The expected role of individuals in the transition to net zero: policies and pathways facilitating an active role

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Abstract

Responding to the climate emergency is widely recognised as a priority at all levels of government – from cities up to the EU. However, what this means for individuals is under debate: are individuals expected to be active citizens co-creating the transition, disengaged recipients of net zero policies, or something in between?

This exploratory paper first summarises the debate about whether individual change is a distraction from demanding system change. It concludes that individual change is inextricably linked with system change. Individuals can have roles in the energy system and transition beyond that of the economically-rational consumer. Indeed, characterisation of current energy efficiency policy shows that a variety of conceptualisations of individuals are already present in European and national policy.

Moving beyond efficiency, new ways of engaging individuals - personal carbon allowances, carbon footprints and energy sufficiency - are considered. The most radical is energy sufficiency which encompasses a very broad understanding of individuals, their needs and wants, and their relationship to the natural environment. Looking at various net zero scenarios shows increased individual engagement will be required to reduce / remove reliance on highly uncertain carbon dioxide removal technologies

This paper builds a picture of how the individual is seen in energy transition research and practice. There are differing expectations according to context, and who is doing the expecting. The paper argues that there are reasons in principle and practice to prefer engaged citizens, and points to policies and pathways which facilitate this active role. Policies which combine multiple levers of change - economic, social and psychological - and/or which move beyond efficiency to sufficiency, will be important in the energy transition.

Introduction

It is just a few short months since the conclusion of COP26, held in Glasgow, UK. There, citizens from all over the world took to the streets in their tens of thousands demanding action on climate change, calling for climate justice. Young people were particularly prominent, demanding that governments at COP26 protect the planet and their future. This paper is being written at a time of crisis in energy markets, with huge price rises in natural gas affecting heating fuel and electricity prices. There is considerable public and political concern about the impact of prices on individual energy users, particularly lower-income households - with ongoing debate about what governments can or should do to ameliorate the impact of high prices. These two events illustrate very different roles for individuals in the energy system and the energy transition to net zero. In the first case, people are concerned about climate, active, demanding huge change. In the second, they are consumers concerned about energy prices, at the mercy of world markets, focused on meeting their immediate energy needs. In both cases, governments are expected to act. The question is, in acting, are governments creating policies for active citizens co-creating the transition to net zero, for passive respondents or for something in between?

Responding to the climate emergency is widely recognised as a priority at all scales of government and governance – from villages, towns and cities up to the multi-national EU level. This paper is not about balancing responses to different aspects of the 'energy trilemma' - environment, economy and energy security – but exploring the role of individuals in the transition to net zero. The focus is on government policy and how individuals and their concerns are framed in policy instruments, whether explicitly or implicitly. Other evidence is gathered from current debates on the role of individuals in energy markets and flexibility - framings which will affect the design of future policy. New policy ideas which call for more engagement in energy-related decisions are also examined.

An underlying assumption in this paper is that the transition to net zero cannot rely solely, or even primarily, on energy supply-side technology change (Eyre and Killip, 2019). Energy experts are agreed that a transition to net zero, particularly a just transition, must go beyond electricity grid decarbonisation and "requires a shift in focus

from technological substitution and conversion efficiency towards greater end-user engagement on the demand side" (Nolden et al, 2021). However, it is not clear that this vision of the role of the individual is shared by policy makers at different levels of government, by the business and organisations that will need to create low and zero carbon goods and services, or indeed by individuals themselves.

One aim of this paper is to surface the different assumptions about individuals and mechanisms for change which underpin different policy instruments and to consider how these compare with the many roles individuals occupy within the energy system and society more broadly. It also makes the case that greater involvement of individuals in the net zero transition will be necessary, and that we have some policies and policy ideas which can enable such a change. This paper focuses primarily on individuals and their existing and potential role in the transition to net zero practices and policies to support this.

The paper begins with the question of whether we should even be talking about individuals. Then, debates about the role of individuals are covered. This is followed by an analysis of the role of individuals in energy efficiency policy. The case is then made for policies which actively engage people, with three examples provided. Two contrasting sets of scenarios are presented, showing how the role of individuals can and, arguably, must be expanded to meet net zero goals. Each of these sections includes brief 'concluding thoughts' to take key arguments forward. The paper closes with a discussion section followed by conclusions.

Should we even be talking about individuals?

This paper focuses on individuals, being aware that there are arguments that this is problematic. Three sets of arguments against a focus on individuals are set out briefly. These do not change the intent of the paper, but it is important to acknowledge these perspectives – doing so helps elaborate the thinking behind this paper.

Individual change or system change?

Prominent academics and activists have engaged in debates about the relative merits of 'system change' versus 'individual change' (e.g. Grover, 2019, Hackel and Sparkman, 2018, Lukacs, 2017, Williams, 2019. There is a body of opinion that individual actions to reduce personal carbon emissions or environmental impact are at best unimportant and at worst a deliberate distraction from a necessary focus on systematic change and corporate action. The following quotations give a flavour of the arguments mobilised:

"Contrary to popular belief, fossil fuel companies are actually all too happy to talk about the environment. They just want to keep the conversation around individual responsibility, not systemic change or corporate culpability." (Grover, 2019)

"Eco-consumerism may expiate your guilt. But it's only mass movements that have the power to alter the trajectory of the climate crisis. This requires of us first a resolute mental break from the spell cast by neoliberalism: to stop thinking like individuals." (Lukacs, 2017).

There has been considerable attention to the claim that BP was responsible for promoting the idea of a personal carbon footprint and therefore that it is a questionable concept (Kaufman, 2021). In his recent book, The New Climate War (2021), leading US climate scientist Michael Mann proposes it is a mistake to focus on personal action as a solution to climate change and that this focus has been a tactic of fossil fuel companies to divert attention from their own responsibility.

Arguments against 'individual action' are primarily resisting the idea of the individual acting only as a consumer (and perhaps have much in common with arguments against 'eco-modernisation' (Jacobs, 2021)). They suggest individuals need to be engaged in demanding system change, whether as voters, activists for, say, divestment from fossil fuels or via lawful protest. This is illustrated by prominent American climate scientist, Katherine Hayhoe, who notes that "important as individuals changes are, they aren't going to solve this problem" (2021: 149). She says:

"The most important thing every single one of us can do about climate change is talk about it – why it matters, and how we can fix it – and use our voices to advocate for change within our spheres of influence" (Hayhoe, 2021:213)

Authors who see a much more important role for individual action typically challenge the assumption that is unconnected from, or in tension with, system change. For example, Hackel and Sparkman (2018) outline several ways in which individual action ripples out to systemic change. Steinberger (2019) notes that personal action is not only recommended because these will collectively add up to big carbon savings but "because people taking action in their personal lives is actually one of the best ways to get to a society that implements the policy-level change that is truly needed." Many academics and commentators conclude that both individual and system

change are needed – and that these changes are interdependent – only individuals can change the system, and without system change most individuals cannot live low or zero carbon lives. It is very rare to find authors arguing in favour of individual action alone.

Language and resonance

'Individual' is a word with unhelpful resonances – connected as it is to 'individualistic'- one meaning of which is 'prioritizing the pursuit of individual interests or rights rather than common or collective ones' (dictionary.com). Synonyms for 'individualistic' include selfish, self-absorbed and narcissistic – not qualities generally considered positive. Individuals might not sound like they are people who are equally members of households and communities, workplaces and educational settings. However, the intention here is that an individual means a person who can play many roles from community member, to engaged citizen, voter, demonstrator, solar PV owner, EV driver or shareholder.

Theoretical grounds for rejecting analysis at the individual scale

There can be theoretical grounds for rejecting analysis at the individual scale, for example within social practice theory, which has been very influential amongst social scientists studying energy. Quoting Giddens' work, Shove and Walker (2014) state that their starting point "is the proposition that 'social practices ordered across space and time' should feature as 'the basic unit of social enquiry'". As such, a focus on the individual would not fit well with this theory where individuals are de-centred. However, there are different interpretations of the central ideas of social practice theory, in some of which individuals have more importance. Whether this is seen as a problem, is up to the reader to decide.

Concluding thoughts

This paper contends that individuals' energy demands and their actions to reduce energy demand are important as is policy to enable and require change. However, this is far from individuals' only significant involvement in energy systems. Recent psychological research has suggested that behaviour change to address climate change should be seen as encompassing more than changing habitual behaviours, to include adoption of low-carbon and climate-resilient technologies, and conversations and interactions with others that raise awareness, enable and normalised low-carbon lifestyles, amongst other roles and activities (Whitmarsh et al, 2021). This broader understanding of individual action is a good starting point for more productive discussion.

Debates about the role of individuals in the energy transition

Energy systems are changing in a way that is often described as the 3Ds – decentralisation, decarbonisation and digitalisation. Following a very brief literature review on individual roles in energy systems, we consider the roles and expected roles of individuals as buyers of energy, and then their role in providing flexibility – a desired characteristic necessitated by the first two Ds and facilitated by the third.

Very brief literature review

There is a range of research on representations of individuals and the public within the energy system, and on competing visions of their place in a future system. This paper does not include a full literature review, rather some key ideas are briefly presented. Looking at representations of the role of individuals in centralised energy systems, Devine-Wright (2007) suggests "the centralized energy system is embedded within, and has helped produce, a social representation of the 'energy public' that is overwhelmingly characterised by deficits of: interest, knowledge, rationality and environmental and social responsibility."

Numerous roles for individuals in energy systems have been identified, and different descriptions of, and distinctions between, these roles are found in the literature. Best et al (2015) distinguish between people as consumers, prosumers, active citizens and employees / entrepreneurs. Prosumers are energy users who also produce, manage, sell and/or trade energy and have a more active role in the energy system than consumers. People as active citizens are described as those engaging with policymakers and companies to secure or defend their interests, e.g. access to affordable and reliable power.

Moving on to the energy transition, Hoggett (2017) brings together literature on the role of the individual in the energy system as part of a study of the role of people, demand and governance in future energy systems. He finds end users should be the centre of the energy system to enable engagement, gain meaningful consent and to build legitimacy and trust. Wahlund and Palm (2021) note that scholarly debates and policy developments on citizen participation have included calls for 'energy democracy' and active forms of 'energy citizenship'. They consider the similarities and differences between the two concepts, They found work on energy citizenship tends to emphasise behaviour change and ways for individuals to participate in energy systems, thereby often focusing

on individuals as agents of change. In contrast, energy democracy tends to focus on institutionalisation of new forms of participative governance and often placing collectives as central agents of change.

Role of individuals in an energy market

The role of individual consumers in European national energy markets has changed considerably over recent decades, and still varies by country. How much choice consumers have, and what prices they pay per unit of energy, depends on several factors including market rules and governance, the number and type of retail energy companies, the range and design of energy tariffs, national energy taxation and the fuels available.

In the UK, much focus has been on how consumers engage in choosing their energy supplier and tariff. Switching and competition was meant to deliver lower prices for all, but many customers do not switch from their default supplier and tariff and were paying unacceptably high prices. This led to the introduction of a price cap for default tariffs, managed by the regulator, Ofgem. Price caps were supposed to be a short-term measure until "Ofgem and the government introduce other reforms, such as faster switching and smart meters, which will make the market work better for everyone" (Ofgem, 2018). The individual's role is as a customer making choices in their own best economic interest. But they also have to be protected from unfair market practices.

Many UK energy companies have gone out of business in recent months in response to high gas & electricity prices. UK Citizens Advice suggests the energy regulator failed to take meaningful action against unfit and unsustainable energy suppliers, with the subsequent failures due to cost households billions of Euros / pounds (Citizens Advice, 2021). This ongoing experience may change thinking around the way in which markets are governed and consumers' roles within them.

The UK government is considering how active individuals could or should be in the current and future energy markets. As shown in Figure 1, their view is that greater engagement will lead to 'better value, lower carbon' outcomes.

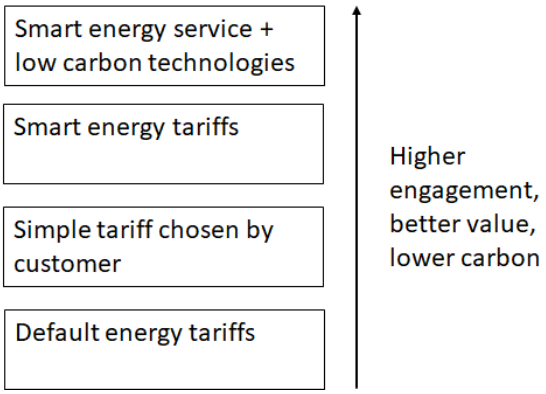

Figure 1: UK government view of engagement outcomes in a future market (adapted from BEIS, 2021)

Citizens Advice note: "The type, level and quality of engagement is likely to be fundamental to consumer outcomes as we transition to net zero – but there's currently no clear vision of what this should look like and what policies will get us there." (Citizens Advice, 2021).

Role of individuals in flexibility

Flexibility can be defined as the capacity to use energy in different locations at different times of day or year (via storage or by changing the timing of activity); to switch fuels; to smooth or create peaks in demand or, in the case of mobility, to re-arrange destinations and journeys in ways that reduce energy demand and/or congestion (www.creds.ac.uk/flexibility). There is a great deal of interest in flexibility, where it arises and the roles of individuals and organisations, as opposed to market design or technologies, say, in delivering it. Arguments about the degree to which individuals' use of energy can or should be flexible have a lot in common with those in the 'smart home' / 'smart tech' versus 'smart user' debates (Darby, 2019). There is concern that some householders have more flexibility capability than others, and a linking of flexibility with concepts of climate justice (Fjellsa et al, 2021).

Questions of flexibility are being investigated via number of field trials of 'smart local energy systems' in the UK, which are being fully evaluated (www.energyrev.org.uk). Smart local energy systems (SLES) tend to rely on 'smarter' and more flexible use of local resources and better energy asset planning and network management,

underpinned by digital infrastructure and more effective use of data. SLES are still rare in the UK and other countries which have mature, centralised energy systems (Fell et al, 2020).

Two SLES trials are happening in Oxford, with which the author and colleagues are involved. Both trials include electrification of heating and transport and provision of electricity storage at a local level (for details see project-leo.co.uk, energysuperhuboxford.org). They differ in the complexity of individual engagement with new technologies and markets. In the Energy Superhub Oxford project, plans to ask social housing tenants to adopt flexible electricity tariffs to complement their new ground source heat pumps have been paused due to the risks of exposure to very high prices in the current market. Time of use flexible tariffs are no longer seen as an unequivocal benefit.

Much of the thinking around flexibility relies on tariffs which are very new to the market, if they exist at all. The positioning of individuals in relation to flexibility is primarily as economic actors who will respond to price signals, either actively or passively. Given the experience of disengagement of a substantial minority in UK retail markets, this is likely to have its limits.

Concluding thoughts

The UK government see value in people becoming more engaged in energy markets, but past efforts to engage the disengaged through appeal to economics and relying on market forces have largely failed. Without a clearer vision of how and on what basis individuals can be engaged in future markets, including for flexibility, these benefits may not be delivered. It may be time to move from the 3Ds model, to the 4Ds - where the fourth D is 'democratisation' (Soutar, 2019).

Current energy efficiency policy & individuals

This section analyses in some detail how individuals are currently conceptualised in EU / nation state energy efficiency policy.

Energy efficiency policy has been effective at delivering energy savings in many European countries and remains very important in EU, member state and UK plans for meeting net zero targets. Table 1 lists key energy efficiency policy types – the first ten types follow the classification used in the EU Energy Efficiency Directive, Article 7. The theory of change for individuals which underlies these policies is set out. Theories of change are based on different evidence / conceptualisations of humans and why they value what they value, hold beliefs and act or fail to act, from habitual behaviours to investment decisions. They embody theoretical and empirical insights from a number of disciplines, notably economics and psychology. Energy efficiency policies focus on individuals in their role as energy consumers, as purchasers of energy efficient equipment, vehicles or homes, and as people with habitual behaviours, which can be changed. Building on the earlier discussion of individual and system change, other key actors and the relevant theory of change are set out. These 'other actor' columns are intended to be indicative rather than comprehensive.

Table 1: Energy efficiency policy instruments and their focus on individual and system change (via actors other than individuals)

Policy instrument	**Theory of change for individuals ***	**Other key actors**	**Theory of change for other actors**
Energy or CO_2 taxes	Response to economic incentives (dependent on elasticity of demand)	Manufacturers of energy-using equipment All actors	Economic incentive to produce more energy efficient options for customers Response to economic incentives
Energy efficiency obligations	Response to economic incentives	Energy companies	Investing in energy efficiency at the customer end may transform business model
Grants	Response to economic incentives	Suppliers of energy efficient products / improvements to buildings	Increases market & encourages business investment / activity / innovation
Tax rebates	Response to economic incentives		
Loans	Lack of access to capital/ high cost of capital as a barrier to investment		
On-bill finance	Lack of access to capital/ high cost of capital as a barrier to investment		
Regulations	Inefficient options no longer available	Manufacturers	Requires technical innovation to higher efficiency standards

Voluntary agreements	Inefficient options no longer available	Manufacturers	Requires technical innovation to higher efficiency standards – at pace agreed with industry.
Standards and norms	n/a - these are underpinning for other policies, but do not affect individuals directly		
Energy labelling schemes	Relevant information/advice at the right time can influence choices	Manufacturers	Incentive to innovate towards more efficient options as more desirable to customers / higher value / company reputation
Information, advice, billing feedback, smart metering	Relevant information/advice at the right time can influence choices	Energy companies	Opportunities for building customer relationships beyond price.
RD&D support	No direct effect	Inventors, Manufacturers	Financial incentives & knowledge exchange to support innovation in energy efficiency
Professional qualification & validation systems	Builds confidence in energy efficiency investments	Installers of energy efficient products / systems	Sets barrier to market entry. Promotes investment in skills.

*In part adapted from Rosenow et al, 2016

The most obvious point to note is that different policy instruments employ different theories of change – this is true for both individuals and organisations. However, some of the most influential instruments – regulations – do not rely on a theory of change for individuals, they simply remove inefficient products from the market. For manufacturers, they require a transition towards more efficient products (or exit from the market) – and for this reason minimum standards are set through a consultative process. Policy instruments which are designed primarily to change individual decisions or behaviours also affect other actors in the energy system.

Policies are seldom used in isolation, and there is a literature on policy mixes and the importance of these in effective policy making (e.g. Rosenow et al, 2016, Kern et al, 2019). Policy mixes are influenced by political priorities and ideas of what is most (cost-)effective to enable people to make lower carbon choices. Successful policy mixes can include policy instruments based on different theories of change.

Concluding thoughts

Current energy efficiency policies are based on a variety of conceptualisations of individuals, mostly rooted in economic and psychological perspectives. Individual response to policy is an important part of delivering higher energy efficiency and energy savings.

Policies & engagement of individuals

This section first makes some arguments for greater engagement of individuals in the energy transition, and then describes three policy ideas which offer greater public engagement.

Arguments for greater engagement

Individuals and their choices and behaviours, and policies to guide these, will be integral to the net zero transition. The potential to deliver policies and changes that go ‘unnoticed’ by the public is now limited and ‘stealth strategies’ will not be sufficient to reach net zero (Willis, 2020). This largely because the changes needed to energy-using equipment and practices involve users. Lower carbon heating cannot be achieved by more gas / oil boiler efficiency regulations, but by a switch to heat pumps or other systems dependent on zero carbon energy supply. Vehicle owners must switch to EVs. Both of these technology changes involve considerable additional capital cost and different practices around use, as well as upgrades to the electricity distribution network & other infrastructures. The UK’s Climate Change Committee (statutory advisors to the government) suggest that over 60% of emissions reduction in their net zero scenarios involve some degree of change from consumers and 10% is driven primarily by consumer choices (CCC, 2019:193). Their analysis largely relates to purchase and use of low carbon equipment (e.g. heat pumps, EVs), but also to changed consumption patterns (e.g. less meat eating, fewer foreign holidays).

Beyond technology & low carbon choices necessitating greater engagement, there are broader arguments that people need to feel that they, their families and their communities are active participants in the transition – not passive recipients or, worse, victims of it (Lord et al 2021). This means approaches to tackling climate change

need to give people a sense of agency in their own lives and communities and ensuring solutions are adapted to local strengths and ways of life, with strong local democratic control over solutions, and local benefits secured.

Citizens assemblies go beyond engaging people in making change and move towards co-creation of strategies and policies for change. They have been shown to be a good venue for thoughtful responses from citizens about what is needed to address the climate crisis. Assembly processes typically come out with a set of recommendations which go further than current policy. Citizens assemblies have been run at national and local level in several European countries, with the UK and France having two of the first national assemblies (Climate Assembly UK, 2020, Mellier and Wilson, 2020). Whether and how their findings are included in governmental decision-making is variable – the French assembly is much more integrated into formal processes than the UK assembly. Making an argument for greater engagement is one thing, designing policies and institutions that successfully enable this is another.

Carbon footprints

Derived from the broader concept of ecological footprints, the carbon footprint of a thing or activity is a quantification of its impact on climate change. Carbon footprints have been calculated at a huge range of scales, from snack foods to whole countries, with a variety of methodologies available. Carbon metrics are relevant to 'other actors' – not just individuals – for example they are critically important to built environment professionals (Lützkendorf, 2020). The effectiveness of carbon footprints aimed at individuals primarily relies on a psychologically-informed theory of change, that the right information at the right time will influence choices. They differ from energy labels in that there is an assumption that environmental values will motivate choices once the relevant information is available. Energy labels rely both on economic (running cost saving) and environmental motivations and are part of policy mix which includes minimum standards of performance which increase over time. Carbon labels or footprints are generally considered as a voluntary measure – whether calculated by individuals for their own lifestyle or provided by companies on their products.

A recent German study reported on a trial where 100 private households in Berlin tried to reduce their personal carbon footprints over one year (2018), with support including a carbon tracking tool, community meetings and personal advice. On average, the households managed to reduce their footprint by 11%, with individual savings of up to 40% (Reusswig et al, 2021). The authors conclude that people *as citizens* would support more stringent climate policies, even if their own performance as low-carbon *consumers* displays a lack of coherence and/or persistence. They suggest this is an important finding, as policy makers in democracies need to get regular support and approval by the majority of the people.

Personal carbon allowances

Personal carbon trading (PCT) is a policy proposal which aims to link personal action with global carbon reduction goals. Several variations of mandatory personal carbon trading schemes have been proposed in the literature under different names. Personal carbon allowances (PCA) is a prominent example. It would entail all adults receiving an equal, tradable carbon allowance that reduces over time in line with national targets. In its original design, the allowance could cover around 40% of energy-related carbon emissions in high-income countries, encompassing individuals' carbon emissions relating to travel, space heating, water heating and electricity (Hillman and Fawcett, 2004). Allowances would be deducted from the personal budget with every payment for transport fuel, home-heating fuels and electricity bills. People in shortage would be able to purchase additional units in the personal carbon market from those with excess to sell.

PCAs are envisaged to deliver carbon-emissions-related behavioural change via three interlinked mechanisms: economic, cognitive and social (Fuso Nerini et al, 2021). This policy proposal explicitly invokes three different understandings of people – as economic actors operating to maximise their own utility, as individuals whose behaviours are influenced by psychological factors, as social beings influenced by social norms. The economic mechanism would work by assigning a visible carbon price to the purchase and use of fossil-fuel-based energy. Cognitive awareness of carbon in daily routines would be increased by increasing carbon visibility and encouraging carbon budgeting. A social norm of low-carbon behaviour would be created via the shared goal of emissions reduction and equal-per-capita allocation of carbon allowances.

PCAs would require greater individual engagement in the transition to net zero, however, engagement is not necessarily positively embraced by everyone. Drost (2021) investigated the public acceptability of PCT in Germany. In a structured online questionnaire, 260 adults in Germany were surveyed in 2021, and five follow-up interviews were conducted. Most respondents supported PCT: 52.7% (highly or somewhat) agreed with its implementation in Germany, compared with 26.5% respondents who disagreed. For comparison, for the existing German carbon price agreement was higher (65.8%) and disagreement lower (17.3%). Acceptability of PCT was significantly higher when participants thought the scheme was fair, feasible, and effective. However, what is

defined as “fair” is hugely contentious. These findings are consistent with previous empirical work in other countries. Regarding the awareness-raising character of PCT, 97.3% of survey respondents agreed that PCT would make their own carbon footprint more visible. However, interviews revealed disagreement as to whether this is desirable; some prefer a system that does not require a high degree of engagement with their own carbon footprint. Whether that is an option in the transition to net zero is open to question.

A new policy philosophy: Energy sufficiency

ECEEE commissioned a series of concept papers on the topic of energy sufficiency, based on a recognition that energy efficiency policy alone is not enough to reduce demand for energy services. The general idea of sufficiency is something which is enough for a particular purpose. Beyond that, different authors favour different definitions of sufficiency and energy sufficiency. One developed for the ECEEE project states:

“Energy sufficiency is a state in which people’s basic needs for energy services are met equitably and ecological limits are respected.” (Darby and Fawcett, 2018: 8)

An alternative definition developed within the same project was purposely narrower and focuses on actions rather than states:

“energy sufficiency actions [are] reductions in the consumption of energy services, with the aim of reducing the energy use and environmental impacts associated with those services.” (Sorrell et al, 2018: 24).

The broader definition of sufficiency positions individuals as having needs, as being entitled to equitable access to energy services, and having a duty to live within ecological limits. By implication, individuals may have wants as well as needs, and these do not have the same status. It also implies that human needs can be met within ecological limits: this is a hypothesis. Currently many millions do not have their energy needs met, and several ecological limits are exceeded.

There are real-world policy initiatives which are building on the ideas of sufficiency and more detailed research into sufficiency actions which lend themselves to policy support (e.g. Wagner et al, 2019).

Concluding thoughts

Contrary to views mentioned earlier (Kaufman 2020), this paper sees carbon footprints as a potentially useful engagement tool. However, it is a fairly modest policy proposal. PCA is more radical and assumes, or creates, a population highly engaged with the net zero transition and climate change. The idea of energy sufficiency encompasses even broader understandings of individuals, their needs and wants, and their relationship to the natural environment. This concept is just beginning to be translated into policy tools.

Net zero scenarios and the role of individuals

Insights into how energy systems could change are available through the plethora of modelling and scenarios created by academia, large fossil fuel multi-nationals, the IEA, government and other actors. Understanding how individuals are represented within models (if at all) is another way of looking at how their future role in the energy system is understood.

CREDS scenarios

The UK Centre for Research into Energy Demand Solutions (CREDS) has recently developed a set of national ‘positive low energy futures’ (Barrett et al, 2021). Researchers devised four scenarios – plausible futures based on social and technological changes. The approach was first to develop coherent narratives and then turn these into quantified scenarios. Five activities were modelled: food and agriculture, transport, residential buildings, non-domestic buildings and industry/products. The scenarios incorporate social changes that would reduce demand for energy (e.g. fewer miles travelled), as well as energy efficiency strategies (e.g. better insulated homes). They are each very briefly described:

Ignore demand – baseline scenario, showing energy demand and supply to 2050 based on current known and planned UK policies. Energy demand falls by 5%. Net-zero target missed.

Steer demand – same energy service demand as in ‘Ignore’ scenario, but incorporating other measures that aim to reduce emissions to net-zero by 2050. Energy demand falls by 31% due to energy efficiency improvements. Net-zero target missed.

Shift demand – a low energy demand scenario with changes that reduce demand for energy across the whole economy using proven technologies and under current social/political norms. Energy demand falls by 41%. Net-

zero is achieved with high investment in zero carbon supply and a range of carbon dioxide removal (CDR) technologies.

Transform demand – a low energy demand scenario that includes transformative change in technologies, social practices and behaviour, infrastructure and institutions. It is intended to generate significant co-benefits in health, local environment, affordable warmth and work-life balance. Energy demand falls by 52%. Net-zero is achieved with lower supply side investment and without engineered CDR.

CREDS' focus on energy demand opens up a greater range of mitigation actions, enabling more diversity of policy options than are currently being considered in many other scenario exercises. People reduce their energy service demand, consume less meat, travel less.

International Energy Agency scenarios

The International Energy Agency (IEA) develops a range of global scenarios, which are published as part of its World Energy Outlook. In World Energy Outlook 2021 (IEA, 2021), four scenarios were modelled. Two of these are normative – that is designed to achieve specific ends. The Net Zero Emissions by 2050 scenario is an emissions trajectory consistent with limiting the global temperature rise to 1.5°C without a temperature overshoot (with a 50% probability), universal access to modern energy services and major improvements in air quality. The Sustainable Development Scenario maps out a pathway consistent with the "well below 2°C" goal of the Paris Agreement, while also achieving universal access and improving air quality. The other two scenarios - the Announced Pledges Scenario and the Stated Policies Scenario are based on existing policies and targets. Individuals within these scenarios are characterised as responding economically to lower-carbon technological options.

IEA state "the scenarios highlight the importance of government policies in determining the future of the global energy system: decisions made by governments are the main differentiating factor explaining the variations in outcomes across our scenarios".

Concluding thoughts

The IEA and CREDS scenarios achieve Net Zero using a very different set of technologies and assumptions about the involvement of individuals. To achieve Net Zero without reliance on engineered carbon dioxide removal, individuals in developed nations will be expected to move beyond taking up more efficiency options, and to engage with philosophies like energy sufficiency and the practical actions that requires. This will not be possible if individuals are thought of solely as 'consumers'. This matters because the availability of CDR at scale and at an acceptable price is very far from certain and it raises serious ethical questions (Lawrence et al, 2018).

Discussion

This paper is deliberately broad, bringing together different topics related to individuals in the current energy system and their potential roles in the net zero transition. It is an exploratory rather than a complete or comprehensive analysis.

The paper began by defending the idea that individuals are an important object of study and policy. However, it also agreed that habitual behaviours and consumer choices are very far from individuals' only significant involvement in energy systems. As the IEA highlighted, the net zero transition will be guided by government policy. How governments and policy experts frame or understand individuals and their concerns, and therefore how policy is designed, is important.

To bring together themes discussed in relation to theories of change for current efficiency policies, and proposed future policies, a characterisation on two axes has been developed. One axis is active to passive – where active means individuals are aware of the policy and must take conscious action to respond (whether in terms of habitual behaviours, efficiency adoption, sufficiency behaviours or others), with passive being the contrary. The other axis is individuals as economic agents to individuals with multiple roles (including as economic agents).

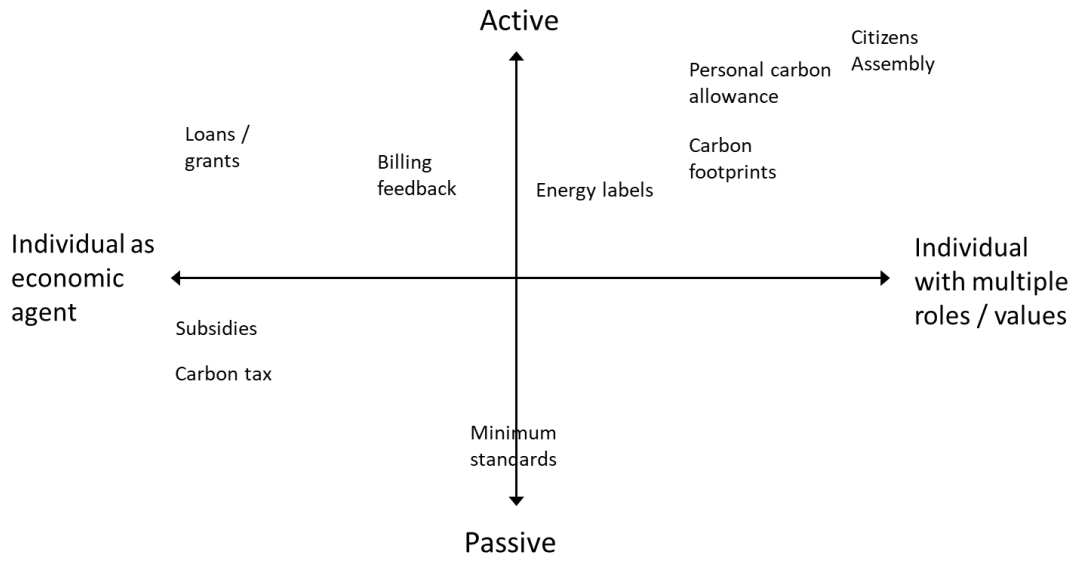

Figure 2: Policies characterised in terms of individual engagement require and individual roles in the energy system

Most policies are characterised as active – the exceptions being minimum standards and subsidies and carbon taxes, which may pass unnoticed by individuals. Many current efficiency policies rely on an economic theory of change. The other policy ideas described here – carbon footprints and personal carbon allowances – rely on a range of roles to create change. Citizens assemblies also enrol people in additional roles as representatives of their communities and thinking about future generations.

This paper has presented evidence and arguments for greater engagement of individuals as citizens (at the right hand of the x axis above) in the energy transition. Does this mean that we therefore should also favour engaging, active policies, bringing energy and carbon to front of mind, using policies which appeal to multiple theories of change / individual roles? Certainly, experience in the UK's retail energy market has shown that policies or market designs which rely solely on active engagement of people motivated by their own economic best interest can fail to achieve the desired result. However, the over-arching argument in favour of citizen engagement, is at the scale of the whole transition, not individual policies. It seems likely that policy mixes which appeal to a variety of theories of change will remain the best approach to delivering carbon and energy savings.

New policies or policy framings show there are options for moving to the top right quadrant of Figure 2. These are not a panacea – not everyone has the capacity to actively engage with the energy system. They may also not wish to do so, but given the scale of the net zero transition, the idea that people can choose to opt out seems illusory. Policies like PCA, ideas like energy sufficiency and the CREDS 'Transform demand' scenario widen the boundary of energy policy considerably. They go beyond technocratic policy to embody a moral stance in relation to climate change. They include interpretations of fairness and climate justice. This can seem a long way from, say, detailed design of minimum efficiency standards, but negotiating the widening of energy policy boundaries in a socially and democratically acceptable way is a key task for energy researchers and policy makers. Citizens assemblies are a process which has been shown to help with this.

For future work, building on the scholarship of Wahlund and Palm (2021) would be a good place to start in thinking more carefully about the distinction between 'energy democracy' and 'energy citizenship' and what this means for policy making. Making an argument for greater engagement of individuals is one thing, designing policies and institutions that successfully enable this is another.

Conclusions

This paper posed the question of whether individuals are expected to be active citizens co-creating the transition to net zero, passive respondents to net zero policies, or something in between. The initial answer seems to be that any or all of these can be expected by governments or policy makers, depending on the context. It is important to analyse and clarify the mix of theories of change and views of individuals embodied in different policy mixes and future expectations, as a basis for better policy making.

The paper argues that there are reasons in principle and practice to prefer engaged citizens and points to policies and pathways which facilitate this. It also argues that policies which combine multiple levers of change

economic, social and psychological, and/or which move beyond efficiency to sufficiency, will be important in the energy transition. The changes needed are so vast, that governments do not have the luxury of relying on 'stealth' policies. The challenge for all of us is to negotiate widening the boundaries of energy policy, and the roles individuals play in the energy system, justly, democratically and swiftly.

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