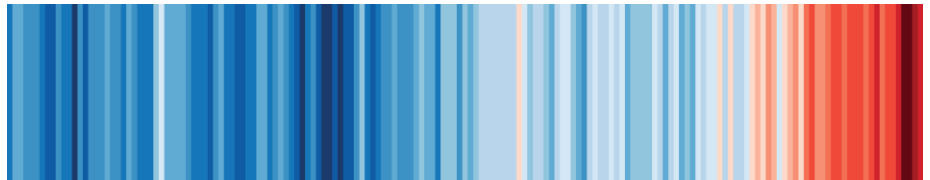
Update on ‘Better Homes…. Report’

Lisa Dobbins - *Head of Housing Decarbonisation*

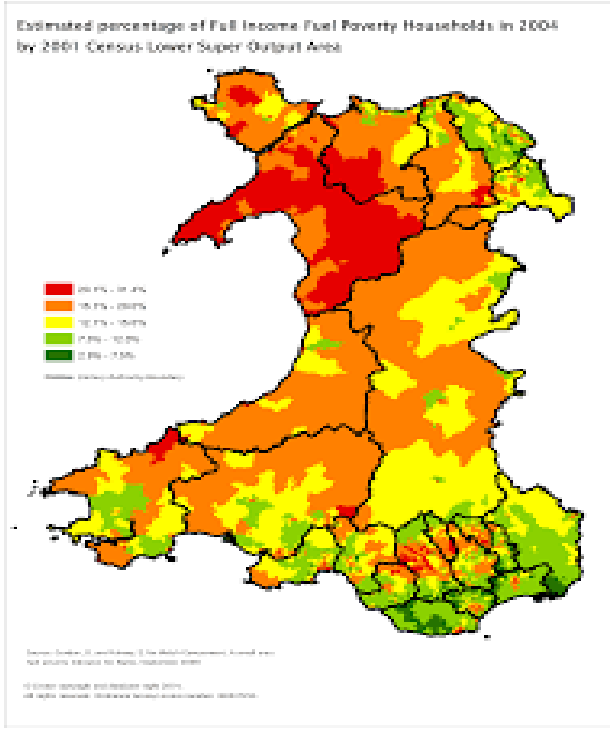


The requirement.....

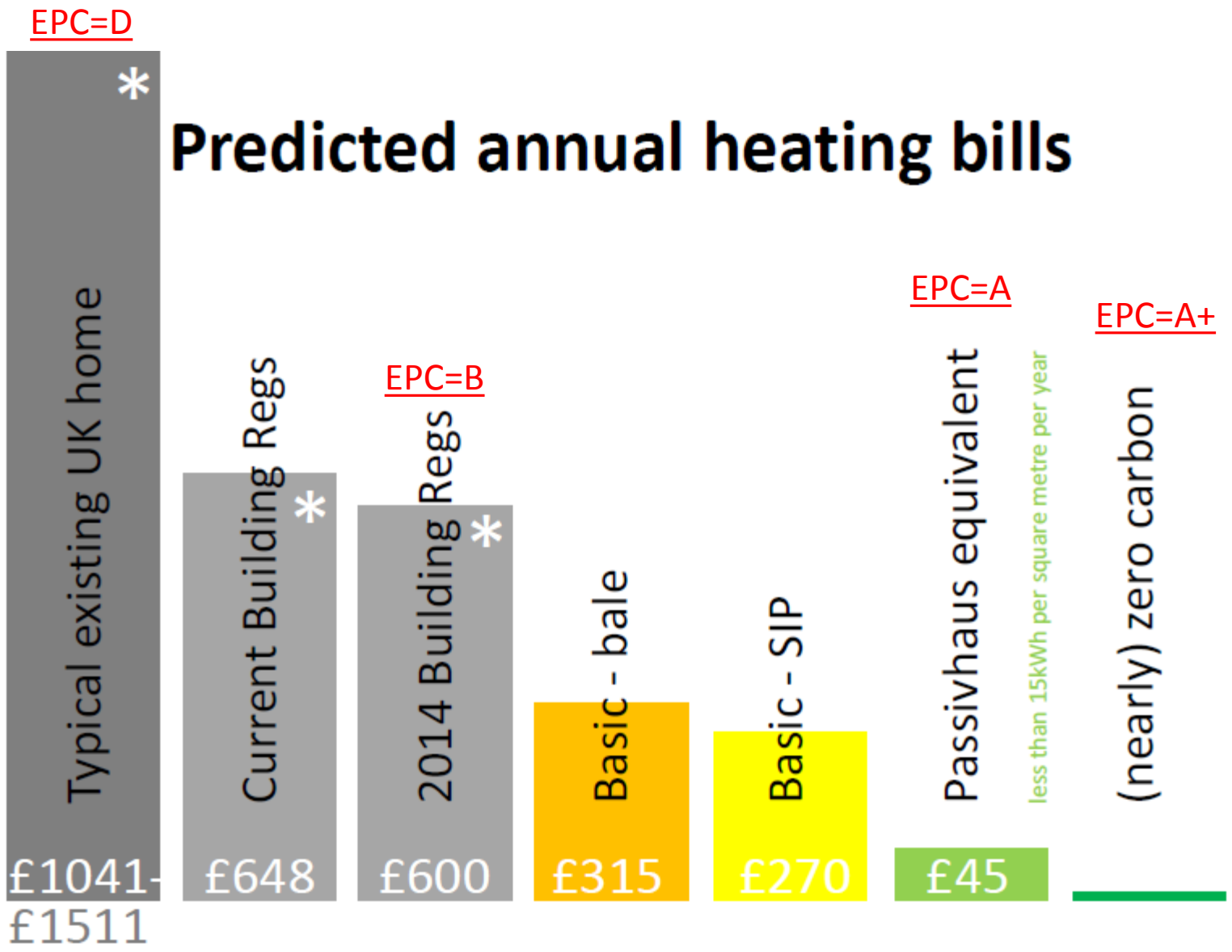
- How to decarbonise 1.4 million homes by ~~80%~~ 95% by 2050 through a new energy efficiency retrofit programme starting in 2021
- Achieve affordable, comfortable and near zero carbon homes for all tenures
- Jobs, training, supply chains, innovation

Legislative & political.....

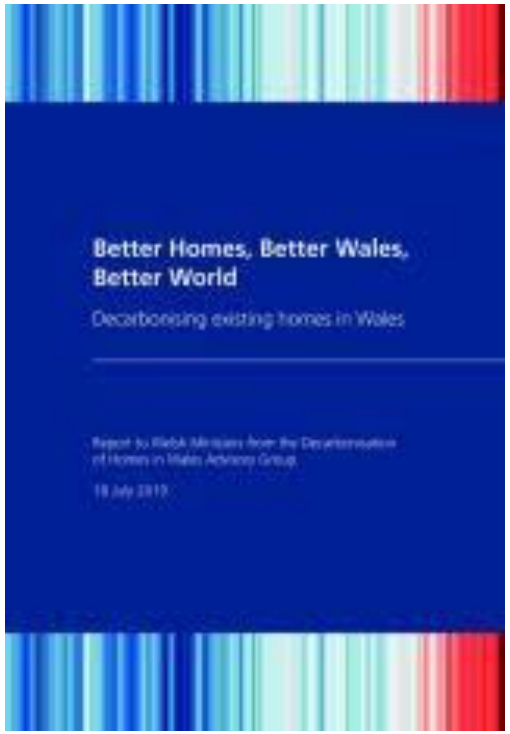
.....and fuel poverty



- 155,000 households were living in fuel poverty. This is equivalent to 12% of all households in Wales.
- Households living in older properties are more likely to be fuel poor. 20% of households living in pre-1919 dwellings were fuel poor.
- 43% of households living in properties with poorer energy efficiency (EPC Bands F and G) were fuel poor compared to 5% of households living in properties in bands B to C.


EPC=D
Predicted annual heating bills
Typical existing UK home
£1041-£1511
Current Building Regs
£648
EPC=B
2014 Building Regs
£600
Basic - bale
£315
Basic - SIP
£270
EPC=A
Passivhaus equivalent
less than 15kWh per square metre per year
£45
EPC=A+
(nearly) zero carbon
*data provided via EST
Heating costs only, based on detached, 5 person 3 bedroom 102sqm home

An Independent Group



The Group's recommendations

1. Make a **30 year commitment** and stick to it – all political parties

2. Set **ambitious stretching targets** to meet our legal duty including a target of **EPC Band A** for homes in social ownership and homes in fuel poverty by 2030.

3. Put the **right support and delivery mechanisms** in place across all tenures

4. Find and implement **effective funding mechanisms** for all tenures including 'refocus' of Dowry and support for traditional RSLs. Model the stock.

5. Collect **data and knowledge** about the state of the stock to inform future decisions and monitor progress.

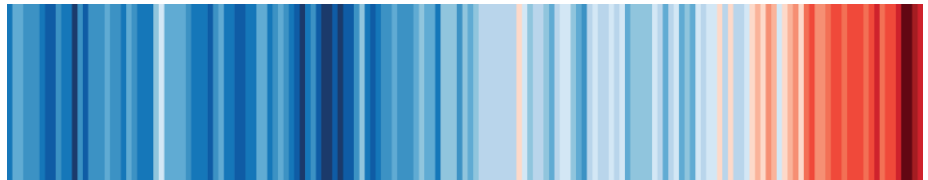
6. **Test & roll out** new solutions to decarbonise homes

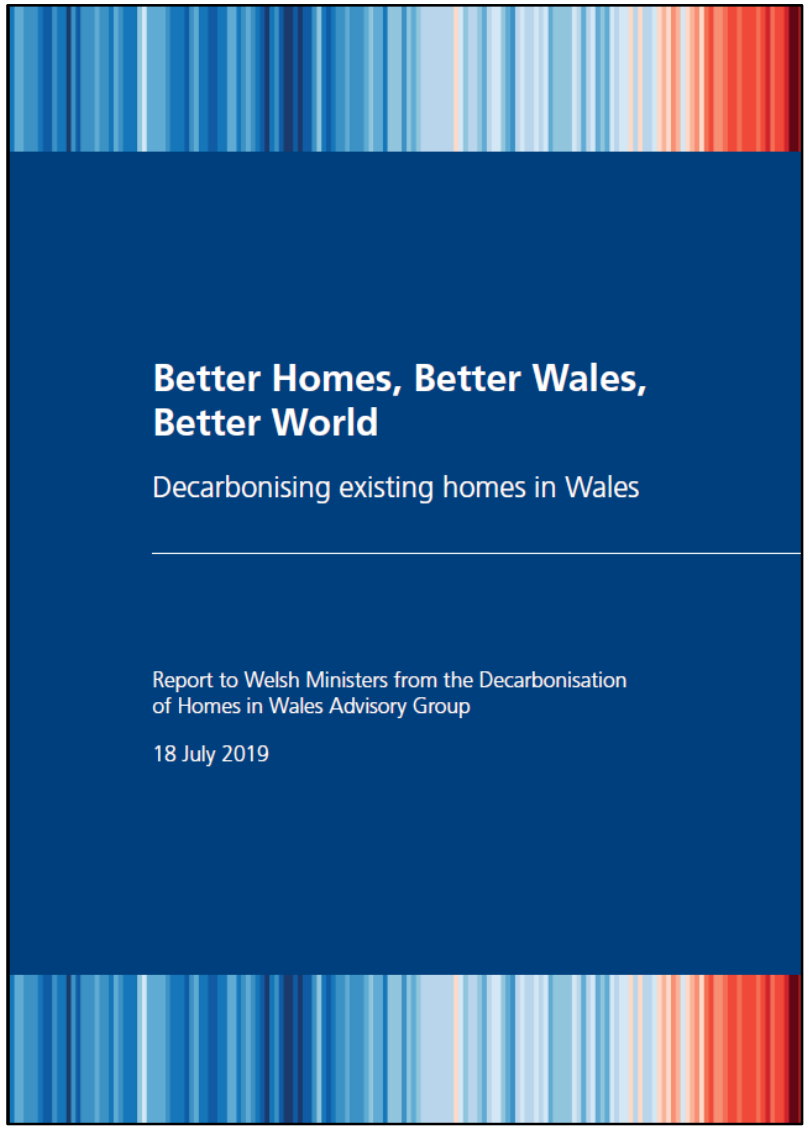
7. Maximise **engagemen**t with communities, networks, associations and Third Sector organisations to achieve targets to help decarbonise homes

Next steps…..

- Ministers responded – cross party support
- Implementation in new term of Government – 2021
- Key priority is modelling social homes against WSA research – pathways, optimal approaches, achievability of targets, timings, carbon reduction……

Summary of background evidence - Patrick Myall





Homes of today for tomorrow

Decarbonising Welsh Housing between 2020 and 2050

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

Llywodraeth Cymru
Welsh Government

Decarbonising Welsh Housing between 2020 and 2050

Stage 1

April 2018 to September 2018

A scoping review combining retrofit best practice and relevant publications to understand ‘what works’ and begin to establish decarbonisation pathways.

Stage 2

November 2018 to July 2019

A modelling exercise to understand the size and shape of the Welsh housing stock, and its potential to be decarbonised - based on the existing knowledge base.

STAGE 1 - understanding the challenge

Legislation requires at least 80% reduction in carbon emissions by 2050 (vs 1990 levels).

CCC has stated that Wales should target >95% reduction in carbon emissions by 2050.

Housing is responsible for 21% of Welsh carbon emissions.

90% of existing Welsh homes are likely to remain in use in 2050.

Wales has one of the oldest housing stocks in Europe.

The stock is diverse, in terms of type and condition.

A decarbonisation pathway must deliver holistically against WFGA.


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

1		STRATEGIC actions and challenges	time	conf	RAG
1.2	**Energy sources** Relevant CS: 9,10	80% of UK homes use mains gas for heat. For successful decarbonisation, around 20,000 homes per week must move to a low carbon heat source from 2025 to 2050 .This will require considerable coordination and communication, resources, and a reliable supply chain. (LR09,10,11,22) In the long term, decarbonisation of electricity at point of generation should mean that where mains electricity is available, dwellings will move to all-electric supply (and generation) via the national grid. (CS09, CS10) However, decarbonisation of the grid could increase energy costs, putting additional homes into fuel poverty. It may not be easy to persuade consumers to move to low carbon alternatives which are more expensive, potentially less effective. (NEA, LR05) There is also the possibility of a less carbon-intensive gas supply (LR29).	**LT**	☹	
1.4	**Fabric first approach** Relevant CS: 1,2,3,4,5,6,7,8,9,10,11,12,14,15,16,17,18,22,23,24,25,27,29,31,35,37,39	Fabric First is a well documented priority action. (CS29: heating demand reduced by 63% through fabric insulation alone, CS37: improved fabric and infiltration saves 66% of CO_2). All but four case studies adopted a fabric first approach. (CS33, CS34,and CS35 focus explicitly on CHP, while CS13 is a PV-only programme.) While fabric first actions are not the most economic options, and do not necessarily have the shortest payback periods, they consistently and reliably deliver benefits in terms of reduced fuel bills and fuel poverty. They consistently reduce energy use and carbon emissions (LR09), and generate measurable social and health benefits (LR28 and LR29). Because changes to fabric tend not to result in changes to the way the dwelling is used, there are not typically issues around underperformance (compared with, for example, systems retrofit). However, quality of workmanship is particularly important for fabric interventions, as poorly executed work can significantly limit effectiveness. This requires a skilled workforce (LR12 and LR23).	**ST**	😐	
1.5	**Development constraints** Relevant CS: 1,2,3,7,14,15,16,17,20,21,22,23,24,28,39	There are 2 types of development constraints: Neighbourhood constraints tend to be implied rather than explicit (i.e. more subjective), and relate to a combination of form, materiality and character. Typically enforced by planning or conservation officers, and may or may not be categoric. Dwelling constraints can be more subjective – e.g. form, materiality, style and character (again the remit of planning / conservation officers (CS 07, 15, 17, 22, 23) OR more explicit, e.g. construction type, room size, dwelling condition, etc. Explicit constraints will be the remit of building control officers, as well as warrantee providers and potentially lenders. These constraints can affect the range of suitable actions and their effectiveness. They need to be taken into account but should not be seen as insurmountable challenges (e.g. CS21 and CS27 had extensive constraints, but significant CO2 savings were achieved).	**ST**	☹	

timescale

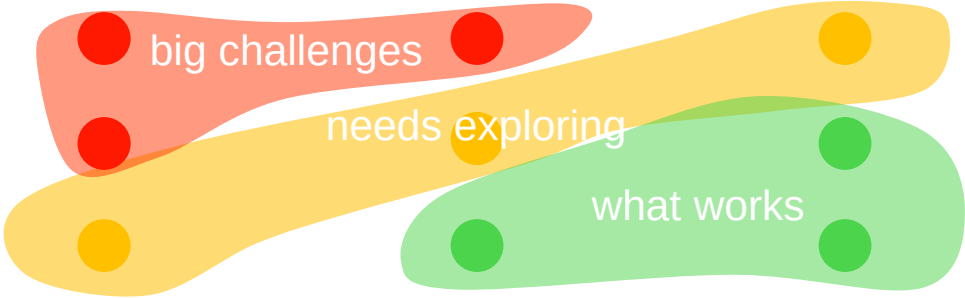
LT Long Term

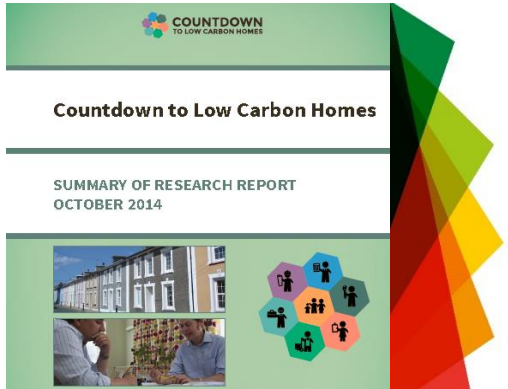
MT Medium Term

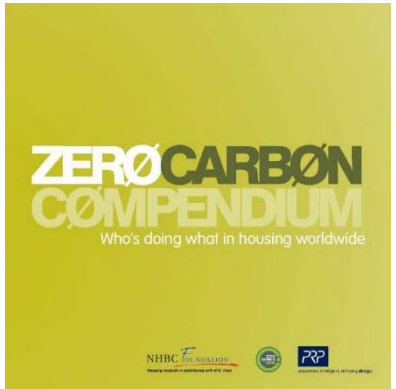
ST Short Term

confidence

☹ anecdotal ☐ documented ☺ understood





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STAGE 1 - findings

There is considerable scope to develop appropriate retrofit strategies utilising actions that are understood, and skills and products that are widely available.

Retrofit actions affecting dwelling fabric are best understood. Renewables and systems-based actions involve more emerging technologies. People represent the least understood aspect of retrofit, and introduce the most uncertainty around effectiveness, making future work around lifestyle and behaviour change particularly important.

The physical size and shape of a dwelling are not necessarily factors that change the approach taken to retrofit, apart from purpose built flats which are prone to overheating. However, these characteristics have considerable impact on capital cost and energy costs.

The selection of retrofit actions is more likely to be informed by the current condition and location of the dwelling, by which retrofit actions have previously been undertaken, and in some cases by the personal choice of the occupant / owner.

STAGE 2 :
modelling decarbonisation of the Welsh housing stock

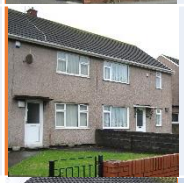
What it included:

- 14 dwelling models to represent the Welsh housing stock.
- 4 retrofit narratives to explore domestic retrofit options.
- 3 energy supply scenarios to investigate the impact of cleaner energy.
- Assumptions made to model the housing stock as a whole.
- Recommendations that informed Independent Advisory group report: *Better Homes, Better Wales, Better World.*

STAGE 2 : 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%

STAGE 2 : 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%**

Four retrofit narratives for the 2050 simulation:

good practice

Actions are driven by best value – in terms of affordability, cost effectiveness, and availability of skills and resources in the current marketplace.
Equivalent to current Building Regulations.
Primary energy is mains gas.

best practice

Assumes an aspirational client or owner occupier, likely to be more concerned with long term quality than cost. Environmental impact is a priority.
Exceeds current Building regulations.
Primary energy is electricity.

heritage

Actions are constrained, e.g. as a result of listed building status or within a conservation area. Impact on exterior appearance is assumed to be challenging.
Does not meet current Building Regulations.
Primary energy is mains gas.

rural

Location or context dictates off grid energy solutions. As a result the focus is on energy conservation and use of locally viable renewables.
Exceeds current Building regulations.
Primary energy is electricity.

3 energy supply scenarios to investigate the impact of cleaner energy:

Scenario 1
minor improvement

Modest improvement on the existing energy supply infrastructure, currently 34% cleaner than in 1990 (BEIS 2017)

40%

Scenario 2
significant improvement

Significant continued improvement of the national grid, with 60% of all energy generated without carbon emissions.

60%

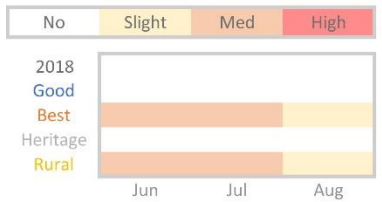
Scenario 3
transformational change

This scenario represents transformation of the national grid to a low carbon energy supply infrastructure.

80%

Dwelling type 2: Mid terrace pre 1919
Scenario 1

Overheating Risk



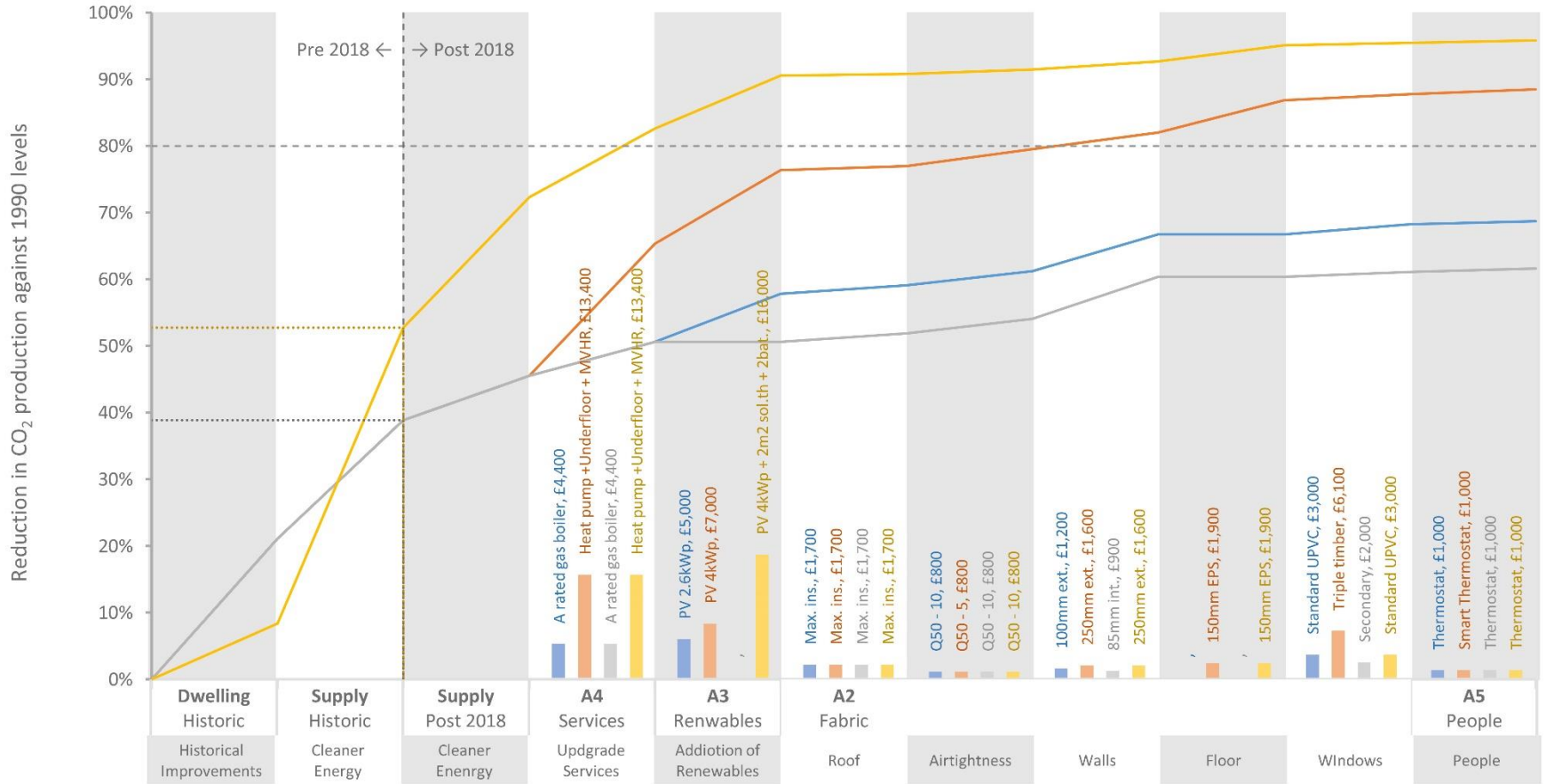
Good Practice

Best Practice

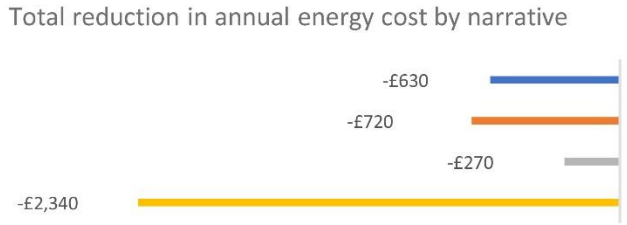
Heritage

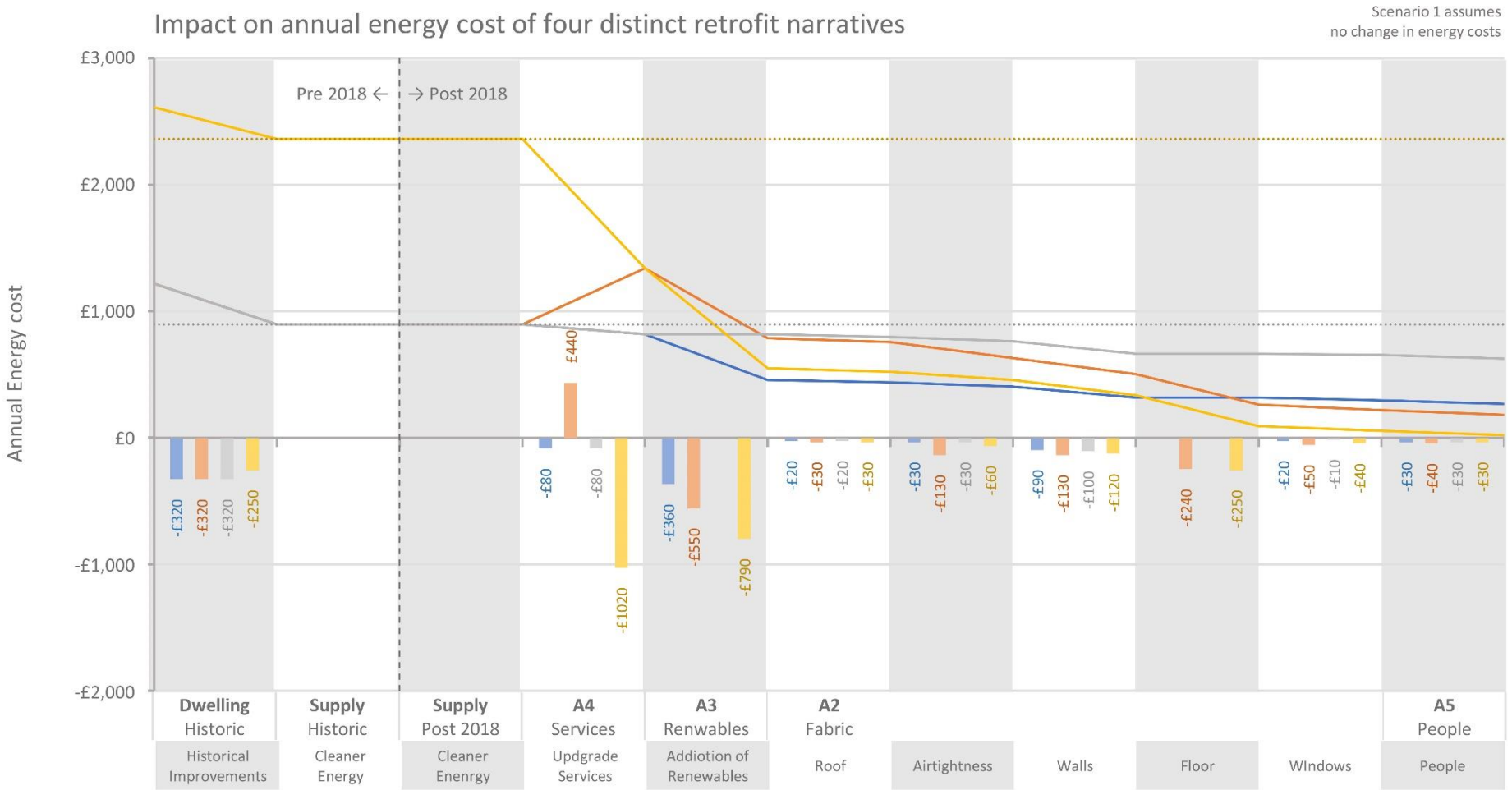
Rural

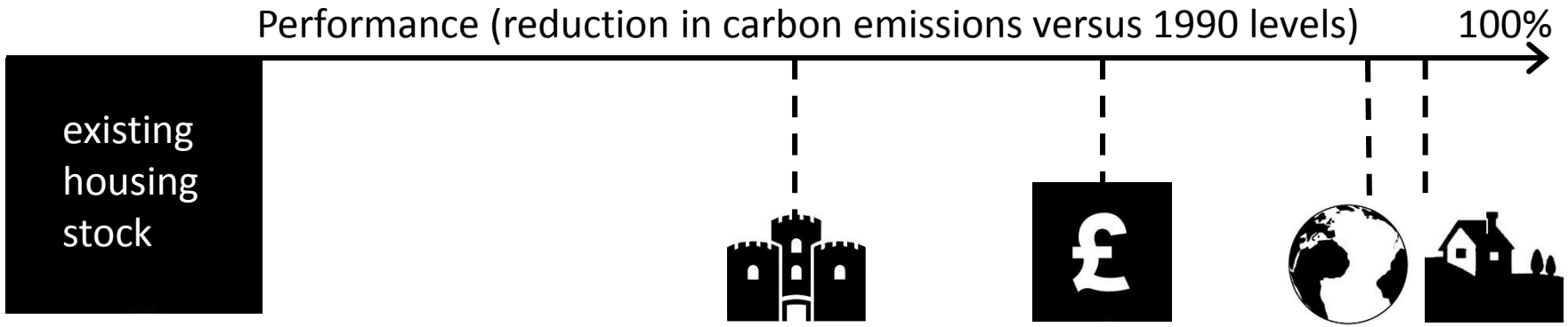
Impact on carbon emissions of four distinct retrofit narratives, each with costed actions

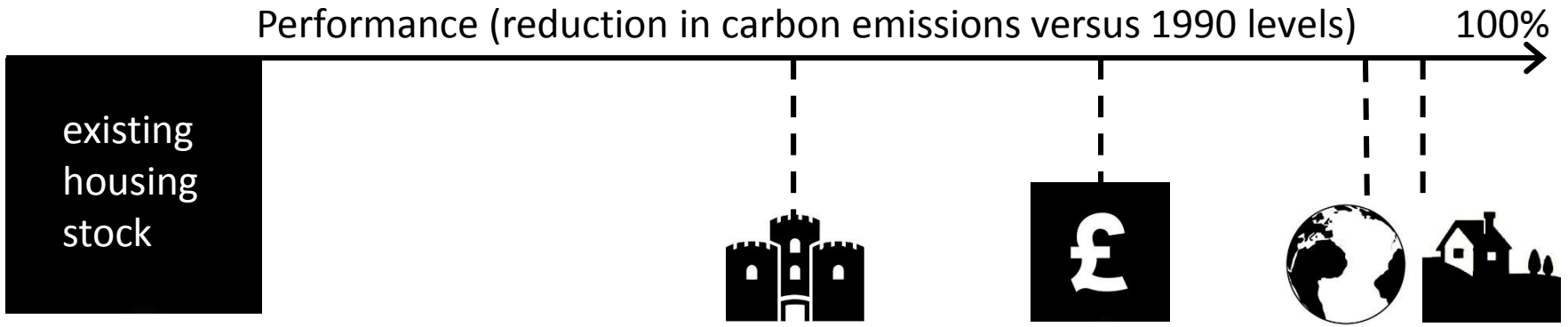



Total capital cost by narrative
£17,100
£33,500
£10,800
£39,400
predicted maintenance, repair and improvement costs over a 30 year period
£11,100
Good Practice
Best Practice
Heritage
Rural

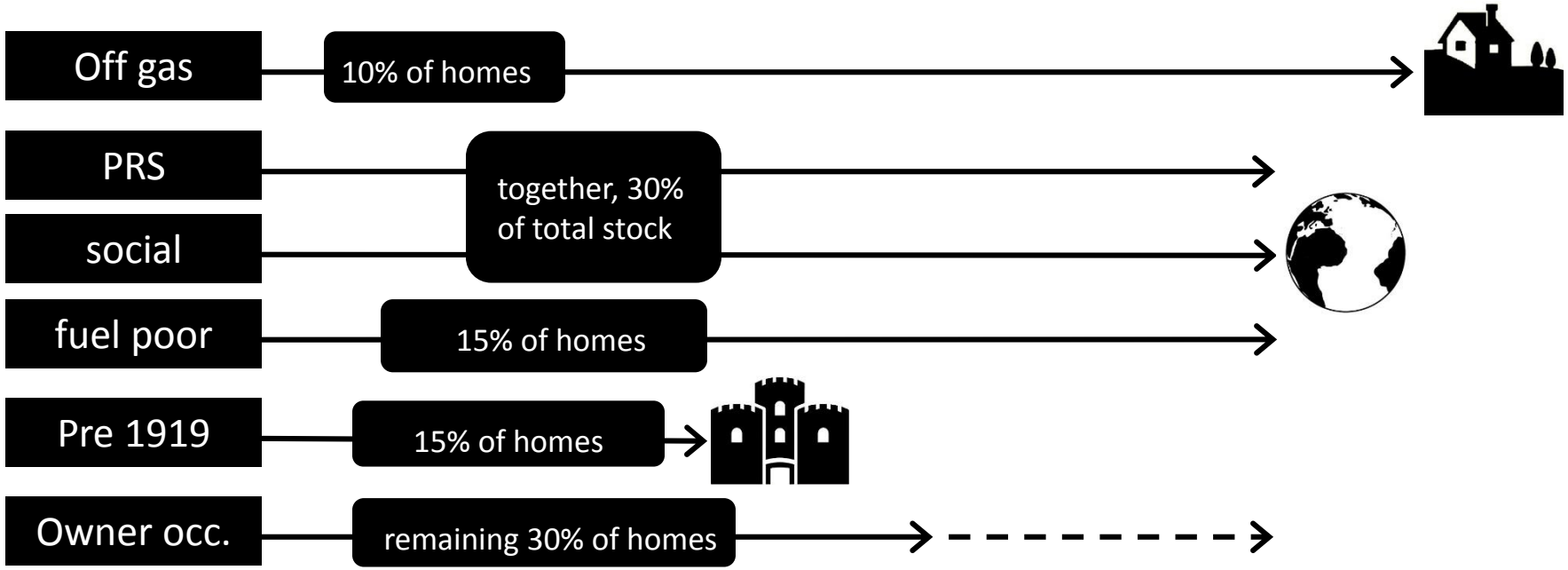

Total reduction in annual energy cost by narrative
-£630
-£720
-£270
-£2,340

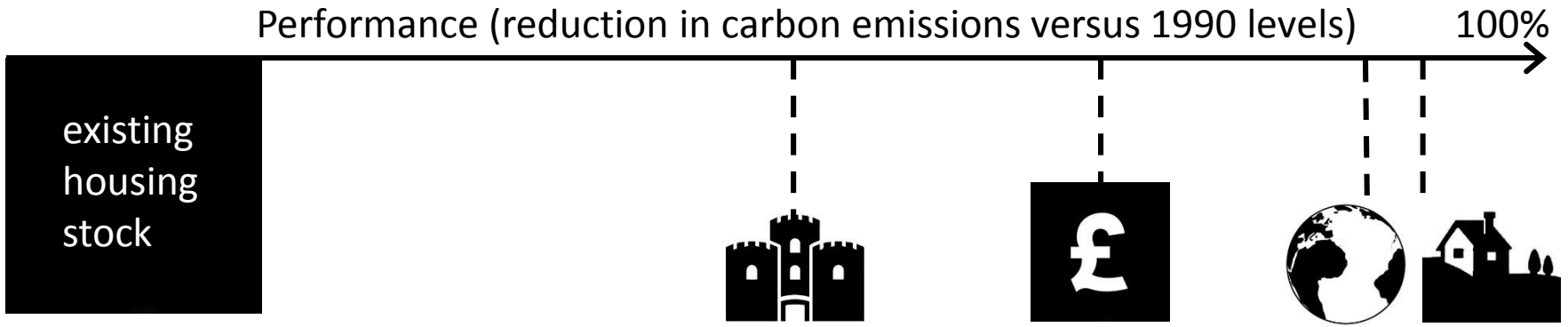

Impact on annual energy cost of four distinct retrofit narratives
Scenario 1 assumes no change in energy costs
Annual Energy cost
£3,000
£2,000
£1,000
£0
-£1,000
-£2,000
Pre 2018 ←
→ Post 2018
-£320
-£320
-£320
-£250
-£80
£440
-£80
-£1020
-£360
-£550
-£790
-£20
-£30
-£20
-£30
-£30
-£130
-£30
-£60
-£90
-£130
-£100
-£120
-£240
-£250
-£20
-£50
-£10
-£40
-£30
-£40
-£30
-£30
Dwelling Historic
Supply Historic
Supply Post 2018
A4 Services
A3 Renwables
A2 Fabric
A5 People
Historical Improvements
Cleaner Energy
Cleaner Enenrgy
Updgrade Services
Addiotion of Renewables
Roof
Airtightness
Walls
Floor
WIndows
People


Performance (reduction in carbon emissions versus 1990 levels)
100%
existing housing stock
£



The Welsh housing stock as modelled, to explore limits to decarbonisation:





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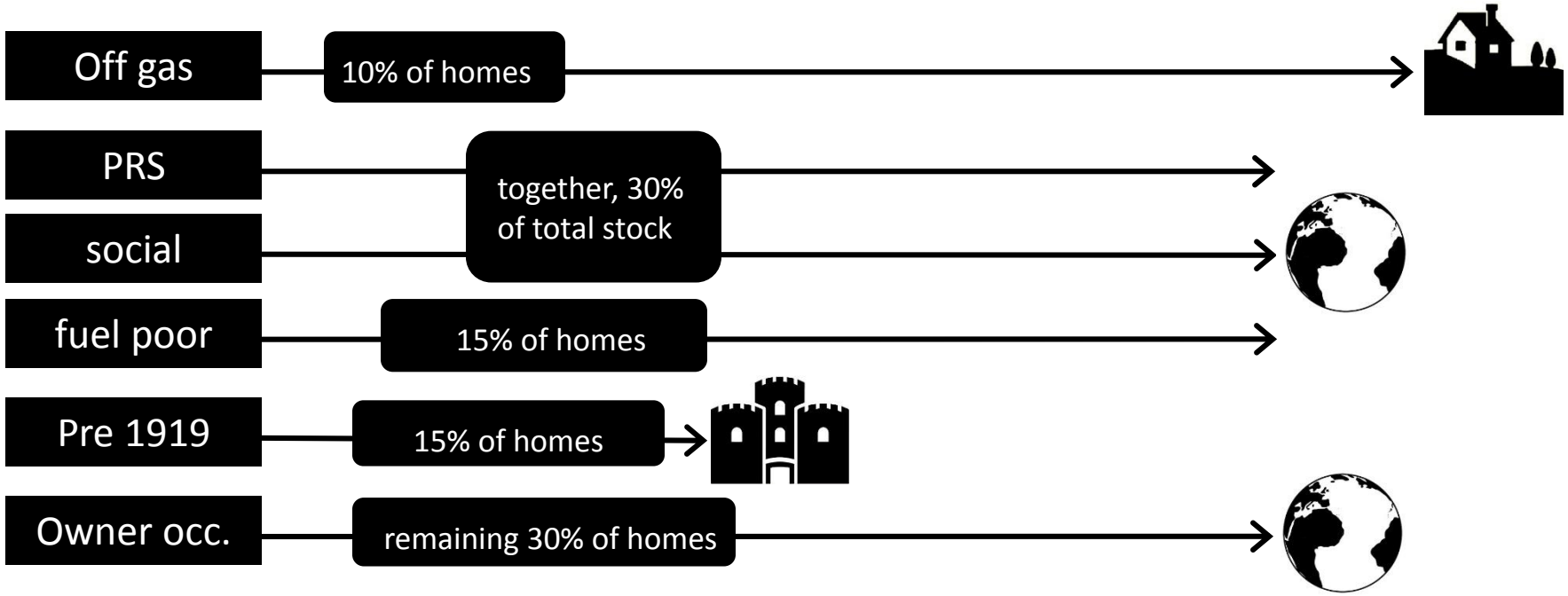


Findings – energy supply

The three distinct scenarios led us to believe that the impact of changes to energy supply on decarbonisation of the housing stock cannot be underestimated:

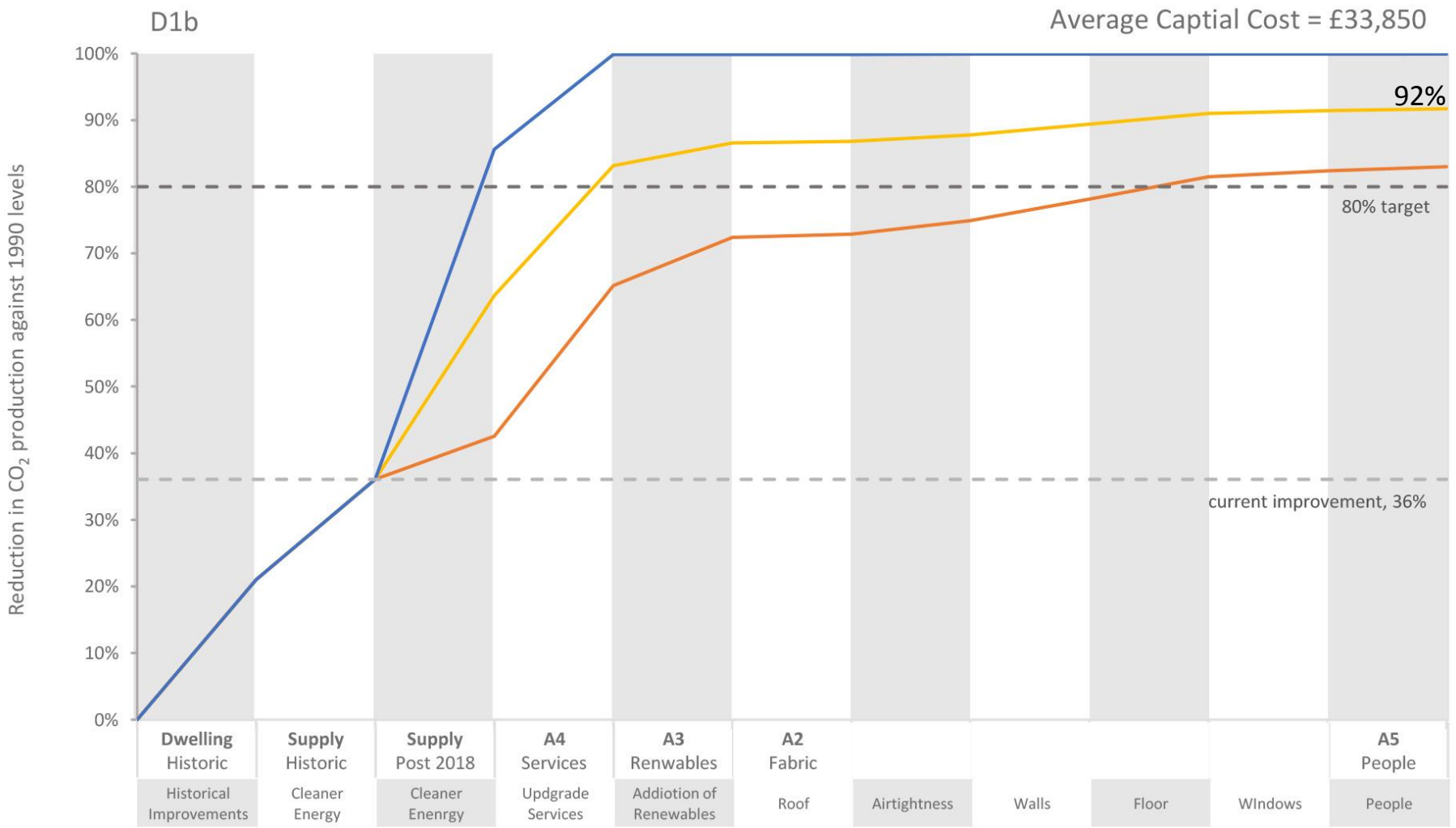
	Carbon reduction (as a range) by energy supply scenario:		
	1: 40% clean	2: 60% clean	3: 80% clean
 heritage	58-66%	78-83%	100%+
 good practice	64-76%	81-87%	100%+
 best practice	83-89%	92-95%	100%+
 rural	86-96%	93-98%	100%+

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%)



Three energy supply scenarios for the 2050 simulation:

Scenario 1 **minor improvement**	It is not tenable to deliver 90%+ decarbonisation with established retrofit methods.	**40%**
Scenario 2 **significant improvement**	90%+ decarbonisation is tenable, but requires a high standard of retrofit throughout the stock.	**60%**
Scenario 3 **transformational change**	Focus shifts from decarbonisation to demand reduction, to limit increases in energy costs and fuel poverty.	**80%**

Findings – capital costs

Baseline capital costs are predictable for the four retrofit narratives, described by the ranges below. (Low costs are consistently for smaller mid terraced properties and high costs are for older, larger detached dwellings.)

Heritage narrative	£10.8k to £25.5k
Good practice narrative	£17k to £32k
Best practice narrative	£33.5k to £63.3k
Rural narrative	£39.4k to £66.8k

The specification of retrofit actions can impact considerably on cost – in particular the use of materials or products that are ethically sourced, environmentally sustainable or have related health benefits.

Anticipated maintenance and repairs across 30 years fall in the range £11.1k to £19.8k.

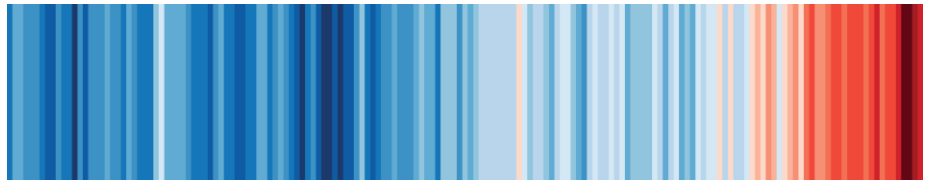
Capital costs assume retrofits are coordinated by the homeowner. Involvement of a contractor is likely to add circa 15%. However, by delivering retrofit in packages of around 50 dwellings or more, this cost increase could be offset by economies of scale.

Recommendations

- UK Government must be lobbied to ensure the national grid exceeds 60% clean energy by 2050.
- Action must be taken to protect vulnerable households, to ensure that increases in fuel costs or retrofit of new heating systems do not increase fuel poverty.
- The Welsh housing stock should, as a whole, be retrofitted to the equivalent of EPC ‘A’ rating.
- There should be no distinction between performance standards for retrofit and newbuild*. There should be no distinction between standards due to tenure, house type or condition.
- Retrofit of some Welsh houses is constrained by character. However the justification for ‘acceptable fails’ must be carefully defined so as not to jeopardise decarbonisation targets.
- Retrofit must overcome the performance gap - targets should be delivered, not just predicted.
- Retrofit is easier to enforce for social housing and PRS sectors. Work must be undertaken to explore how to initiate retrofit in the owner occupied sector.
- A flexible approach requiring all homes to achieve appropriate standards by 2050 is the only way to anticipate achieving 90%+ decarbonisation under assumed energy supply scenarios.

* The Independent Review of Affordable Housing Supply (WG, 2019) recommended that “all new affordable homes be built to EPC ‘A’ using a fabric first approach from 2021”.

Optimised Retrofit– Kevin Hammett

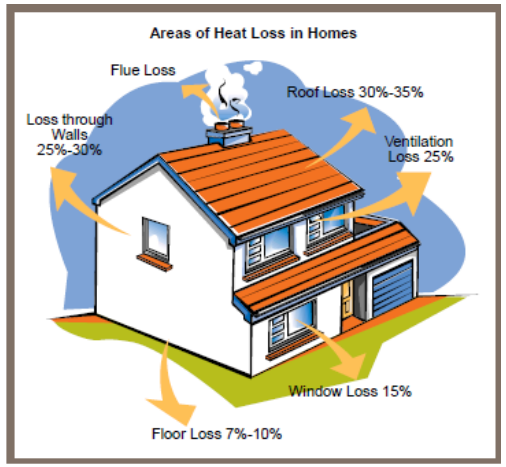


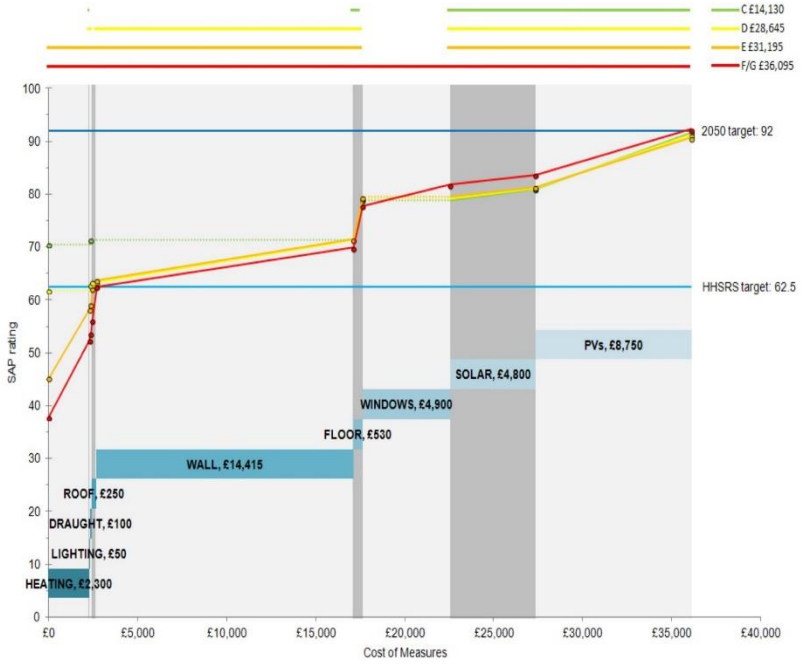
Optimised Retrofit

Optimised Retrofit is the best combination of decarbonised heating systems and fabric improvements to make homes,

‘Net Zero Carbon Ready’.

Decarbonisation of Welsh Homes – The Practical Challenges

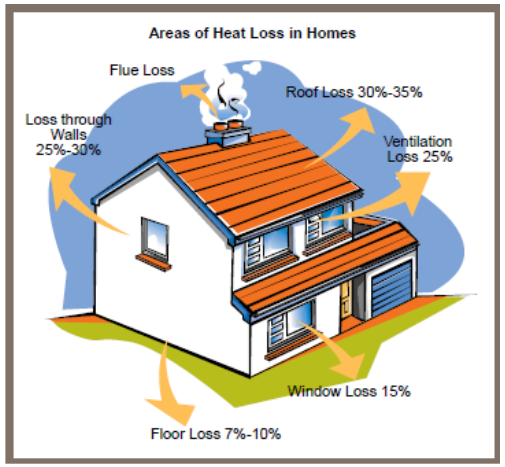


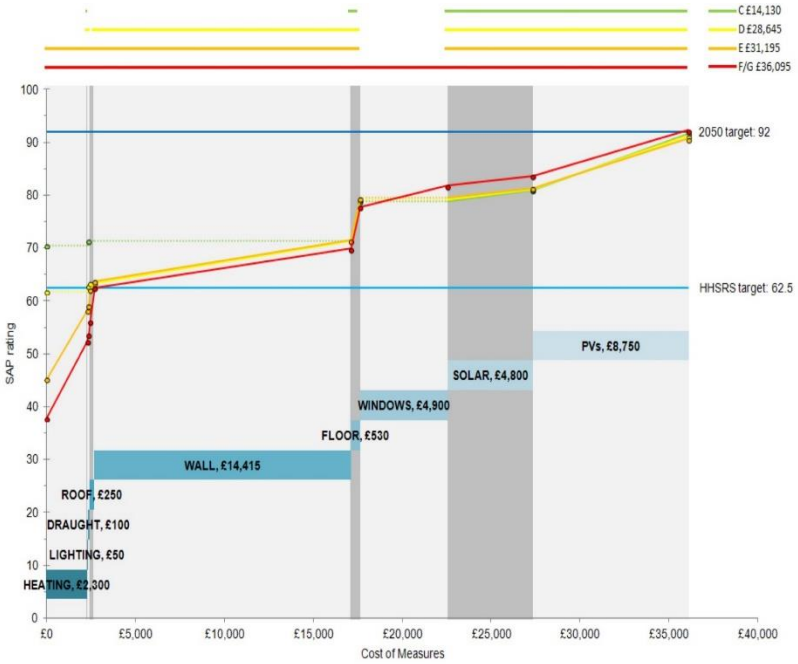


- **Big challenge!!!**
- **Tough targets**
- **Too difficult**
- **Huge cost to get there**
- **Massive disruption**
- **Takes too long**
- **No supply chains**
- **Who to trust?**
- **Why not wait for the grid?**
- **What should I do first?**
- **Where to start?**
- **Getting people onboard!**

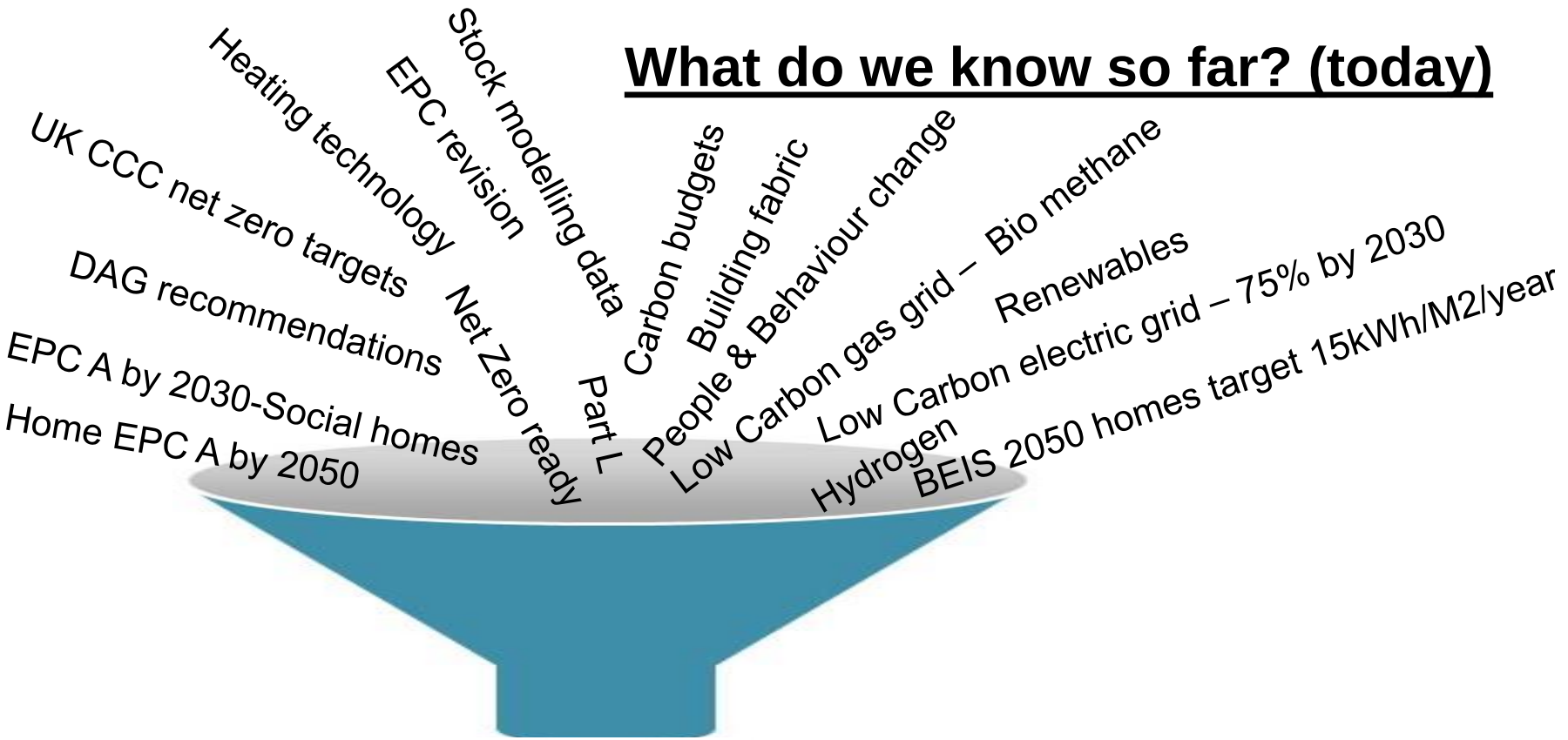
The opportunities - Decarbonisation of Welsh Homes

- A lot of work – 30 years worth!!!
- Wide range of actions
- New technology and innovation
- New skills and training
- Large demand for SMEs in all skills areas
- Long term projects with market confidence to develop and create jobs
- New local supply chains
- Trusted local installers
- More efficient and comfortable homes
- Reduced energy bills and fuel poverty – more available money in peoples pockets
- Community leadership and engagement

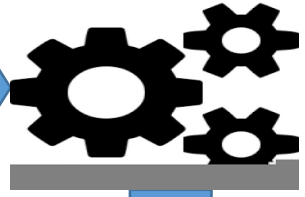




What do we know so far? (today)



Welsh government policy



Optimised Retrofit

Optimised Retrofit

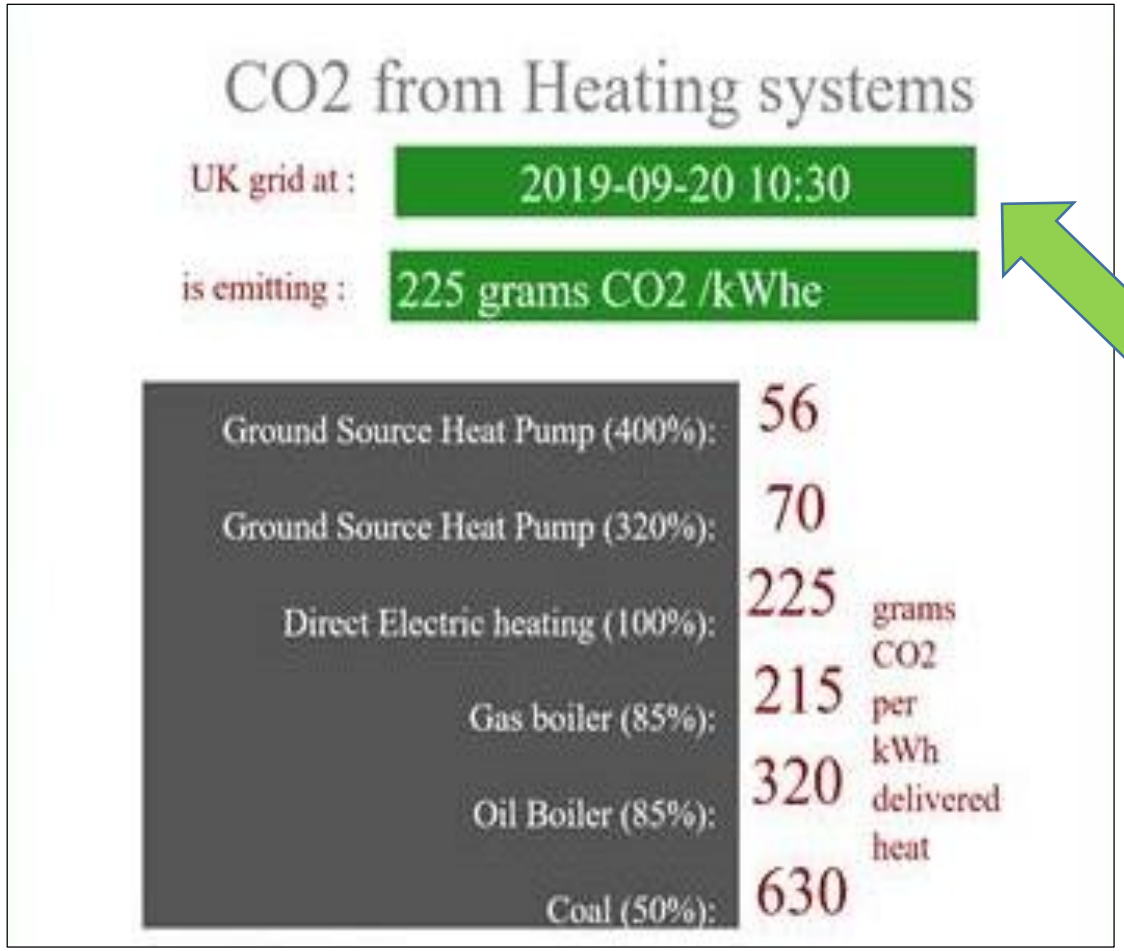
Optimised Retrofit is the best combination of decarbonised heating systems and fabric improvements to make homes,

‘Net Zero Carbon Ready’.

The Grids Impact - How Much Carbon is your energy costing – Typical values

Cleaning the grids will do the heavy lifting

in a home



on the grid

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

Electricity grid is currently 45% but will be 70% renewables by 2030

Gas grid is less certain but DNO (WWU) already committed to low Carbon gas by 2050

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 ✓

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

- Low levels of cost or technical competency

- Moderate levels of cost or technical competency

- Higher levels of cost or technical competency

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

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Technology Measures

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- Heat storage

- Active homes thermal panels
- Advanced PV Fabric systems

- Gas boilers are currently a reasonably efficient measure but still use a Carbon based fuel that has no certainty over becoming low carbon.

- Electric heat pumps are a low Carbon technology when the supply is renewables. But there is a risk of impacting fuel poverty in some cases and building fabric needs to be carefully considered.

- Hybrid heat systems can overcome the above issues by using smart systems to optimise on both cost or Carbon as appropriate while addressing peoples demand for high grade heat and gaining normalised acceptance of the technology.

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

- Draughts waste energy but improved airtightness can lead to reduced air quality and needs a ventilation strategy. Don't insulate without ventilation!!!

- All the modelling so far suggests a fabric improvement of around 12-20% is needed to:
  - Reduce Carbon emissions at POU to baseline levels.
  - Minimises the investment in grid infrastructure needed
  - Minimises the fuel cost impact on homes

Fabric retrofit Measures

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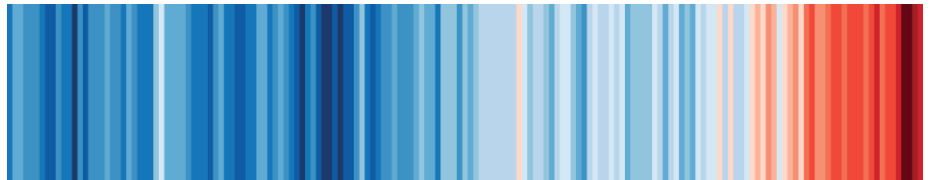
Optimised Retrofit

This is a strategy for an approach, not the solution to the problem.

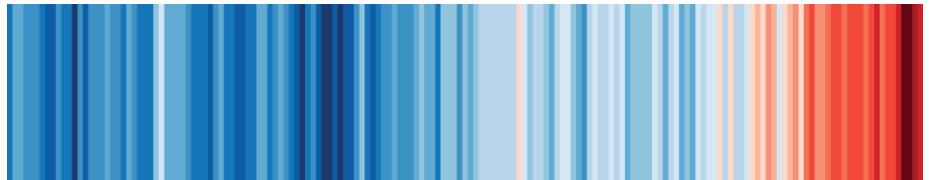
Early deployment of insulation measures to maximise energy bill and carbon savings prepares the stock for low carbon heating.'

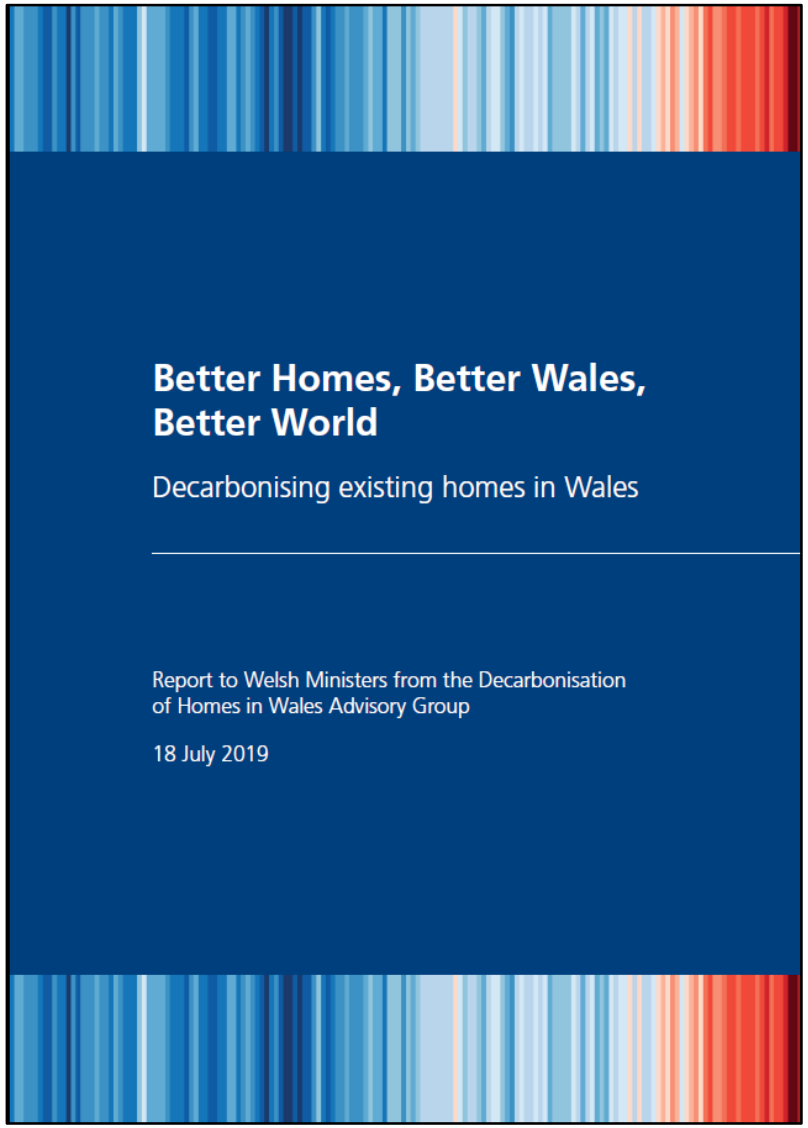
[CCC Net Zero Tech Report p.79]

Questions on Part 1



The need for stock modelling – Patrick Myall





Action 2.3 – The Welsh Government should urgently commence a 10-year programme to prioritise the retrofit of certain homes.

(a) The Welsh Government should set a target of EPC Band A for homes in social ownership and homes in fuel poverty.

(b) The Welsh Government should incentivise early adopters to retrofit homes to a target of EPC Band A.

This is set in the context of,

- Environment (Wales) Act 2016
- Welsh Ministers have made decarbonisation one of their top six cross government priorities in “Prosperity for All: the national strategy’
- Declaration of a ‘Climate Emergency’ by Welsh Ministers on 29 April 2019 – pushing towards a 95% target.

‘Better Homes….’ was an **advisory** report.

The Minister, in response, said;

- Need to pursue ‘optimised retrofit’ solutions.
- To future proof homes so they are zero carbon capable, - ready to adopt future solutions and approaches.
- Testing and trialling referred to in the Report will be vital.

Decarbonisation of Social Homes Focus Project

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 with costs
- Real energy performance data by home
- Real people (tenants) and behaviours

<u>Before</u> identifying a pathway to 2030

- Build capacity and market demand
- Understand pathways
- Evaluate and evolve

3 Phases to decarbonisation of Social Homes Focus Project

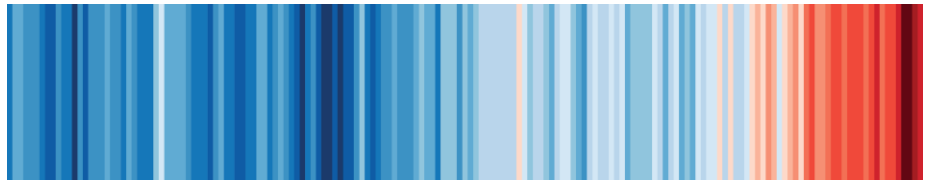
(1) WG led data – with KAS and WHQS teams – Nov 2019 to Jan 2020

links to….

(2) Pilot ‘focus project’ – December 2018 to March 2020

(3) Discussion about roll-out with all Social landlords – March 2020

Phase 1 – WG Data Collection– Gowan Watkins



Phase 1: WG led data

WSA 14 Archetypes estimated to cover 84% of housing stock (WHCS 2017-18).

	HOUSE End terrace	HOUSE Mid terrace	HOUSE Semi-	HOUSE Detached	FLAT (Purpose blt)	Total
pre 1919	type 1, 3%	type 2, 9%	type 3, 4%	type 4, 7%		23%
1919- 1944			type 5, 5%			5%
1945- 1964			type 6, 10%			10%
1965 - 1990	type 7, 4%	type 8, 6%	type 9, 10%	type 10, 9%	type 11, 4%	33%
Post 1990			type 12, 5%	type 13, 7%	type 14, 1%	13%
Total	7%	15%	34%	23%	5%	84%

Phase 1: WG led data - Archetypes

Please insert the number of properties in each category

	On Gas Non-Heritage	On Gas Heritage	Off Gas Non-Heritage	Off Gas Heritage	Total
1. Pre 1919 end terrace house					0
2. Pre 1919 mid terrace house					0
3. Pre 1919 semi-detached house					
4. Pre 1919 detached house					
5. 1919 – 1944 semi-detached house					
6. 1945-1964 semi-detached house					
7. 1965-1990 end terrace house					
8. 1965-1990 mid terrace house					
9. 1965-1990 semi-detached house					
10. 1965-1990 detached house					
11. 1965-1990 purpose built flat					
12. Post 1990 semi-detached house					
13. Post 1990 detached house					
14. Post 1990 purpose built flat					
Total	0	0	0		

Please insert the number of properties in each category

	Number of properties	Comment (e.g. cloned data, age of data etc.
EPC A		
EPC B		
EPC C		
EPC D		
EPC E		
EPC F		
EPC G		

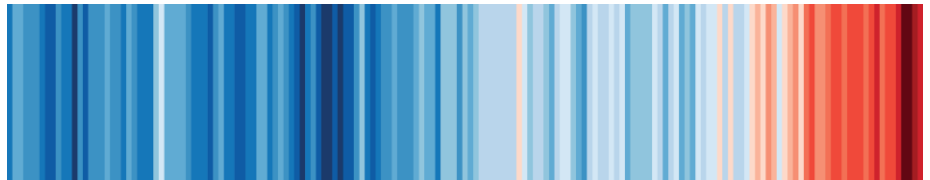
Phase 1: WG led data – ideal world

Individual record level:

- **unique ID (pref. UPRN)**
- **construction date (yyyy)**
- **property type (semi, dethatched, purpose build flat, converted flat, detached bungalow, semi-bungalow, terraced, end terraced, terraced bungalow, maisonette, other)**
- **construction type (solid wall, cavity wall, timber frame, etc.)**
- **on grid/off grid?**
- **heritage property?**
- **EPC; date; cloned?**
- **Latest SAP score (e.g. done since improvement works); date; cloned?**

UPRN	Construction date	Property type	On Grid?	Heritage?	EPC			Latest SAP score		
					EPC	date of EPC	cloned?	SAP	Date	cloned
0001	1909	terrace house	Yes	Yes	D	-	Yes			
0002	1923	end terrace	Yes	No	E	Aug-15	No	69	Oct-18	No
0003	1850	detached house	No	Yes	D	Nov-18	No			
0004	1939	detached bunglaow	Yes	No	C	-	Yes			

The aims of the research project– Patrick Myall



Aim 1: **Understanding current practice.**

- Understand the existing data in terms of 14 archetypes, the EPC rating for each property,

- To understand what work landlords have already undertaken in their properties,

- The costs of the work,

- The extent to which we know the carbon savings generated,

- The way in which that data is held – Asset Management,

- To understand the future plans of social landlords to reach energy efficiency targets.

Aim 2: **Identify a pathway**

'Early deployment of measures to maximise energy bill and carbon savings and prepare the stock for low carbon heating.'

(Committee for Climate Change - Net Zero Tech Report, Feb 2018 p.79)

- **'Optimised Retrofit'.**

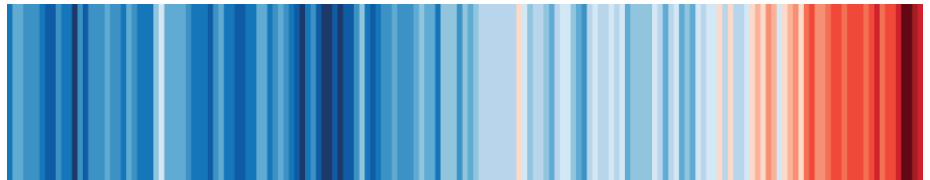
'The best (value) combination of decarbonised heating and fabric improvements for decarbonisation of a home to make it 'Net Zero' ready.'

- **Each landlord's stock is different.** And has different 'typologies' with it.
- **Realistic programme** (Target is fixed!)
- **Identify Outline Costs**

Aim 3: **Evaluating a process**

- To gather social landlords views on the best approaches to making the changes,
- The most economical approaches; the most ‘carbon advantageous approaches’,
- Competing priorities,
- How the work planned relates Welsh Housing Quality Standard (WHQS)
- How to improve the quality of the modelling undertaken,
- Frequency with which the modelling should be updated and how a modelling process can be developed,
- To develop an understanding of the barriers / enablers.

Questions on Part 2



Thank You!