ESO

Consumer flexibility in FES and how it is changing

Every year National Grid Electricity System Operator (ESO) produce the Future Energy Scenarios (FES) which explore a range of credible pathways for energy supply and demand in Great Britain. As we transition towards Net Zero, there will be an increasing need for consumer flexibility and demand side response (DSR) services, as greater volumes of intermittent generation are connected to the electricity network.

James West, in the Energy Insights and Analysis team considers the importance of consumer flexibility in reaching Net Zero, as well as how DSR services can benefit both consumers and the ESO. With the launch of the Demand Flexibility Service (DFS) in November 2022, consumers have been able to engage with the energy transition in an entirely new way.

Introduction

Every year the National Grid Electricity System Operator (ESO) publish the Future Energy Scenarios (FES) which outline three credible pathways for Great Britain to decarbonise and reach Net Zero by 2050. These scenarios take a holistic view of electricity supply and demand, and how these will change due to electrification of heat, an increasing volume of renewable generation connecting to the electricity network and changes in consumer habits.

It is this last part, consumer behaviour, which will be explored in more depth during this thought piece. Consumers have a key role to play in Great Britain's transition to Net Zero. Our scenarios with higher levels of societal change, Leading the Way and Consumer Transformation, make assumptions about consumers being a driving force in reaching Net Zero, through their increasing awareness of climate change and desire to be part of the energy transition. This can include measures such as (but not limited to) buying an electric car, using more energy efficient appliances, and becoming more involved with Demand Side Response (DSR) services.

The ESO launched a new Demand Flexibility Service (DFS) in November 2022. This has allowed customers to receive financial incentives of at least £3/kWh to reduce their energy usage at specific times, the first time that consumers have played a direct role in balancing the electricity network. As we approach 2050 and greater volumes of renewable generation are connected to the grid, services like this will become increasingly important to help balance supply and demand during peak times.

Why consumer engagement is important to the ESO

Over the last few years, the government has set more interim targets to ensure the country is on track to reach Net Zero by 2050, with one of the targets being that Great Britain must generate all its electricity from clean energy sources by 2035. At the same time, the ESO has set itself a target - to be able to operate a zero-carbon grid by 2025. This is an unprecedented challenge and has led to a huge growth in predicted renewable generation capacity across the rest of the decade. However, there is a need for demand side measures as well. In previous years the ESO has been operating a demand-led grid – meaning supply is increased or decreased to meet demand. In the future, where there will be greater volumes of intermittent generation on the electricity system, the grid will shift to become a more supply-led grid – meaning demand will be increased or decreased to meet supply. FES 2022 states that there will need to be significant demand side flexibility to run the electricity system from clean energy sources (with no unabated natural gas) after 2035. To deliver this demand side flexibility, consumers must be enabled to engage with the energy system through developments such as increased smart automation and Time of Use Tariffs (ToUTs).

Many consumers are already willing to make changes that will help Great Britain reach Net Zero faster, whether that be through purchasing domestic solar PV systems or buying an electric car. As these technologies become

more widely available and affordable, they will continue to increase the importance of consumer behaviour, and the way we all use energy in the future.

One previous initiative in this area was the Carbon Intensity app that the ESO launched back in 2020.[1] The aim of this free app was to provide a resource that allowed consumers to make a conscious choice about when to use energy, as the app would display what the energy generation mix was at that moment. This meant that consumers who were engaged with the ESO could choose to run their appliances when their electricity was less carbon intensive, and those consumers with smart meters could save some money as well, by running appliances when electricity was cheaper.

Following on from this, consumers engaging with services that the ESO provide will help reduce the carbon intensity of the grid. An increasing consumer awareness of energy usage has meant that services like the DFS could grow and operate, helping adapt the electricity system to a Net Zero future.

Consumer flexibility in our Future Energy Scenarios

Considering how consumers behave in the future is an important input into the FES modelling process; the Future Energy Scenarios must not only consider the importance of consumer actions in helping reach Net Zero, but also ensure that the scenarios deliver Net Zero in a credible way. The potentially changing role of consumers is best reflected in the Leading the Way and Consumer Transformation scenarios, which both show a credible pathway to Net Zero by changing the way we use energy.

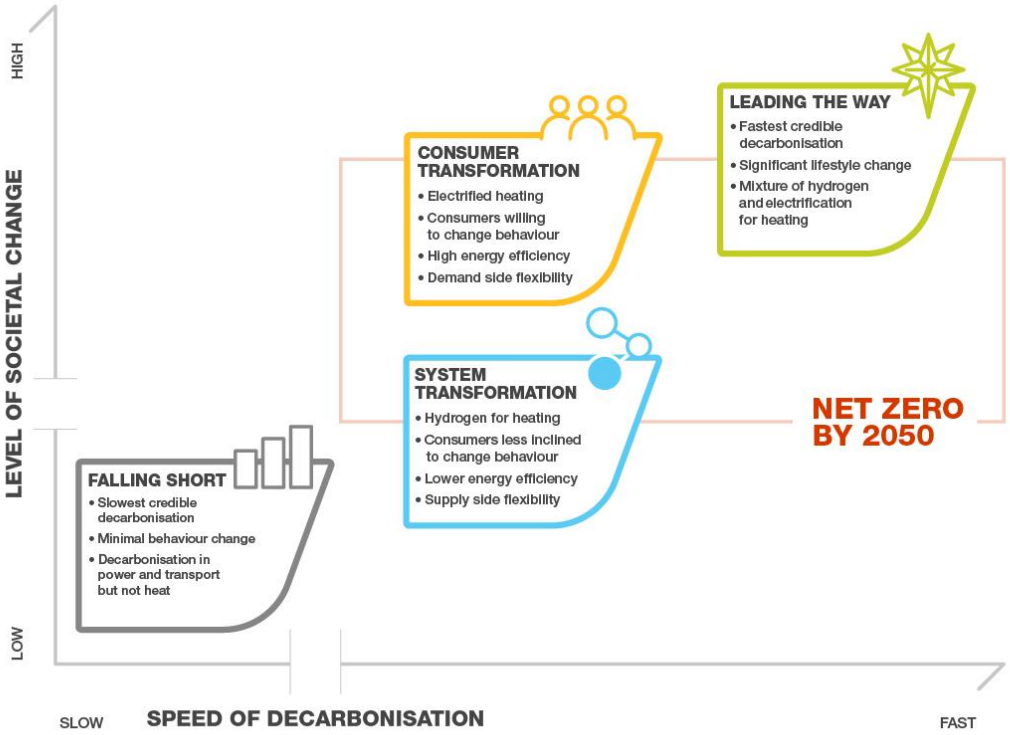

Figure 1: The FES 2022 scenarios and their key assumptions.

Consumer flexibility plays a key role in both the Leading the Way and Consumer Transformation scenarios. Leading the Way is the scenario with the most aggressive emission reduction policies, therefore the scenario assumptions have the highest levels of societal change and flex from consumers, because it is assumed consumers will be highly engaged with managing and reducing their own energy consumption. In Consumer Transformation, one of the primary assumptions is that in future years smart meters are further integrated into society, allowing for greater flexibility on the system. Consumer flexibility can be enabled by:

[1] Introducing our Carbon Intensity app | National Grid ESO

- Consumer Information
- Digitalisation and Innovation

By informing consumers of the choices they can make, it will be easier for them to engage with the ESO and make more climate-conscious decisions.

Digitalisation and Innovation are equally as important – there is a greater need for smart meters and other technology to help improve the granularity of demand data available to the energy industry. By increasing the use of these services, the ESO will be able to better forecast demand in the future. As we move towards Net Zero, technologies will change. Electric Vehicles (EV's) will become more prevalent, and technologies like heat pumps will replace gas boilers. This will mean that consumer demand for electricity will increase in the coming decades, and there will be a greater peak demand for electricity during specific periods (e.g., overnight charging for EV's, heating homes during the evening). Also, with renewable generation being built across Great Britain, there is a greater need to look at supply and demand from a regional perspective, to determine more localised trends in electricity usage and to understand what future flows on the transmission and distribution networks will look like.

Consumer flexibility will become increasingly more important to help balance the electricity system. With technologies such as smart meters, customers can be rewarded for choosing to reduce electricity usage at peak times or charge devices like EV's when there is high renewable output on the system. This has the added benefit of helping to reduce constraint costs, which benefits all consumers.

To deliver increased flexibility on the system new services must be developed and the number of flexible tariffs energy providers offer needs to increase so that customers can take advantage of lower prices. This will allow us to develop insights at a regional level and improve local demand forecasts.

How consumers can engage with the energy transition

Over the last few years, energy supply and climate change has become a more pressing issue in the minds of consumers. The BEIS Public Attitude Tracker, a quarterly survey which 'collects data on public awareness and behaviours' relating to their policy areas, showed that in Autumn 2022, 45% were 'very concerned' about climate change, with over 80% of those surveyed either being 'fairly concerned' or 'very concerned' about it, showing that climate change is very present in the mind of consumers.[2] In a similar Public Attitude Tracker from Spring 2022, 82% of people said they had given 'a lot or a fair amount' of thought to saving energy in their home.[3] This shows that there is a significant public willingness to engage with measures to help reduce the impact of climate change and rising energy bills – especially if both can be done through one action.

One of the ways that consumers could engage with the energy transition is through future flexibility services, similar to the Demand Flexibility Service used across the 2022/2023 winter period. This was a service that the ESO introduced in November 2022 which aimed to reward consumers for reducing their energy demand during peak times. The DFS was conceived to support the operation of the electricity system throughout the winter, especially due to the challenging circumstances highlighted in the Winter Outlook report.[4] With concerns about security of supply and an increasing focus on reducing the carbon intensity of the grid, introducing consumer flexibility as a demand side measure has given the ESO a new avenue to help manage the system.

During a DFS event, households were encouraged to reduce their electricity usage, and avoid running energy intensive appliances such as washing machines and dishwashers. They are then compensated for reducing their energy usage during this time. The amount that consumers receive is dependent on both the offering from their supplier, and how much their supplier is paid for providing the reduction in demand. Some suppliers also set a minimum threshold that consumers must reduce their energy usage by before they can be compensated. The compensation that consumers receive is not only to incentivise them to sign up and use the DFS, but also to provide a benefit for the inconvenience. Therefore, finding a suitable incentive was key to making the DFS work efficiently.

[2] BEIS PAT Autumn 2022 Net Zero and Climate Change (publishing.service.gov.uk)
[3] BEIS PAT Spring 2022 Heat and Energy in the Home (publishing.service.gov.uk)
[4] Winter Outlook | National Grid ESO

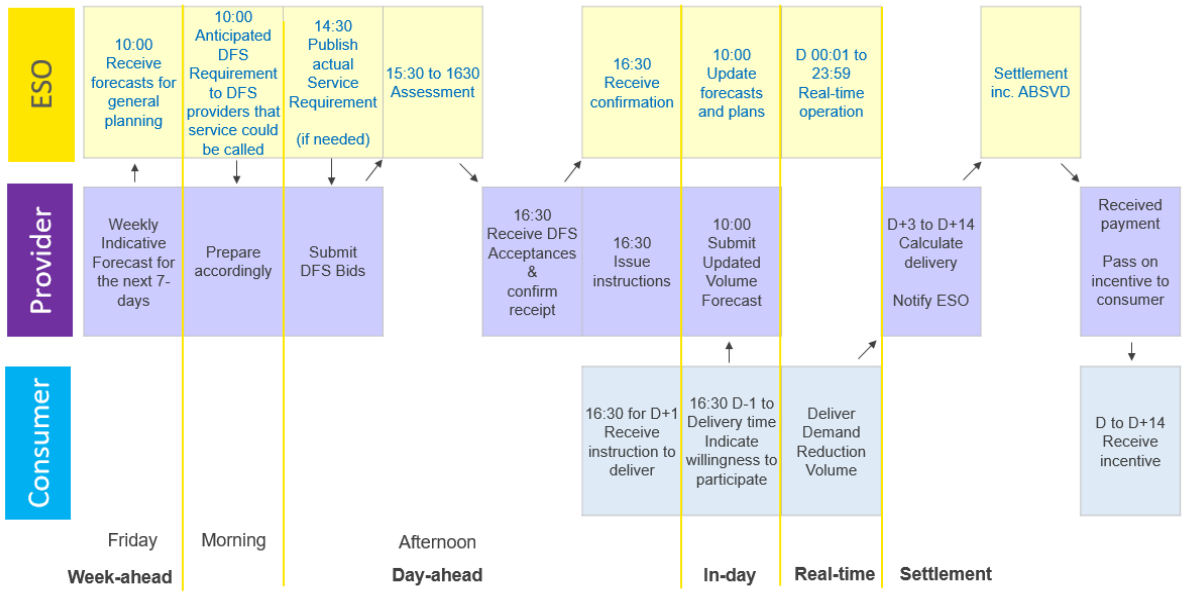

Figure 2: A DFS event from start to finish.

The impact of DFS

Across the winter period from November 2022 to March 2023, there were 13 DFS tests, each one taking place at peak time between 4pm and 7pm, and two live events on the 23rd and 24th of January 2023, where the DFS was used to ensure that the supply margins were met. The DFS grew substantially over this time frame to 31 providers of the service, up from the original four. Over 1 million households and businesses signed up, helping to expand the service even further than initially predicted. All of this has shown how successful the DFS has been, giving greater merit to delivering other consumer demand side response services in the future.

This success has also been echoed by customer feedback, with most of it being positive across the different energy providers. In the original pilot scheme with Octopus, out of 100,000 customers, 57% said that they loved the scheme. Looking at both industry and customer feedback, it is also clear that consumers are thinking more about when they use energy after signing up to the DFS, which will help influence energy usage long after the scheme has ended.

There are many advantages to the DFS. As outlined earlier, it allows the ESO to run the grid at a lower carbon intensity, which is particularly significant given the target of being able to run a zero-carbon grid by 2025. It also has the potential to, if the margins are tight, avoid the ESO triggering an emergency response, by reducing demand on the system. The DFS was an easy-to-use system, with consumers being informed a day ahead of a DFS event, and then having the choice of whether to participate in it or not.

The DFS also gave consumers the ability to lower their energy bills through either delayed demand or avoided demand. Delayed demand is when consumers avoid using energy intensive appliances like the dishwasher during peak times, and instead use it when demand on the system is lower. Avoided demand is when consumers don't add to demand during the DFS event, such as not turning on the radio when they get home.

Looking to the future

The DFS was a time limited service which ran from November 2022 to March 2023. However, it has many supporters in industry for its further development into an everyday option for consumers[5]. In the future DSR services could be expanded so that they are used more commonly, even on a day-to-day basis. This is particularly important as a demand side flexibility service may be needed not just in winter months to reduce

[5] Demanding change: Is DFS a game-changer or gimmick? - Utility Week

demand on the system, but in the summer months to increase demand to use high levels of wind and solar generation at times. This could also help reduce constraint costs on the electricity network.

A key part of expanding the DFS or a similar service is consistent and clear messaging. After the novelty of the DFS has worn off consumers may be less engaged with it. Therefore, going forward there will need to be a greater focus on showing the benefits of the service, and highlighting consumer savings to specific actions they have taken to reduce electricity usage. This will help consumers make well-informed decisions on how much disruption they are willing to endure and will mean that only the use of high energy appliances will be shifted, as opposed to consumers trying to lower energy usage as much as possible.

The other factor that needs to be looked at is making it easier to utilise domestic demand. With a greater variety of technologies coming onto the system in future years, including EV's and heat pumps, a greater volume of automation will be needed. There are a few advantages to this; the first of which being that it allows us to increase or decrease demand on a more granular level. The second is that it allows a DSR service to be run more cheaply, as instead of relying on consumers to manually adjust their demand it will be done automatically, meaning it is easier for consumers to participate and the financial incentives required per response may be lower.

Another way to make it easier for households and businesses to get involved is changing the incentives that are provided. In the future there needs to be a greater focus on what incentives are offered to consumers, and a more accurate forecast of the savings they can make.

Next steps

The DFS has allowed the ESO to see how a live demand side response service involving domestic consumers works and has enabled us to learn more about the issues it could face going forwards. In the future, with DSR services becoming more prevalent in at least two of our Future Energy Scenarios, successors to the DFS should be considered as one of a range of tools to help balance the system. Following on from the end of the DFS in March, the ESO will continue to consider whether increased flexibility could be helpful in managing the system and reducing costs and will plan ahead for winter 2023/24.

Get involved with the conversation

We'd love to hear your thoughts on consumer flexibility and how it may develop in the future. Get in touch with us at fes@nationalgrideso.com