

Net Zero: The role of the built environment

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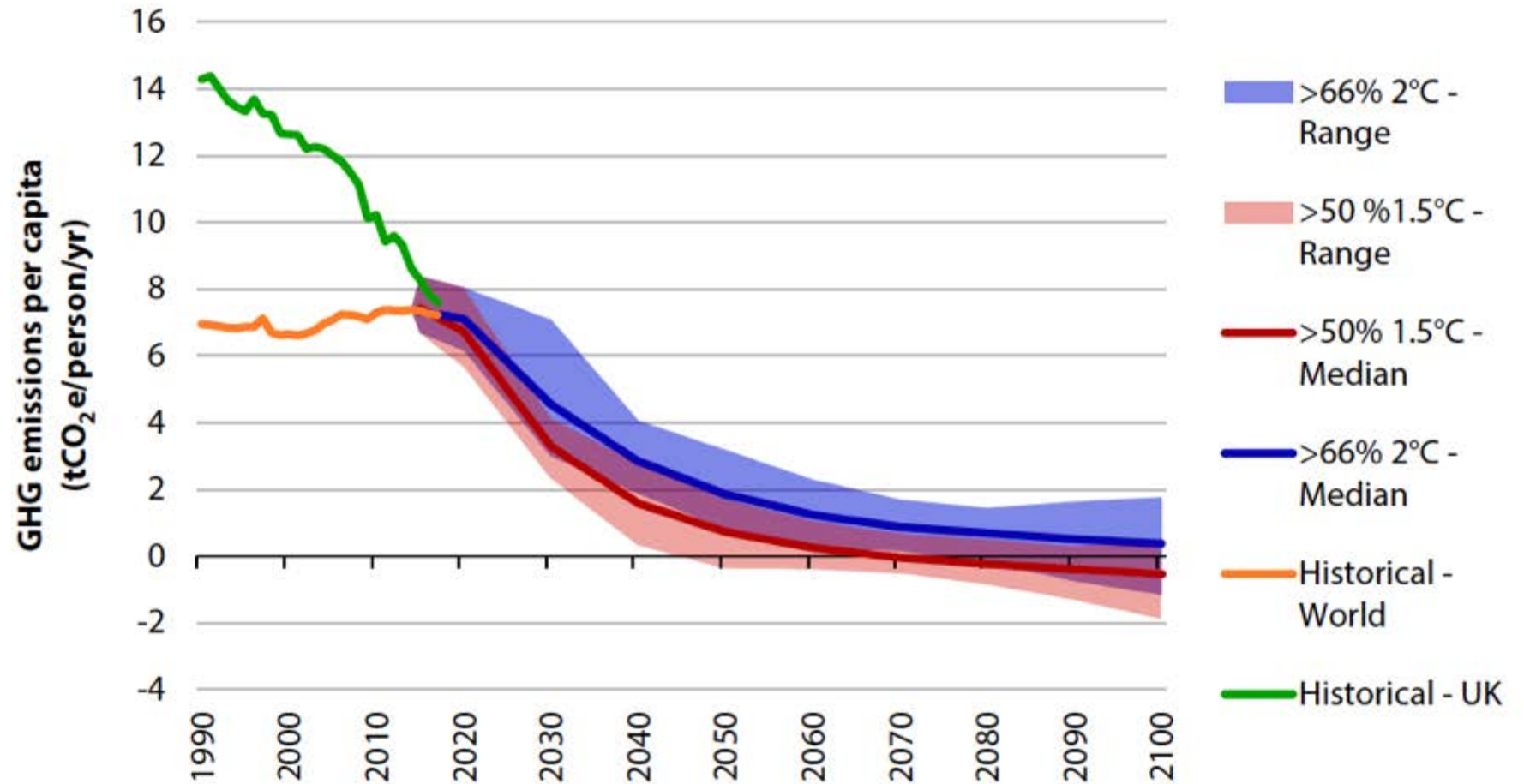
UCL Energy Institute

"The world will not be destroyed by those who do evil, but by those who watch them without doing anything." -- Albert Einstein

What actions will your Institute take?

Figure 3.8. Evolution of global and UK per capita emissions over time

The Good News!



Source: CCC analysis; Huppmann, D. et al. (2018) A new scenario resource for integrated 1.5°C research. *Nature Climate Change*, 8 (12), 1027; Olivier, J. & Peters, J. (2018) *Trends in global CO₂ and total greenhouse gas emissions*.
Notes: UK GHG emissions per capita include land-use change emissions and emissions from international aviation and shipping. Land-use emissions from the Global Carbon Project are included in 'Historical - World'.

Good news

- Many technical feasible routes to – net zero
- They are all challenging,
 - will cost more than people think
 - be slower to deploy than everybody hoped.
 - Many things will be changing at the same time. Everything needs to decarbonize!
- The optimum/best is unlikely to be the winning route



ROADMAP 2035



A BLUEPRINT FOR NET-ZERO



Supporting net-zero

- On track to be a net-zero oil and gas basin
- Developing Carbon Capture Usage and Storage and other low-carbon technologies, at scale
- Underpinning an increasingly diversified energy system



Helping meet UK energy needs

- Providing over half of the UK's oil and gas demand
- Delivering over 1 million barrels of oil and gas each day
- Foundation of an integrated energy system on the UK Continental Shelf



Developing people and skills

- Developing a diverse workforce with transferable skills, supported by an inclusive culture
- Attracting 40,000 people, a quarter of which will be in new roles
- Be recognised as a global leader in carbon management



Driving technology and innovation

- Establishing a Net Zero Technology Solution Centre
- Creating more than 100 new technology start-ups, adding £2 billion in economic value
- Adding over £10 billion in economic value through technology and innovation



Growing the economy and exports

- Continuing to add billions of pounds of value to the UK economy
- Increasing exports from the diversified oil and gas sector to £20 billion each year
- Increasing the number of supply chain firms exporting by 50%

Oil and Gas Industry Roadmap to 2035

SUPPORTING NET-ZERO

WHAT WE WILL DO

TARGET 2050

We will be on track to being a net-zero oil and gas basin by 2050

LOW CARBON SOLUTIONS

We will support development of Carbon Capture Usage and Storage and other low-carbon technologies, at scale

DIVERSE ENERGY SYSTEM

Our industry will underpin an increasingly diversified energy system

- ✦ Access additional funding for net-zero solutions technology development
- ✦ Deliver OGTC's roadmaps
- ✦ Identify and leverage key digital technologies across the oil and gas industry
- ✦ UK established as a world class energy technology hub
- ✦ Establish a cross-sector innovation culture which builds on the OGTC, **Innovation Centres**, and other key initiatives, and is supported by appropriate funding mechanisms
- ✦ Establish and leverage value from cross-sector hubs such as the **National Decommissioning Centre, National Subsea Centre**, and Global Underwater Hub)
- ✦ Leverage OGTC and the sector's capabilities across the wider energy spectrum
- ✦ Support delivery of sector leading cost and efficiency performance across the energy spectrum

The roadmap, built on engagement with over 2,500 industry stakeholders, is one of the first major industrial responses to government plans to reduce or offset carbon emissions to net zero by 2050 in the UK and 2045 in Scotland.



Buildings: low hanging fruit to coconuts ?

- **“Heating buildings.** An overhaul of the approach to low-carbon heating and energy efficiency is needed. The Government’s planned 2020 Heat Roadmap must establish a new approach that will lead to full decarbonisation of buildings by 2050. **This must be fully-funded, following the Spending Review, and it is essential that the Treasury commits now to working with BEIS on this.** Recent announcements on new build must be delivered.”
- **“Switching homes to low-carbon heating** remains a major challenge. It is currently funded by Exchequer spending, but roll-out is limited and less than £100 million was spent in 2018. Our estimates imply an annual cost, reflecting higher upfront costs, **for switching to low-carbon heating of the order of £15 billion.** Large-scale deployment must begin before 2030. It would be **regressive, and probably restrict progress, to pass the cost on fully to households.** This should be a **key focus for the HMT funding review.** We note that in the long run this cost is similar to the combined saving from falling power costs (see above) and electric vehicles (see below).”

Table 7.3. Average abatement costs by sector and measures (2050)

Sector or measure	Abatement cost (£/tCO ₂ e)	Sector or measure	Abatement cost (£/tCO ₂ e)
Power	20	Agriculture	-55
Variable renewables	-5	Agricultural soils	-80
Firm low carbon power	50	Land use	85
CCS for mid-merit generation	80 – 120	Tree planting	10
Residential buildings	155	Forestry management	-50
New homes	70	Peatland restoration	See note
Heat in space constrained homes	310	Waste	10
Heating in homes off the gas grid	-20	Transport	-35
Non-residential buildings	95	Cars	-40

What do we need to build on this opportunity?

1. We need to speak with one voice and with clear leadership.
2. We need to have a very robust and clear message
3. The industry can not cope in the time available with complex messages, to use Bills words - its not about optimizing the irrelevant. Focus the finite resource around simple things to implement, monitor, evaluate and train for?
4. Buildings are part of the energy system infrastructure, but also homes.
5. We do not need to save the planet alone! Leave the problems that others have responsibility to others, we have big enough problems of our own?

5th Avenue in New York in 1900. Can you spot the car?



The 'Great Horse Manure Crisis of 1894, The Times newspaper predicted... "In 50 years, every street in London will be buried under nine feet of manure."



1913. Where's the horse?

2529-12



Illustration: People gathering around a tile stove. *Die Bauern und die Zeitung*, a painting by Albert Anker, 1867.



George Orwell "The Case for the Open Fire"

Evening Standard, December 8, 1945

"To one side of the fireplace sits Dad, reading the evening paper. To the other side sits Mum, doing her knitting. On the hearthrug sit the children, playing snakes and ladders. Up against the fender, roasting himself, lies the dog. It is a comely pattern, a good background to one's memories, and **the survival of the family as an institution may be more dependent on it than we realise.**"

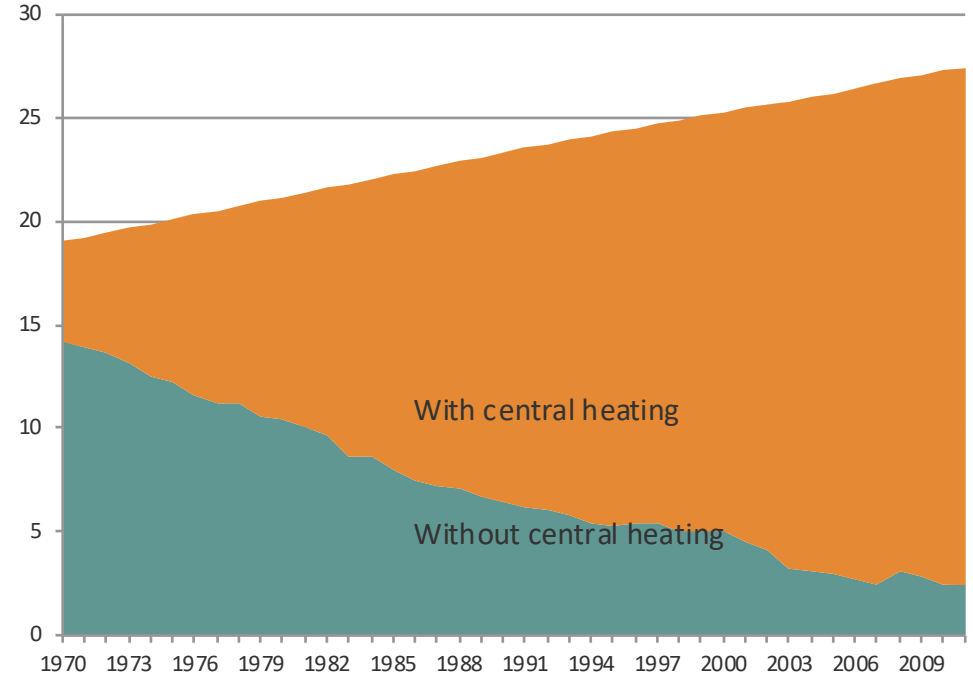
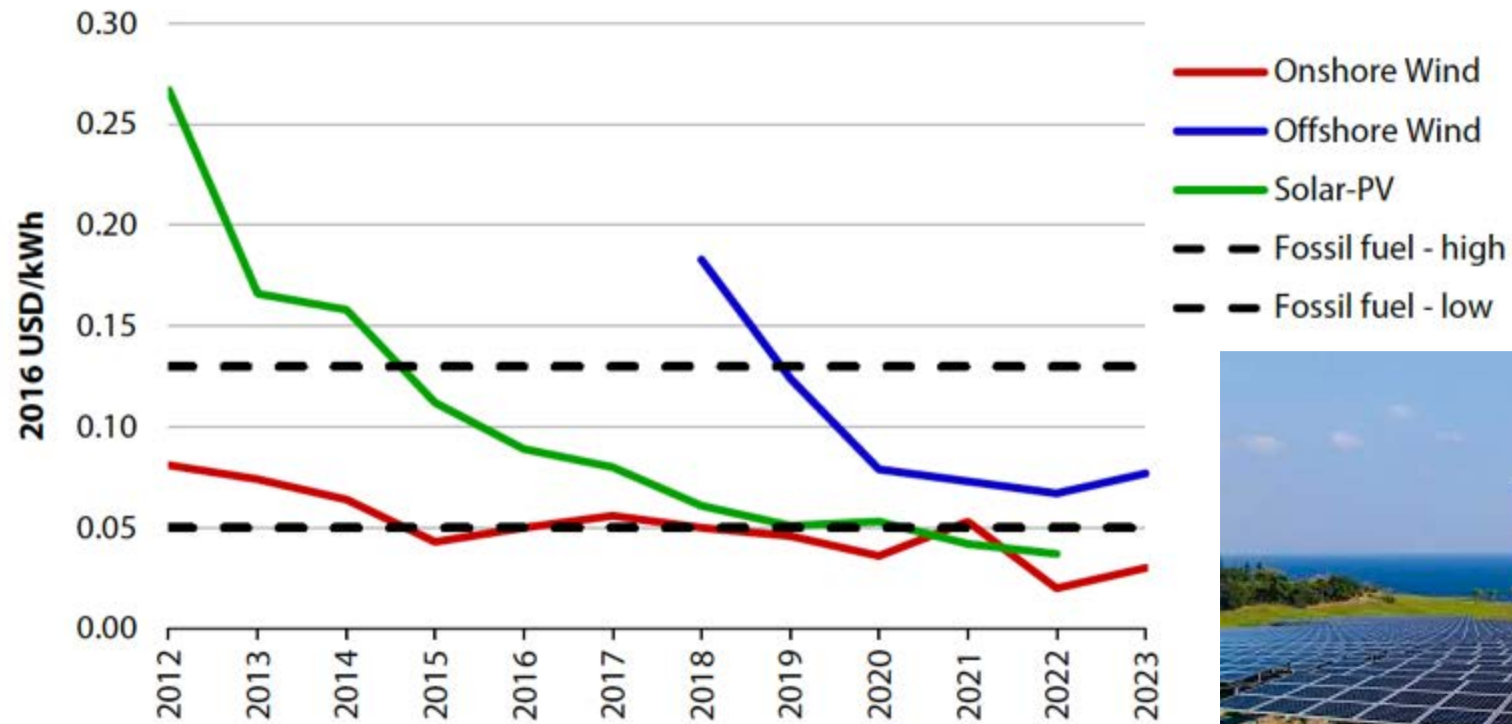
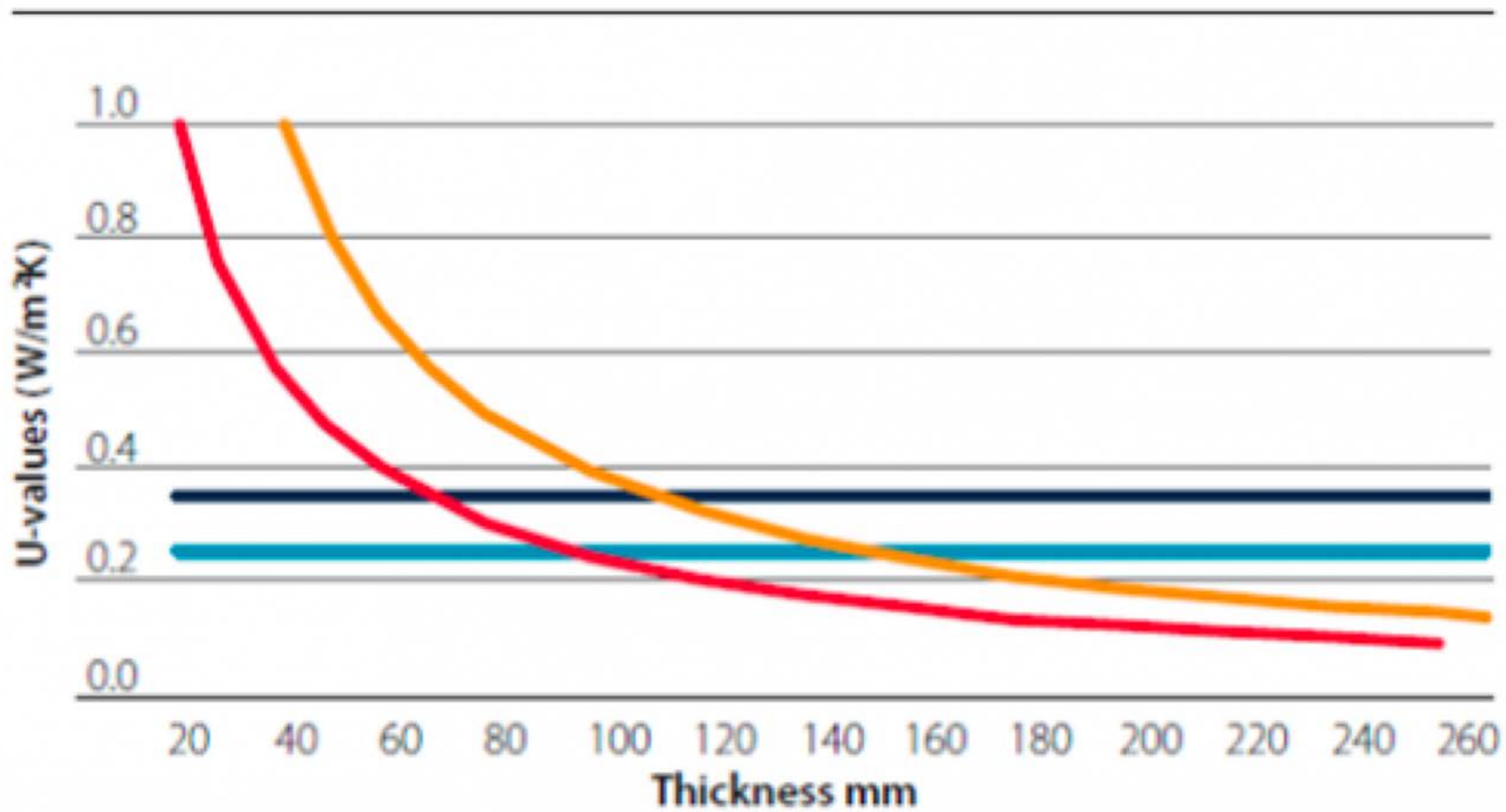


Figure 3.7. Levelised costs of renewable power generation around the world (top) and global average auction prices by commissioning date (bottom)



Source: IRENA (2018) *Renewable Power Generation Costs 2017*; IEA (2019) *Renewable Energy 2018*.

Notes: Scatter points represent the capacity-weighted average levelised electricity cost generated in that region over 2016 and 2017. Auction strike prices since 2017 have lower costs, particularly for solar-PV and offshore wind. Auction results indicate the continuing trend of falling prices, but are not directly comparable to levelised costs (e.g. apart from the UK, European auction results for offshore wind do not cover costs of grid connection).



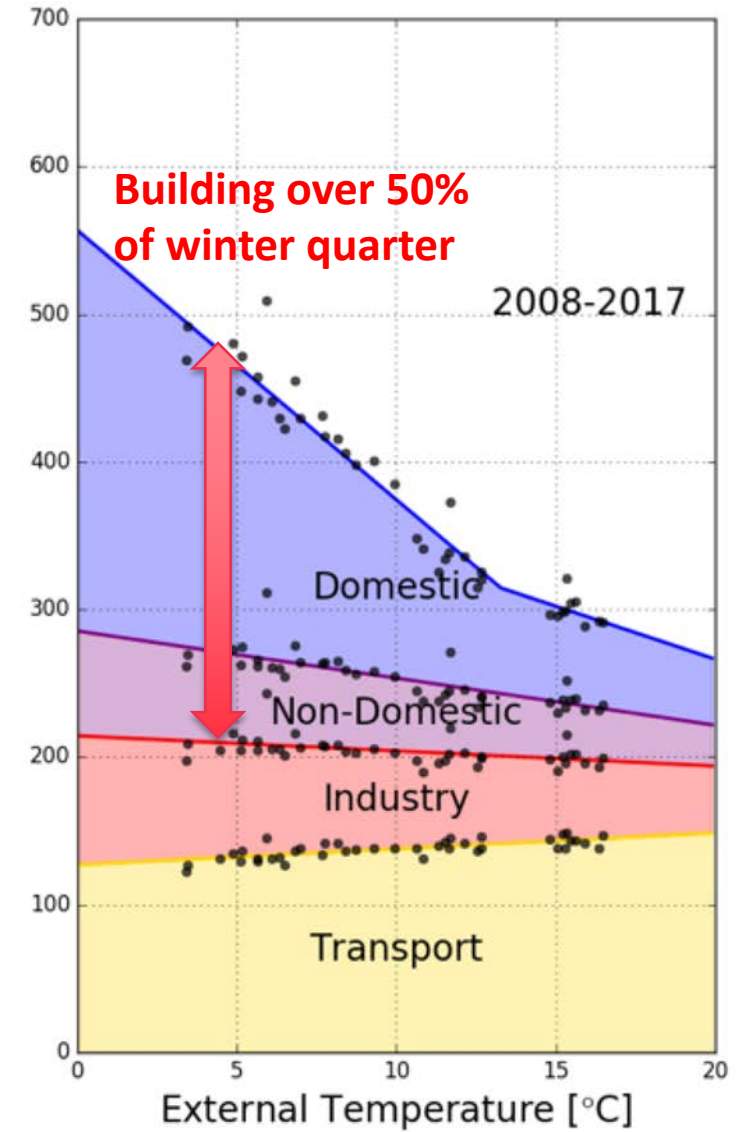
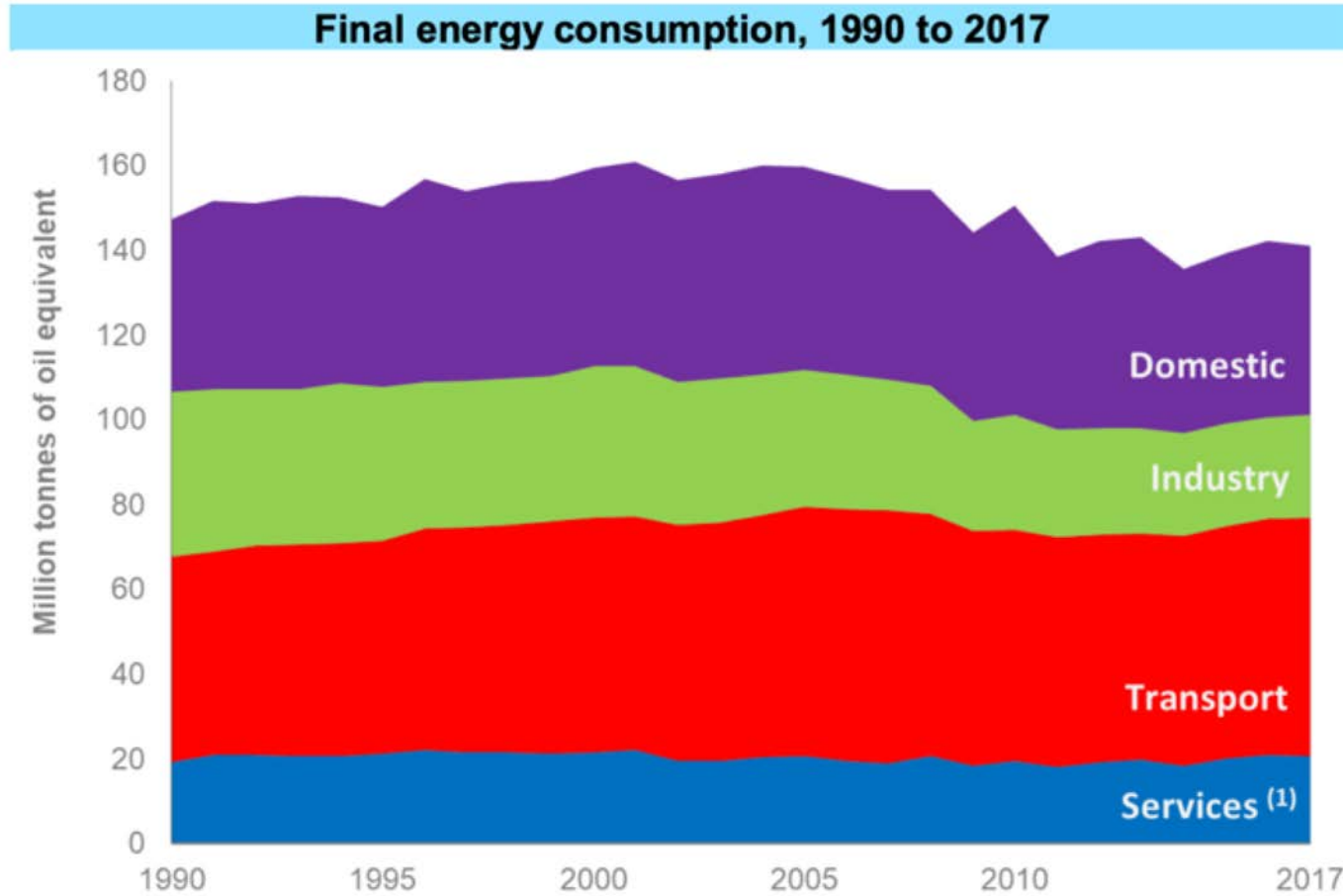
Key

Wall backstop value 0.35
Mineral Wool

Roof backstop value 0.25
Polyurethane foam

Building largest user of seasonal energy

(Gas+Electricity+Oil+Coal) vs Temperature

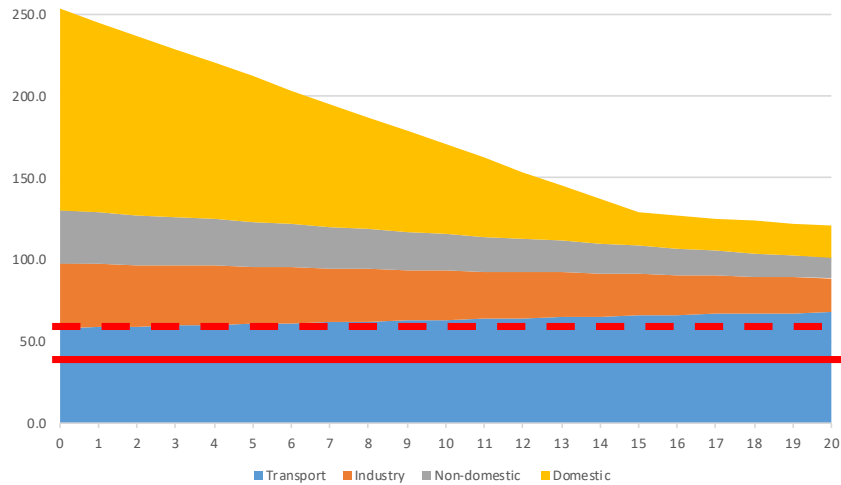


Thought experiment/ back of the envelope calculation: What happens if we electrify all energy use.



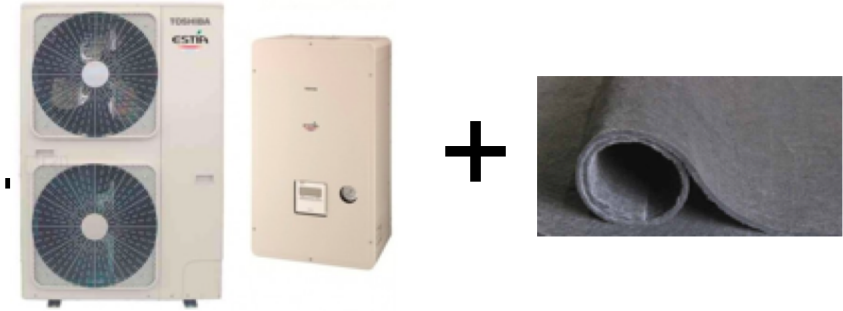
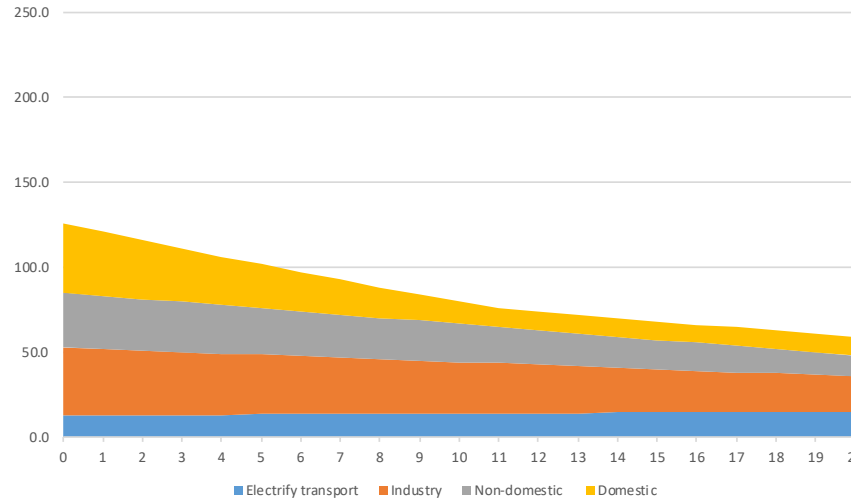
X 29

AS IS (Average quarterly energy demand in GW versus quarterly air temperature C) 29 x Wind



X 14

Domestic heat pumps (COP 4 to 2 versus Text), 20% reduction in fab heat loss and efficient lights and appliances, 14 x Wind



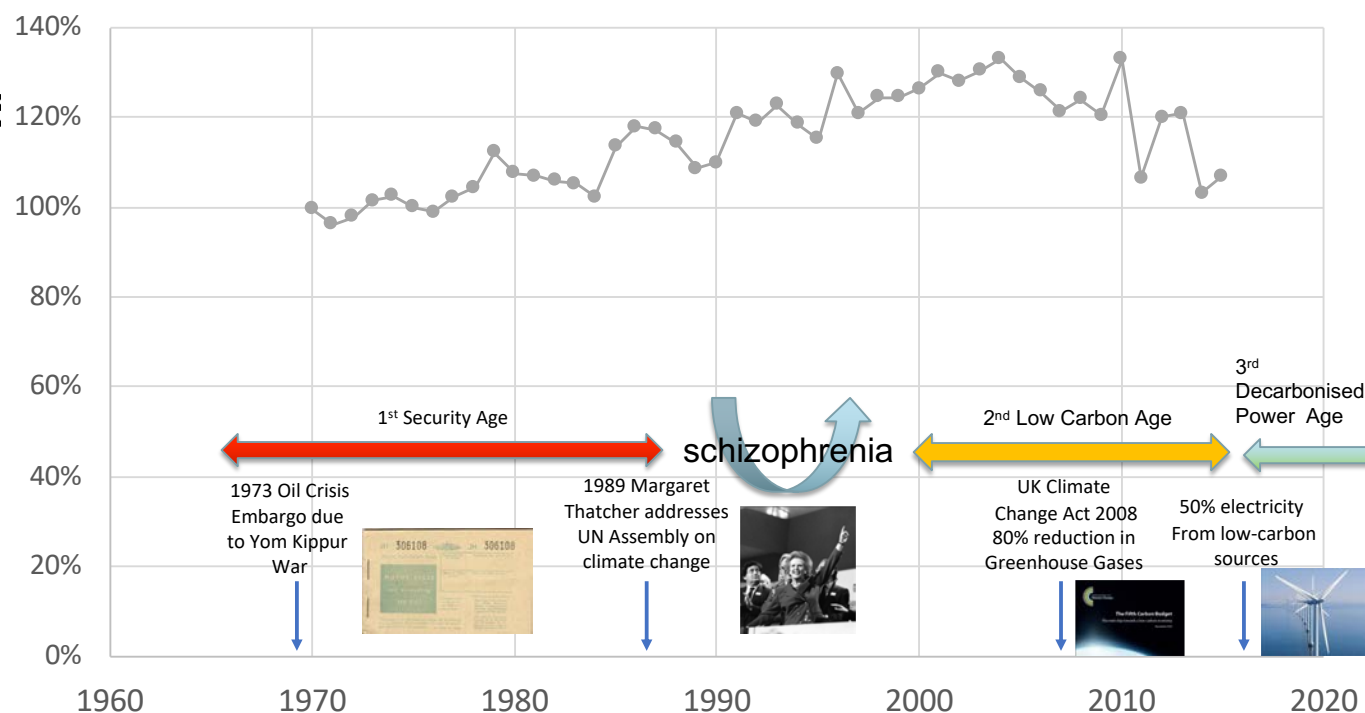
CCC says

- doubling of electricity demand, with all power produced from low-carbon sources (compared to 50% today).
- X 10 offshore wind in 2050 75 GW of offshore wind would require up to 7,500 turbines and could fit within 1-2% of the UK seabed, comparable to the area of sites already leased for wind projects by the Crown Estate.

The future is different

- Renewables change the efficiency game. They have High CapEx, low OpEx, opposite to fossil fuels but similar to reducing demand!
- 1st age reduction in primary energy use
- 2nd age reduction in CO2 emissions
- 3rd age power as important as energy?

The 3rd Age of Energy Efficiency: Power and Energy



More wind or more insulation?

Bobs back of the envelope:

Can you reduce the heat loss to 25% in a uninsulated house for £17k?

If you install heat pump in a poorly insulated house, you would need to reduce the heat loss to a quarter in under £17k to make it cost competitive with building more wind turbines. You would need to have a

Rough estimate of economics of deep retrofit at Sneinton for a future 100% wind powered electricity system		
GFA		100m ²
HLP before retrofit		4 W/m ² K
HLP after retrofit		1 W/m ² K
design day delta T (in-ext)		20K
design day house heat loss before retrofit		8000W
design day house heat loss post retrofit		2000W
reduction in design day heat loss due to insulation		6000W
HP COP		3
efficiency of resistance heating		1
<u>capital cost of additional wind turbines</u>		
cost per peak Watt of offshore wind ?		3£/W
capacity factor of offshore wind ?		0.35
cost per mean Watt of offshore wind ?		8.6£/W
<u>reduction in design day electricity load brought about by insulation</u>		
reduction in electricity load with no heat pump		6000W
reduction in electricity load with heat pump		2000W
<u>saving in cost of offshore wind brought about by insulation</u>		
saving in cost of offshore wind with no heat pump		51429£
saving in cost of offshore wind with heat pump		17143£
<u>capital cost savings for HP from insulation - £</u>	<u>heat pump rating (W)</u>	
(NB needs a simple model of HP costs)	8000	2000
capital cost of individual HP?	10000	5000
capital cost share of grouped HP?	5000	2500

Key questions?

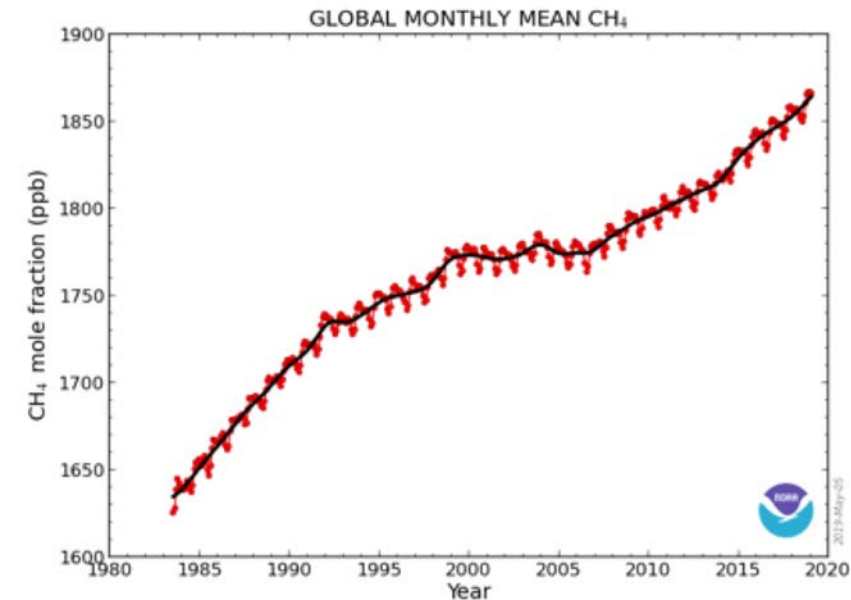
- Do we stick with and adapt EPC's as the main currency, or move to something different? Switch units to kWh and peak power?
- How we transition from gas? Do we have a clear message, no more gas in buildings, its bad for the planet, and bad for health and safety? Or do we need gas to balance the system during the transition?
- How much insulation is enough?
- Decision tipping points - ventilation, three phase electric?
- Making controls work?
- Cooling: Mitigation and Adaptation?
- Zero carbon does not need to be autonomous, or whole house retrofit?

Managing the transition

- We are not a centrally planned economy, so plan for uncertainty.
- We are in the transition already.
- How quickly we roll out renewables, will in part depend on how quickly price drops including storage, will we use hydrogen, how much will we use district heating and will we force people to use it?
- We need to do things now! We must maintain a pathway of decarbonisation. This pathway has to be facilitated by a reduction in demand. Boiler ++, Hybrids, Heat pumps?
- There will be rebound and comfort taking. Older, bigger uninsulated homes will become warmer when insulated and so save less energy.
- Our sector can only cope with simple messages and we need to start deploying now with current markets, methods, skills, etc. We must ramp up slowly and learn lessons quickly!
- Stranded Assets. We need to try and look at costing this into our decisions

A thought experiment

- The uptake of electric vehicles and heat pumps exceeds the installation of renewables. We therefore start to bring on more gas plant to the network. This costs 10x more than if we kept with gas heating! For minimal carbon savings!
- Is there a role for hybrid (gas boiler/heat pump) systems, that can help balance the grid?
- Are we focusing on CO₂ when Methane is the short term problem!



A way forward for the sector?

- Keep it simple, focused and practical. We do not have time for great words, aspirations, turf wars. What sacrifice will your professional institute make? The climate crisis is not an opportunity for your institute to increase turnover or membership.
- Concentrate initial agreement around residential (biggest problem, simplest to understand) once that is agreed move to non-domestic.
- Focus on fabric insulation and efficient heating systems and their control? Appliances and generation other sectors know more are better skilled to cover.
- Four things work in this sector: regulating, giving it away, co-benefits, energy price, need all four.
- Our professional institutes has most influence around regulation can we collaborate together on this? Regulated Consequential Improvements and Point of Sale/rent. What do we want government to do to support this?

Finish