Competent retrofitting policy and inflation resilience: The cheapest energy is that which you don't use

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1. Introduction

Inflation induced by rising energy prices has become a focal point or 'nexus' for analysis. In the current environment, from a macroeconomic perspective, there can appear to be important trade-offs for policymakers between supressing inflationary tendencies and exacerbating recession. There is, however, also an underlying problem of disruption to that most important of longer term policy goals – radical decarbonisation to tackle climate change. On the one hand, rising energy costs, especially gas and oil, create incentives for transition to renewables, while also forcing many consumers to reduce current energy use. On the other hand, immediate fiscal concerns and what in the UK is termed the 'cost of living crisis' (a set of circumstances replicated in many countries) leads to potential delays to and reductions in transitional infrastructure spending, while also reducing household commitment to or capacity for emissions reducing investment (a situation of people in straightened circumstances more concerned with getting to the end of the week than with what happens in ten years' time). As many have noted, the UK government's Energy Price Guarantee (EPG) and similar schemes, created a large and relatively open-ended fiscal liability for the duration they run. Meanwhile, many households face an invidious choice between 'heating and eating' and fuel poverty has grown.

In the UK the 2008 Climate Change Act created a legally binding national framework for targeted emissions reductions. An independent Climate Change Committee (CCC) advises government on this process and assesses progress. According to a recent CCC communique sent to the UK Chancellor, 'Decarbonising the UK's economy and conserving energy can alleviate… risks and shield households, businesses and the Exchequer from future price shocks' (CCC, 2022d: 1). In February 2023 the UK Department for Business, Energy and Industrial Strategy (BEIS) was divided up and refocused, and a new Department for Energy Security and Net Zero was created. However, much of existing policy formulation and comment has rested with the BEIS and it too makes clear, the cheapest energy is that which you don't use (BEIS, 2022a). With this statement in mind, we take a tangential approach to issues of energy prices and inflation and focus on energy efficiency policy that reduces demand at source. Our focus is housing retrofitting. As the CCC also notes, 'Reducing energy demand in UK buildings is now the biggest gap in current energy policy' (CCC, 2022d: 1). As such we focus on the scope and efficacy of policy. This is an institutional or fundamental framework issue rather than a statistical-analytical issue.

In what follows we briefly set out what retrofitting is (since this is a moving target), and what the need for retrofitting is in the UK. We then focus on the CCC's current assessment of policy. This in turn brings to the fore that the BEIS, and to some degree its successor, has chosen to frame its role in relatively minimal terms as 'developing a market'. We argue that this approach invokes an individualised market psychology which is both conceptually and practically problematic, given the need for urgency and current situation of inflation and uncertainty. We conclude by suggesting a fundamental rethink is required. The point is an important contribution to the discourse, since it is all too easy for myopia to set in insofar as a focus on the specificities of policy tends to obscure the more fundamental issue of whether an overall approach is appropriate to the problem at hand. Data analysis can sometimes neglect this basic question.

2. What is retrofitting?

To state the obvious, not all dwellings are built at the same time, a country's housing stock is a cumulative product of design styles, building standards and planning laws.[1] Clearly, these vary through time and in the UK (as in many countries that have not typically been subject to extreme heat or cold) energy efficiency has not always been a significant consideration. Moreover, until relatively recently electricity generation has been dominated by fossil fuels and domestic heating/cooling and cooking technologies remain heavily carbon based. Retrofitting then, has two parallel aims. First, to improve the energy (heating/cooling) efficiency of housing stock, bringing it up to some designated standard. Second, to substitute low/no carbon alternatives for emissions producing or dependent heating/cooling systems and appliance technologies. Towards these ends there are several different aspects of a building that might be modified, these involve focus on the 'fabric' of the building and on its integrated technologies (e.g., Pacheco-Torgal et al., 2017; CCC, 2019a: 10):

- The roof space, exterior and interior walls and floor might be insulated to maintain a consistent interior temperature and/or reduce heat loss.
- Windows may be swapped for double or triple glazed units and tinted or electrochromic glass (capable of changing colour in response to conditions) may be fitted.
- Draft exclusion may be applied to doors and other gaps (possibly in combination with modifications to enhance capacity to create air flow to the exterior for 'passive cooling').
- In conjunction with a broader process of 'electrification', oil heating, coal fires and natural gas boilers may be swapped for newly installed low carbon heating/cooling systems (solar, micro-wind, heat pumps, green hydrogen etc.), hot water tanks may be insulated, and, if relevant, battery storage may be fitted for any electricity generated.
- Smart environmental control technologies may be installed for micro-environmental management and efficiency optimisation (smart meters, advanced thermostats, thermostatic valves, and perhaps, ultimately, AI supported management systems).[2]

A combination of all relevant modifications undertaken in a comprehensive plan is termed 'whole house retrofit' and this is considered the 'gold standard' for the procedure. In combination with technological change this whole house approach is, of course, itself subject to alteration in terms of what is materially available, but not in how it is conceived.[3] Whole house planning ensures modifications are coordinated and undertaken in the appropriate order and with a view to both compatibility and efficiency. It is also undertaken with due attention to the appropriateness of different materials and modifications, since these depend on housing type. For example, fabric modifications are a different consideration for a solid

[1] Approximately 38% of housing stock in the UK was built before 1946 and on the average the UK has an older housing stock than all other EU members. More than 50% of the housing stock was built before the introduction of the 1965 Building Regulation, which was the first to require thermal insulation be installed in new construction. See Anis-Alavi et al. (2022).
[2] Systems may also allow for installation of energy efficiency 'smart appliances', and a home management AI, though this is currently an innovation in its infancy (Morgan, 2019).
[3] For state-of-the-art testing facilities visit: https://www.salford.ac.uk/our-facilities/energy-house-labs

stone house than one with cavity walls, while a detached house in its own grounds is different than a terraced house that opens onto the street and this is different again than a flat or apartment. Problems of ventilation, air quality and damp, and/or inappropriate use of materials or installation of technologies may easily arise.[4] As these considerations indicate, whole house retrofit is highly skilled and requires considerable expertise and training in order to oversee the activity of others who are, in turn, often highly skilled.

In principle, retrofitting is a companion to newbuild energy efficiency standards that are far more exacting than in the past. Ideally, standards for both retrofit and newbuild would lead to a future housing stock whose thermodynamic impact is minimal and which is both carbon neutral and climate resilient, though achieving these goals involves more than an energy efficient retrofit. For example, creating climate adapted buildings may involve changes to the building and its grounds to conserve water or to cope with flooding and other increasingly likely extreme weather events. Moreover, there is a whole set of issues related to the 'embodied emissions' of construction materials.

To be clear, in the post-Paris era, where each country is expected to maximise its nationally determined contributions (NDCs) to emissions reduction, the long-term purpose of retrofitting is *not* primarily concerned with cost savings to individual households. Costs savings may well lead to resilience in the face of energy cost inflation, but according to the CCC, while reduced energy consumption may significantly reduce home 'operating costs' in the future, this is a secondary consideration (see CCC, 2020: 120-122).[5] From a climate policy point of view, cost savings are assumed to be motives for or benefits from action that is otherwise required to address climate emergency. It is also important to note that whole house retrofitting is likely to be expensive and in reality most retrofitting tends to be incremental with a focus on some subset of modifications – especially insulation and glazing (however see Hamilton et al., 2013). We will return to the policy issues evoked by cost considerations later. We now turn to the role retrofitting is expected to play i.e., what the 'need' for it is in the UK.

3. The need for retrofitting

The 2008 UK Climate Change Act set a target of 80% reduction on 1990 baseline levels in specified greenhouse gas emissions. The Act put in place a system of five yearly carbon budgets to map out a pathway to achieve this goal. These budgets are proposed by the CCC based on a range of possible pathways and, subject to possible modification and policy specification, are adopted by the current government using a 'Carbon Budget Order'.[6] The first three were adopted/set May 2009 (covering 2008-2022), a fourth in 2011 (2023-2027), and a fifth in 2016 (2028-2032). In accordance with the Act the intention going forward has been that budgets be published twelve years in advance to allow dissemination, discussion and planning. The CCC also regularly reports to Parliament regarding progress towards achieving targets. Following the Paris agreement at COP21, the subsequent publication of the IPCC's

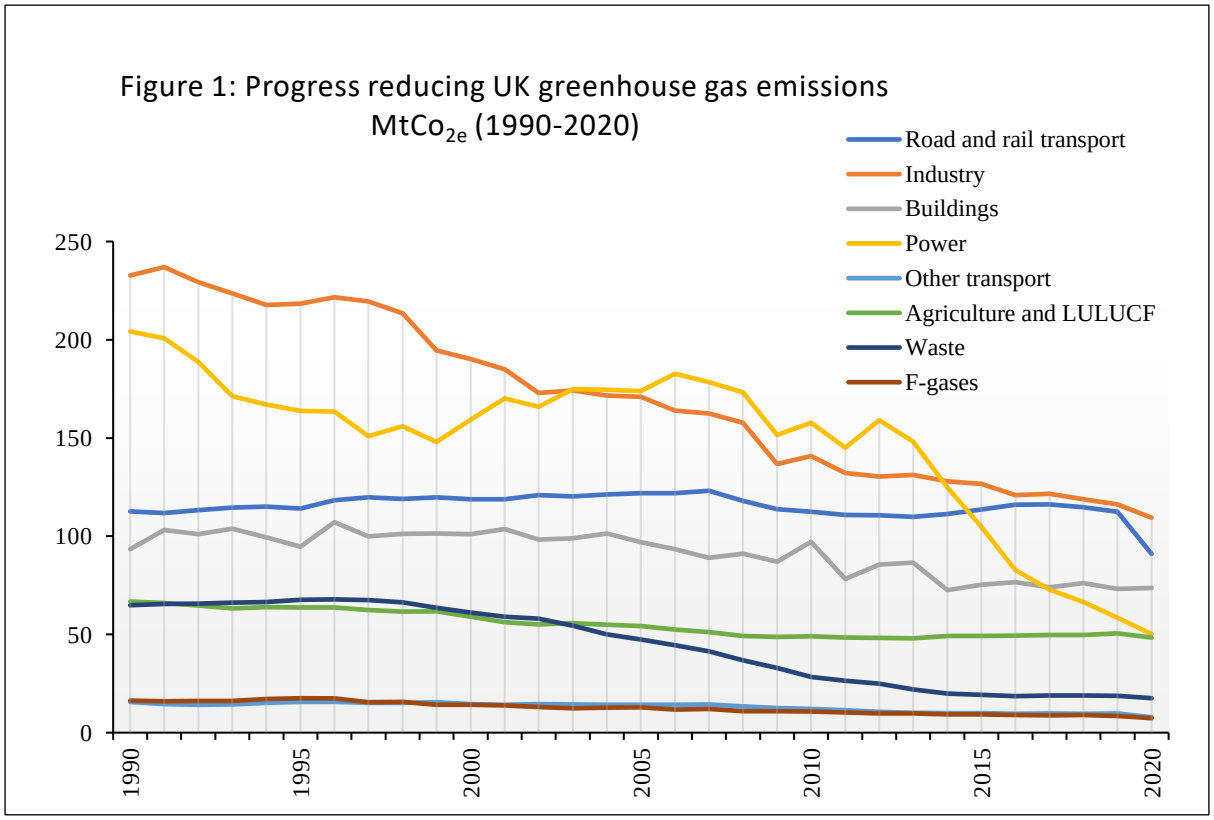
[4] Note, following growing concern regarding retrofit failures (damp etc.) and a UK government commission and report, a universally recognized quality approval stamp (Trustmark) and an industry-wide code of practice PAS2035 were introduced, and this has then been further updated to address a 'performance gap'. This was sponsored by BEIS and developed by the British Standards Institution (BSI). The regulation requires some degree of coordination, implying a whole house perspective, and became mandatory in June 2021. For problems see Fylan and Glew (2022).

[5] Anis-Alavi et al. (2022), for example, note that an EPC D rated home uses 58% more gas for equivalent outcome to an EPC C rated home (see later on EPC ratings).

[6] There is, therefore, a distinction between CCC pathways and eventual Government pathways (see e.g. CCC, 2022b: 79).

SR1.5 and the CCC's *Net Zero* report, the UK government adopted a new net zero target and the 2008 Act was amended to reflect this in June 2019 (see CCC, 2019b; IPCC, 2018). In 2020 the CCC published proposals for the sixth budget (2033-2037), and this was adopted in 2021.

While the UK has broadly achieved the targets set out in the first three budgets and is among the best performing countries in terms of emissions reductions, this has mainly been a result of the shift from coal to gas and subsequent improvement in the proportion of renewables in the UK's 'energy mix'.[7] Moreover, the CCC has become increasingly critical regarding progress, since future reductions require potentially greater transformations in systems and practices across great swathes of economy and society. UK Office for National Statistics (ONS) and Figure 1 BEIS data make it clear that several emissions sources (measured in $MtCo_{2e}$) remain relatively high and stubbornly resistant to reduction:



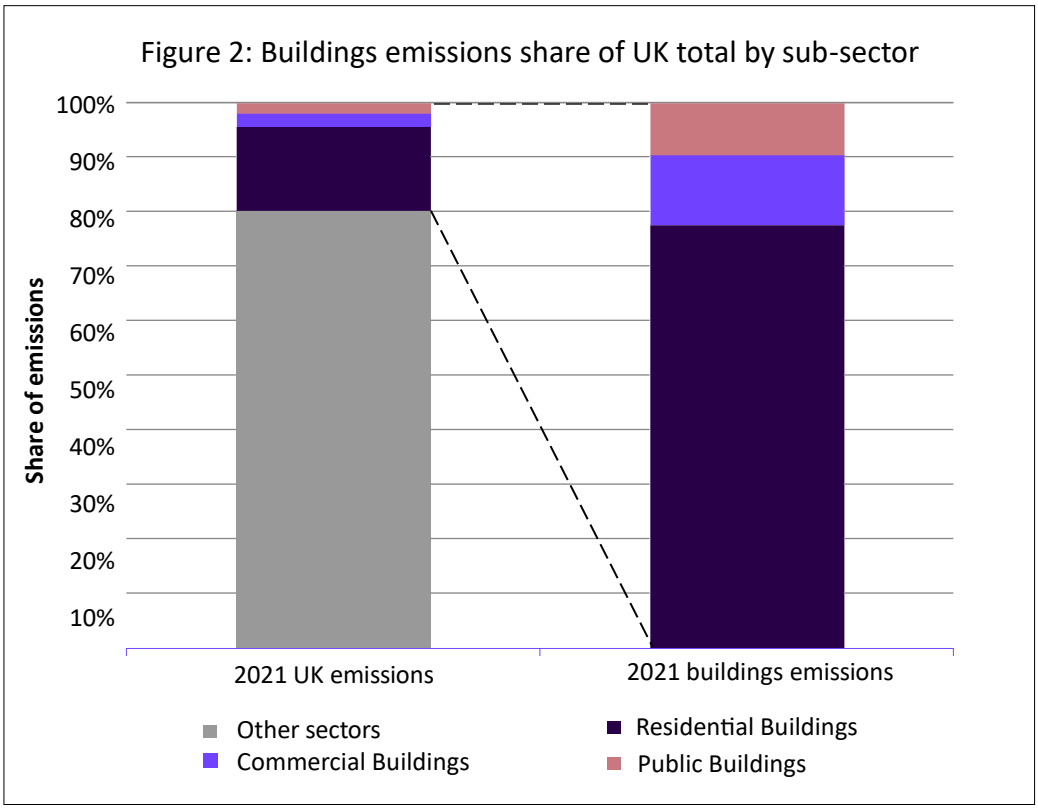
Source: BEIS (2022), 2020 UK greenhouse gas emission, final figures.
Note: 2020 was the latest year for which final data was available. Figure based on the current emissions inventory and does not reflect forthcoming revisions to peatland emissions or global warming potentials.

The precise quantities in Figure 1 are less important than the trend it illustrates. Building emissions have changed little and remain a significant source of emissions. The CCC continually draws attention to the significance of emissions from buildings and of private dwellings as a subset of this. According to the CCC there are approximately 28 million homes in the UK, 65% of housing stock is owner-occupied and the number of households is

[7] Based on a *production* rather than consumption accounting measure emissions fell in seven consecutive years 2013-2019 and by about 40% compared to the 1990 benchmark (figures vary and some sources put this at around a third for production measures and much less for consumption measures). See CCC (2019b: 102 and 105); CCC (2020: 60). For different measurement approaches see ONS (2019). Note also the reduction in the UK ought also to be put in the broader context of the dubious nature (especially from fracking) of the claim that natural gas is a 'bridge' or 'transition' fuel.

continually growing, which according to the ONS is because of both a trend increase in people living alone and because of population growth (CCC, 2022b: 158-159; CCC, 2022c: 1).[8] A succession of governments have produced targets for minimum numbers of new houses to be built (for example, the 2018 industrial strategy targeted 1.5 million by 2022), and these have consistently not been achieved. In any case, the majority of housing stock that must contribute to achieving radical decarbonisation has already been built (CCC, 2019a). In its recent progress report to Parliament the CCC stated that building sector emissions were 20% of total emissions in 2021, direct emissions changed little from 2015 to 2019 and the majority of emissions derive from homes, of which the biggest source was heating and hot water provision to private homes (CCC, 2022b: 158-161). Figure 2 sets out housing, public buildings and commercial buildings share of total emissions in 2021:

Figure 2: Buildings emissions share of UK total by sub-sector



Source: CCC (2022b: 160) and modified from BEIS data.

Figure 2 is a static snapshot, but in combination with Figure 1 and the significant reduction in emissions from power generation and industry, it is clear that housing's proportion of total emissions has tended to increase.

For clarification, the CCC provides a main 'Balanced Pathway' scenario for carbon budgets in order to achieve net zero by 2050. It is termed 'balanced' because it assumes that all possible types of contribution to emissions abatement will contribute in a 'balanced' way rather than one source of change or sector will dominate or lag. Within this balance the:

[8] See ONS (2022a).

> Balanced Pathway reaches Net Zero in 2050 for all greenhouse gases, including the UK's share of emissions from international aviation and shipping… The Balanced Pathway represents a decisive transition to Net Zero, with over 60% of the necessary reduction to Net Zero achieved in the coming 15 years and the fastest rate of decarbonisation occurring in the early 2030s. (CCC, 2020: 63).

Relevant reductions are summarised in Table 1.

Table 1: Balanced Net Zero Pathway emissions targets

		2019	2025	2030	2035	2050
UK greenhouse gas emissions	Total ($MtCO_{2e}$)	522	445	316	191	0
	Per person (tCO_{2e} capita)	7.8	6.5	4.5	2.7	0

Source: adapted from CCC (2020: 68).

'Alternative pathways' meanwhile refers to several other scenarios which are less 'balanced': a 'headwinds' scenario involves slower behavioural change and innovation, a 'widespread engagement' scenario accelerates behavioural change, a 'widespread innovation' scenario accelerates technologically driven reductions in emissions, and a 'tailwinds' scenario combines both these 'widespread' effects (CCC, 2020: 77-82).

In 2019 the CCC published a special report titled *UK Housing: Fit for the Future?* and the 'key messages' section begins with the blunt statement, 'UK homes are not fit for the future' (CCC, 2019a: 9). The underlying message of the report is then, that UK housing stock is unfit and a great deal remains to be done. The report is also quite clear, 'We will not meet our targets for emissions reduction without near complete decarbonisation of the housing stock… [and] we are currently off track' (CCC, 2019a: 11). According to the report, by 2017 building emissions were already 4% off track from the preferred modelled pathway (and this is before the more stringent net zero target was adopted) and 'uptake of energy efficiency measures' for buildings has been low and there has been 'limited deployment of low carbon heating options' (CCC, 2019a: 28, 140). In the context of the later augmented net zero aim, Chapter 2 of the CCC's proposed sixth carbon budget confirms that 'Our pathways to 2050 aim to reduce emissions in buildings to zero by 2050 at the latest' (CCC 2020: 109).

4. Retrofitting and policy issues

It is probably worth beginning this section by noting we have been here before. A decade ago Ian Hamilton wrote of government policy (see also Stafford et al., 2011):

> The UK government has identified the residential building stock as being one of the most cost-effective and technology-ready sectors to substantially reduce greenhouse gas (GHG) emissions over the next decade (DECC, 2012a). Proposals, for example, include cutting GHG emissions in existing homes by 29% by 2020 through a challenging 'whole house' retrofit programme, enabled under the 'Green Deal' (DECC, 2010a); plans also include all new homes to be 'zero carbon' by 2016 (CLG, 2007). (Hamilton et al., 2013: 462)[9]

[9] See also Hamilton et al (2016) on recognising that uptake is conditional.

The Department of Energy and Climate Change (DECC) is now long gone and as the previous section indicates, DECC policy was not achieved in any meaningful sense over the decade and transition to a whole house approach has likewise not been the case. For context one should also note that in May 2020 the UK Parliament Environmental Audit Committee (EAC) launched an inquiry into current progress on improving the energy efficiency of housing stock. This was published the following year and was scathing (EAC, 2021).[10]

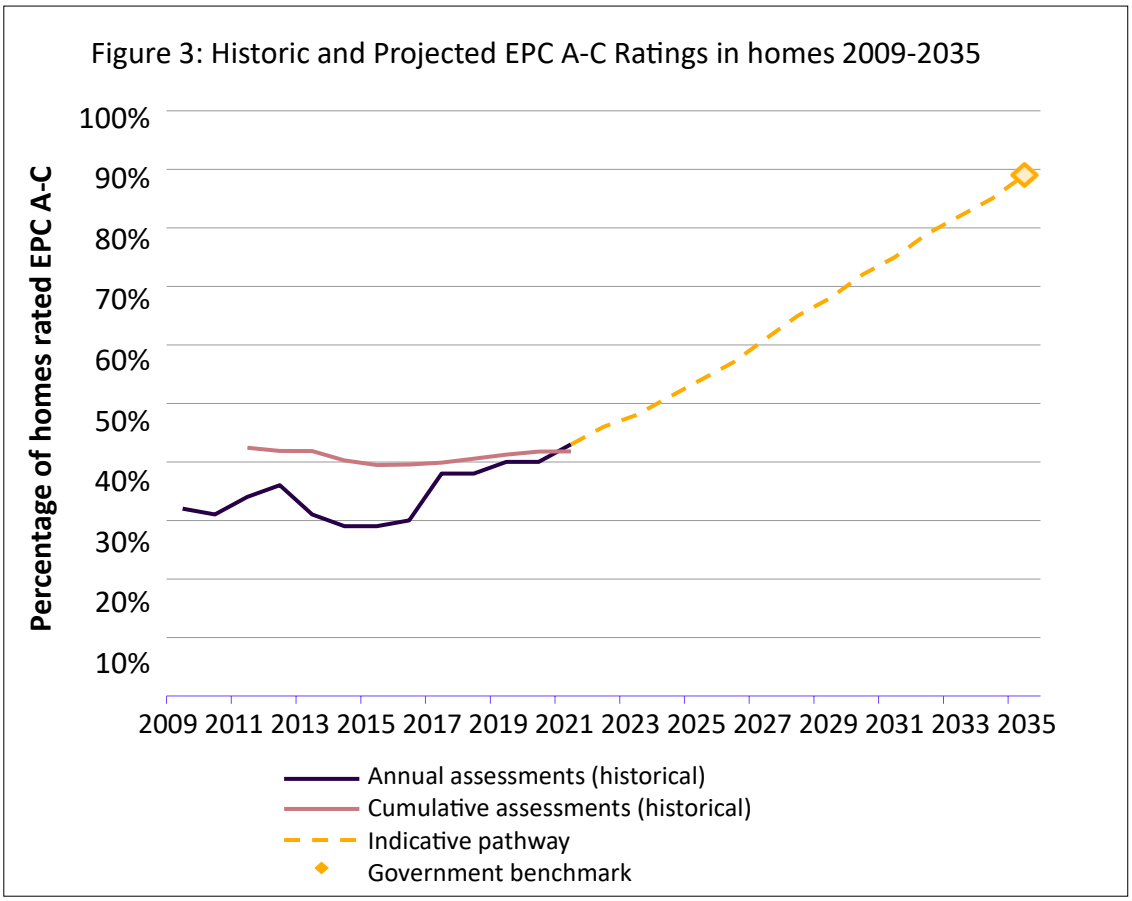
In any case, the CCC's recent special report on housing provides a useful summary of the UK's Standard Assessment Procedure (SAP) and energy efficiency rating system (Energy Performance Certificates or EPC) used for certification of buildings:

> The Standard Assessment Procedure (SAP), is the methodology used by the Government to assess and compare the energy and environmental performance of dwellings. It is the basis for establishing compliance with Building Regulations, and for Energy Performance Certificates (EPCs) [every building should have an EPC]. EPCs have two metrics, a fuel cost-based energy efficiency rating (commonly called the 'EPC' rating, in £/kWh/m^2) and a rating relating to emissions of CO_2 (the Environmental Impact (EI) rating, in CO_2/m^2). Ratings are banded A-G, with A being the highest performing. The EPC rating is based on a 'SAP' score. A higher 'SAP' score indicates lower running costs, with an EPC rating of A being equivalent to a SAP score of 92 to 100 points. A score of 100 indicates that no heating or hot water costs are required for that building. (CCC, 2019a: 29)[11]

As all recent reports from the CCC confirm, an EPC rating of D remains the most common in the UK for existing housing stock and a fraction of ratings are A or B (see also MHCLG, 2022). The recent progress report to Parliament states that approximately 40% of housing stock is estimated to be EPC rated C (or higher) while the current government aim is for all homes (where 'practical and cost-effective' and so somewhat less than all) achieve a C rating or higher by 2035 (CCC, 2022b: 165). Figure 3 establishes just how rapid an acceleration this is from the historic rate.

[10] The main finding oriented on for news dissemination was 'making net zero near impossible'. See: https://committees.parliament.uk/committee/62/environmental-audit-committee/news/152918/net-zero-impossible-unless-urgent-action-taken-on-energy-efficiency-this-decade/

[11] See: https://bregroup.com/sap/standard-assessment-procedure-sap-2012/ Also note, in 2016, the average SAP score of English dwellings was 62 points, up from 45 points in 1996, but progress has subsequently stalled.



Source: CCC (2022b: 168).

Achieving an EPC rating of C is, of course, just one step in decarbonisation of housing stock. 'Zero carbon' requires far more than achievement of a C rating and broader policy assumes both improvements to energy efficiency and transition to low carbon technologies. Table 2 summarises 'critical dates and key metrics' for buildings from the CCC's Sixth Budget, and so includes housing stock as a subsector:

Table 2: Critical dates and scenario metrics in the Balanced Net Zero Pathway for buildings		
	Balanced Net Zero Pathway date	Range
All new homes are zero-carbon	2025 at latest	2024-2025
Rented homes achieve EPC C	2028	2027-2030
Mortgage eligibility targets EPC C	2025-2033	Extending to 2035
All homes for sale are EPC C	2028	2025-2030
Commercial building energy efficiency complete	2030	2030-2035
Public sector energy efficiency complete	2032	2030-2032
Oil and coal phase out	Residential: 2028 Commercial oil: 2026 Public oil and all coal: 2025	Residential: 2026-2028 Commercial: N/a Public: N/a
Natural gas phase out	Residential: 2033 Commercial: 2033 Public: 2030	Residential: 2030-2035 Commercial: 2030-2033 Public: 2030-2033

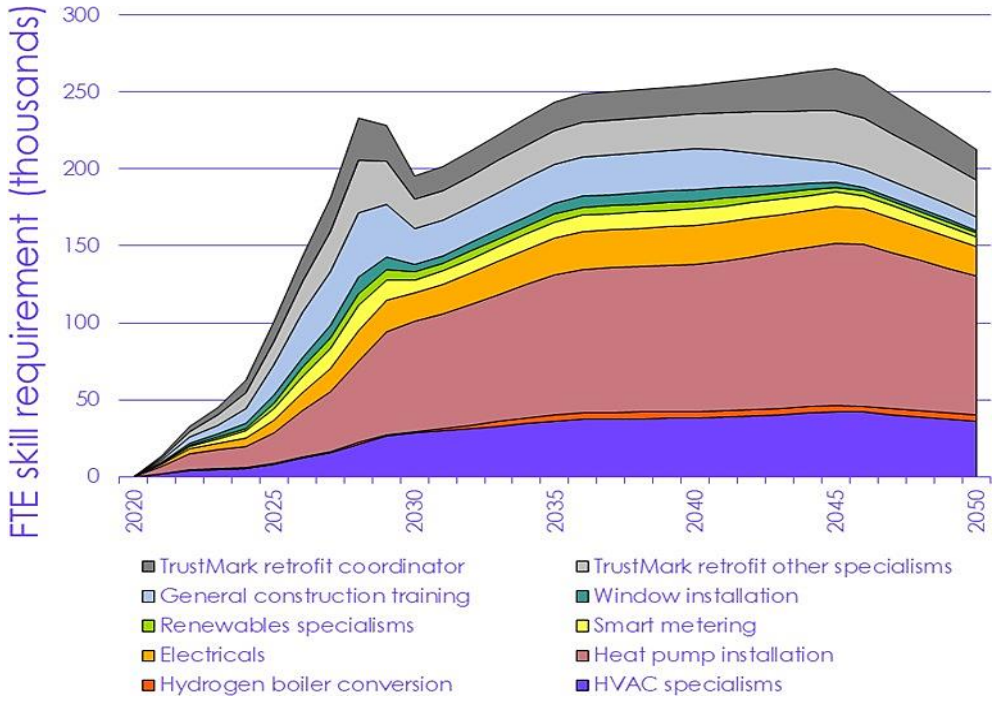
Source: adapted from CCC (2020: 119).

Based on previous discussion, the policy foci for targets in Table 2 should be self-explanatory. Those that apply to existing residential buildings clearly indicate a need for widespread retrofitting of the current housing stock. For example, the Sixth Budget suggests that within the Balanced Pathway loft insulation needs to accelerate from the 27,000 undertaken in 2019 to more than 700,000 per year by 2025, while cavity wall insulation needs to increase from 41,000 to more than 200,000 per year, again by 2025. This scaling up, along with similar activity in respect of insulation to solid wall buildings, to floors and with associated behavioural change (energy conservation awareness) enable a sharp acceleration in heating-directed energy efficiency measures from around 2025 into the early 2030s, after which the scale of activity allows for further cumulative progress to 2050 (CCC, 2020: 114). A similar growth pattern is assumed to occur in the uptake of heat pumps, albeit from a far lower base and assuming growth to around 1 million installations per year by 2030 (CCC, 2020: 115).[12]

While there is a great deal more that might be said here, it ought to be clear that there is a presumption of massive increase in the scale of retrofitting activity. This very obviously involves significant growth in administration, supply chains and public awareness and uptake. Materials and technologies need to be made available, a workforce needs to be recruited and trained, an education system to deliver the required training and an administrative system to monitor work and standards and provide certifications needs in some cases to be developed and in others scaled, and overall, a broader infrastructure into which individual activity can be integrated needs to be created. It is difficult to underestimate how monumental a task this is. Consider, for example, the CCC's estimations of the required workforce. As Figure 4 indicates, around 100,000 additional qualified full-time employees will be needed by 2025 and more than 200,000 by the late-2020s:

[12] Note, the feasibility of different technologies remains a matter of dispute. For example, the Science and Technology Committee, a UK 'Parliamentary Select Committee', inquiry into the role of hydrogen in achieving net zero reported considerable expert witness skepticism regarding the efficacy of 'blue hydrogen' compared to alternatives and especially in the next few years (Science and Technology Committee, 2022). Various problems of wasted resources, time and lock-in apply.

Figure 4: Additional full time skilled workforce requirements by specialist skill and qualification type



Source: CCC (2020: 123).

As the recent progress report to Parliament makes clear, there is 'currently no publicly available data on the current size of this workforce' (CCC, 2022b: 176).[13] Moreover, energy efficiency fabric retrofit installations have declined significantly from 2012 (CCC 2022b: 167).

However, there is a danger here of giving the impression that nothing is being done. There is, rather, a great deal of activity of sorts. The CCC, makes policy foci recommendations to government and assesses government formulation of policy. As Figure 4 illustrates, it identifies 'enablers' or 'factors that have a bearing on potential success of government policy' and assesses policy and progress in their regard (e.g., CCC, 2022b: 174). The CCC produces a colour-coded policy 'scorecard' (not to be confused with the colours in Figure 4) ranging from green for 'credible plans' to yellow for 'some risks', orange for 'significant risks' and red for 'insufficient plans' (for key see CCC, 2022b: 105). Buildings is currently carded at an overall orange. Reports to Parliament also provide an assessment of the achievement of recommendations from previous reports, followed by new recommendations. The most recent report at time of writing states that of the fourteen recommendations made in the previous year's report (i.e., 2021) only one had been 'achieved', nine had been partly achieved and four not at all (CCC, 2022b: 189). The report then goes on to make thirty-eight recommendations on 'policy gaps' etc. (CCC, 2022b: 196-198).

Reading through the various reports, it becomes clear that the main areas in which policy has been achieved is in creating initial policy plans in accordance with CCC recommendations. Drawing on the latest BEIS plans, the *Heat and Buildings Strategy* (BEIS,

[13] For recent survey data on lack of awareness of 'green skills' see Jones (2022); for recent survey data on public climate awareness see ONS (2022c).

2021), the CCC provides timelines (e.g., CCC, 2022b: 163 and 199). To be clear, very little of intended action is yet at the point where implementation is expected, albeit some are, at the time of writing, imminent in 2023. Still, it is past failure of policy and targets and current absence of sufficient action to facilitate implementation that is mainly at issue – the building of capacity, the creation of awareness and so on. This has changed little since the EAC's scathing report in 2021, despite a detailed government response. In March 2022, the CCC published its assessment of the BEIS *Strategy* and it is worth quoting from the introduction to the executive summary:

> The UK Government's Heat and Buildings Strategy has laid out important high-level decisions on the UK's approach to reducing emissions from heating buildings. The Strategy sets a new policy direction, focusing on a rapid scale-up of supply chains through a market-based approach. However, plans are not yet comprehensive or complete and significant delivery risks remain across the Strategy. Consultations need to move forward, followed rapidly by final decisions on policy design and effective implementation if the Strategy's ambitious goals are to be met… Delivering on these goals will help to protect UK consumers from future price spikes and increase energy security by reducing energy needs and shifting demand from gas to electricity, which in future will be predominantly supplied from UK-based renewable generation (CCC, 2022a: 4).

The detailed findings of this assessment report provide the basis (with some updating) for the thirty-eight recommendations previously noted from the later Parliamentary progress report, both suggest the CCC's concerns are made in the context of the need to rapidly translate intentions and goals into fully conceived plans and actions. The diplomatic language which the CCC must (as a mandated independent public body) adopt cannot conceal the evident frustration felt. This is reinforced by the recent communique sent to the UK Chancellor, among other things its 'making it happen' subsection highlights 'a lack of long-term policy stability' and 'shortages of skills and supply side constraints' (CCC, 2022d: 4).

Policy stability, of course is absolutely basic to addressing a continual and long-term problem like climate change and ecological breakdown and one would think it is a given. And yet the turmoil at the heart of government in the UK in recent years has brought this into question (the original ten point plan that led to the *Heat and Buildings Strategy* was put forward by Boris Johnson – three Prime Ministers in the past – and the Secretary of State responsible for the Strategy document (Kwasi Kwarteng) is now gone). Moreover, as the various documents make clear, there are immediate problems with 'enablers' and then an underlying issue in terms of assumed policy coherence in relation to a relatively unstable political period (where key decisionmakers are apt to change), as well as problems with actual policy coherence – whatever good intentions there might be at the initial policy stage.

As such, timelines are beginning to appear not just 'ambitious', but 'unrealistic' insofar as they are insufficiently supported by facilitating activity, and near-term goals seem likely unattainable.[14] There is, however, a further and fundamental issue that is arguably built into housing stock (no pun intended) transitions and this is intensified and illustrated by 'cost of living' dilemmas…

[14] Though one might note some builders are beginning to implement change ahead of government intervention. For example, Redrow became the first housebuilder to announce it will only be building gas-free homes in future (Vaughan, 2023).

5. Market mechanisms and the economic agent

While the previous section may indicate the situation is bleak, it is important to recognise government has acknowledged how vital decarbonising the housing stock is and, criticism notwithstanding, has set out some basic strategy points that are eminently sensible (BEIS, 2021: 11-18). The BEIS *Heat and Buildings Strategy* specifically states there is a need for a 'whole building' or whole house and 'whole system' (i.e., within the context of all other contributing sectors, but especially electricity generation) approach and that, given technology such as heat pumps depend on highly effective insulation, there is a need to adopt a 'fabric first' emphasis. There is also explicit focus on both a 'futureproofing' perspective and 'no regrets or low regrets' principle (defined as long term 'cost-effective' from both a householder and systemic point of view). However, as the previous section and its final quote indicates, the Strategy was in many respects an under-response to the urgency and scale in practical policy terms. As Professor David Glew, a BEIS seconded expert on retrofitting and building energy efficiency from the School of Built Environment, Engineering and Computing at Leeds Beckett University noted at the time the Strategy was published:

> To stand a chance of succeeding, the new government zero carbon heat strategy needed long term support in the order of tens of billions of pounds per year for decades. It also needed to be under an umbrella of a National Retrofit Strategy to ensure the fabric first issues could be addressed. The indications from the published strategy document are that the government is only willing to provide short term three-year support in the order of several billion pounds, gambling that industry can pick up the short fall. The government has provided £60m of innovation funding as part of the announcements to allow industry to react, though in terms of industrial research, this money will not stretch very far. (Glew, 2021)

Glew concludes that the scale of funding is a 'missed opportunity', but one might go further here and suggest there is an underlying issue with how the problem and its solutions are framed and this is likely to remain an issue even as policy continues to evolve and funding change. As the final quote from the previous section and a subsequent consultation document also make clear, the emphasis is on facilitating a 'market mechanism' (BEIS, 2022b).

The fundamental approach assumes that it is government's *role* to 'develop a market'. First, by encouraging firms to either expand or come into existence to create a scaled supply chain able to employ sufficient labour, while also providing support for further innovation in relevant technologies (which, in turn, it is assumed will reduce unit costs of those technologies while also improving their effectiveness). Second, by making households aware of the timeline for regulation and what their obligations and options are. For example, when and under what circumstances an EPC rating of C or higher may be required, at what future point gas boilers will be phased out, what potential cost savings may accrue to undertaking retrofitting, what (if any) financial support or financing options are available. The underlying assumption is that the government's task is to create the grounds for both demand and supply investment decisions. We might describe this as mainly a focus on institutional formation in the form of clear and stable strategy, certainty, confidence and trust, but with some degree of kick-starting

to facilitate scaling-up of supply in conjunction with some targeted support for householders (a policy-set ranging across various possibilities – grants and subsidies for early adopters, extra help for those least able to afford retrofitting and so on).

There are many things one might focus on here, but an important one is how policy treats the owner of housing stock (who may or may not be the resident). The underlying assumption is that housing stock is someone's asset and that the relevant decision is about investing in that asset. A collective climate policy abatement decision thus translates into an individual economic decision. As any informed reader is likely aware, this way of framing has become basic to general government policy in the UK over the last forty years and more recently to climate policy. If a market does not exist for something, one creates a market and thereafter it is assumed a process of price signalling induces allocative and dynamic efficiency, whose indirect consequence is the solving of some further goal. In this case, owners invest in housing stock and this, in turn, reduces emissions. Clearly, this leads to a need to establish that the process is 'affordable' and either ultimately 'pays for itself' or has some further pay-off i.e., an investment is, over some recognisable time horizon, 'worth it'. As such, the particular approach to retrofitting ascribed to the household mirrors the broader perspective taken by government and that is some version of cost-benefit analysis. This has become a 'common sense' and thus may appear reasonable, but it is equally reasonable to ask what this common sense presupposes and how it shapes the subsequent evolution of policy and to what eventual ends.

The first point to make here is that policy treats the decision as primarily transactional, calculative and monetary. Clearly, this is not absurd, insofar as retrofitting should be of value in some context and someone is paying for it, but the context has immediately become an individual economic agent engaged in a rational calculation regarding the costs and benefits of a financial decision, and where it is assumed that this is an investment in property. So, in addition to supply-side issues, a demand-side is invoked which then becomes a series of obstacles to be negotiated in order to remove barriers to scaling up retrofitting and especially low or no carbon technology adoption. Given the process places responsibility with the household (or other owner), this entails not just making the changes affordable, but also making the householder *see* that they are affordable, and that this is something they must commit to or ought to commit to. This, in turn, makes clear that the primary context of delivery becomes *dependent* on the household acting as the kind of agent assumed by policy.

What form does this economic agent take?[15] They are assumed to be information-receptive and/or information-seeking in the context of a need for energy efficiency measures and prepared to take on the task of processing available information, with all that entails in terms of time and engagement; all of which presupposes an agent motivated by the underlying goal of maximising (or at least increasing) some targeted metric (typically, for economists, under the umbrella of utility or preference related welfare, revealed in a pecuniary act).

We've made this sound rather complicated and abstract, but the point is simple. Government policy adopts what we might call a 'market psychology' approach. Among other things, policy then depends for its success on three associated characteristics: the existence

[15] There is, of course, a great deal of variation in the acknowledgement of and treatment of the scope of human agency in economics. For example, while often considered a founder of modern economics, Alfred Marshall had a great deal to say about multiple influences on activity in contexts and this multiplicity is the basis of Original Institutionalist Economics (Veblen, Commons, Hodgson etc) and, somewhat differently, Behavioural Economics. All of these contrast with the narrowly conceived agent found in Samuelson or Stigler and modified through the Savage axioms. For a range of treatments in this journal see Bakaloglou and Charlier (2021), Comerford et al. (2018), Dolšak et al. (2022) and Fuerst et al. (2015).

of, the activation of and the adequacy of the required agent identity – i.e., a calculative market psychology. Clearly, this invokes a set of possible criticisms, each implying the underperformance or failure of policy. People's conduct may not fit this psychology, another psychology may be more effective (either in some cases or in all cases), and even if conduct does broadly follow according to some of what is assumed, the agent may still *choose* not to commit to retrofitting (at least up until the last moment that statute/regulation allows), and still may not be able to afford it.

Let's say for the purpose of argument that it is possible to activate a market psychology and that a person or household does in fact engage with the process according to this type of individual economic agent perspective, i.e., seeking out information, making calculations regarding retrofitting as an investment decision. A key additional problem emerges here. Policymakers do not control the wider world in which the relevant agent is making their calculation. In the case of 'investment' decisions where new debt is likely being take on, the obvious relevant factors are: current debt levels or real household debt, current savings, job security and general sense of confidence. Each of these affects the psychology of 'affordability' and does so in a way that is not simply precisely calculative. Each can also be a reason why an anxious agent opts out of the process (a waste of their time, better things to do, not worth it, can't know, don't want to know). Equally, each may form an *unquantifiable* background that leads the householder to quite reasonably *choose* not to invest in the kind of changes policy anticipates. This is because background characteristics inform sentiment that affects how calculation is undertaken and with what degree of 'risk aversion'. Moreover, standard ideas of risk may also be inappropriate here in real situations and for real people.

6. Financing, risk and uncertainty: invest in your own inflation resilience?

It is surely also relevant that the aspects of life one feels in control of shrink in times of greater experienced uncertainty (when the overall situation or open future seems more in flux). The economic distress caused by first the pandemic and then persistently high inflation and the cost of living crisis clearly invoke such concerns. According to the most recent ONS statistical release at time of writing, the UK Consumer Prices Index (CPI) rate of inflation stood at 10.1% for the twelve months to January 2023 (ONS, 2023a). While this is lower than the 11.1% reported for the twelve months to October 2022 and 10.7 % to November, it remains historically high and far above the target rate of 2%. Similar trends are exhibited across the full range of measures, albeit the rate varies considerably, from the Retail Price Index (RPI) at around 14% to CPI incorporating owner-occupier costs (CPIH) at 8.8%.[16] Moreover, it is worth noting that the CPI rate in December 2021 was approximately 4.5% and the Bank of England was forecasting a peak in Spring 2022 at about 5%. This was against the background of several months of divisive argument amongst economists regarding just how long newly high inflation would persist, and where a sizeable constituency were on one side or the other. The forecast,

[16] The existence of multiple inflation measures reveals an obvious problem if one asks, 'what is the rate of inflation?', since it indicates all measures are constructs which include or exclude for given purposes and no single figure metric can be truly representative of a complex phenomenon. CPIH, for example, uses 'imputed rent', a calculation of what the homeowner would pay if they rented. As an imputation this is different than measurement of other aspects of inflation, which involve data on actual prices.

of course, was prior to the invasion of Ukraine and the subsequent turmoil in energy markets, but this in itself indicates something about forecasting. Events in Ukraine constitute a shock within standard modelling approaches, an unforeseen event disturbing the prior expected unfolding of key economic metrics. To the public, however, the war and its economic consequences (and likely to a lesser degree, the continual deviation from target rates over previous months and the lack of consensus on how long this might persist) are 'information' about the reliability of forecasts. Economic reality, as it is lived, has no neat compartmentalisations, which place pandemics or geopolitical matters beyond its purview (Rescher, 1998).

As Keynes noted long ago, using the example of war, some things are simply unknown and likely unknowable beforehand (Keynes, 1937: 213-214).[17] Models that provide quantity-probabilistic claims about the future are at their most useless when such events occur, and the more the world reminds a population of its inherent uncertainty, then the more difficult it becomes to persuade people that investing in the future is something they are in a position to undertake. This is particularly so, somewhat ironically, given the point just highlighted, when the messaging coming from the state confirms that 'things are bad' – which has clearly become the case in the UK regarding both its monetary position, as set out by the Bank of England, and its fiscal position, as set out by the Office for Budget Responsibility (OBR) and UK Treasury (e.g. Bank of England, 2022: 5). Nor does it help much, in the grip of uncertainty, that the recent inflation trend has been downwards and that projections anticipate some eventual significant improvement in conditions. Even if this should be so, one cannot ignore that the level of prices do not fall back merely because rates of inflation slow, and there are, as already noted, good reasons (by dint of observation) why the public may place little credence in such claims for the purposes of making current decisions about the future; and towards the same point, consider that not much more than a year ago debate centred on negative interest rates and since then central bank interest rate rises have been rapid. In any case, and as the final point about interest rates indicates, high inflation does not just impose burdens to different degrees on a population, it interacts in complex ways with other characteristics. This is a point worth illustrating at some length in order to provide a sense of the lived reality of many in the UK and the background conditions which may influence how they might engage with 'investment' in housing stock.

The UK exhibits significant income and wealth inequality. According to a recent analysis by the Institute for Fiscal Studies (IFS), the 90:50 ratio (the ratio of household disposable income between the 90th percentile in the distribution and the 50th) is around two and the 50:10 is also around two (Bourquin et al., 2022). Wealth inequality, moreover, is far higher. The 90:50 ratio for wealth is about five and the 50:10 is 'meaningless' insofar as the bottom 10% of the population have zero net wealth. Furthermore, while growth in income inequality has varied since the 1980s, wealth inequality has increased more or less continuously – for example, since 2006 the 5th decile of the distribution increased its net wealth by about 60% of an average UK salary and the 10th decile by 8.9 times.

As anyone familiar with the UK will be aware, housing ownership has played an important role in this wealth effect, and ownership sits behind access to cheaper secured credit, capacity to accumulate other assets and to save. As phenomena like 'generation rent' indicate, this has affected life chances and current choices. Equally, however, the centrality of housing stock has had a double effect. On the one hand, lack of ownership in an environment

[17] Note uncertainty may refer to a transient state of mind or an intrinsic state of the world (i.e., epistemic versus ontic definitions).

of high rents creates an inability to save and an absence of security of tenure. On the other hand, over several decades house prices have tended to increase faster than incomes, and so for many people mortgages have become a source of financial vulnerability, especially given relatively low wage growth in the UK (and recent real wage falls) and given that the population had become accustomed to relying on historic low interest rates. The combined effect has been relatively low savings among great swathes of the UK population and thus, given the mentioned patterns of wealth and income inequality, a significant level of financial vulnerability. According to the UK Financial Conduct Authority (FCA) Financial Lives survey, conducted May 2022, twenty four million adults (45%) were struggling to meet existing bill and credit payment commitments, twelve million lacked savings to cover such commitments over a three month period, nearly thirteen million adults exhibited 'low financial' resilience and 4.2 million UK adults were categorised as already in financial difficulty, having missed domestic bill and credit payment commitments in three of the last six months (FCA, 2022).

Financial vulnerability is often paralleled by greater vulnerability to poverty. Historically the two main measures of poverty are relative (living on 60% or less of that year's median income) and absolute (living on 60% or less of inflation-adjusted median income for some base year), but more recently in the UK the Social Metrics Commission (SMC) has developed a more complex set of indicators and measurements (e.g., SMC, 2020). The Joseph Rowntree Foundation (JRF) has adopted the SMC measure, but the two simpler measures remain in use by organizations such as the Resolution Foundation and the UK Department for Work and Pensions (DWP) – who notably refers to the measures as relative/absolute 'low income' rather than poverty. The last available statistical release for the DWP was from May 2022 and provides data for 2020/21 i.e., prior to acceleration of the current cost of living crisis (DWP, 2022). It reports the percentage of households living in relative low income (poverty) at 20% and absolute low income (poverty) at 17%, both after housing costs. According to the most recent available Rowntree report, 22% of the UK population or 14.5 million people were living in poverty in 2021 (JRF, 2022). The Rowntree report is again prior to the acceleration of the cost of living crisis, but it does note in its foreword that inflation has significant potential to exacerbate poverty. These concerns were expressed in January 2022 and were raised in the context of OBR expectations that inflation would still be more than 3% in April 2023. Given subsequent events, the situation of many can only have worsened and the periodic ONS Winter Survey reports provide a snapshot of this. In January 2023 using a representative sample of 4053 individuals matched to ONS census data the ONS reported that half of adults were buying less food because of budgetary constraints, 13% were skipping meals and 9% were unable to afford to buy food at the end of the month (ONS, 2023b). Poverty is no longer a situation experienced only by the long-term unemployed and marginalised, but by great swathes of the working population. The UK, the fifth wealthiest country on Earth as measured by annual GDP according to the World Bank, has normalised dependence on food banks.[18]

Poverty, of course, has multiple effects. As the Centre for Social Justice reports, the poor pay more for essential products and services (Centre for Social Justice, 2022). Approximately seven million people pay an average £478 per year more according to their calculations across a range of insurance, credit, food and energy. Though the two intersect, paying more for products and services is not quite the same as being in 'fuel poverty' and according to the Green Alliance an estimated 6.7 million people in the UK were in fuel poverty in mid-2022, compared to 4.5 million in 2021 (Dossett, 2022). As the New Economics

[18] Visit: https://www.trusselltrust.org/

Foundation noted in October 2022, government energy bill interventions have so far prevented this becoming far worse, but have not in general resolved the cost of living crisis (Sandher and Tims, 2022). In late 2022 and early 2023, according to the ONS, nearly half the UK are struggling to meet bills and service debt (ONS, 2022b; ONS 2023b). More generally, if we return to the point we began with when setting out this long litany of evidence, as the IFS confirms, inflation is experienced differently by households in different parts of the income distribution. Low-income households are disproportionately impacted by energy and food inflation since these are a larger proportion of their expenditures. The cost of living crisis is thus an inequality amplifier (Cribb et al. 2023: 6).[19]

Clearly, once one steps beyond an abstract economic agent and starts to consider economic reality as it is and people as they are, activating a demand-side and building a market become highly problematic. While one could argue that a simplistic 'market psychology' understanding of an economic agent has always been conceptually problematic, depending on it in the current environment seems even less likely to be effective as a main pillar of retrofitting policy**. Incomes are constrained, confidence is low, expectations of the future negative and uncertainty is high, and this situation does not seem set to turn merely because inflation reduces (if it in fact continues to do so).** To be clear, however, beyond its broader commitment to 'developing the market', little is yet settled about the type and degree of government support or role in financing for retrofitting over the rest of the decade, but to some degree this matters little for the point we are making.[20] Unless there is a fundamental change in how the issue is framed, the presumption is that households in the main will be paying for retrofitting and will be expected to come to decisions on an individual basis, which, in turn, invites a focus on individual 'affordability'. As the Resolution Foundation recently pointed out, the majority of previous rounds of retrofitting were low-cost loft insulation, and these accounted for seven in ten at the high point of installations 2010-12 (Anis-Alavi et al., 2022). As such, the vast majority of outstanding actions are likely to be far higher cost fabric retrofits and heating technology changes. Estimates for upfront costs and recouping of those costs are dependent on many factors that tend to vary, such as current energy prices and whether financing is zero interest or carries an interest rate charge, but this notwithstanding the Resolution Foundation estimates it could take between eleven and eighteen years to recoup upfront costs.

Still, what people can 'afford' is not a simple matter of present-focused arithmetic, it is a determination of what obligations it is sensible to take on for the future. So, there will be many who cannot afford to retrofit now and many more who fear to take on the cost, and the size of both these groups is likely to fluctuate. Even if people are made aware that fabric retrofit, changing their gas boiler etc. are something they eventually will have to do, in the absence of other factors, the result may be delays to a process whose policy effectiveness is predicated on rapid scaling up and (subject to growing the pool of skilled labour) a manageable *annual* rate of implementations/installations; and, of course, assumptions about falling unit costs also turn on this. There is, therefore, a basic tension in terms of 'invest in your own inflation resilience' whatever the long-term possible pay-off may be.

[19] For example, year-on-year January 2022 to January 2023 adjusted gas and electricity inflation for the top-decile of household income was 7% and for the bottom decile 11%; and for food 11% and 21% respectively.

[20] There were, for example, new commitments in the 2022 Treasury Autumn Statement (HM Treasury, 2022). On limitations in access to financing see also the Green Alliance *Locked Out* report (Fotherby et al., 2022).

7. Conclusion: ways forward

Retrofitting is widely considered to be one of the more difficult climate policy foci because it requires multiple changes to many millions of buildings with many millions of owners. The problem is granular in a way that dealing with corporate agents is not. Clearly there are issues regarding choice between types of and feasibility of low or no carbon technologies, as well as issues of embodied emissions and financialization of housing stock (e.g., Ermgassen et al., 2022), but the problem is mainly one of mobilising resources. As the CCC makes clear and as the UK government acknowledges, failure to decarbonise the housing stock is not an option. Moreover, achieving this decarbonisation has multiple benefits if any were needed beyond absolute necessity. For example, as the CCC also make clear, the more rapidly and effectively the UK achieves reductions the less it depends on the more dubious components of the 'net' in net zero, such as carbon capture and negative emissions technology.[21]

In addition, reducing demand for energy through retrofitting not only facilitates improved energy security insofar as energy use is potentially reduced (though this is not certain in a growth system where only 'relative decoupling' pertains), but also the process of transition presupposes use of technologies (heat pumps, solar, micro wind and battery storage etc.) that are less dependent on external energy sources and especially fossil fuels. Retrofitting is, therefore, as the Department for Energy Security and Net Zero is aware, likely to have a long-term inflation-dampening effect, given that it cannot be assumed (despite significant reductions in late 2022 in wholesale prices for gas in therms and energy in MWh)[22] that there will be no future price rises caused by a combination of shortages, exploitation of opportunity and a conflict in Europe whose main protagonist exhibits a tendency to weaponize energy.[23] Consensus in early 2023 among forecasts for inflation in the UK anticipate CPI reducing to around 4% by the end of the year, but it is important to keep in mind that, as we noted earlier, standard models treat 'non-economic' events as shocks in the form of price rises that then drop out of measures. Things can very easily turn out differently and given the current context it would be counter to the precautionary principle to assume a return to some imaginary basic equilibrium position. Furthermore, reference to some notional 'normal' is a reminder that it is short-sighted to focus solely on inflation consequences and neglect both causes and further context (not least opportunistic corporate mark-up behaviour)[24]

In any case, **framing retrofitting as an individualised investment decision and thus locating retrofitting policy within the vagaries of affordability in uncertain times is reckless at best, and to reiterate, decarbonisation of housing stock is not optional**. One ought also to

[21] *All* CCC scenario pathways involve some role for negative emissions technologies. The headwinds scenario requires a role for negative emissions because of failure elsewhere, while the tailwinds scenario benefits from the technology rather than is driven to need it. For a chart of different required or assumed capture rates see CCC (2020: 81).

[22] Also, while acknowledging uncertainty, according to the Resolution Foundation February 2023, despite a 71% fall in gas futures for 2023-2024 from their peak in August 2022, and despite a fall in the forecasted average energy bill from £3,000 to £2,400 p.a. average bills will still be about twice what they were in the pre-pandemic year of 2019-2020 (Fry and Smith, 2023).

[23] For standard treatment of energy shocks and energy security issues in this journal see, for example, Blum and Legey (2012); Nasir et al. (2020, 2018).

[24] Much of this going forward also speaks indirectly to issues of security and competition. For example, the USA's Inflation Reduction Act (a set of subsidies and incentives built around a massive investment in green energy and infrastructure as a form of industrial strategy) is already resulting in unintended consequences in terms of claims and counterclaims of protectionism. In the UK, existence of this and the REPowerEU agenda is already leading to concerns that the UK will be left behind in the 'global race' for economic supremacy, an emphasis that somewhat misses the point of collective jeopardy and sits awkwardly with the Paris agreement commitment to technology transfer.

note that the issue is not unique to the UK. Climate change is everybody's problem if not (in the causal sense) everyone's responsibility, and the need for carbon neutral, ecologically sensitive and environmentally resilient housing is universal.[25] Policy and progress, of course, vary by country and for the much of the world retrofitting is a subset of a broader set of issues related to achieving the UN Sustainable Development Goals (notably some combination of Goal 1 on poverty, Goal 11 on sustainable cities and communities and Goal 13 on climate action).

Returning to the UK, as any literature review would indicate, there are many attempts to assess and improve the monitoring of the retrofitting process (e.g., Hardy and Glew, 2019), as well as encouragement from government to improve relevant technologies and practices, such as the BEIS 'Whole House Retrofit Innovation Competition' launched in 2019.[26] This, however, should be distinguished from depending on technological change as a substitute for other actions. As the CCC notes of current UK government strategy:

> While its proposed pathway is similar to the CCC's, the Government has made a relatively high-risk choice to rely heavily on technology to reach its targets, with much less focus on efficiency improvements and demand management across the economy. This is a narrow approach that could lead the UK down a more expensive path to Net Zero, with a higher risk of failure and energy insecurity. (CCC 2022b: 79)

Retrofitting then, is an area of policy in need of a major rethink – though there are others (e.g., Haines-Doran 2022; Newell 2021; Morgan 2020). To be clear, there is no shortage of analysis and recommendations. The Resolution Foundation report, for example, contains various constructive recommendations, including mandating energy rating upgrades during ownership or tenancy changes and significantly increasing financial support (Anis-Alavi et al., 2022). This latter suggestion, however, speaks to a further problem that inflation and a cost of living crisis only intensify. We have to stop thinking of retrofitting as an individualised and monetised cost-benefit market problem (e.g., Currie & Brown, 2019). It is collective or community focussed climate emergency planning. There are various positives here. The CCC recently supported an exercise in local deliberative engagement, and this is a step, albeit a small one, in the direction of creating a community of concern for climate issues (Climate Citizens/Lancaster University 2022a, 2022b). Moreover, as policymakers on both the left and the right are beginning to realise, there is no path to net zero without massive and accelerated government financing. This, albeit implicitly, can be read into the recent government-commissioned 'Skidmore Review' on net zero and also, perhaps the work of the conservative-leaning pro-market think tank Bright Blue (Skidmore, 2023; Cullimore, 2023). There are also signs in early 2023 that government will commit to widespread substantive subsidies, though the devil will be in both the detail and whole house retrofit coordination. On the financing front more generally, the UK Treasury is increasingly aware that its own cost-benefit analysis focused rules are becoming a barrier to greenlighting the kinds of projects a changed world requires. This too is only a small step. Devolution is also allowing local government to take responsibility and university-led initiatives, such as Yorkshire & Humber Policy Engagement &

[25] See, for example, Egner and Klöckner (2021); Frantál and Dvořák (2022).

[26] Visit: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/890019/Whole_House_Retrofit_Competition_Guidance__2___withdrawn_.pdf
Innovation is continual. For example, infrared heat emitting wallpaper (containing graphene layers and a succession of copper strips to which a 24-volt supply is applied). See also Perlman (2023).

Research Network (Y-PERN), hold out the prospect that they might go beyond central government's approach to climate emergency. Y-PERN, for example, advocates a new 'system of systems' approach and this is potentially more radical than the BEIS *Heat and Buildings Strategy* marketized 'whole system' principle, since it suggests taking a 'social provisioning' approach to economy, and this implies, though few are likely aware of it as yet, greater emphasis on social redesign along the lines of 'social ecological economics' (see Spash, 2023).[27] As Spash suggests, at this stage unrelenting pessimism is debilitating and unhelpful, 'there are only alternatives'.

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[27] See also Buch-Hansen and Nesterova (2023); Gills and Morgan (2022).

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