Measuring energy savings in housing refurbishments

Stephen Passmore

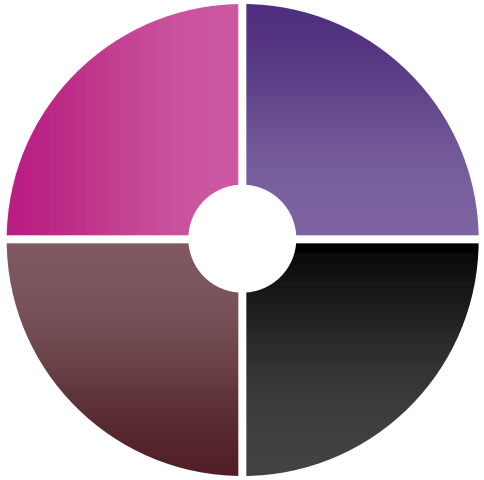
12th September 2012

Energy Saving Trust

We are the **UK's leading** impartial organisation helping people **save energy** and **reduce carbon emissions**

We've **saved £1.5 billion** on people's fuel bills and **140 million tonnes** (lifetime savings) of CO_2 since 1994.

Providing quality assurance for goods, services and installers

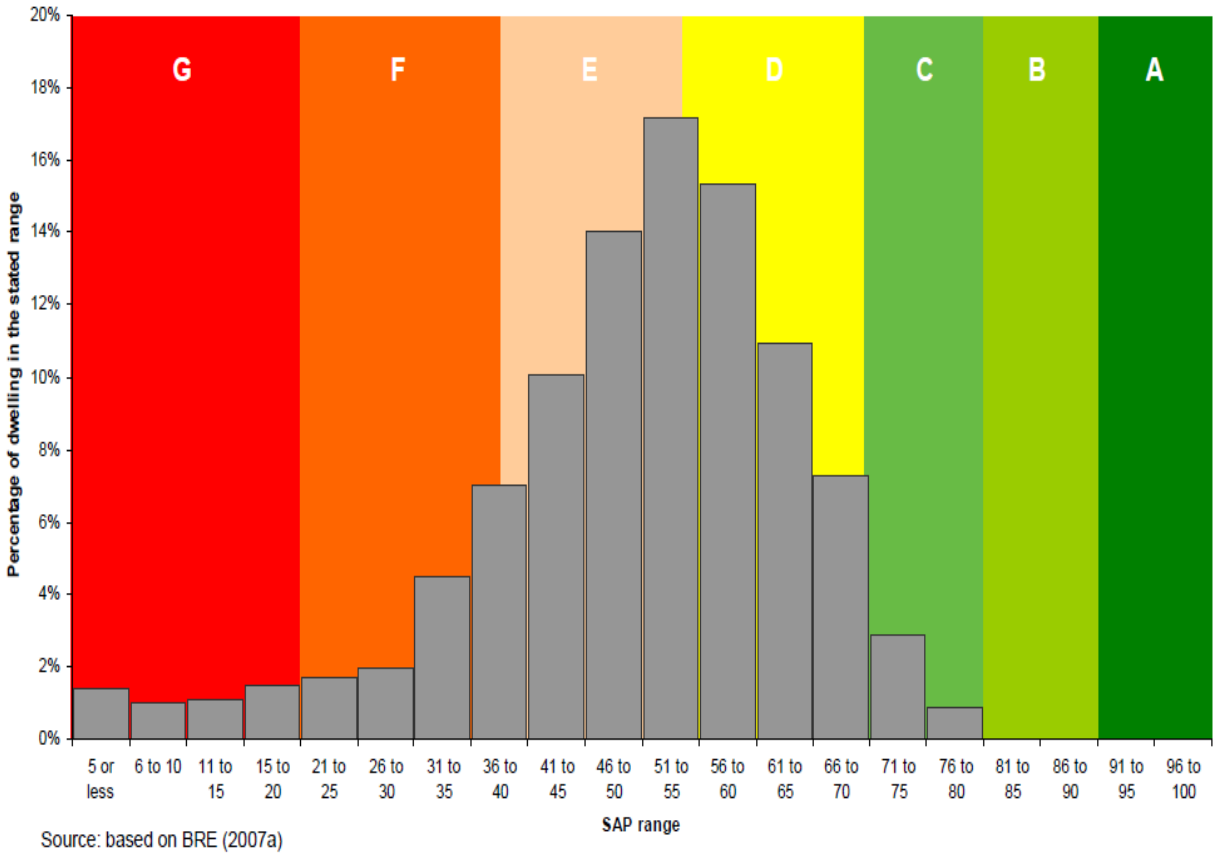


Expert insight and knowledge about energy saving

Helping local authorities and communities to save energy

Supporting consumers to take action

The headline challenge



Source: based on BRE (2007a)

Home energy use is responsible for over a quarter of UK carbon dioxide (CO_2) emissions

Staged target of 29% cut in CO_2 from homes by 2020

By 2050 all homes will need to achieve an energy performance rating in the range of a high B if we are to reach our target of a 80% cut in CO_2 emissions across the entire housing stock

Why do we need building performance evaluation?

What is actual performance

- energy and carbon savings

Factors that influence performance of the technology

- what works and (importantly) what doesn't

Evaluate how householders use the technology

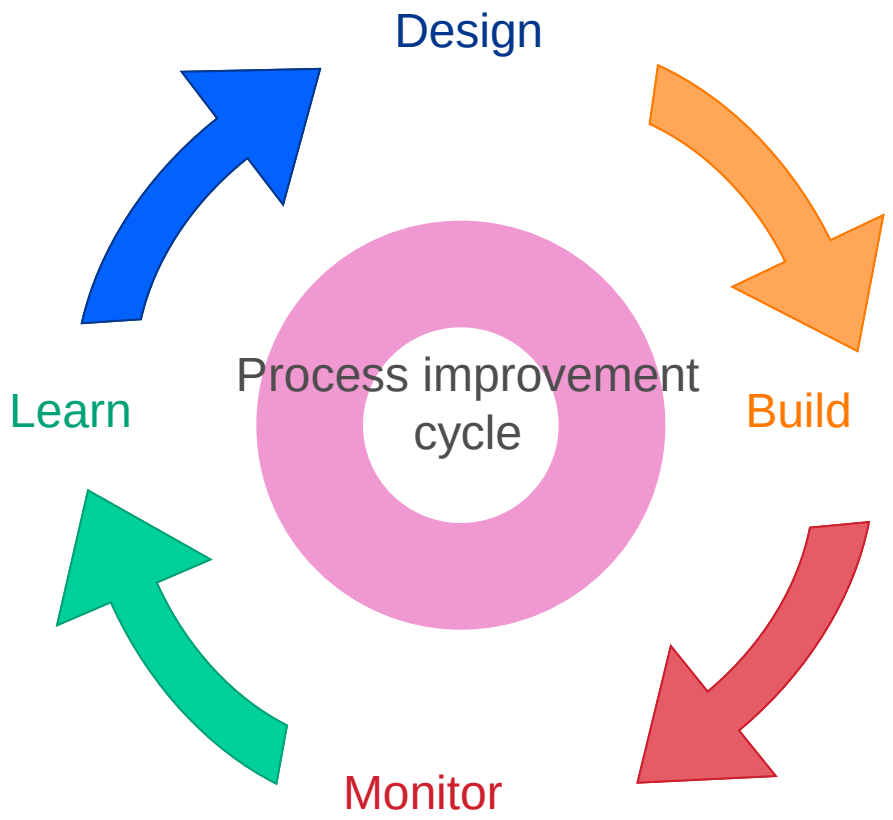
- to inform the consumer

Ensuring confidence in new products

Consumer pull vs. regulatory push

How the key features of properties (enhanced airtightness, increased fabric insulation levels, efficient heating design and controls *plus* occupant behaviour) contribute to the improved energy performance of the properties new designs

Why evaluate performance?



DECC in-use factors

Measure	In-use factor %
Internal Solid Wall Insulation	25
Double Glazing	15
Air source heat pump	25
Micro CHP	25

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National Refurbishment Centre

www.rethinkingrefurbishment.com

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National Refurbishment Centre

Refurbishment Portal

The refurbishment comparison tool providing evidence about energy efficiency from real homes

Click Here to start

Exemplar Map

Click the map to see the independent and industry-led refurbishment projects that span the length and breadth of the UK.

You can also learn more about key exemplar projects that partners have been involved in, including the Victorian Terrace project and Retrofit for the Future.

Click here to find out more

See all news

News from Building4Change

6/9/2011
Electric vehicles: the road ahead

Justin Hayward, director of CIR Strategy, charts the development of the electric vehicle sector in the run up to the EV2BE Conference at BRE on 27 September.

6/9/2011
The growing use of wood biomass

New BRE report shows that supply and demand of biomass is on the increase.

5/9/2011
Twenty four projects to demonstrate building resilience

Developers, local authorities and consultants all lead on latest round of Design for future climate projects.

5/9/2011
Monitoring for the elderly among CIOB innovation winners

CIOB International Innovation and Research Awards will be presented at INSITE11.

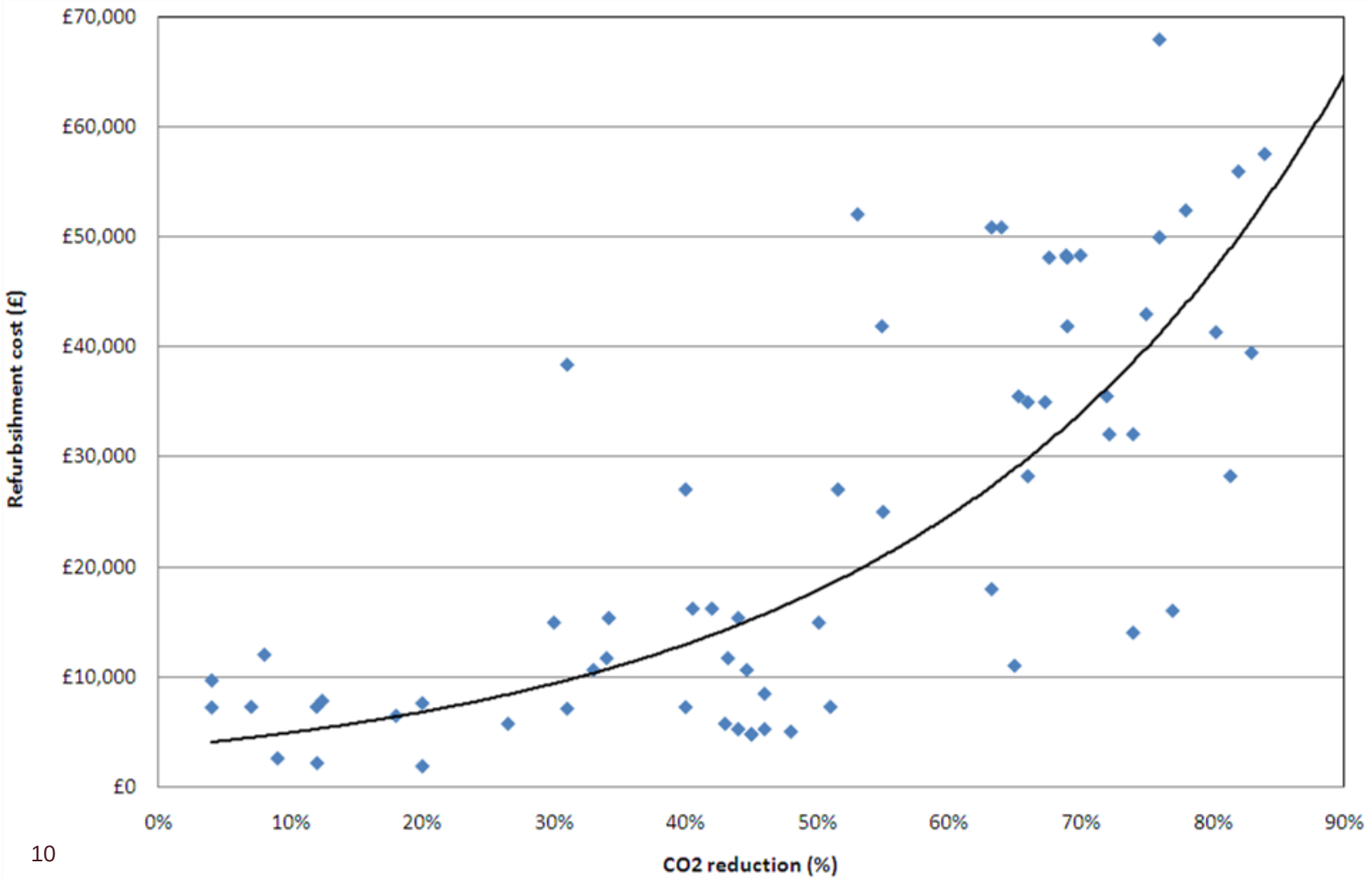
See all news

Internet

Rethinking Refurbishment.

National Refurbishment Centre

Low-energy housing refurbishment - Costs



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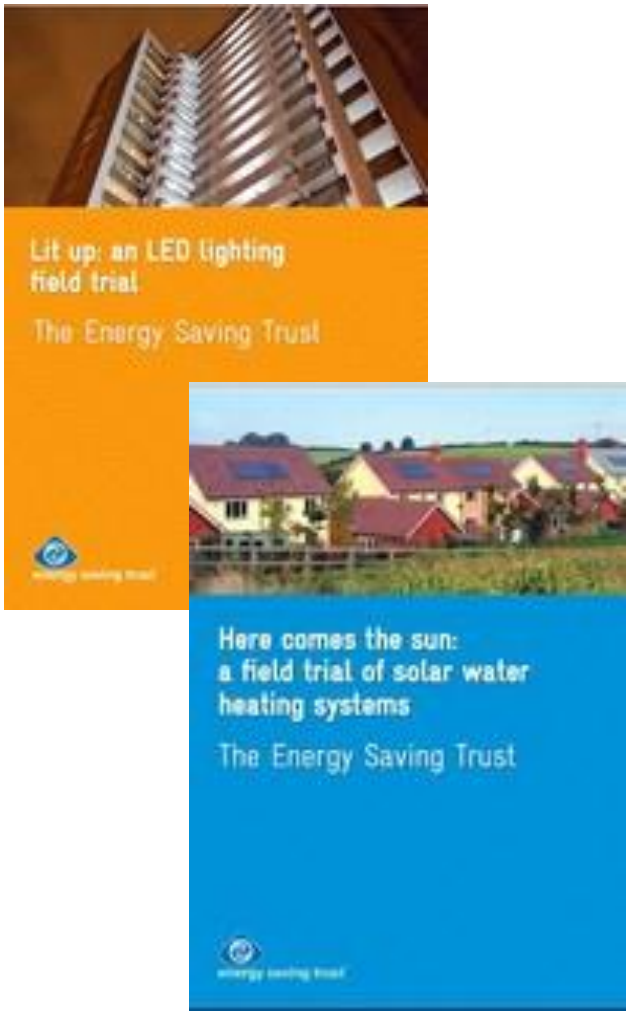
Housing refurbishment monitoring, evaluation activity

Technical monitoring projects

- Heat pumps
- Micro-wind
- Solar Thermal
- Condensing boilers
- Smart home energy
- Insulation (loft, cavity and solid wall)
- LED lighting
- Advanced heat controls



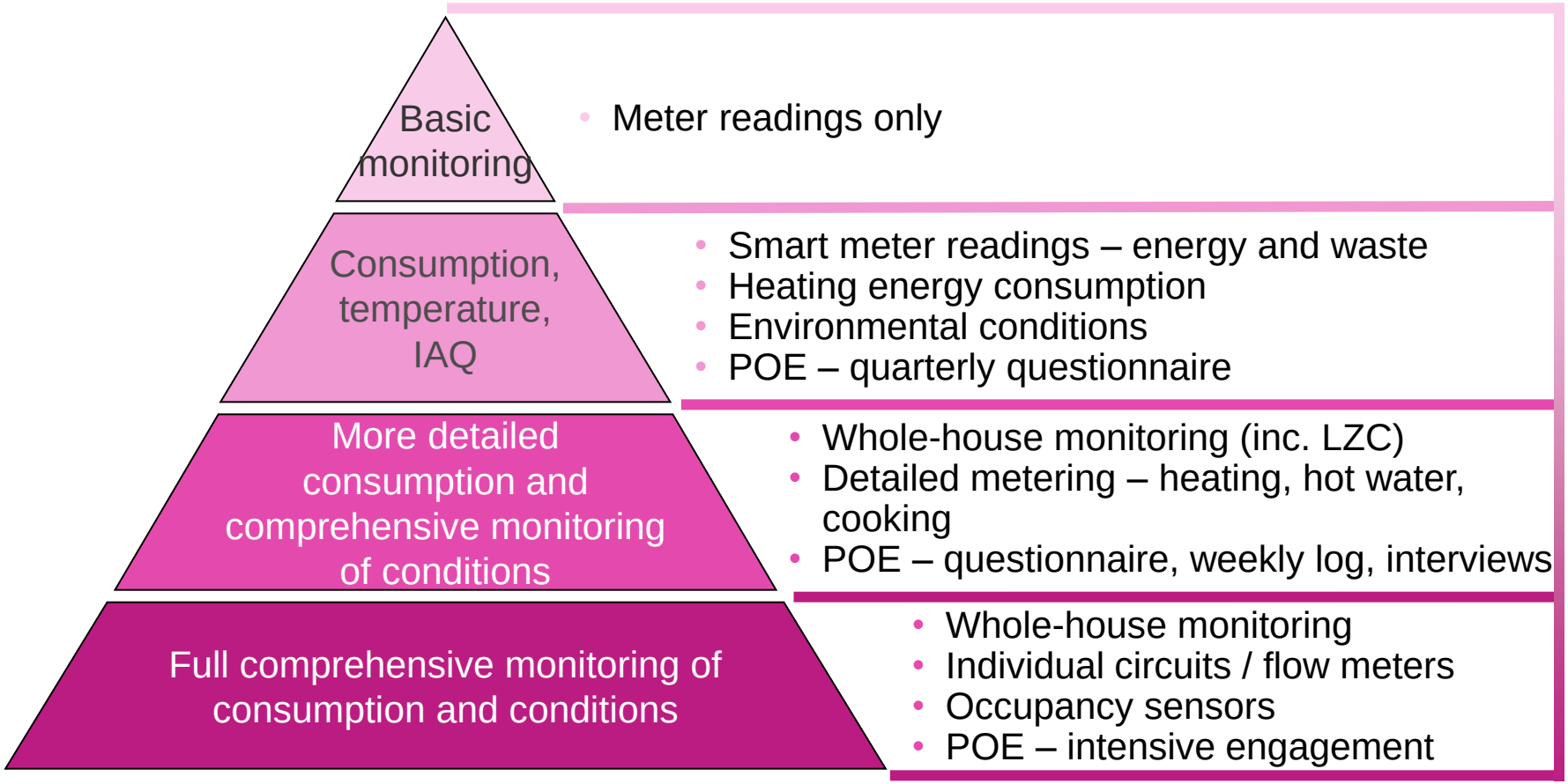
Heat Pumps - key findings

- Large variance in COP / Efficiency - 1.2 min to 3.6 max
- Performance sensitive to installer skills/knowledge – need to improve standards
- Some GSHP generally not performing as expected – need to find out why.
- Good potential for CO_2 savings, especially replacing oil and direct electric. Savings compared with gas are poor.
- Significant differences of user satisfaction with warmth, comfort, fuel bills & control

SWI summary of measured U-values

Statistical measure	Measured U-value (W/m^2K)
Average	1.43
Max	2.52
Min	0.64
Sample size	87
Current SAP value	2.1

Staged monitoring approach



Source: Good Homes Alliance / Energy Saving Trust

Performance monitoring of buildings

Detailed performance monitoring involves three main approaches:

1. Pre/Post construction/retrofit testing: the thermal efficiency of the building shell
2. Monitoring in use: collection and analysis of in-use data about energy and water consumption, and temperature and Internal Air Quality (IAQ) conditions
3. Occupancy evaluation (OE): analysis resident and user induction process, behaviour patterns, comfort and satisfaction levels and perceptions

Along side this performance monitoring a Post Construction Review will be carried out on the dwellings to inspect building fabric, installed technologies and measures. Check and record changes to the planned retrofits and comment on and comment on quality of works.

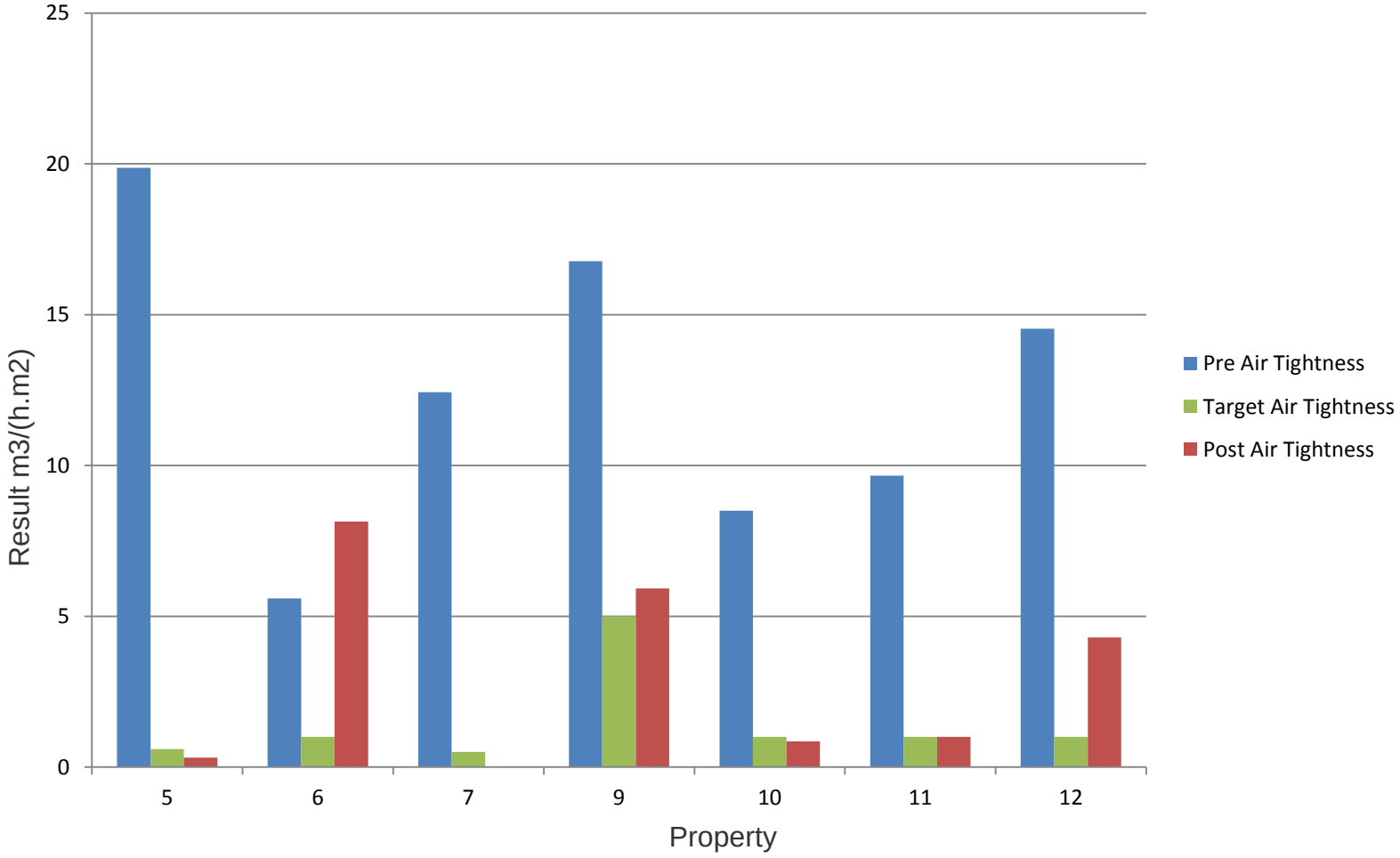
Short term tests

Test	*Requirement*
Airtightness	Two airtightness tests on the dwelling required One pre and one post retrofit works Dwelling access is required
Thermal imaging	Thermal imaging of all external sides of the dwelling Two tests required, one pre and one post retrofit works Although dwelling access is not necessary for external imaging, preparation by participants is required
Ventilation system	Volumetric air-flow rate and system effectiveness Should only be undertaken by a specialist contractor or accurate results cannot be guaranteed
Walk-through inspection	Visual inspection for defects and damp A photographic record of the retrofit should also be undertaken

Long term tests

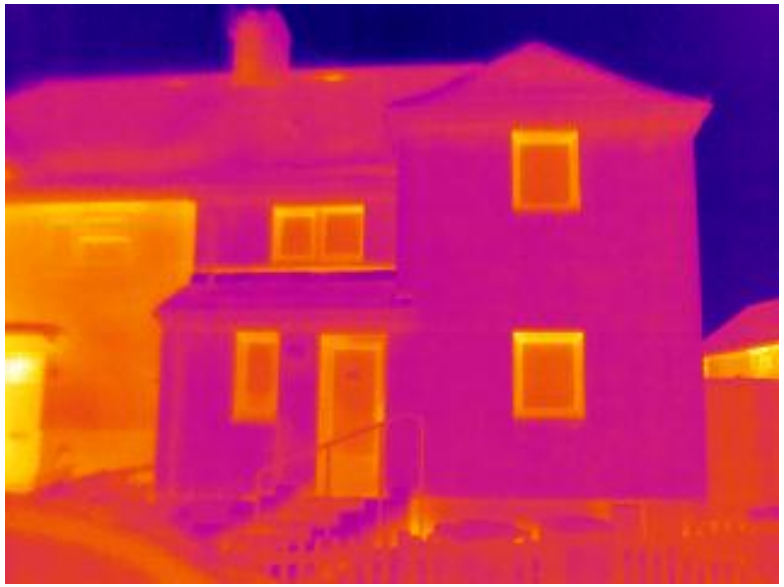
Test	*Requirement*
Utilities	Heating energy consumption (gas, electricity, oil, bio-fuel, etc) Electricity consumption Water consumption Communication via a smart meter or pulse output meter with remote access data logger
Internal and external conditions	Internal and external temperature Humidity CO_2 Communication via remote access data logger
Microgen technologies	Contribution to electric and or heating requirements (technology dependant)

Air tightness comparisons vs targets



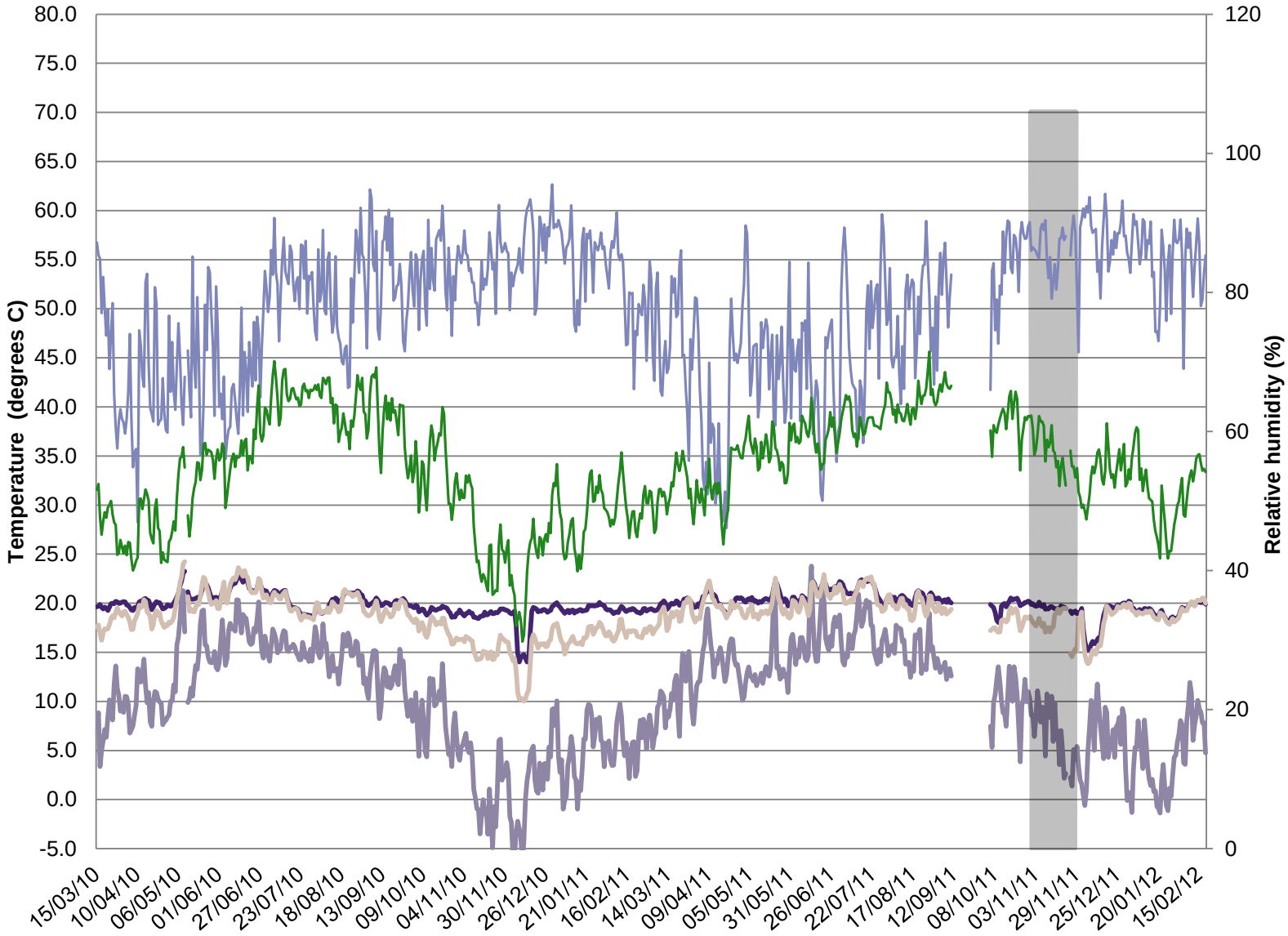
Thermography - Site 4 before and after

Before



After

All environmental data, property 81



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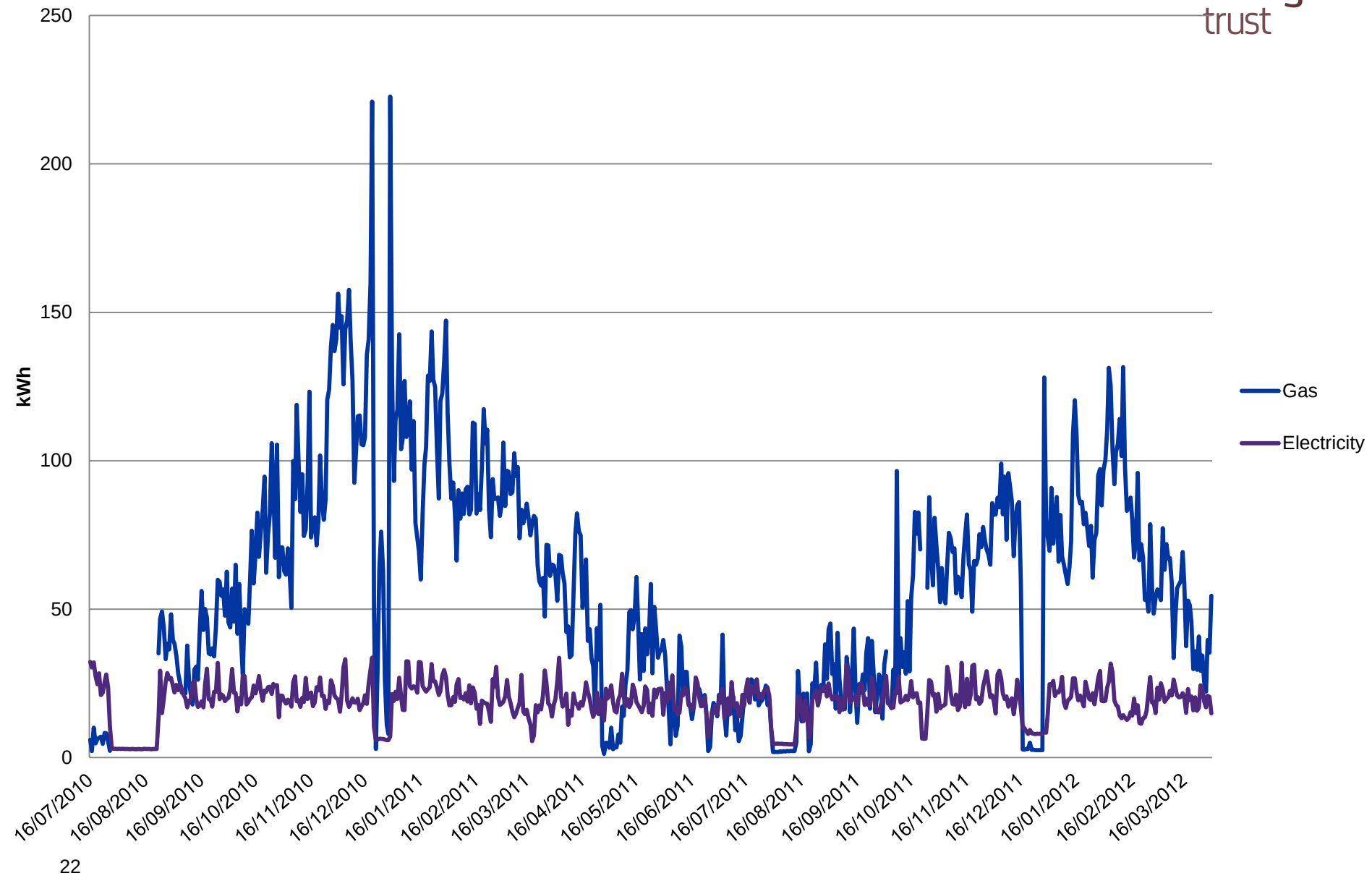
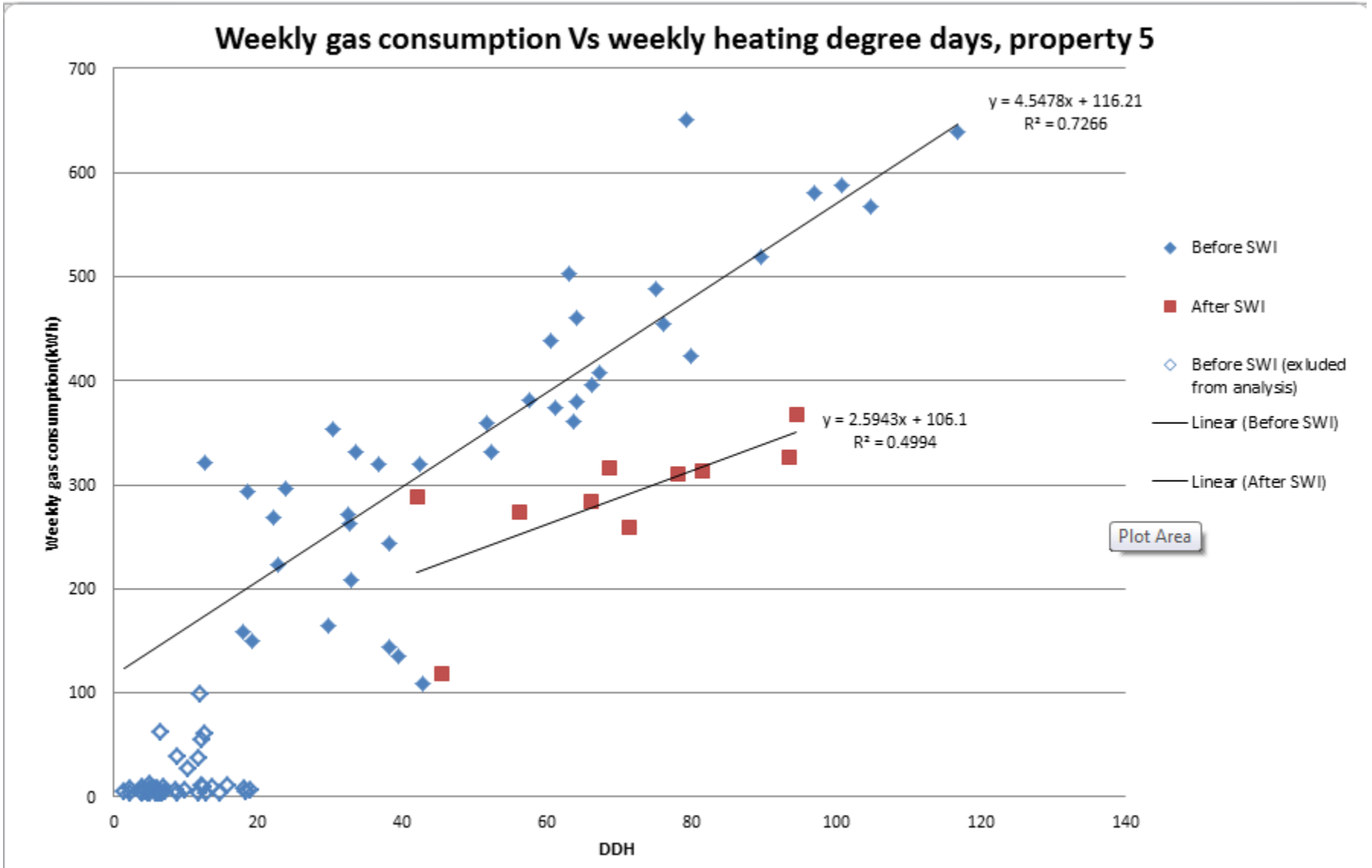
- Average internal temperature
- External temperature
- Wall surface temperature
- Installation period
- External humidity
- Average internal humidity

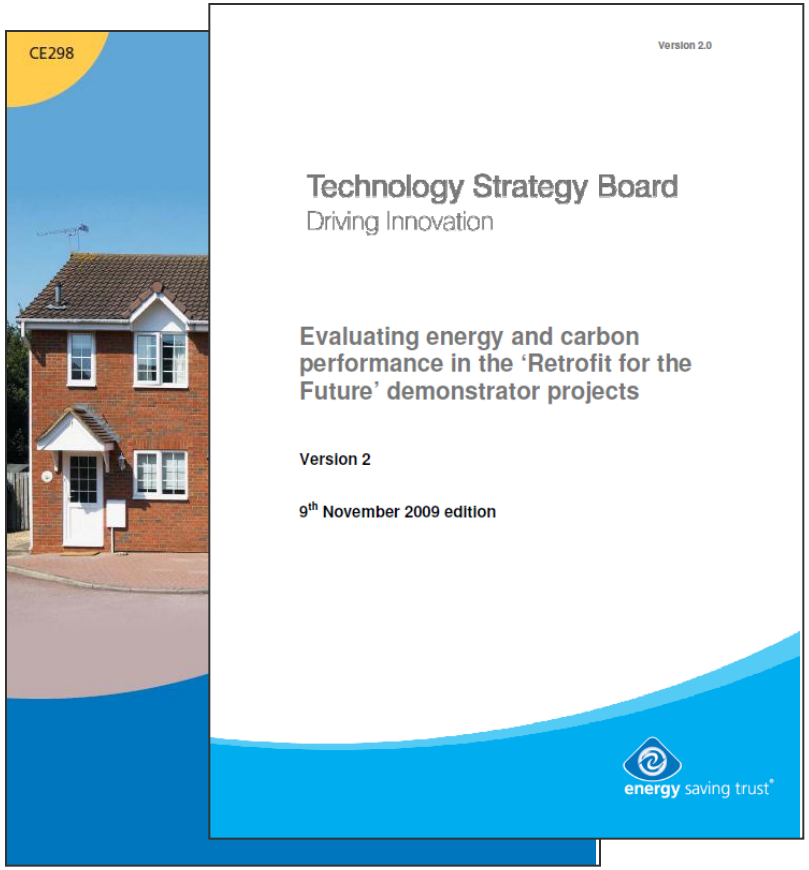
Yearly gas and electricity consumption, property 81




Weekly gas consumption Vs weekly heating degree days, property 5
Weekly gas consumption(kWh)
DDH
0
100
200
300
400
500
600
700
0
20
40
60
80
100
120
140
y = 4.5478x + 116.21
R² = 0.7266
y = 2.5943x + 106.1
R² = 0.4994
Before SWI
After SWI
Before SWI (excluded from analysis)
Linear (Before SWI)
Linear (After SWI)
Plot Area

More information is found in…

- Why we monitor
- What various tests mean
- Approximate costs of equipment
- Further useful information



Thank you

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