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ROUNDTABLE SERIES ON DELIVERING A DECARBONISED ELECTRICITY SYSTEM

Consumers, flexibility and efficiency: How can consumption contribute to the decarbonisation of the electricity system?

Introduction

To achieve the government's target of a decarbonised electricity system by 2035, a whole systems approach is required. In order to feed into the government's ongoing work on a delivery plan for a net zero electricity system, the National Engineering Policy Centre is organising a series of roundtable discussions. The roundtables are convened with senior officials from industry, academia, and government to discuss crucial systems-level challenges for an effective delivery plan. The intention of the roundtables is to build a greater shared understanding and recognition of the actions and barriers that need to be addressed to implement a net zero electricity system.

This briefing summarises the discussions at the third roundtable, held on Friday 20 October 2023, with the title *Consumers, flexibility and efficiency: how can consumption contribute to the decarbonisation of the electricity system?* The document does not intend to give a complete view of the whole discussion, but rather to summarise key themes. The aim of these discussions is not to reach a consensus on all topics discussed but to contribute to a better shared understanding through gathering key perspectives on important systems-level questions which need to be addressed for the delivery of a fully decarbonised electricity system. Given this and the broad range of stakeholders involved in the discussion, there was no definite consensus on all the topics listed below.

Roundtable 3: **Consumers, flexibility and efficiency: How can consumption contribute to the decarbonisation of the electricity system?**

The focus of the third roundtable was to explore the role, demands and expectations of residential, commercial and industrial electricity consumers in the decarbonisation of the electricity system, and the mutual interactions required between them and an electricity system where large amounts of flexibility will be required to balance an increasingly intermittent electricity supply. This involved exploring how electricity consumers would need to be engaged and what would be required of them to provide more demand response and how current challenges can be ameliorated.

To focus the conversation, the following high-level questions formed the overall focus of the roundtable discussion:

- What role does demand response need to play in a decarbonised electricity system?
- What are realistic expectations on what demand response can deliver?
- How can residential, commercial, and industrial consumers deliver the demand response needed for the decarbonised electricity system?
- What changes are required in governance and market design for commercial and residential consumers to provide demand response?

Clarification of terms

Consumers: In this summary, consumers refer to all end-users of the electricity system. This includes residential, industrial and commercial end-users, such as house and flat residents, factories, data centres, shops, restaurants and offices.

Energy efficiency: The efficient use of energy is an important strategy for decarbonisation. It is about how we can achieve more output with the same energy input, or how we can reduce the amount of energy input needed to achieve the same output. Improving energy efficiency helps conserve energy resources, can contribute to cost savings for consumers, can help reduce fossil-fuel dependency and can help improve energy security.

In some cases, energy efficiency is an enabler of flexibility services. For example, the better a building retains heat (energy efficiency), the greater the scope for flexibility services to be introduced alongside the electrification of heat provision to that building. There are several ways to improve energy efficiency that involve utilising different strategies by different sectors. For electricity decarbonisation, energy efficiency for consumers can be improved by investing in energy-efficient strategies and technologies, such as high-efficiency insulation, smart metering and thermostats, energy-efficient vehicles and public transport, industrial process optimization and waste heat recovery.

Flexibility services and technologies: The decarbonisation of the electricity system will diversify the sources of electricity, increase their intermittency, and vastly alter the demand (with the electrification of heating and transport). The electricity system will have to be able to adapt to these changes as well as to other changes to electricity supply and demand. Flexibility services and technologies will play a crucial role in ensuring the stability and reliability of the electricity system in this new landscape and will help balance the supply and demand of electricity in real-time. Some flexibility services and technologies are: energy storage such as batteries or pumped hydroelectric storage; digital communication and control systems in the grid infrastructure to enable real-time monitoring and optimisation; improved forecasting; and demand response (see below).[1]

Demand response: Demand response is a strategy that provides flexibility to energy systems by redistributing consumption patterns. It is also referred to as flexible demand or demand flexibility. Demand response includes all intentional electricity consumption pattern modifications by end-use consumers that are intended to alter the timing, level of instantaneous demand and total electricity consumption on the electricity system.[2] With the help of smart meters and tariffs, consumers can track their electricity consumption patterns and shift their consumption

in response to signals or incentives from energy providers and retailers. This reduces or shifts peak demand, which helps reduce the network and generation capacity required to meet that peak. This can help balance demand and supply and contribute to the overall stability and reliability of the electricity system by providing frequency response and managing network congestion. Demand response can also allow consumers to adjust their electricity usage in response to fluctuating electricity prices and reduce their electricity bills as part of this strategy.

> Without energy efficiency and demand response, building electricity networks at excess capacity would be required, increasing whole system costs dramatically

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Key themes of discussion

The broad range of stakeholders[i] at the roundtable provided a diverse set of inputs, and several key themes emerged from the discussion.

Energy efficiency and demand response: a neglected but urgent policy area

The measures needed to achieve increased energy affordability for individual households overlap largely with the measures necessary to decarbonise the electricity system. Energy efficiency and demand response are key to achieving a cost-effective low-carbon electricity system. Demand response can help consumers access cheaper renewable electricity and the beneficial pricing associated with this. This will improve energy efficiency for both consumers and the wider energy system. Improving energy efficiency and providing flexibility services and technologies such as demand response, will also reduce consumers' bills while contributing to decarbonisation of the wider energy system.

Without energy efficiency and demand response, building electricity networks at excess capacity would be required, increasing whole system costs dramatically. Likewise, without energy efficiency and flexibility services and technologies, there would be a need for even more investments in new low-carbon electricity production, which would increase the total cost of decarbonisation. A recent report suggests that without household demand response, there is a need to build the equivalent of four new gas-fired power stations to meet peak-demand in 2030, and that by 2040 household demand response could provide national annual savings of £14 billion and consumer annual savings of £375.[3] Modelling in a separate study demonstrated that system flexibility solutions can save up to £4.7 billion per year as the system decarbonises.[4] While there is a range in savings estimates, the evidence and an extremely strong consensus at the roundtable demonstrates that flexibility services including demand response have an important role to play in achieving decarbonisation in a cost-effective way.

Energy efficiency and demand response need to be prioritised by government and their benefits

i All stakeholders are listed at the end of the document

communicated clearly. This will help ensure that the public understands these benefits and that, if done correctly and with suitable consumer protection in place, energy efficiency and demand response measures could potentially increase the support for the energy transition.

As the electricity system is decarbonised, large amounts of flexibility will be required to balance an increasingly intermittent supply. Demand response can be provided in different ways by different users through a range of technologies such as smart meters, heat pumps, electric vehicles and their ancillary services such as vehicle-to-grid (V2G) systems. To decarbonise the electricity system at an acceptable cost and an acceptable level of demand for new infrastructure, energy efficiency and demand response are not optional, but required. This is in agreement with statements from the National Grid ESO in their most recent Future Energy Scenarios (FES) report.[5] This will change how all consumers interact with the system. There is a need to consider the role of consumers in achieving the energy efficiency and demand response required, for their interaction with the electricity system plays a crucial role in the feasibility, achievability and reliability of a decarbonised electricity system.

Despite the need for demand response, the role of consumers in a decarbonised electricity system is a neglected policy area. Despite the complexity of the future system, there is an opportunity to simplify the process to bring in the benefits of a decarbonised system and improve consumer engagement, accessibility and capabilities.

Demand response is already here

Despite a lack of policies, demand response is already a key component in parts of the electricity system. This can be illustrated by the ESO's Demand Flexibility Service which was introduced in winter 2022/2023 in which over 1.6 million GB households and businesses participated, providing around 350 MW of flexibility.[6] With a rapid take-up of demand response, smart charging and V2G, the National Grid ESO predicts a potential for peak demand to be reduced by almost 15 GW in 2030 and by 40 GW in 2050.[7] However, further actions are needed to ensure the rapid take-up needed for this.

Experience from the energy supplier Octopus shows that demand response is widely accessible today and that consumers respond to price signals, not only in emergency situations, which can be seen from large increases in demand during periods of high wind and low prices.[8] At an aggregate level, demand response can be very predictable and the response to price signals is noticeable. However, most electricity consumers currently have electricity contracts without any price signals or other incentives for flexibility. This is a failure to incentivise the provision of flexibility to the system and a failure to provide the opportunity to consumers to benefit from the potential economic savings from doing so. In line with the discussion at the roundtable and recognising the increasing need for flexibility, the National Infrastructure Commission recommends that government incentivise households to participate in demand response and stressed that clear price signals were crucial to enabling their participation.[9]

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Consumer engagement and accessibility

Consumers will need to be supported in their take-up of demand response, flexibility and energy efficiency through a range of mechanisms. This support includes help with the capital costs required for buildings retrofit for energy efficiency and heat decarbonisation. Demand response, flexibility and energy efficiency is often linked to electric vehicles and heat pumps use where capital costs act as a major deterrent. Provided appropriate opportunities to benefit are available via price signals, some element of demand response can however be provided by any household with a smart meter, which can help reduce the overall cost of electricity and therefore lower the capital costs needed for new electrified systems. Consumers will also benefit from active engagement and information that build trust across users, suppliers and retailers. A national campaign for demand response can help communicate the benefits and drive the correct incentives and trust for consumer participation.

Effective consumer protection will be needed to build confidence and consumer capabilities in the system. There is a need for fairness in the market design of electricity supply from renewables, with clear and transparent expectations that avoid offloading the cost of not participating in demand response to those who are not equipped to engage in it. With regards to fairness, there is also a need to address the various needs and capabilities of different users, from homeowners to renters, leaseholders to freeholders, small-medium enterprises, and commercial or industrial consumers. Needs and capabilities of users also vary between sectors and need to be addressed accordingly to encourage consumer participation. For example, within the rental sector, those with more security of tenure may have the capability to engage with flexibility services unlike other renters who may need additional forms of protection against paying more than they can afford. Conversely, larger industrial and commercial consumers such as data centres could benefit from stronger instrumental controls to encourage them to use energy more efficiently.

Confident and active participation in demand response can only be enabled and supported by an adequate digital infrastructure that coordinates data collection and use while maintaining consumer privacy. One crucial step in this is implementing the recommendations by the Energy Digitalisation Taskforce, which has recommended that consumer data governance needs to be finalised.[10] Consumer engagement and interaction can be further supported by research on consumer motivations and decision-making processes.

Independent, personalised advice

Low trust in energy suppliers needs to be addressed if the consumer engagement and participation that is needed for energy efficiency and demand response is to be achieved. Trusted sources of information and personalised advice are critical for consumer confidence. Such advice is currently difficult to find and, while some is available, funding is uncoordinated which reduces its impact. There may be a role for local government to play in providing the trusted advice needed by consumers.

Service design and industry capabilities

The electricity system is complex to navigate, both for residential and commercial consumers. There is a need for increased accessibility to low-carbon services. Quality interactions with consumers will be critical to implementing decarbonisation of the electricity system and there is a need to demonstrate the potential savings or revenue streams from using energy more flexibly and efficiently. There is a need to improve customer engagement by energy providers and retailers, in how they communicate the benefits of and support consumer participation in demand response and energy efficiency. This is needed to improve the customer journeys and experiences, and to enable easy access to flexibility services and variable pricing. Improving support for customer participation also includes making new devices in homes easy to use. Engineering and design of the user experience is a central component to enabling access and achieving the levels of take up that are needed to both decarbonise the electricity system and maximise the available benefits and cost-savings.

Industry will need to coordinate across various parts of the electricity system, including across both suppliers and retailers. To improve interaction and participation in the system, better market design and price signals that clearly communicate the value of participating in demand response, flexibility and energy efficiency are needed. Within this, there is a need to address regional challenges and the large variation in flexibility potential in different areas. There is a particular need to build trust in regions that have historically been underserved.

All of this will be further supported through innovation in the interface between industry services, low-carbon technologies and user engagement. An example of this, albeit restricted to new developments, is the coordination needed between building engineers and architects to build new energy efficient buildings. Centralised thermal storage was highlighted at the roundtable discussion as a promising way forward to store heat as it is cheaper than electricity storage and can further enable heat decarbonisation. Utilising this where possible, instead of electrifying heat and therefore depending on households to install their own heat pumps, could lower the costs of decarbonising heat. This is an area where developers and industry can take a lead.

District Network Operators (DNOs) could benefit from prioritising flexibility over network expansion but to ensure this, there is a need to change the regulatory system to provide DNOs with incentives to do so. In addition to making flexibility services more accessible for consumers, the energy industry could take a proactive approach to providing energy efficiency and flexibility services to their consumers.

To improve interaction and participation in the system, better market design and price signals that clearly communicate the value of participating in demand response, flexibility and energy efficiency are needed

Implementing demand response

Consumer engagement in the decarbonisation of the electricity system and the co-benefits that are associated remains a neglected policy area. Enabling demand response and providing energy efficiency will require additional services that connect and support consumers to the energy industry, but this will only be possible at scale with suitable government support and arrangements. The dominant perception that consumers prefer not to actively engage with their energy consumption and pricing, needs to be challenged. There is a need for policy development in support of flexibility services and technologies, energy efficiency and demand response. This includes policies to increase trust, confidence, and protection of electricity consumers to participate actively in the electricity system.

There is a need from the highest political level to recognise that energy efficiency and demand response are crucial to the energy transition and future energy affordability. One way to progress this important agenda would be through appointing a Flexibility Commissioner, similar to the Electricity Networks Commissioner, and setting national targets for flexibility. The current lack of flexibility governance has lead to issues such as the lack of incentives and coordination across individual initiatives.

There is also a need to develop appropriate consumer protection and incentives for participating in energy efficiency and demand response. Consumer protections need to be at the appropriate level, where too much could stifle innovation and too little would fail to protect vulnerable consumers. Consumer protections and regulation will further contribute to building trust in the interactions between consumers and industry. They also have a role to play in stimulating investment for the innovation needed for low-carbon technologies and positive user experiences of them.

Half-hour metering[ii], smart tariffs (not just smart meters), further roll-out of heat pumps and electric vehicles[iii] and policies for increased affordability are required to further enable demand response. These suggestions are well-aligned with those made in the National Infrastructure Commission's Second Infrastructure Assessment, where numerous recommendations are also made for how government can enable energy efficiency without adversely affecting low-income groups.[9]

Local authorities and the devolved administrations have a significant role to play in linking local needs with national objectives in the move towards decarbonisation, and to work with local communities to provide trusted sources of information to enable energy efficiency measures such as buildings retrofit and district heating.

ii A half-hour electricity meter is a type of metering system that provides fully automated readings of the electricity meter every 30 minutes to the energy supplier. It allows for a more accurate record of electricity usage[11]

iii Effective electric vehicle charging infrastructure will enable the uptake of electric vehicles and flexibility services[12]

Key messages from the NEPC Working Group on decarbonising the electricity system

The roundtable highlighted some of the key challenges that need to be addressed in decarbonising the GB electricity system by 2035 in a secure and affordable way.

Based on this discussion, the NEPC Working Group on decarbonising the electricity system have identified a number of key messages. While these were informed by the discussion in the roundtable, the conclusions are made independently by the Working Group and do not reflect the opinions of the participants in the roundtable.

- **Energy efficiency and demand response are not optional and have already been proven to pay off**
  The only way to decarbonise the electricity system at a reasonable cost to end-users as well as to the system as a whole is by realising the potential for energy efficiency and demand response. While there is a need for upfront investments to deploy energy efficiency and flexibility at the scale required, these will replace some of the investment required for new low-carbon electricity generation and network expansion.[13] Investments in energy efficiency and flexibility can further contribute to reduced consumer bills, helping to alleviate the current cost of living crisis while increasing support for the wider energy transition. Steps need to be urgently taken to prepare the country for half-hour metering, to help support demand response, with all necessary safeguards and ensure that the introduction of variable pricing is successful, alongside more information on carbon impacts for usage within those periods.

- **Energy efficiency and demand response need to be a policy priority**
  Given the urgency of electricity decarbonisation, the challenge of affordability, and the scale of the benefits, government needs to make energy efficiency and demand response a defined policy priority. Government should double down on its efforts on energy efficiency, making its current ambition of a 15% reduction by 2030 a strategic priority and introduce national targets for flexibility.[14] In addition, a Flexibility Commissioner should be appointed to lead on the rapid development of policies including for consumer engagement in a decarbonised electricity system. These measures would increase the clarity for industry and signal a clear government commitment to this strategically important priority.

- **Coordinated, independent and personalised advice is essential**
  To engage actively in the energy transition, consumers need trust, confidence, and protection. The current complexity of the system as well as the low trust in energy suppliers are major deterrents. Trust can be built through personalised, independent, and trustworthy advice, which is readily available and coordinated at a national level. Much needs to be done to coordinate the provision of trusted, independent expertise which can act as a source of coherent advice tailored towards the full range of consumers. The forthcoming Regional Energy Strategic Planners could be provided with the funding to support local community energy initiatives who provide this advice.[15]

- **Consumer protection is vital**
  To comfortably navigate the electricity system and actively engage, with it, consumers need a suitable amount of protection. This needs to ensure vulnerable consumers are protected, while not stifling innovation. Critically, less competent industry actors who, by their actions or inaction, impact negatively on consumer confidence need to be subject to heavy sanctions from the regulator.

- **Economic incentives will be needed**
  To reap the potential benefits of demand response, there is a need for economic incentives for consumers – residential, industrial and commercial – as well as suppliers and DNOs. The effects of the current Review of Electricity Market Arrangements (REMA) will have limited impact before 2030s and there is a need for additional ways of achieving price signals to shift demand.

- **A national campaign for flexibility will also be essential**
  In addition to intensified policy development on this area, there is a need for a national campaign on the benefits of demand response and energy efficiency. This should include information about potential savings for individual households and businesses as well as the benefits for the whole system, in terms of reduced need for new infrastructure and additional electricity generation, and improved security of supply. It needs to be supported by competent and user-centric services from key actors, so that any initial enthusiasm is not squandered.

- **Regional challenges must be addressed**
  While there is potential for flexibility throughout the country, its characteristics will vary between different regions. The uptake of technologies for demand response and energy efficiency will vary between different areas and different groups, and there may be a need for targeted campaigns in areas lacking investment and infrastructure.

- **There needs to be increased industry responsibility**
  The energy industry, including electricity suppliers and distribution system operators, have the potential to proactively increase the roll-out of smart tariffs and smart technology. This is currently handled very differently by different companies with some doing this proactively and others not at all. Increased responsibility could be placed on companies to pursue this more actively. Critically, competence of key industry actors is vital for this to be successful. Individual poor performers can lead to significant damage to broad consumer confidence. It is vital for the industry to lead with competence and with empathy for consumers, providing a much more customer-centric service, and not imposing ill-thought through systems on consumers.

- **Delivering a digitalised energy system must be a priority**
  Digitalisation is crucial for sufficient consumer engagement in the electricity system and one starting point is to implement the recommendations from the Energy Digitalisation Taskforce from 2022.[10] These recommendations cover core aspects of digitalisation and have the potential to dramatically increase consumer engagement but have resulted in limited uptake in policy thus far. Ownership of data is likely to be a contentious issue, but it is important that this is also clarified for the new systems to be successful.

Roundtables and briefings in the series

This is roundtable 3 of a series. The full series of roundtables and reports is listed below:

Roundtable 1	**Decisions now for a future system: Making design and construction decisions for the electricity system of 2035 and 2050**
Roundtable 2	**Local, regional and national: What interests, opportunities and challenges exist at these levels? How does each contribute to net zero?**
Roundtable 3	**Consumers, flexibility and efficiency: How can consumption contribute to the decarbonisation of the electricity system?**
Roundtable 4	**Governing transformation, transforming governance: Managing ambiguity, interconnection and digitalisation**
Roundtable 5	**Delivering electricity decarbonisation by 2035: What do we need across industry capacity, procurement and skills?**

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This roundtable series is being convened by the National Engineering Policy Centre (NEPC).

The working group includes representatives from the Institution of Engineering and Technology (IET), the Energy Institute (EI), the Institution of Mechanical Engineers (IMechE), the Institution of Civil Engineers (ICE), the Permanent Way Institution (PWI), the Royal Academy of Engineering, and the Energy Systems Catapult.

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