

Passivhaus and zero carbon

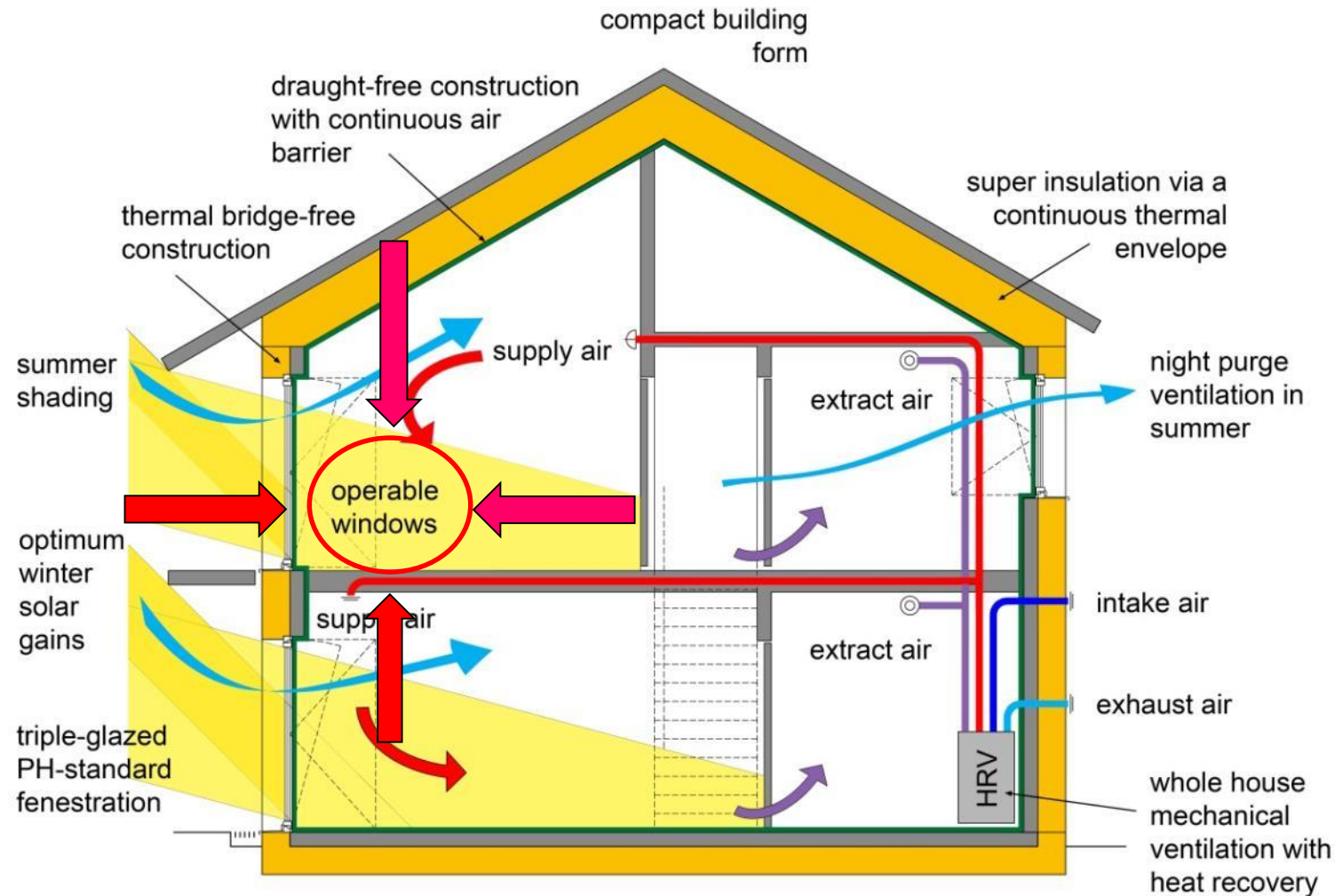
28 Nov 2019



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Email: info@passivhaustrust.org.uk Web: www.passivhaustrust.org.uk

Erneley Close, Manchester : 2E Architects

What is Passivhaus?



Not just housing

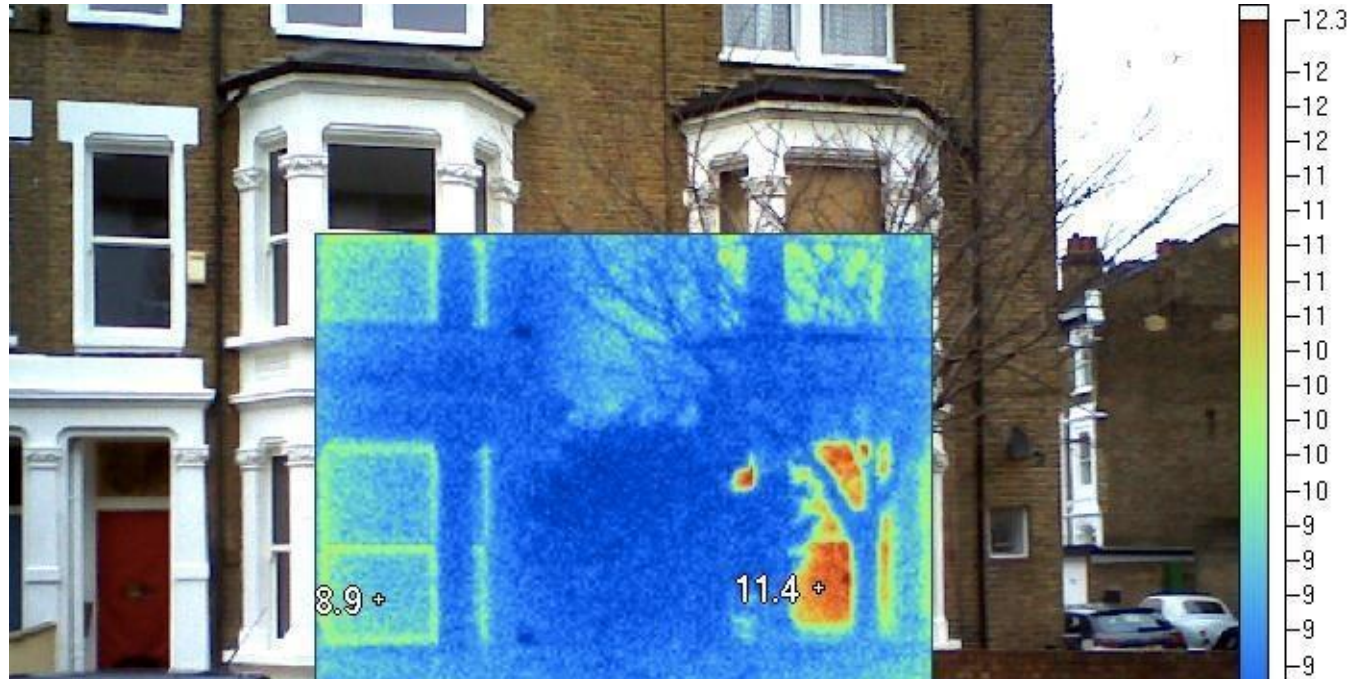
The Passivhaus standard is not confined to residential properties and has been achieved in several office buildings, schools, supermarkets etc around Europe.



Also refurbishment

“Quality-Approved Energy Retrofit with Passive House Components”

The goal was to create a standard for an economically and ecologically optimal energy retrofit, for old buildings that cannot achieve Passive House Standard with reasonable effort. (PHI)

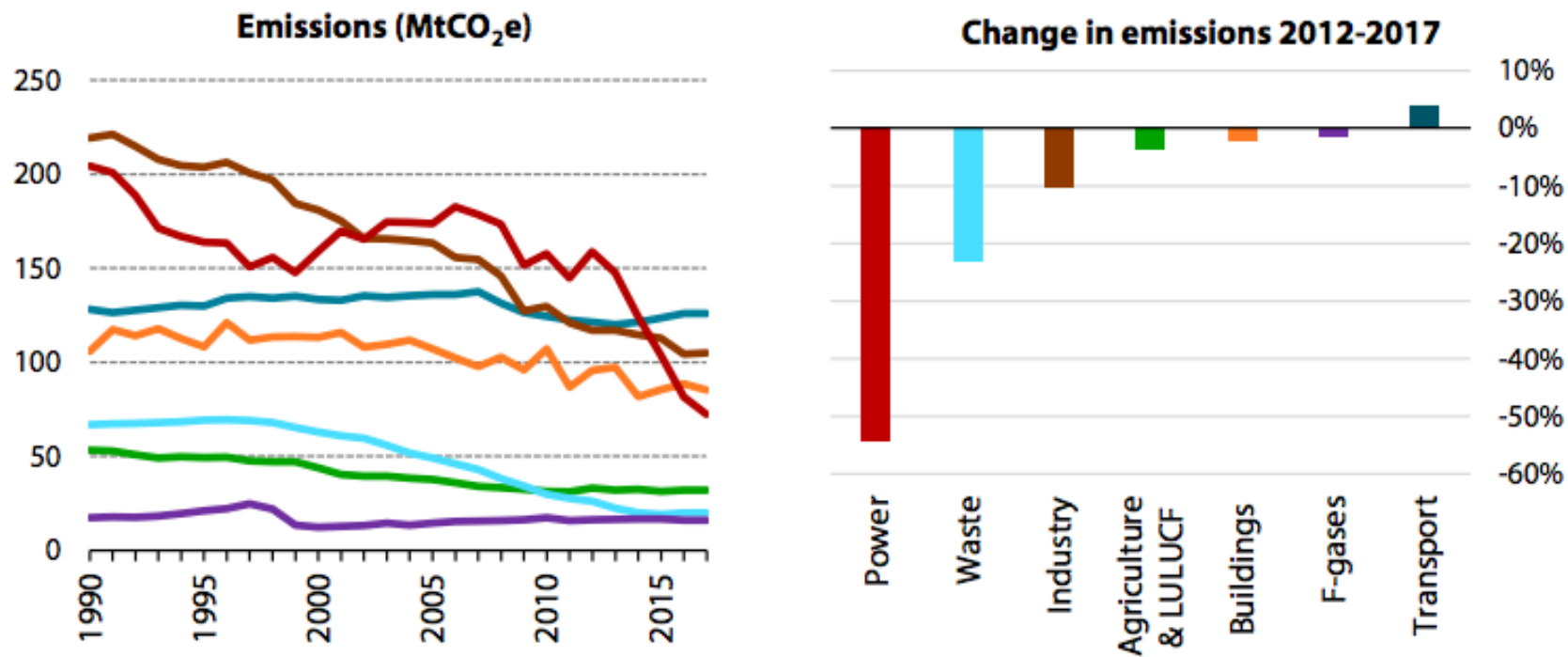


Lena Gardens

Passivhaus: The route to Zero Carbon?

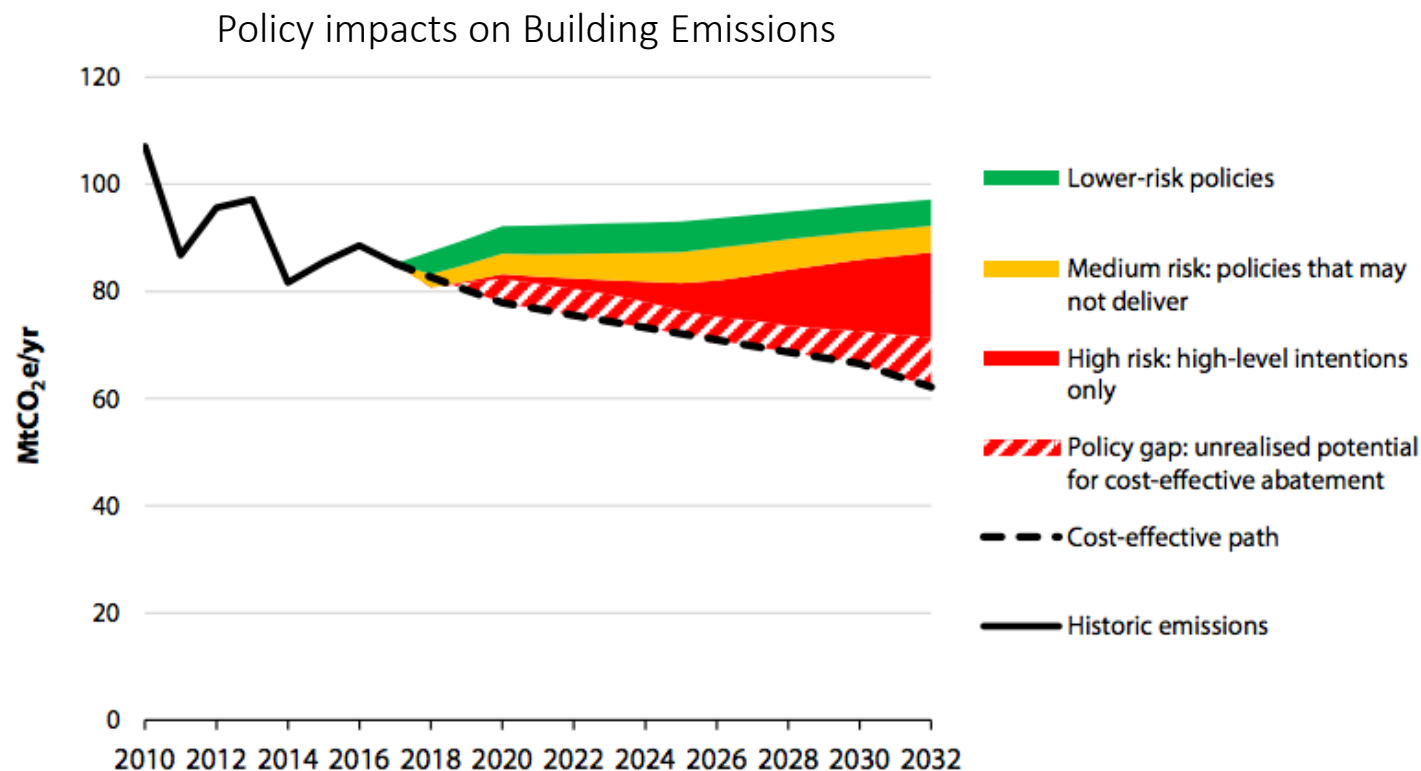
Jon Bootland, Passivhaus Trust
jon@passivhaustrust.org.uk

The Challenge



Building emissions are slowly reducing ...

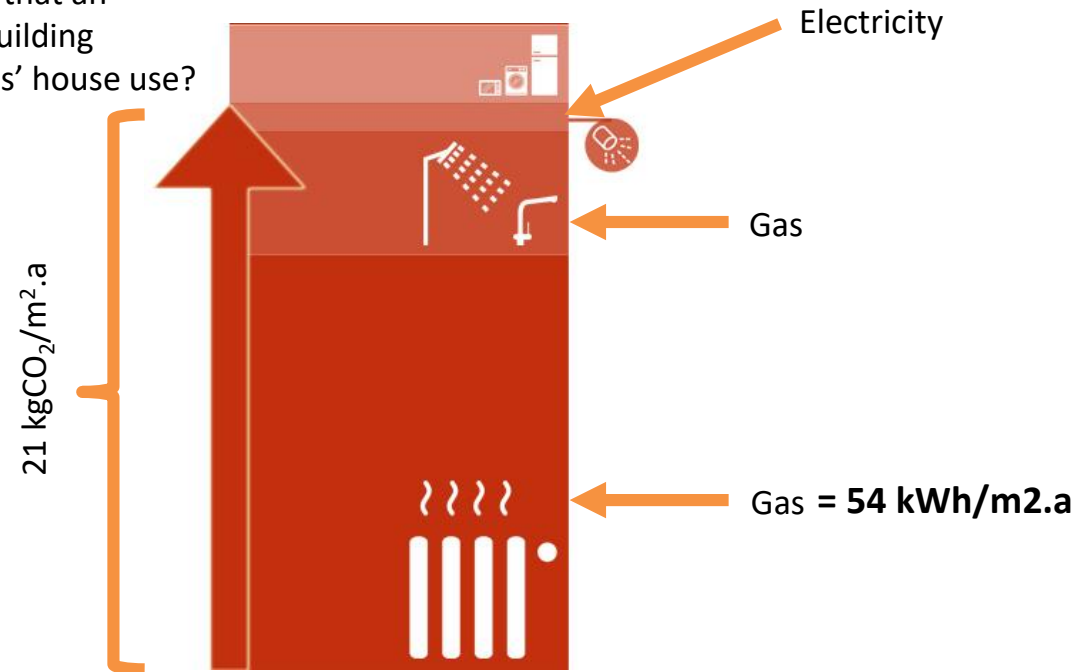
The Challenge



... but we're not going to meet our targets with current policies
.... And note the text about "High risk interventions"

Where are we coming from?

How much energy does
SAP tell us that an
average 'Building
Regulations' house use?



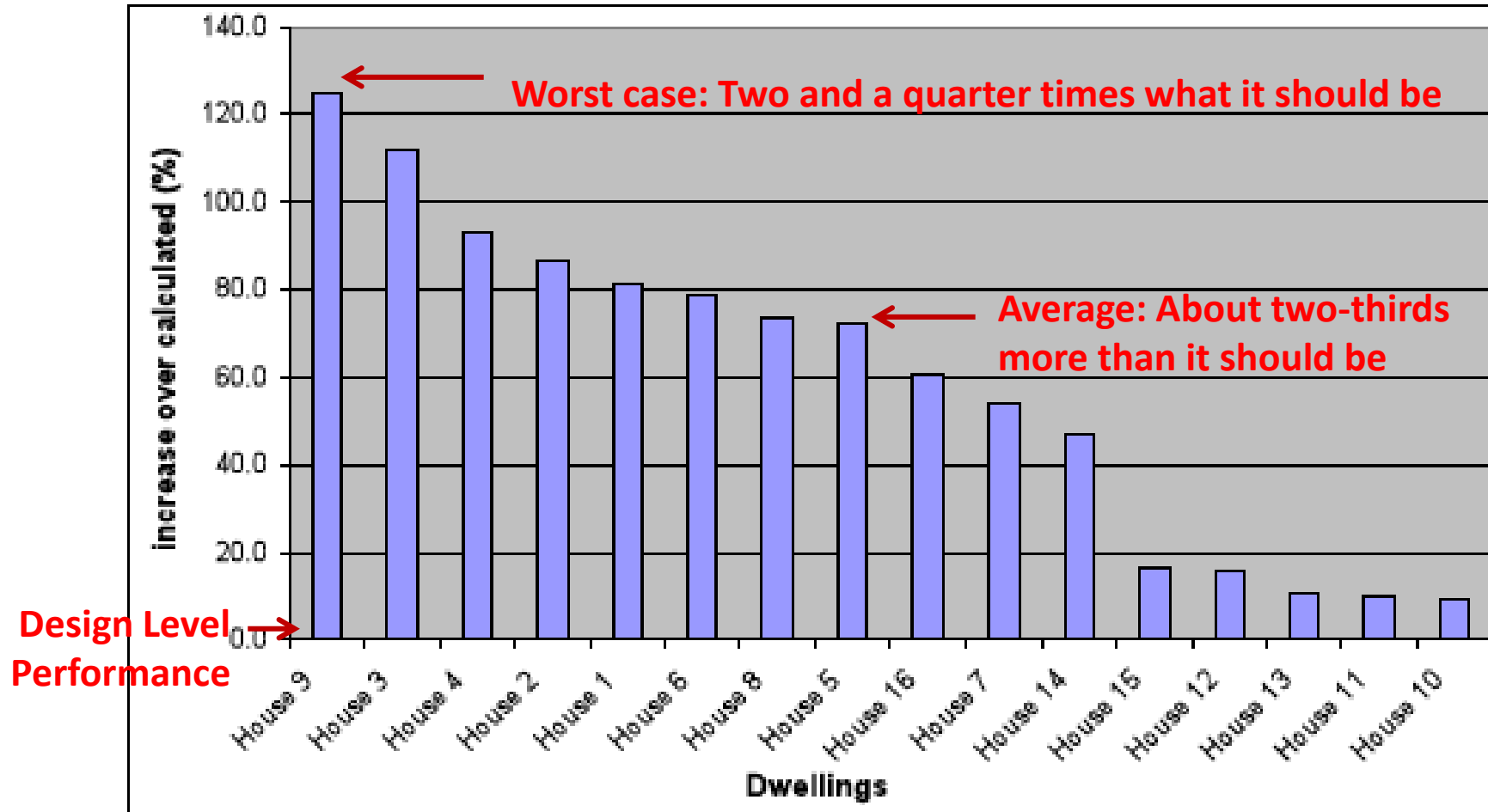
Actual energy use in new homes

How much more energy does a typical new home use for heating, compared to its design target?

+10% + 25% +50% 60 - 80% +75% +100%

Source: Zero Carbon Hub, Carbon Compliance for Tomorrow's New Homes: a review of the modelling tools and assumptions – Topic 4 Closing the gap between designed and built performance, NHBC Foundation, Aug 2010.

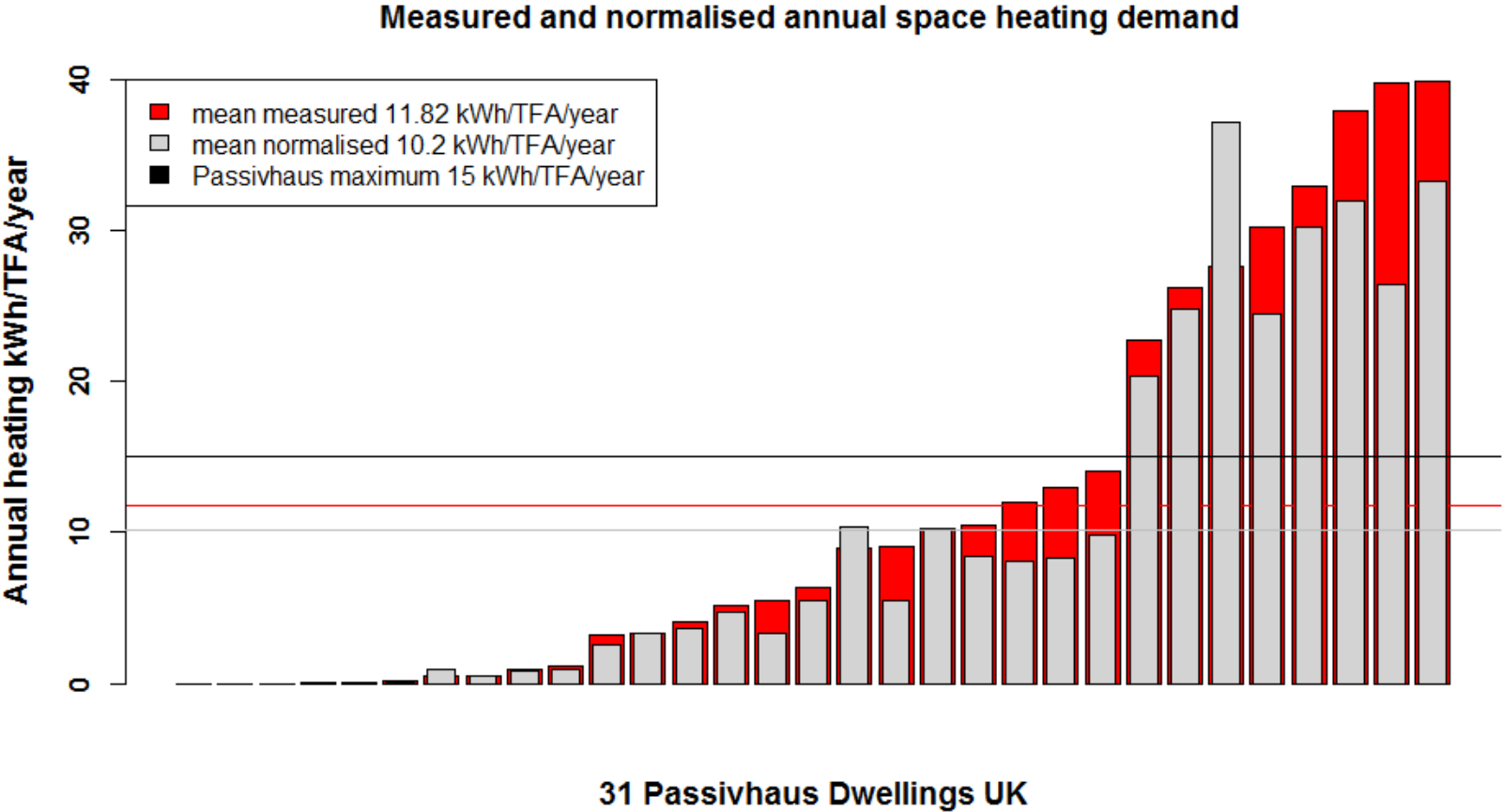
The Performance Gap



Measured vs predicted whole house heatloss (Leeds Met University)

Passivhaus UK Performance

UK Measured Data (Bath University)



Passivhaus

How is it achieved?

A quality assured process with Certification for:



Buildings

- Through UK based certifiers

Products / Components

- Through Passive House Institute
- Is a demonstration of performance but not required (except for MVHR systems)

Designers / Consultants

- Through CEPH courses
- List of CEPH designers / consultants on the PH Trust website

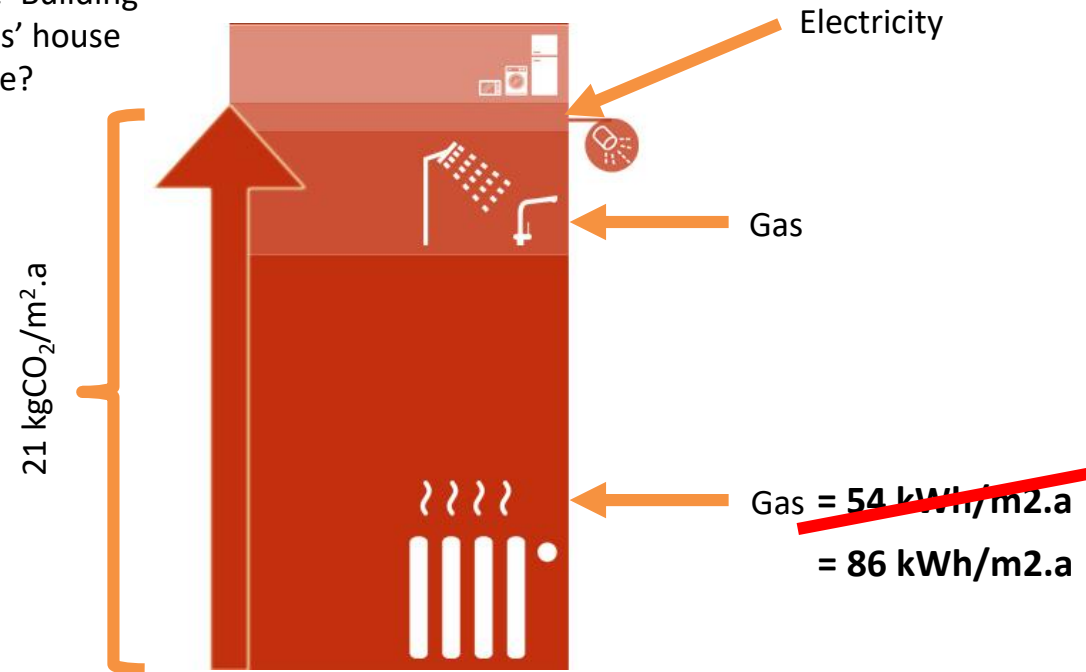
Tradesmen / Installers

- Through Certified Tradesman courses

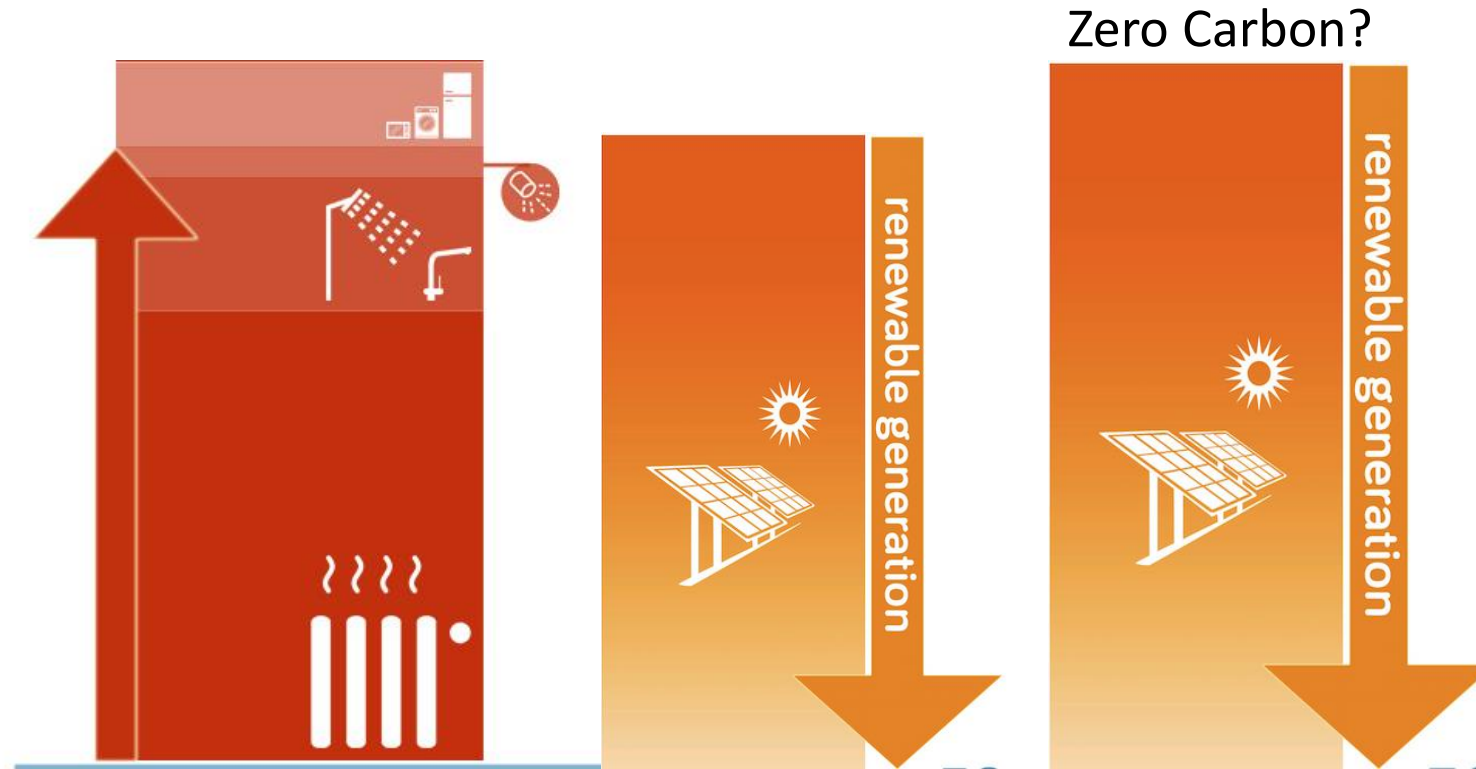
Building to Passivhaus Principles is NOT the same as building to Passivhaus Standard!

Where are we coming from?

How much energy does
an average 'Building
Regulations' house
actually use?



Where do we want to get to?



Passivhaus: the route to Zero Carbon?

- Where are we coming from and where do we want to get to?
- What are the challenges?
- How could we get there?

Zero Carbon – easy right?



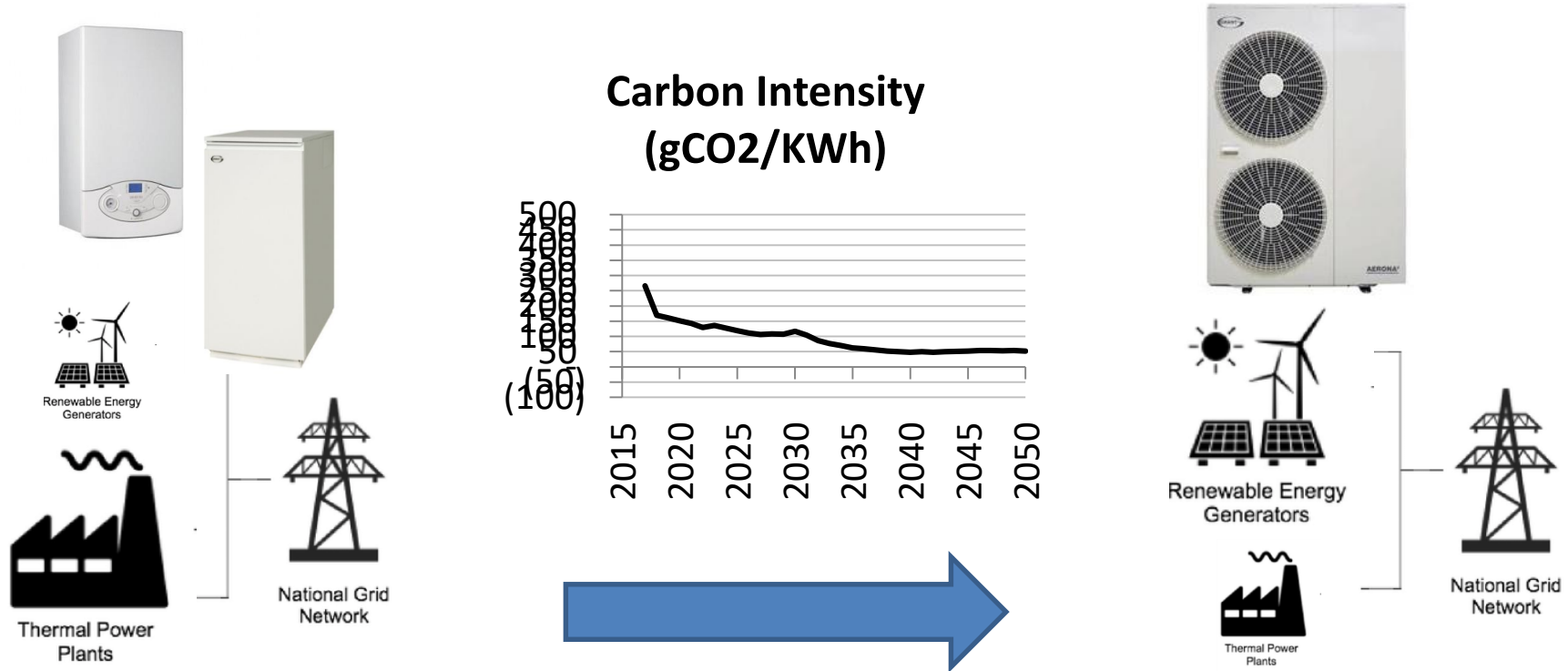
'Not a pipe dream': Labour unveils fastest path to 2030 net zero



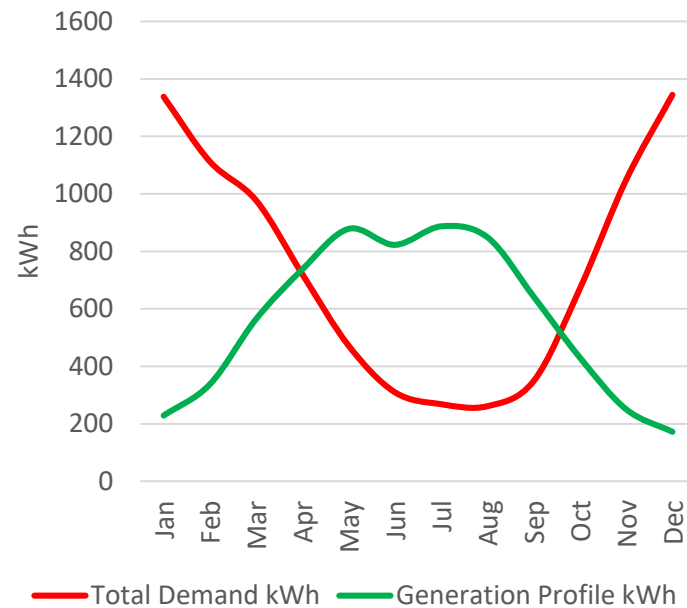
Khan is one of 19 mayors from countries across the world to ring new buildings in their cities are net zero carbon by 2030.



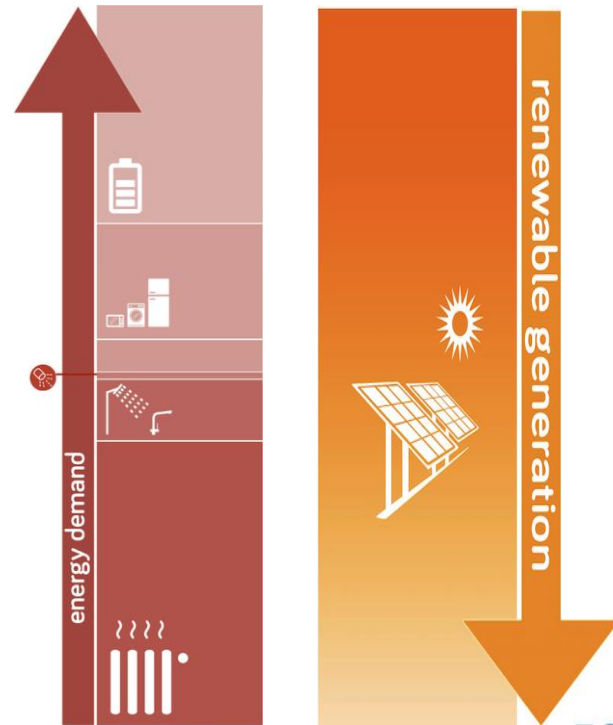
Let's just decarbonise the grid ...



The problem with renewables ...



So real net zero is ...



How much renewable energy?

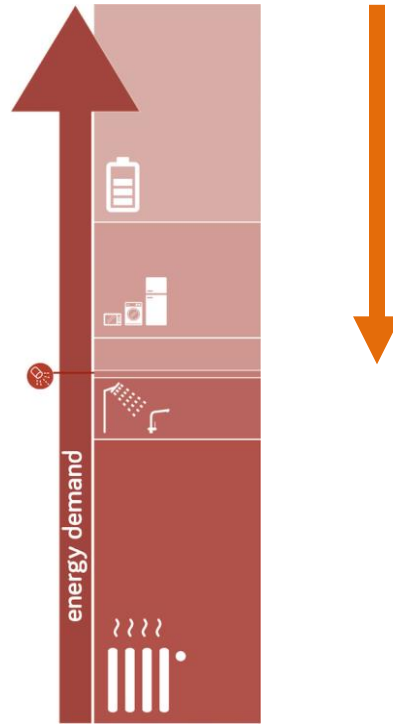
Achievable?

Let's just decarbonise the grid part 2...



- 26M Homes in the UK – most heated by gas or oil
 - Need to move many of these to use electricity to be able to capitalize on grid decarbonization ...
 - The rest ... low carbon heat?
 - Heat demand in winter is approx. 6 times as much as power demand in summer
-
- That's a huge additional load on the grid ...

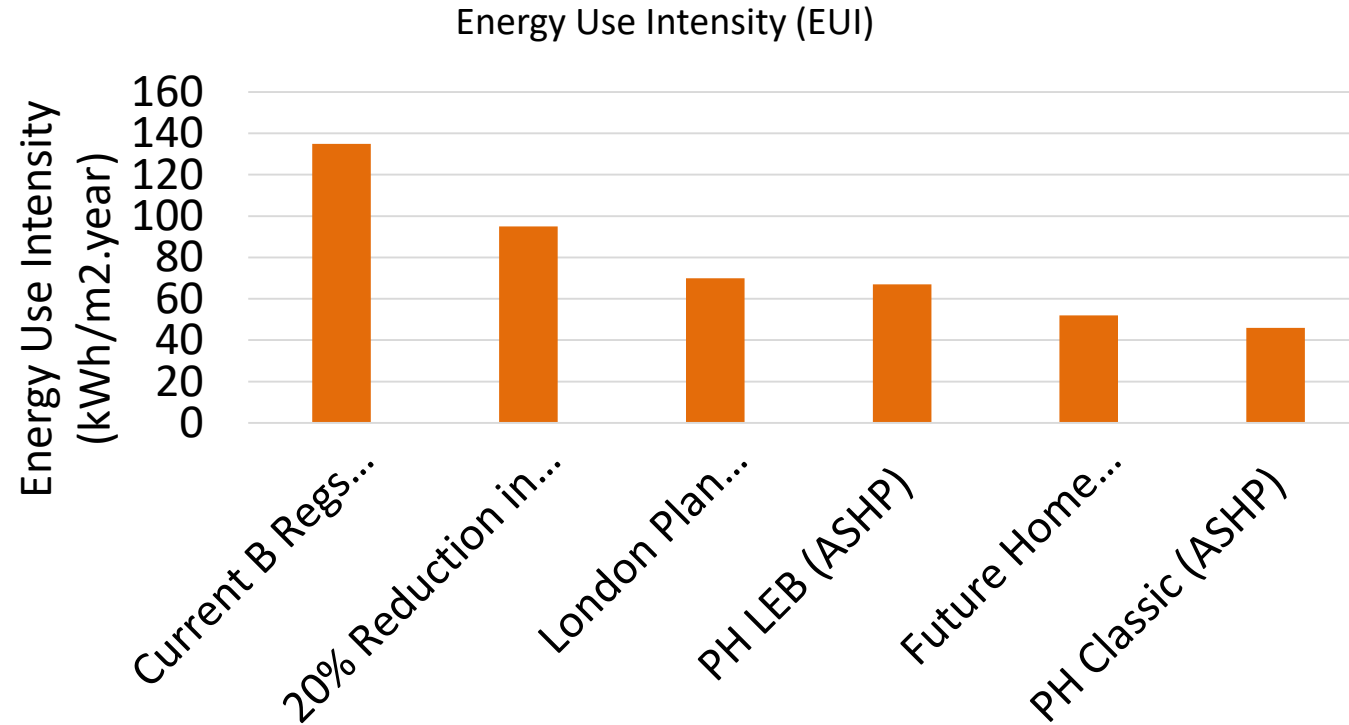
So we need to minimise load first...



Passivhaus: the route to Zero Carbon?

- Where are we coming from and where do we want to get to?
- What are the challenges?
- How could we get there?

How could we get there?

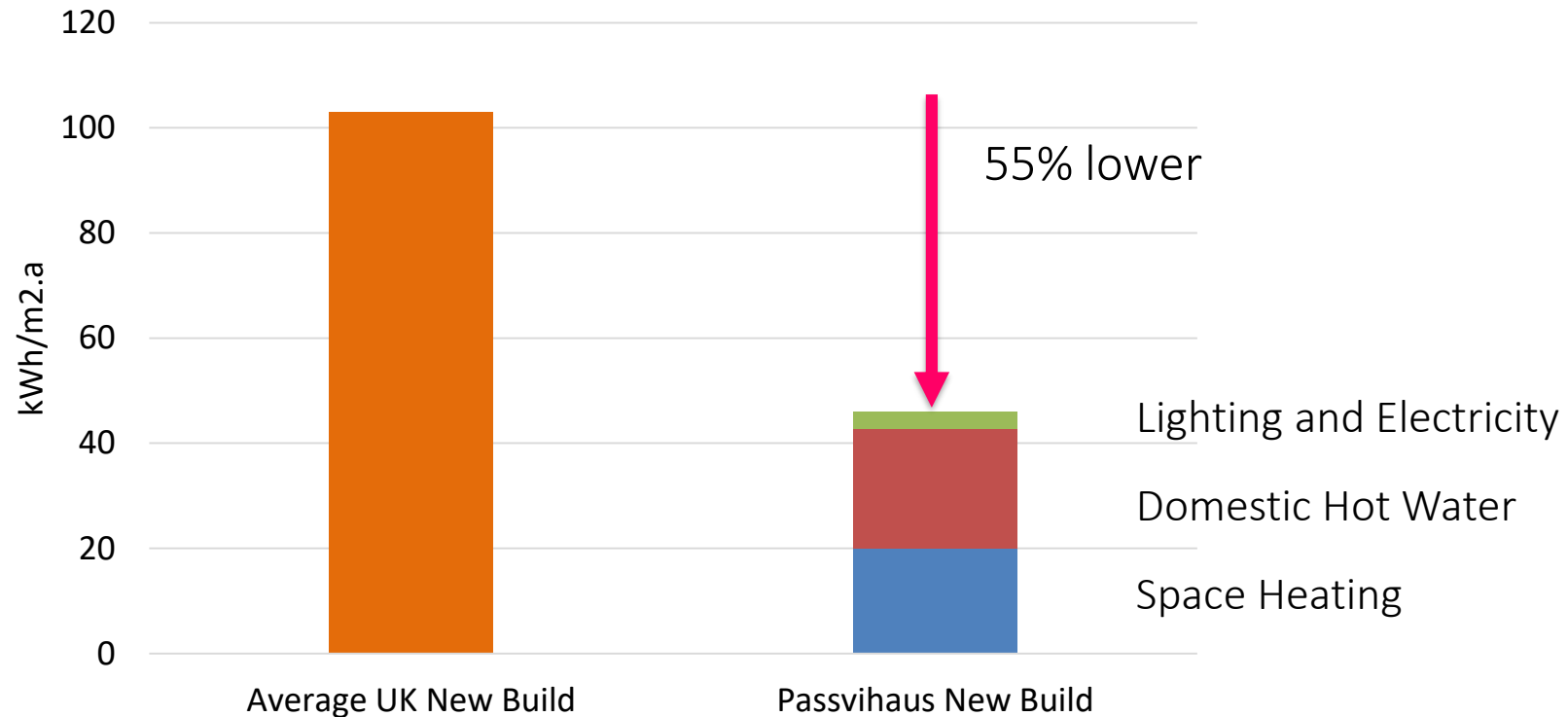


What does that look like?

	Baseline	2021 (20% TER)	2025 Option A (London Plan)	2025 Option B PH LEB	2030 (PH Classic)
Airtightness (ACH@50Pa)	5	1.5	1	1	0.6
Fabric Performance Gap (%)	60	60	60	20	0
Average u-value Glazing	0.17 Double	0.14 Double	0.15 Triple	0.15 Triple	0.14 Triple
Ventilation Strategy	Natural	Natural	MVHR	MVHR	MVHR
Thermal Bridges	Typical	Typical	Improved	Good	Good
Form Factor	Typical	Typical	Typical	Improved	Improved
Glazing Proportion	Typical	Typical	Typical	Optimised	Optimised
Domestic Hot Water Design	Typical	Typical	Improved	Good	Good

Passivhaus Energy Use

Predicted Energy Use for New Build Dwellings

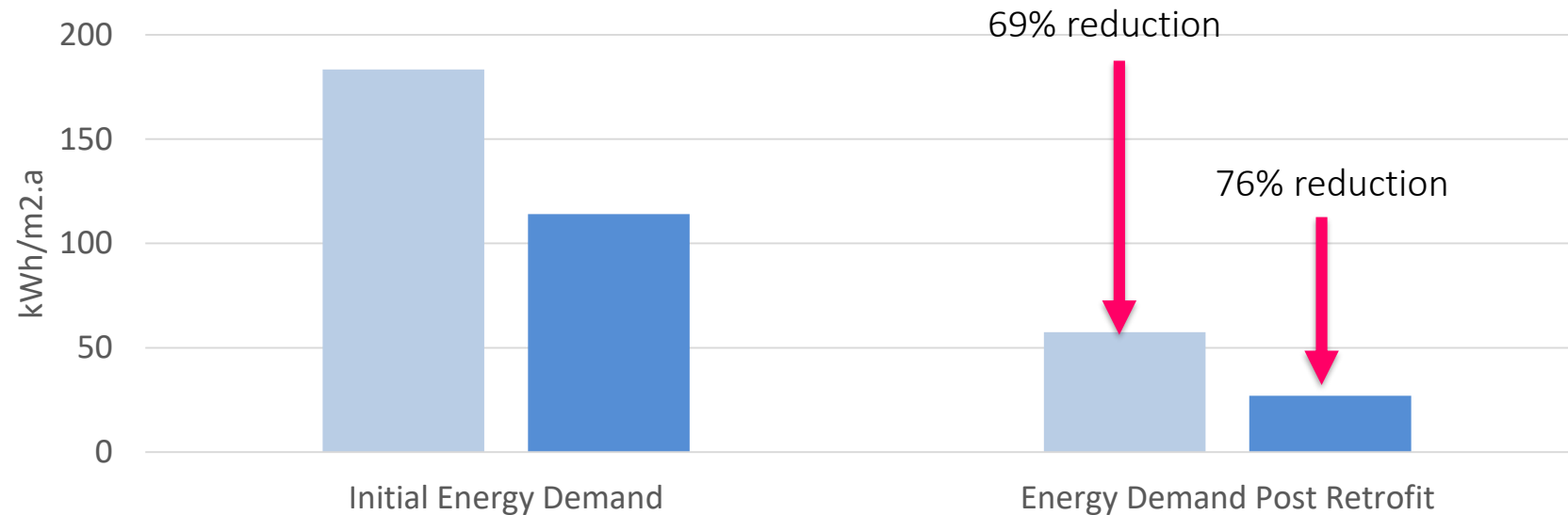


Notes:

1. Source for UK Average New Build: Home Builders Federation Report – You’ve Got the Power, published Oct 2017
2. Passivhaus calculations assume an average occupancy of 3 people
3. Passivhaus calculations include space heating, domestic hot water and lighting – i.e. regulated energy use
4. Assumes a gas boiler for both space heating and domestic hot water

Passivhaus Retrofit

Large Retrofit Examples



Example 1

Cedar Court, Glasgow – complete refurbishment of an 8000m2 tower block



Example 2

Erneley Close, Manchester - Regeneration of two dilapidated blocks of flats in one of the poorest parts of Manchester

So ... to summarise

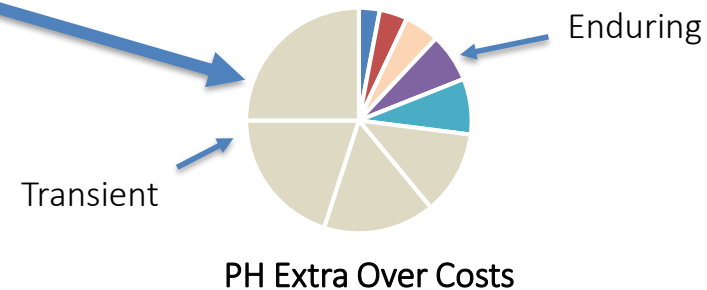
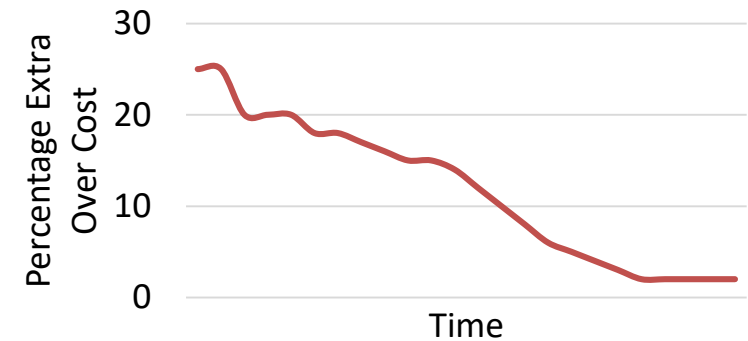
- It's not as easy as we might think ...
- To have any chance of getting to Zero, we need to build to high levels of fabric efficiency - Passivhaus ... or beyond?
- The Performance Gap remains a challenge that we haven't dealt with
- Maximise renewable generation – we need more than we're planning for 2030 ...
- Grid decarbonization will help ... but we need to minimize and spread the load

... and how do we get there ...

- “Passivhaus is coming ...”
- Performance gap ... skills, technology and supply chains
- Need to give the industry time
- 2020: Clear signals from government setting out trajectory
- 2020-2025: Build experience and volume of Passivhaus
- 2025-2030: Passivhaus fabric targets on all projects
- 2030: Full Quality Assured Passivhaus plus renewables

Passivhaus New Build Costs

- Reported extra over costs (good practice) of around 8%
- Costs declining as adoption increases
- Key factors to reduce costs:
 - Considering PH from the start – form factor/orientation/glazing
 - First-time contractors building in risk
 - Training/Skills
 - Maturing supply chain
 - Architectural aspiration – simple vs complex
 - Project size – large projects are better than small
- Two examples with no cost uplift



Exeter

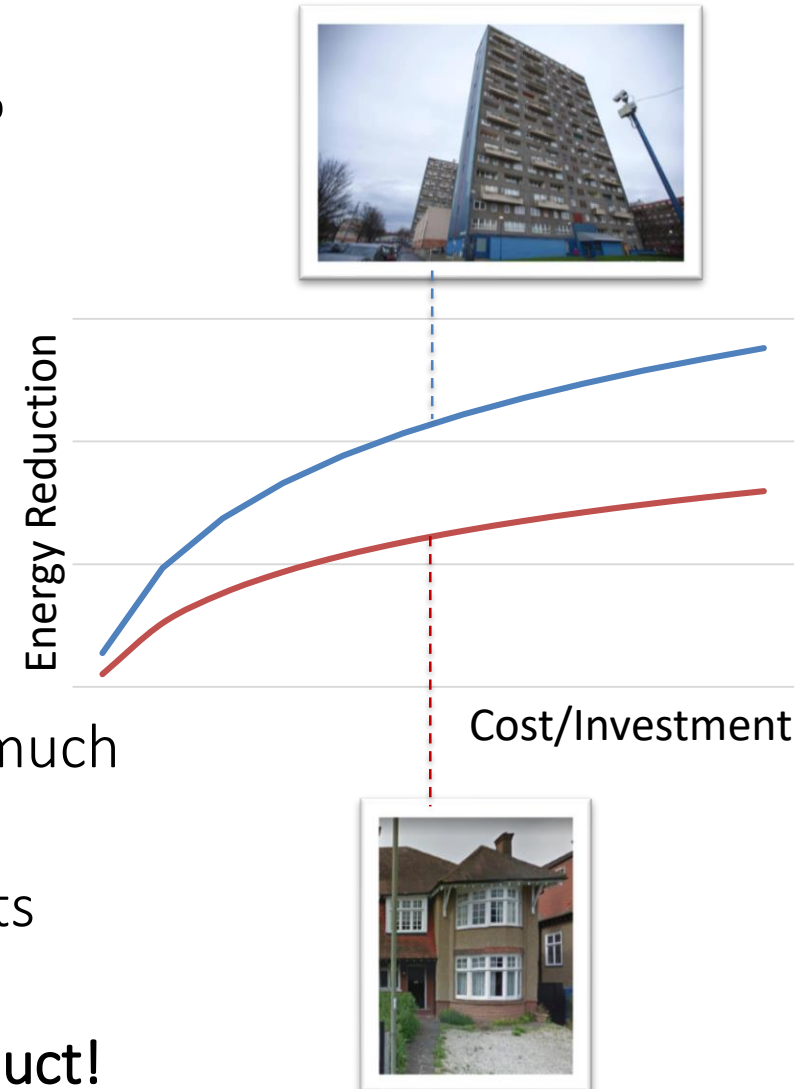


Plymouth

But you are getting a better product!

Passivhaus Retrofit Costs

- Very little data and it's very variable due to different specifications
- Reported extra over costs of 5 - 25%
- Similar factors help reduce costs:
 - Considering PH from the start – form factor/orientation/glazing
 - First-time contractors building in risk
 - Training / Skills
 - Maturing supply chain
 - Project size
- Law of diminishing returns ... small projects expensive – large projects much more economical
- 2020 study will look at EnerPHit costs



But you are getting a much better product!