

Better Homes, Better Wales, Better World

Recommendations of the Welsh Government advisory group
on the decarbonisation of existing homes

Christopher Jofeh, Arup, and Kevin Hammett, Welsh Government

27 September 2019

**Cartrefi
Cymunedol
Cymru** | **Community
Housing
Cymru**



Better Homes, Better Wales, Better World

Decarbonising existing homes in Wales

Report to Welsh Ministers from the Decarbonisation
of Homes in Wales Advisory Group

18 July 2019

Cartrefi Gwell, Cymru Well, Byd Gwell

Datgarboneiddio cartrefi presennol
yng Nghymru

Adroddiad i Weinidogion Cymru gan y Grŵp Cynghori
ar Ddatgarboneiddio Cartrefi yng Nghymru

18 Gorffennaf 2019

Ateb Housing Association
Building Research Establishment
Cadwyn Housing Association
Cardiff Council
Catrin Maby, Independent Consultant
Community Housing Cymru
Constructing Excellence Wales
Design Commission for Wales
Development Bank of Wales
Energy Savings Trust
Federation of Master Builders
Fusion21
Grwp Cynefin
Institute of Welsh Affairs
Melin Homes
Mid Wales Housing Association

National Energy Action
National Landlords Association
Office of the Future Generations Commissioner
Residential Landlords Association
Royal Institution of Chartered Surveyors
Royal Society of Architects Wales
Royal Town Planning Institute
Sero Homes
SPECIFIC at Swansea University
Sustainable and Traditional Buildings Alliance
Taff Housing Association
UK Finance
Valleys to Coast Housing Association
Wales and West Utilities
Welsh Local Government Association
Welsh School of Architecture



Llywodraeth Cymru
Welsh Government

Arolwg Cyflwr Tai Cymru (ACTC) 2017-18: Prif ganlyniadau

Welsh Housing Conditions Survey (WHCS) 2017-18: Headline results

Gowan Watkins

Pennaeth Tîm Rhaglen Tystiolaeth Cyflwr Tai
Head of Housing Conditions Evidence Programme

Homes of today for tomorrow

Decarbonising Welsh Housing between 2020 and 2050

STAGE 2:
**Exploring the potential of the Welsh housing
stock to meet 2050 decarbonisation targets**

Ed Green, Simon Lannon, Jo Patterson, Heledd Iorwerth
Welsh School of Architecture, Cardiff University

Issue: 20.05.2019





UCL

Understanding Entry Points for Changing Behaviours to Decarbonise the Privately-Owned Housing Stock in Wales

Dr. Paul Chadwick

Associate Professor and Deputy Director

UCL Centre for Behaviour Change

Dr. Jo Hale

Senior Research Associate

Complex Urban Systems for Sustainability and Health (CUSSH)

UCL Centre for Behaviour Change

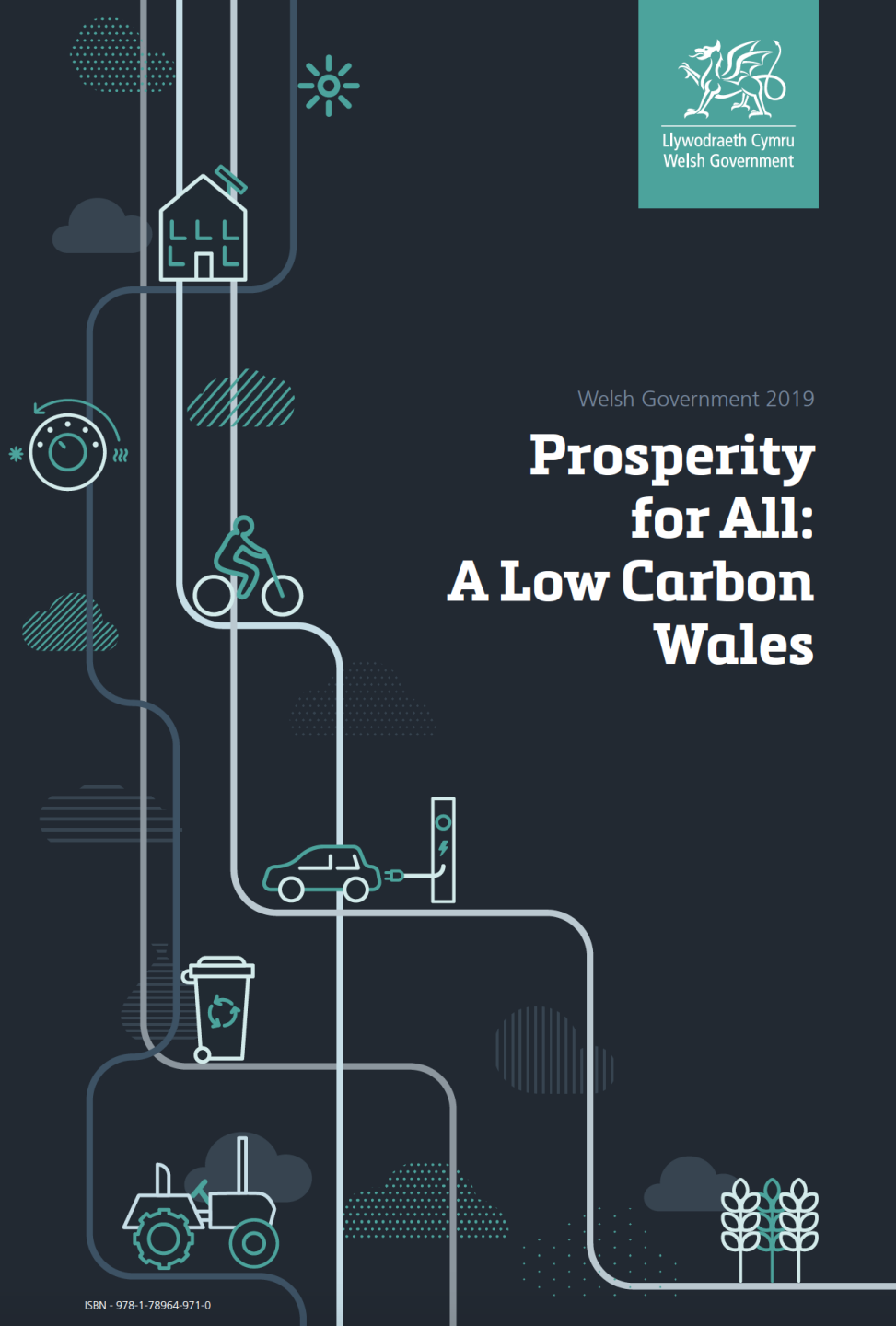




Llywodraeth Cymru
Welsh Government

Welsh Government 2019

Prosperity for All: A Low Carbon Wales



ISBN - 978-1-78964-971-0

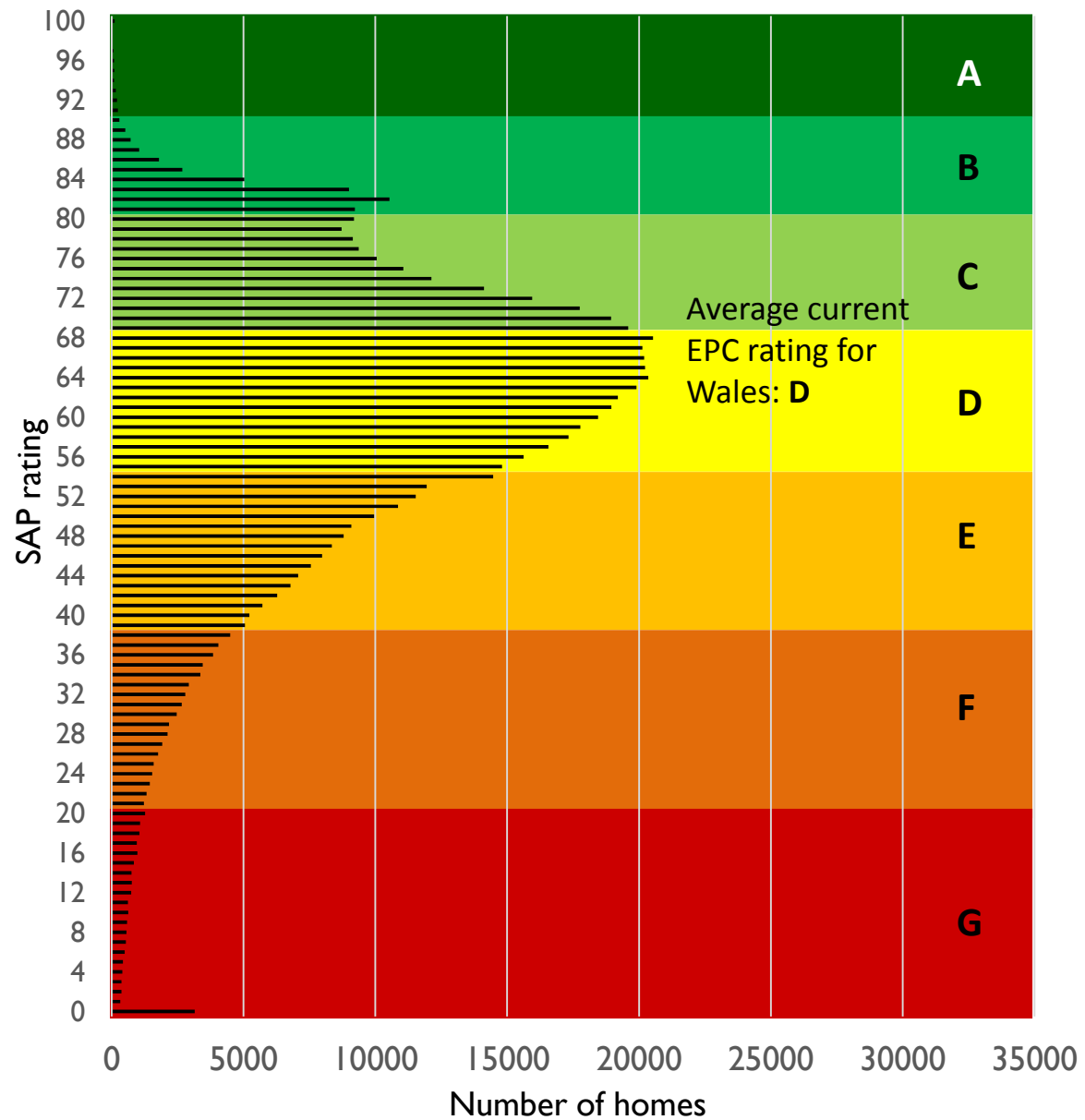
➤ Wales' commitment to tackling climate change

Sharing the journey, for a better future

March 2019



EPC Rating Distribution - Wales

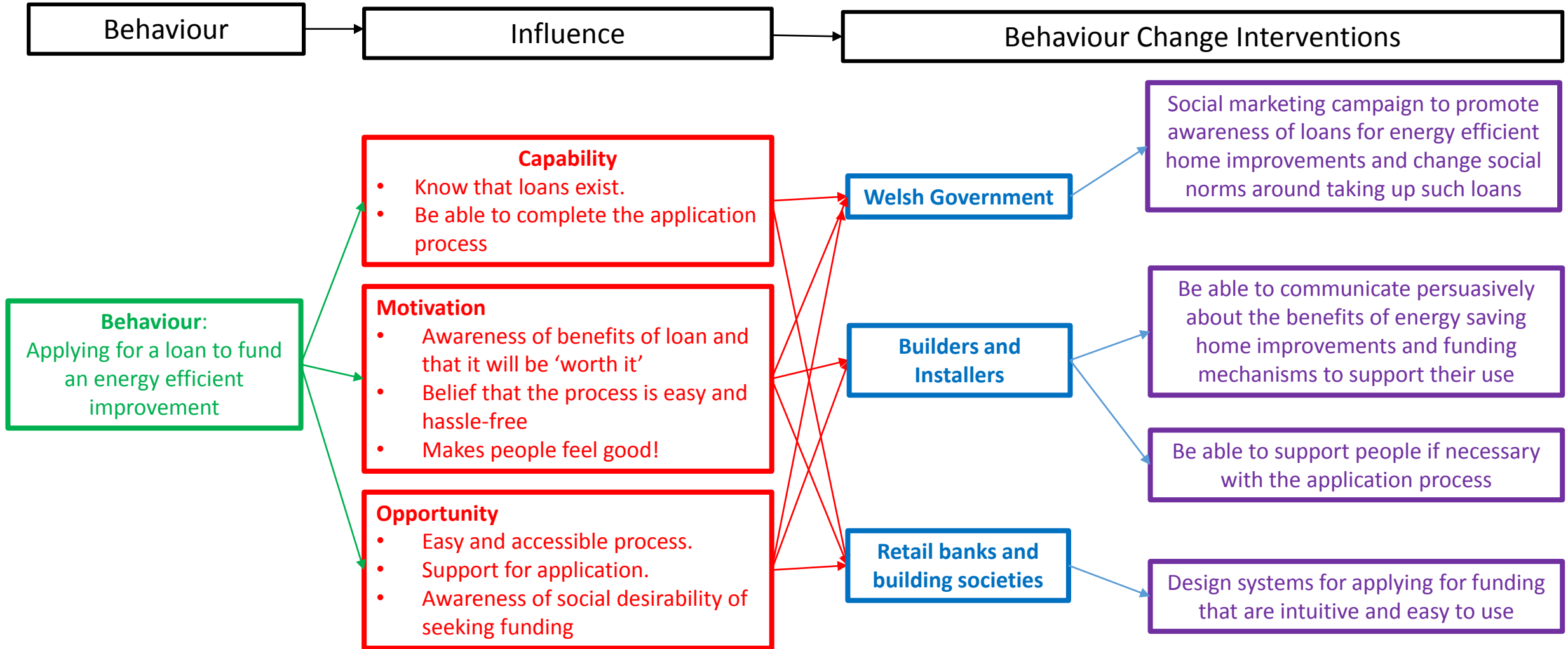




Designing interventions from behavioural systems maps



UCL

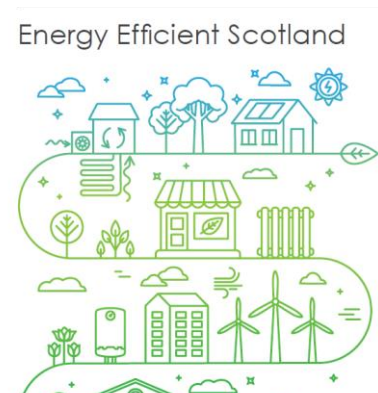
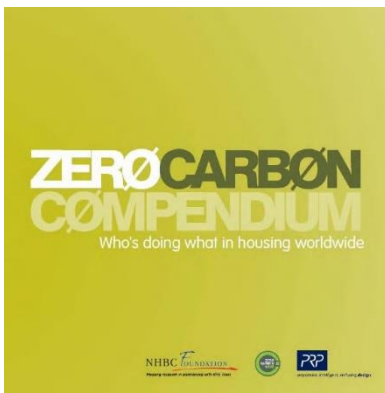
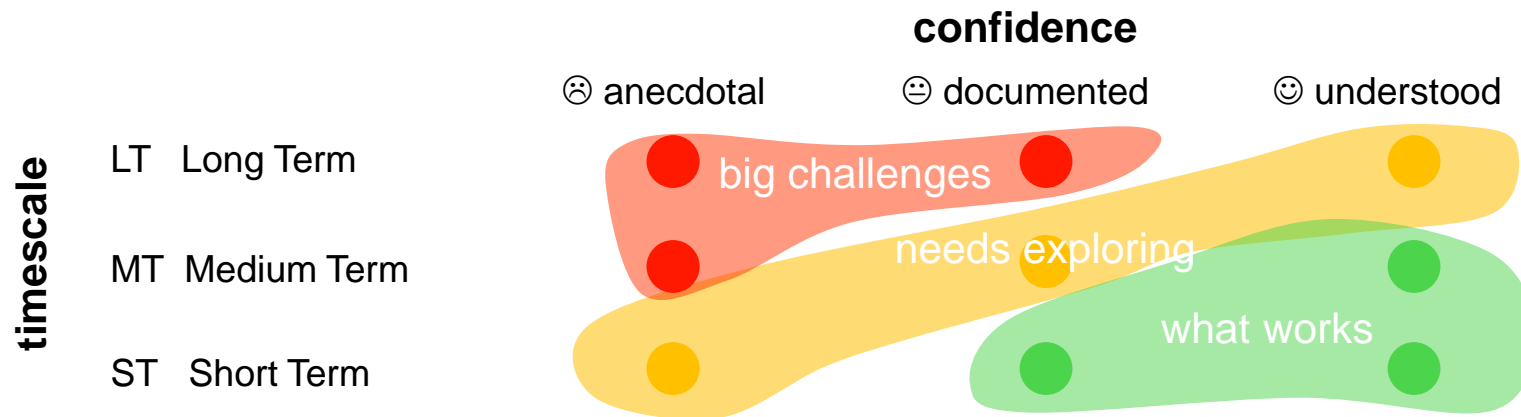


Homes of today for tomorrow

Decarbonising Welsh Housing between 2020 and 2050

Ed Green and Simon Lannon, 18 July 2019



















1 thinking strategically	1.1 taking advantage of funding	Green	4 services	4.1 gas	Green	
	1.2 energy sources	Red		4.2 oil	Yellow	
	1.3 change in primary energy supply	Green		4.3 biomass	Yellow	
	1.4 fabric first approach	Green		4.4 heat pumps	Yellow	
	1.5 development constraints	Yellow		4.5 radiant heat	Green	
	1.6 addressing overheating	Yellow		4.6 underfloor	Yellow	
	1.7 standards beyond Building Regulations	Green		4.7 storage	Yellow	
	1.8 void reductions	Yellow		4.8 ventilation	Yellow	
2 building fabric	2.1 spatial constraints	Yellow	5 financial	4.9 district heat networks	Red	
	2.2 construction or condition not as expected	Yellow		5.1 availability of finance	Yellow	
	2.3 roof upgrade	Green		5.2 high cost of actions	Yellow	
	2.4 wall upgrade	Green		5.3 unexpected costs	Yellow	
	2.5 floor upgrade	Green		5.4 payback periods	Yellow	
	2.6 windows	Green		5.5 maintenance costs	Yellow	
	2.7 shading	Red		5.6 locked-in investment	Yellow	
	2.8 air tightness	Green		6 supply c.	6.1 Knowledge - good advice / emerging tech.	Yellow
3 renewables	3.1 Heat recovery	Green	6.2 Materials and products- perf. and availability		Yellow	
	3.2 Combined Heat and Power (CHP)	Yellow	6.3 skills- workforce and capacity		Green	
	3.3 Photovoltaics (PV)	Green	6.4 skills – training and apprenticeship		Yellow	
	3.4 Electric battery	Yellow	7 people		7.1 occupant engagement	Green
	3.5 Wind	Yellow			7.2 occupants stay put	Yellow
	3.6 Solar Thermal	Green			7.3 simple controls	Green
	3.7 Transpired solar collectors	Yellow			7.4 smart meters and homes	Red
		7.5 entrenched behaviour		Green		
		7.6 health issues		Yellow		
		7.7 influencing lifestyle		Red		

A representative taxonomy of 14 dwelling types

	HOUSE End terrace	HOUSE Mid terrace	HOUSE Semi- detached	HOUSE Detached	FLAT (Purpose built)	Total
pre 1919	3%	9%	4%	7%		23%
1919- 1944			5%			5%
1945- 1964			10%			10%
1965 - 1990	4%	6%	10%	9%	4%	33%
post 1990			5%	7%	1%	13%
Total	7%	15%	33%	23%	6%	84%

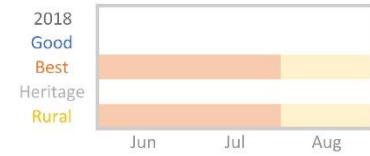
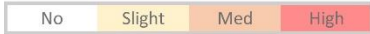
A representative taxonomy of 14 dwelling types

	HOUSE End terrace	HOUSE Mid terrace	HOUSE Semi- detached	HOUSE Detached	FLAT (Purpose built)	Total
pre 1919						23%
1919- 1944						5%
1945- 1964						10%
1965 - 1990						33%
post 1990						13%
Total	7%	15%	33%	23%	6%	84%

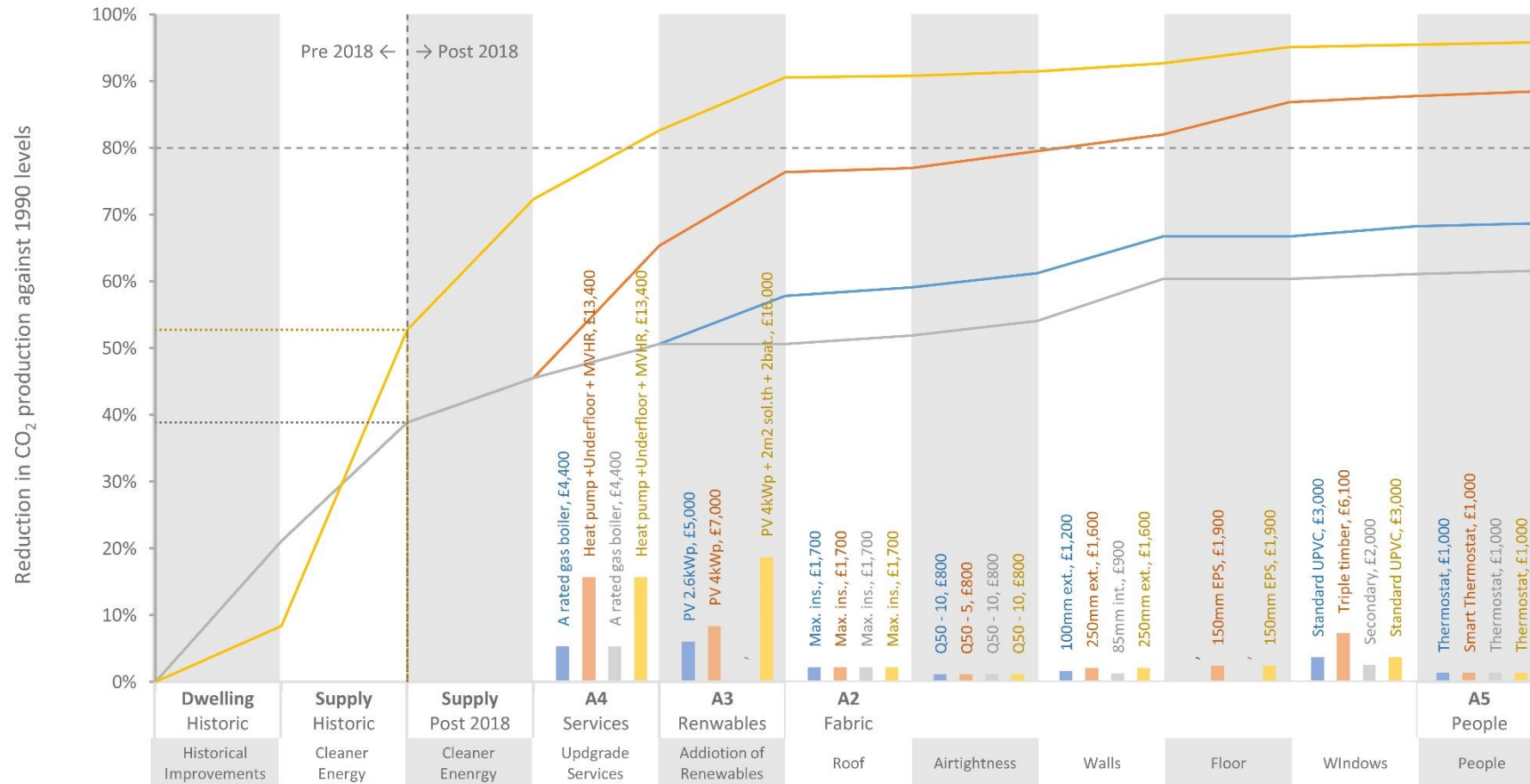
Dwelling type 2: Mid terrace pre 1919

Scenario 1

Overheating Risk



Impact on carbon emissions of four distinct retrofit narratives, each with costed actions

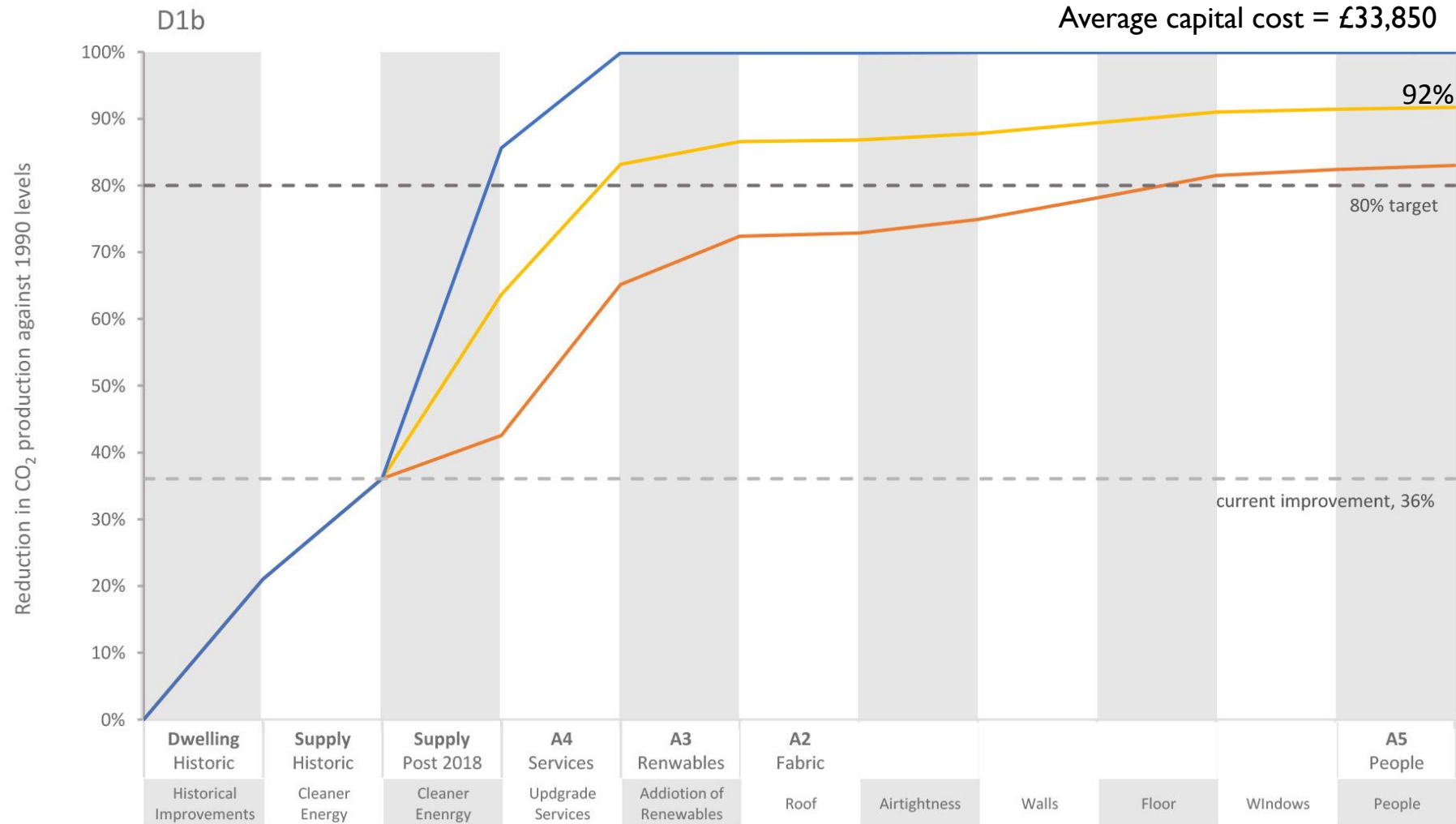


Predicting decarbonisation resulting from retrofit of the Welsh housing stock

Blue scenario – transformative improvement (80% clean energy)

Yellow scenario – significant improvement in clean energy supply (60%)

Red scenario – minor improvement in clean energy supply (40%)





Green Finance Strategy

Transforming Finance for a Greener Future

July 2019





The Well-being of Future Generations (Wales) Act 2015



A Prosperous Wales



A Resilient Wales



A More Equal Wales



A Healthier Wales



**A Wales of Cohesive
Communities**



**A Wales of Vibrant Culture
& Welsh Language**



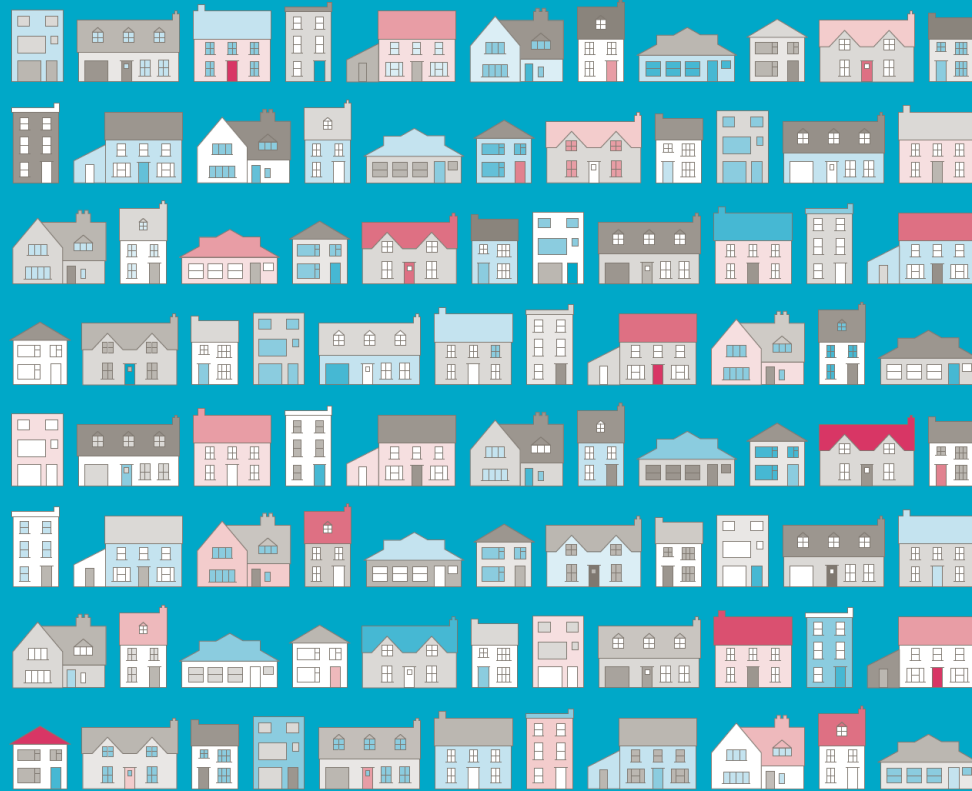
**A Globally Responsible
Wales**

TRUST



Each Home Counts

An Independent Review of Consumer Advice, Protection,
Standards and Enforcement for Energy Efficiency and
Renewable Energy



Dr Peter Bonfield, OBE, FREng



Department for
Business, Energy
& Industrial Strategy



Department for
Communities and
Local Government

December 2016

THINK BIG. START SMALL. SCALE FAST



What more can we model???



High level model on what works ✓

High level model on what cost of actions ✓

High level model on what housing stock condition ✓

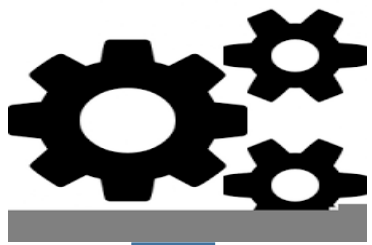
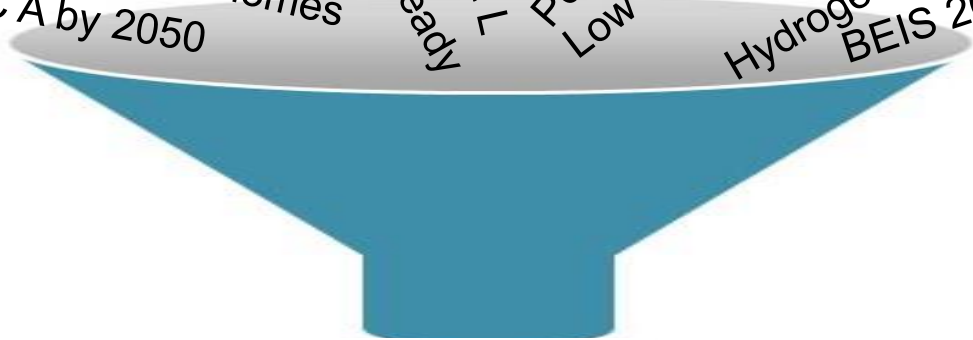
Social landlord partners to model actual homes

- Real archetypes
- Real condition
- Real records of improvement actions at scale
- Real evidence of the costs of energy efficiency measures
- Real energy performance data by home
- Real people (tenants) and behaviours
- **Identify what needs to be done next (scale of future challenge)**

- Build capacity and market demand
- Build capability
- Identify skill requirement
- Trial innovative solutions

What do we know so far? (today)

Heating technology
UK CCC net zero targets
DAG recommendations
EPC A by 2030-Social homes
Home EPC A by 2050
Stock modelling data
EPC revision
Net Zero ready
Part L
Carbon budgets
Building fabric
People & Behaviour change
Low Carbon gas grid – Bio methane
Low Carbon electric grid – 75% by 2030
Hydrogen
Renewables
BEIS 2050 homes target 15kWh/M2/year



Welsh policy



Optimised Retrofit ?

How Much Carbon is your energy costing – Typical values

in a home

CO2 from Heating systems

UK grid at : **2019-09-20 10:30**

is emitting : **225 grams CO2 /kWh**

Ground Source Heat Pump (400%):	56	
Ground Source Heat Pump (320%):	70	
Direct Electric heating (100%):	225	grams CO2
Gas boiler (85%):	215	per kWh
Oil Boiler (85%):	320	delivered heat
Coal (50%):	630	

on the grid

https://www.parliament.uk/documents/post/postpn_383-carbon-footprint-electricity-generation.pdf

Download this link and check how low Carbon (or not) your electricity is at any time.

<http://electricityinfo.org/real-time-british-electricity-supply/>

Optimised retrofit to be Net Zero ready



Avoid over investment ✓

Solution appropriate to each home ✓

No regret actions that can be built upon in future ✓

Energy efficient to be robust to fuel cost increases ✓

Best Carbon vs capital cost vs fuel cost performance ✓

Flexible and smart, grid connected and progressing along the route to net zero capable in readiness for low Carbon energy supplies ✓

Fabric retrofit Measures

- Draught-proofing
- Well insulated Loft
- Thermally efficient windows and doors

- Airtightness
- Ventilation
- Wall insulation (CWI)

- Wall insulation (EWI)
- Wall insulation (IWI)
- Floor insulation

- Low levels of cost or technical competency

- Moderate levels of cost or technical competency

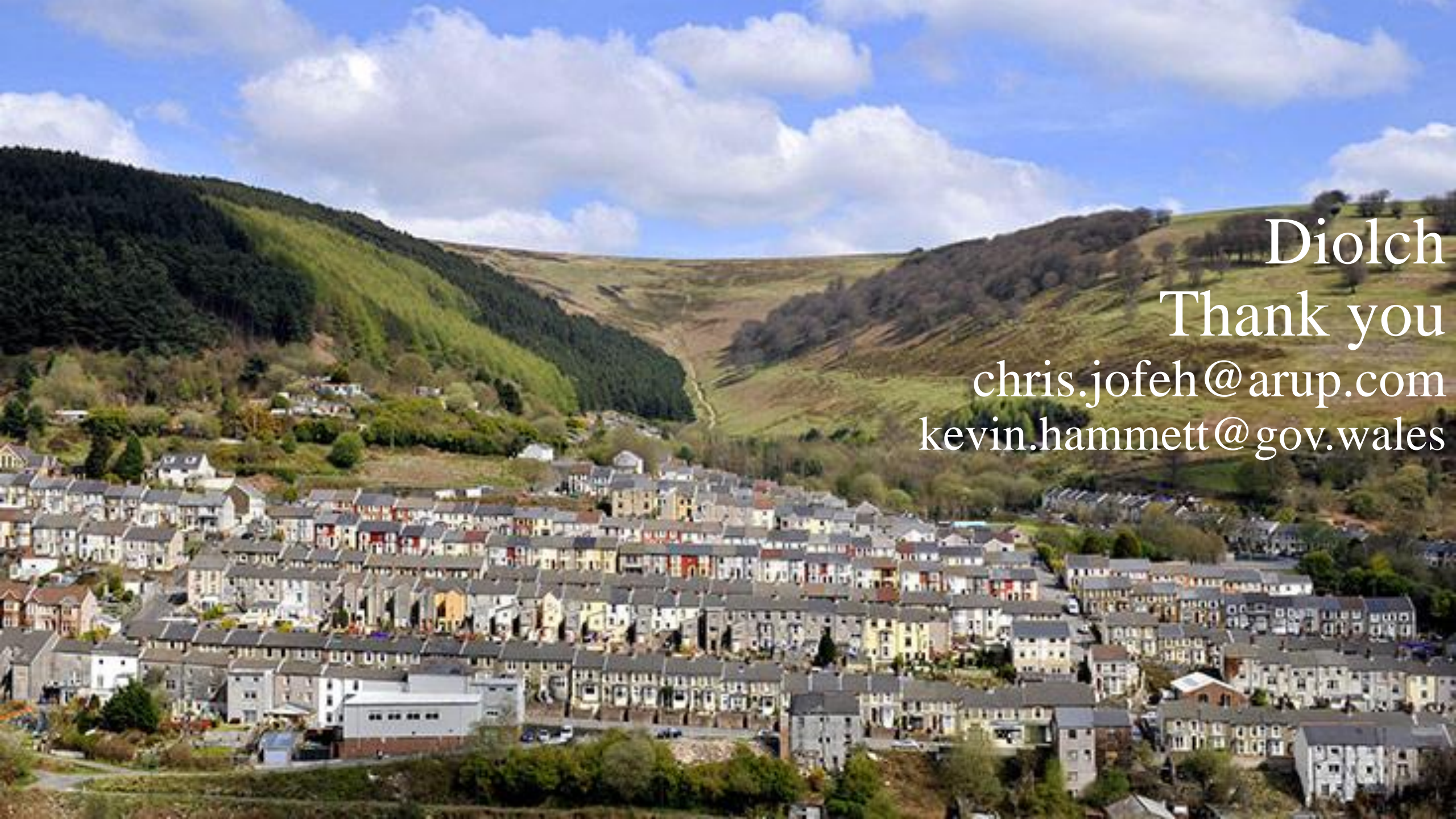
- Higher levels of cost or technical competency

Technology Measures

- A-rated gas boiler – grid connected
- A-rated LPG boiler with wet heating system

- Smart hybrid heat pump system
- Smart grid connected heating controls
- Battery storage
- Solar Panels
- Heat storage

- Active homes thermal panels
- Advanced PV Fabric systems



Diolch
Thank you
chris.jofeh@arup.com
kevin.hammett@gov.wales