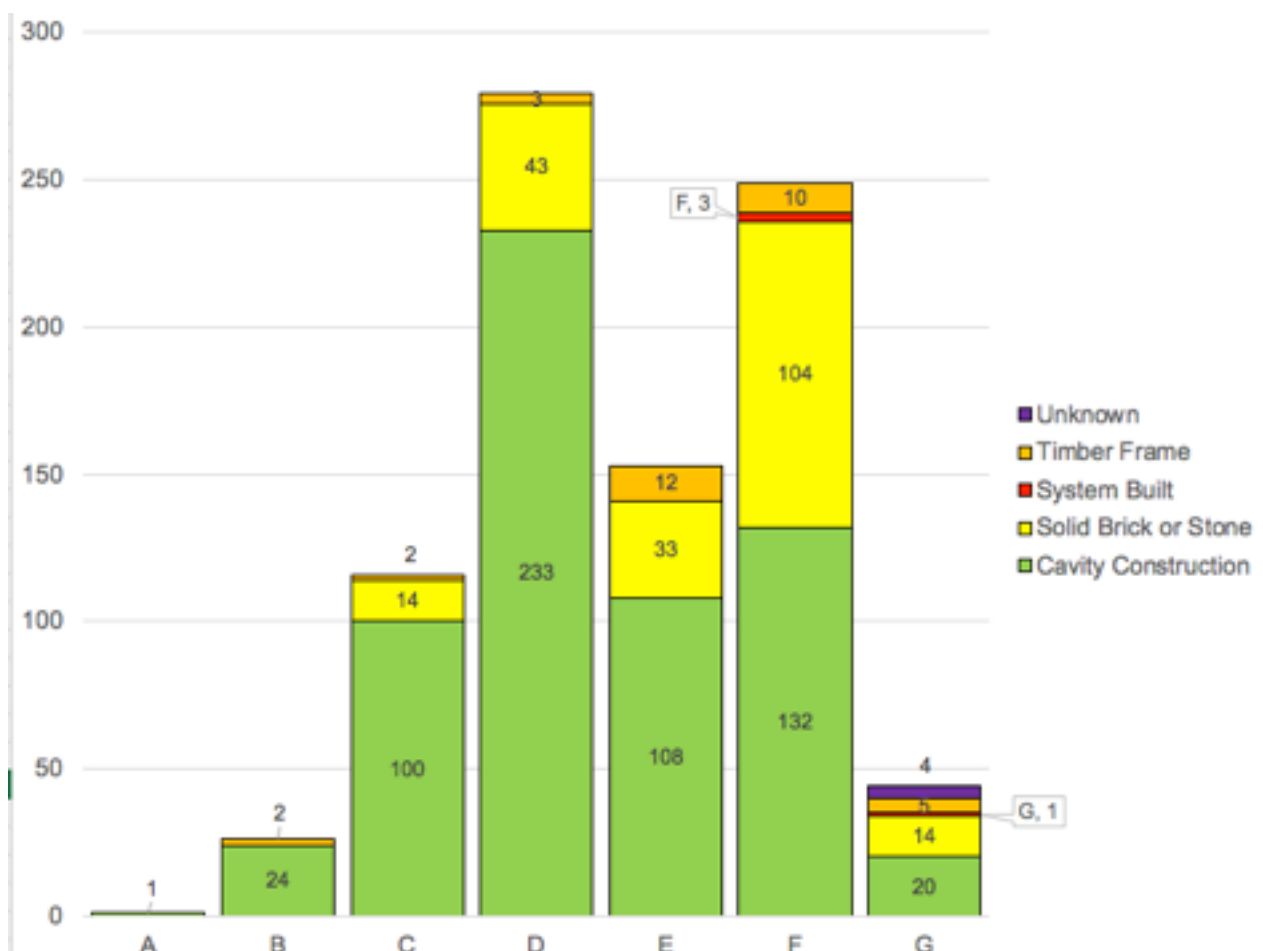
Further analysis shows that the parish’s housing stock comprises a significant proportion of older housing built before 1950. This is more pronounced when considering the least energy efficient bands.

- Band G of the 44 homes, 14 or 32% were built before 1950.
- Band F of the 249 homes, 116 or 47% were built before 1950.
- Band E of the 153 homes, 52 or 34% were built before 1950.
- Band D of the 279 homes, 124 or 44% were built before 1950.
- Band C of the 116 homes, 33 or 28% were built before 1950.
- Band B of the 26 homes, 9 or 35% were built before 1950.
- Band A the 1 home in Band A was built between 1900-1920.

The Band A-B result is surprising and suggests these properties have been retrofitted with energy efficiency measures.

Building Fabric

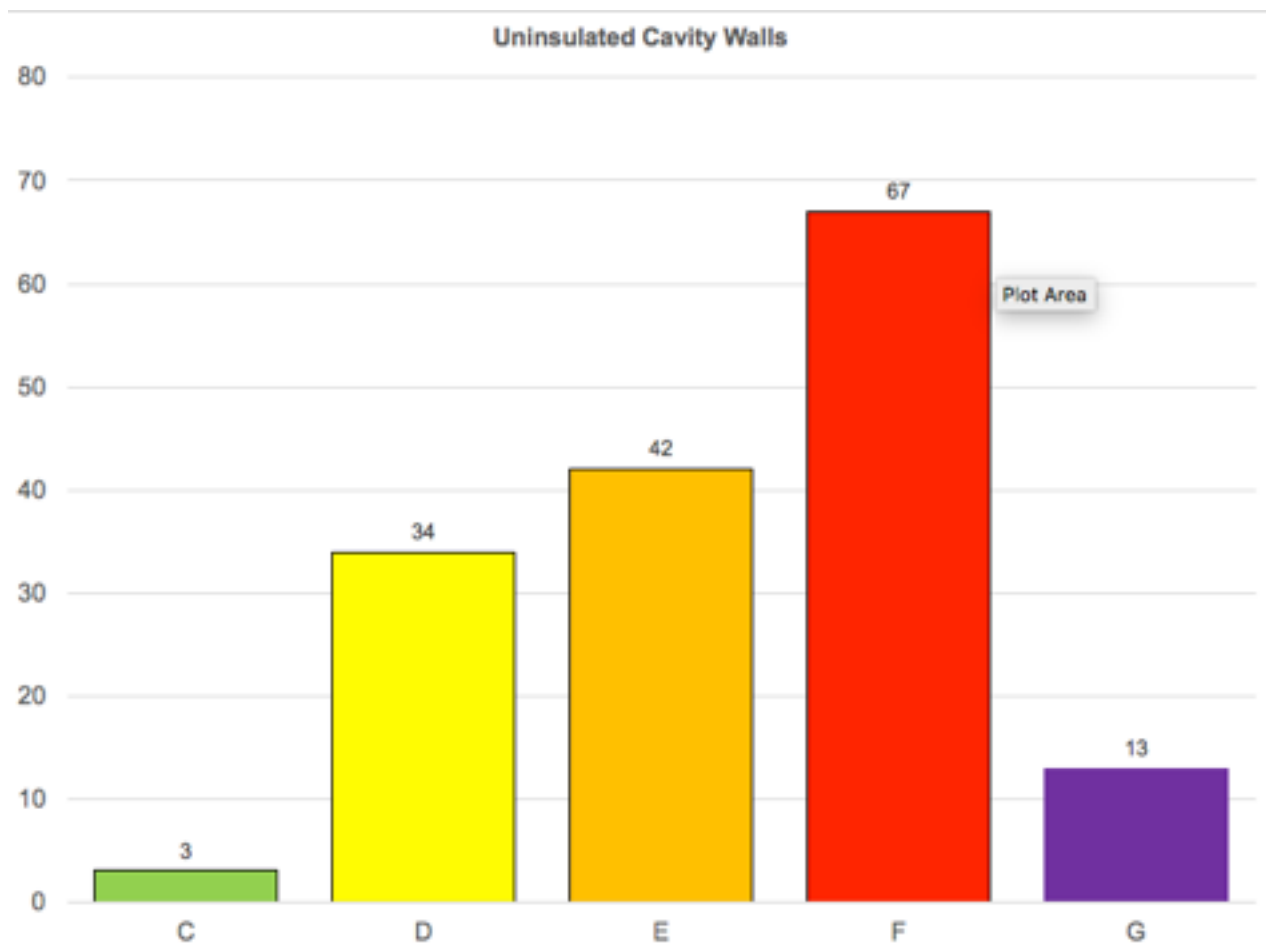
Walls



The wall construction with the SAP Bands comprises:

- Band G = 20 cavity wall, 14 solid brick or stone, 1 system built, 5 timber frame.
- Band F = 132 cavity wall, 104 solid brick or stone, 3 system built, 10 timber frame.
- Band E = 108 cavity wall, 33 solid brick or stone, 12 timber frame.
- Band D = 233 cavity wall, 43 solid brick or stone, 3 timber frame.
- Band C = 100 cavity wall, 14 solid brick or stone, 2 timber frame.
- Band B = 24 cavity wall, 2 timber frame.
- Band A = 1 cavity wall.

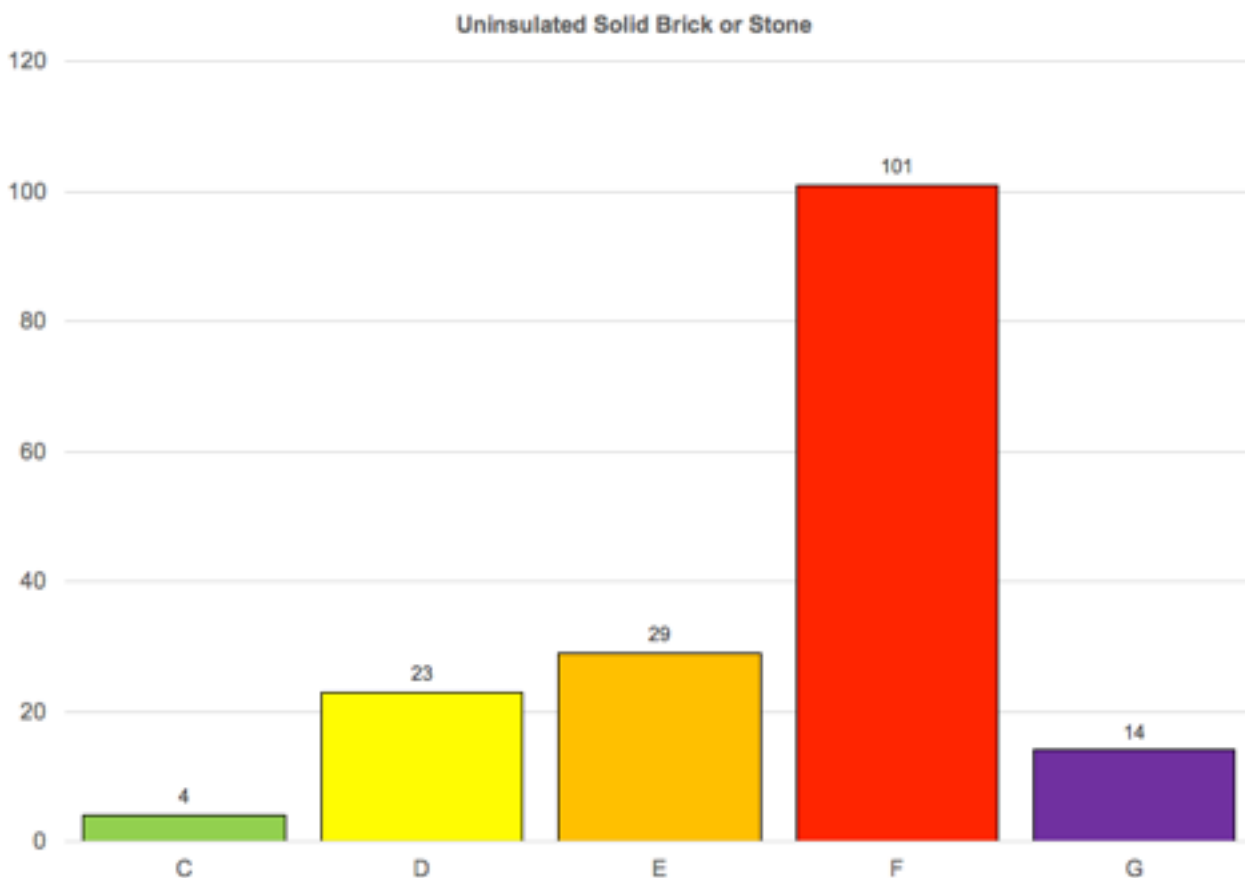
Cavity Walls



Of the 618 homes with cavity walls there are:

- Band G = 44 homes of which 13 or 30% are uninsulated.
 - Band F = 249 homes of which 67 or 27% are uninsulated.
 - Band E = 153 of which 42 or 27% are uninsulated.
 - Band D = 279 homes of which 34 or 11% are uninsulated.
 - Band C = 116 of which 3 or 3% are uninsulated.
 - Of the 27 homes homes in Band A-B all are insulated.
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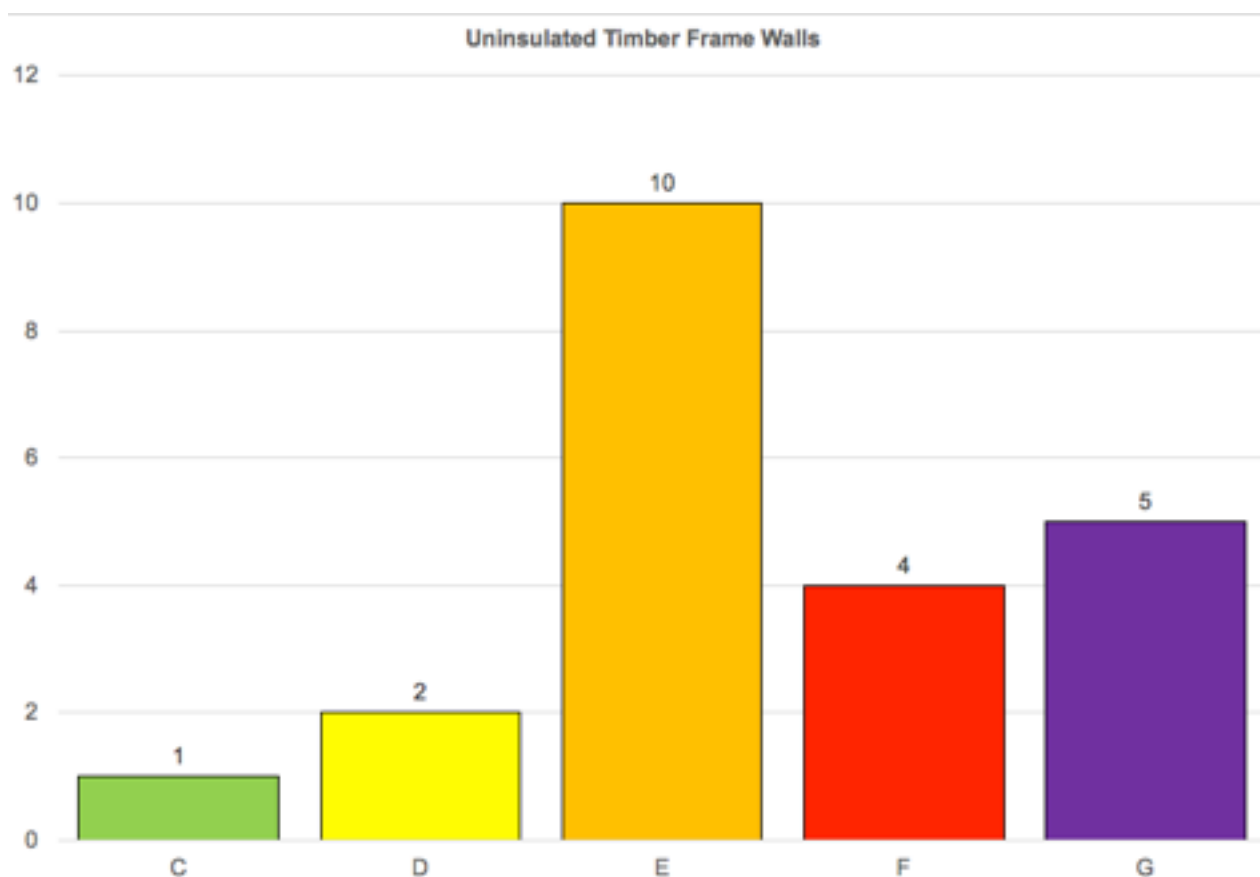
Solid Brick or Stone Walls



Of the 208 solid brick or stone walled homes there are:

- Band G = 14 homes of which 14 or 100% are uninsulated.
 - Band F = 104 homes of which 101 or 97% are uninsulated.
 - Band E = 33 of which 29 or 88% are uninsulated
 - Band D = 43 of which 23 or 53% are uninsulated.
 - Band C = 14 of which 4 or 29% are uninsulated.
 - There are 0 homes in Bands A or B with solid brick or stone walls.
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Timber Frame



Of the 34 homes with timber frame walls there are:

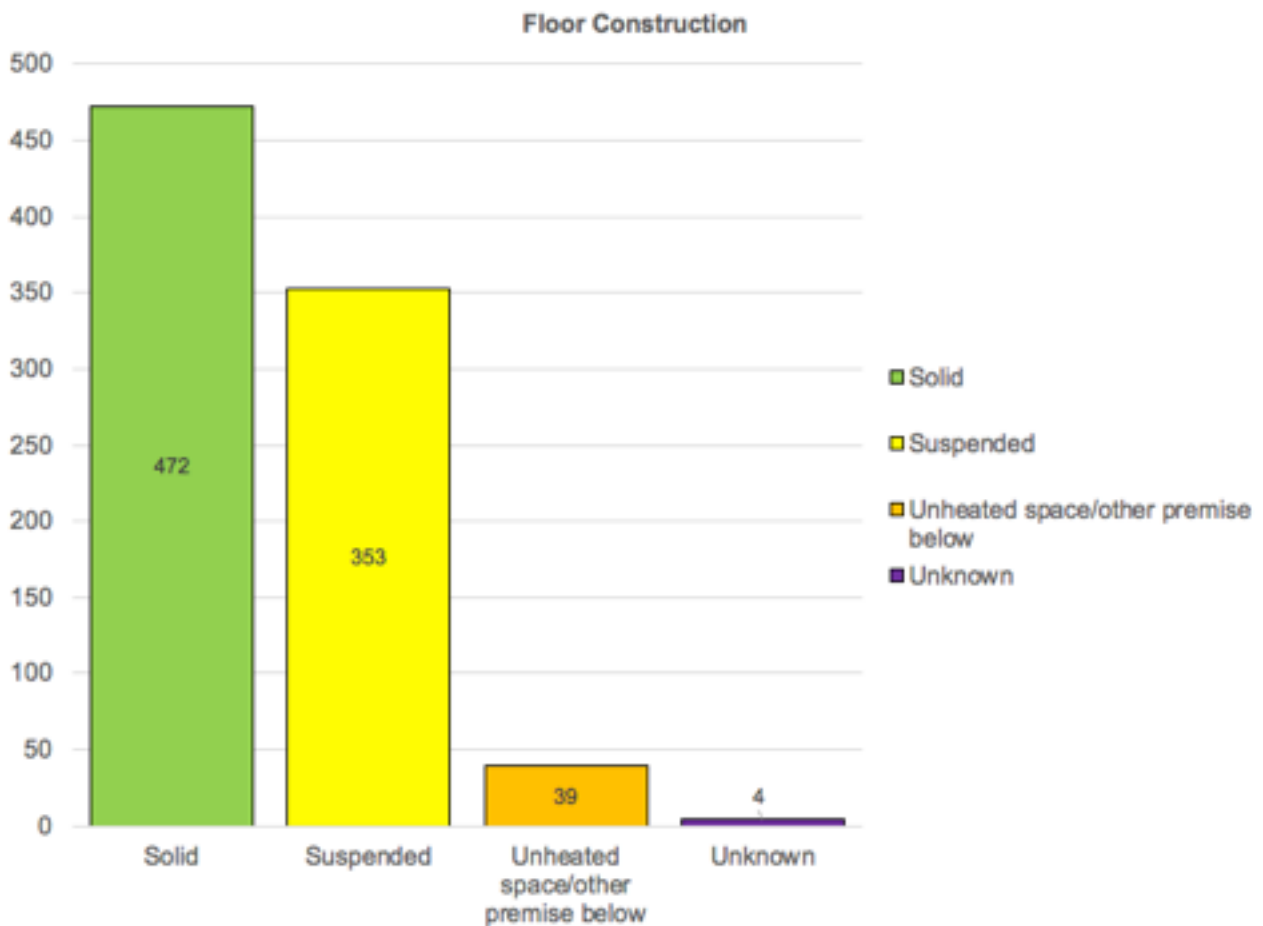
- Band G = there are 5 of which 5 or 100% are uninsulated.
- Band F = there are 4 of which 4 or 100% are uninsulated.
- Band E there are 10 of which 10 or 100% are uninsulated.
- Band D there are 2 of which 2 or 100% are uninsulated.
- Band C there is 1 of which 1 or 100% is uninsulated.
- In Band A-B there are 2 both of which are insulated.

System Built

Band G = 1 home which is uninsulated.

Band F = 3 homes which are uninsulated.

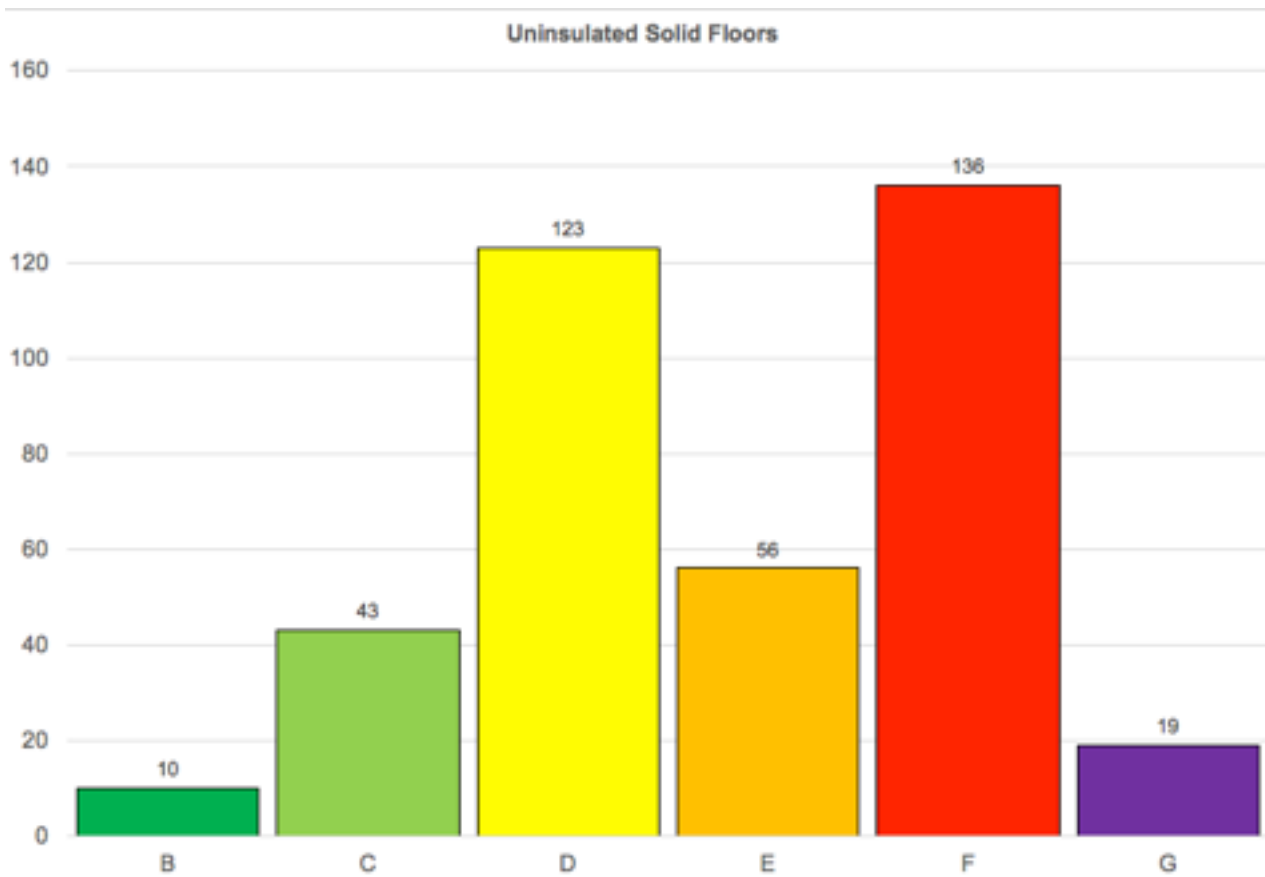
Floors



Of the 868 properties, there are:

- 472 homes with solid floors.
 - 353 homes with suspended floors.
 - 39 flats with unseated space or other premises below.
 - 4 properties where there are no data.
-

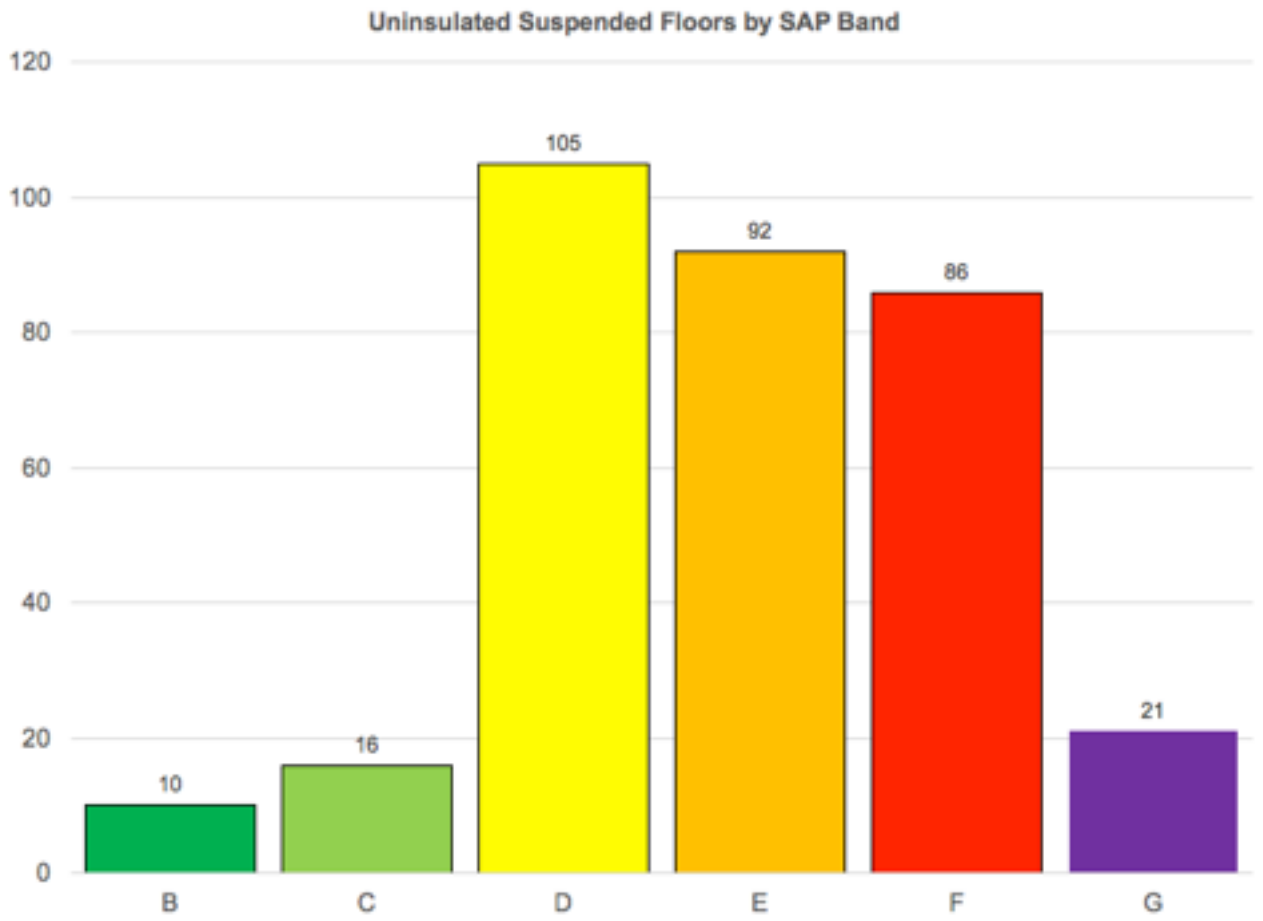
Solid Floors



There are 387 properties with uninsulated solid floors:

- Band G = 19
 - Band F = 136
 - Band E = 56
 - Band D = 123
 - Band C = 43
 - Band B = 10
-

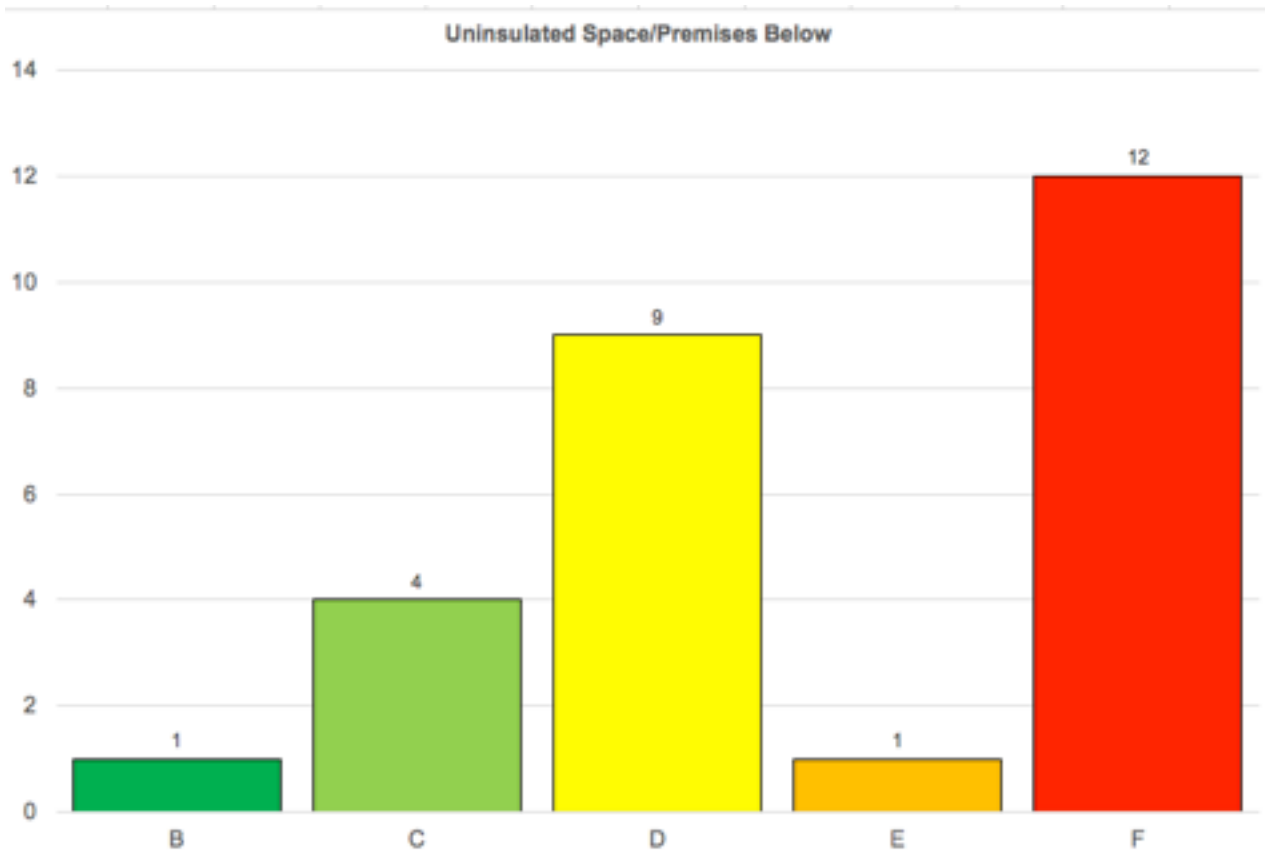
Suspended Floors



There are 353 properties with suspended floors, of which:

- Band G = 108 21 are uninsulated.
 - Band F = 86 are uninsulated.
 - Band E = 92 are uninsulated.
 - Band D = 105 are uninsulated.
 - Band C = 16 are uninsulated.
 - Band B = 10 are uninsulated.
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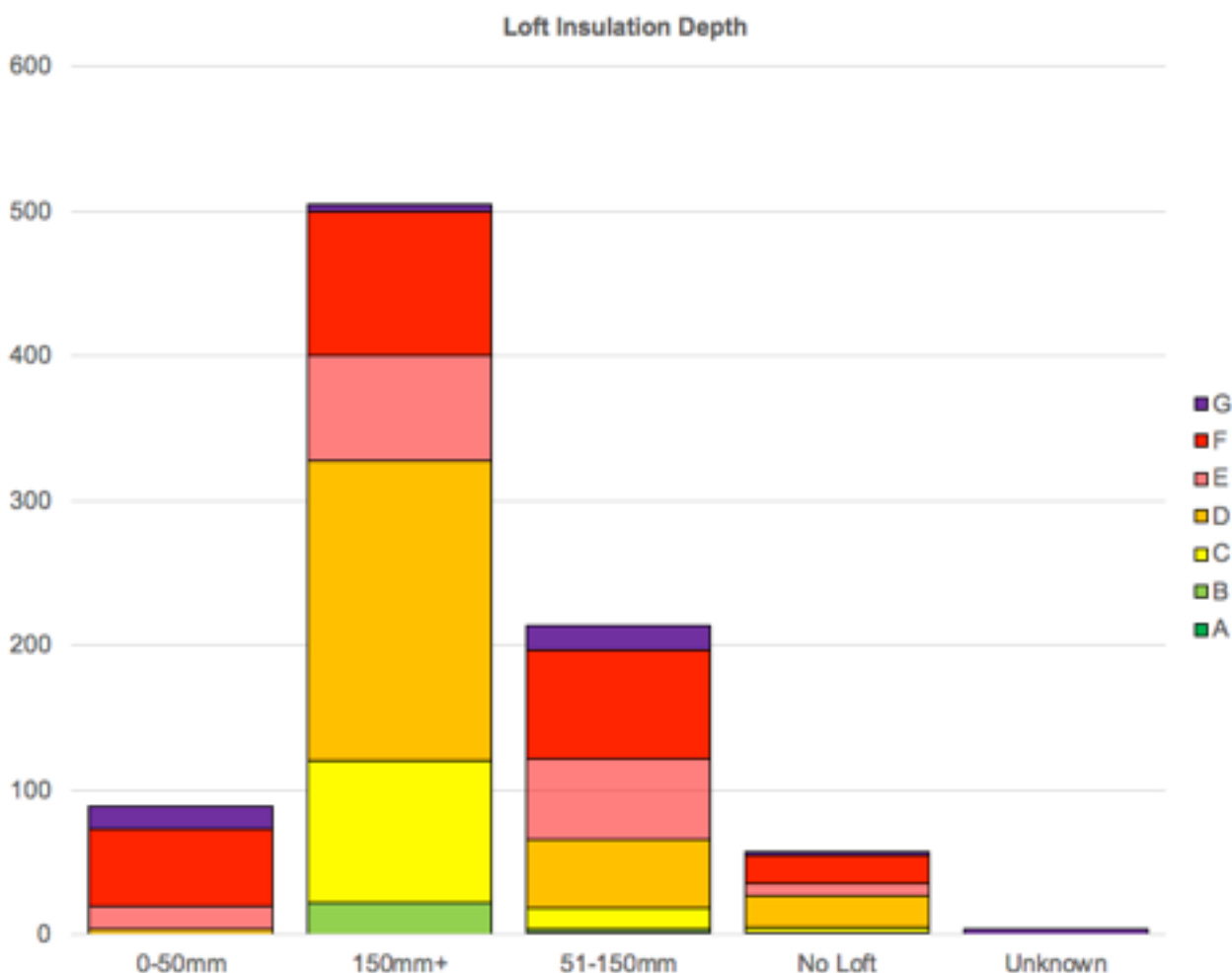
Unheated Space/Other Premise Below



There are 39 properties with unheated space or other premises below of which:

- Band F = 12 are uninsulated.
 - Band E = 1 is uninsulated.
 - Band D = 9 are uninsulated.
 - Band C = 4 are uninsulated.
 - Band B = 1 is uninsulated.
-

Loft Insulation



Depth of Insulation

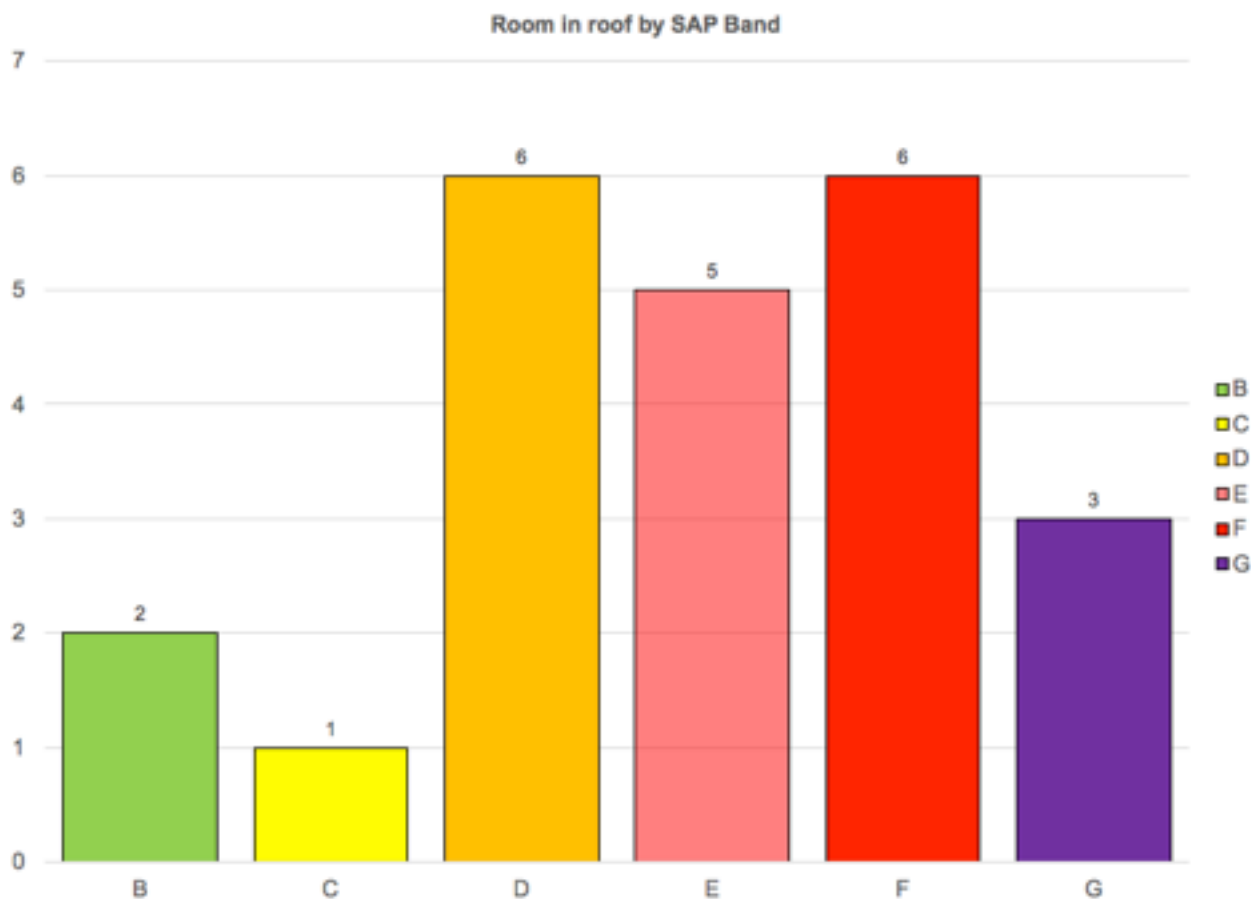
The data reports a maximum depth of 150mm plus, the current standard is for a minimum of 270mm, with a recommendation for 300mm. As such the actual depth of insulation requires further investigation.

However analysis of the data shows:

- 88 properties only have 0-50mm
- 214 have between 51-150mm
- 505 have 150mm plus
- 57 have no loft.

Loft insulation has been recommended for each property with a loft.

Room In Roof



There are 24 homes reported to have rooms in roofs as follows:

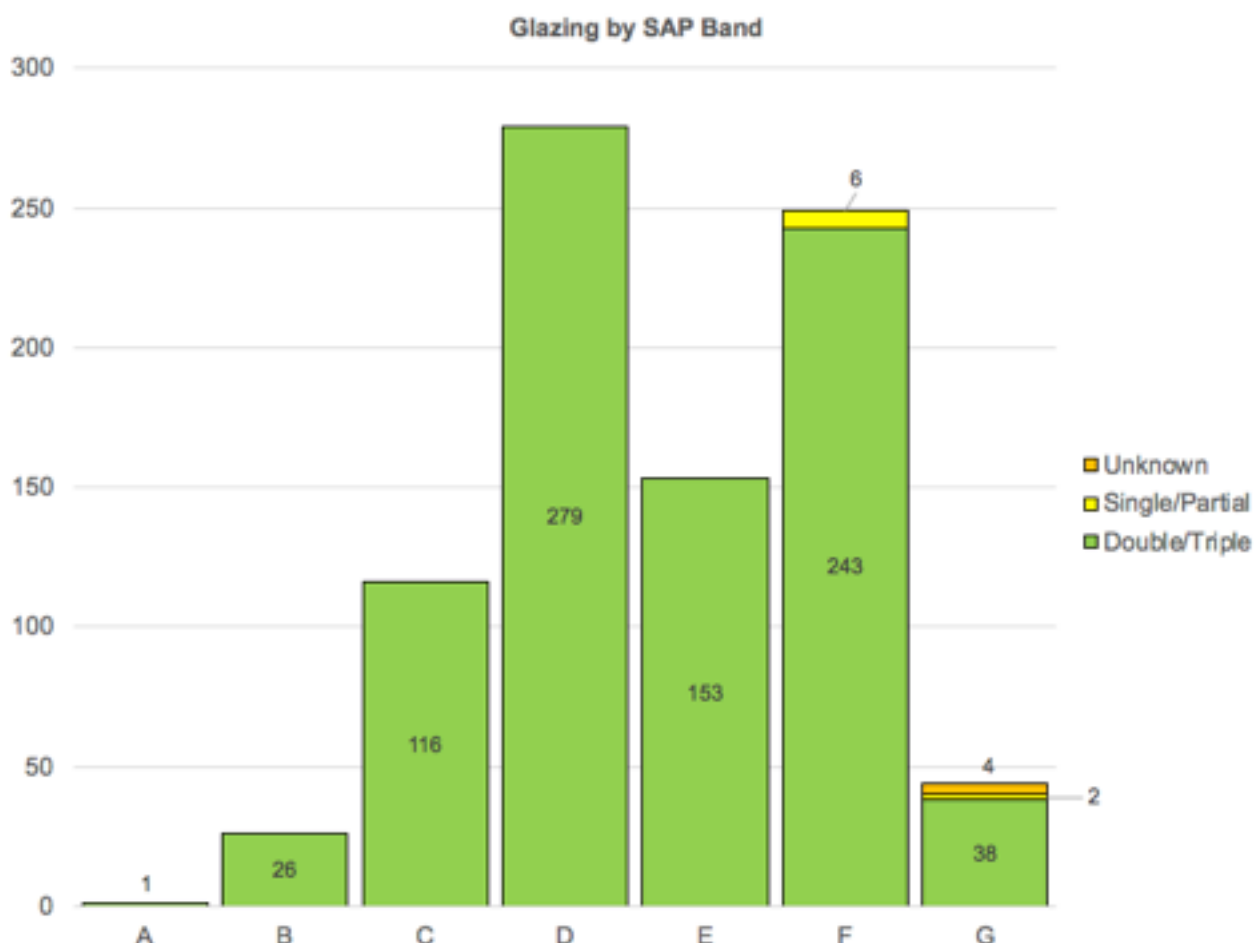
- Band B = 2
- Band C = 1
- Band D = 6
- Band E = 5
- Band F = 6
- Band G = 3

Rooms in roofs makes insulation more complex & may contribute to condensation in unventilated lofts.

There are no data for the costs of insulation of rooms in roofs.

Glazing

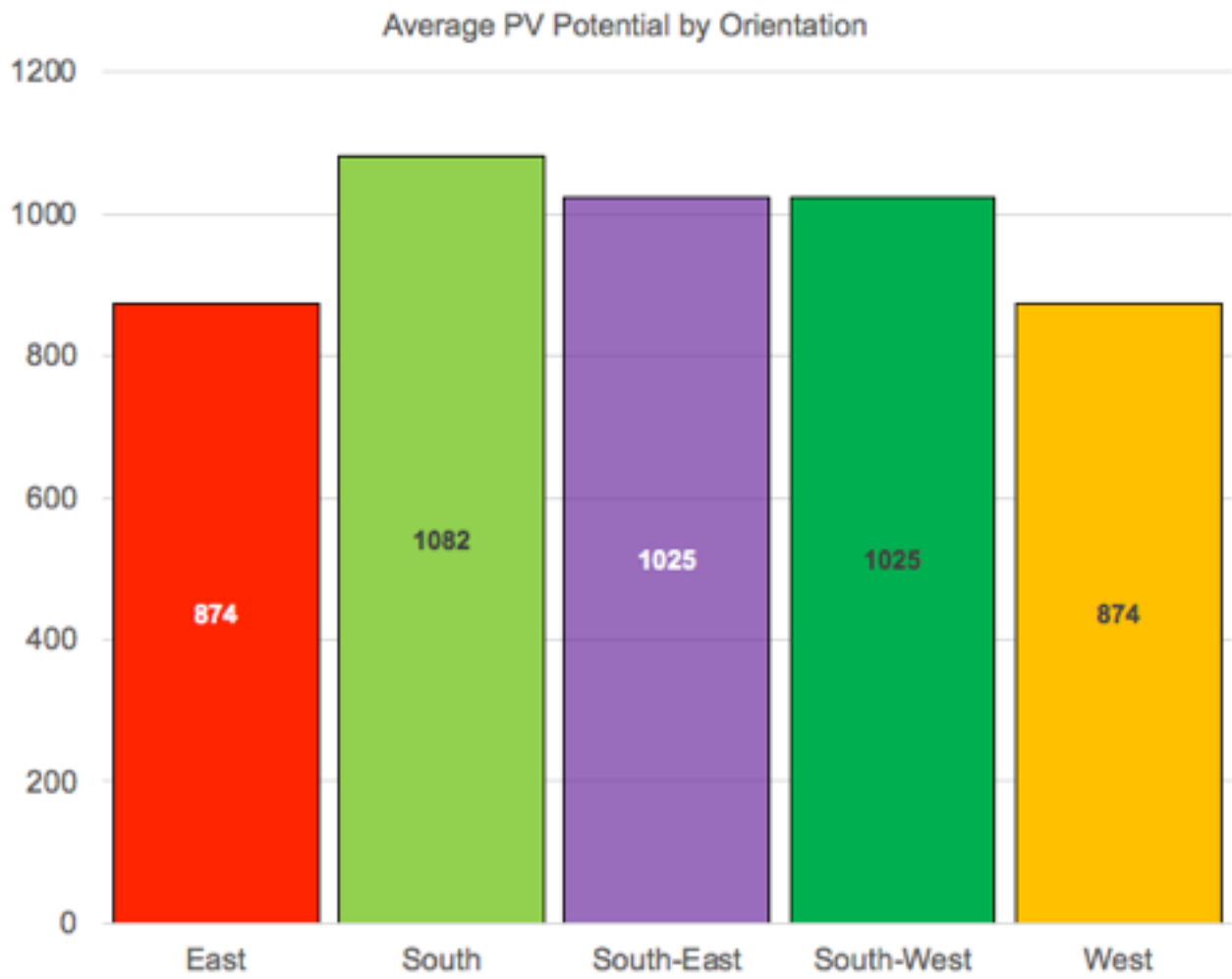
Double/Triple Glazing



The data shows that the vast majority of homes are double or triple glazed, however the data does not stipple the age of the glazing and it is widely recognised that glazing units do deteriorate over time. In the cost/benefit analysis double or triple glazing has been recommended where single or partial glazing has been identified i.e.

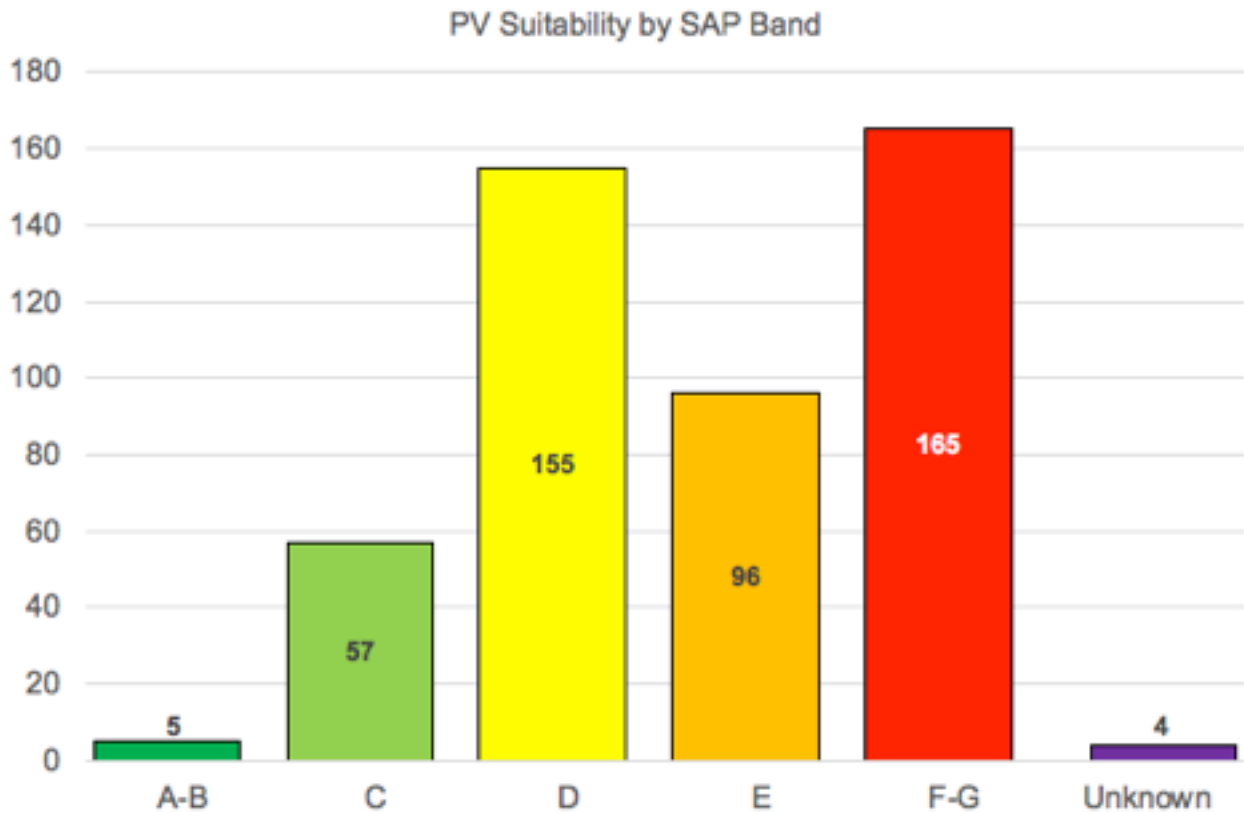
- 6 in Band F
- 2 in Band G

Further analysis is required to determine whether replacement glazing would be beneficial.



RENEWABLE TECHNOLOGIES

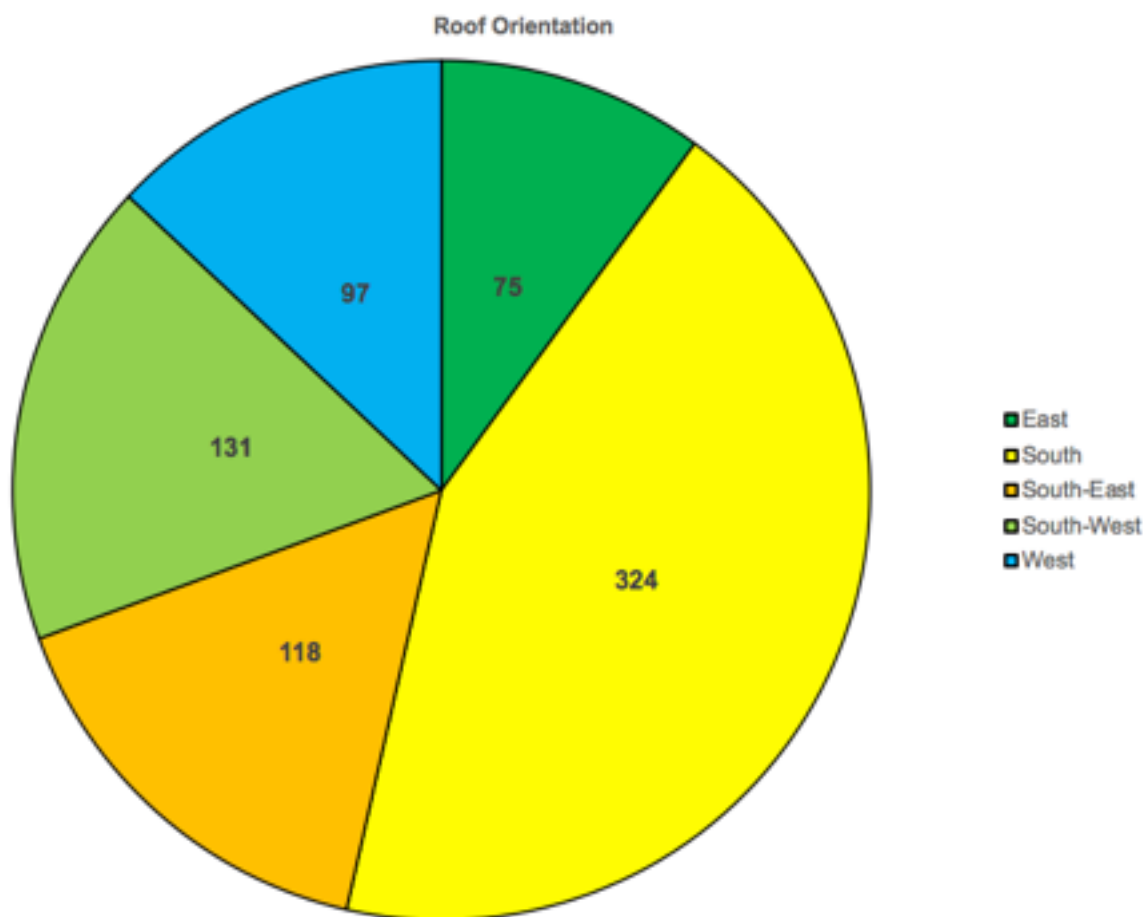
Solar Photovoltaics



The data shows the PV suitability:

- Band F-G =165
 - Band E = 96.
 - Band D = 155.
 - Band C = 57.
 - Band A-B = 5.
-

Roof Orientation



Amongst the properties suitable for solar PV there are:

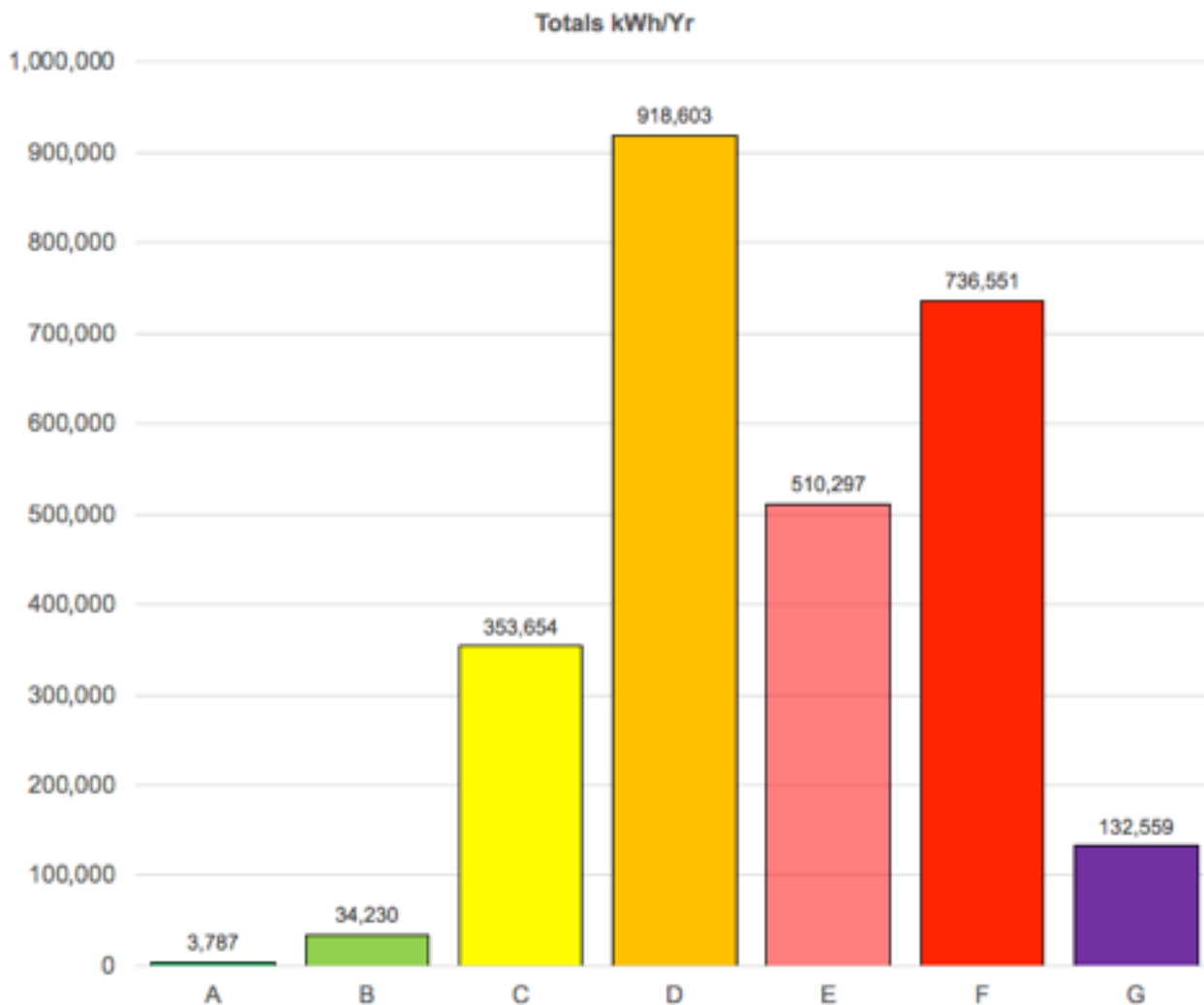
- 320 have south facing roofs.
- 118 have south east facing roofs
- 131 have south west facing roofs
- 97 have west facing roofs
- 75 have east facing roofs

There is a number of variables affecting the amount of PV generation, these include:

- Array size
- Roof orientation
- Shading

For the purposes of calculating the potential PV generation an array of 3.5 kW peak has been used.

Solar PV Generation

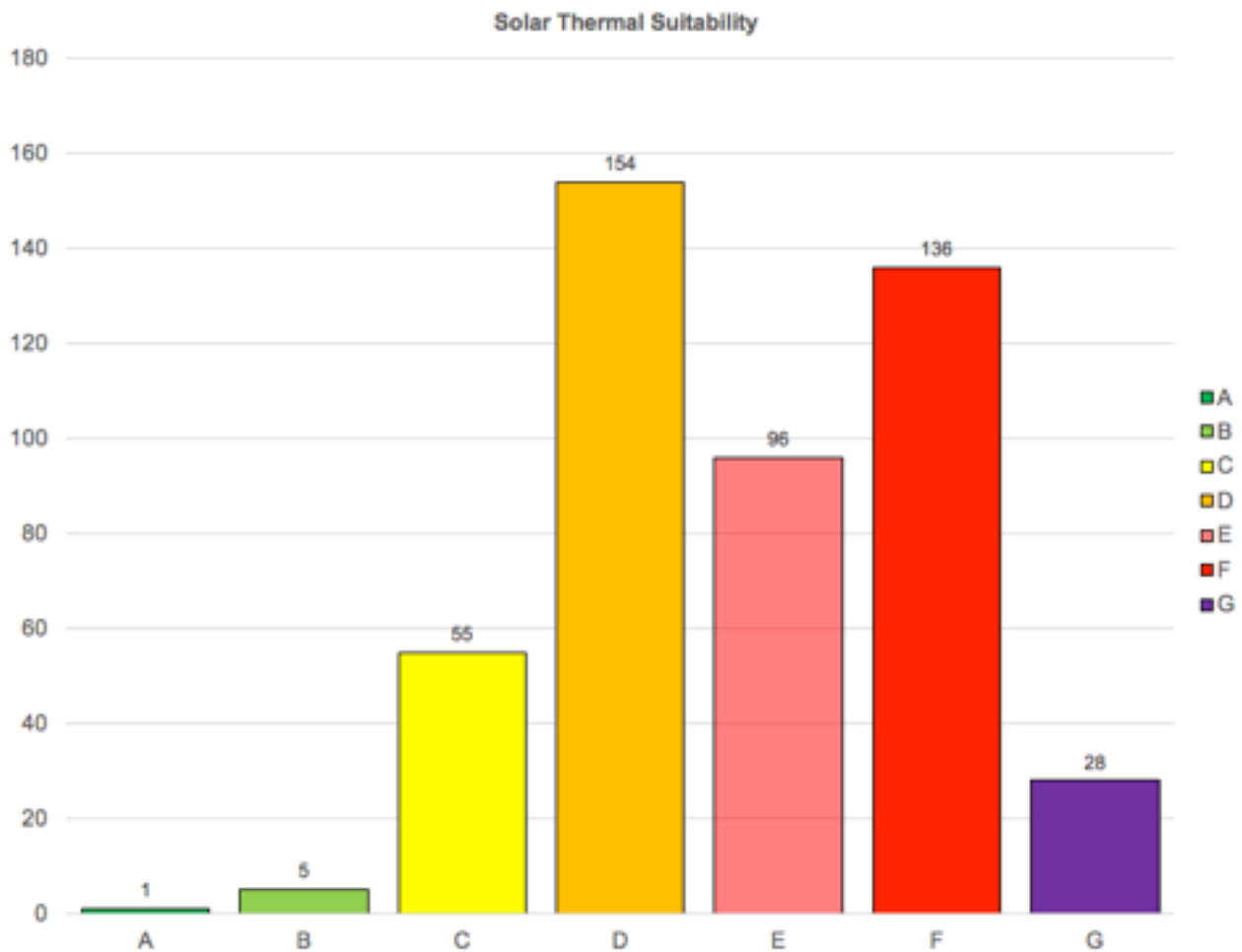


The average solar PV generation kWh/annum shows that:

- South facing roofs generate the most.
- South-west and south-east facing roofs generate slightly less than south facing.
- West & east facing roofs generate on average 81% of that on a south facing roof.

The analysis suggests the annual PV generation, assuming all properties deemed suitable have PV installed, is 2,689,680 kWh.

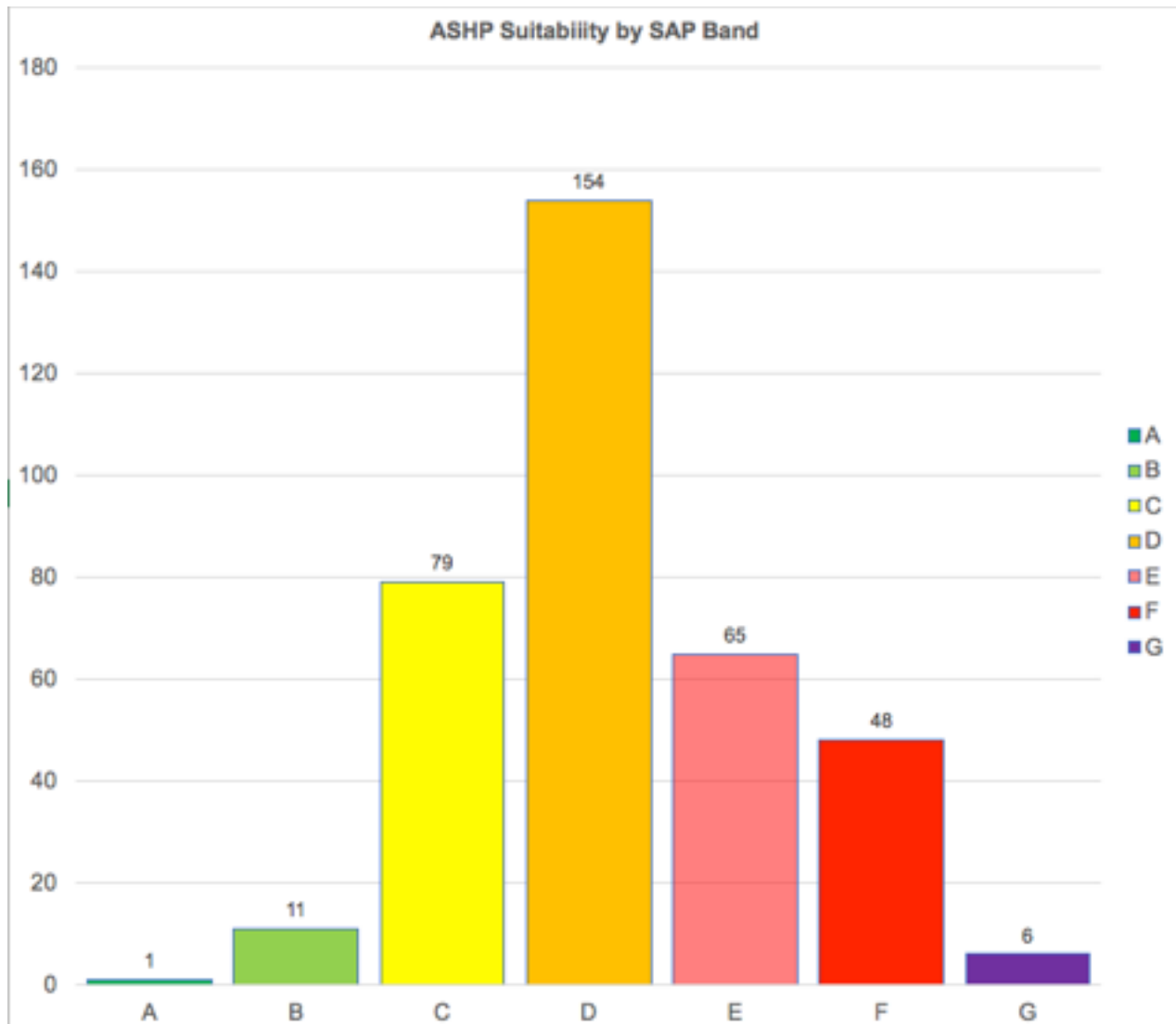
Solar Thermal



The data for solar thermal suitability shows that;

- Band G = 28 properties are suitable
 - Band F = 136 properties are suitable
 - Band E = 96 properties are suitable
 - Band D = 154 properties are suitable
 - Band C = 55 properties are suitable
 - Band B = 5 properties are suitable
 - Band A = 1 property is suitable.
-

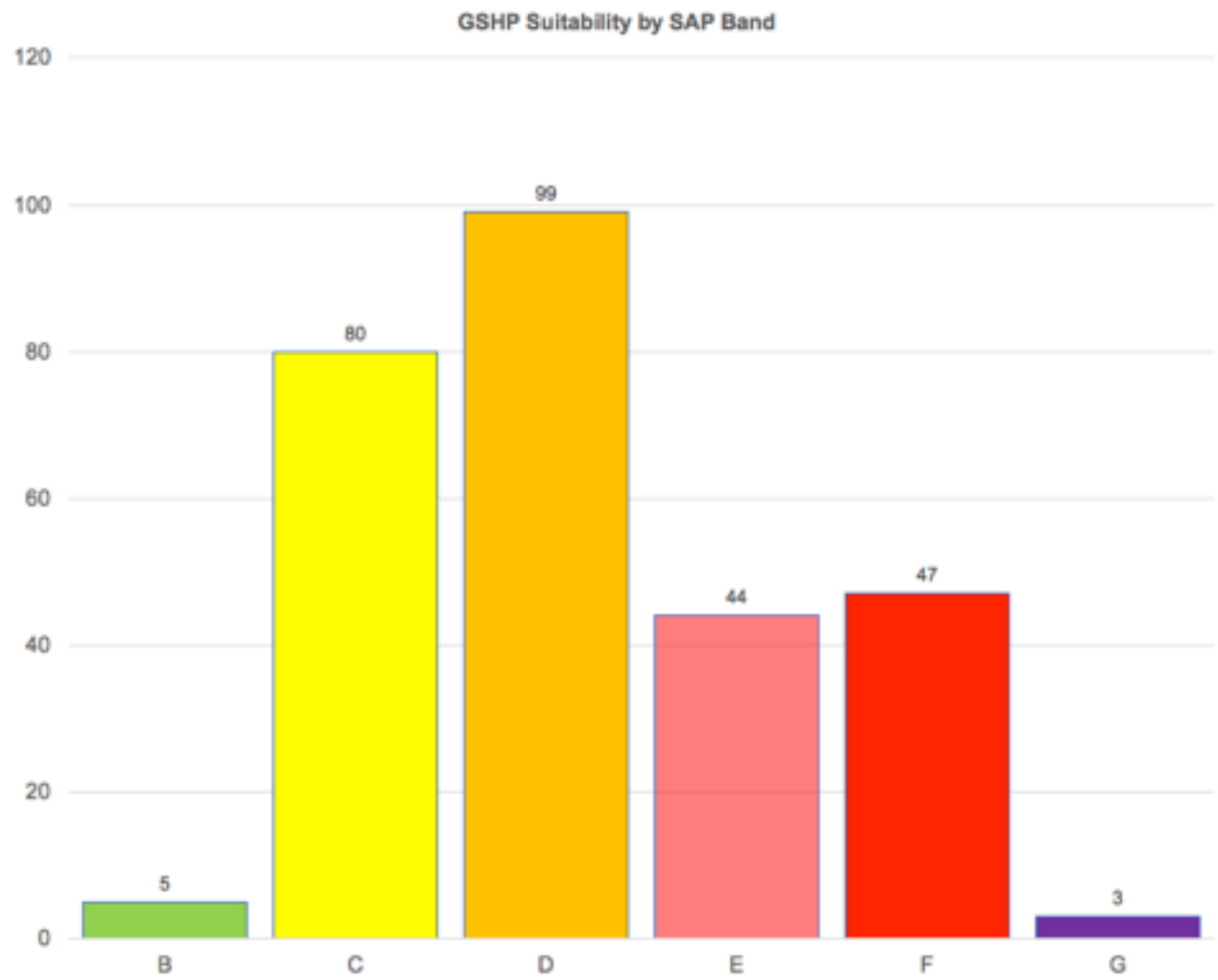
Air Source Heat Pump Suitability.



The data shows that there are:

- Band G = 6 homes that are suitable for ASHP.
 - Band F = 48 homes suitable for ASHP.
 - Band E = 65 homes suitable for ASHP.
 - Band D = 154 homes suitable for ASHP.
 - Band C = 79 homes suitable for ASHP.
 - Band B = 11 homes suitable for ASHP.
 - Band A = 1 home suitable for ASHP.
-

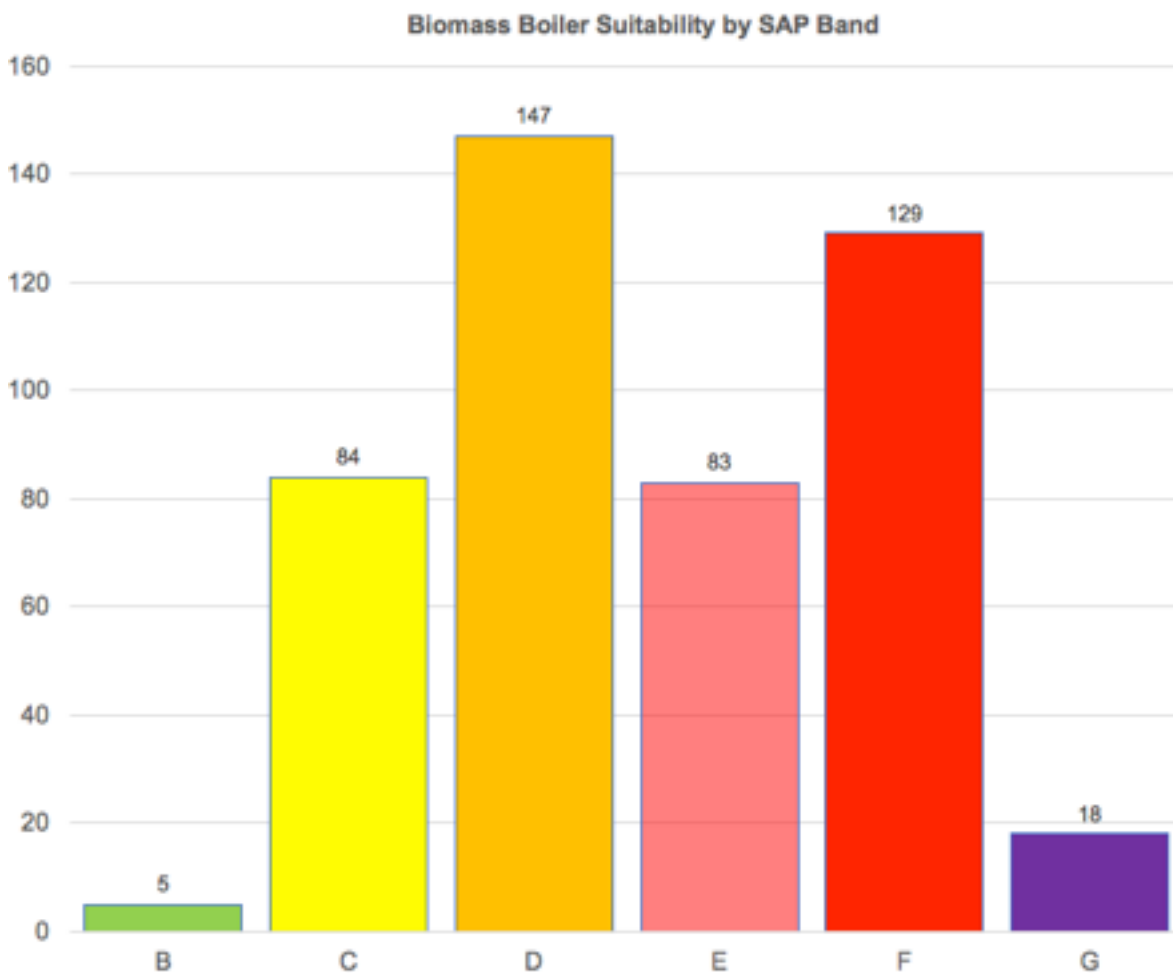
Ground Source Heat Pump Suitability



The data shows that there are:

- Band G = 3 homes which are suitable for GSHP.
 - Band F = 47 homes which are suitable for GSHP.
 - Band E = 44 homes which are suitable for GSHP.
 - Band D = 89 homes which are suitable for GSHP.
 - Band C = 80 homes which are suitable for GSHP.
 - Band B = 5 homes which are suitable for GSHP.
-

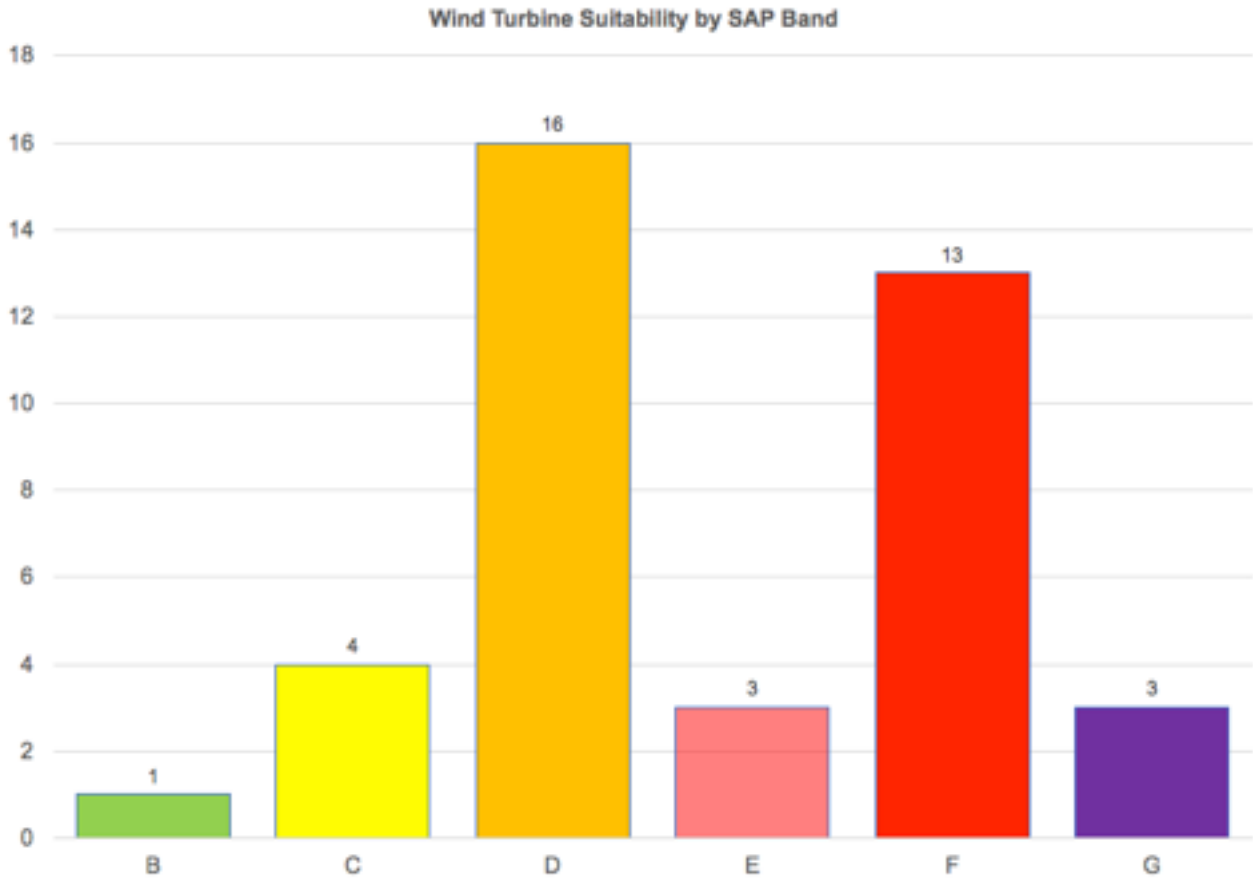
Biomass Boiler Suitability



Homes suitable for biomass boilers are;

- Band G = 18.
 - Band F = 129.
 - Band E = 83.
 - Band D = 147.
 - Band C = 84.
 - Band B = 5.
-

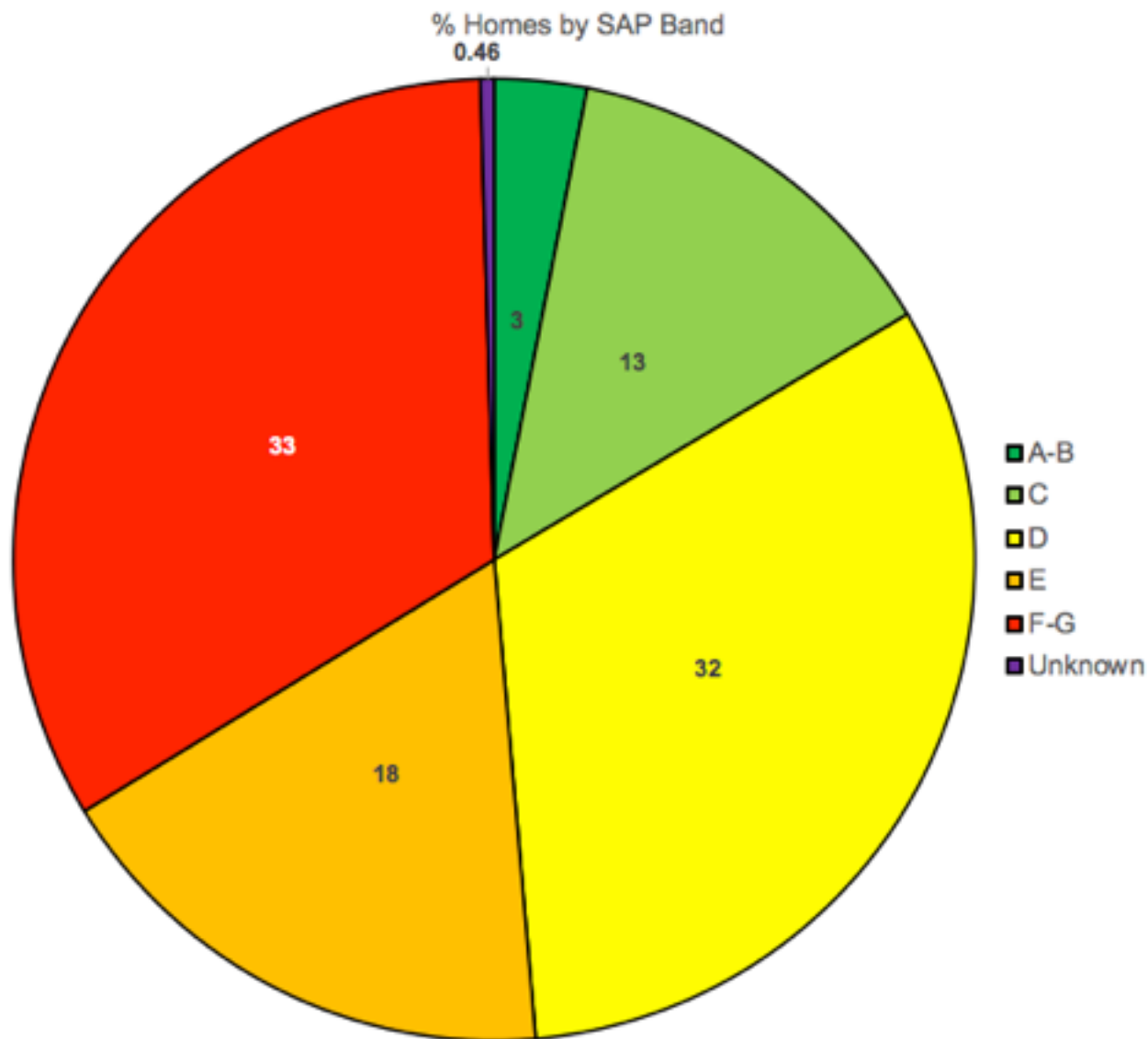
Wind Turbines



Homes considered suitable for wind turbines are:

- Band G = 3.
 - Band F = 13.
 - Band E = 3.
 - Band D = 16.
 - Band C = 4.
 - Band B = 1.
-

Energy Demand

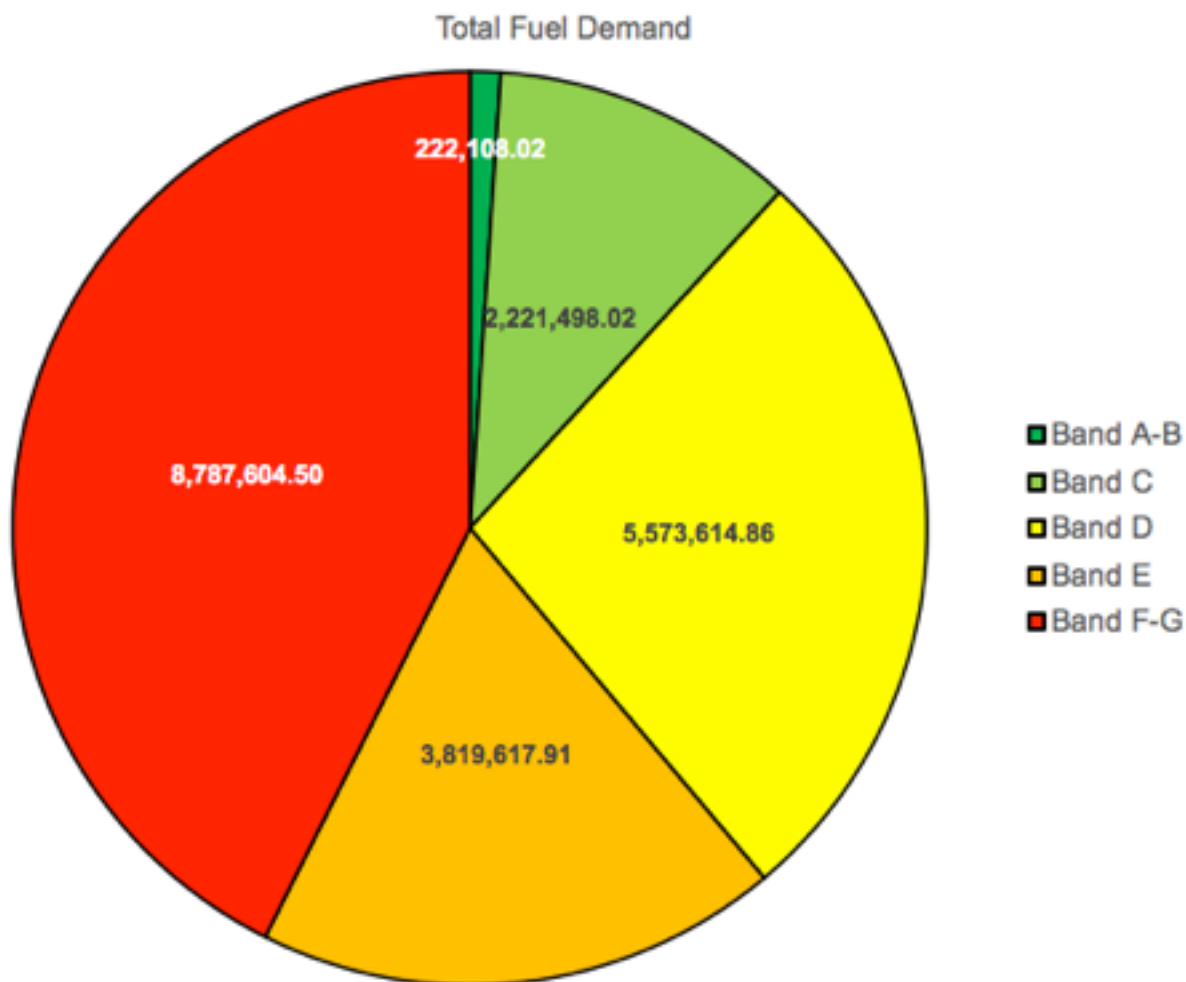


% Homes by SAP Band

83% of homes in Georgeham are in the least energy efficiency bands D-G, with:

- Band F-G = 33%
- Band E = 18%
- Band D = 32%

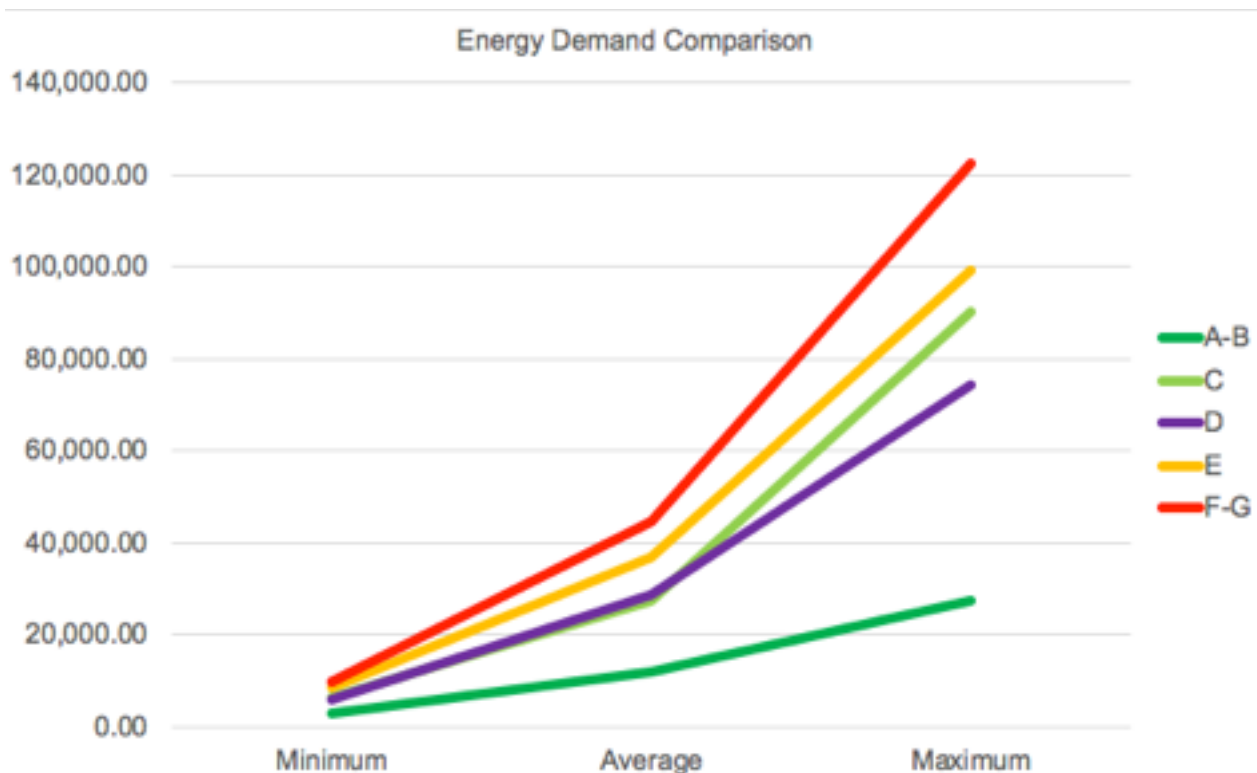
Energy Demand by SAP Band



The total energy demand within each SAP Band shows that:

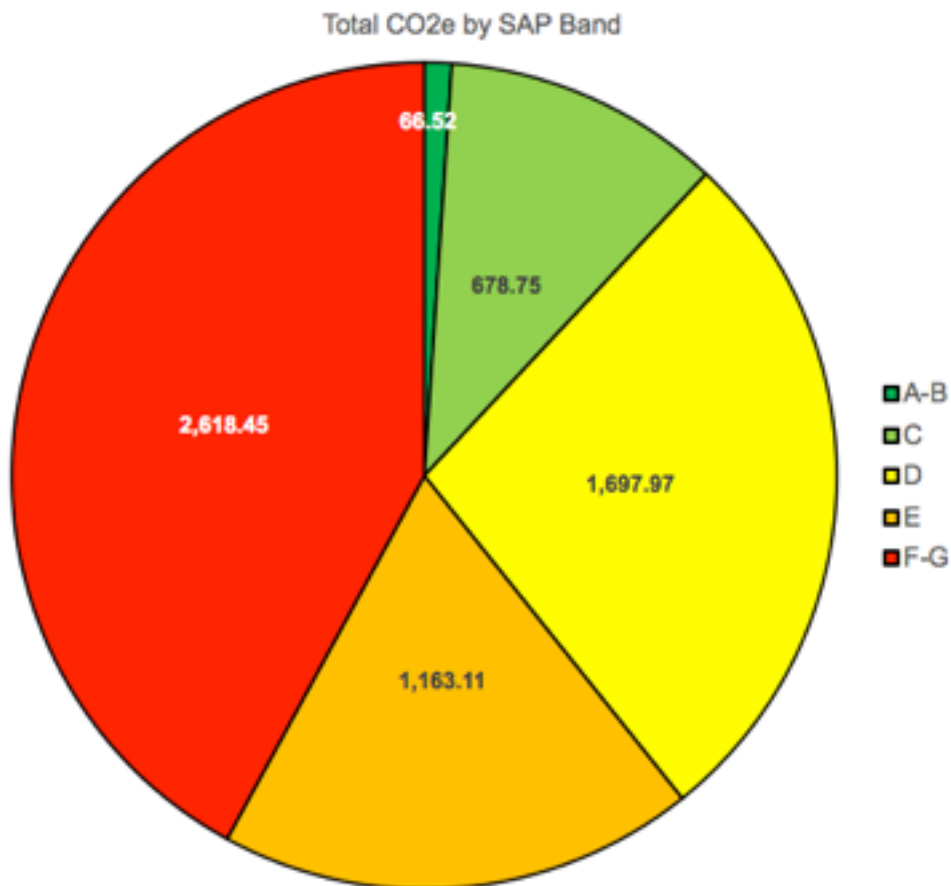
- Band F-G = 8,787,604.50 kWh/annum
- Band E = 3,829,617.91 kWh/annum
- Band D = 5,573,614.86 kWh/annum
- Band C = 2,221,498.02 kWh/annum
- Band A-B = 22,108.02 kWh/annum

Energy Demand Comparison



Analysis of the energy demand of all homes within each SAP Band shows, in the main, a reasonable degree of separation within each Band, however, the situation with Band C & D is less clear. As the shows the average demand in Bands C & D are almost identical and the maximum demand for Band C significantly exceeds that of Band D.

CO2e Emissions by SAP Band



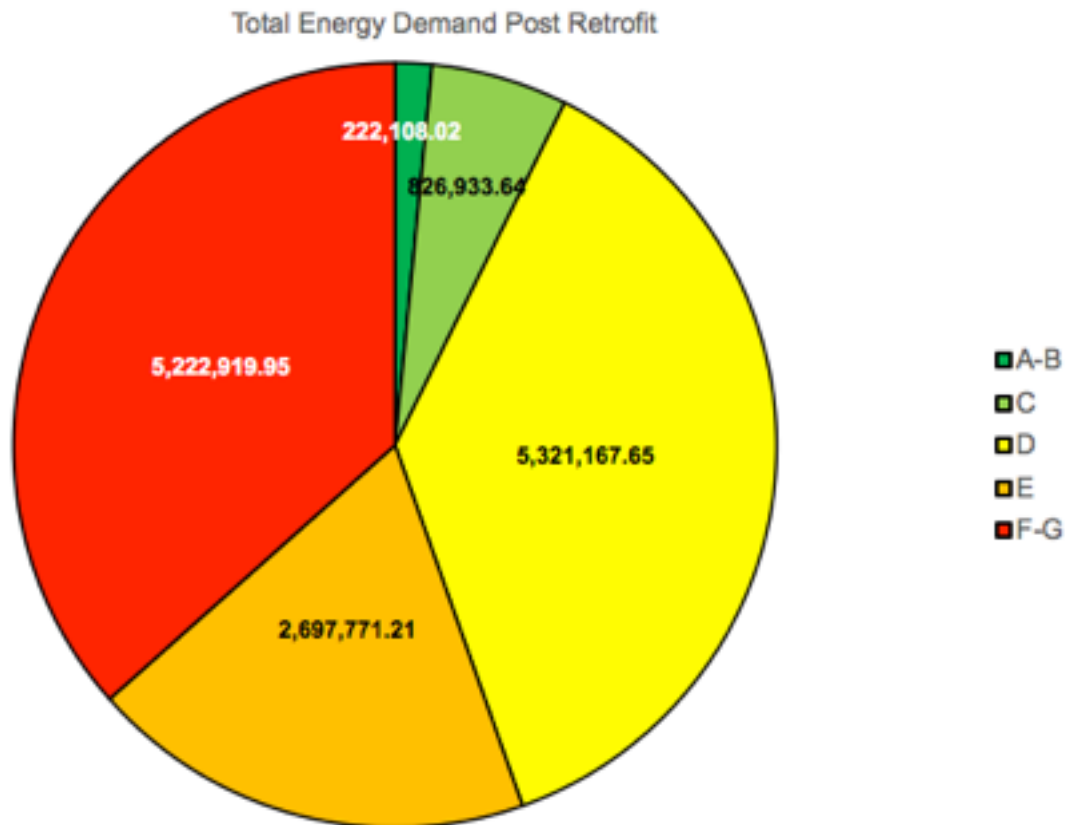
The graph shows that 42% of housing CO2e emissions are from Band F-G properties. This is due to their low energy efficiency and the number of properties in that Band.

- Band F-G = 2,618.45 tCO2e
- Band E = 1,163.11 tCO2e
- Band D = 1,697.97 tCO2e
- Band C = 678.75 tCO2e
- Band A-B = 66.52 tCO2e

The total housing emissions = 6,224.79 tCO2e compared with the Impact tool baseline of 6,612.31, indicating good correlation between these figures and the Impact tool.

POST RETROFIT

Energy Demand



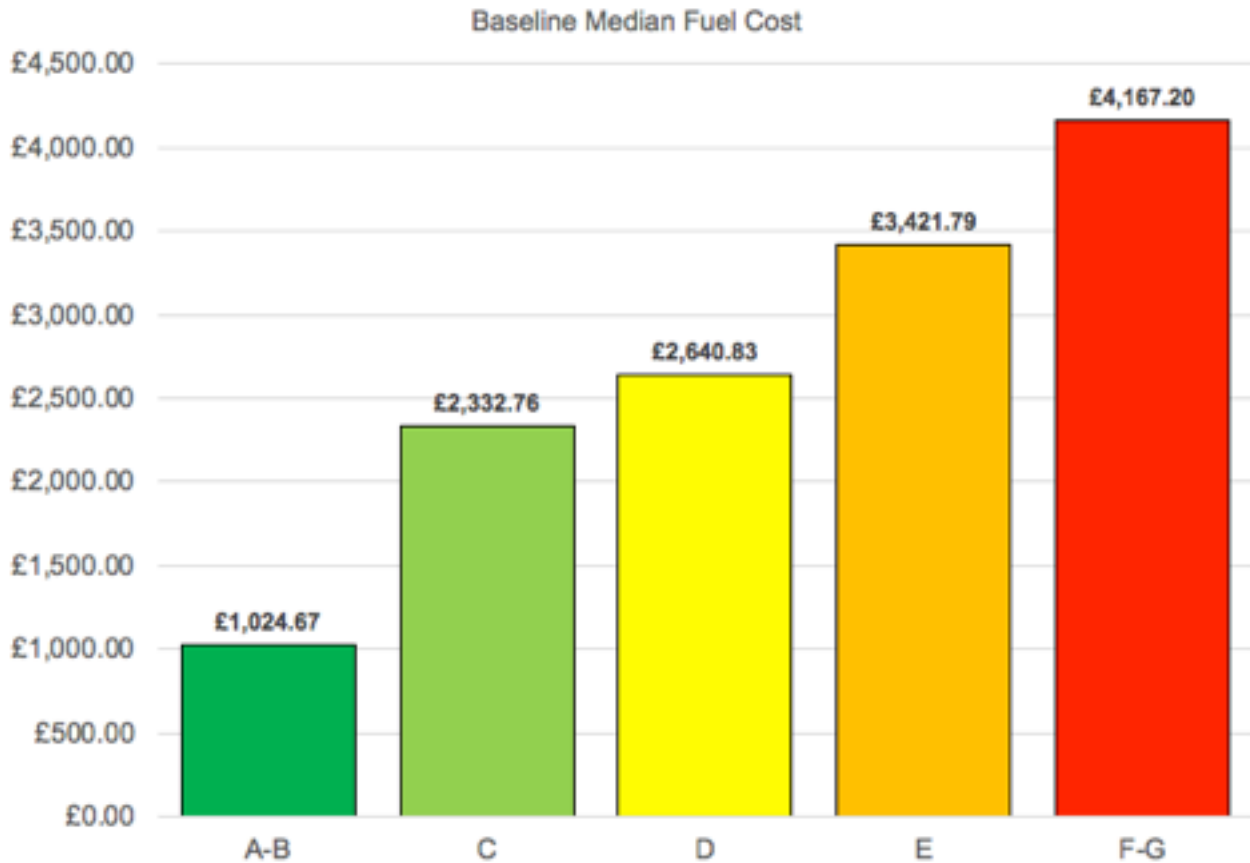
The government's intentions are to retrofit all Band D-G properties to Band C standard by 2035, furthermore the intention is to convert to all electric.

ENERGY DEMAND COMPARISON

Comparing the energy demand pre & post retrofit the results are:

- Band F-G = 8,787,604.50 kWh/annum reduces to 5,222,919.95 kWh/annum
 - Band E = 3,829,617.91 kWh/annum reduces to 2,697,771.21 kWh/annum
 - Band D = 5,573,614.86 kWh/annum reduces to 5,321,167.65 kWh/annum
 - Band C = 2,221,498.02 kWh/annum reduces to 826,933.64 kWh/annum
 - Band A-B = 22,108.02 kWh/annum remains the same.
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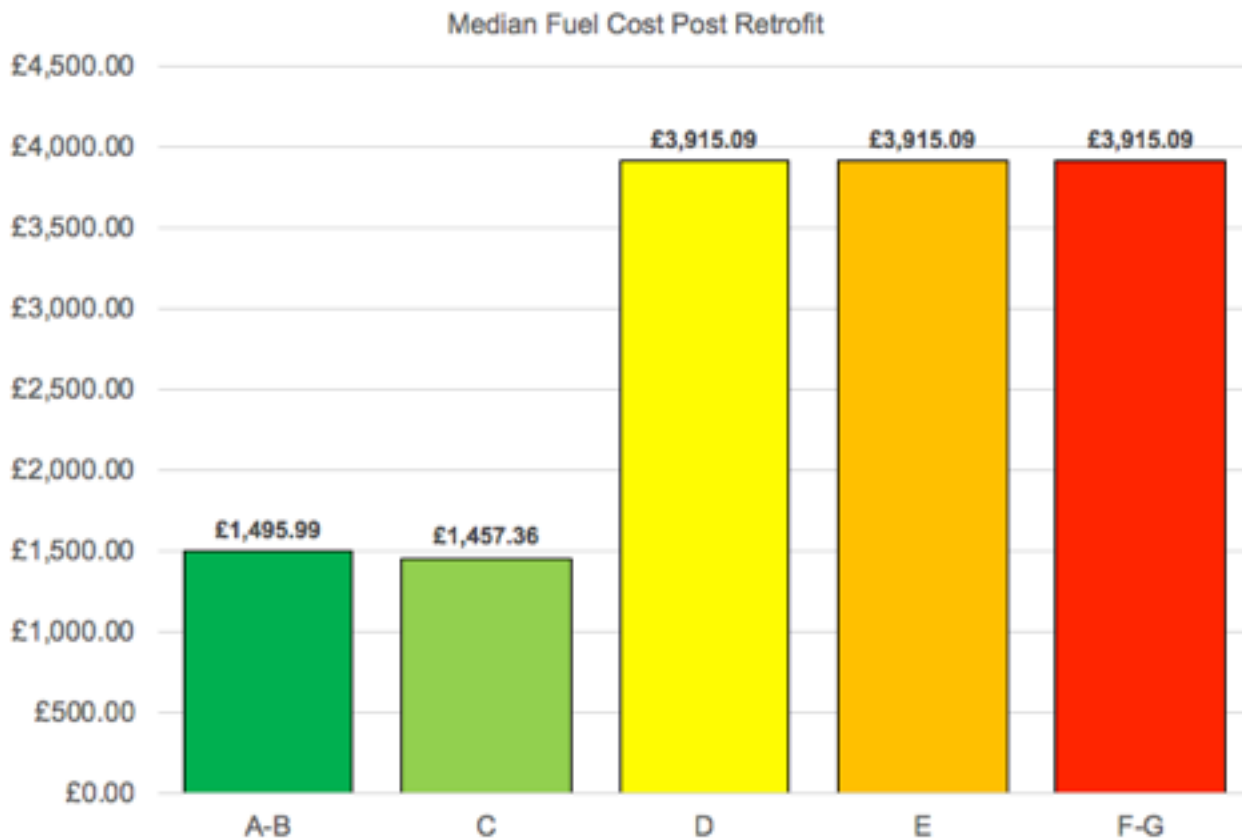
Median Average Fuel Cost Comparison



Pre retrofit the median average fuel costs were:

- Band F-G = £4,167.20
- Band E = £3,421.79
- Band D= £2,640.83
- Band C = £2,322.76
- Band A-B = £1,024.67

As shown there are significant differences between the bands except between Bands C & D.

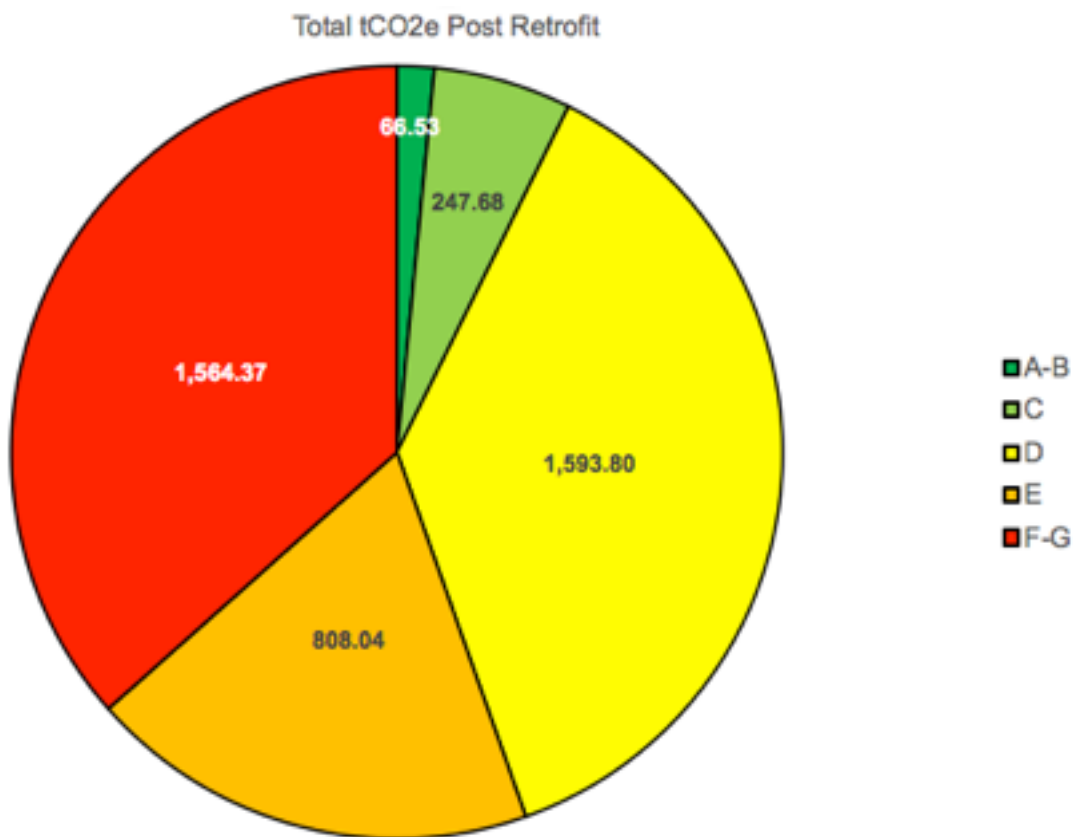


Post retrofit the median average fuel costs are:

- Band F-G = £4,167.20 reduces by £251.30 to £3,915.90
- Band E = £3,421.79 increases by £494.11 to £3,915.90
- Band D= £2,640.83 increases by £1,275.07 to £3,915.90
- Band C = £2,322.76 reduces by £865.54 to £1,457.36
- Band A-B = £1,024.67 increases by £471.32 to £1,495.00

The reductions in fuel costs are as a result of lower energy demand due to increased energy efficiency of the homes, whereas the increases are as a result of the disproportionate cost of electricity compared with other fuels.

CO2e Emissions Comparison



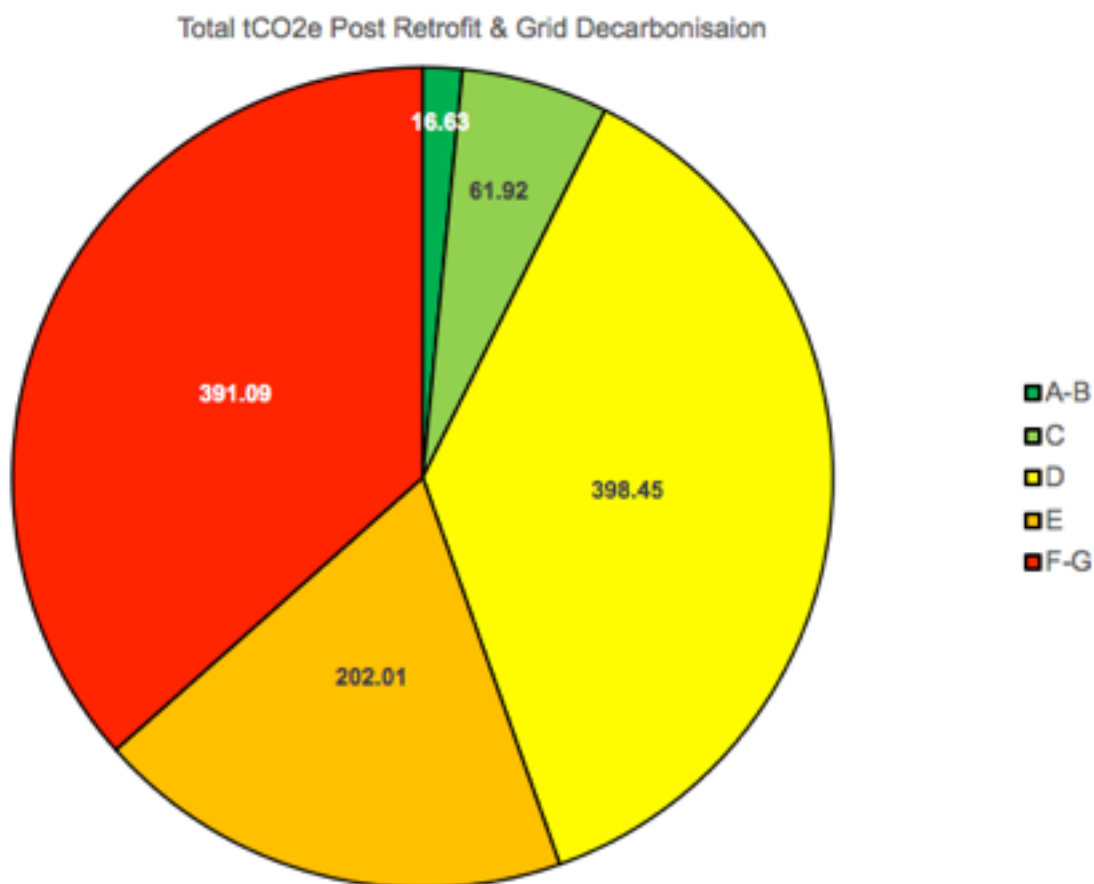
The reductions in CO2e emissions post retrofit are:

- Band F-G = 2,618.45 tCO2e reduces to 1,564.37 tCO2e
- Band E = 1,163.11 tCO2e reduces to 808.04 tCO2e
- Band D = 1,697.97 tCO2e reduces to 1,593.80 tCO2e
- **Band C = 678.75 tCO2e reduces to 247.68 tCO2e**
- **Band A-B = 66.52 tCO2e remains the same.**

Aspiration	Band F-G	Band E	Band D	Band C	Band A-B	Total
Pre Retrofit	2,618.45	1,163.11	1,697.97	678.75	66.52	6,224.80
Standard Aspiration	1,564.37	808.04	1,593.80	678.75	66.52	4,711.48
Higher Aspiration	1,564.37	808.04	1,593.80	247.68	66.52	4,280.41

The Standard Aspiration provides a 23% reduction in CO2e emissions, whereas the Higher Aspiration realises a 31% reduction in CO2e emissions.

Grid Decarbonisation



Government plans are to achieve 78% grid decarbonisation by 2035, the impact on the housing stock emissions by SAP band is shown below:

- Band F-G reduces to 391.09 tCO₂e
- Band E reduces to 202.01 tCO₂e
- Band D reduces to 398.45 tCO₂e
- Band C reduces to 61.92 tCO₂e
- Band A-B reduces to 16.63 tCO₂e

Total housing emissions:

- Baseline (Impact tool) = 6,612.31 tCO₂e
 - Calculated baseline = 6,224.79 tCO₂e
 - Post Retrofit + All Electric = 4,280.41 tCO₂e
-

- Post Retrofit + All Electric + Grid Decarbonisation = 1,070.10 tCO₂e

This equates to a 83% reduction in the calculated baseline, applying the same % reduction the Impact tool baseline figure reduces to 1,124.09 tCO₂e.

tCO₂e Emissions (All Electric + Grid Decarbonisation)						
Aspiration	Band F-G	Band E	Band D	Band C	Band A-B	Total
Baseline	2,618.45	1,163.11	1,697.97	678.75	66.52	6,224.80
Standard Aspiration	391.09	202.01	398.45	678.75	66.52	1,736.82
Higher Aspiration	391.09	202.01	398.45	61.92	16.63	1,070.10

COST BENEFIT ANALYSIS

Pre Retrofit

SAP Bands Pre Retrofit							
	A	B	C	D	E	F	G
	1	26	116	279	153	249	40

As shown above there are:

- Band A = 1 property
- Band B = 26 properties
- Band C = 116 properties
- Band D = 279 properties
- Band E = 153 properties
- Band F = 249 properties
- Band G = 40 properties

Post Retrofit

SAP Bands Post Retrofit								
	A	B	C	D	E	F	G	Totals
A	1	25	89	42	0	0	0	157
B		1	25	125	10	0	0	161
C			2	106	71	28	0	207
D				6	67	120	0	193
E					5	101	14	120
F						0	25	25
G							1	1
							864	864

Post retrofit there is the potential for 157 properties to get to Band A standard, 1 already Band A, 25 Band B properties, 89 Band C properties & 42 Band D properties.

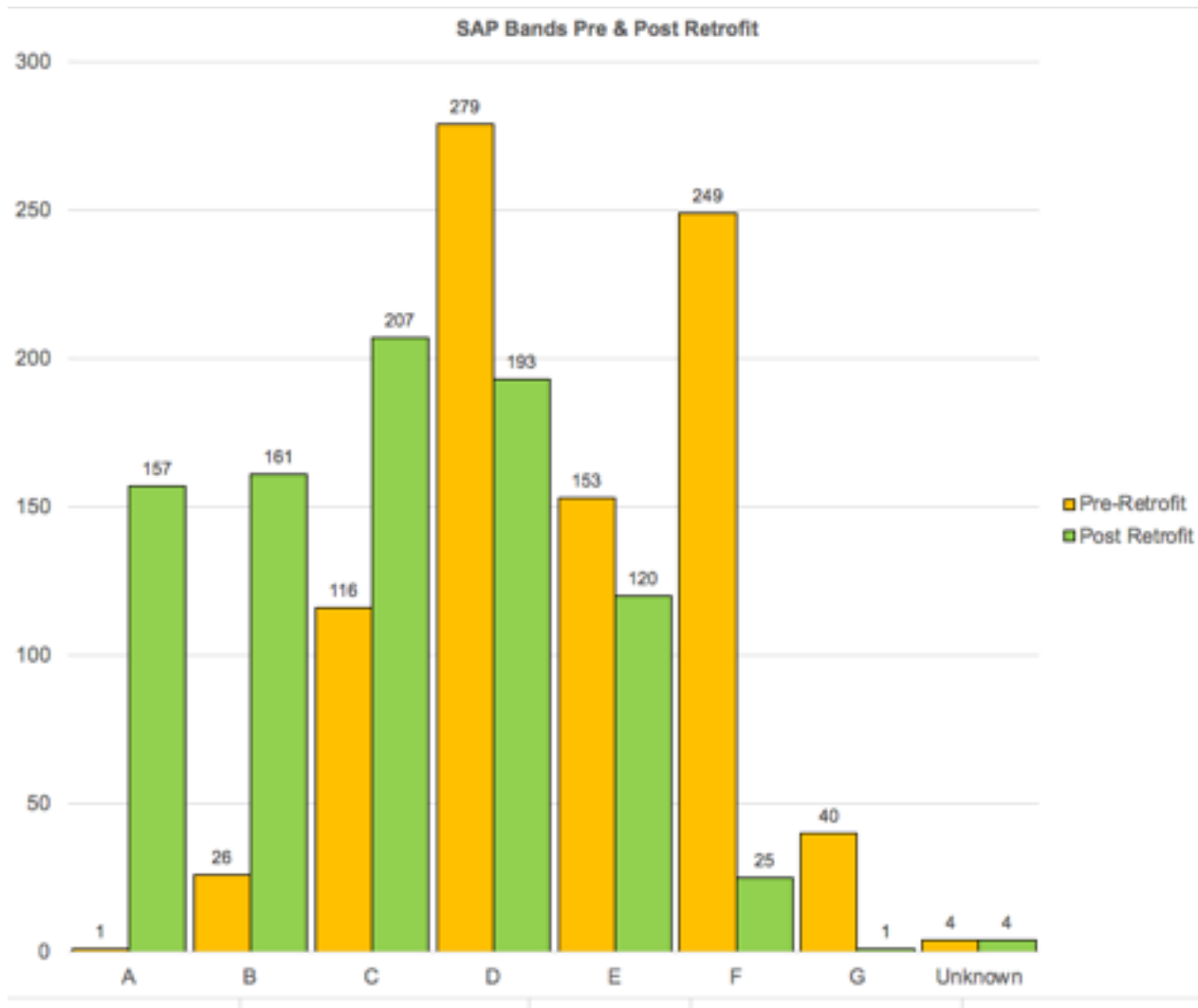
161 properties have the potential to reach Band B, 1 existing Band B, 25 Band C properties, 125 Band D properties & 10 Band E properties.

207 properties have the potential to reach Band C, 2 existing, 106 Band D properties, 71 Band E properties & 28 Band F properties.

193 properties are at Band D standard, 6 existing, 67 Band E properties, & 120 Band F properties.

120 properties are at Band E standard, 5 existing, 101 Band F properties & 14 Band G.

There are 25 at Band F standard which are all previously Band G properties.
1 property remains at Band G standard.



The above graph shows the increase in more energy efficient properties and the reduction in less energy efficient properties. There are 4 homes for which there are no data and these have not been included in the analyses.

The ambition for all homes to be retrofitted to at least Band C standard has not been achieved, the reasons for this are:

- The base data does not reflect all the potential energy efficient measures available.
 - It does not include behavioural changes
-

- Not all Energy Efficient Measures (EEMs) are allocated SAP Point increases. SAP & RdSAP (the applications that determine EPCs are being revised but these are not currently available.
- The analyses are not property specific, property specific retrofit assessments will provide a more accurate assessment.

Retrofit Measures

Building Fabric					
Number of Homes	Wall Insulation	Floor Insulation	Loft Insulation	Room in Roof Insulation	Double/Triple Glazing
868	356	744	868	23	8
Heating & Controls					
Number of Homes	Condensing Boiler	Programmer & Thermostat			
868	737	371			
Renewable Technologies					
Number of Homes	Solar PV	Solar Thermal	Air or Ground Source Heat Pumps	Biomass Boiler	Wind Turbine
868	469	475	364	466	40

BUILDING FABRIC

The above table identifies the EEMs being considered:

- 356 homes require wall insulation either cavity wall or solid insulation.
- 744 homes require floor insulation either solid or suspended.
- 868 homes require loft insulation, this figure may be overstated as the base data only reports up to 150mm+ whereas the recommended minimum is 270mm.
- 23 homes are identified as having rooms in roofs which are harder to insulate and may contribute to condensation within unventilated loft spaces.
- 8 properties are identified as requiring double/triple glazing, this figure may be understated as the base data does not reflect the age of the existing glazing, which may deteriorate over time.

HEATING & CONTROLS

Georgeham is off the gas grid which limits the options available for heating boilers:

- 737 homes are identified as benefitting from boiler upgrades using the same fuel.
- 371 homes could benefit from fitting programmers and thermostat.

RENEWABLE TECHNOLOGIES

469 homes are identified as being suited for Solar Photo-Voltaic (PV).

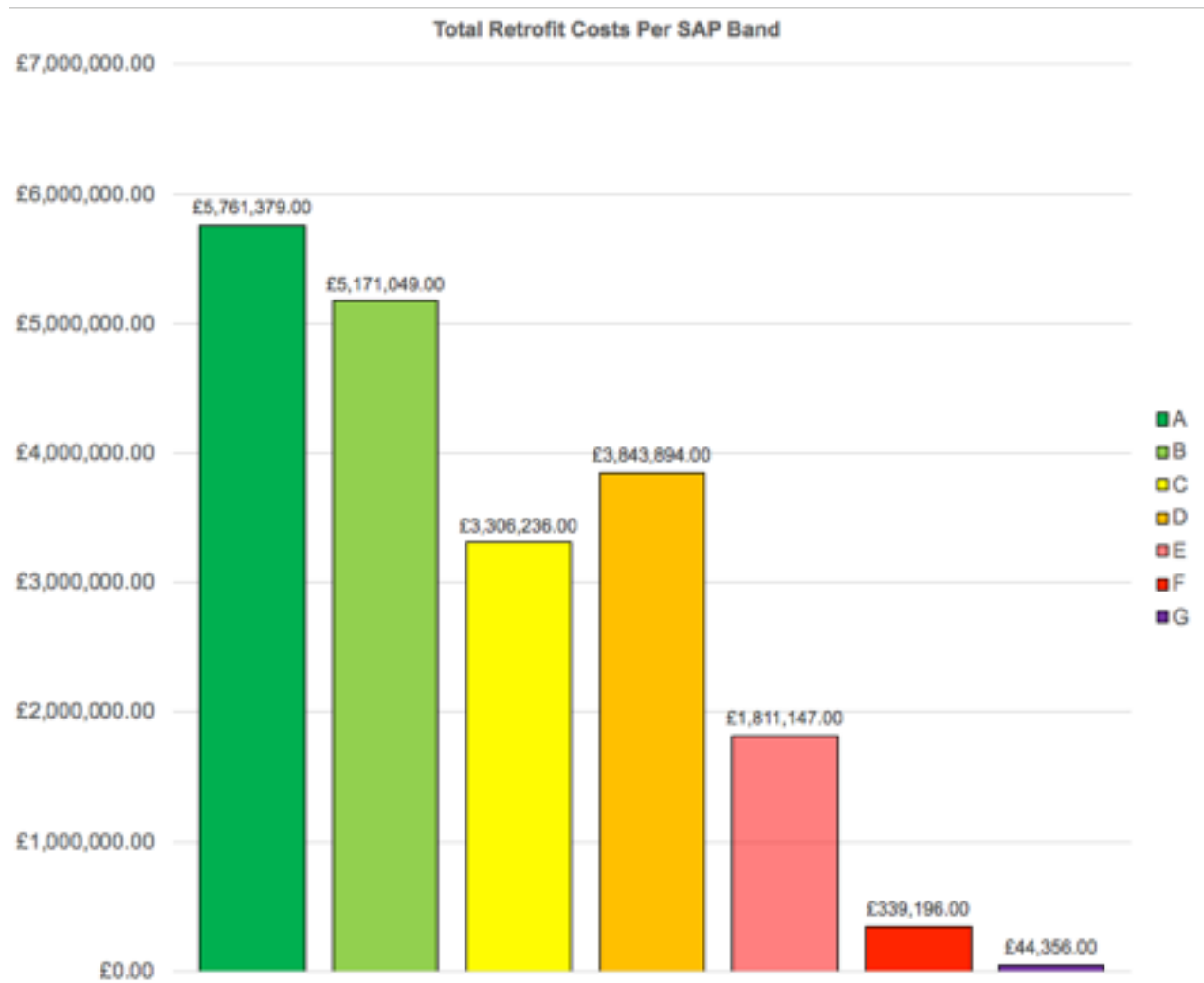
475 homes are identified as being suitable for Solar Thermal.

364 homes are identified as being suitable for either a ground source or air source heat pump, however heat pumps do not result in an increase in SAP Points, currently.

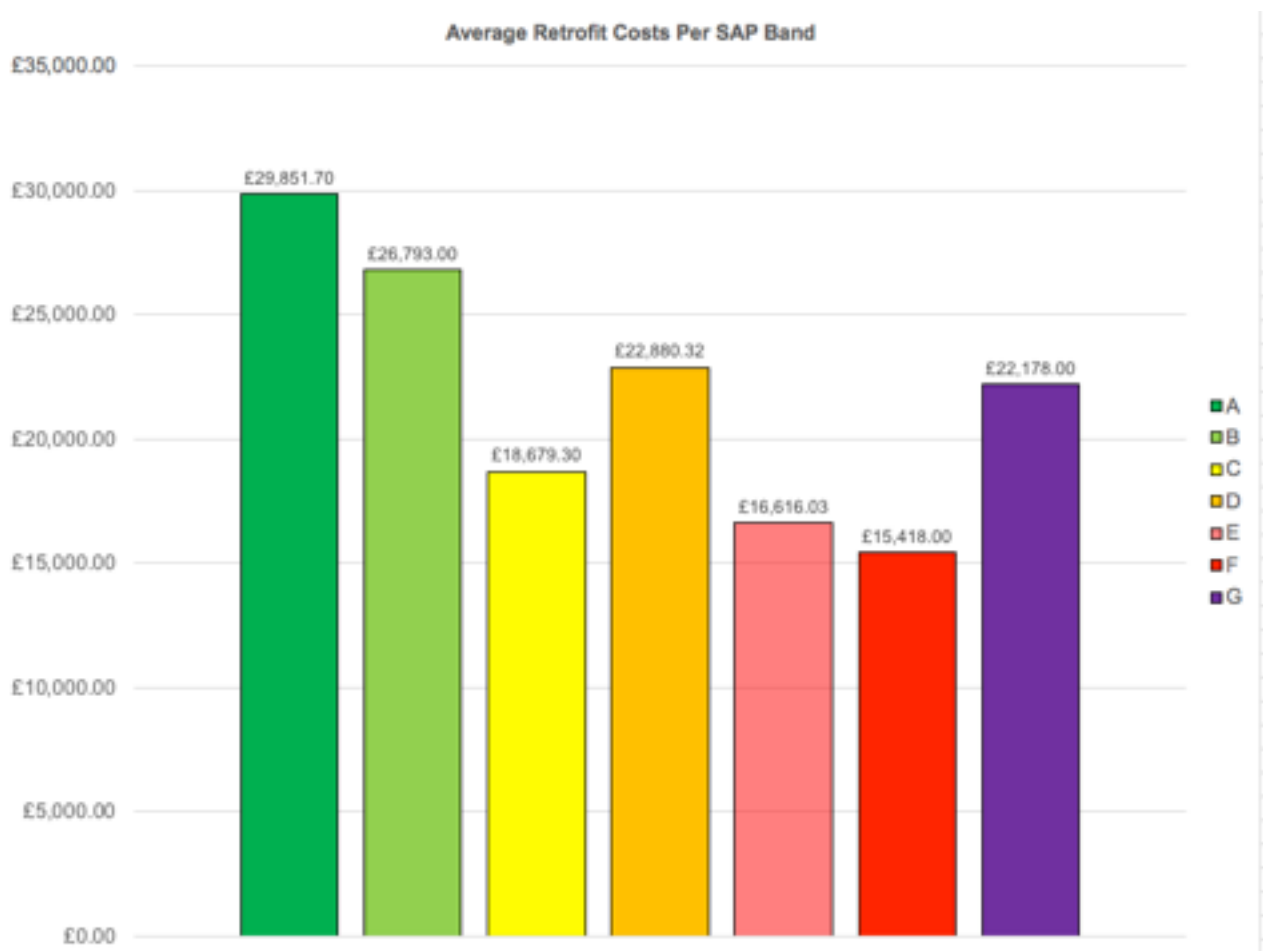
466 homes are identified as suitable for biomass boilers

40 homes are identified as suitable for micro wind turbines.

Costs



The total cost of the EEMs assessed is £20,277,257.00.



The average cost of the EEMs assessed is £23,469.05.

Benefits

It is difficult to determine the energy saving, CO₂e reductions & fuel cost savings at the individual property level due to the number of variables in such a determination, however from the assessment undertaken the typical % energy savings are:

- Minimum = 6.83%
- Average = 40.85%
- Maximum = 78.88%

This assumes that all the EEMs identified are installed.

In addition to the benefits identified above, there are further benefits:

- More energy efficient homes have health benefits
- More energy efficient homes offset issues of fuel affordability