Petersfield Climate Action Network

Online Q&A: Heat Pumps and Subsidies

January 2022

Speakers

Peter Moss – PeCAN Trustee, introduction to PeCAN

Bean Beanland – Heat Pump Federation, an introduction to heat pumps and government policy

Colin Meek – rb&m, former Which? researcher, the economics of heat pumps

Alison Glasspool – local homeowner who has recently converted from an oil system to an air source heat pump

You can click on the speakers name to jump to their slides

PeCAN's background

- Environmental charity started in Dec 2020
- Set up by local residents in and around Petersfield
- Network of likeminded people who have skills and energy, over 300 supporters
- 3 part time members of staff, 10 trustees, many volunteers
- Funded by National Energy Foundation and South Downs National Park

Petersfield to become carbon neutral as quickly as possible


To restore and protect our
local environment

Information and education

- Information events
- East Hampshire COP
- Green Businesses Initiatives

Campaigns

- Verges
- Pesticides
- Working with town, district and county councils

Decarbonising

- SuperHomes
- Fruit trees/tree planting
- Community Energy

How to get involved

Tree planting

Newsletter

SuperHomes

Volunteering

Residential carbon emissions

Petersfield

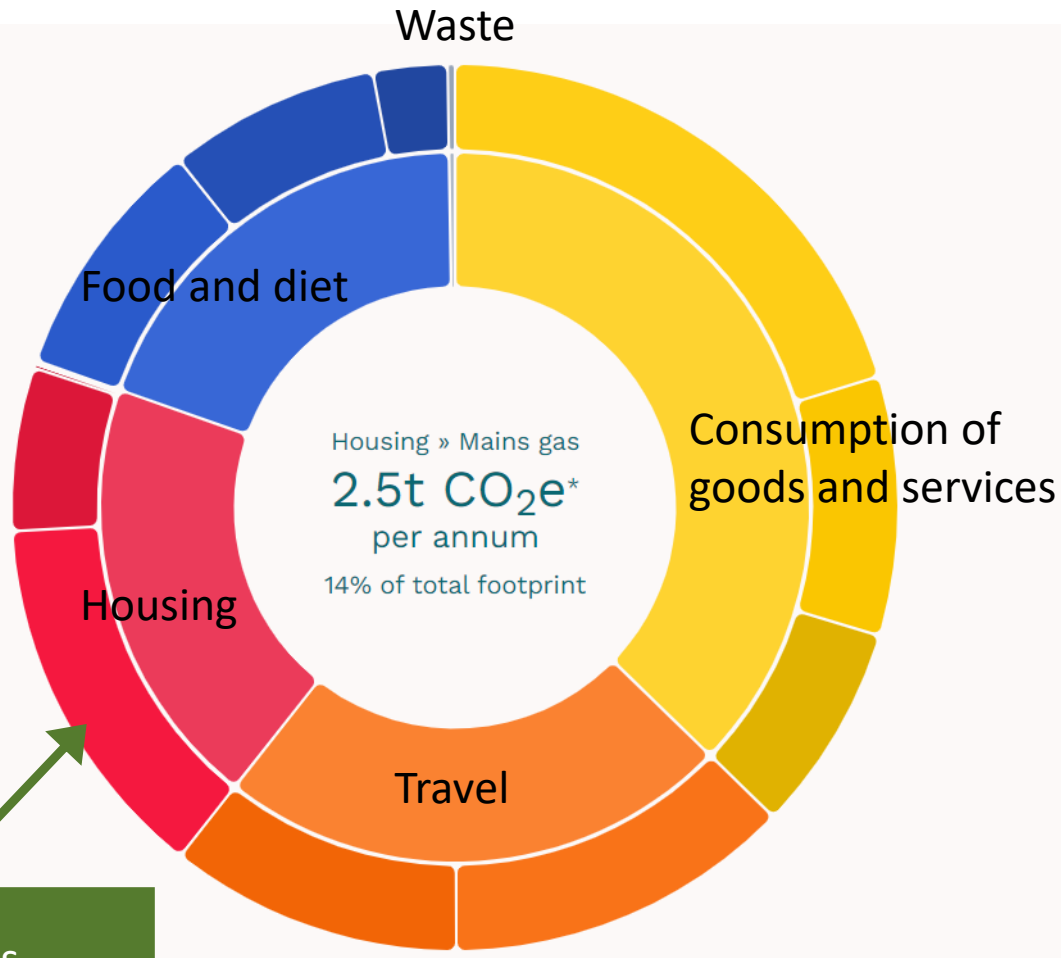
18.8t CO_2e*

per-household consumption footprint (p.a.)

EMISSIONS BREAKDOWN (t CO_2e)

Consumption of goods and services	6.99
Food and diet	4.38
Housing	3.7
Travel	3.63
Waste	0.05

*CO2e stands for "carbon dioxide equivalent" and is a standard unit of measurement in carbon accounting. It expresses the impact of a number of different gases collectively as a common unit.



Mains Gas

www.impact-tool.org.uk

PeCAN

SuperHomes – Invest in your home

Create a comfortable, healthier home with lower fuel bills and a reduced carbon footprint

- ✓ While also increasing the value of your house

How can the Petersfield Area SuperHomes project help?

- ✓ Demystify the process and understand what is possible with your home
  - ➢ A home survey from a qualified and accredited expert
  - ➢ Understand what changes could deliver what benefits?
    - ➢ Insulation, Double Glazing, Solar Panels, Heat Pump, etc…
- ✓ Reassurance through an independent Whole House Retrofit Plan
  - ➢ Subsidised survey cost for low and middle income homeowners
- ✓ Support from PeCAN with the retrofit journey

Petersfield Area SuperHomes

→ The opportunity to make your home a ShowHome

- ➢ Tracking your progress and Inspiring others

PeCAN

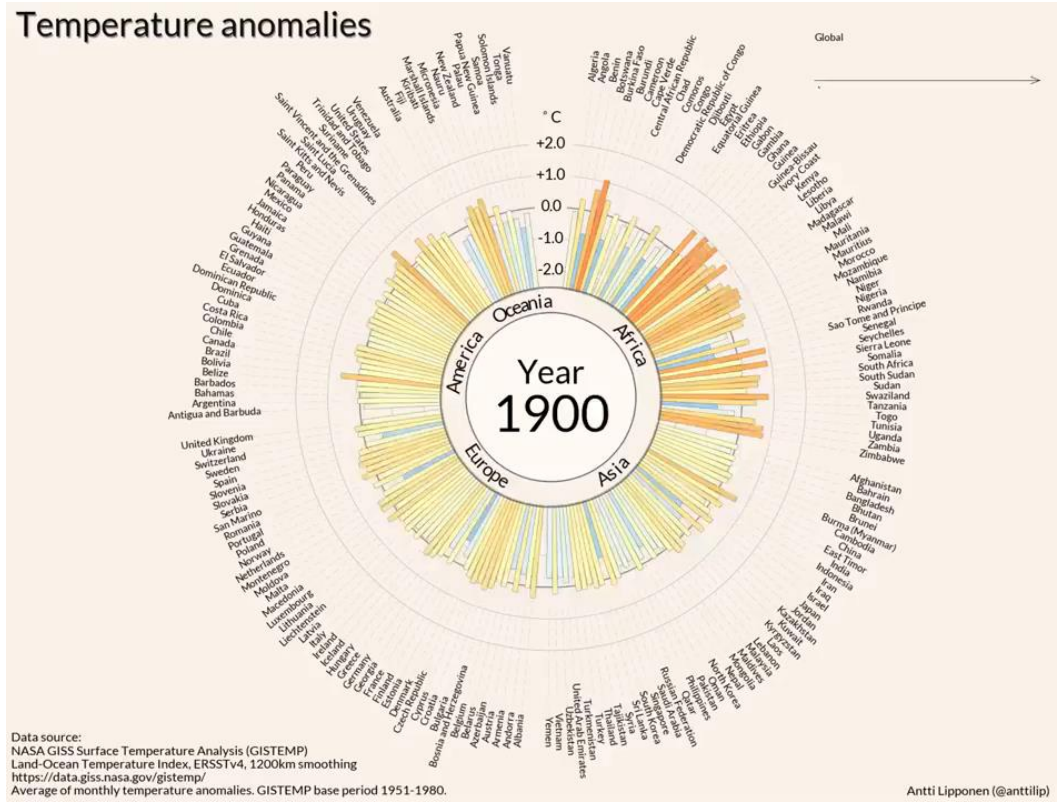
Decarbonised Heat Briefing

The role of electrification in decarbonising homes, all you ever wanted to know about heat pumps & the implications of current government policy

January 2022

HPF
HEAT PUMP FEDERATION

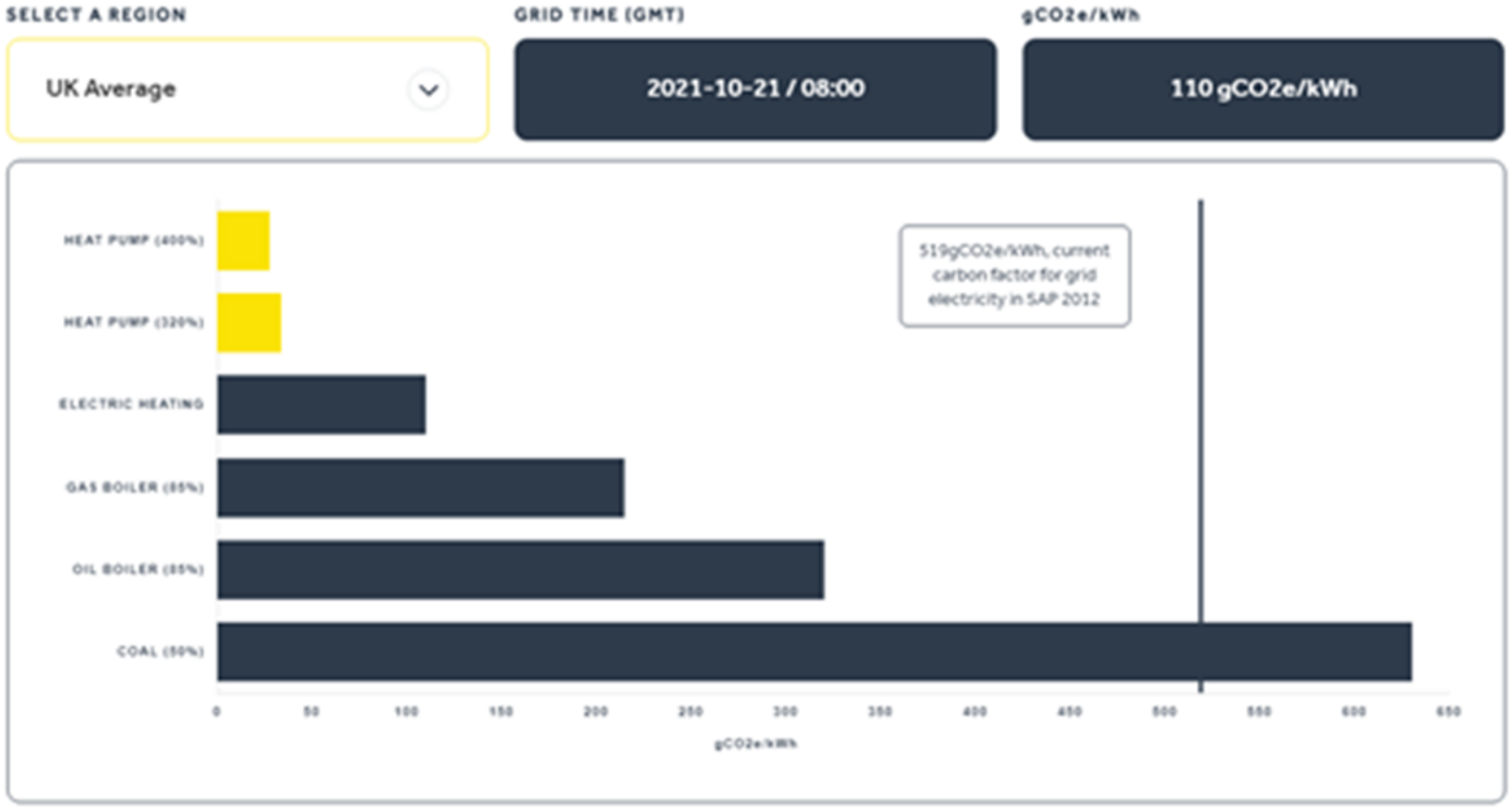
Why decarbonise at all?



One hundred years of impact in 35 seconds using data from NASA observations

HPF
HEAT PUMP FEDERATION

Why is electrification carbon-efficient?



https://www.hpf.org.uk/carbonwatch

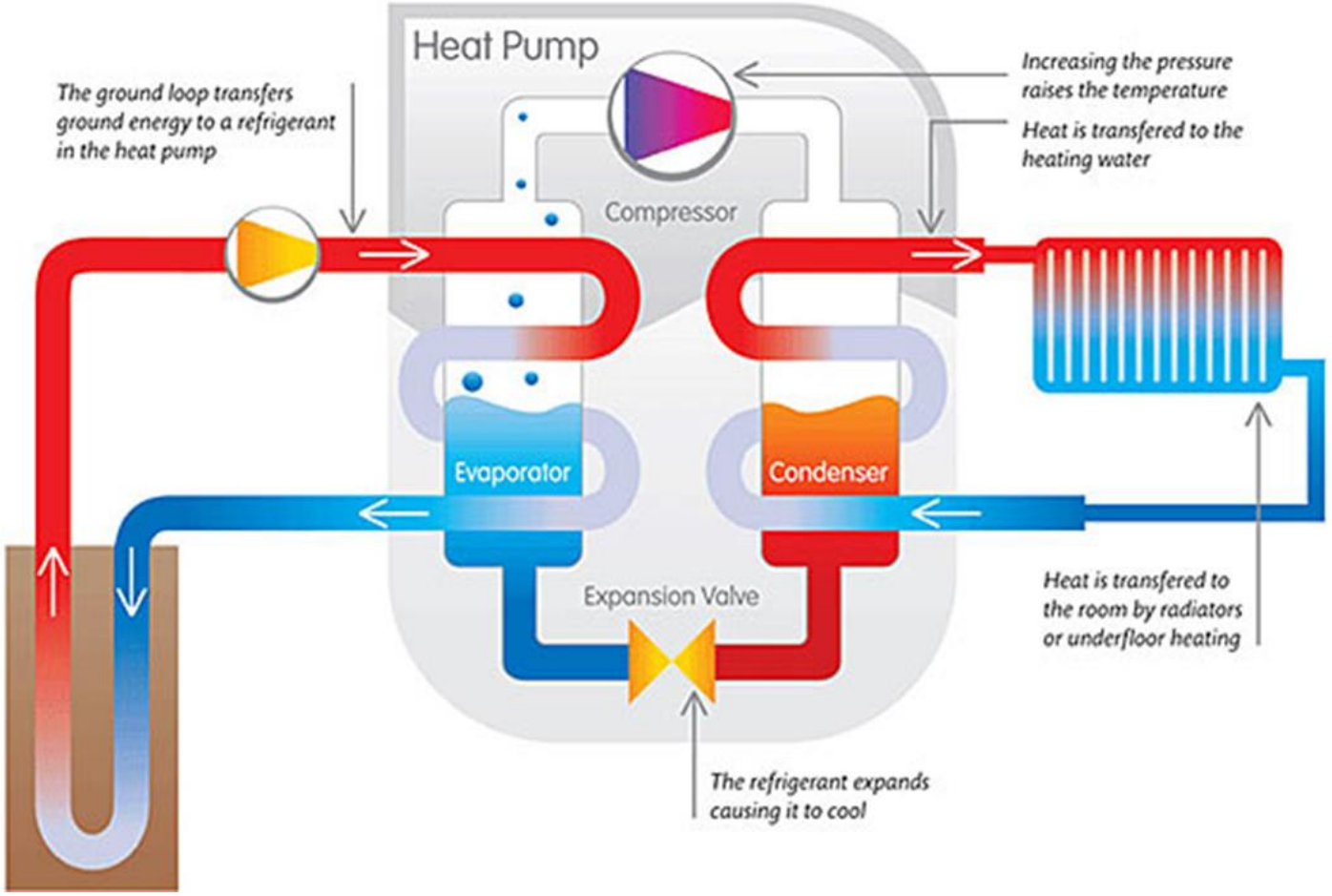
HPF
HEAT PUMP FEDERATION

Carbon Dioxide Emissions Comparison - Electricity vs. Oil vs. LPG vs. Gas

Total Heating (+ DHW) Demand	**10,800**	kWh/annum	Note :						
SPF	3.20								
Electricity Consumed By Heat Pump	**3,375**	kWh/annum	Note :						
Fuel/Carbon Emissions		Boiler Efficiency %	Carbon Dioxide Factor		Demand kWh/annum	Carbon Dioxide Emissions kg	Heat Pump CO2 Saving Against Fuel	% CO2 Saving With Heat Pump	Average no. of family cars displaced
Electricity (National Grid)		100	**0.212**	kgCO2/kWh	10,800	**2,290**	**1,574**	**69%**	0.9
Oil		89	**0.268**	kgCO2/kWh	12,135	**3,252**	**2,537**	**78%**	1.5
LPG Gas		90	**0.215**	kgCO2/kWh	12,000	**2,580**	**1,865**	**72%**	1.1
Mains Gas		92	**0.184**	kgCO2/kWh	11,739	**2,160**	**1,445**	**67%**	0.8
Coal		80	**0.333**	kgCO2/kWh	13,500	**4,496**	**3,780**	**84%**	2.2
Biomass (High Quality Pellets)		85	**0.040**	kgCO2/kWh	12,706	**508**	**-207**	**-41%**	-0.1
Electricity - Heat Pump		320	**0.212**	kgCO2/kWh	3,375	**716**			
Assumes that electricity is purchased from a standard supply. Purchasing from a green energy tariff will significantly increase CO2 emissions savings.									
			Carbon factors taken from Defra figures for 2021.						
	Average family car :		Ford B-MAX 2017 1.4 Petrol						
	Emissions (DVLA Vehicle Certification Agency) :					0.139	kg/km		
	Average annual mileage (RAC Foundation) :					12,560	km		
	Average annual emissions :					1,746	kgCO2e		

HPF
HEAT PUMP FEDERATION

Heat pumps 101



HPF
HEAT PUMP FEDERATION

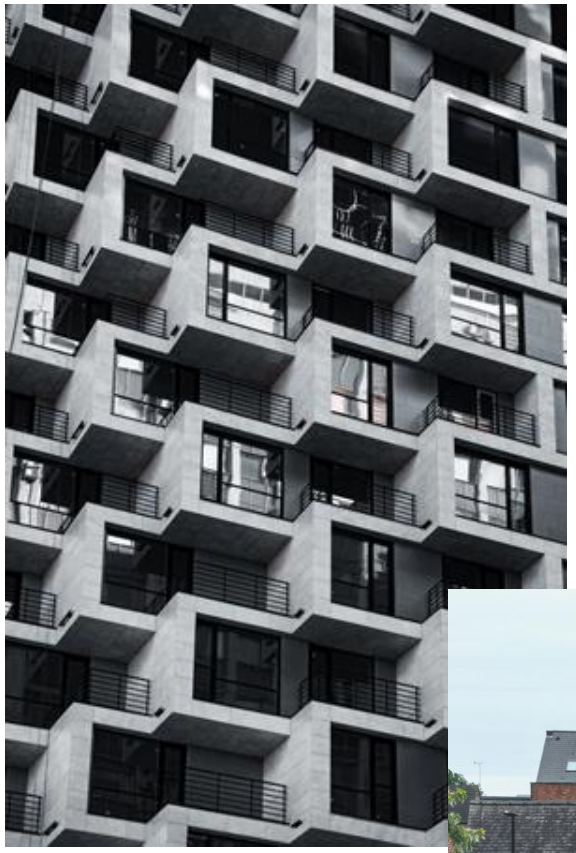
Heat pumps 101 – what do they look like?

HPF
HEAT PUMP FEDERATION

Heat pumps 101 – any emitter type

HPF
HEAT PUMP FEDERATION

Heat pumps 101 – all house & development types



HPF
HEAT PUMP FEDERATION

Incumbent fear & doubt

Massive radiators, probably not!

Garden a disaster, yes, but worth it, or drill!

Re-plumb the whole house and UFH, just not necessary!

Installing central heating was a disruption, but stay with coal, really?

HPF
HEAT PUMP FEDERATION

Heat outputs & the value of “design”

- Heat outputs; can a heat pump system provide enough heat or are supplementary systems required? What are the benefits and limitations of heat pump systems?
  - Heat loss calculations & proper design – the lost art
  - Flow temperatures and losses – where does the heat come from, and does the building know?
  - Supplemented or hybrid systems – what is the Plan B?
  - Benefits – improved comfort, internet control (landlords), carbon, air quality (both internal and external)
  - Procurement advice – https://www.hpf.org.uk/advice/homeowners

HPF
HEAT PUMP FEDERATION

Location & planning

- Locating heat pump equipment and potential planning constraints, noise concerns from neighbours and adjacent properties
  - Current generation machines are very quiet
  - MCS 020 applies to Permitted Development Rights (which vary across the four countries of the Union) and which need updating (GLA, Welsh and NI activities)
  - Conservation areas or Listed buildings may need additional consents
  - New form factors and “finishes”
  - Significant differences between air-source and ground-source in these respects
  - Overnight operation for flexibility value

HPF
HEAT PUMP FEDERATION

The Visuals

HPF
HEAT PUMP FEDERATION

Case Study : Large domestic air-source

- Barn conversion, heating & hot water
- 60,000kWh/annum
- CO2 emissions reduction against natural gas 67% (2021)
- Over 8t CO2 saved per annum
- Equivalent to 4.6 average cars displaced

HPF
HEAT PUMP FEDERATION

Building Regulations & EPCs

- Building Regulations
  - The Interim Uplift should include a mandated 55˚C flow temperature to improve condensing boiler performance
  - In 2024/25, a further update should include the full Future Homes Standard
- EPCs; do heat pumps improve the EPC for a commercial landlord.
  - EPCs report on cost, rather than carbon, so whilst electricity is penalised, no EPC will ever recommend a heat pump
  - Will the Interim Uplift to Building Regulations change this? We'll find out in December
  - There is no current recognition of the value of thermal storage and time-of-use tariffs

HPF
HEAT PUMP FEDERATION

The ultimate renewable energy resource

"The stone age did not end because the world ran out of stones, and the oil age will not end because we run out of oil"
Don Huberts (Shell) 1999

HPF
HEAT PUMP FEDERATION

Thank you

www.hpf.org.uk
https://www.hpf.org.uk/advice/homeowners

Bean Beanland
Director for Growth & External Affairs
Bean.Beanland@hpf.org.uk
info@hpf.org.uk

HPF
HEAT PUMP FEDERATION

BUILDING TRUST IN THE ENERGY TRANSITION

Heat Pumps – the economics

Petersfield Climate Action Network

January 2021

Colin Meek

rb&m BUILDING TRUST IN THE ENERGY TRANSITION

rb&m partners:

Sit on 5 MCS technical working groups.

Work with regulators, Government agencies and companies.

Audit installers, heat network providers and flexible energy companies.

Deliver ground-breaking research.

Represent the consumer voice.

rb&m

Our mission is to give consumers the power to make informed decisions in the low-carbon energy transition.

rb&m BUILDING TRUST IN THE ENERGY TRANSITION

Three research projects:

- **Renewing Britain.** https://renewingbritain.com/
- **Heat pumps and UK's decarbonisation:** lessons from an Ofgem dataset of more than 2,000 domestic installations.
- Current research into the domestic renewables market **drivers and barriers.**

Early impressions:

Our early work on this project shows that consumers are confused about who their friends are and how best to access good impartial advice that is household specific.

Although the research is in its early stages, the PeCAN Superhomes project is exactly the kind of initiative that a large proportion of the consumers we have talked to say they would welcome and value.

Drivers and Barriers: Hopes and Fears

- The aim of the project is to better understand market drivers and barriers.
- The identification of consumer hopes and fears.
- We're using a large-scale consumer survey and focus groups.

Fears

Cost, 'cowboy' workmanship, hassle, disruption, on-going fuel bill increases, lack of regulation, inadequate impartial information, lack of redress, access to finance, lack of consumer protection, hidden costs, ugly emitters or heat pump units, inadequate heat, cost, noise, £££.

Hopes

Reduced fuel costs, lower carbon emissions, quiet efficient heat, no on-going need for fossil fuel supplies, flexible energy, energy independence, being a pioneer, 'doing something' about climate change, ability to integrate with Solar PV, future-proofing.

rb&m BUILDING TRUST IN THE ENERGY TRANSITION

The Renewable Heat Incentive:

- Closes to new applicants on 31st March 2022.
- EST:

  “Customers starting their renewable heating installation and RHI application in early 2022 may struggle to complete before this deadline.”
- You can’t apply after that date, even if your system is commissioned before then.
- If your system was commissioned after 1st March 2019, you can still apply until the scheme closes (assuming eligibility).

- The best source of information about the RHI is Ofgem’s **Essential Guide for Applicants:**
- https://www.ofgem.gov.uk/publications/domestic-renewable-heat-incentive-essential-guide-applicants

rb&m BUILDING TRUST IN THE ENERGY TRANSITION

The Renewable Heat Incentive:

The RHI is designed to pay (compensate) consumers for the difference in cost between installing a renewable heating system and a fossil fuel system such as a gas or oil boiler.

- The scheme provides regular quarterly payments for 7 years based on your heat demand. The payments increase with the RPI or CPI.
- The payments only cover the renewable portion of the generated heat. IE, if your heat demand is 16,000kWh and your system is forecast to generate 3kWh of heat energy for every 1 kWh electricity used to run the heat pump, then your payments are based on 10,667kWh of eligible heat energy.
- There is a total heat demand limit of 20,000kWh for ASHPs and 30,000kWh for GSHPs. If your home's heat demand is higher your payments cannot exceed the limit.
- There are strict eligibility criteria.
- Your installation may need to be metered for payment.

rb&m BUILDING TRUST IN THE ENERGY TRANSITION

The Boiler Upgrade Scheme:

- Will launch in April this year and will be administered by Ofgem.
- The strategy shifts to upfront capital grants of £5,000 for heat pumps per household.
- MCS accreditation.
- The grants will be paid from a pot of £450 million which currently limits the number of homes that can benefit to just 90,000.
- The scheme will last for 3 years.
- Again, the scheme is designed to bring the costs of a renewable installation in line with the cost of a new gas or oil boiler.
- The government has said it is working with industry to bring the cost of heat pump installations down to match fossil fuel installations in time for 2030.
- The government has said it expects 'low carbon heating systems will become the obvious, affordable choice for consumers.'

The ASHP roll out:

- The number of UK, MCS Certified installs has grown from 4 in 2008 to more than 83,000 with a cumulative carbon equivalent saving of 1.25 million tonnes.
- Roll out focused in rural and remote areas that are off the gas grid. Remote parts of Scotland have the highest installation rates.
- The demographics show that the households that install tend to be professional or skilled owner-occupiers aged between 30 and 64 in single (30%) or two-person (34%) households. Eight in 10 are installed in detached or semi-detached homes.
- In the ten LAs with the highest % of ASHP installs, an average of 60% of homes are off the gas grid.

https://renewingbritain.com/

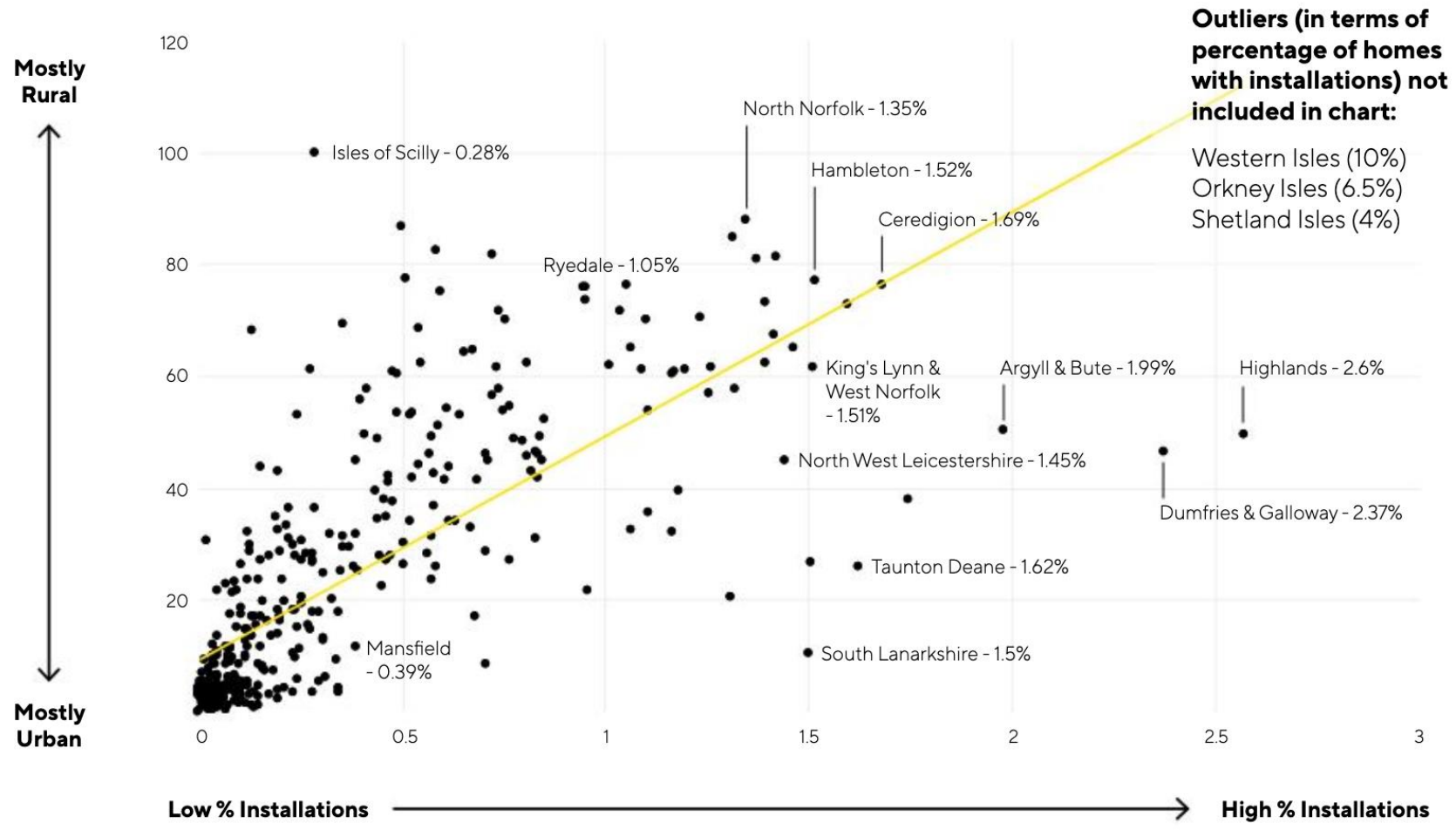
rb&m BUILDING TRUST IN THE ENERGY TRANSITION

Correlation between rural location and ASHP Installation

18

18 out of the top 20 LAs by rate of small-scale renewable installations are rural or semi-rural

20



Outliers (in terms of percentage of homes with installations) not included in chart:

Western Isles (10%)
Orkney Isles (6.5%)
Shetland Isles (4%)

rb&m BUILDING TRUST IN THE ENERGY TRANSITION

ASHPs:
Local Authorities with the most ASHP installs as a % of population:

	LocalAuthority	Percentage
1	Na h-Eileanan Siar	9.72%
2	Orkney Islands	6.43%
3	Shetland Islands	3.97%
4	Highland	2.50%
5	Dumfries and Galloway	2.37%
6	Argyll and Bute	1.96%
7	Forest Heath	1.74%
8	Ceredigion	1.67%
9	Taunton Deane	1.62%
10	Mid Suffolk	1.59%
11	King's Lynn and West Norfolk	1.51%
12	South Lanarkshire	1.50%
13	Stroud	1.50%

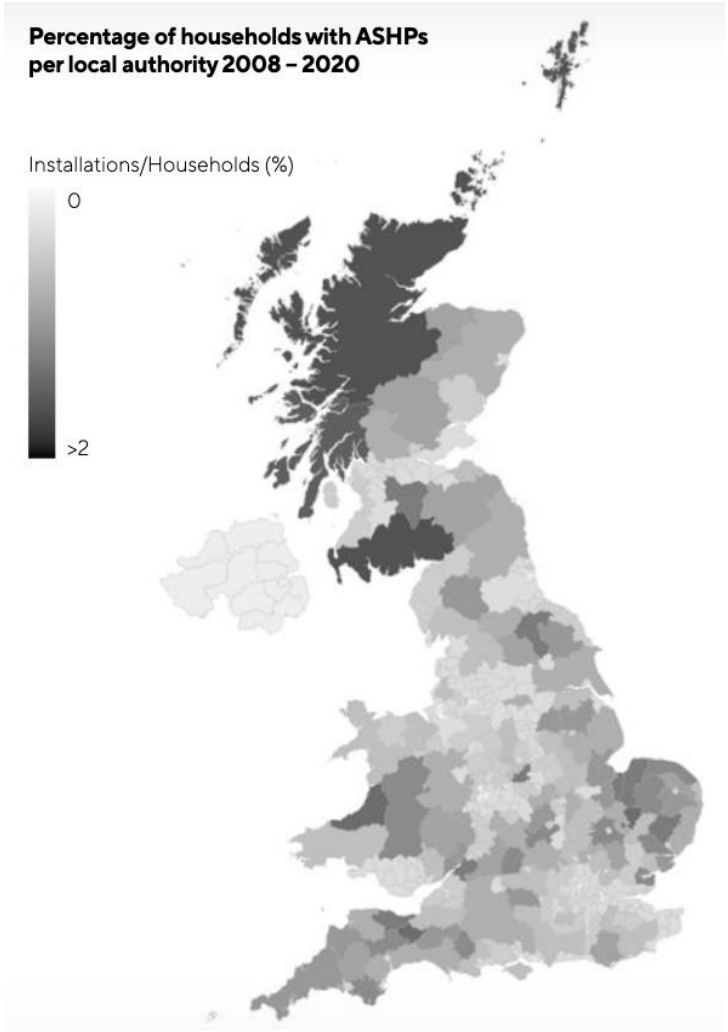
East Hampshire:

The East Hampshire ranks 114th out of 378 Local Authorities:

110	Sedgemoor	0.46%
111	Colchester	0.45%
112	East Hertfordshire	0.45%
113	East Dorset	0.45%
114	East Hampshire	0.44%
115	Tunbridge Wells	0.44%
116	Denbighshire	0.44%
117	Epping Forest	0.43%

With about 0.5% of households with an ASHP.
But outliers are important. 15.5% of East Hampshire's households are off the gas grid. That's almost the same % as Stroud (15.9%) and South Lanarkshire has fewer households off the gas grid (10%), yet both have very high installation rates (see left).

rb&m BUILDING TRUST IN THE ENERGY TRANSITION



The ASHP roll out:

Differences around the country were dramatic and we summarised the differences using three consumer groups:

- Rural Resilient

Remote/rural areas with strong local promotion of renewables, community information and local heat strategies (Orkney, Cornwall)

- Urban and Semi-Urban Early Adopters

These areas 'buck the trend'. Wrexham, Stroud, South Lanarkshire.

- Urban and Commuter Disengaged

Sluggish or non-existent demand. Most obvious in London but also in other large city areas.

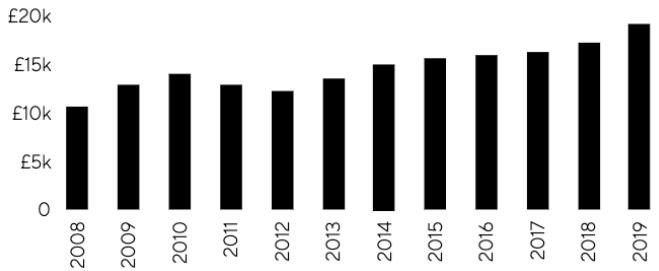
https://renewingbritain.com/ includes a section on recommendations targeted at different levels for different agencies.

rb&m BUILDING TRUST IN THE ENERGY TRANSITION

The ASHP roll out: costs

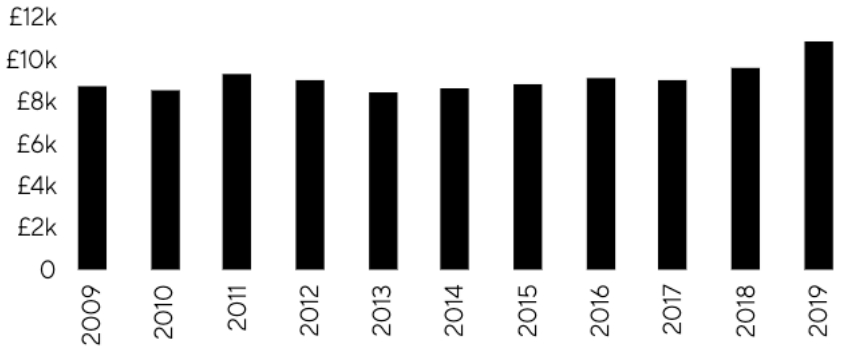
Ground Source Heat Pumps:

Chart 16: Cost of a 12kW G/WSHP system 2009 - 2019



The cost of a typical GSHP was £19,000 in 2019 and the EST says £19,000 is at the top of its estimated range. Costs may be higher depending on the property.

Chart 12: Average cost of a 10kW ASHP system 2009 - 2019



The costs vary depending on a range of factors including the heat demand, whether retrofit or new build and what type of heat emitters you want. For example, whether you need new radiators or you want underfloor heating (if feasible and cost effective).

More recently, the EST estimate costs ranging from £7,000 to £13,000. In my experience costs can be much higher.

rb&m BUILDING TRUST IN THE ENERGY TRANSITION

Economics: What is COP, SCOP and SPF?

• the Coefficient of Performance (CoP) of a heat pump denotes the efficiency at a specific point in time or over a very defined period. For example, a CoP value of 3 means that 1 kWh of electric energy is being used in the generation of 3kWh of heat energy.

• the Seasonal Coefficient of Performance (SCOP) is a factory-based product assessment using a limited system boundary. SCOP is combined with climate data to estimate renewable energy output. It is a product efficiency metric.

• the Seasonal Performance Factor (SPF) is the measured annual efficiency of a heat pump in a specific location. Usually, the SPF refers to how the heat pump system actually performs in real life.

NOTE: unfortunately, Ofgem describes installer forecasts of efficiency as the 'SPF' which are estimated by the SCOP.

rb&m BUILDING TRUST IN THE ENERGY TRANSITION

Economics: Research on Efficiency and Performance Claims

The efficiency metric used to describe and estimate heat pump performance is the SCOP.
These issues have been subject to intense scrutiny and debate for several years. Field trials have not found that SCOP efficiencies do reflect actual efficiencies experienced.

My own research on performance claims for the Renewable Energy Consumer Code (RECC) and the performance estimate methodologies used in pre-contractual information was first published in 2015 with a follow-up report in 2016.

RECC has highlighted poor practice in performance claims as a source of consumer harm and stressed the need for a better approach to performance estimate methodology.

rb&m BUILDING TRUST IN THE ENERGY TRANSITION

Ofgem database:
A dataset containing anonymised information from over 2200 domestic heat pump installations that are subject to 'metering for payment'.

Heat pumps and UK's decarbonisation:

lessons from an Ofgem dataset of more than 2,000 domestic installations.

- To contribute to rb&m's work on the evaluation of performance claims and estimates, we asked Ofgem for the monitored data. As it was our understanding that the data included energy consumption and heat energy generation.

- Two-year project investigating actual performance of heat pumps versus installer estimated performance. Methodology development was part-funded by RECC. The installations are a sub-set of those eligible for the Domestic RHI (DRHI) and are all subject to the rules for 'metering for payment' (compulsory metering as a condition for RHI eligibility.

- The Department of Business Enterprise and Industrial Strategy (BEIS) has carried out similar research with similar results.

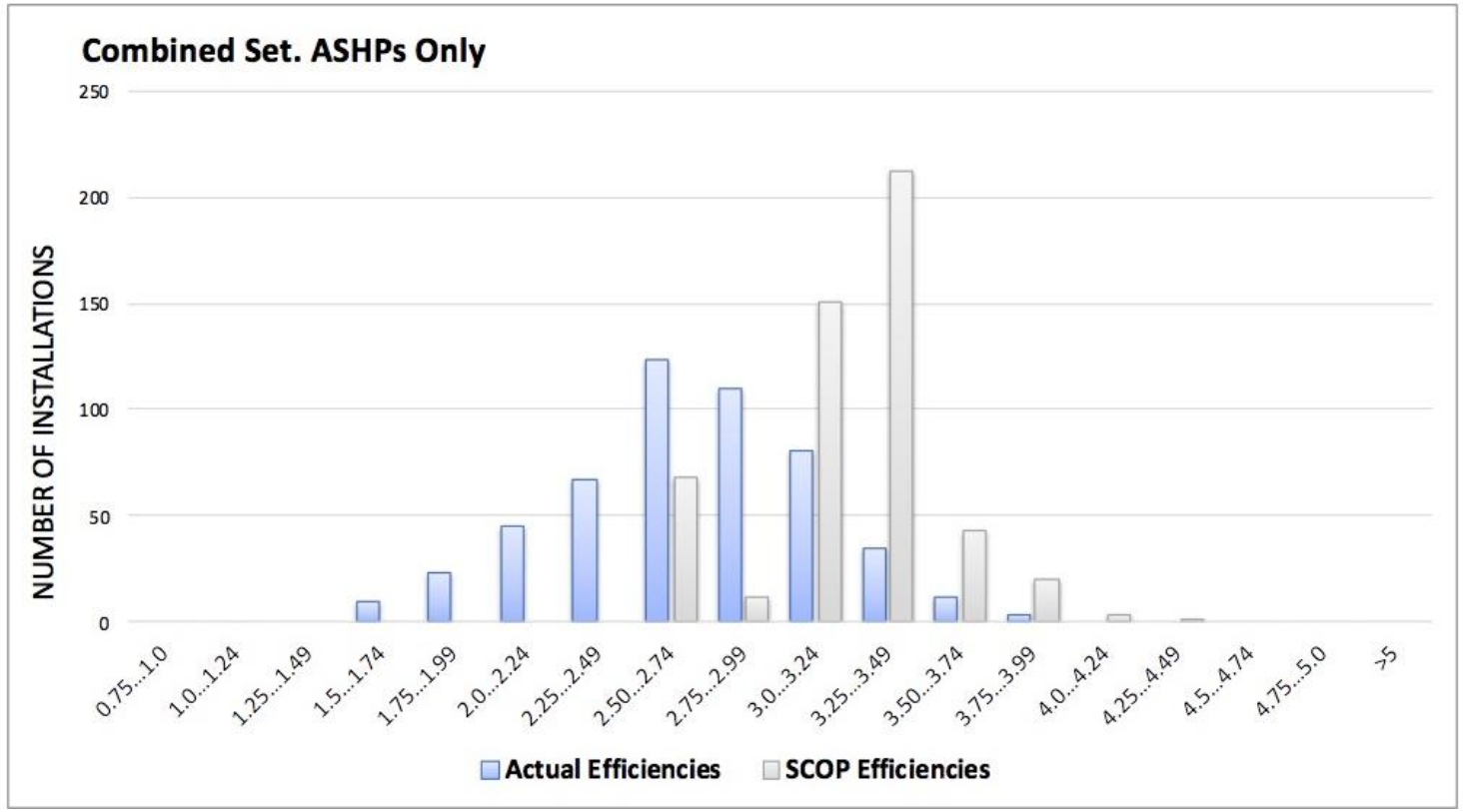
rb&m BUILDING TRUST IN THE ENERGY TRANSITION

ASHPs:

The overall combined sample included 510 ASHPs

Overall combined sample ASHPs

Total in Sample ASHPs only	510
Average Actual Efficiency SPF	2.71
Average Installer Forecast Efficiency	3.25



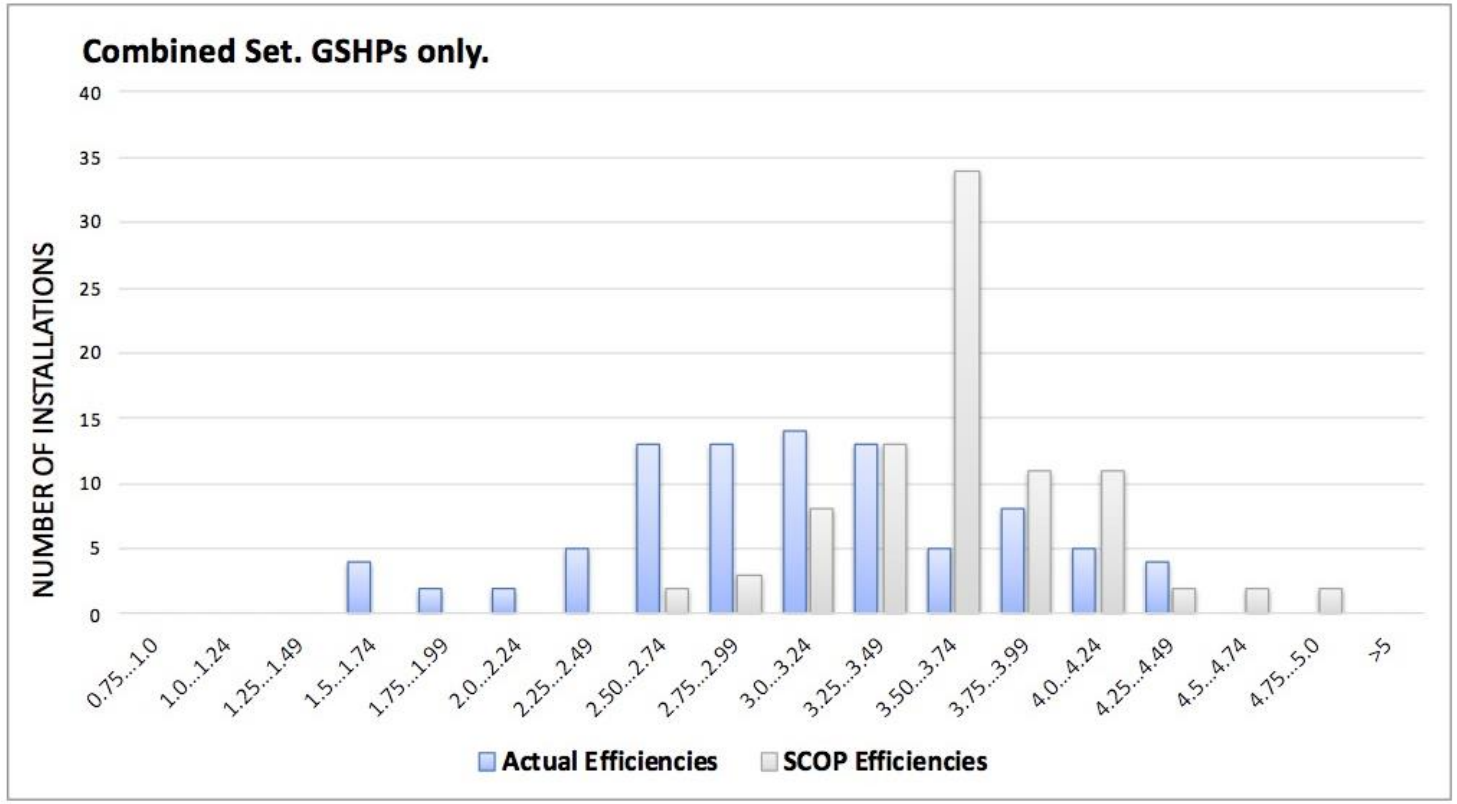
rb&m BUILDING TRUST IN THE ENERGY TRANSITION

GSHPs:

The combined set included 88 GSHPs

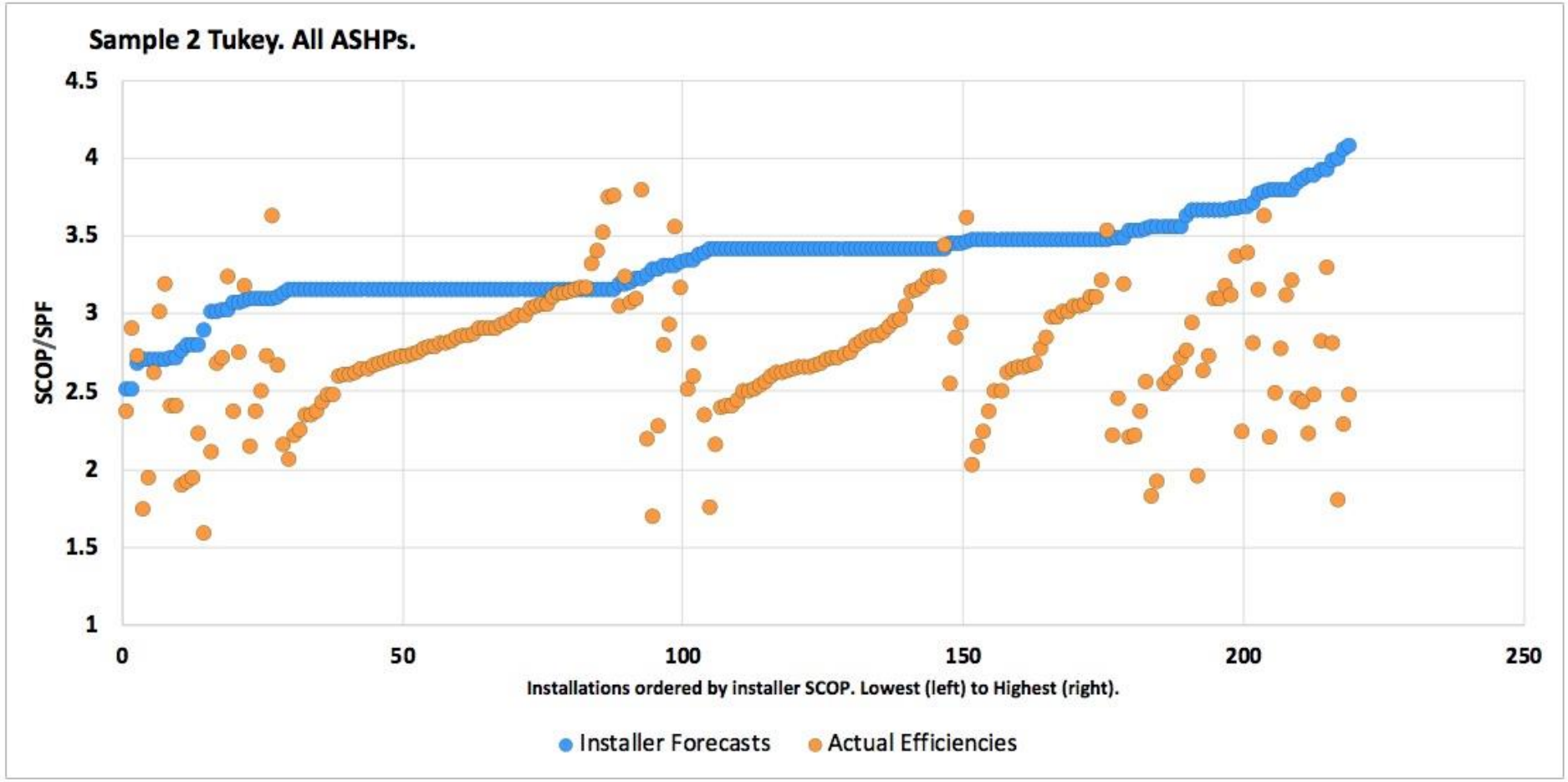
Overall combined sample GSHPs

Total in Sample GSHPs only	88
Average Actual Efficiency SPF	3.07
Average Installer Forecast Efficiency	3.65

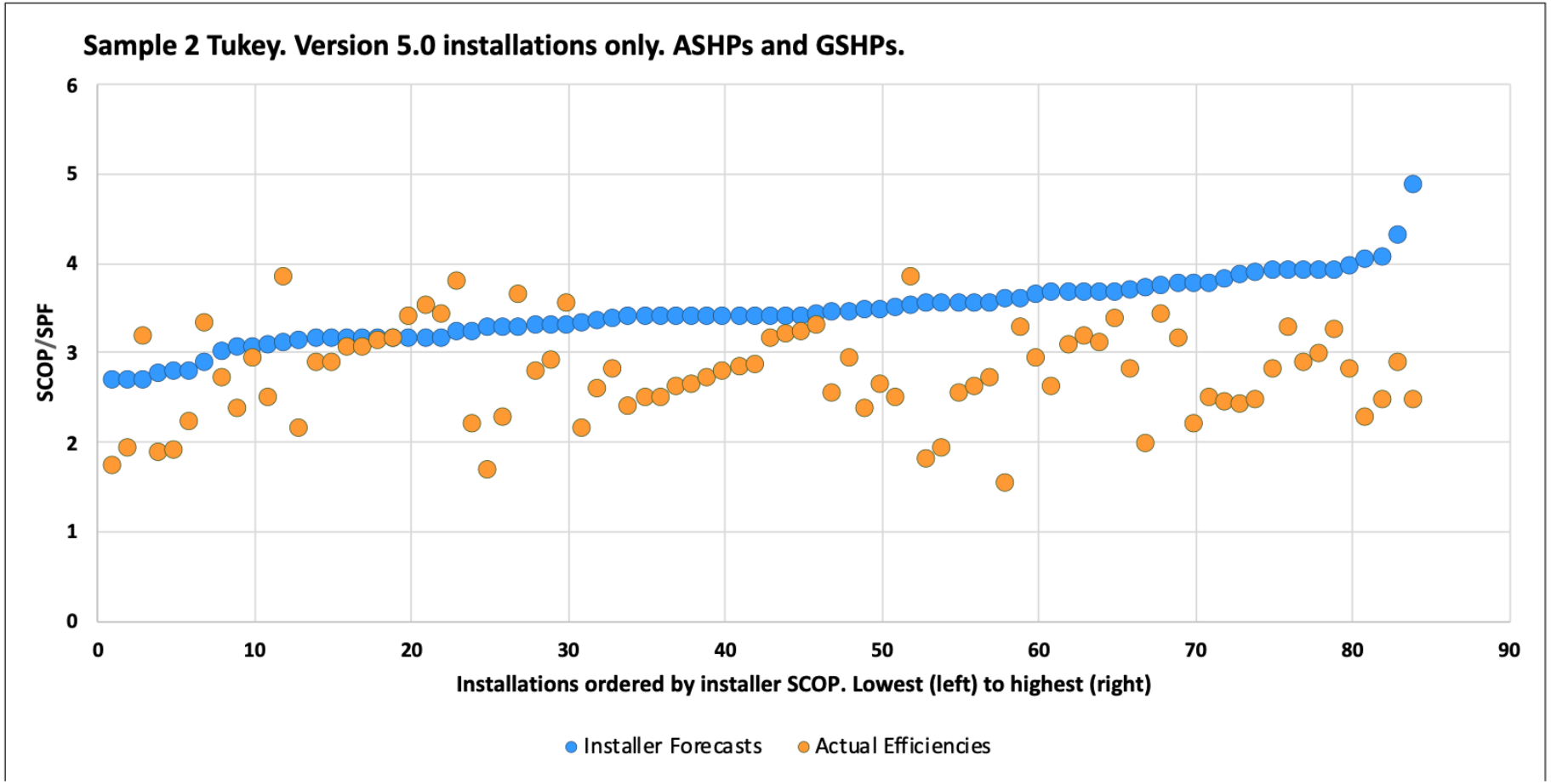


rb&m BUILDING TRUST IN THE ENERGY TRANSITION

Correlation. Sample 2 Tukey. All ASHPs



Correlation. Sample 2 Tukey.
V5 Only. ASHPs and GSHPs.



Ofgem Metering:
The metering arrangements described by Ofgem for Metering for Payment installations is set out in the full report.

Limitations

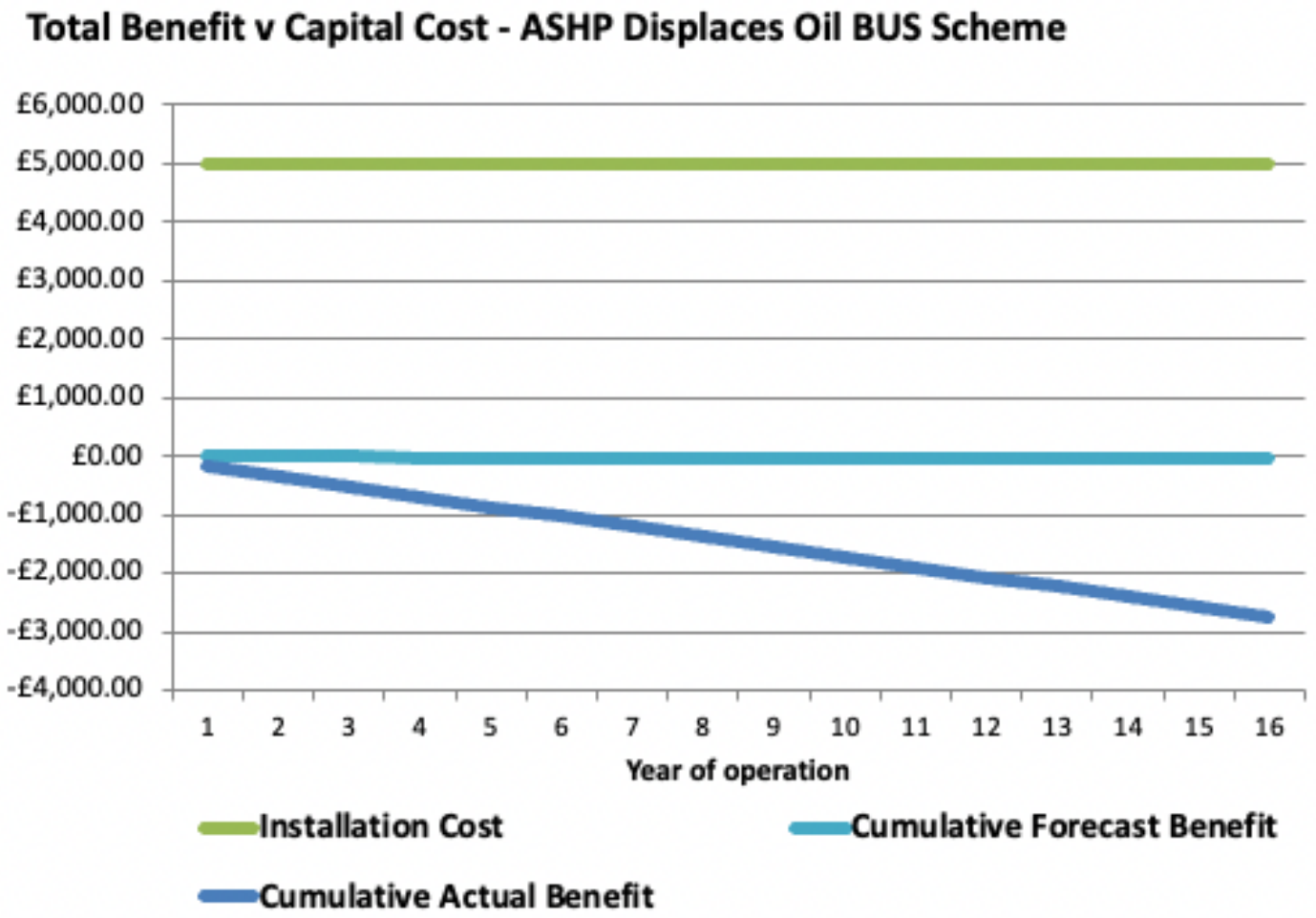
As for all field trials on this issue, this study was not a controlled experiment.

The Ofgem data relates to a specific sub-set of RHI installations and it is impossible to know if the performance assessed in that sub-set is representative of installations under the RHI or more generally. On the other hand, the sample size is very large compared to other field trials and the results are broadly consistent with results in already published studies.

Financial Outcomes – Scenario 1

Electricity: 16.36ppkWh
Oil: 47.14ppl (4.81ppkWh)
Installer Forecast: 3.32 (Sample 2)
Calculated SPF: 2.72
BUS Grant: £5000
Install Cost: £10,000

Jan 2021 Fuel Prices (EST)

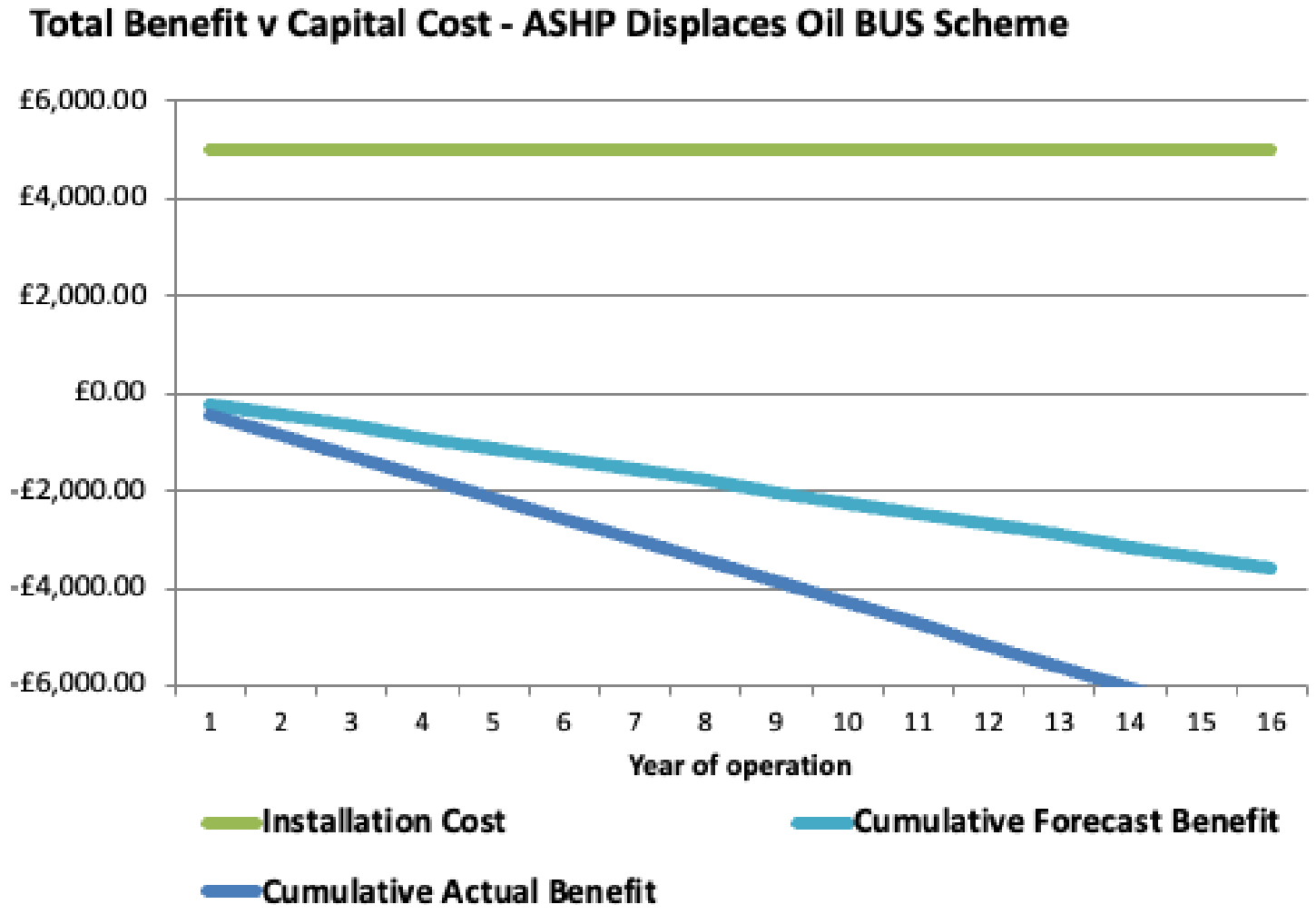


rb&m BUILDING TRUST IN THE ENERGY TRANSITION

Financial Outcomes – Scenario 2

Electricity: 20.06ppkWh
Oil: 47.14ppl (4.81ppkWh)
Installer Forecast: 3.32 (Sample 2)
Calculated SPF: 2.72
BUS Grant: £5000
Install Cost: £10,000

Nov 2021 Fuel Prices (EST)

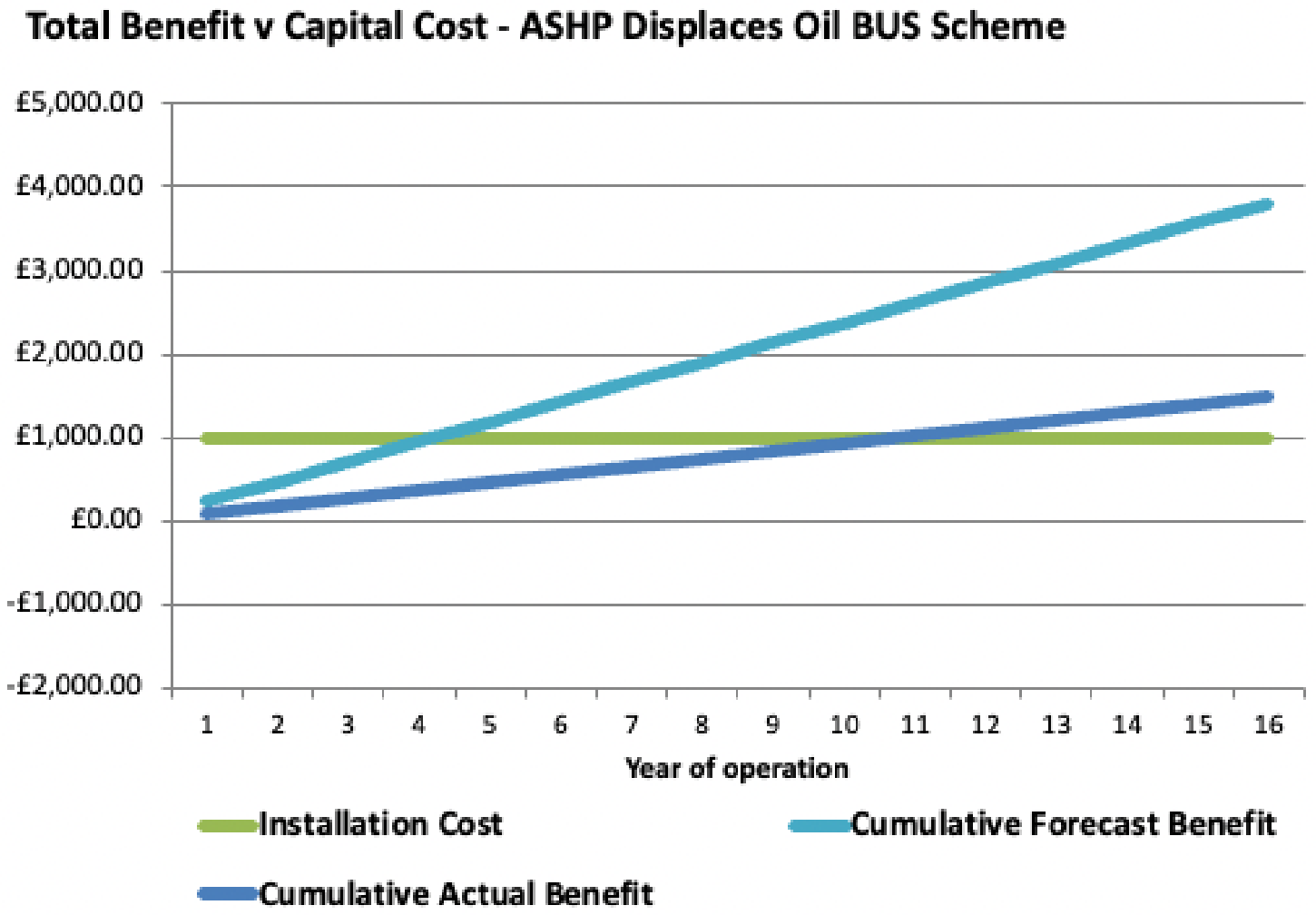


rb&m BUILDING TRUST IN THE ENERGY TRANSITION

Financial Outcomes – Scenario 3

Assumed Flexible Tariff: 14ppkWh
Oil: 55.00ppl (5.6ppkWh)
Installer Forecast: 3.32 (Sample 2)
Calculated SPF: 2.72
BUS Grant: £5000
Install Cost: £10,000
Saving on Cost of New Oil Boiler: £4,000

Fuel Prices – Possible Scenario



rb&m BUILDING TRUST IN THE ENERGY TRANSITION

Ofgem dataset:

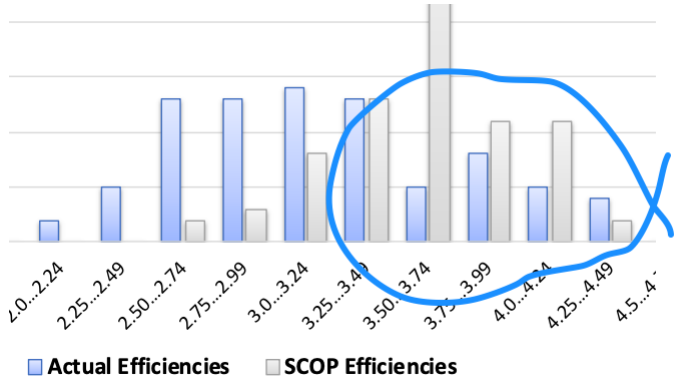
The SCOP estimates are most likely to match or exceed the SPFs where the installers provide cautious estimates of performance (lower SCOP estimates). The installers who provide the most optimistic estimates (above 3.5) are almost never correct.

Lessons and Interpretation

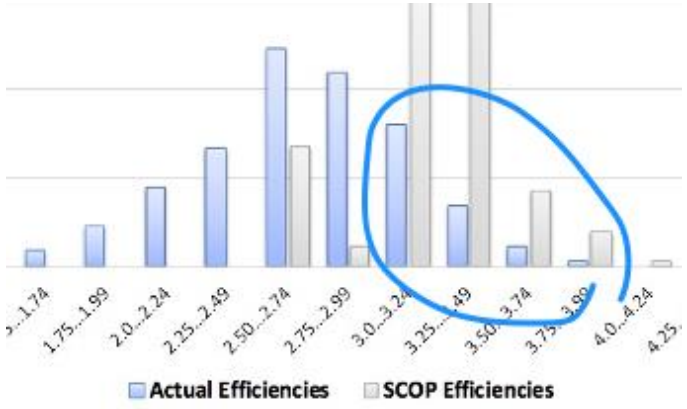
Important lessons:

- out of the 510 ASHPs (in the Combined Sample) 145 (28%) had SPFs below 2.5 and 33 of those were below 2.0;
- out of the 88 GSHPs, 13 (15%) had SPFs below 2.5; and
- in the whole of the later sample (ASHP and GSHP combined), 66 installs out of 260 (25%) had SPFs below 2.5.

Ofgem dataset:
A large proportion of GSHPs achieved SPFs of over 3.5



Ofgem dataset:
and a significant proportion of ASHPs have an SPF of over 3.0



Lessons

Positive findings:

- the average GSHP SPF was above 3 in two samples including the whole Combined Sample (as above).

The frequency distribution for GSHPs shown above (and left) shows that very high SPFs are delivered:

- out of the 88 GSHPs in the Combined Sample, 22 (25%) had SPFs above 3.5; and
- within the same sample, fifteen ASHPs out of the total 510 (3%) were found to have SPFs above 3.5 and 124 (24%) had SPFs above 3.0.

For the Full Report: Colin Meek Performance Data Analysis (full) here: **https://www.recc.org.uk/scheme/research**

rb&m BUILDING TRUST IN THE ENERGY TRANSITION

Citizens Advice:

*Companies providing energy products, services or supply must be required to make information about products and services transparent and accessible. This will be crucial to give consumers the con**fi**dence to engage with (and change) the way they use energy.'* Citizens Advice, Net Zero.

Conclusion 1

Heat Pump Installations are Not Financial Products

Installations are often sold with claims of 'returns on investment' (ROI) with financial returns forecast for 15 or even 20 years. These projections depend on assumptions about efficiency and forecasts about electricity and alternative fuel prices. They are very often misleading.

Installations are not regulated by the Financial Conduct Authority (FCA) and, in our view, using terms that normally relate to (regulated) investment products should not be used.

CO2e savings:
Because electricity generation has decarbonised so successfully, heat pumps are key to decarbonising heat.
Total net CO2e saving for 2018 for the total generation of all installations (in *the most recent sample of the study)* using installer estimated efficiency (3.37): 912 tonnes (3.50t per install).
Total net CO2e saving for 2018 using actual calculated efficiency (2.77): 830 tonnes (3.19t per install)

Conclusion 2

Heat Pumps are extremely good at reducing CO2e emissions

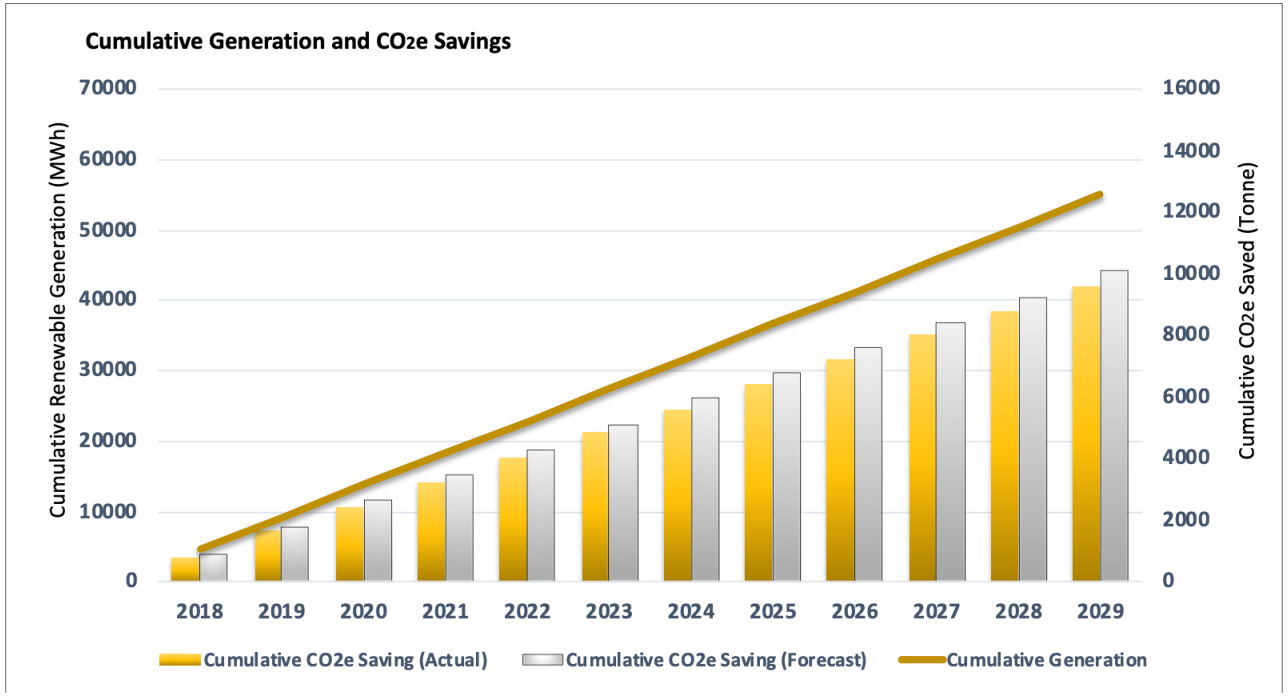


Figure 19: *Cumulative Generation of Installations in Sample 2 Tukey and CO_2e Savings.*

Thanks

Use information provided by:

MCS

www.mcscertified.com

And:

RECC

RENEWABLE ENERGY CONSUMER CODE

www.recc.org.uk

(Installers can use other Trading Standard Institute Approved Codes)

rb&m BUILDING TRUST IN THE ENERGY TRANSITION

Example of a home renovation, from an oil system to an air source heat pump

Thank you!

You can find more info from all the organisations involved here:

Petersfield Climate Action Network – www.petersfieldcan.org

Heat Pump Federation - www.hpf.org.uk

rb&m - www.r-b-m.com