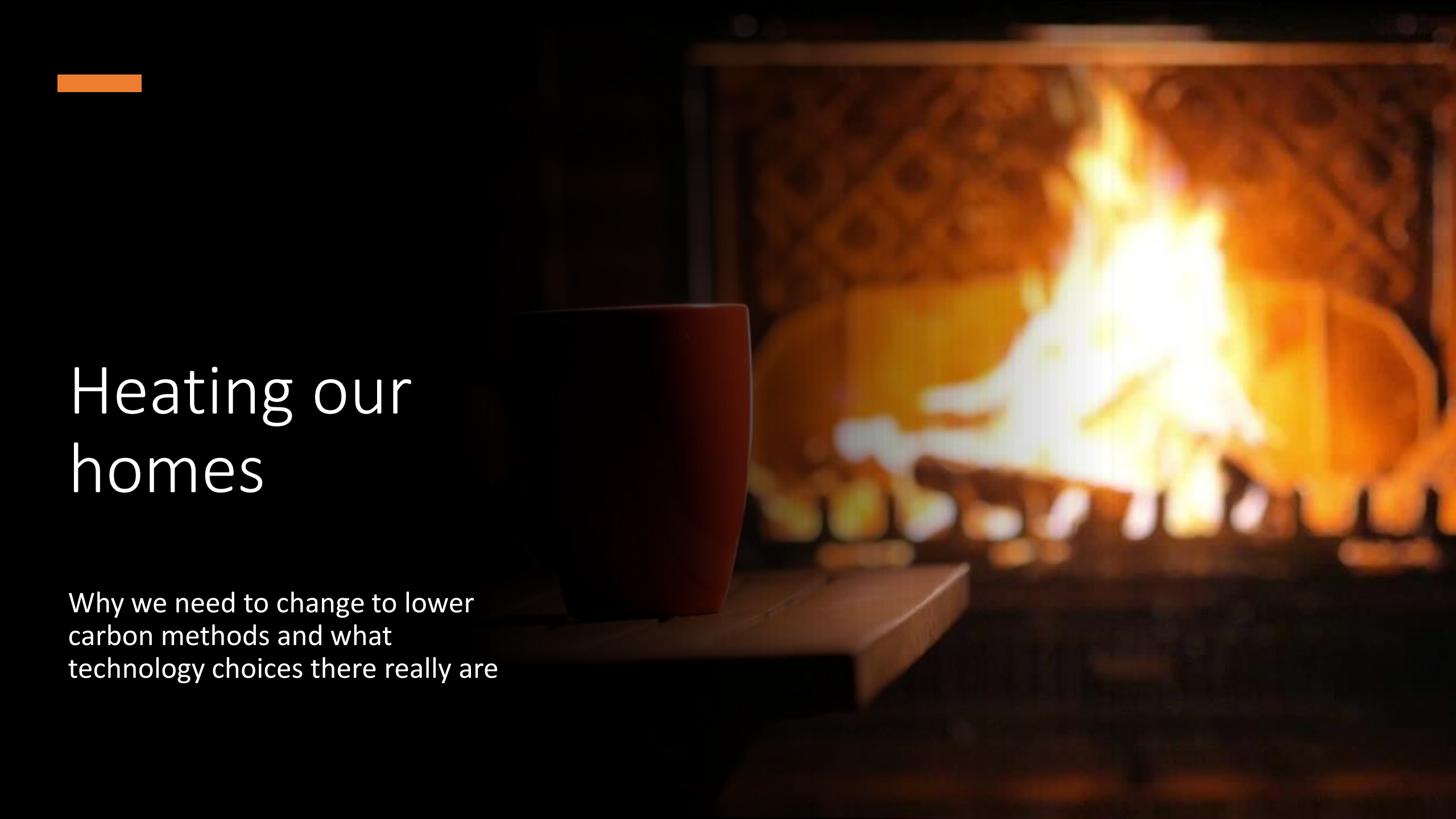
Heating our homes

Why we need to change to lower carbon methods and what technology choices there really are



Who am I?

Scan me for contact details

Roger Bradley, FHEA

I teach at the Open University on a variety of modules including:

U116, Journeys through a changing world (environment foundation module)

T213, Energy for a sustainable future.

T313 Renewable Energy.

T452 Engineering Project Module (Sustainable Energy strand).

Burning stuff to heat our homes makes extreme weather events more *frequent* and *severe* (aka deadly)

Just today, 12th October 2023, the media shows us what is happening around the world of which we are a part…

Don’t think this affects you?
Think about food supplies…
E.g. soya produced in South America is used for animal feed around the world, including Europe as well as directly included in food products we eat as humans.

Heating

- change is coming, but what choice do we have?

Why change?

Others will tell you about climate change, but in all honesty, there are 2 other reasons and for many people in the UK, these will be even more of an incentive to change the way we heat our homes.

Local air quality

- Even the most modern wood-burning stove produces as much particulate emissions as 18-20 diesel cars.
- Even gas stoves, cookers and boilers lead to elevated indoor levels of air pollution and the most efficient will still release significant levels of nitrous oxides that again contribute to ill health.
- solid fuel, wood stoves et cetera release both indoor and outdoor pollutants that aggravate disease including cancer, heart attack, strokes, dementia, asthma, eye infections and many others.

Cost

- Cleaner, healthier, low-carbon options are invariably cheaper to run.

Need to decarbonise

- In effect, that mean electrify everything.

- Yes, the grid is partly generated by fossil gas, **but** that is decreasing every year and grid electricity is becoming cleaner and lower carbon all the time.

- You will have heard about “Carbon Capture & Storage”, and there is a little bit of that being done, but it is a fraction of one percent of global output and there will simply not be enough “capacity” in time to mitigate sufficiently to avoid catastrophic global warming.
- It is not so much a question of just being a little bit warmer.
  Remember that is an average, and some parts of the world will be so much warmer that they may become uninhabitable and long before that will become “un-farmable”.
  Water shortage = food shortage (and disease/pests will also reduce yields).

It’s all about heat pumps

Types of Heat pumps

- Air Source Heat Pump (ASHP)
- Ground Source Heat Pump (GSHP)
- Water Source Heat Pump (WSHP)
- There are others, but for **most** of us it boils down to one of these (probably **ASHP**)

A typical air source heat pump

Daikin Altherma HP
This is a so-called monobloc, with everything built into one box located outside your property.
Other designs may be so-called split units that have an outside box and an indoor box about the size of a conventional boiler. Most (but not all) are installed in conjunction with your conventional hot water cylinder, thermal store et cetera (which you probably already have).

Typically, they might look like the box on the left, but new designs are being developed in fun shapes and sizes, such as the one from Octopus Energy, featured below.
By the way, they made this one coloured for the product launch, but supplied units would usually be more muted tones.

All heat pumps run on electricity but they are massively more efficient than gas/oil

- A typical heat pump will be at least 300% efficient… How is that possible?

- For every one kWh of electricity you use to run the heat pump, you get at least 3 kWh of heat energy out!

- Contrast that with a conventional fossil fuelled boiler that will never give you more that 95% (and is frequently significantly less than that).

Hydrogen boilers?

- Mostly hype
- They do exist, but will be more expensive, potentially leaky and certainly MUCH less efficient than a heat pump alternative.
- Heat pumps are typically more than 300% efficient, whereas hydrogen boiler could never be more than 98% efficient at best and probably much less than that.

Hydrogen – problems

Is there enough UK produced H_2 available?
No. Not to meet all demand and certainly not enough renewably generated or so-called green hydrogen (see next point).

Is it 'green'?
No. Most is actually produced by **steam reformation** of fossil gas. A process that results in more greenhouse gas and harmful emissions than if we simply burnt that gas in conventional boilers/vehicles.

Does it leak?
Yes. Always. Hydrogen (H_2) molecules are very much smaller than methane molecules (that form most of what we call natural or fossil gas). Consequently, the leakage is inevitably greater than with the gas we use now. The gas industry considers some leakage "acceptable".
In addition, hydrogen causes "embrittlement" of steel leading to cracks and even more leaks. Rubber seals can be redesigned to cope with hydrogen, but this adds to their expense. Even if the distribution (gas grid) pipes are replaced with plastic (at great expense) this will not solve the problem of leaks within *domestic* premises.

Want more details of actual low carbon home improvements?

I can recommend a very interesting blog called “Protons for breakfast” – see following side.

He proves that you can dramatically reduce your carbon footprint and save on running costs, with no adverse impact on quality-of-life.

A Short Talk about my Low-Carbon Home

Michael de Podesta

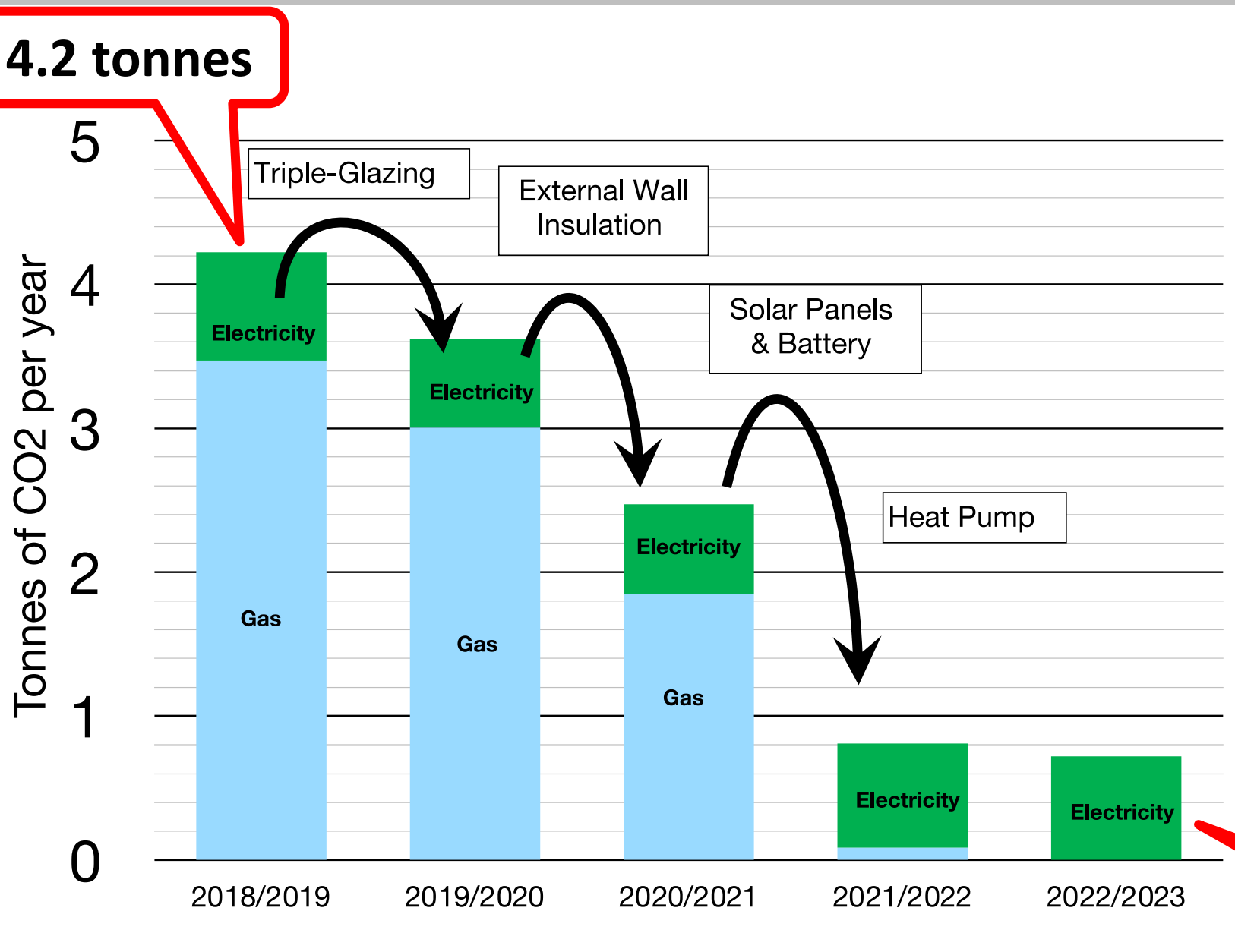
@Protons4B http://protonsforbreakfast.org

More than 30% of total UK emissions!

How do we stop emitting CO_2?

It's to do with how we use energy…

How much CO_2 do I emit?



- I estimate the carbon dioxide emissions from my home by reading my gas and electricity meters each week
- I have reduced carbon dioxide emissions from my home by around 80%.
- In future years this will improve slightly to about 90%.
- No loss of quality of life.

Heat Pump

Running Costs (approximate)

Before (when energy was cheap!)

	Rate	Notes	Annual Cost	
Gas	@3.5 p/kWh	15,000	£525	
Electricity	@25p/kWh	3,800	£950	**£1,475**
Gas Standing Charge	@25 p/day	365 days	£91	
Electricity Standing Charge	@25 p/day	365 days	£91	**£181**
				£1,656

Now (when energy is expensive!)

	Rate	Notes	Annual Cost	
Electricity (peak rate)	Expensive @42p/kWh	~100	£42	
Electricity (cheap rate)	@7.5p/kWh	~3,000	£225	
Electricity (Exports)	**@4.3p/kWh**	**~1100 kWh**	**£47**	
Electricity Standing Charge	@40 p/day	365 days	£146	**£366**
				£366