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Reducing CO_2 emissions of our homes – what happens next?

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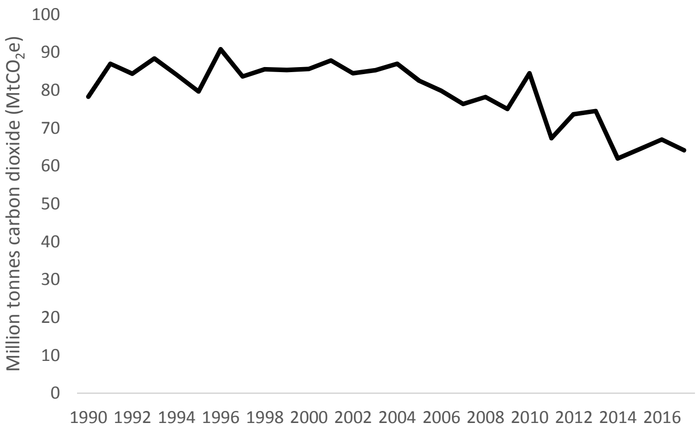
Introduction

The UK has been through a period of significant change in terms of the carbon dioxide emissions related to energy use in our homes. The figure below is a clear illustration of this:



Carbon dioxide emissions (mtCO2e) of residential sector [i]

In a twenty year period (1997-2017), the carbon dioxide emissions associated with our homes reduced by 23%. Whilst year-to-year fluctuations are impacted by the health of the economy, the weather, and other less controllable elements, this reduction is significant. However, to reach the level of carbon reduction called for by 2050 targets (80% reduction on 1990 levels, with approximately 3% reduction every year), this trend needs to accelerate; so what confidence should we have that the UK is ready for this scale of change? Is the above a foundation that will be built on, or are we heading for a carbon reduction plateau?

Policy

Despite some clear successes, as evidenced above, it is fair to say that policy connected with low-carbon homes has been something of a mixed bag in the UK in the last 10-15 years. Some low-hanging fruit (loft insulation, some cavity walls, condensing boilers) have to some extent been plucked, though ladders to reach opportunities further up the tree have been less forthcoming. The cancellation of the Code for Sustainable Homes, and dented aspirations for near-zero carbon as a new-build standard, raises questions around whether we are able to find a balance between what is possible, and what is required.

A recent Committee on Climate Change (CCC) report[ii] provided an overview of where we are, and where we need to go. Some of the reported headline recommendations focus on the new build sector; indeed, communicated with such effectiveness that the Chancellor's Spring Statement supported the plan to have all new-build homes off the gas grid and heated with a low-carbon alternative by 2025. On the one hand, this is the type of step-change in policy that the UK needs to enter a new phase of carbon reduction. It will open up dialogue around precisely what we intend to do with our highly valued gas grid (and the benefits this has given us in recent decades) in an era where the current use of that gas is somewhat contradictory to challenging carbon targets. On the other hand, as has happened in policy statements in the past, it focuses on a relatively small percentage of the stock, i.e. the new build sector.

The challenges posed by the legacy of our existing buildings have still not been adequately addressed. Despite the aforementioned modest successes (and over 16 million homes have loft insulation of more than 125mm; 13.4 million have cavity wall insulation[iii]), much of the language used in recent reports focussing on retrofit of existing homes is not actually that different to similar reports a decade ago. Even the CCC report, amidst the more eye-catching announcements, has relatively familiar recommendations around what we need to do with our existing homes; but, rather than being due to a lack of imagination of the authors of that report, this is possibly an accurate reflection of where we are with retrofit.

There is even a case to make that, for residential retrofit, following a period of relative success, policy is now taking a retrograde step. Cavity wall insulation was being installed into over 40,000 homes a month when the Carbon Emission Reduction Target Scheme, prior to 2013, was active. The introduction of the Green Deal (accompanied by the Energy Company Obligation Scheme) saw that plummet to c. 1,000/month in April 2013. Feed-in tariffs (FiT), between 2012 and 2014, saw a rapid rise of domestic PV installations but the inconsistent approach to managing that tariff produced peaks and troughs in interest that may have caused a plateau in that particular technology in the longer term. Between January 2011 and January 2016, PV installed through FiTs increased from 80MW to 4.3GW[iv] (not accounting for PV installations supported by Renewable Obligation Certificates and other finance). By December 2018, this was at 4.9GW, clearly demonstrating a curtailing of activity. It remains to be seen how the residential PV market responds to a post-FiT world.

Even for some of the more innovative areas of residential retrofit, such as the Energiesprong[v] initiative, the discussion is brought back to decades-old arguments over cost. Energiesprong provides a concept, and series of exemplars, that are both useful and interesting for those considering the challenges of materials, technologies and multi-measure installations for low-carbon refurbishments. Once again, however, a feeling of déjà vu approaches; the cost of these deep-cut retrofits have been estimated at £40,000/house. The nature of the challenge is therefore very similar to studies of yesteryear, quoting similar scales of capital cost. When imagining such exemplars at scale, the same issue of “who pays and how?” arises, and it remains to be seen whether the Energiesprong approach to energy repayments has mass-market potential, or if it might succumb to a Green Deal-style malaise.

A plateau or a springboard?

Some of the above might suggest that we are indeed sitting at the end of a journey, rather than the beginning of a new one. But that would be to ignore some genuine game-changers that have occurred in the last decade.

Firstly, the reduction in the carbon intensity of the National Grid has changed how we think about electricity, and the carbon reduction potential of electrified heating in particular. Grid carbon intensity of 0.5kgCO_2/kWh provides quite a different energy landscape to that of 0.25kgCO_2/kWh. This should not mean that we abandon targets for demand-saving opportunities on the consumer-side of the energy meter, but it is important to tailor our retrofit strategies such that they reflect rapid changes in the decarbonisation of energy systems.

Also, of the successful demand reduction programmes that did tail off, these technology-specific plateaus did not occur through any technical limitation. Policy, for good and bad, has had a near-instantaneous impact on installation rates of insulation, new boilers and solar panels in a largely intuitive way (though we may express some surprise at, for example, the sheer number of solar PV panels that were installed on rooftops between 2012 and 2014).

There are also signs that the way we assess energy efficiency in our homes could become more nuanced. The much critiqued, and often criticised, Standard Assessment Procedure (SAP) (and iterations of) has been used to produce energy assessments of UK dwellings since its development in 1992, though in a more structured way for existing homes since 2005. Unable to adequately assess how homes are being used in any great detail, this process has at least allowed for a standardised energy categorisation of buildings to be developed. With high expectations on how these energy ratings might be used in the future[vi], there is greater focus on the methodology itself – in particular, should an approximate form of home energy rating be used to limit the sale or leasing of a property? Or for making alterations to, for example, payments associated with a property such as council tax or stamp duty?

Some recommendations around building regulations (such as those in the aforementioned CCC report) have suggested the need for SAP to better reflect real energy use. Whilst this is a sensible endeavour, it does partly ignore that a SAP energy rating is fundamentally not real, nor is it designed to be such. It has previously been noted by the authors of this paper that attempts at amending the theoretical, standardised energy prediction of SAP to make it more aligned with real energy bills – such as through the "occupancy assessment" used by the Green Deal – have not been a complete success[vii]. However, as we enter a period of smart meters and associated smart data, the ability to use real data to characterise real energy patterns is greater than ever before. This may, feasibly, mean a future energy rating that is empirically-based, perhaps referencing a real demand dataset of millions of buildings to understand the energy efficiency of a home. Or we may see greater use of real energy demand data to note patterns of energy consumption, whilst maintaining a simplified theoretical energy rating for purposes of recording and encouraging market transformation.

Either way, it is worth noting that the EU Energy Performance in Buildings Directive, which is the genesis of current energy ratings in homes adopted by EU member states, does not preclude the use of real energy data within the framework of an energy rating scheme; it merely requires that it is standardised. Indeed, other EU member states have elements of real energy data incorporated into their energy rating schemes, and it might be imagined that actions and advice stemming from these may be more grounded in reality. The UK has an opportunity to exploit these data-rich times and ensure that retrofit guidance is steered by real-world technology performance, for technologies being used by real people.

Next Steps

With an aim of turning a plateau into a springboard, the following recommendations are therefore suggested:

1. A return to the use of large subsidies, as part of simple, condition-light schemes, to reduce capital cost of low-regret retrofit options for homes
2. A demand reduction strategy that is framed by the existing building sector, but which can be stimulated by technologies that have a market in the new build sector
3. A new approach to measuring and assessing our residential energy use – understanding that standardised energy ratings are not designed to be, and are not to be treated as, indicators of real energy bills
4. Data on www.gov.uk on everything from insulation levels to solar installations has also become less regularly curated, as associated energy policy vehicles have become retired. This data must be regularly updated, and made visible; we must know the state of our building stock.
5. Future energy systems have to be designed to serve future, not current, energy demand. Carbon reduction targets will only be achieved if the coming decades correspond to a period of considerable transformation in demand. To achieve an optimised design of these energy systems, there is a need to "back a horse" – making key decisions about our evolving energy systems – so that infrastructure has the time to develop to correspond to a fundamentally different relationship between energy supply and demand.

And, of course, many or all of these recommendations could have been made (and often were) many times in the past. Success requires that, in another decade, we are not still asking these same questions, but rather are evidencing how we developed the answers. For its part, the EPSRC National Centre for Energy Systems Integration will be attempting to capture future trends in energy demand (in itself no mean feat) and communicate that with models of our wider energy systems. In doing so, we aim to ensure that evolution of demand complements evolution of supply for a low-carbon future.

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[i] BEIS (2017), Final UK greenhouse gas emissions national statistics: 1990-2017, https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2017

[ii] Committee on Climate Change report (2019), UK housing: Fit for the future? https://www.theccc.org.uk/publication/uk-housing-fit-for-the-future/

[iii] DECC Statistical Release (2013), Estimates of Home Insulation Levels in Great Britain https://www.gov.uk/government/statistical-data-sets/estimates-of-home-insulation-levels-in-great-britain

[iv] BEIS (2019), Solar photovoltaics deployment https://www.gov.uk/government/statistics/solar-photovoltaics-deployment

[v] Energiesprong, https://energiesprong.org/

[vi] BEIS (2019) Energy Performance Certificates in buildings: Call for Evidence https://www.gov.uk/government/consultations/energy-performance-certificates-in-buildings-call-for-evidence

[vii] DECC (2014) Green Deal Assessment Mystery Shopper Research https://www.gov.uk/government/publications/green-deal-as sessment-mystery-shopping-research

Further information

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