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# Flex appeal

## How to reform electricity pricing for a cleaner and cheaper energy system

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## Executive Summary

Achieving net zero carbon emissions means rapid deployment of renewables like wind and solar. As how we generate electricity evolves, so must how we use it. Fundamentally, the task is to move from an electricity system which is customer-led, with big, regional power stations ramping up and down at will to meet fluctuating demand, to one in which demand is more responsive to supply. The aim must be to do so in a cost-effective way that doesn't pile the cost onto unsuspecting families, who are already struggling to cope with the high cost of energy. How to achieve that is the focus of this paper.

### The key to delivering the electricity system we need is to increase consumer flexibility

The Government, the Climate Change Committee and the National Energy System Operator are all agreed that this means adding 'flexibility' to the system. That is, greater capacity for energy consumers to shift their demand at particular times, or from a particular location. Because estimates suggest that such flexibility could take up to £18 billion a year in current prices off the cost of the electricity system by 2040, the benefits of these changes are worth striving for.

Much of the benefits of flexibility will be industrial use, which will account for two thirds of electricity use by 2030. But to avoid high electricity prices – induced by the need to 'overbuild' the system, so it can accommodate high peak demand and transport electricity further distances – we also need households to do their bit. That will require exposing more families to the true costs of their energy use, which varies by time and place, so they are incentivised to flex energy use themselves. This inevitably means transferring more risk to households. So finding a path to a flexible system which protects families while minimising electricity prices is the key to success. To date, little focus has been paid to how the journey will affect families, especially those on lower incomes who feel energy price changes most keenly.

### An important first step is to allow wholesale electricity prices to vary by location, but doing so comes with risks that will need to be addressed

Generating and supplying electricity has different costs in different places, reflecting local supply and demand and the costs of transporting energy. This issue is set to grow as we move towards renewables, which are geographically dispersed.

For the most part, this spatial variation is not reflected in wholesale (and certainly not retail) prices, leading to inefficiencies and higher bills. Constraints on moving electricity to where it's needed – e.g. from wind-rich areas in Scotland to power-hungry English

cities – could see us wasting (or 'curtailing') as much as a tenth of national electricity use by 2030 (31 terawatt hours), forcing us to switch on generation elsewhere (likely high-cost gas) to make up the shortfall. Doing nothing is a high-cost option. Curtailing such huge amounts of power could cost £3 billion a year in current prices, pushing up household bills.

There are plans to bolster the transmission network to address this: the National Energy System Operator has outlined plans to spend £58 billion upgrading the backbone of our electricity system by 2035. This would affect families, especially as the current approach is to recoup such costs through standing charges on energy bills – so there are considerable benefits from adopting a zonal pricing system (which varies retail and wholesale prices by region) that reduces transmission costs, as the Government is considering.

But moving to zonal pricing comes with some extra risks which will need to be managed, even if it would ultimately make the system cheaper to run. At a time of high investment need it is important to be mindful of the risk that reforming markets could increase uncertainty and so push up the cost of borrowing for energy generators. So if zonal pricing threatens the viability of investments in our energy system, the Government may be able to use GB Energy (for example through structured guarantees) as a vehicle to reduce the costs of uncertainty for investors. Another key risk with this approach is that prices may spike in parts of the country where electricity generation is more expensive. This can be addressed by shielding households by averaging domestic energy unit costs across regions, as is the case in Italy.

## Families who are able to shift their energy use away from peak times should do so…

Delivering a low-cost, low-carbon electricity system will require households to flex their energy use across time to smooth through periods when energy is abundant and periods when it is not. That's because the cost of delivering electricity at peak times (particularly between 4.30pm and 8.00pm, when residential and commercial demand overlap) is, on average, twice as high as other times of the day, meaning we have to use the most expensive generation types. And the best way to ease pressure on peak times is to incentivise energy use when it is cheap and disincentivise it at peak times through tariffs where the price of electricity varies through the day.

As a purely practical matter, however, families may find it difficult to shift their energy use significantly. This is partly because peak hours are when households are returning from work and cooking dinner: the proportion of adults away from home halves during peak hours, which also cover over half of all time that adults spend cooking. These are not schedules that households can reasonably shift. But it is also because current technologies do little to facilitate this. What are often referred to as 'flexible appliances' – essentially 'white goods' found in many homes – offer only a very limited ability to shift energy use through time. For example, shifting all dishwasher usage outside of peak times would save the average household just £30 a year.

But looking ahead, continued adoption of greener technology will mean some families have much more scope to shift their energy use. EVs are expected to account for almost three quarters of new capacity to shift energy use by 2030. Owners of key technologies could shift their energy use fairly easily, and stand to benefit most from doing so due to their high energy demand (£120 a year for typical EV owners). They also impose the biggest extra pressures on the system if allowed to continue with high peak use, inflating bills for everyone else: electric vehicles (EVs) and electric heating are set to be the main drivers behind a 40 per cent increase in residential electricity use by 2035.

This points towards a policy framework that leads to more energy-intensive, but potentially highly flexible, households facing the true cost of peak-time electricity. This might seem harsh, but those who own EVs stand to make a lot of savings from moving to a time-of-use tariff. Of course, there will always be some who don't engage actively, but owners of flexible technologies are on average richer – we estimate that 30 per cent of EV owners will be in the top income quintile in 2030 – and so there should be relatively few concerns about the impact on vulnerable households. Variable tariffs could reduce the cost of running the electricity system by up to £14 billion a year by 2040 in current prices, equivalent to taking 3 pence (or 13 per cent) off the price of a kWh of electricity. Targeting those with the most to contribute would help to ensure that benefits also flow to the 86 per cent of the poorest households not expected to own an EV by 2030, in the form of passive bill savings as a cheaper system brings prices down.

## …but again the Government must be careful in its approach to minimise the risks to households

Increasing the take-up of variable tariffs would be a significant change, given that only 2 per cent of households are currently on such tariffs. And it is one that must be done carefully given that energy bills are one of the largest non-housing outlays facing families.

The first-best option would be to put all households with an EV onto a variable price tariff. But such an approach is unlikely to be possible, as energy companies can't identify with certainty who is using them. For example, around two-thirds of new cars sold in 2024 were fleet and therefore registered to a commercial entity rather than an individual.

One way around this issue would be to use a household's annual use of electricity as a proxy for EV ownership and set a usage limit above which suppliers would no longer have to offer a fixed price cap tariff, with variable pricing the default alternative covering all electricity demand. A reasonable limit would be five megawatt hours of electricity per year: this is almost double the current typical household consumption, but lower than typical consumption of a household with an electric car covering 7,500 miles per year (a mileage achieved by 38 per cent of drivers, covering 56 per cent of mileage).

But such a cut-off would also affect some families that have very high levels of electricity use without an electric car. We estimate that a 5 MWh usage cap would see a tenth of households in England impacted based on their current (non-EV) use. These 2.5 million households include 12 per cent of low-income households, a third of families with five or more members, and a huge four-fifths (79 per cent) of those with electric-resistive heating.

Not all of these households would see financial downsides to variable pricing: we estimate that it would have cost 29 per cent less to heat a home with electric resistive heating on a variable price tariff than under the price cap in 2024, even without changing behaviour, as most heating demand is already outside the peak times. But these are just averages. Given that it is very challenging to distinguish between households that are vulnerable high users of electricity, and those that are well positioned to shift their energy use, removing the protection of the current Ofgem price cap from all high energy users risks hitting lower-income families hard.

To get around this, a new Ofgem-regulated 'time-of-use tariff' should be introduced. This would force suppliers to offer a tariff that has higher prices at peak times than off-peak times, but where these prices are capped. This would create a regulated middle ground between the current price cap and fully exposing all high-energy users to volatile half-hourly prices.

## Policy makers must get serious about changing how energy retail markets work to deliver cheaper bills

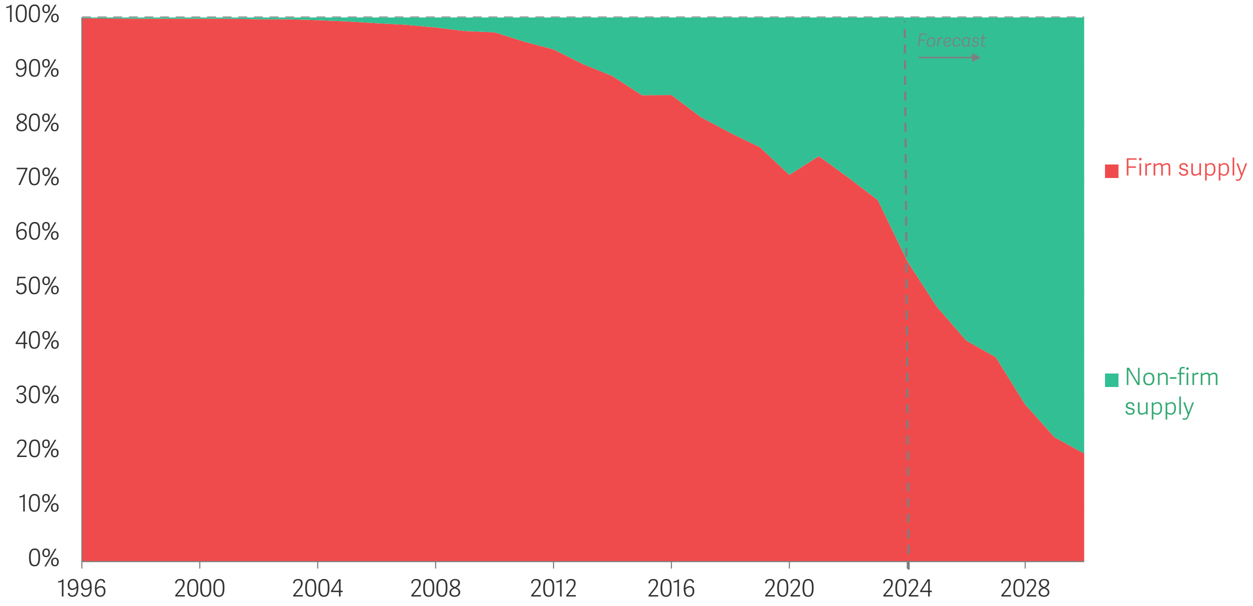
Splitting our energy market into zones across the UK, and a widespread shift to variable tariffs that change throughout the day are both big changes. But combined they would improve the efficiency of the energy system, cut emissions and reduce bills. The potential upside of both these changes has been pegged at up to £18 billion by 2040: equivalent to 4 pence off the price of a kWh of electricity by 2040, worth £200 per household on average. So if we get the balance right and expose households to price signals while maintaining adequate consumer protection, reform can ease the cost of living while also making a big contribution to achieving the Government's net zero commitments.

## The challenge for policy is to deliver a cheaper and cleaner energy system

There is no route to achieving the Government's binding commitments to achieve net zero carbon emissions in a cost-effective way without the rapid deployment of renewables like wind and solar. These sources of power will account for the vast majority of new capacity over the coming years.[1] This will be a substantial change in how we generate electricity with a move to more intermittent sources of power. As Figure 1 shows, the proportion of generation that is 'firm', meaning that generation can be calibrated or predicted by system operators, is set fall rapidly between now and 2030, replaced by non-firm supply like wind power, which is weather dependent.

FIGURE 1: **The electricity system is changing to one where supply no longer responds to demand**

Historical and forecast share of electricity generation from 'firm' and 'non-firm' sources: GB




NOTES: Firm supply refers to generation types that are independent from weather conditions and includes both baseload generation types like nuclear, and dispatchable generation types like gas. Non-firm supply, like wind and solar, varies by weather conditions.
SOURCE: RF analysis of Elexon, NESO data.

As our energy mix changes, so must how we use it. One solution would be to build enough batteries to store the energy produced when it's not needed so we can draw on those when demand exceeds supply. But relying on this alone would be very expensive. The much cheaper alternative is moving from a system that was historically demand-led

1 DESNZ, Clean Power 2030 Action Plan, December 2024.

– power stations ramp up and down in response to variations in final energy demand – to one that is supply-led, where consumption must adapt more to generation patterns.

The Government, the Climate Change Committee and the National Energy System Operator are all agreed that we need 'flexibility' in the energy system. Flexibility would mean more energy consumers shifting or reducing their demand at particular times of the day or in particular places.[2] Relocating energy-intense industry to places with cheaper energy, or changing the times when machines run is an obvious place to start. But households account for nearly two-fifths (39 per cent) of electricity use, and so will need to be flexible too.[3] To that end, the Government's Clean Power Action Plan estimates that we will need 10 to 12 gigawatts of this 'consumer-led flexibility' from households by 2030.[4]

Reforms are already underway to introduce new forms of flexibility for households. For example, energy suppliers are rolling out smart meters and will be exposed to the half hourly prices of their customers' energy use from 2026, which we discuss further in Box 1. But this is only the beginning of a process that will soon materially impact the way households engage with the energy system.

## BOX 1: **A smarter energy system is already on its way**

A smarter energy system which allows for more price variation by time of day has been on the way for some time. Seven-in-ten meters in England are now 'smart', with 1.5 million electric smart meters going into homes in 2024.[5] These meters allow energy suppliers to track energy usage on a half-hourly basis and are required for suppliers to track when electricity demand happens and charge by the hour.

Another change already in the pipeline is what is known as 'market wide half hourly settlements', or MHHS.[6] This market reform will mean that, from 2026, energy suppliers pay different costs for electricity they supply at different times of the day, using actual electricity use for their customers tracked by smart meters rather than profiles based on typical consumer patterns.

Customers won't need to do the same – the price cap will still exist – but suppliers will be forced to pay extra for their 'expensive' consumers with high

2 See DESNZ, Clean Power 2030 Action Plan, December 2024; Climate Change Committee, Delivering a reliable decarbonized power system, March 2023; National Energy System Operator, Future Energy Scenarios, July 2024.
3 RF analysis of NESO, Future Energy Scenarios: Data Workbook 2024, July 2024.
4 DESNZ, Clean Power 2030 Action Plan, December 2024.
5 DESNZ, Smart meter statistics, May 2025.
6 Ofgem, Electricity settlement reform, accessed 9 June 2025.

demand at more expensive times. This could spur innovation in the market, resulting in much improved efforts from suppliers to shift their customers onto tariffs that better reflect the price of energy. These reforms show that change to the system is already on its way.

Increasing flexibility means some will need to pay more for electricity at times when, or in places where, it is expensive to generate or supply, while others will pay less. Different prices can incentivise 'flexing' of demand to lower-cost periods and places, and building infrastructure in places where electricity use is supply-constrained.

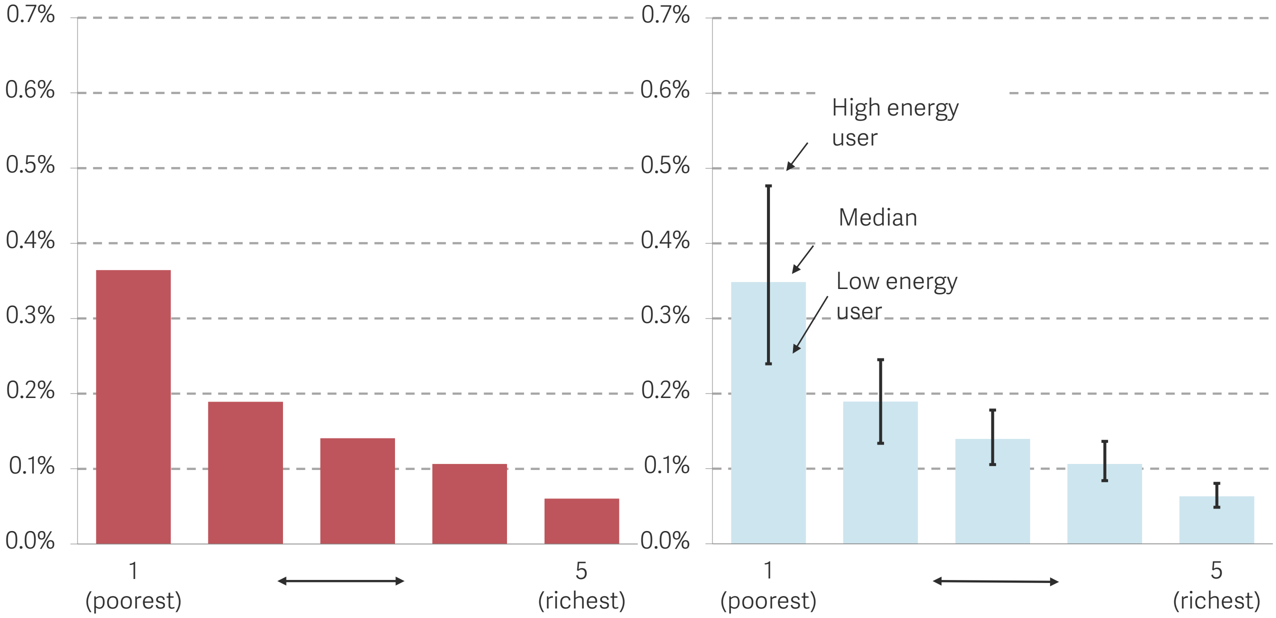
This inevitably means households being exposed more to the price risk. Price volatility is inherent in a market like electricity, which must clear at all times despite significant variations in demand from hour to hour, day to day and place to place. So it will be important to find a way to shift electricity across times and places that also protects families from excessive risk.

The prize here – a lower-cost energy system in which electricity is used and generated efficiently – is one worth striving for. Estimates suggest that varying prices across time and space could save as much as £18 billion a year by 2040, equivalent to taking around 4 pence off the cost of a kilowatt hour of electricity, 16 per cent of current unit prices.[7] An efficient electricity system is materially important for living standards. As Figure 2 shows, falls in electricity prices are progressive and disproportionately benefit lower-income households.

7 RF analysis of FTI Consulting, Impact of A Potential Zonal Market Design in Great Britain, February 2025; Cornwall Insight, The power of flex: Rewarding smarter energy usage, August 2023; NESO, Future Energy Scenarios. This is an average across national electricity demand, including industrial users.

FIGURE 2: **Low-income households will benefit most if electricity bills fall**

Savings from an avoided £1 billion spend via standing charges (left panel) and unit prices (right panel), as a share of AHC incomes, by household income quintile: GB




SOURCE: RF analysis of Ofgem, DESNZ, LCFS data.
NOTES: A high and lower energy consumer are those in the 75th and 25th percentiles of energy use by income quintile.

But, so far at least, little focus has been paid to how this will affect families, especially those on lower incomes for whom changes in energy costs are felt particularly keenly. So that is the focus of this paper. We start by setting out why this change is important and necessary before moving onto to settting a policy framework for implementing this approach.

## Electricity prices need to vary more by place

Currently we have a single Great Britain wide wholesale market for electricity (with Northern Ireland operating separately). But generating and supplying electricity has different costs in different places, reflecting local supply and demand, and the costs of transporting energy to other areas. For example, Britain's offshore wind resources increasingly means that northern Scotland produces lots of electricity, but transporting that electricity into England and Wales – where 92 per cent of British families are – is expensive.[8] This is not reflected in the wholesale or retail price, leading to inefficient use of resources and ultimately higher bills.

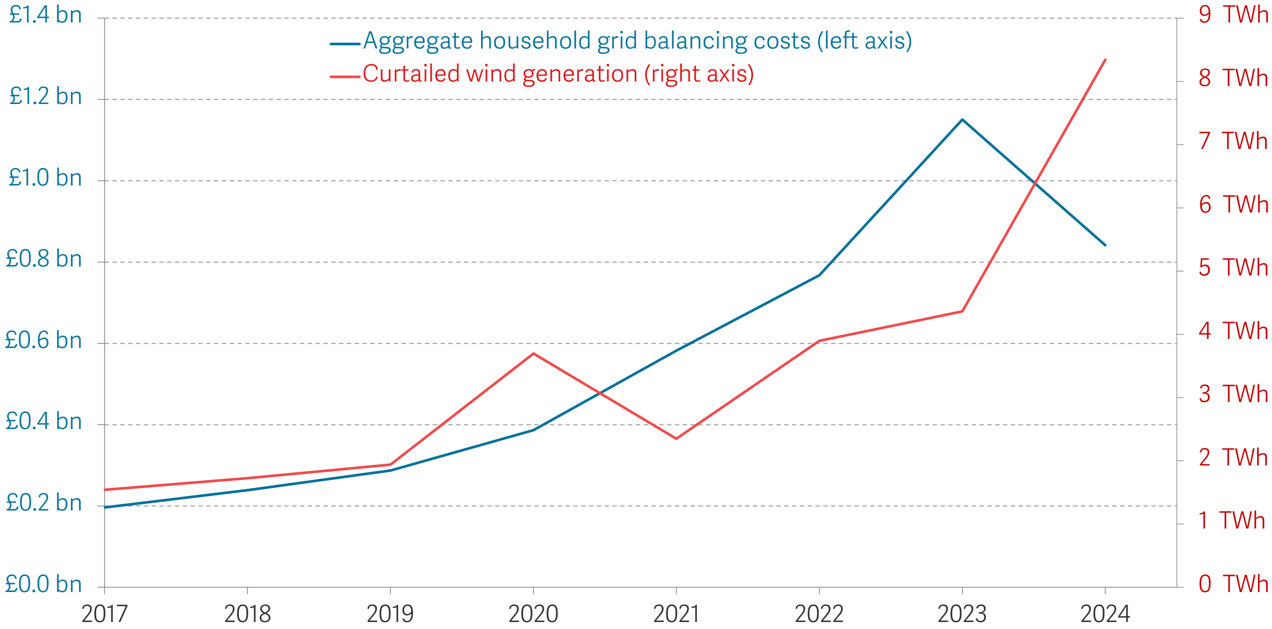
Because electricity generation is set to shift from large, centralised generators to more geographically dispersed renewables, the importance of different locational costs is set to increase. Transporting electricity to where it's needed – e.g. from wind-rich areas in

8 ONS, Families by Great Britain constituent countries, May 2024

Scotland to power-hungry English cities – faces network constraints (meaning that there is insufficient infrastructure to move electricity where it is needed) which could see us wasting (or 'curtailing') as much as a tenth of national electricity use by 2030 (31 terawatt hours).[9] Curtailment forces us to switch on generation elsewhere (likely dispatchable gas plants) to make up the shortfall. This is already an issue – as Figure 3 shows, the costs of balancing the grid, of which curtailment is a part, is rising fast, up four times over since 2017.

FIGURE 3: **Intermittent renewables are costly to manage with our current grid**

Aggregate grid balancing costs borne by households and wind curtailment volumes: GB




SOURCE: RF analysis of Elexon, NESO data.

Doing nothing is a high-cost option. The problem shown in Figure 3 will get worse in the coming years as more renewables come online. And if National Energy System Operator's (NESO's) projection of 31 terawatt hours of renewable curtailment by 2030 becomes a reality, this could cost up to £2.7 billion a year (in current prices), when scaled up from the latest renewable prices settled last September under contracts for difference.[10] There are plans to bolster the transmission network to address our inadequate grid infrastructure: the NESO has outlined plans to spend £58 billion upgrading the backbone of our electricity system by 2035, a hefty price tag that will only be higher with a system that continues to protect users and suppliers from the true cost of energy use, as a less efficient system needs a bigger grid to service it.[11]

9 NESO, Future Energy Scenarios Data Workbook 2024, July 2024.
10 RF analysis of DESNZ, Contracts for Difference Allocation Round 6: results, September 2024. The price used to estimate the cost of offshore wind curtailment is a weighted average of the settled price for offshore wind and floating offshore wind.
11 NESO, Beyond 2030, March 2024

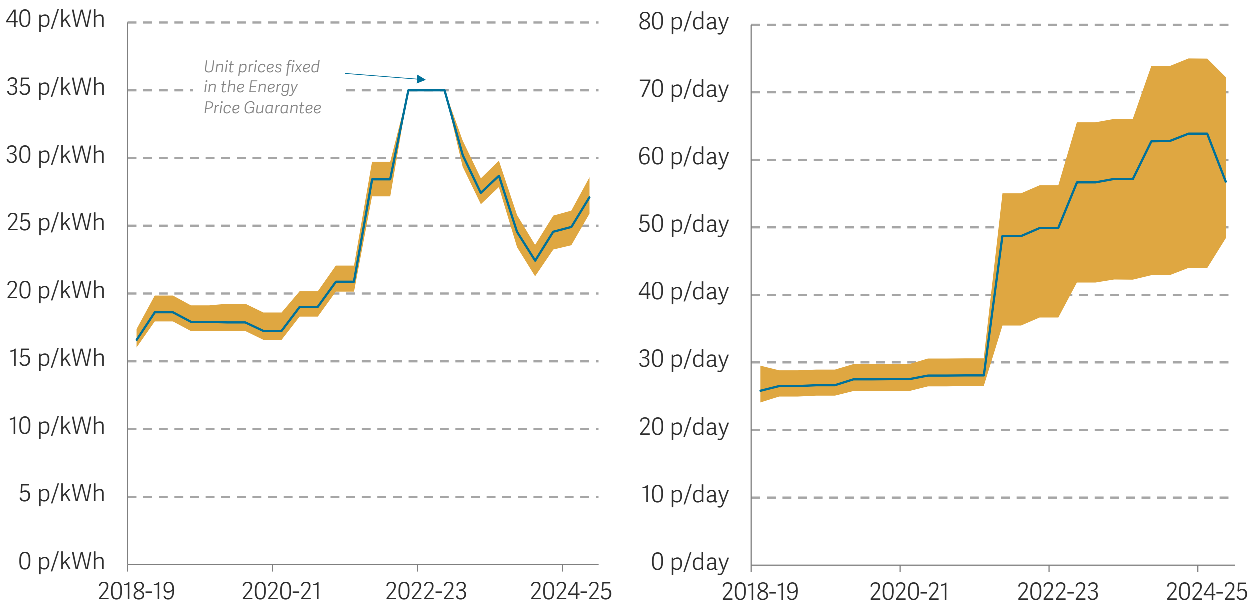
So failing to make our energy system more efficient in ways that control our investment needs would work against the interests of billpayers, especially as, under current policy, any grid upgrade costs would be recouped from consumers through standing charges on energy bills. And as Figure 2 shows, this would hit low-income households hardest.

This is why the Government is considering whether we should move to a GB-wide wholesale market that allows more geographical variance in wholesale prices. The proposal is to split the market into 'zones', each with their own wholesale and retail prices. This would give signals to consume less and supply more in high-cost areas. Estimates suggest this would reduce the cost of running the electricity system by as much as £3.7 billion a year.[12]

There are those who would argue that it is unfair for energy prices to vary across the country. In fact, there are already some regional differences. Figure 4 shows that there is already small variation in unit prices, while those paying the highest standing charges (households in North Wales and Merseyside) already paying half as much again as those paying the least (households in Southern England). Rather than wholesale prices – which are the same everywhere – current regional differences are driven by variations in network costs, that is the cost of moving energy across the country.

FIGURE 4: **Regional differences already exist in the price cap**

Average standard variable tariff unit price and max-min range (left panel) and average standard variable tariff standing charge and max-min range (right panel): GB




NOTES: Prices shown are for direct debit consumers.
SOURCE: RF analysis of Ofgem Price Cap methodology data.

12 FTI Consulting, Impact of a potential Zonal Market Design in Great Britain, February 2025.

These price disparities across the country exist without widespread outcry, and are also a typical feature of other bills – such as water, where bills are 28 per cent lower in water-rich Northumberland than the drier South East.[13] So price disparities that accurately reflect the different costs of delivering goods in different areas are good for efficiency and have, so far at least, been accepted by the public.

### But regional variation in energy prices comes with risks and we should act to mitigate them

Although the zonal pricing should make the system more efficient and bring down bills on average, the Government needs to acknowledge that it comes with risks. We flag two of those here.

First, some argue that zonal pricing will increase revenue uncertainty for generators, and that would increase capital costs associated with energy infrastructure projects.[14] It is not possible to know in advance how large any increase in capital costs might be, so the extent to which this becomes a headwind to investment is itself uncertain. But, given the ultimate objective is to ensure that energy investment actually happens, the Government should act to mitigate this risk. This can be done in a way that is analogous to the approach taken to shield investors from significant price uncertainty, with the aim of reducing capital costs i.e. the 'contracts for difference' (CfD) scheme. CfDs guarantee long-term energy prices for renewable projects, with the government shouldering price volatility after operation has begun. Under zonal pricing, CfDs would still protect generators from substantial price uncertainty, but projects would settle for different prices in different places. If our current toolset for guaranteeing revenue for electricity system projects is not enough to prevent a prohibitive rise in capital costs, and greater uncertainty materially impacts projects in their early stages, then the Government should consider ways of derisking this further. One option would be for GB Energy to take a short-term stake in projects that struggle to access capital at affordable prices, using its balance sheet and already-assigned capital (including £4 billion of financial transactions capacity, set aside in the spending review) to de-risk investment.[15] Actions like this could help with projects at their most nascent stages and would be a step towards delivering lower bills as well as new technologies.

Second, the main risk for households, particularly if capital costs go up, is substantially higher prices in high-cost areas, creating problems for people living in affected regions (most likely to be southern England, which has high demand and few wind resources). Zonal prices are likely to be welcomed by many if households in all regions end up better off than they currently are, as some have predicted, but this is not guaranteed: it is

13 Water UK, Annual average bill changes 2025-26, accessed 9 June 2025.
14 Energy consultancy Afry found that zonal pricing would result in a £9.6 billion welfare loss (NPV 2030-2050) if it caused an increase in the cost of capital of 100 basis points. Accessed 18 June 2025.
15 HM Treasury, Spending Review 2025, June 2025.

challenging to know ahead of time precisely how large the price disparities will be, and whether efficiency savings will be enough to ensure that all areas see lower bills than before.[16] The Government may, therefore, worry about putting energy prices up for some in the name of a more efficient system overall. So policy makers should stand ready to minimise this risk.

One way to achieve this is by averaging consumer energy prices across regional markets – as is the case in Italy.[17] Household energy prices would vary no more than they do now weakening the price signals which would otherwise encourage people to change their usage.  However, industrial consumers would still be exposed to regional variations, encouraging energy intense industries to move into low-cost areas. And higher wholesale prices would still encourage expanded generation in the highest-cost places.

## The bigger challenge is to encourage households to shift energy use out of peak times

Delivering a low-cost, low-carbon electricity system will require households to flex their energy use across time to smooth through periods when energy is abundant and periods when it is not. This would be a profound change, but estimates suggest that the potential system savings on offer by 2040 from flexing energy use over the day is almost four times higher than zonal pricing, at £14 billion a year.[18] If delivered, that would be equivalent to a 3p/kWh reduction in the average price of electricity by 2040, over a tenth of today's price cap.[19]

Achieve this will require substantially more people being exposed to unit costs that vary over the course of the day, rather than a single price of electricity.[20] Currently these fixed-price tariffs are the norm: they cover close to nine-in-ten (88 per cent) British households (see Figure 5). Most other households are on Economy 7 tariffs, introduced in 1978 for those with electric heating wanting to cheaply fill hot water tanks overnight.[21] The popularity of these has declined over time, meaning that there are fewer households on variable price tariffs now than there were in 2010. Finally, a very small number of

16 While most agree that there are large system benefits to implementing zonal pricing, there remains disagreement on the distribution of those benefits and the extent to which all consumers would see lower prices under locational pricing. For example, some point to LCP delta's findings that by 2035 wholesale prices would be higher in every region in the UK but northern Scotland, while Ofgem found in 2023 that all will benefit, as reduced constraint management costs outweigh higher wholesale costs in all regions.

17 Italy has seven unique pricing 'zones', which function as distinct wholesale markets, but household consumers pay only a single price (Prezzo Unico Nazionale) which is averaged over the different wholesale markets. Source: Power Engineering International, Volatile zonal pricing impacting Italy's renewable energy producers, December 2023.

18 Cornwall Insight, The power of flex: Rewarding smarter energy use, August 2023.

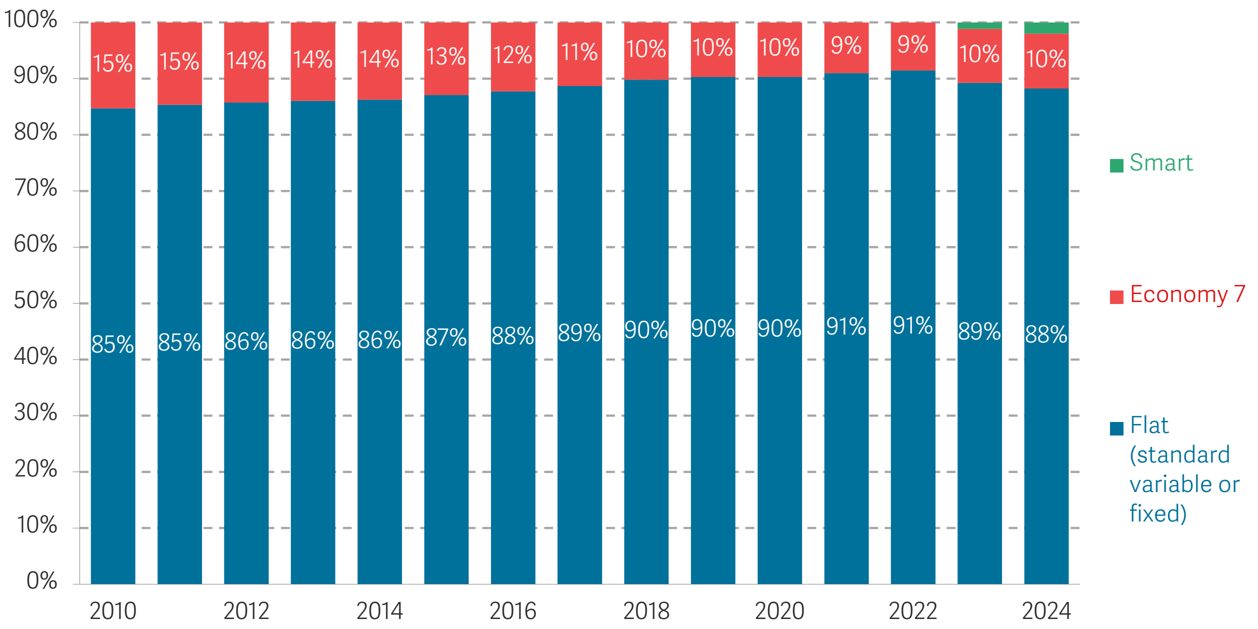
19 This is calculated by dividing Cornwall Insight's estimate of £14.1 billion in annual system savings by NESO's projection of 2040 electricity demand under its 'Holistic scenario', which is then compared to the current Ofgem price cap. The actual impact on the electricity price, if these system savings are realized, could differ substantially between consumers.

20 The Cornwall Insight estimate of £14.1 billion a year in reduced system costs analyses a case where 80 per cent of consumers are on time of use pricing by 2040.

21 Hansard, Electricity For Domestic Heating, November 1978.

households (575,000) are on so-called 'smart tariffs', which are those that can vary every half-hour, enabled by smart meters.

FIGURE 5: **Flat electricity prices are currently the norm**



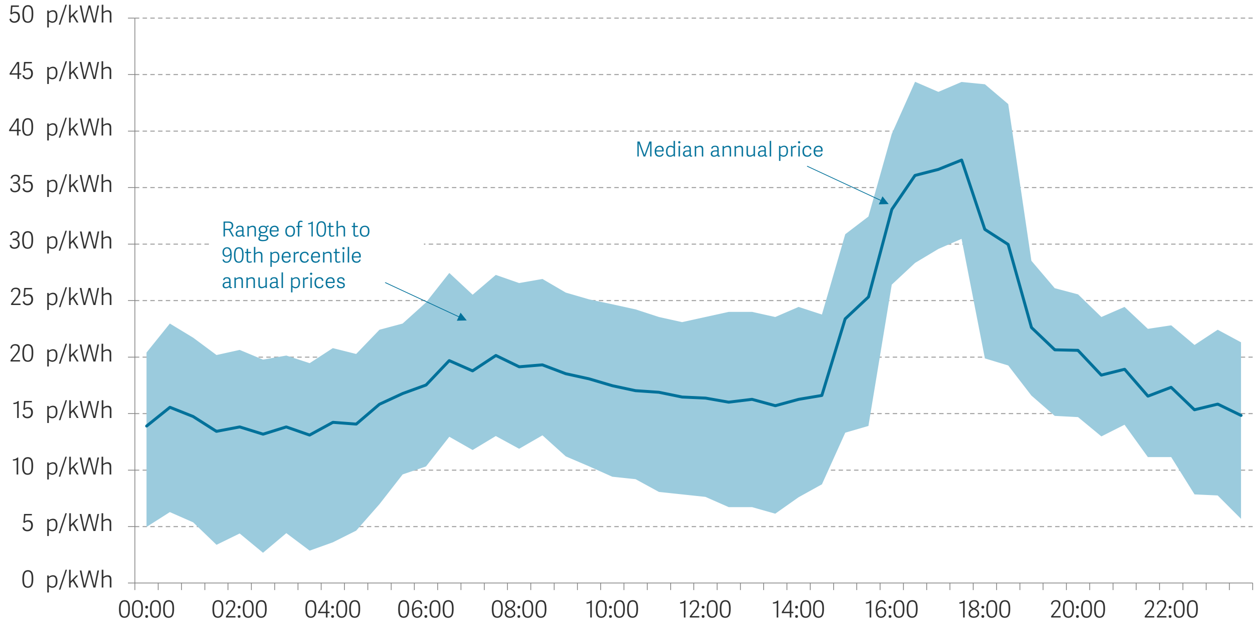

Proportion of households by domestic electricity tariff type: GB

NOTES: Data is customer level, but assumes that all households are connected to the electricity system and only one account per household.
SOURCE: RF analysis of DESNZ, Ofgem data.

But the sort of overnight tariffs provided by Economy 7 aren't appropriate for the peak problems of tomorrow. Costs of producing electricity vary considerably through the day, and not just between daytime and nighttime, as generation types with different costs turn on and off to meet demand. For example,  Figure 6 plots the range of prices over 2024 under Octopus' Agile tariff, under which prices are more closely linked to wholesale prices, and vary every half hour. To encourage households to shift their energy use out of peak times, more people will need to be on tariffs that are capable of charging different prices every half hour.

FIGURE 6: **Consuming electricity is more expensive at peak hours**

Average half-hourly retail electricity prices and p10-p90 range: GB 2024




SOURCE: RF analysis of Octopus Agile data.

But energy bills are one of the largest outlays facing families, so adding complexity and uncertainty to them should not be undertaken lightly.[22] There's no getting around the fact that variable retail pricing of energy is a transfer of risk away from suppliers (who currently manage variations in prices across the day) towards households. But in general, households are much less well placed to manage these sorts of risks. Tracking and responding to prices that change every half hour and day to day isn't an easy task and many will find optimising energy use an unwelcome use of limited time and attention. So while there are substantial upsides if electricity costs come down as predicted, the policy challenge is how to ensure households face the price signals that alter the pattern of their demand, without sacrificing consumer protection or lumping costs onto poorer families.

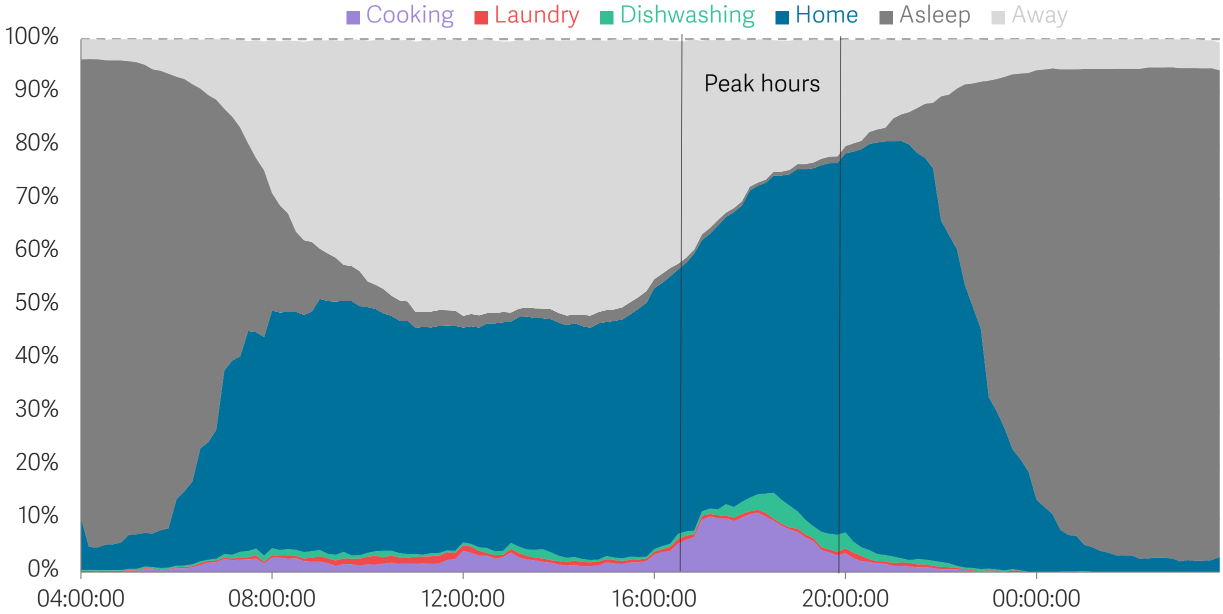
## Shifting energy use out of peak times isn't always easy

The main goal of consumer-led flexibility is to reduce the amount of electricity used in the peak hours, roughly 4:30 pm to 8:00 pm. But this could be challenging for some. As Figure 7 shows, the proportion of adults at home increases by 20 percentage points over the course of peak hours, increasing energy use as lights and appliances are switched on. Meanwhile. over half of all time spent cooking happens during peak hours, as households power up ovens, hobs, microwaves and kettles (see Figure 7). These are not activities that most households will want to shift.

22 Households spent £1,930 on energy on average in 2023. Source: ONS, Living Cost and Food Survey.

FIGURE 7: **These peak hours are when most people are going home and cooking**

Proportion of adults doing various activities by time of day: UK, 2023



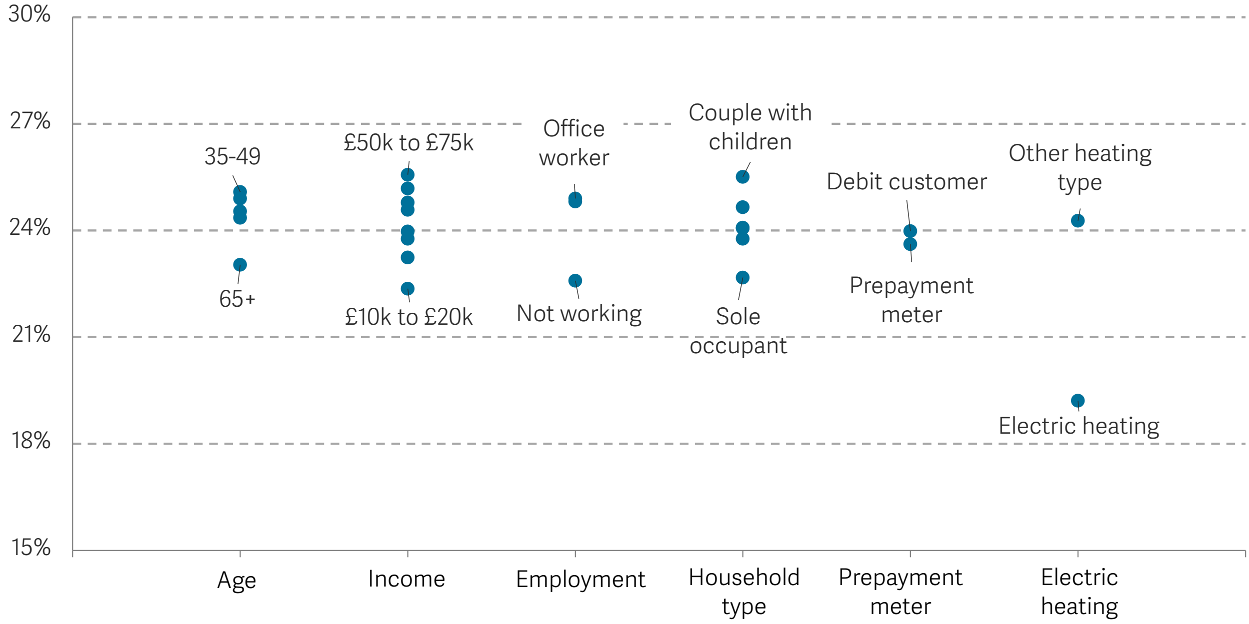

SOURCE: RF analysis of Centre for Time Use Research, Time Use Survey.
NOTES: Adults that are cooking, doing laundry, or dishwashing are also at home.

But there is also variation between households. The best way to think about who is likely to be impacted most is to look at the percentage of a household's energy use that takes place during peak times. It is important to look at this proportion, rather than absolute peak demand, because variable tariffs imply both savings and additional costs, as cheaper off-peak energy is balanced by expensive peak use. Households with demand that is more concentrated at peak times will save less on off-peak energy use and stump up more at the peak, potentially tipping the balance to higher bills overall.

Figure 8, based on actual use of electricity from EDF customers with smart meters, shows the range in average proportions of energy used at peak times within different demographic groups. In fact, there is little variation between these broad demographic groups, on average, but the data suggests that families with children, with parents on comfortable incomes that are in work, may be those facing the largest downsides from time-of-use tariffs, using, on average, a quarter of their energy between 4:30pm and 8:00pm. Meanwhile, those households that spend more time at home or have more flexible schedules – such as sole occupants, pensioners, and those out of work – have energy demand that is slightly more distributed across the day, using up to 4 percentage points less of their energy in the peak period.[23] The big winners would be those that already have electric heating, who use just 19 per cent of their energy at peak times. Of course, many in this group likely already use Economy 7 variable tariffs to heat hot water overnight, something that accounts for a substantial portion of their energy demand.

FIGURE 8: **And typical concentration of energy use in peak times varies little across demographics**

Range in the average proportion of electricity used in peak times, maximum and minimum across demographic segments: UK, 2022




NOTES: This shows the range of average proportion of energy use between 4:30pm and 8:00pm for EDF customer segments along a range of characteristics. Data labels show the group with the highest and lowest concentration of energy use for each characteristic. The identification accuracy of household characteristics is expected to be 60-70 per cent, meaning that the data likely underestimates between-group variation.
SOURCE: EDF energy data.

This low variation doesn't mean there will be few losers. First, these averages hide variation within groups – at least a quarter of households in every group shown in Figure 8 use more than 27 per cent of their energy at peak times.[24] Second, the balance of savings and costs aren't the only reason to be worried about some groups ending up on time-of-use tariffs. Figure 8 also suggests that those on pre-payment meters are no more exposed than other kinds of consumers to high-cost peak energy use. But these users are likely to face other problems, because energy prices vary not just from hour to hour, but also from week to week. This is discussed more in Box 2.

23 It is commonly said that those with high energy needs related to their disability are those most vulnerable to variable pricing. There are several reasons to think this is an overstated issue. First, the energy usage of most medical devices and mobility aids is relatively low. Second, it is not clear that medical equipment is particularly needed at peak times. Where equipment is always on, or is charged at times chosen by the household, time of use tariffs are likely to save more in off-peak energy use than they cost in peak demand. For example, Energy Systems Catapult estimates that those with mobility scooters could, like EV owners, save over £100 a year by charging them overnight. Source: R Fleck, Energy Systems Catapult, Discovering disabled consumers' future energy needs, November 2023

24 EDF, Aggregated smart meter statistics, June 2025.

### BOX 2: Those on prepayment meters and in energy debt have different kinds of vulnerabilities

Vulnerability to disruption in the energy market shouldn't only be measured in the likely balance of costs and savings. People with pre-payment meters and those in energy debt have other reasons to be worried about shifting away from fixed prices.

First, many time-of-use tariffs imply substantial variance in costs from week to week. This may mean little for those that already smooth their energy use over the year using direct debits, but pre-payment meter customers have no such luxury. In 2024 the weekly cost of serving median electricity use varied from £5.30 to £16.40 under Octopus' agile prices, a volatility that may have big implications for someone topping up ahead of time with no savings to fall back on.[25] That is a lot of extra uncertainty to pile onto a group already struggling to cope with volatility relating to the concentration of energy use in the winter.[26]

Second, time-of-use tariffs are less regulated, meaning that there could be high variation in prices between energy suppliers. That may be good for tariff innovation, a stated aim of Ofgem's.[27] But those in energy debt or on pre-payment meters are less able than others to shop around, as those in debt – a very common reason for having a pre-payment meter – cannot easily switch supplier. Inability to shop around for the best tariffs makes price protection (not currently afforded to those on variable pricing) more valuable for these customers, who may otherwise struggle to get a good deal.

So it's reasonable to conclude that these kinds of households, who already experience volatile and uncertain interactions with the energy retail market, should not be forced to shoulder the further risks that time-of-use pricing brings.

## And current technologies do little to facilitate shifting demand through time

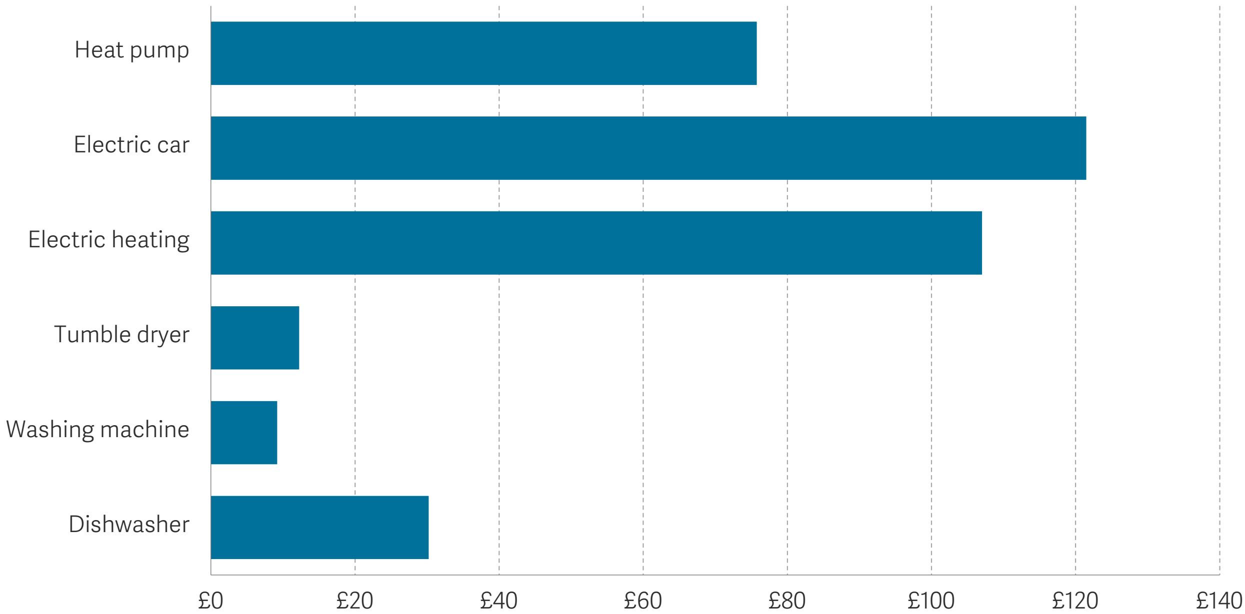
At present, the most common of these so-called 'flexible technologies' are dishwashers, tumble dryers and washing machines. But electricity usage for these is relatively low (at most 450-600kWh a year), and most probably already happens outside of peak times.[28] Just 17 per cent of time adults spend doing laundry is in peak times, and 42 per cent of

25 RF analysis of Octopus, Agile energy prices; Smart Energy Research Lab, Statistical Data, 2020-2023, May 2024
26 For more see J Marshall, Paid in full, December 2024.
27 Ofgem, Innovation in the energy retail market, October 2024
28 Assumes that these appliances use 2-3kWh per cycle and are used up to 300 times per year. Source: National Energy Action, Electricity Consumption Around the Home, June 2025

time spent washing dishes, limiting the overall contribution that flex can make.[29] As a result, as shown in Figure 9, the scale of savings available from shifting will be small for households: for example, shifting all dishwasher usage outside of peak times would save just £30 a year for an average household. And we will need many more of them shifting to substantially impact the grid.

FIGURE 9: **The most valuable technologies to households under flexible time-of-day tariffs will be those that electrify heat and transport**

Typical annual bill savings from selected types of electricity use in off-peak hours: GB, 2025-26




NOTES: Savings based on peak hours electricity consumption of dishwashers, washing machines, tumble dryers, and electric car charging. Cooking not included. Based on 27 pence electricity costs under the Q2 2025 Ofgem price cap and an assumed off-peak electricity price of 15 pence. This is likely to understate the benefits, as households moving from the price cap to variable pricing in order to save on shifting their energy demand will also make savings on existing off-peak use.
SOURCE: RF analysis of USOC, Ofgem, Octopus, HBAI, EHS and UK Time Use Survey data.

## Looking ahead, continued adoption of greener technology will mean some families have much more scope to shift their energy use

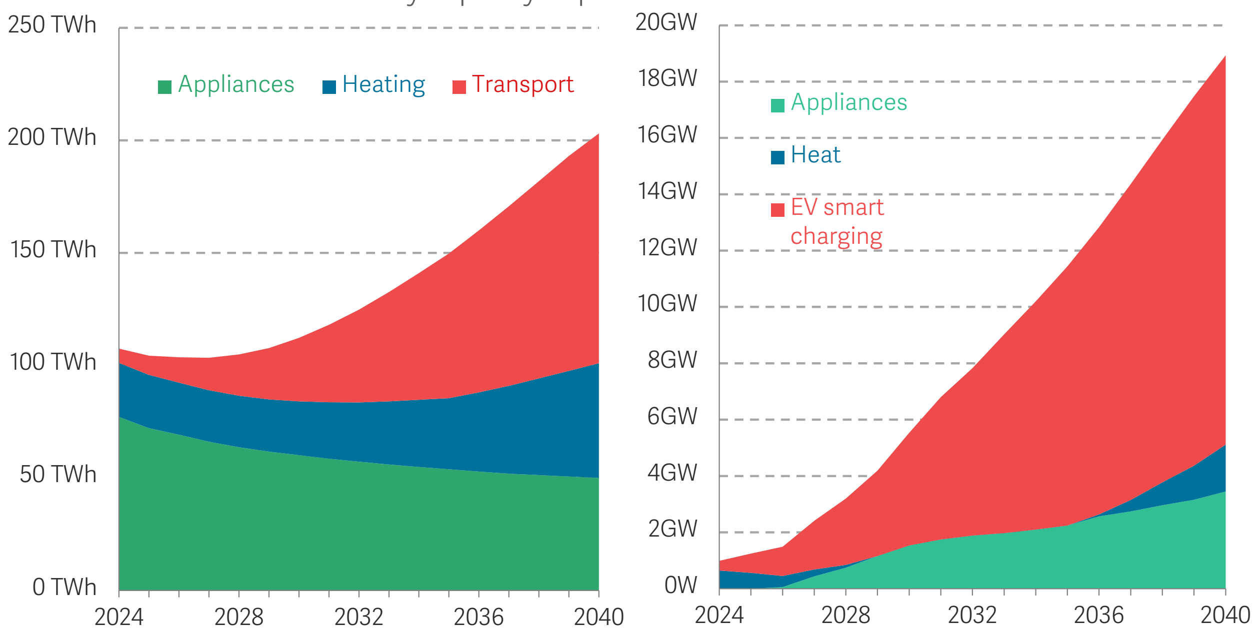
If some, like those on prepayment meters, shouldn't be exposed unnecessarily to more price uncertainty, who should? The big savings on offer to households (and the big benefits to the grid) will be in the flexible technologies of the future, particularly EVs. They are relatively easy to flex: cars are rarely driven late at night, making overnight charging an obvious approach. And, importantly, they use a lot of energy – many EVs and electric

29 RF analysis of Centre for Time Use Research, UK Time Use Survey, March 2023

heating consume more electricity alone than a typical household. [30] This means there are much larger savings on offer to EV-owning households if energy use is shifted to cheaper times, with average savings of up to £120 a year (see Figure 9).[31] The greater potential for EV charging to be flexed means they are expected to account for almost three quarters of new capacity for households to shift their electricity demand by 2030, shown by Figure 10.

FIGURE 10: **EVs will be the key to household flexibility**

Forecast residential electricity demand by final use: selected sectors (left panel), and forecast consumer-led flexibility capacity at peak: GB




NOTES: NESO 'Holistic Transition' shown. New consumer-led flexibility is forecast additional capacity in each sector compared to 2023.
SOURCE: RF analysis of NESO FES 2024.

But the flipside to the savings on offer by shifting their EV demand is that if these households fail to flex their energy use, then rising demand would increase bills for everyone else, by making the already-expensive peaks even harder to serve. Indeed, their high electricity use means that EVs are set to be one of the main drivers behind a 40 per cent increase in residential electricity demand by 2035, putting extra pressures on the system.

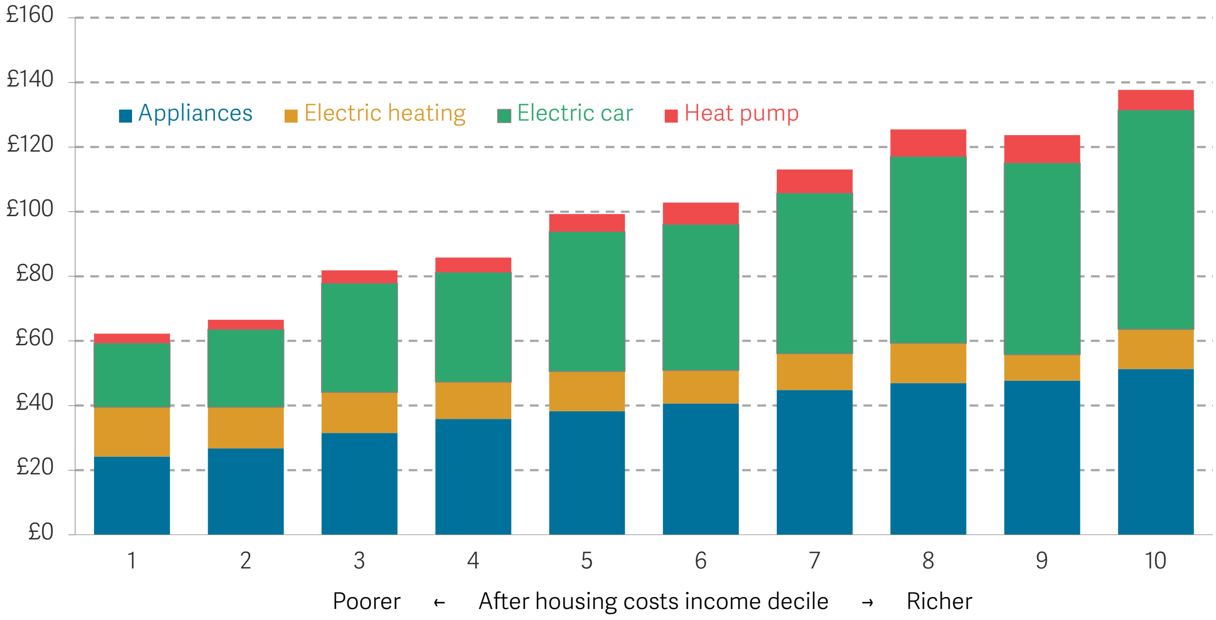
30 Typical household consumption is 2,700kWh according to Ofgem. A heat pump with a coefficient of performance of 3 meeting typical heating demand (11,500kWh for a gas using household) would consume 3,450kWh, while an EV meeting a mileage of 10,000 miles would consume around 3,000kWh. Source: RF analysis of Ofgem and Department for Transport data.

31 Though as Figure 10 shows it will be EVs that contribute most flexibility, electric heating (including both electric resistive heating and heat pumps) is another high-electricity-use technology that can be shifted outside peak times. Homes with electric heating typically have water storage tanks that can be heated overnight, while some homes – particularly energy efficient ones – could be pre-heated outside of peak hours.

This points towards pursuing a policy framework that moves these consumers on to time-of-use tariffs. Compelling households to switch tariffs shouldn't be taken lightly. But people who own flexible technologies stand to make savings from moving to a time-of-use tariff, so it's not all downside. Figure 11 shows that higher ownership rates of most flexible technologies means that richer households have more to gain by switching and shifting – more than double on average for the richest households (£140 a year) than the poorest (£60), mostly driven by higher EV ownership rates. It's fair to use regulatory action to ensure households take up those savings, especially when doing so reduces bills paid by everyone else.

FIGURE 11: **Richer households own more tech – so they have more to contribute and more to save**

Potential average annual bill savings from selected types of electricity use in off-peak hours, by income decile: GB, 2030




NOTES: NOTES: Appliance savings based on electricity consumption of dishwashers, washing machines, tumble dryers, and electric car charging. Cooking not included. Assumes that by 2030 the price of electricity will be 25p/kWh for fixed pricing and 10p/kWh for off peak energy. This is likely to understate the benefits of a time-of-use tariff, as households moving from the price cap to variable pricing in order to save on shifting their energy demand will also make savings on existing off-peak use.
SOURCE: RF analysis of USOC, Ofgem, HBAI, Octopus, EHS, NESO data.

Of course, there will inevitably be those that don't shift their energy use and therefore end up facing significantly higher costs than under current tariffs, but EV-owning households that own this kind of technology tend to be wealthier, suggesting few distributional concerns. By 2030 we estimate that 30 per cent of EV owners will be in the top-income quintile.[32]

32 RF analysis of University of Essex, Understanding Society; and NESO, Future Energy Scenarios. Assumes that in 2030 the distribution of cars across households by car age will be the same for EVs as it is currently for all cars.

So it's fair that those households that are wealthy enough to afford these flexible technologies are prevented from using them in a way that increases electricity costs for everyone, and instead encouraged to save themselves and society money, thereby maximising the benefits that flow to the 86 per cent of those in the bottom income quintile not likely to have an EV by 2030. [33]

## There are downsides to a voluntary approach

Increasing take-up of variable price tariffs is important. But this will be a significant change, with only 2 per cent of families currently on such tariffs. And while it is one that must be done carefully, given energy bills are one of the largest non-housing outlay facing families, we shouldn't shy away from using stick as well as carrot to ensure that those who have most to contribute to lower bills do so.

Another reason to consider a targeted approach is that relying solely on voluntary participation could mean that those who switch are those with most to save – not those with most to contribute. This could challenge the typical assumption that moves towards variable pricing will deliver savings for all, through both direct savings from favourable tariffs and system savings that trickle down to price cap customers.[34]

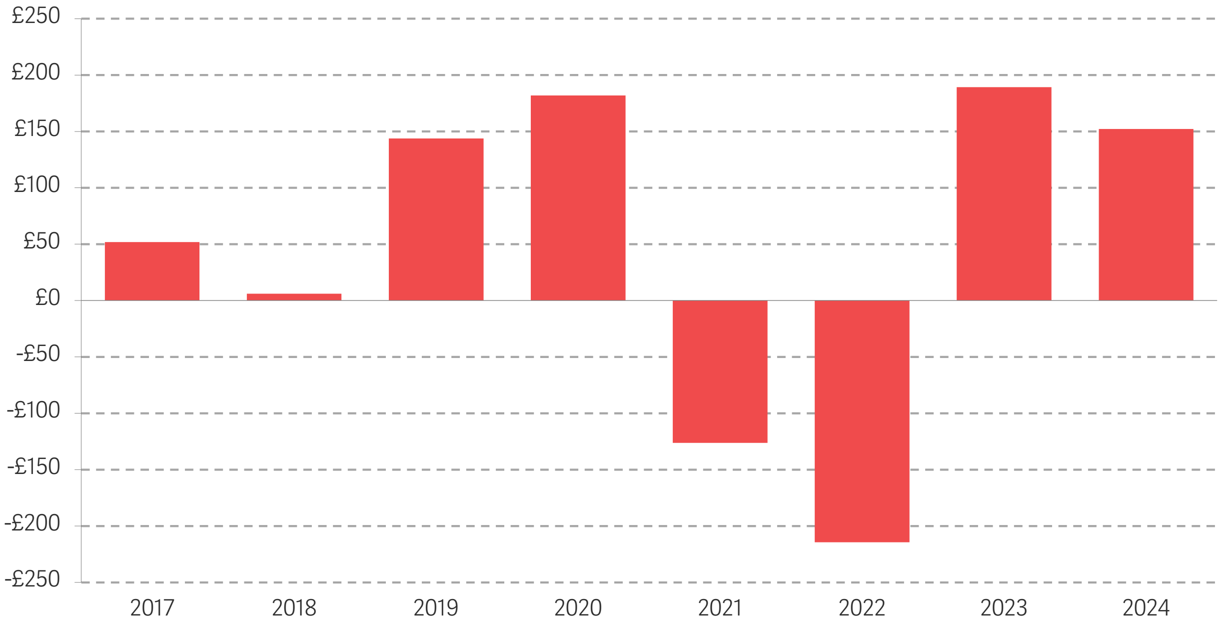
But this isn't guaranteed. Households switching to a time-of-use tariff generate two types of savings – one from shifting energy use in a way that reduces peak demand and ultimately accrues to all of us by making the system more efficient. But they also make savings on their existing off-peak energy use. If switchers already have 'cheap' energy use – that is, they tend to consume little of their electricity at peak hours – then the savings made on off-peak use could exceed the system savings they contribute. That would take revenue out of the system, forcing energy suppliers to raise prices for more 'expensive' customers left behind on fixed price tariffs. Ofgem has raised concerns, using this argument, that coming reforms exposing suppliers to the true cost of their customers' energy use may put upwards pressure on the fixed price cap.[35]

This could be more than just a possibility, particularly if consumers realise the savings they could make. As Figure 12 shows, a consumer with median half-hourly consumption would have been better off overall with an Octopus time-of-use tariff in all years outside the energy crisis since 2017, even without shifting any energy use. That's a huge pool of 'cheap' customers that might switch to other tariffs while contributing little to reducing peak demand on today's levels.

33 RF analysis of University of Essex, Understanding Society; and NESO, Future Energy Scenarios.
34 For example, Cornwall Insight estimate that those staying on the price cap and without flexible technologies could save as much as £115 by 2040 from broader take-up of variable price tariffs. Source: Cornwall Insight, The power of flex: Rewarding smarter energy usage, August 2023.
35 Ofgem, Future of domestic price protection, March 2024.

FIGURE 12: **Most consumers would be better off on a time-of-use tariff**

Savings on electricity unit costs by switching from price cap to agile prices under median half-hourly consumption: UK




NOTES: Compares the cost of paying for median half hourly consumption under agile prices with the cost of the same energy demand under the price cap. Assumes no change in behaviour between the two tariffs, meaning that it is likely an underestimate of the savings from moving to a variable price tariff.
SOURCE: RF analysis of Ofgem, Price cap data; Octopus, Historic agile prices; Smart Energy Research Lab Observatory Data.

So, if there is an exodus from the fixed-price cap, those worried about taking on the risk of variable pricing could be left with a choice between price risk and higher costs.

Ultimately, the distribution of savings between those that are on time-of-use tariffs, and those that are not, is highly uncertain and depends on a variety of factors. So there's no guarantee that this issue will, in fact, drive prices up for fixed price cap households.

So this is just another reason to ensure that the Government targets those with most capacity to offer flexibility, and ensure that they contribute that flexibility, to maximise system cost reductions and system savings for everyone else.

## The best option would be to put those with EVs onto variable price tariffs

So what options does Ofgem have to push those with flexible technologies to do their bit to reduce system savings? The best option here would be to shift those owning EVs onto time-of-use tariffs. That would allow energy suppliers – who, once they are exposed to customers' true energy costs, will have incentives to increase take-up of time-of-use tariffs – to use a more heavy-handed approach to expose those with flexible technologies to variable pricing.

But such an approach is simply not possible as energy companies can't identify with certainty who is using them. Even data sharing within different bits of the public sector won't help here because the majority (around two-thirds, in 2024) of new cars sold are fleet cars and therefore registered to a commercial entity rather than an individual.[36] There may be creative ways around this obstacle, but it is worth thinking about other options.

## A simple way around this issue would be to use annual electricity consumption as a proxy for EV ownership

The obvious alternative is to use total electricity consumption as a proxy for EV ownership, and to withdraw the protection offering by the current price cap from high-energy-using households. Under that approach, Ofgem could set an electricity use limit above which suppliers would not be obliged to offer households the current price cap tariff, with a time-of-use tariff being the default alternative for all electricity use. Suppliers, who will soon be incentivised to ensure their most expensive-to-serve customers are on time-of-use tariffs, can then ensure that all households with high electricity use are exposed to the right incentives and do their bit.

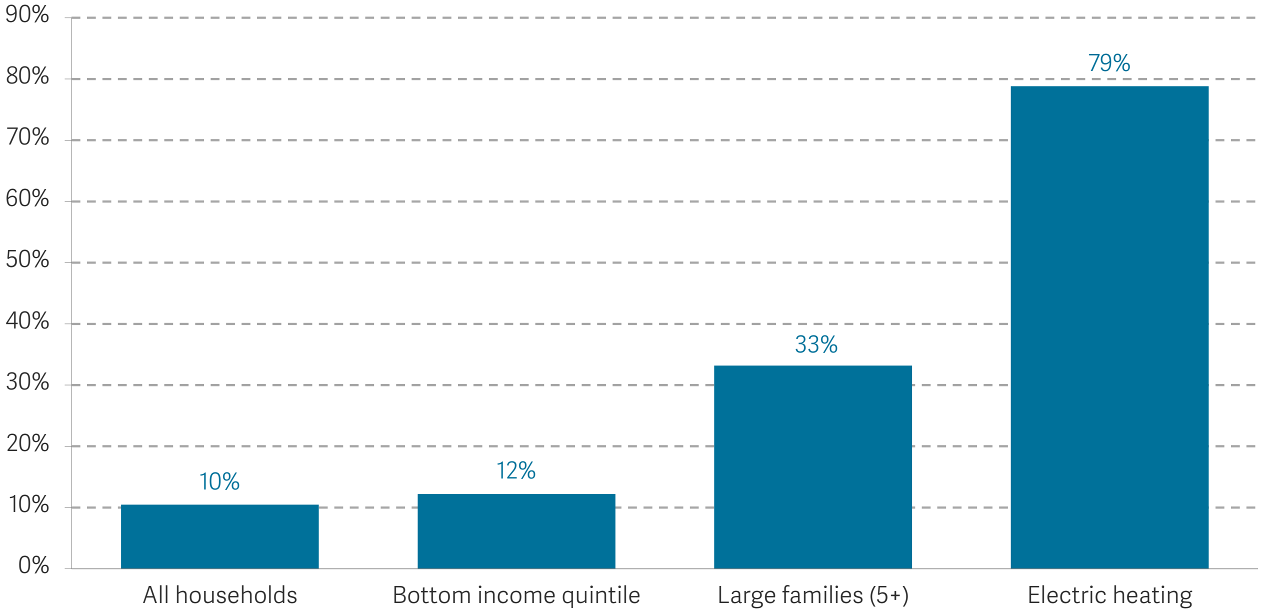
We suggest that a reasonable limit would be 5 megawatt hours (MWh) of electricity per year: this is almost double the typical 2.7MWh per household consumption, and sufficiently low that typical households with an electric car covering at least 7,500 miles per year (a mileage achieved by 38 per cent of drivers, covering 56 per cent of mileage) would breach the cap.[37] So capturing households with high usage would also capture lots of those with flexible technologies – such as electric cars – forcing them to reconsider their demand or face the true cost of energy use.[38]

But, although such a cut-off would capture the vast majority of households that have a flexible technology, it would also affect some families that have very high levels of electricity use without an EV. In particular, Figure 13 shows that a 5MWh usage cap would see one-in-ten households in England (2.5 million) impacted based on their current (non-EV) need. This group includes 12 per cent of low-income households and a third (33 per cent) of households with five or more people. And, most starkly, four-fifths (79 per cent) of households with electric-resistive heating consume more than 5MWh of electricity per year.

36 SMMT, UK Car Registrations, accessed 10 June 2025.
37 RF analysis of Department for Transport, National Travel Survey and DESNZ, English Housing Survey Fuel Poverty Dataset.
38 Not all of these high-demand households will have a smart meter that enables time of use pricing, so the Government may also want to consider mandatory smart meter installations for high-use households.

FIGURE 13: **The vast majority of households with electric heating have high electricity use**

Proportion of households with a required electricity consumption above 5MWh, by household characteristics: England 2021-22




SOURCE: RF analysis of English Housing Survey Fuel Poverty Dataset.

Ofgem might think about whether larger limits could be given to larger households. And as we have already shown, those with electric-resistive heating are likely to benefit from variable pricing (and many already do through Economy 7) – we estimate those with electric resistive heating could see their bills fall by 29 per cent by switching to Octopus' agile tariff.[39] But electric heating is an expensive way to keep warm – used by around one tenth of the poorest families and one-in-seven prepayment customers – and three-in-four larger families have income below the median.[40] So regulations that disproportionately affect these groups deserve careful consideration.

## To get around this, an Ofgem-regulated 'time-of-use tariff' should be introduced

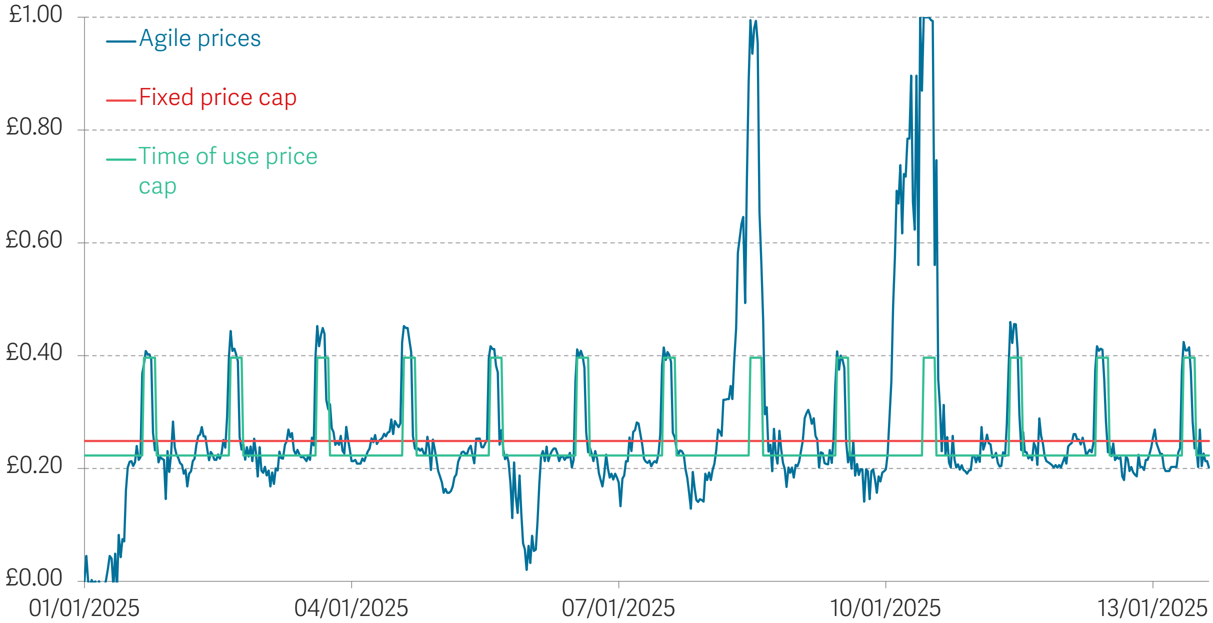
One approach is to encourage suppliers to isolate different kinds of price variability. There is no reason why time-of-use tariffs must combine the price volatility that comes from expensive peak hours – that are expensive every day – with volatility that results from some days being windier than others. Only the most engaged households, or those with their own home batteries, will want to track the rise and fall of prices day to day. But it is plausible that more households than at present might change routines and schedules in response to a consistent set of peak hour prices.

39 RF analysis of UKERD, Half hourly heating profiles; Octopus, Agile prices; Ofgem, Price cap data.
40 RF analysis of DESNZ, English Housing Survey Fuel Poverty Dataset, March 2024.

So one option is for Ofgem to set out a regulated 'time-of-use tariff', something that would allow prices to vary across the day, but subject to (different) caps for peak and off-peak periods.[41] This would create a regulated middle ground between the current price cap, with a same electricity price across the day, and volatile half-hourly prices. It would also offer a degree of consumer protection to what is currently a lightly regulated market where it can be difficult to make comparisons between providers. Figure 15 shows an example of how these regulated tariffs would work, comparing Octopus' 'agile' tariff with a fixed and time-of-use price cap for the first two weeks of 2025. A time-of-use price would capture most of the variation in costs from hour to hour, but shield households from the weather-induced peaks and troughs that are more difficult to track.

FIGURE 14: **A time-of-use price cap could expose customers to peak prices but not weather induced spikes**

Energy price by half hour under Octopus' agile tariff, time-of-use price cap, and existing price cap: GB, first two weeks of 2025




NOTES: The time-of-use price cap assumes a fixed price for 4:30pm-8:00pm and one for all other times, based on the average price under Octopus' agile tariff across these times.
SOURCE: RF analysis of Ofgem, price cap data and Octopus, Agile prices data.

There would be efficiency losses from using this tariff compared to those that perfectly reflect the true changing costs of energy.[42] But the popularity of the price cap shows the demand from households for a simple-to-understand and consistent offer from energy suppliers, and the rising complexity of energy tariffs in future can only increase the need for adequate consumer protection. Meanwhile, we should also be cautious about removing price protection from potentially vulnerable households, even if lower bills seem possible.

41 In principle there could be more than two periods or more than two rates.
42 Time of use tariffs are not the only way energy suppliers can create consumer-led flexibility. Turn-on and turn-off events – in which energy suppliers provide financial incentives to increase or decrease energy demand – might be a better way of creating a consumer demand response for weather-induced spikes, as they do not punish inattention to fluctuating prices.

So extending the price cap to more variable price tariffs in this way would be a welcome step to reforming consumer protection for a world where households buy and consume energy in a very different way to today.

## We need to change our energy retail markets to deliver cheaper bills

The big challenge for policy makers is to change the nature of our energy retail markets from a demand-led system to one that is more responsive to supply conditions. For households, this will be a radical departure from what many are used to.

Splitting our energy market into zones across the UK should contribute to a lower-cost energy system. But this approach comes with important downsides in the form of potentially higher capital costs and a jump in prices for those in some regions. Policy must be active should capital costs rise, and also keep domestic consumers out of regional pricing, leaving the supply side and industrial consumers to provide the savings.

Tariffs that change throughout the day will be a more obvious change for families, particularly as rising ownership of EVs will mean an increasing number of families with high energy use and a high capacity to shift it around. Policy shouldn't shy away from focusing on these consumers, who are the key to unlocking system savings in a way that benefits everyone else. Preventing high energy users from being on the fixed price cap would help to shift those that can save and contribute most onto time-of-use tariffs, but it would be necessary to accompany this with a new Ofgem-regulated time-of-use tariff to ensure it doesn't hurt vulnerable households.

Combined, these changes would improve the efficiency of the energy system, cut emissions and reduce bills. The potential upside of both these changes has been pegged at up to £18 billion by 2040: equivalent to 4p/kWh off the price of electricity by 2040, worth £200 per household on average.[43] So these reforms would ease the cost of living while also making a big contribution to achieving our net zero commitments.

43 RF analysis of Cornwall Insight and FTI Consulting analysis, and NESO, Future Energy Scenarios Data Workbook 2024.

## Annex 1 – Data citations

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University of Essex, Institute for Social and Economic Research. (2024). Understanding Society. [data series]. 12th Release. UK Data Service. SN: 2000053, DOI: http://doi.org/10.5255/UKDA-Series-2000053

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