# Energy retrofitting in Scotland: skills and the supply chain

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HEAT AND THE CITY

# Agenda

12.00 – 12.45:Lunch

12.45 – 13.00: Welcome & introductions

13.00 – 14.00: Session 1: what skills exist and what more will be needed?

14.00 – 14.15: Break

14.15 – 15.15: Session 2: who is part of retrofitting supply chains?

15.15 – 15.45: Discussion

15.45 – 16.00: Close

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# Session 1:

# What skills exist and what more will be needed?

# Exploring the requirements of skills and the supply chain for Energy Efficient Scotland

## Recommendations from the Short Life Working Group

Ian Cuthbert

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# Quality, Skills & Consumer Protection

## QUALITY ASSURANCE PRINCIPLES

**1. ROBUST CONSUMER PROTECTION AND ENFORCEMENT** Across the board there will be robust consumer protection that focuses on high standards of quality, customer care, competence, skills, training and health and safety. The Programme standards will be robustly enforced.

**2. COMPETENT AND APPROPRIATELY TRAINED WORKFORCE** Individuals and businesses carrying out work under the Programme umbrella should be competent, appropriately trained and should agree to adhere to the Programme Code of Conduct. Individuals or businesses who fail to adhere to the standards or Code of Conduct will be removed from the scheme.

**3. SUFFICIENT SUPPLY CHAIN CAPACITY** There will be sufficient capacity in the supply chain to meet the demand for the Programme and be able to deliver the Programme offer.

**4. PROGRAMME FINANCE** The Programme finance will only be made available where the Programme approved individuals or businesses are used.

**5. SIMPLE AND EFFECTIVE COMPLAINTS PROCESS** Consumers will have access to simple and effective complaints process if things go wrong.

**6. BUILD ON EXISTING STANDARDS** The Programme consumer protection should build on existing standards and frameworks and should represent good value for money.

# Short Life Working Group


energy saving trust

HISTORIC ENVIRONMENT SCOTLAND | ÀRAINNEACHD EACHDRAIDHEIL ALBA


Highlands and Islands Enterprise
Iomairt na Gàidhealtachd 's nan Eilean

Skills Development Scotland

WARMWORKS Scotland

Scottish Enterprise

SCOTLAND EXCEL

CONSTRUCTION SCOTLAND

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# Recommendations

Quality

Skills & Capacity

Consumer Protection

Procurement

Non-Domestic

# QUALITY

- Need to define what success looks like.
- Quality assurance criteria needs to be developed linked to new Quality Mark.
- Any criteria should be fair, proportionate and not cost prohibitive to SMEs.
- A new designer role should be considered.
- Independent inspections must be carried out

# SKILLS AND CAPACITY

- Suppliers must meet appropriate skills and competency requirements with a skills matrix developed for the Programme.
- A mobilisation plan for developing skills should be developed and communicated to suppliers.
- The Programme should be well advertised to suppliers.

# CONSUMER PROTECTION

- There should be a clear, simple well defined complaints process.
- There should be data sharing between key agencies.
- There should be an awareness raising campaign about the Programme.

# PROCUREMENT

- Scottish Government should work with partner organisations to bolster existing guidance for SMEs.
- Scottish Government should consider developing guidance for buyers including local authorities.

# NON-DOMESTIC

- Work to identify improvement targets for non-domestic buildings should be fed into ongoing supply chain activity.
- Examine the need for qualification and skill requirements for installers working on non-domestic buildings.

# Consistency and quality of EPC ratings and future energy assessment

**Dr David Jenkins**
*Urban Energy Research Group*

***School of Energy, Geosciences, Infrastructure and Society, Heriot-Watt University***

# An assessment of consistency

- **The "Performance Gap" of energy assessments is well-documented**
  - **Modelled energy demand is rarely similar to energy bills of buildings**
- **Consistency is often assumed within a standardised framework**
  - **But is that true?**
  - **And what happens when we ask for "more" of that assessment (and assessors)?**

# “Mystery Shopper” exercise

- **Commissioned by Department of Energy and Climate Change (DECC) ~2014**
- **What happens when the same properties are assessed by different assessors?**
  - **Householders sign up to receive multiple energy assessments from different assessors**
  - **Investigate consistency of Green Deal (GD) and EPC assessments across an identified sample**
  - **Indicate reasons for any identified variability by looking at three stages of assessment**

# How GD assessments work(ed)

- **Energy Performance Certificate**
  - An assessor generates results of a standardised EPC for a "typical" occupancy (RdSAP model)
- Green Deal **Occupancy Assessment**
  - Results altered to account for specific occupancy of that dwelling
    - Number of people
    - Showers/baths/fridges/freezers
    - Use of energy billing information
- **Recommendations** are provided following both analyses

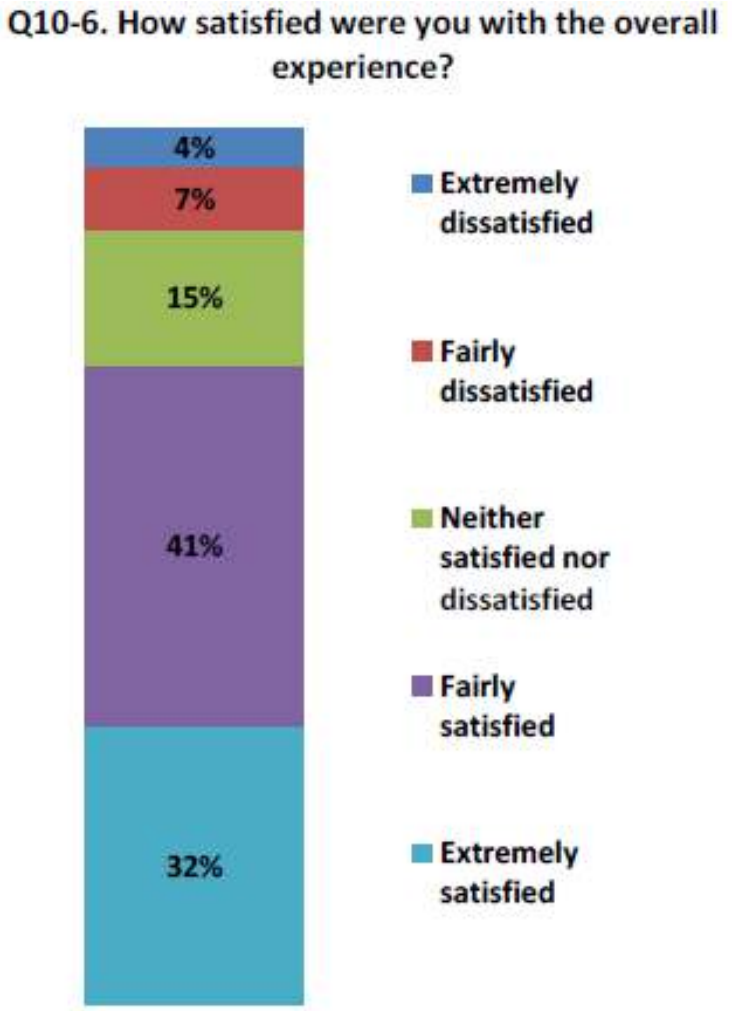
# Sample size

- **A relatively small sample of households took part**
  - **Part of a slightly larger sample (48) involved in a "customer journey" survey**
  - **29 households assessed by four registered GD assessors**
  - **A fifth assessment was carried out by an independent assessor (CADS) as part of the project team**
  - **Results must be placed in context of sample size**
    - **But 145 assessments still provided a revealing picture...**

# Data sources

- **Assessments registered on central GD Oversight and Registration Body database, including:**
  - **EPC inputs and results**
  - **Occupancy Assessment (OA) inputs and outputs**
  - **Summed post-OA improvements**
- **Mystery Shopper questionnaires**

# Respondents satisfied...



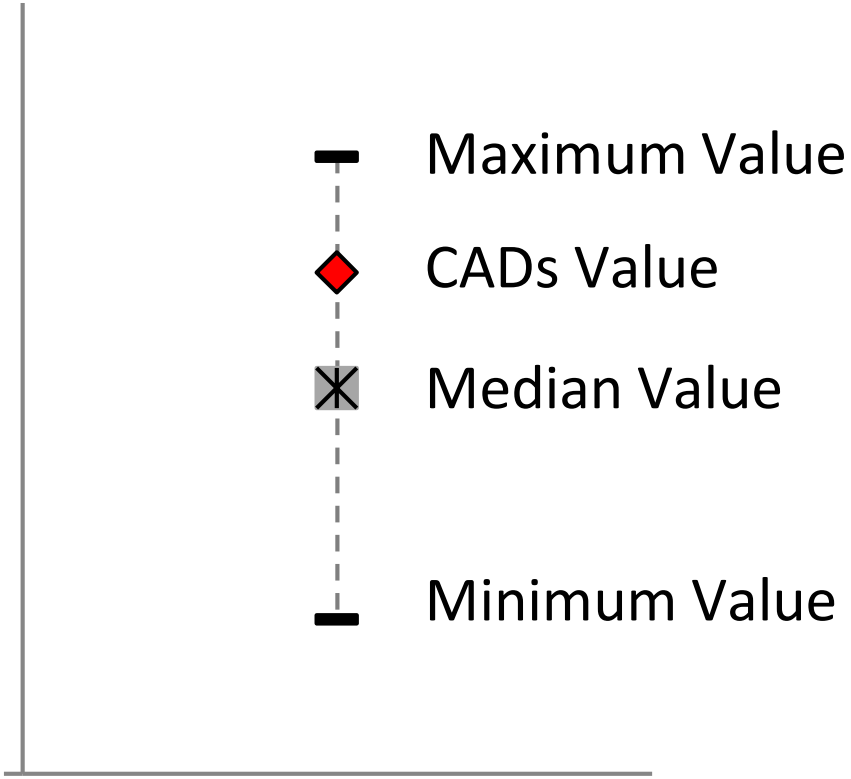
# Respondents satisfied...usually....

***"He [the assessor] rushed through the assessment. He started drilling holes in my outside wall without telling me he was going to do that or why. The only recommendation he made was the loft insulation, despite my boiler being 15 years old and I did not have cavity wall insulation or energy saving bulbs."***

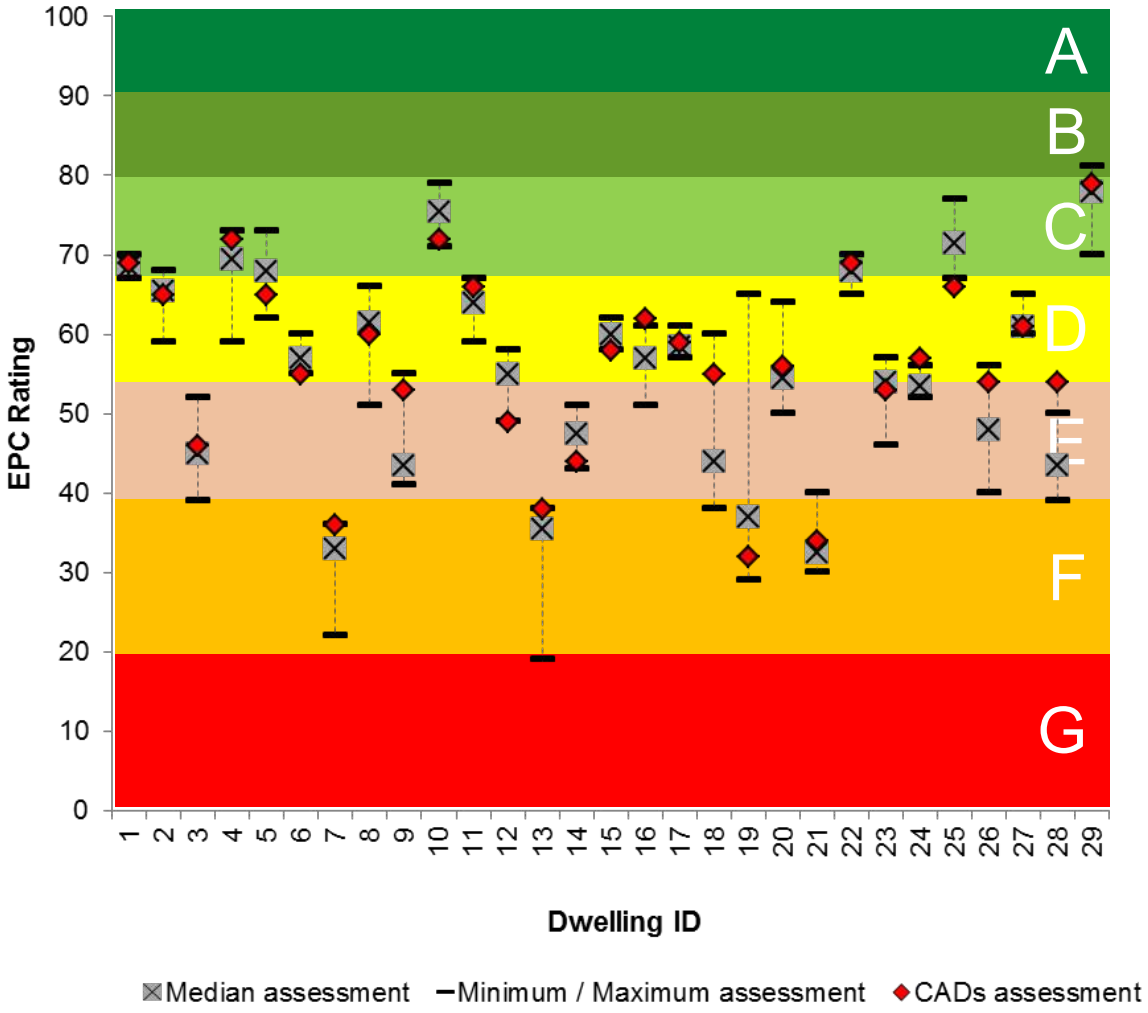
***-***

***Quote from householder***

# Format of quantitative results



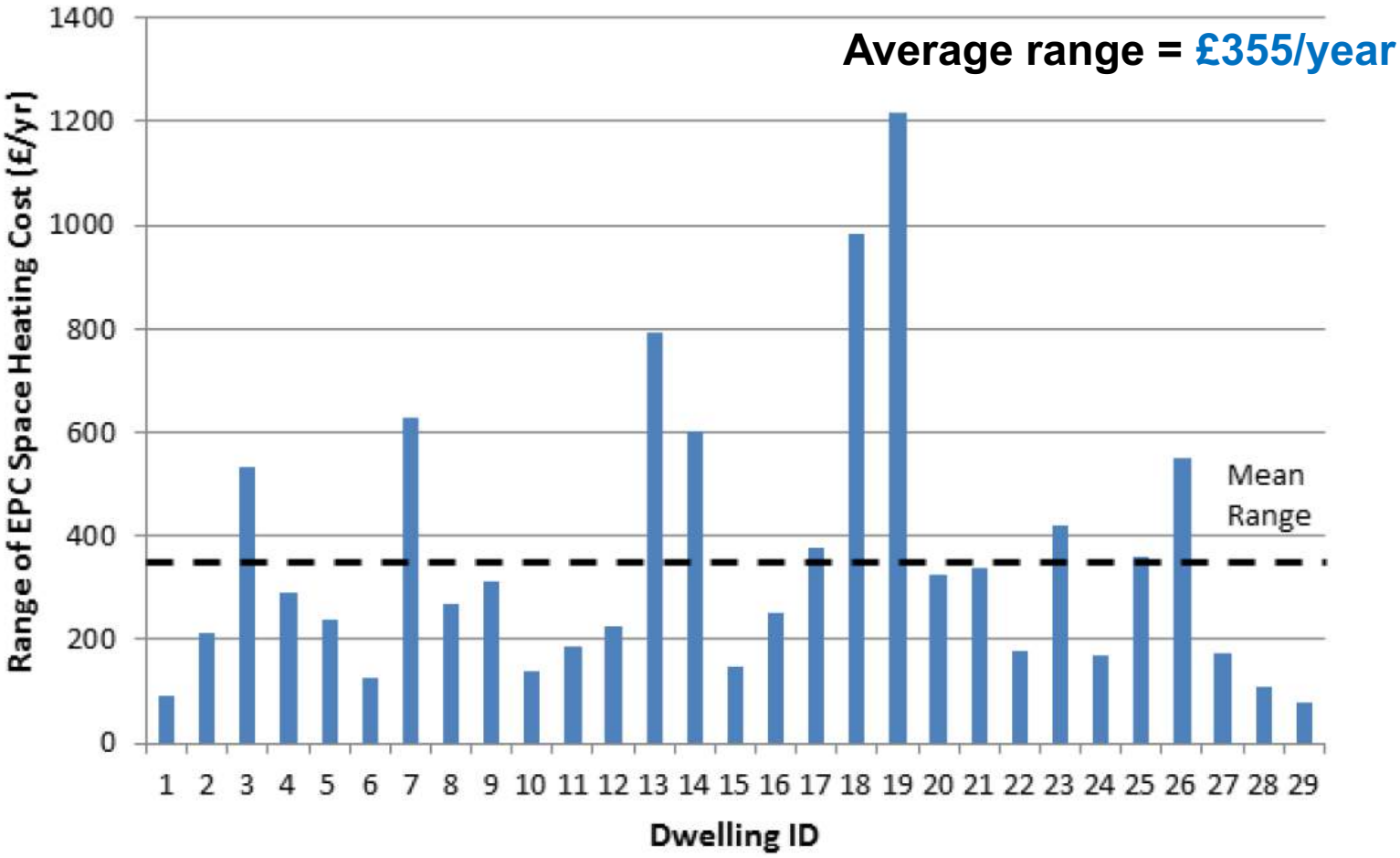
# Variations in EPC results



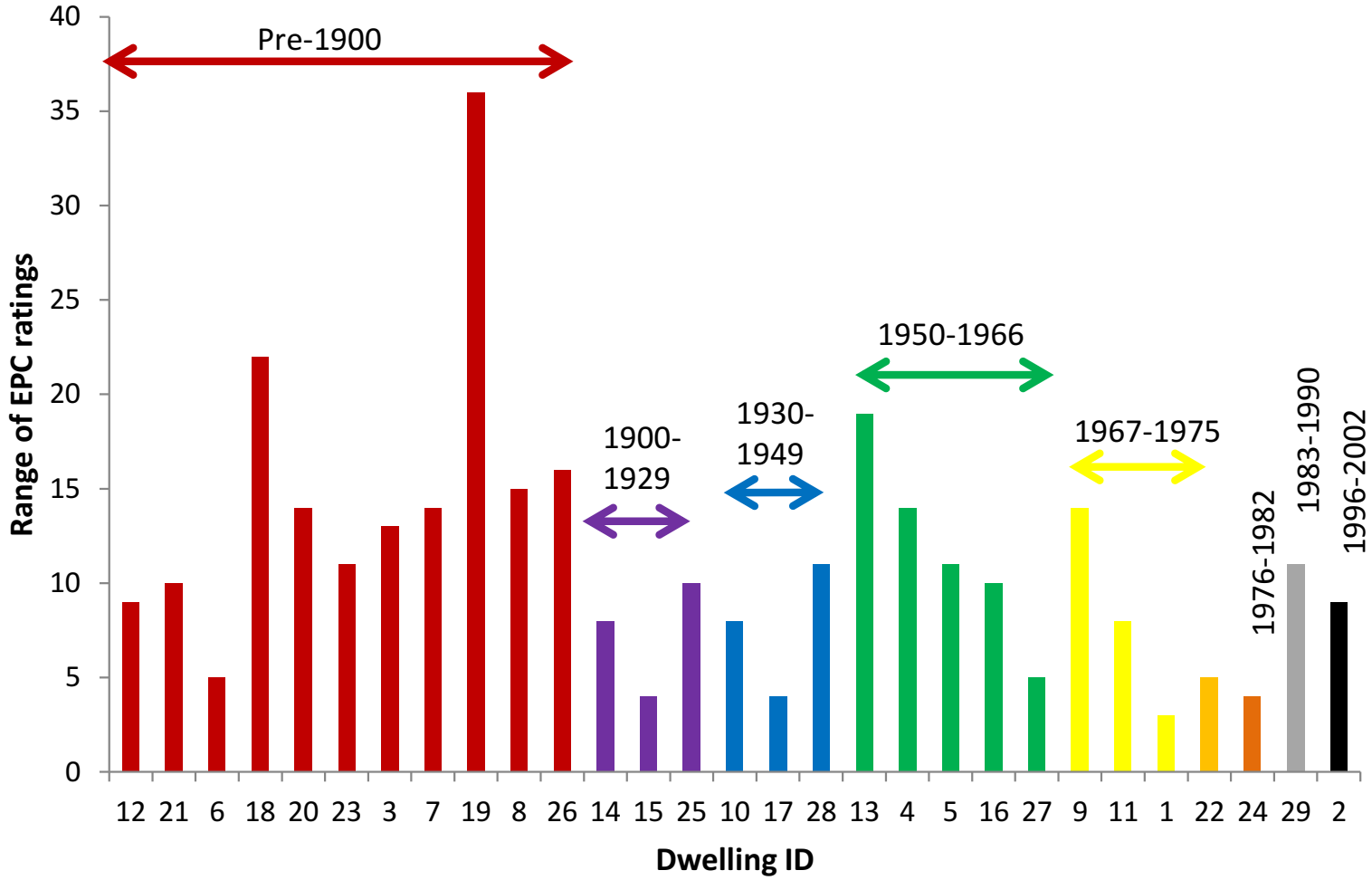

**Average range = 11.1 ratings points**

**Nearly two thirds of households showed variation across two or more energy bands**

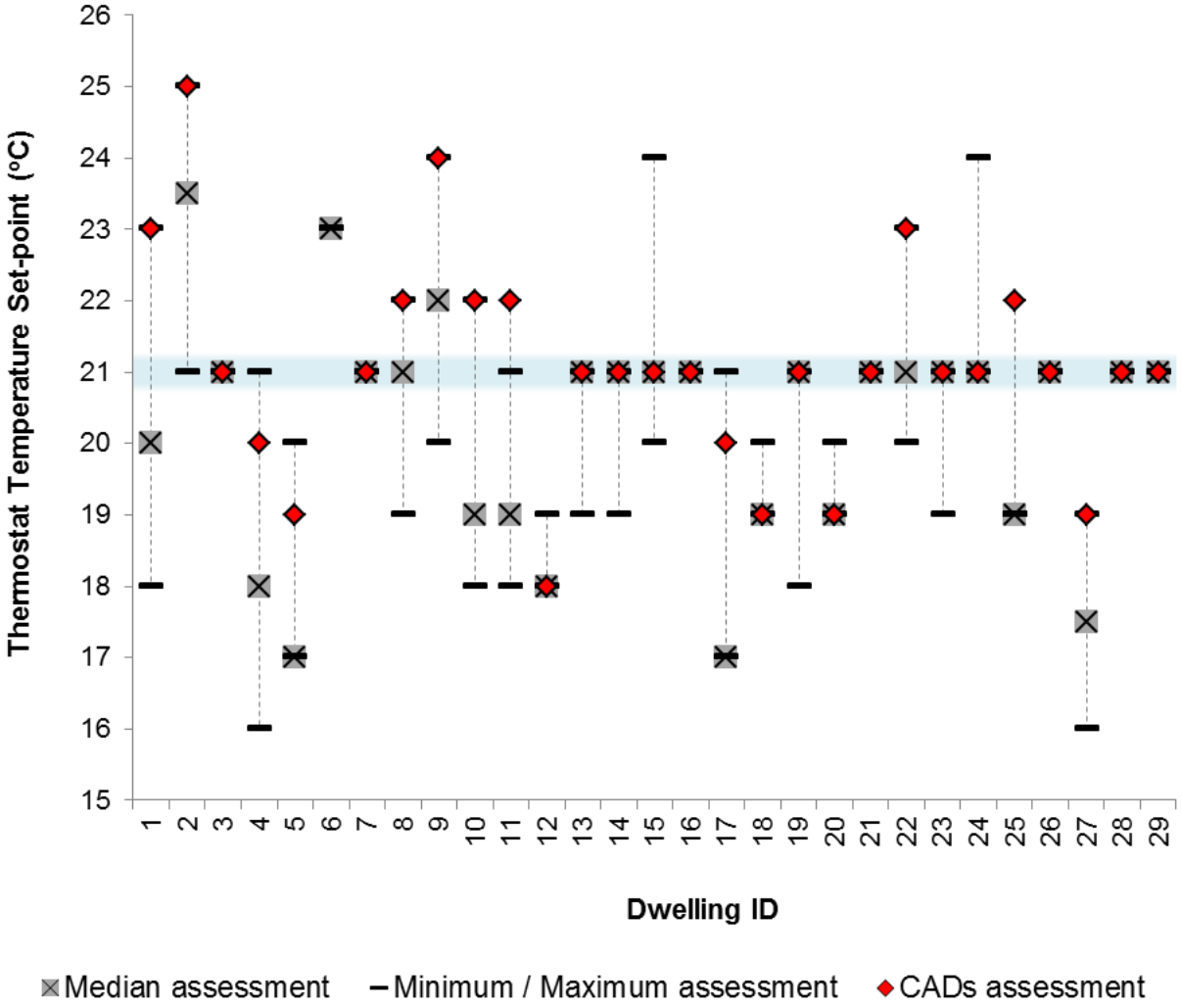
# Variations in EPC space heating



# Older buildings more variable?



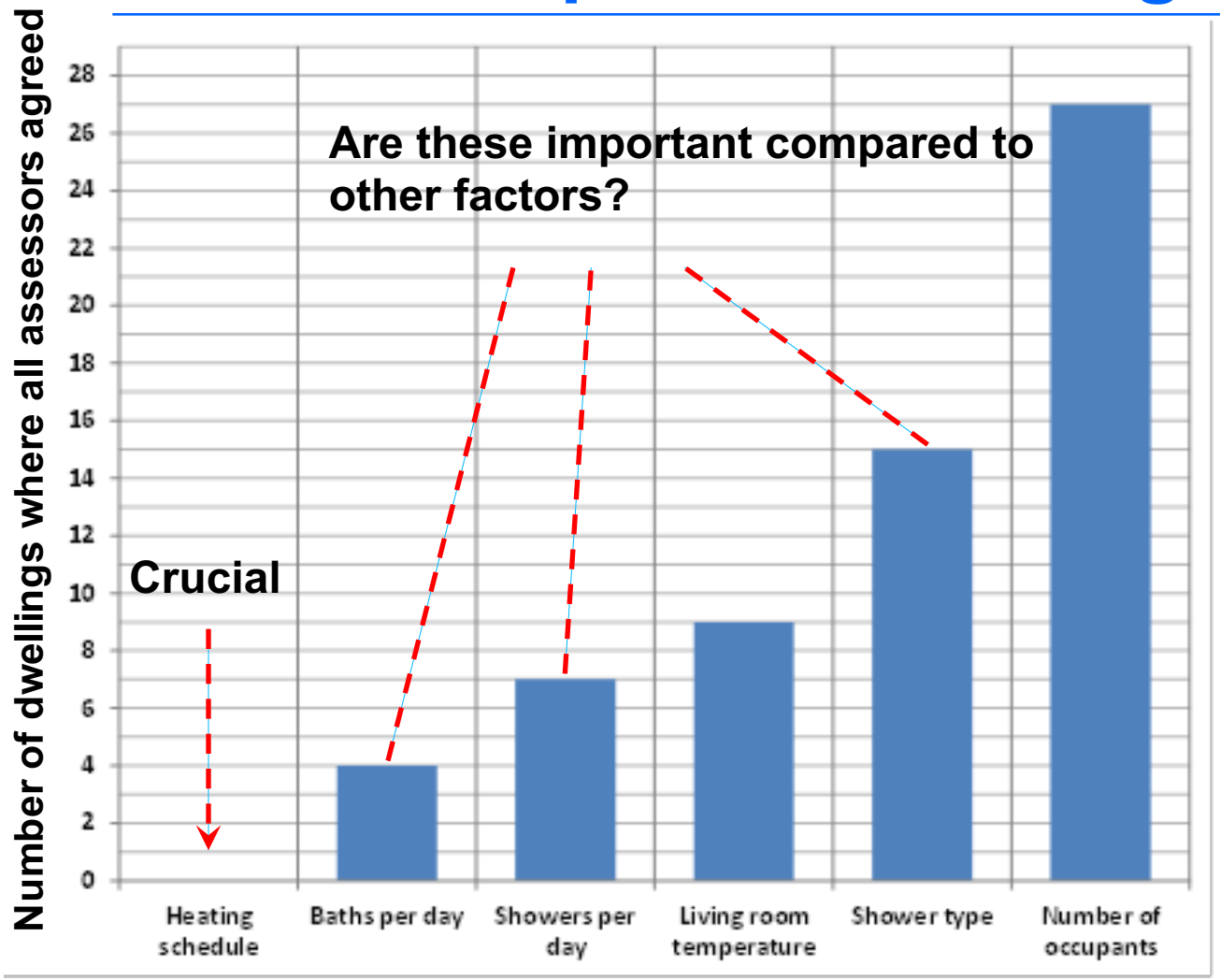
# Occupancy Assessment – thermostat temperature




**Mean range = 2.1 °C**

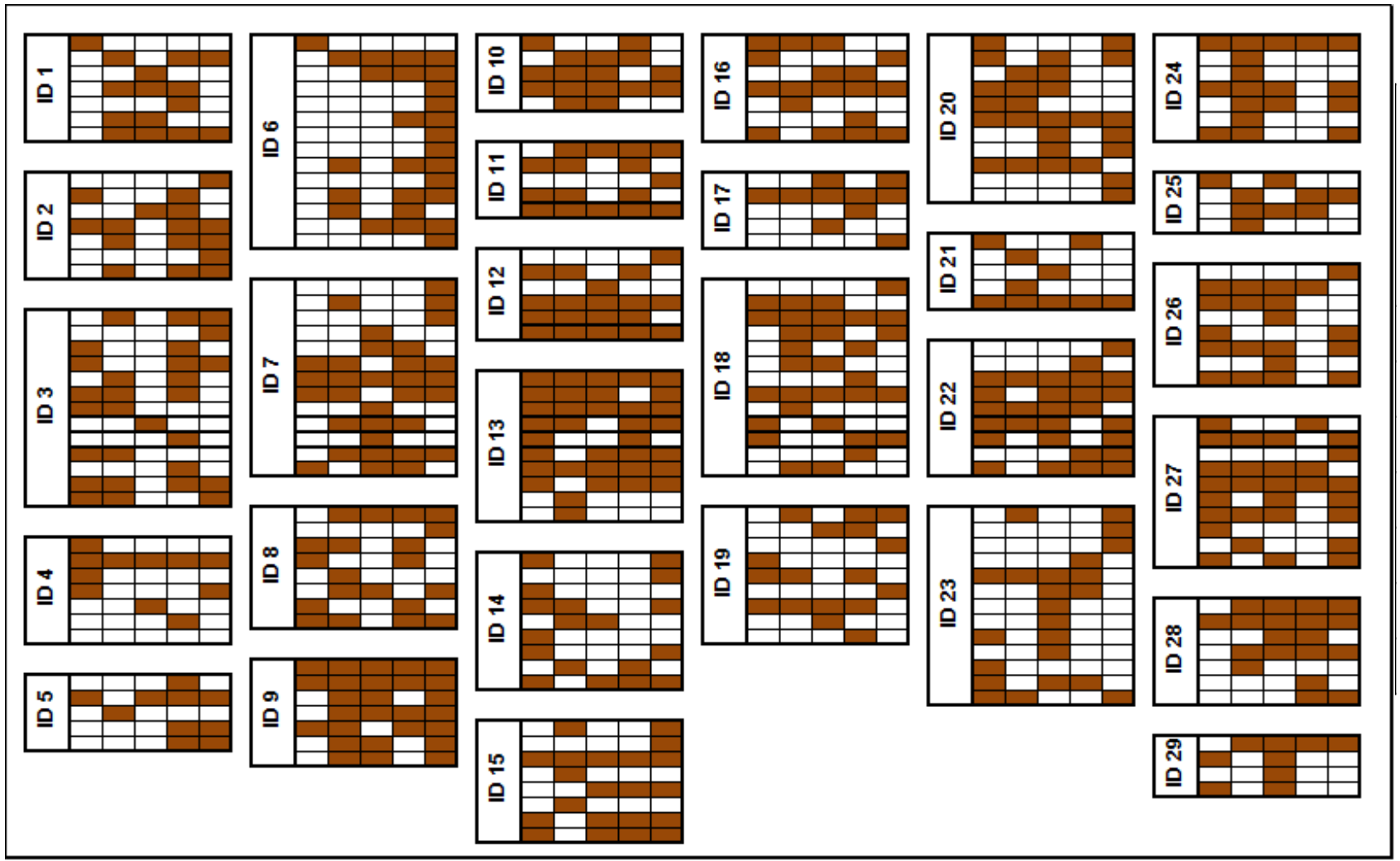
**13 dwellings had a difference of 3 °C or more**

# Other OA inputs – lack of agreement?

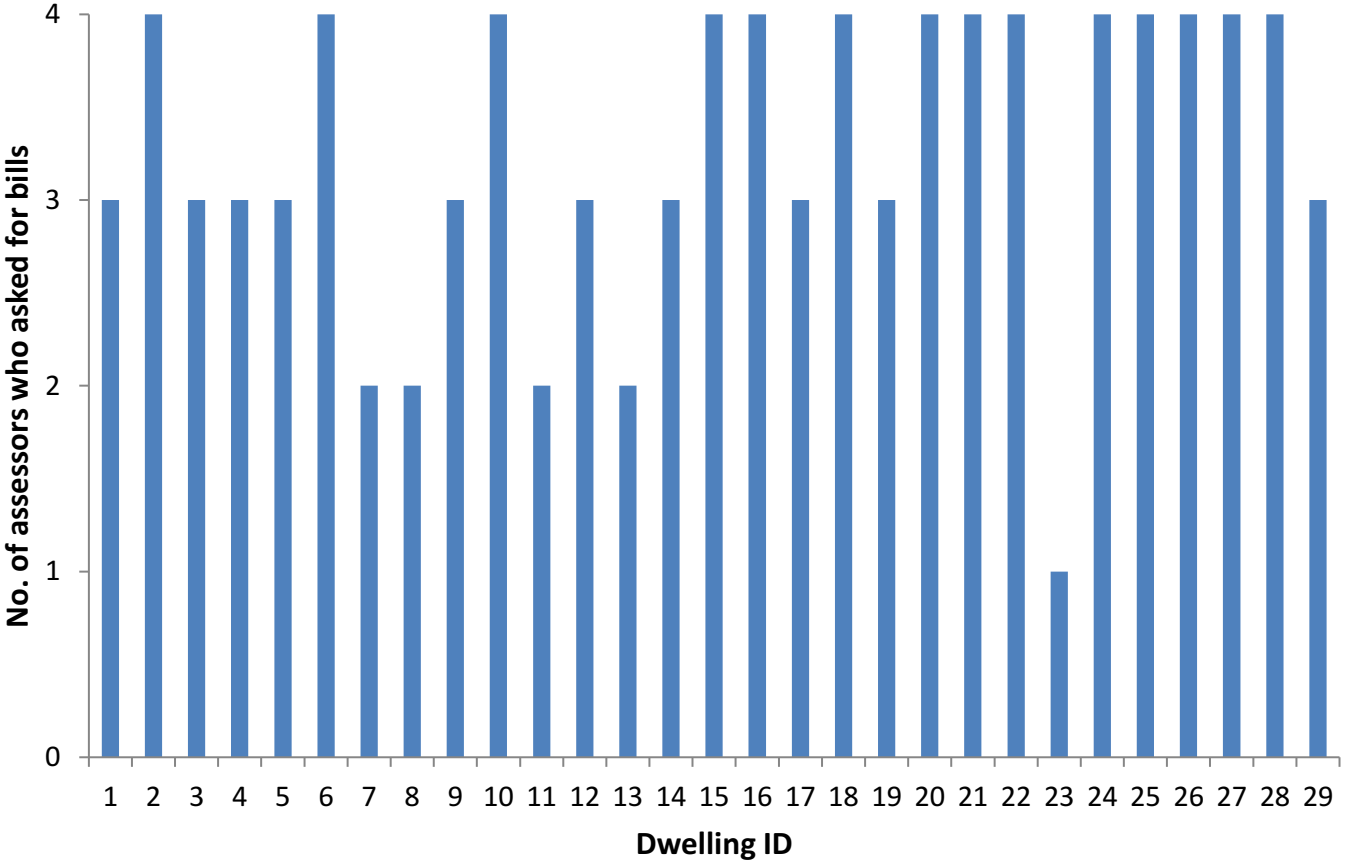



**Further signs of assessor interpretation becoming more of a factor**

# Differences in type of measure (GD)



# Source of disagreements – did they ask for energy bill data?




**In 21 of the 116 assessments, bills were not asked for**

# Questions from study

- **Did errors occur due to lack of knowledge rather than guidance?**
  - **Is the problem the methodology or those applying the methodology?**
- **Green Deal/OA required assessors to make even greater level of judgement for inputs**
  - **Differences between OA and EPC approach might have caused confusion**
  - **What level of building modelling expertise should be required for this judgement?**

# Evidence of clear errors and mistakes....

- Assessor asked for depth of LI and CWI in a stone-walled house with no loft
- DG and SWI recommended for a house with DG and SWI already present
- Thermostats recorded in homes without thermostats
- One assessor refused to use energy bill data provided as it was “online”
- Householder told that a technology was not possible (e.g. SWI) but this was then included in the report
- Building orientation repeatedly incorrect

# What might we conclude?

- **Did GD push this form of modelling too far?**
  - **Focussed on bill predictions rather than "energy compliance"**
  - **This form of "steady-state" model has very little empirical validation even for standard EPCs**
  - **More general problems with energy modelling are *magnified* by GD – but perhaps already existed?**
- **Assessors can become accredited after 7-9 days training**
  - **Is this sufficient? Does it explain variation in quality/knowledge of assessors in the sample?**

# Why is this still important?

- **A common (and intuitive) argument:**
  - **Do they?**
  - **But we want to upgrade our building stock regardless of who ends up living there?**
  - **Shouldn't we firstly judge whether those models are suitable for using those "new" inputs?**
  - **There is very little evidence of this – yet we might give the households a false impression of this**

  **for the occupant**

# The role of EPC assessments for retrofit

- What are we trying to promote and do we need EPCs to do that?
  - e.g. loft insulation can be recommended on the back of ~3 questions
- What measures require more robust modelling?
  - But which of these are not reliably modelled by current compliance modelling?
- What skills do we need for all of the above?
- "Tailored" does not mean more accurate, and this is not likely to be understood by a householder

# Understanding Local Supply Chains

**Louise Cox**

**Economic Development**

**Scottish Borders Council**

## Key Energy Issues – large area, very rural

- **Housing stock –** largest town 15,000 residents, older properties, stone built, significant off-gas, 31% fuel poverty, huge need for very costly upgrades
- **Business premises very varied –** some modern purpose built, lots of small workshops, town centre retail, increasing home based businesses
- **Local home insulation programme –** HEEPS:ABS across the Scottish Borders
- **No ability to engage with local contractors**
- **No business need to increase skills/diversify –** unclear, limited market
- **Feed-in Tariff –** focus on PV/biomass, unclear limited market

## Early Actions

### 2006 - Scottish Borders Sustainable Energy Association/Borders Energy Agency

- Network of local energy businesses and public bodies
- Engagement and awareness of opportunities
- Open events inc. annual conference
- Identification of issues/barriers and lobbying

## Early Actions

**Scottish Borders Low Carbon Economic Strategy – '*To develop a workforce equipped with low carbon skills and awareness'***

- **Assess Energy Skills Gap -** Skills Development Scotland/Borders College
- **Business engagement –** suppliers, installation & maintenance
- **Registered Social Landlords –** key clients, EESSH targets
- **Identify training need -** Low Carbon Skills Fund/ Individual Learning Accounts

## Peebles Scotland's Energy Efficiency Strategy Pilot – Non-domestic support

- **Awareness and Engagement focus** - domestic and non-domestic properties
- **Business Referrals to Resource Efficient Scotland**
- **Supply Chain study – Nautilus consultants –** individual interviews with construction sector businesses in Peebles, compiled business listing, survey and workshop
- **Key findings –** limited engagement in energy efficiency works, word of mouth recommendations, restricted up take of training

## Challenges and Barriers

- Communication is primarily word of mouth for local trades
- Clients demand for energy efficiency is not clear
- Lack of scale, time and finance to invest in energy efficiency
- Red tape and administrative burden are a disincentive
- Lack of information on energy efficiency for local small businesses
- Energy efficiency is part of what tradespeople do, and is not the specific focus
- Impractical building standard regulations concerning energy efficiency for older buildings

## Recommendations

- **Minimise red tape and administrative burden for small businesses**
  - streamline procurement procedures
  - reduce administrative burden of frameworks
  - Green Deal and Constructionline review

- **Strengthening capacity of the local businesses**
  - improve communications/relationships
  - support access to training/upskilling
  - identify business devt. needs for construction
  - support for administration & accreditation

- **Specify the scope of the market for energy efficiency upgrades**
  - Affordable Warmth Strategy
  - EESSH, PRS, Self-funded

## Recommendations

- **Better information and finance for end users**
  - strengthen and simplify the messages
  - increase understanding of benefits
  - improve awareness of routes and costs
  - ease access to support – local trades
  - ‘Trusted Traders’ schemes

- **Specific messages for consumer groups**
  - identify key drivers for different groups
  - engage through local & social networks
  - embed energy issues in wider service delivery
  - Changeworks in Peebles pilot findings

# BREAK

# Session 2:

# Who is part of retrofitting supply chains?

# Network Brokerage in Supply Chains

Implications of outsourcing for innovative energy retrofit

**Henry Myers & Dr Faye Wade**
**Heat and the City Team, University of Edinburgh**

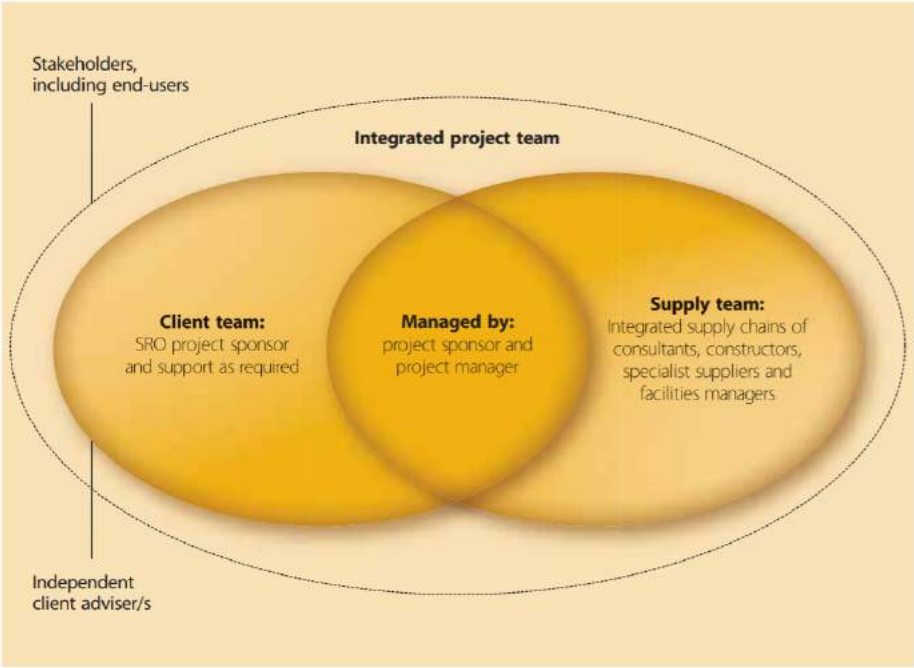
# Energy Efficient Scotland

- Latham and Egan reports: need to develop supply chain integration and innovation

- Supplier-side complexity:
  - whole-house approaches require cooperation of specialists
  - unclear about the presence of skills and expertise in market to deliver energy efficient technologies in older buildings
  - partnering strategies still emerging

- Client-side complexity:
  - residential and non-residential
  - multi-ownership buildings
  - historically listed stock; third sector involvement
  - diverse demands and interests

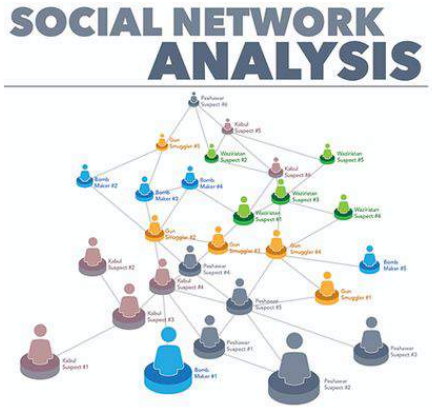
1 The integrated project team



# Energy Efficient Scotland: supply chain challenges

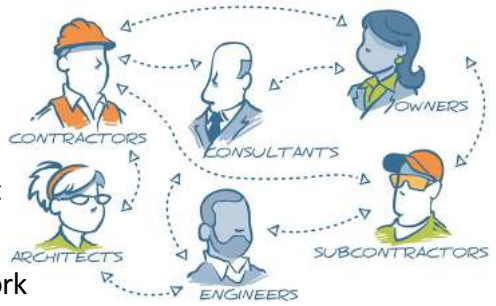
- Uncertainty and complexity in the supply chain can mean unforeseen **risks and costs**
  - Hidden transaction costs can make up to 30% total costs in Energy Efficient Retrofitting projects (Moore et al, 2018)
  - Complexity can account for 25% of manufacturing expenditures (Aelker et al., 2013)
  - Hidden risks/costs difficult to manage through contractual mechanisms
  - Certain actors bear higher risk of incurring such costs (Network Brokers, Project Leads, SMEs)
- Such risks/costs may discourage SMEs from participating in Energy Efficient Scotland
- **Social Capital** helps mitigate the risk of hidden costs.

# Method: Social Network Analysis (SNA)

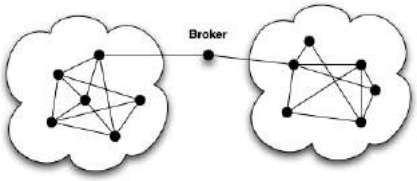



- **Social Capital**
  - The capacity for cooperation, power, & influence in social networks
  - Formed through iterative communication, shared values and goals, and trust

- **Social Network Analysis (SNA)** is a tool for analysing social capital by measuring the relationships and structure of a network




- **Construction supply chains are temporary networks**
  - Different types of **ties**: contracts; communication; shared interest; trust
  - Different types of **actors**: Contractors, clients, consultants, government
  - High interdependence: ineffective cooperation may affect whole network
  - How does effective communication and coordination occur? **Brokers!**



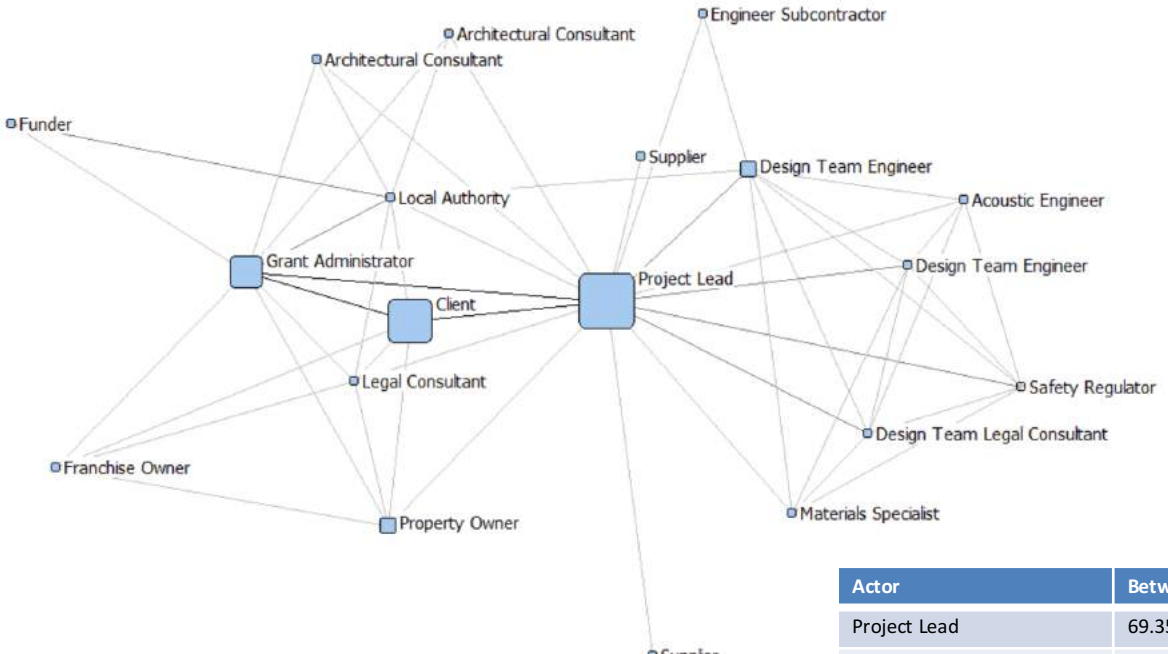

# Supply Chain Brokerage

- Definition of Brokers:
  - Position: Actors that connect otherwise unconnected actors in a network
  - Role: Crucial for facilitating information exchange and coordination
    - Their role is pronounced when mediating between different groups, such as public, private, & third sector organisations or clients and contractors. They act as "translators" to make different interests and meanings mutually intelligible.
  - They bear significant risk of incurring transaction costs. On the front line of conflicts.
- Supply Chain Brokers come in different forms (Gould and Fernandez, 1989):
- We do not know the impact that Brokers have on supply chains for energy efficient retrofitting
  - Helpful? Facilitating communication, coordination, innovation, and integration?
  - Harmful? Bottlenecking and controlling communication, engaging in opportunistic behaviour?

# Method: Data Collection

- Semi-structured interviews:
  - Snowball sampling approach to understand shape of network
- Emergent themes and questions:
  - How do different types of communication brokerage result in experiences of trust and social capital?
  - How do these different experiences of social capital affect transaction cost risks and coordination?
- Interviews coded and "translated" into SNA measures:
  - 3 types of ties: Contracts; Communication; Trust;
  - Network Density: Level of supply chain cohesion/fracturing
  - Betweenness Centrality (all ties): Measures brokering activity
  - Degree Centrality (Trust): Who is most trustworthy

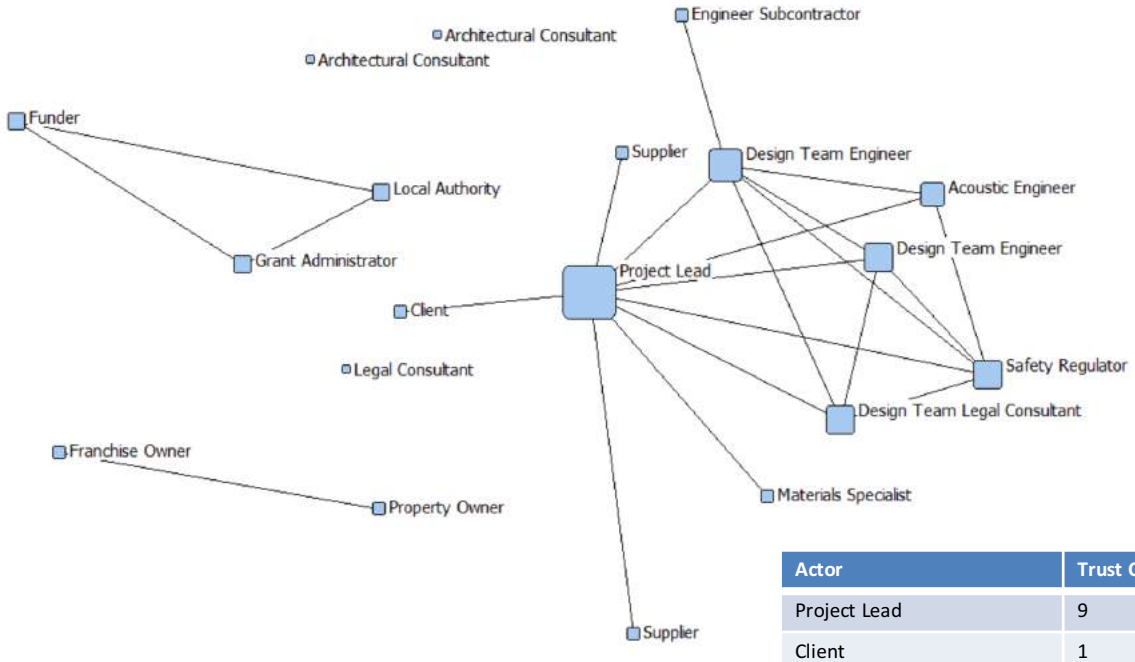
# Communication Network




| Actor | Betweenness |
|---|---|
| Project Lead | 69.357 |
| Grant Administrator | 6.458 |
| Client | 5.306 |

**Communication Betweenness = Brokerage**

# Trust Network




| Actor | Trust Centrality |
|---|---|
| Project Lead | 9 |
| Client | 1 |
| Grant Administrator | 2 |

**Trust = Social Capital**

# Network Experiences

- "[Project Lead] I'm entirely comfortable with. [The Grant Administrator] I recognise they've got, it's all about what people's interest is. I recognise they've got a vested interest in certain aspects of this. Their priority is not us….So it just goes back to what I was saying earlier, I think [Project Lead] got such a huge stake in this in terms of future business and potential bad reputation if it doesn't go well so I could relax and I'm confident…. [The Grant Administrator] is a different kind of beast and so it has to be treated differently. so I'm a bit less comfortable with them…" (The Client)

- "[the Grant Administrator] holds the budget so for some reason we've never been told what it is… We've never seen or we've never been involved in any discussions with Scottish Government or [Local Authority] … but they always kind of kept [program specifics] to themselves and we haven't seen their original funding application so … sometimes we'll take things out of the project from a funding point of view or [Client] interest point of view… but then it was fed back that actually that was part of the original funding application and so our ability to do much to … manage that was [affected]," (Project Lead)

# Discussion: Brokerage and Social Capital

- When brokers share risk and have aligned interests with other actors, these relationships give rise to trust, confidence, and mutual understanding. These forms social capital have knock-on effects for retrofitting supply chains.
- When brokers do not share in risk (don't have skin in the game) or have unaligned interests, they can deteriorate trust, generate significant transaction costs, reduce network performance, and discourage risk-averse SMEs from entering the energy efficient retrofitting market.
- Greater transparency in communication plays an important role in building social capital and transforming brokers who prevent supply chain cohesion into brokers who facilitate it.
- When procuring supply chain, attention should be paid to the effect that an increased number of client-side stakeholders has on the level of uncertainty and risk in a project. The importance of finding brokers who have a vested interest in a project and who can communicate effectively with both industry organisations and clients should not be overlooked.

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# Developing a trusted trader list to engage private owners & businesses in retrofit.

**Diarmid Turnbull**

**20th June 2019**

# Contents

- **Background**
  - Energy Agency
  - EES Pilot Programme
- **Development of Accredited Installer List**
  - Research, vetting & marketing
- **Results so far**
- **Barriers and challenges faced**
- **Lessons learned & future development**

# The Energy Agency

- **Registered energy efficiency charity.**
- **Operate across the South West Scotland.**
- **Aim to reduce energy consumption and promote sustainability to reduce carbon emissions.**
  - Free and impartial advice to householders, businesses, community groups.
  - Energy Efficiency, renewable technology, sustainable transport.

# Local Authority Partnership

- **Manage Scottish Government-funded programmes & contracts.**
  - Home Energy Scotland.
  - Local Authority partnership.

- **HEEPS ABS**
  - Manage on behalf of South Ayrshire, East Ayrshire and Dumfries & Galloway councils.
  - Solid wall insulation installed in over 6000 hard-to-treat properties.
  - Skill & experience of supply chain has a major impact on success.

# EES Pilot Overview

- **Management of two EES pilot programmes:**
  - East Ayrshire and Dumfries & Galloway.
  - South Ayrshire.

- **Aims of EES pilot programmes:**
  - Test appetite within self-funding sector to invest in energy efficiency.
  - Provide a bespoke 'handholding' advice service in partnership with HES & RES.
  - Develop an accredited installers list for householders/SMEs.


HOME ENERGY SCOTLAND

RESOURCE EFFICIENT SCOTLAND

# EES Journey


Identify Target
Engagement
Pre-Install EPC
Advice Visit
HES Call
Post EPC
Post Install Visit

# Purpose of Accredited Installer Network

- **Provide a level of quality assurance and consumer protection.**
  - Through delivering a network of trusted and reliable installers.
    - Market has been badly affected by cold calling, misinformation and poor workmanship.
    - Therefore network should give householders confidence when selecting an installer.

- **Provide a matrix allowing householder to select an installer based on personal requirements.**
  - Pilot programme – test and evaluate what types of installers are popular – small local service or large well-known brand.
  - Displayed as a search tool – allow householder to search based on their personal requirements.

# Accreditations

- First level of quality assurance – ensure contractor is accredited/qualified to carry out work.
- Challenge: Large number of different accreditation and trade bodies.
  - Each providing varying levels of vetting & consumer protection.
  - E.g GasSafe legal requirement, others beneficial but not essential.
- Requirement: Installer required to hold at least one relevant accreditation.
- Following accreditations essential:
  - Gas condensing boiler – GasSafe.
  - Complex insulation measure – PAS2030:17.
  - Renewable technology – Microgeneration Certification Scheme.
  - Closely aligned with HEEPS loan installer criteria.
- Most bodies have complaints procedure or arbitration service for disputes.

# Installer Research

- **Researched Installers through following channels:**
  - Accreditation websites.
  - Trade body memberships.
  - Existing installer relationships.
- **Vetting:**
  - Around 300 Accredited Installers scoped – then filtered by customer reviews.
  - Installer must have 90% positive reviews to be considered.
  - Hold at least 3 customer reviews left across different review sites.

| Accreditation | Sourced From | Comments | Review Sites checked |
|---|---|---|---|
| GasSafe, TrustMark | Gas Safe | Large company, mainly positive reviews. | Google reviews |
| GasSafe, Trusted trader, OFTEC, SNIPEF | Gas Safe | Lots of positive ratings - trusted trader | Reference line, facebook. |
| Gas Safe | Gas Safe | Mainly negative reviews | Yell, google reviews |
| GasSafe | GasSafe | Mixed Reviews | Yell, Google |
| Gas Safe, SNIPEF, OFTEC, Trusted Trader | Trusted Trader | Mainly positive, trusted trader | Referenceline, yell |
| Gas Safe | Gas Safe | Very positive reviews - including for installs | Boiler guide, my builder, facebook |
| Gas Safe | Gas Safe | Positive reviews | Facebook, google review |
| GasSafe | GasSfe | Only 1 Review but positive. | Yell |
| GasSafe | GasSafe | Only 2 Reviews but postitive | Google |
| Gas Safe, SNIPEF, OFTEC, Trusted Trader | GasSafe | Excellent reviews. | Referenceline, Google, Yell |
| Gas Safe, Trusted Trader | Gas Safe | Works with Anne - positive reviews, trusted trader. | Reference line, trust pilot, google reviews. |
| Gas Safe, OFTEC, Trusted Trader | Trusted Trader | Works with Anne - Positive reviews, trusted trader. | Reference line, Yell |
| Gas Safe, Trusted Trader | Trusted Trader | Quite a bit of work with Anne, she rates, positive reviews, trusted trader. | Facebook, Yell, referenceline |

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# Vetting - Trading Standards

- **Potential further vetting methods of applicants:**
  - Financial history, consumer complaints, interviews.

- **Barriers:**
  - Resource & time to investigate each installer.
  - Access to database & records to carry out this level of vetting.
  - Complex application process could be prohibitive to quality installers.

- **Trading Standards:**
  - Looked to enlist the help of Trading Standards – have experience of carrying out this level of vetting and have access to records.
  - Trading Standards manage Trusted Traders Scheme in each Local Authority – very limited number of energy efficient installers registered as Trusted Traders.
  - Shared goals – consumer protection, promotion of reputable traders.

# Vetting - Trading Standards

- **Proposal: Work in partnership with Trading Standards.**
  - Trading Standards assist with vetting process and we would cross promote installers to boost their numbers.

- **Issues:**
  - Additional time and pressure on Trading Standards resources.
  - Trusted Traders Scheme in East/South Ayrshire had paid membership – could cause dissatisfaction with existing traders as our network is free.

- **Workaround:**
  - Encourage applicants to Accredited Installer list to make a separate application to Trusted Traders scheme.
    - Worked well in D & G where no membership fee, less successful in other LA's where there is a fee.

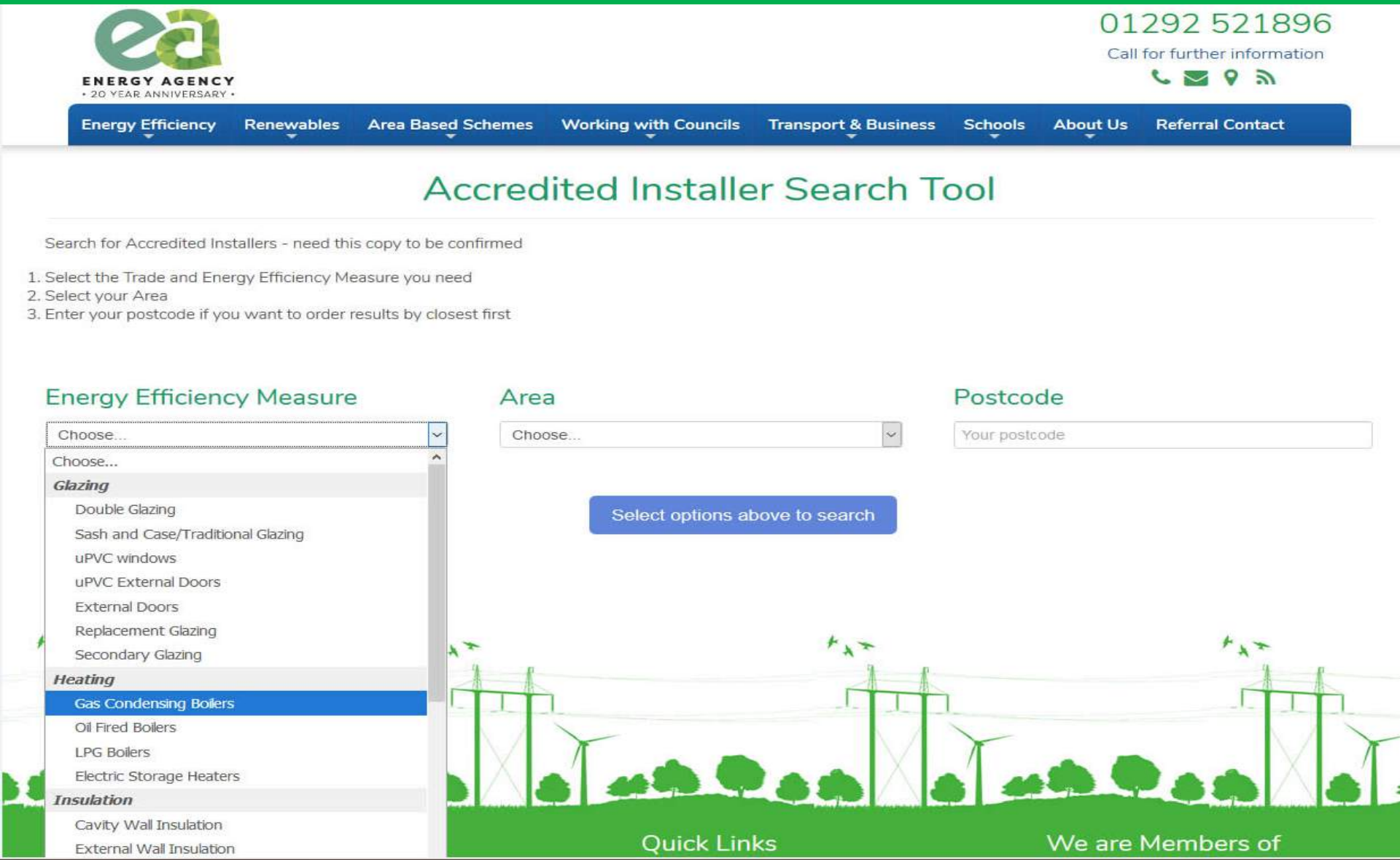
- **Vetting in absence of Trading Standards:**
  - Public liability insurance checks, trading for at least 6 months & Company House check on financial information.

# Marketing to Installer

- **Promoted benefits – why would installers want to join:**
  - Promote reputable brand image & boost company profile.
  - Specialised and specific to energy efficiency measures.
  - Opportunity to be retained for future programmes.

- **Barriers**
  - High quality installers are often already very busy and don't always have need for additional works.
  - Installers used to working on large 'whole street' projects less interested in quoting for individual jobs.

# Presenting to Householder



# Presenting to Householder

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## Accredited Installer Details

This is the installer detail view. We need some introductory copy here.

### Installer

Ecosave Installations Ltd

71 Kilbowie Road, Clydebank, G81 1BL

### Contact Details

Phone: 0141 952 9004

Email: monica@ecosaveinstallations.co.uk

Website: www.ecosaveinstallations.co.uk

Back

### Accredited to install

- Gas Condensing Boilers
- Cavity Wall Insulation
- External Wall Insulation
- Internal Wall Insulation
- Loft Insulation
- Room-in-Roof Insulation
- Under-Floor Insulation
- Draught Proofing

### Accreditations

GAS safe | GREEN DEAL APPROVED | PAS2030

### Reviews

> This is the test review.
>
> Some user
> — Rating ★ ★ ★ ★

> Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

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# Results so Far

- **44 installers registered for Accredited Installer network so far.**
  - 24 Heating Engineers, 16 Insulation Installers, 2 Renewables Technology Installers, 2 Efficient Glazing Installers.
  - Around 20% of installers invited to apply made an application.

- **27 householders requested access to Accredited Installer Network**
  - 65% of householders who have received advice visit have accessed network.

- **20% of registered installers are now members of Trusted Traders Schemes and have been vetted by Trading Standards.**

# Barriers & Challenges

- **Resource and experience required to carry out relevant vetting.**

- **Quality control at installation stage:**
  - Contract between householder and installer.
  - Installation stage not managed directly by Local Authority or managing agent in same way as HEEPS ABS.

- **Measure specific:**
  - Less interest from installers of certain measures to join scheme.
    - 24 Heating Engineers registered but only 2 renewables and glazing installers registered.
  - Lack of local installers who hold accreditation to install certain measures:
    - e.g. most installers who hold PAS2030:17 for certain insulation measures are based in the central belt.

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# Lessons & Thoughts for Future

- **Possibility of a standardised vetting process:**
  - **Relationship with Trading Standards at national level?**
- **Quality vs Choice:**
  - **Thorough vetting process to ensure quality without being excessive/time consuming and prohibitive to applicants.**
- **Experience has been positive:**
  - **Installers and householders are receptive and enthusiastic.**
  - **Bodes well for development of future energy efficient supply chains.**

# Energy Performance Certificates: An Alternative Approach

**Dr Keith Baker**
**Built Environment Asset Management (BEAM) Centre, Glasgow Caledonian University, The Energy Poverty Research initiative, & Common Weal**

**T. +44 (0) 7884 125540**
**E. keith.baker@gcu.ac.uk**
**W. www.energypovertyresearch.org**
**Twitter: @Stumpysheep**

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# Outline

- A very brief introduction to the Energy Performance of Buildings Directive
- What's wrong with using Energy Performance Certificates?
- Using real data
- An alternative Energy Performance Certificate
- Rethinking fuel poverty as a complex problem
- Further reading on fuel poverty and supply chains

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# A very brief introduction to the implementation of the Energy Performance of Buildings Directive (EPBD)

- EPBD requires EPCs to be produced for all new buildings and those being sold or rented, as of August 2007
- In the UK, EPCs are produced using the BREDEM 12 model for dwellings and the SBEM model for non-domestic buildings however, this is a devolved responsibility, so Scotland could choose to adopt an alternative approach
- The Scottish Government's Operating Framework requires only 2% of domestic EPCs to be sampled, and their 'validity' is checked against the (modelled) SAP rating, not actual (measured) energy performance

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# Key quotes from the EPBD

*"The prospective buyer and tenant of a building or building unit should, in the energy performance certificate, be given correct information about the energy performance of the building and practical advice on improving such performance."*

*"The energy performance of a building shall be determined on the basis of the calculated or actual annual energy that is consumed in order to meet the different needs associated with its typical use"*

*"When setting energy performance requirements for technical building systems, Member States should use, where available and appropriate, harmonised instruments,"*

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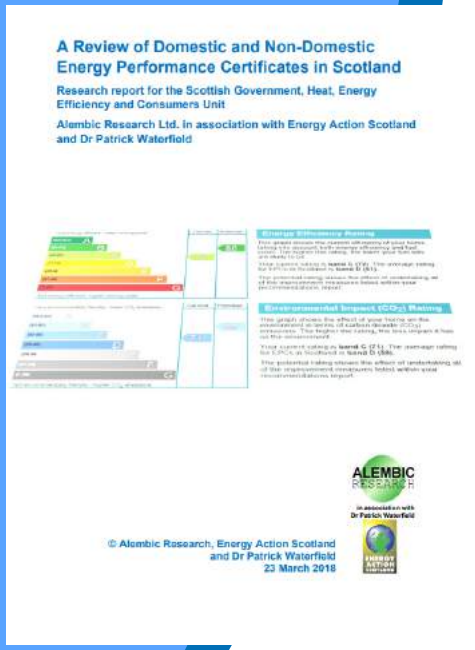
# What's wrong with using EPCs?

*"The current EPC process was designed to produce an asset rating to comply with the requirements of the EPBD. What may have been sufficient as a general measure of energy performance, using a simplified energy model and an A to G banding may not be appropriate if the same system is utilised to regulate compliance with energy efficiency standards in existing buildings".*




**Alembic Research, Energy Action Scotland, & Dr Patrick Waterfield, 2019. A Review of Domestic and Non-Domestic Energy Performance Certificates in Scotland. Report for the Scottish Government.**

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**But using Energy Performance Certificates to drive mandatory improvements to dwellings is a key part of the Scottish Government's Energy Efficiency Strategy, which aims to eliminate energy inefficiency as a driver for fuel poverty, so surely they must be a reasonable measure of success?**

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# Sorry….

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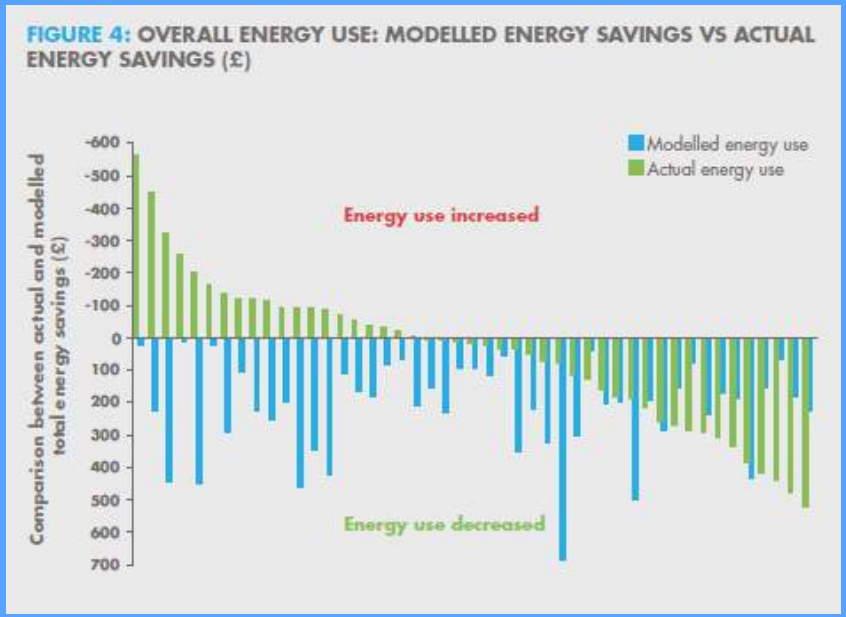
# Real data versus Energy Performance Certificates

***"FutureFit has found that SAP is not an accurate modelling tool for existing homes"***

**Study based on 150 homes across England, metered energy data and monitored internal and external temperatures, pre and post-intervention.**




**Source:** Jones Lang LaSalle, 2012. A Tale of Two Buildings: Are EPCs a true indicator of energy efficiency?. Better Buildings Partnership.

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# It’s only a model!!!!


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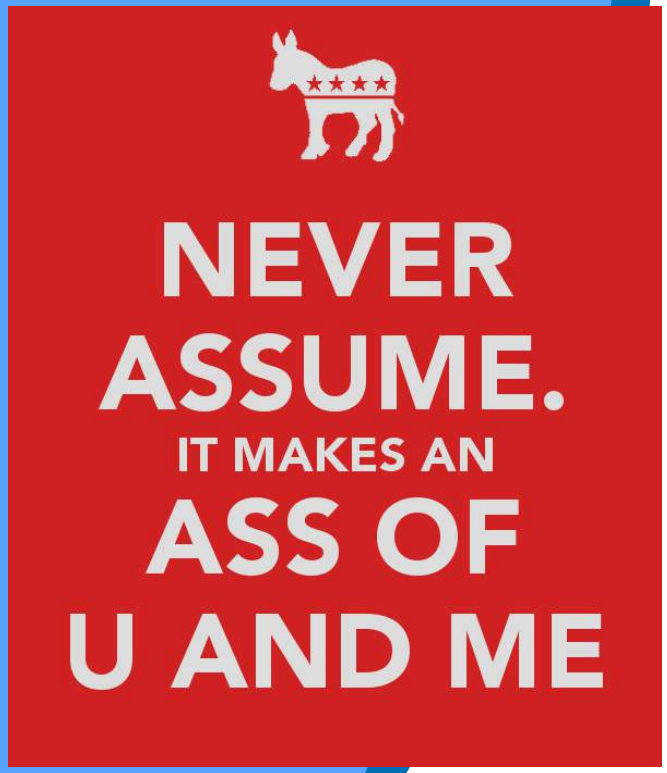
# Models are built on assumptions

*"Real data may also enable more extensive validity-testing of some key assumptions made in estimations of fuel poverty prevalence which derive from the UK's application of the BREDEM model."*




**Bramley, G., Fitzpatrick, S., Liddell, C., & Webb, J., 2017. A new definition of fuel poverty in Scotland: A review of recent evidence. Report for the Scottish Government.**

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# Models are insensitive

*"While a key strength of Boardman's definition is its rootedness in robust evidence from building science, an unintended consequence is that the definition is insensitive to the human realities of being fuel poor, which are diverse in both origin and solution (Mould & Baker, 2017a). Consequently, Scottish discourse related to energy vulnerability focuses on alternative concepts such as exposure to fuel poverty, sensitivity to its impacts, and a household's adaptive capacities for coping with it (e.g. Mould and Baker, 2017b)."*

**Bramley, G., Fitzpatrick, S., Liddell, C., & Webb, J., 2017. A new definition of fuel poverty in Scotland: A review of recent evidence. Report for the Scottish Government.**

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# Using real data

- **To date, 8 studies of socio-economic influences on household energy consumption / expenditure using real data have been conducted in the UK**
  - We claim the first (Leicester and Sheffield), the first in Scotland (the Renfrewshire study), and the first to look specifically at the impact of the urban / rural divide (Proiseact Spéird).
  - The methodologies for all three studies were deliberately designed to avoid the need for additional data collection beyond that already available to central and local government, and (wherever possible) to eliminate the use of assumptions and proxy data.
  - Making greater use of real data is one of the recommendations made in the 2017 academic panel review of the fuel poverty definition commissioned by the Scottish Government. So far, it has been rejected.

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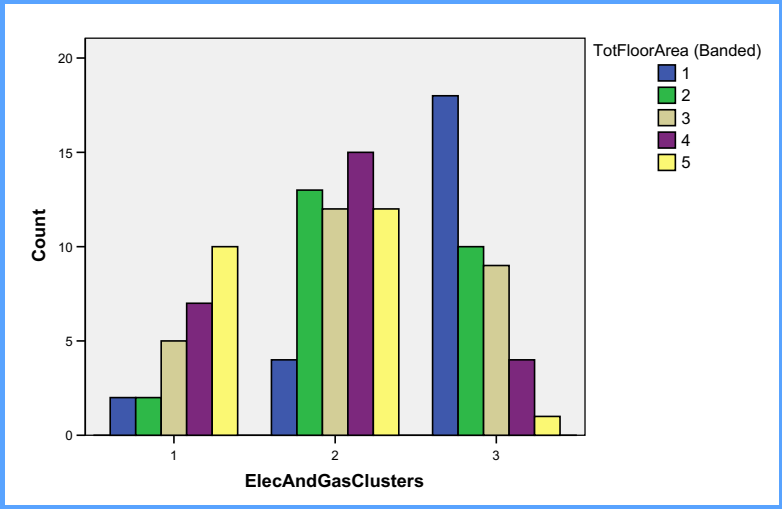
# What does real data tell us?




**Total floor area is a strong predictor of energy consumption**

Data for 154 households across three groups of homogenous (enough) dwellings in Leicester and Sheffield. The three clusters are statistically significant groups of high, medium and low energy users (note: in reverse order). In this study TFA (even grouped to 20% bands) was found to explain ~49% of the variation in energy consumption.

**Source: Baker, K.J., 2007. Sustainable Cities: Determining indicators of domestic energy consumption. PhD thesis. Institute for Energy and Sustainable Development (IESD), De Montfort University, Leicester, UK.**

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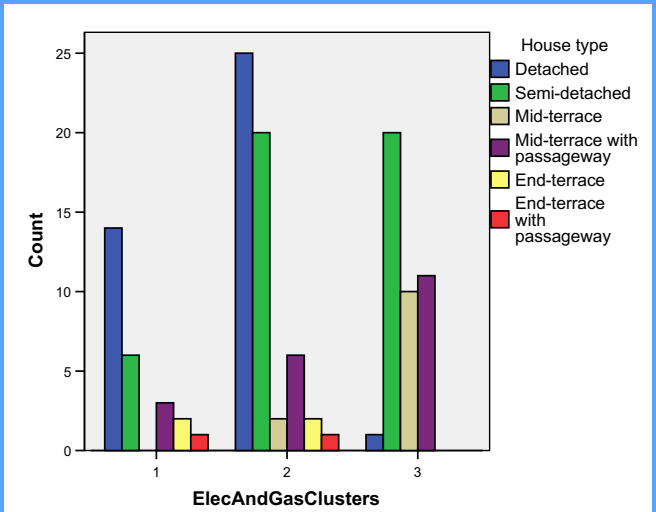
# What does real data tell us?




**Built form is a poor(ish) predictor of energy consumption**

Data for 154 households across three groups of homogenous (enough) dwellings in Leicester and Sheffield. The three clusters are statistically significant groups of high, medium and low energy users.

**Source: Baker, K.J., 2007. Sustainable Cities: Determining indicators of domestic energy consumption. PhD thesis. Institute for Energy and Sustainable Development (IESD), De Montfort University, Leicester, UK.**

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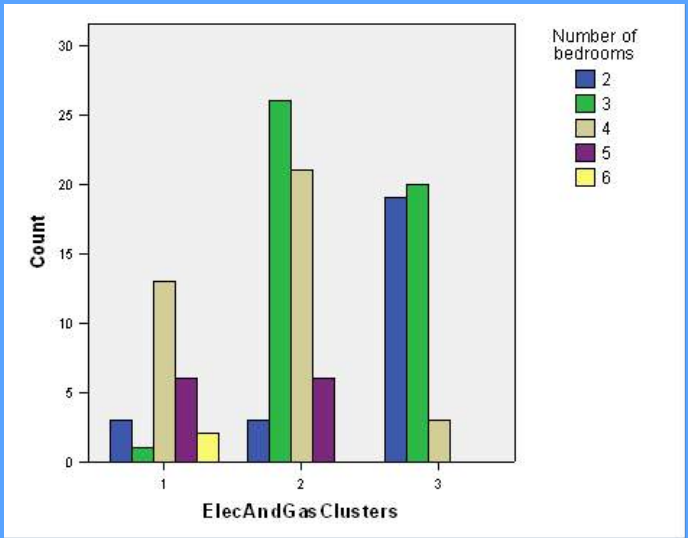
# What does real data tell us?




**The number of bedrooms is a strong predictor of energy consumption - ?**

For those same clusters there was a strong correlation between the number of bedrooms and household energy consumption – or at least that's what we thought back in 2007.

Source: Baker, K.J., 2007. Sustainable Cities: Determining indicators of domestic energy consumption. PhD thesis. Institute for Energy and Sustainable Development (IESD), De Montfort University, Leicester, UK.

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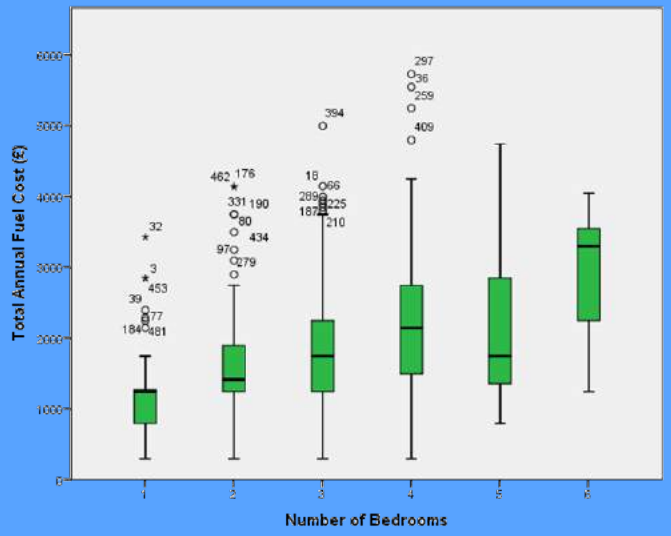
# What does real data tell us?




**The number of bedrooms is a *poor* predictor of energy consumption - ?**

Proiseact Spéird - Data for total annual energy costs (all uses) for 515 households in heterogeneous dwellings in the Orkney Isles (mixed fuel – includes mains gas, main electricity, oil, LPG, coal, biomass, and some micro-renewables).

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# Interjection!

**But the number of bedrooms is only a proxy for occupancy, and the Orkney households are highly heterogeneous, so if we use actual occupancy and normalise a load of the variables the correlation will be stronger, right?**

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# Sorry again….

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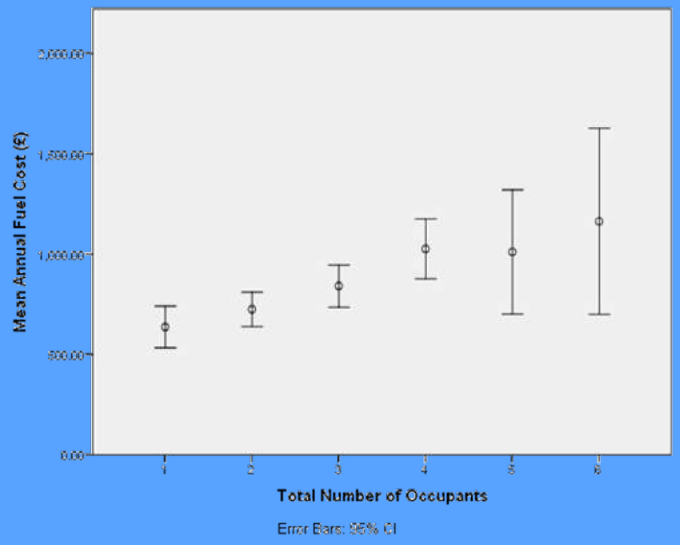
# What does real data tell us?




**Occupancy is a *poor(ish)* predictor of energy consumption**

Although commonly assumed to be a strong predictor of household energy consumption, an analysis of real heating cost data for a highly homogeneous group of dwellings illustrates the dangers of assuming correlation means causation.

Proiseact Spéird - Data for mean annual heating (only) fuel costs for 128 households in highly homogeneous dwellings near Portree, Skye (metered data, biomass DHS).

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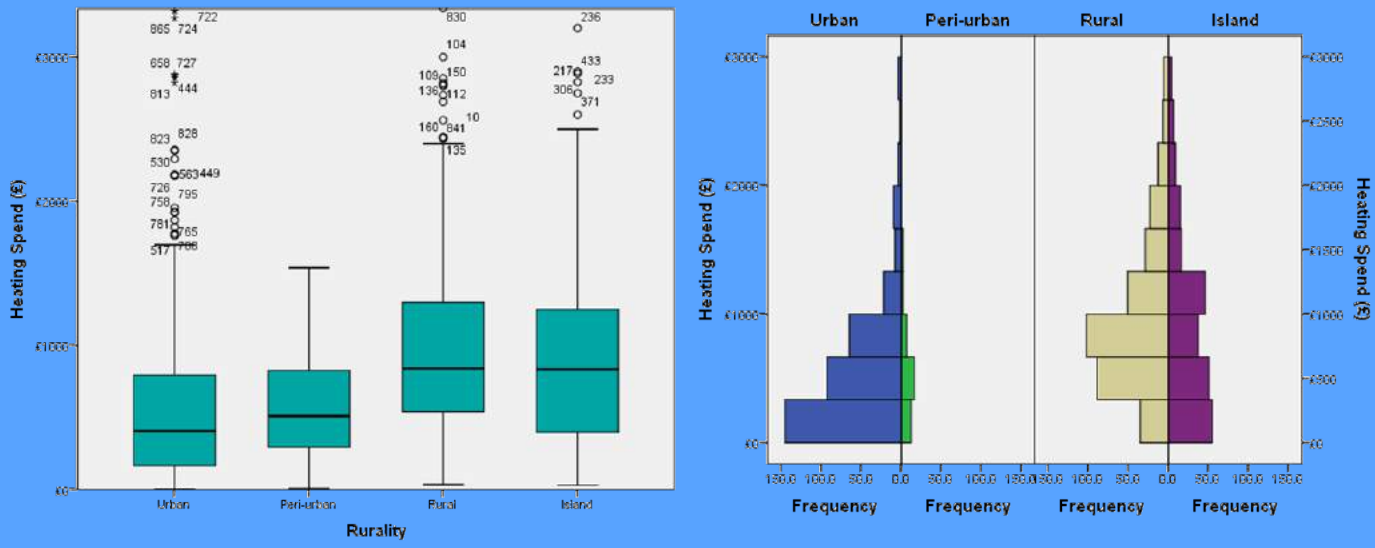
# What does real data tell us?




**Rural and island households not only spend significantly more on energy for heating, but the distributions of expenditure across the urban-rural divide are different too**

Proiseact Spéird – Data on heating energy expenditure for 1,015 households across Aberdeenshire, Argyll and Bute, Lochaber, the Orkney Isles, Renfrewshire and Skye

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**Building scientists have been telling governments about the limitations of energy models for *decades*….**

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# For example….


Affinity Sutton, 2013. FutureFit: Final Report Part 2. Affinity Sutton July 2013. Available at: http://www.affinitysutton.com/media/364652/futurefit-quick-links-PDF-1.pdf

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Bruhns H, Steadman P, Herring H. 2000. A database for modelling energy use in the non-domestic building stock of England and Wales. Applied Energy, 66, pp. 277-297.

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# For example….


IMechE, 2011. Scottish Energy 2020? Institution of Mechanical Engineers, London, UK. Available at: http://www.imeche.org/docs/default-source/2011-press-releases/IMechE_Scottish_Energy_Report.pdf?sfvrsn=0

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Kelly S. 2011. Do homes that are more energy efficient consume less energy?: A structural equation model of the English residential sector, Energy, 36, pp. 5610-5620

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UKGBC, 2010. Zero-Carbon Non-Domestic Buildings. UK Green Building Council, March 2010.

Watts, C., Jentsch, M.F., & James, P.A.B., 2011. Implications of Energy Performance Certificates for the UK domestic building stock – Feedback from a Southampton homeowner survey. CIBSE Technical Symposium, De Montfort University, Leicester, UK – 6th and 7th September 2011.

Wright, A., 2008. What is the relationship between built form and energy use in dwellings? Energy Policy, Vol. 36, Issue 12, December 2008, pp.4544-4547.


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# Are we having fun yet?

**Real data – great fun for researchers, but not so much fun for policymakers**

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# So what can we do about EPCs?

- Business as usual - carry on believing in the validity of EPCs in their current form, fail the fuel poor, and get ready for legal action when mandatory upgrading is brought in (as it should be)
- Keep plugging away at improving the existing modelling – and watch those costs steadily add up whilst getting only incrementally closer to what real data can tell us today
- Develop bespoke Scottish domestic and non-domestic building models – at a huge (prohibitive) cost to the public purse
- Or maybe it's time to rethink the approach?

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**In late 2018 we published a full critique of EPCs and our proposals for an alternative approach that is better aligned with the requirements of the EU's Energy Performance of Buildings Directive.**


**See:** https://commonweal.scot/library/energy-performance-certificates-an-alternative-approach/

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# An Alternative Domestic EPC

- It is entirely possible to construct an alternative EPC that meets the both the requirements and the intentions of the EPBD without resorting to modelled data on the energy consumption of an existing building.
- For a domestic dwelling this would replace this modelled data with measured energy consumption (and, noting the tariff, cost) as an annual figure, and per square metre, and be for the previous year as of the date of the inspection unless the property has been void for a significant period of time. This would meet the EPBD criterion for 'correct information'.
- In order to be 'practical' and reflect 'typical use' some additional, and suitably anonymised, contextual information on the previous occupants would be added as regards their household type and occupancy regime, sufficient for a potential buyer or tenant to relate these to their own circumstances, and therefore infer how much their own energy use may differ. (In reality, as many buyers and tenants already meet the previous occupants this merely formalises an otherwise common informal exchange of information.)

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# An Alternative Domestic EPC

- The proliferation of smart technologies should ultimately mean internal temperatures will be monitored by heating and cooling systems, and the data reported as part of an EPC. However, in the meantime, owners and landlords would be encouraged to record, or at least report, these voluntarily for inclusion in an EPC as a further steer for buyers and tenants.
- For new build, it is inevitable that the initial EPC will be based on modelled data due to the need for production pre-occupation. However, this would be replaced by a second EPC one year post-occupation, with financial penalties applied where modelled energy consumption is significantly lower than actual consumption.
- The 'recommended measures' section of an EPC would be split into two sections, one covering simple measures (e.g. insulation) for which good (enough) Scottish data is available, and the other covering more complex measures (e.g. renewable energy technologies) for which additional on-site assessments are needed, and which would be filtered by an assessor. The data gathered as part of this could also form the basis of a Scottish fork for BREDEM / SAP.

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# An Alternative Domestic EPC

- The approach also provides an opportunity to merge the Scottish Sustainability Label with EPCs to provide a more holistic set of recommendations (the resource use section of an SSL already replicates part of an EPC and SSL criteria relate directly to the Building Standards). The costs of this would be partially offset by owners self-reporting against the additional SSL criteria, which would then be verified by an assessor as part of producing a new EPC.
- New EPCs would be required for all properties periodically (e.g. every 10 years) should an assessment not be triggered by sale, rental or extension.
- This alternative approach would leave the general appearance of EPCs unchanged and meet with the requirements of the EPBD, and would provide a much more realistic and tangible assessment of energy use and general building performance to potential buyers and tenants. It would also introduce an element of enforcement and discourage 'optimistic' assessments of energy performance.
- It is entirely within the powers of the Scottish Government to do this.

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# An Alternative Non-Domestic EPC

- Essentially the same approach as for alternative domestic EPCs.
- The availability of half-hourly data would be used to provide full load profiles to buyers and tenants (where not deemed commercially confidential).
- Adopting the 'soft landings' approach to post-occupancy evaluation of new build would become mandatory, with full second assessments required at 3-5 years post-occupation.
- Although the Scottish Sustainability Label is not fully developed for non-domestic buildings this could be finished in parallel with preparing to implement alternative EPCs, and if necessary non-domestic EPCs could be extended to include the full SSL criteria as part of future revisions.
- Again, it is entirely within the powers of the Scottish Government to do this.

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# And EPCs are only one barrier (albeit a substantial one) to tackling fuel poverty

*"As academics and practitioners we share the view that in an energy rich nation it is not acceptable that such a large proportion of households suffer daily the deleterious effects of energy rationing, or that they are forced to manage debts just to maintain a reasonable modern standard of living.*

*We believe we have a duty to continually question our understanding of this modern societal inequality, and the methods and approaches we take to identifying and tackling it."*

**Founding statement of the Energy Poverty Research initiative, August 2017.**

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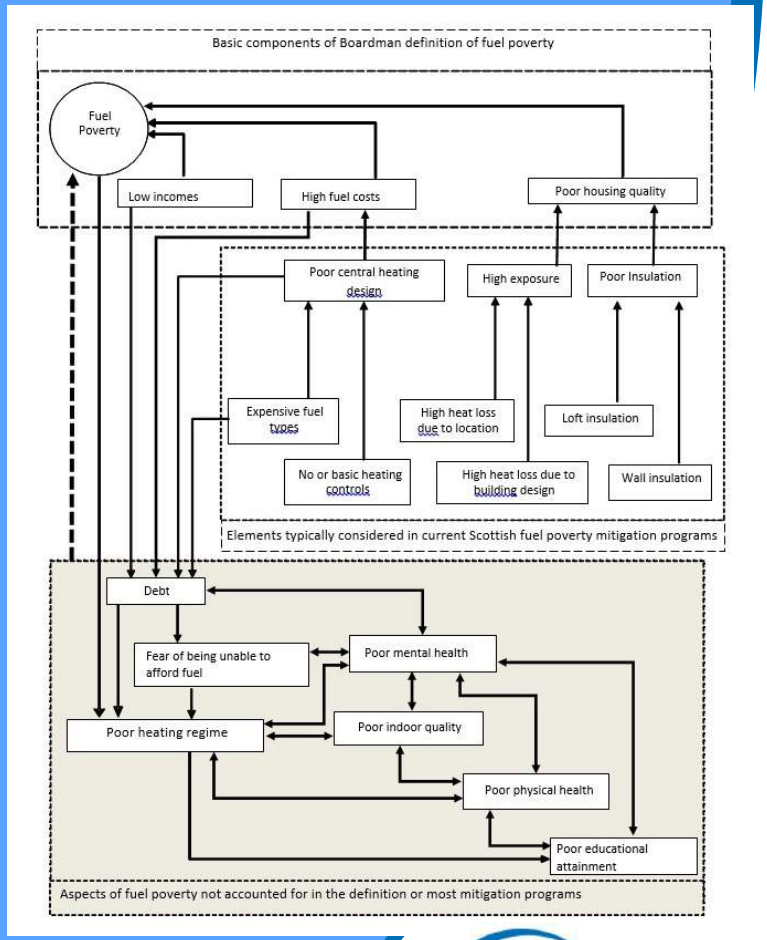
# Reconceptualising Fuel Poverty as a Complex Problem

**Our research has shown how it is entirely possible, and socially desirable, to reconcile the Boardman-based ('10% of income') definition of fuel poverty with a wider complexity and risk-based assessment of householder vulnerability.**




**Source:** Mould, R., & Baker, K.J., 2017. Documenting fuel poverty from the householders' perspective. Energy Research & Social Science, 31, (2017), pp.21–31.

**Reproduced in:** Baker, K.J., Mould, R., & Restrick, S., 2018. Rethink fuel poverty as a complex problem. Nature Energy, Nature Energy, 2nd July 2018. Available at: https://rdcu.be/2j8E

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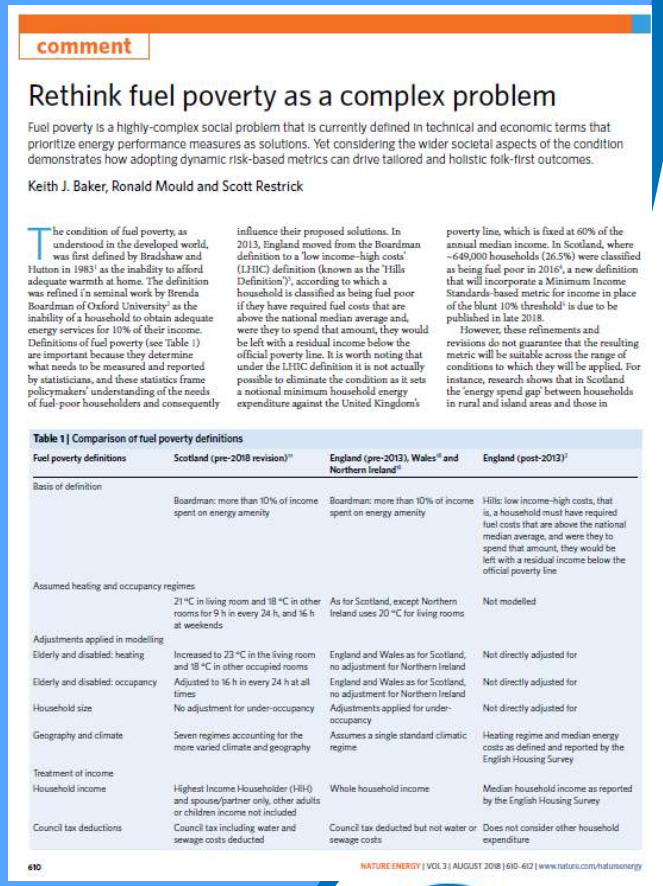
# Did we mention making Nature Energy?

**Invited article.**

**Baker, K.J., Mould, R., & Restrick, S., 2018. Rethink fuel poverty as a complex problem. Nature Energy, 2nd July 2018.**

**Available at: https://rdcu.be/2j8E**



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## Rethink fuel poverty as a complex problem

Fuel poverty is a highly-complex social problem that is currently defined in technical and economic terms that prioritize energy performance measures as solutions. Yet considering the wider societal aspects of the condition demonstrates how adopting dynamic risk-based metrics can drive tailored and holistic folk-first outcomes.

Keith J. Baker, Ronald Mould and Scott Restrick

The condition of fuel poverty, as understood in the developed world, was first defined by Bradshaw and Hutton in 1983[1] as the inability to afford adequate warmth at home. The definition was refined in seminal work by Brenda Boardman of Oxford University[2] as the inability of a household to obtain adequate energy services for 10% of their income. Definitions of fuel poverty (see Table 1) are important because they determine what needs to be measured and reported by statisticians, and these statistics frame policymakers' understanding of the needs of fuel-poor householders and consequently influence their proposed solutions. In 2013, England moved from the Boardman definition to a 'low income–high costs' (LIHC) definition (known as the 'Hills Definition')[3], according to which a household is classified as being fuel poor if they have required fuel costs that are above the national median average and, were they to spend that amount, they would be left with a residual income below the official poverty line. It is worth noting that under the LIHC definition it is not actually possible to eliminate the condition as it sets a notional minimum household energy expenditure against the United Kingdom's poverty line, which is fixed at 60% of the annual median income. In Scotland, where ~649,000 households (26.5%) were classified as being fuel poor in 2016[4], a new definition that will incorporate a Minimum Income Standards-based metric for income in place of the blunt 10% threshold[5] is due to be published in late 2018.

However, these refinements and revisions do not guarantee that the resulting metric will be suitable across the range of conditions to which they will be applied. For instance, research shows that in Scotland the 'energy spend gap' between households in rural and island areas and those in

**Table 1 | Comparison of fuel poverty definitions**

| Fuel poverty definitions | Scotland (pre-2018 revision)[37] | England (pre-2013), Wales[38] and Northern Ireland[39] | England (post-2013)[3] |
|---|---|---|---|
| Basis of definition | | | |
| | Boardman: more than 10% of income spent on energy amenity | Boardman: more than 10% of income spent on energy amenity | Hills: low income–high costs, that is, a household must have required fuel costs that are above the national median average, and were they to spend that amount, they would be left with a residual income below the official poverty line |
| Assumed heating and occupancy regimes | | | |
| | 21 °C in living room and 18 °C in other rooms for 9 h in every 24 h, and 16 h at weekends | As for Scotland, except Northern Ireland uses 20 °C for living rooms | Not modelled |
| Adjustments applied in modelling | | | |
| Elderly and disabled: heating | Increased to 23 °C in the living room and 18 °C in other occupied rooms | England and Wales as for Scotland, no adjustment for Northern Ireland | Not directly adjusted for |
| Elderly and disabled: occupancy | Adjusted to 16 h in every 24 h at all times | England and Wales as for Scotland, no adjustment for Northern Ireland | Not directly adjusted for |
| Household size | No adjustment for under-occupancy | Adjustments applied for under-occupancy | Not directly adjusted for |
| Geography and climate | Seven regimes accounting for the more varied climate and geography | Assumes a single standard climatic regime | Heating regime and median energy costs as defined and reported by the English Housing Survey |
| Treatment of income | | | |
| Household income | Highest Income Householder (HIH) and spouse/partner only, other adults or children income not included | Whole household income | Median household income as reported by the English Housing Survey |
| Council tax deductions | Council tax including water and sewage costs deducted | Council tax deducted but not water or sewage costs | Does not consider other household expenditure |



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# Rethinking Fuel Poverty as a Complex Problem

***"Fuel poverty is a highly complex social problem that is currently defined in technical and economic terms that prioritise energy performance measures as solutions. Yet considering the wider societal aspects of the condition demonstrates how adopting dynamic risk-based metrics can drive tailored and holistic folk-first outcomes."***

**Source: Baker, K.J., Mould, R., & Restrick, S., 2018. Rethink fuel poverty as a complex problem. Nature Energy, 2nd July 2018. Available at: https://rdcu.be/2j8E**

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# Redefining success

***"An effective policy or intervention is one which not only serves to lift a household out of fuel poverty but which also serves to increase their resilience to the fuel poverty condition".***

**Source: Baker, K.J., Mould, R., & Restrick, S., 2018. Rethink fuel poverty as a complex problem. Nature Energy, 2nd July 2018. Available at: https://rdcu.be/2j8E**

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# Further reading on supply chains

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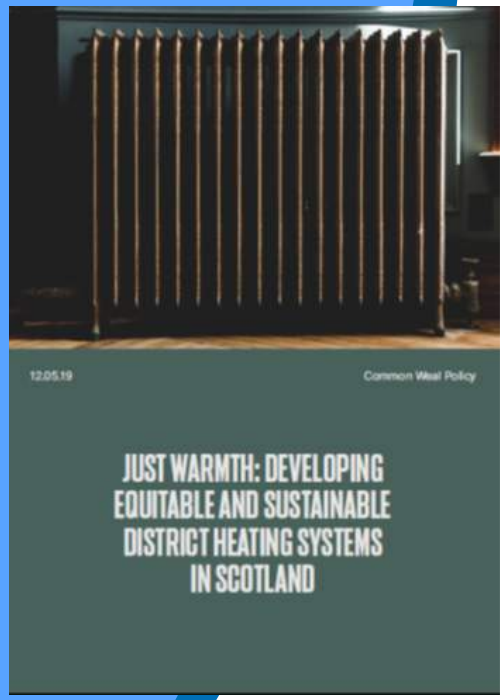
# Tackling fuel poverty and deprivation by enabling sustainable district heating and supply chains

*"The development of local, sustainable biomass supply chains to provide fuel for new 'Danish model' multi-technology district heating schemes presents significant opportunities to leverage direct and co-benefits for job creation, recreation, tourism, enhancing biodiversity, tackling climate change and fuel poverty, and regenerating deprived rural and remote areas of Scotland. This is an opportunity Scotland cannot afford to miss."*

## Just Warmth: Developing equitable and sustainable district heating systems in Scotland




**Available at:** https://commonweal.scot/policy-library/just-warmth

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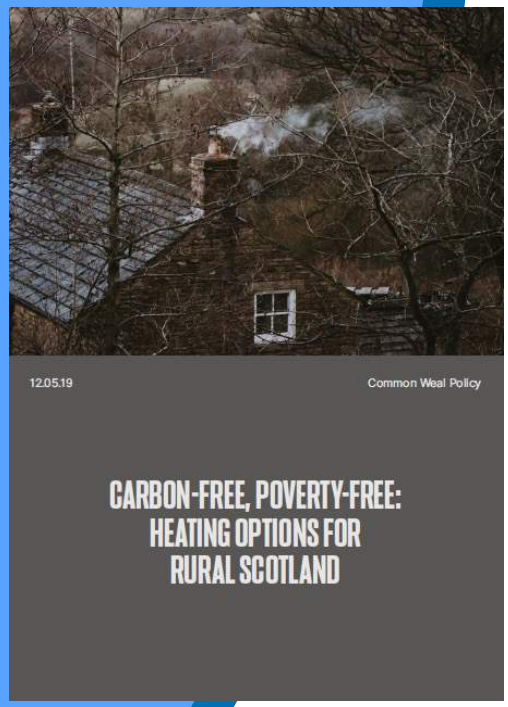
# Tackling fuel poverty and decarbonising off-gas households

*"We recommend that a ban on the sale of all new oil and coal boilers be implemented alongside the introduction of the revised Scottish Building Standards in 2021.*

*In order to develop the necessary infrastructure and fuel supply chains necessary to maximise the benefits of heat networks we recommend the urgent adoption of a Danish-style Heat Supply Act, which should also be introduced alongside the revised Scottish Building Standards in 2021."*




## New paper: Carbon-free, Poverty-free: Heating options for rural Scotland

**Available at: https://commonweal.scot/policy-library**

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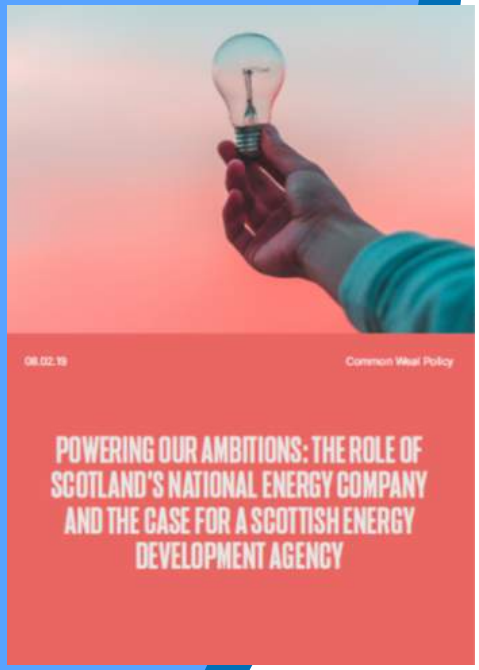
# The case for a Scottish Energy Development Agency

*"The Scottish Energy Development Agency should coordinate the distribution of R&D funding and any funds associated with strategic planning and overcoming the rural / urban fuel divide, coordinate and prioritise the training of technology experts in various district heating technologies and enable wider social and economic value through identifying projects that may offer poor commercial returns but would deliver indirect benefits (co-benefits) to the economy, society, and the environment."*




## Powering Our Ambitions: The role of Scotland's Publicly Owned Energy Company and the case for a Scottish Energy Development Agency

**Available at:** [https://commonweal.scot/policy-library/powering-our-ambitions](https://commonweal.scot/policy-library/powering-our-ambitions)

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**And coming from Common Weal and EPRi in autumn 2019….**

**The case for a publicly-owned Scottish National Energy Service**

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# And finally…. the inevitable plug ☺

# Managing the decline of fossil fuels: The Long Goodbye?

**Dr Geoff Wood & Dr Keith Baker (eds). Palgrave Macmillan, Oct 2019.**

**Contributions by over 20 international experts including: Olafur Grimsson, former President of Iceland; Dr Paul Dorfman on nuclear; Prof David Elliott on carbon capture and storage; and special guest authors on Russia and gas.**

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# Discussion