Energy consumers' experiences and perceptions of smart 'Time of Use' tariffs

Ofgem smart 'time of use' (ToU) tariffs qualitative research

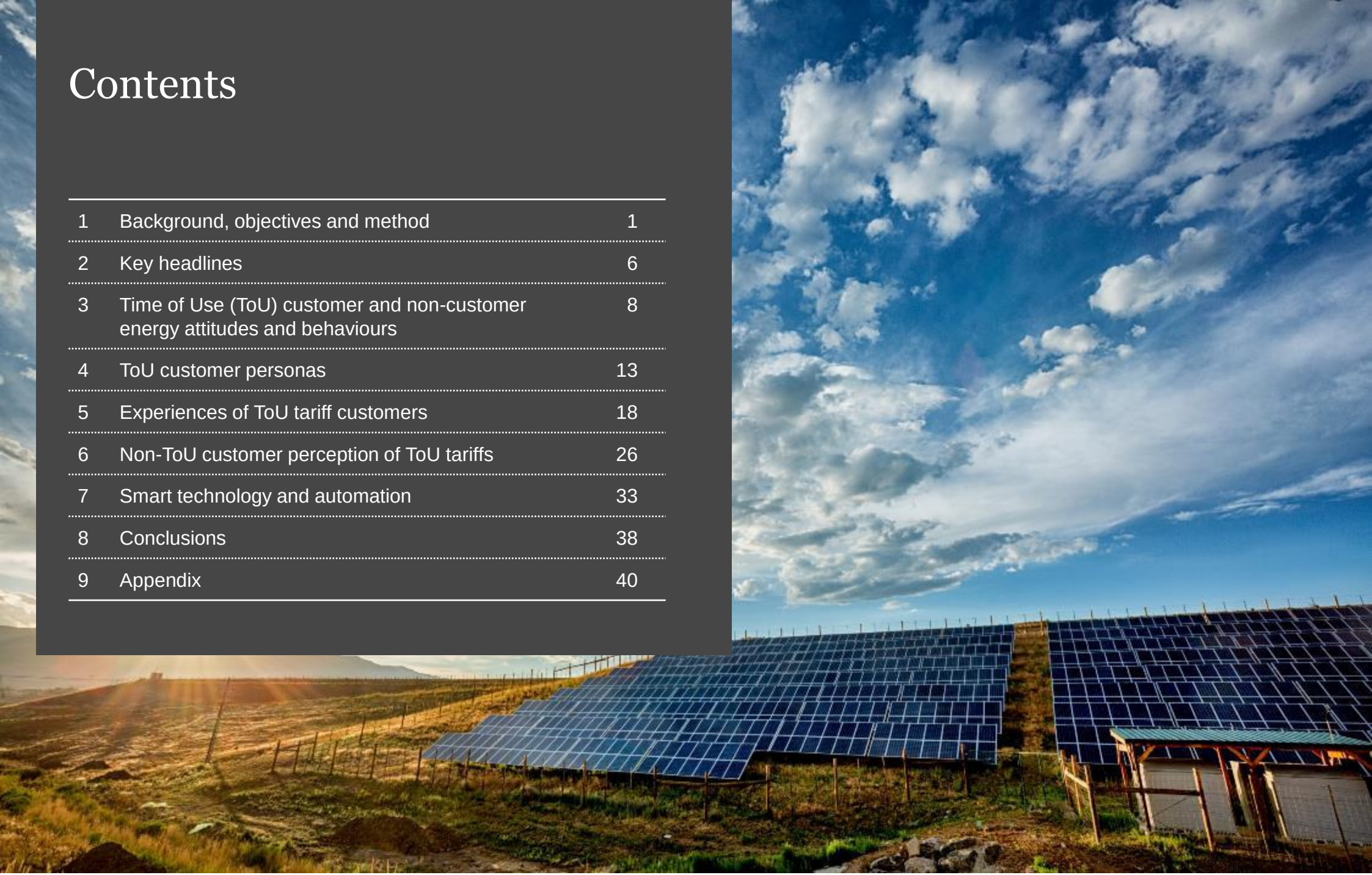
September 2020

Research conducted March 2020

ofgem
Making a positive difference for energy consumers

pwc

Contents



1

Background, objectives and method

Background and context

1	**Ofgem's Settlement Reform (SR) project is a key enabler to smarter, more flexible energy system.**	Settlement Reform will place incentives on retailers to offer tariffs and services to consumers that encourage more flexible energy usage. ToU tariffs will encourage consumers to use electricity at times of the day when grid demand is lower or where generation from renewable sources of energy is higher. This could help electricity suppliers reduce the cost of moving towards a zero carbon future in Great Britain.
2	**Some suppliers have already launched smart time of use (ToU) tariffs – many of which specifically target electric vehicle (EV) owners.**	While take-up remains relatively low, there are examples of time of use tariffs with more mainstream target audiences which have gained traction in the past.
3	**Ofgem is currently undertaking work to understand more about the role of the consumer in decarbonisation, and in particular their behaviours around flexibility.**	As part of this Ofgem wanted to understand more about the needs, expectations and behaviours of consumers in relation to smart time of use tariffs and services. In order to inform future policy decision making Ofgem needs a comprehensive and robust understanding of these needs, expectations and behaviours.

Smart time of use tariffs

- **Smart Time of Use (ToU) tariffs** are tariffs where the price of energy changes throughout the day. These include both static and dynamic ToU tariffs (see slide 32 for definitions)

- The tariffs are designed so that it's cheaper to use electricity at times of the day when there is less demand on the grid– i.e. when fewer households are using electricity, such as overnight and at the weekend

- Smart ToU tariffs are different from previous ToU tariffs because they are enabled by smart meters

- The intended benefits of the tariffs are management of demand on the grid and cheaper electricity for customers

Research need and objectives

The overarching purpose of this research was two-fold

1

To understand consumer experiences of and preference for ‘smart time of use’ tariffs amongst consumers who are currently enrolled.

2

To understand consumer needs, attitudes and preferences for ‘smart time of use’ tariffs amongst non users.

Detailed objectives can be found in the appendix

Methodology

- **10 x telephone depths and 28 x video depths** were conducted with ToU and non ToU customers.
- All respondents conducted a **pre-task** covering attitudes towards energy and perceptions of energy use across the week and at the weekend before the interview.

Regions covered

- London;
- South-East;
- Midlands;
- North-West;
- Yorkshire and Humber;
- Wales.

20 x ToU customers

- **10 x tele-depths**
- **10 x video depths**
- 15 Electric vehicle (EV) owners;
- Even gender split;
- Mix of suppliers and tariff terms.

18 x Non ToU customers

- **12 x video depths with non EV owners**
- 10 smart meter owners;
- 12 gas central heating, 6 electric heating;
- Even gender split;
- Mix of household composition.
- **6 x video depths with EV owners**

Fieldwork was conducted between the 18th and 30th March 2020

Due to Covid-19 we decided to conduct all fieldwork virtually. All fieldwork was carried out at a social distance, either online or over the phone.

Limitations of the research:

Given the nature and focus of this research, the sample was not intended to be representative of the wider energy population. As a result, the findings should not be generalised to the wider energy consumer population.

In addition, the findings are based on energy consumers' current viewpoints. These viewpoints may not necessarily be reflective of the viewpoints of consumers of the future.

2

Key headlines

Key headlines

1. Current smart ToU tariff customers are typically highly engaged, with three broad personas emerging; energy enthusiast Electric Vehicle (EV) owners, cost-conscious EV owners, and non-EV owners.
2. Satisfaction with ToU tariffs is high among Electric Vehicle (EV) owners, but non-EV owners feel less able to capitalise on off-peak periods.
3. While most ToU EV owners plan to stay on their tariff, there was recognition that it is difficult to compare ToU tariffs and get an accurate read on cost savings.
4. Among non ToU customers, appeal was mixed due to uncertainty around if/how they could save using these tariffs. This perception is reinforced due to expectation that off-peak periods are at times customers are typically less likely to be using energy.
5. The exception to this is EV owners who are not on a ToU tariff where there is a clear use case and low awareness appears to be the greatest barrier to take-up.
6. ToU tariffs were felt to be more appealing when: static (so can fit into or create new routines), less complex (2 or 3 rates) and framed in terms of rewards (e.g. discounted off-peak period).
7. Automation could help people take advantage of off-peak periods and navigate more complex dynamic pricing, but there were some concerns around loss of control.

3

ToU customer and non ToU customer energy attitudes and behaviours

ToU tariff customers tend to more consciously manage their energy usage, considering cost and environmental factors

ToU and non-ToU customers describe their energy use in similar terms, although eco-friendliness is more prominent for ToU customers.

ToU Customers

- **ToU customers** are open to new tariffs/trialling options to reduce their energy bills. Some actively research ways to reduce their usage and are willing to invest in long-term energy solutions.
- **Many of our sample were EV owners** and therefore have a stronger understanding of costs as they need it for fuel.

Non-ToU Customers

- **Non-EV Owners** have a mixed understanding of energy costs. Energy use is something that ticks along in the background.
- **Non-ToU customers with EVs** tend to have stronger understanding of energy costs (although not all are aware of cost of charging) as it's needed for fuel

Daily usage patterns are similar across the board, although ToU customers move some behaviours into off-peak hours

Generally, most feel they use the most energy in the mornings and evenings, and the least during the day and overnight. However, there are some differences for specific groups

Perceived usage on a 'normal' weekday

6am – 11am	11am – 4pm	4pm – 7pm	8pm – 12am	12am – 5am
High	Low	Highest	Medium	Lowest
Getting up and ready for the day	Lowest for TOU tariff customers with solar panels	Coming home and turning things on – especially families		
	Medium			Highest
	For people at home during the day (retired, working from home, stay at home parents)			For EV drivers charging overnight
			Higher for TOU customers – tend to have EVs that they charge and/or set timers to use appliances overnight.	

Pattern on weekend days varies, although typically expect there to be more even usage across the day (e.g. not the same peak between 4 – 7pm).

Consumers tend to have a fixed energy usage pattern – the Covid-19 lockdown has disrupted this and overall daytime usage is likely to have increased. Consumer perception at the time of the research was that energy use would return to normal when lockdown lifted.

Generally all consumers we spoke to claim to make some effort to reduce usage, but mostly through small, easy to modify behaviours

Main behaviours adopted are small and well known energy savers

- Most common behaviours:
  - Turning off lights;
  - Turning off appliances instead of leaving them on standby;
  - Batch cooking.
- Some conscious of choosing energy efficient appliances;
- Finding the right tariff and switching a way to save money, but level of research varies – activity is stronger amongst ToU customers;
- Some ToU customers have alternative energy solutions such as solar panels and heat pumps.

There are barriers to making further changes

- Not everyone in the household making the same effort;
- Feel unable to reduce energy usage further;
- Don't understand what they can do to reduce energy – a challenge for all, although some ToU customers have a higher awareness of this through their own research;
- Cost (of new energy solutions).

> "It's hard to change a routine when [it already] works around everyone's work/life.
>
> **Non ToU, EV owner, North**

Understanding which behaviour changes reduce energy usage by the most is a challenge for all, but some ToU customers are willing to research this further and even invest in more sophisticated energy-saving solutions.

Mixed views on which appliances use the most energy, and non-ToU customers in particular have little understanding of relative costs

Appliances/activities with perceived highest energy use include:

EV Charging	Dishwasher
Tumble dryer	Electric heater (underfloor, fire, storage)
Washing machine	TV/home entertainment
Kettle	Electric oven/hob

> If I'm honest, I don't actually know what uses the most energy. I guess my hob and my washing machine?
>
> **Non ToU, North**

> I use my smart meter to control my energy use and check what uses what, but I'd love to be able to see which appliances use the most in more detail.
>
> **ToU, North**

For Non-ToU Customers, these appliances are felt to be high energy due to:

- Common knowledge;
- Heating up;
- Seeing spikes on smart meter (esp. kettle);
- Frequent/heavy usage (e.g. TV);
- Low energy efficiency rating (few);
- Family behaviours (e.g. parents never turning heaters on);

Consumers, in our sample, can think of why something might use more electricity but do not understand the cost of running different appliances.

For ToU Customers, these appliances are felt to be high energy due to:

- Common knowledge;
- Monitoring using smart meter;
- Low energy efficiency rating;
- Own research online.

Most ToU customers, that we spoke to, monitor energy use in detail, but some would like more granularity on what's using the most in order to reduce this, potentially by shifting into off-peak hours.

4

ToU customer personas

Our research identified three ToU customer personas

1	**Energy Enthusiast EV Owners**	EV owners investing in a range of energy saving solutions
2	**Cost-Conscious EV Owners**	EV owners seeking to maximise savings from their EV investment
3	**Non-EV Owners**	Non-EV owners willing to experiment to save money on energy

In our sample:

8 x Energy Enthusiast EV Owners, 7 x Cost-Conscious EV Owners, 5 x Non-EV Owners

These personas are a description of the types of participants who had smart ToU tariffs in our research. Given the sample size, they are not intended as a segmentation or typology of the wider energy consumer.

Energy Enthusiast EV Owners are highly engaged, environmentally conscious and trial new solutions to be more efficient

> We had the smart meter and the solar panels. Then we wanted to move away from fossil fuels, so we got the hybrid car. We use a heat pump for the swimming pool. What I would really love next is to be able to see exactly how much energy my appliances use individually, beyond what the smart meter shows.
>
> **ToU, EV Owner, South**

> The more you have smart meters, or solar panels, or EVs, it trains you to be more aware of energy use just by using them. It's for environmental reasons just as it is for cost.
>
> **ToU, EV Owner, Midlands**

- Energy Enthusiasts **invest in a range of longer term energy-saving solutions** in their homes. All own electric vehicles, and beyond this, all have invested in at least one of the following:
  - Renewables – solar panels, heat pumps;
  - Battery storage systems;
  - Loft and cavity wall insulation.
- Energy Enthusiasts **closely manage their energy consumption** for both cost and environmental benefits, and are willing to spend time researching new tariffs and other potential energy conservation solutions online.
- They have a **detailed understanding of the energy market,** including tariffs and costs – in part due to often having relatively complex set-ups (battery/feed-in tariffs) which has required them to research solutions online. Most have understanding of grid capacity constraints due to own research and awareness of older ToU tariffs like Economy 7.

ToU tariff uptake is triggered by finding out about the tariff through online EV forums, or moving house/installing a charge point or battery storage system.

Cost-Conscious EV Owners are energy conscious, but have simpler home energy set-ups and engagement tends to be driven by their EV

> I'm a black cab driver and I got the EV a while back after doing a bit of research. It's been a win-win situation – it's cheaper for me to run, it's good to drive, and corporate customers love it, which is good for business – and then on top of all that, it's better for the planet, which is a nice bonus.
>
> I would say that I'm quite energy conscious, I'm always telling my kids to turn the lights off, that kind of thing. You notice it more when you're the one paying the bills.
>
> **ToU, EV Owner, South**

- Cost-Conscious EV Owners are **open to new solutions** and **consider themselves early adopters** through their EV ownership.
- However, they **don't tend to spend time researching energy reducing solutions** and tend to have simpler home set-ups (haven't invested in battery storage or heat pumps).
- Although **sustainability is important** to Cost-Conscious EV Owners, they are also driven by a desire to **maximise the petrol cost savings** they're making by having an EV. Their energy cost consciousness means they're **eager to find the best tariff** to balance their increased electricity use and ensure they're saving.
- They sometimes **engage with EV forums** to share experiences.

ToU tariff uptake is triggered by finding out about the tariffs via EV forums and EV trade press, or from supplier marketing emails.

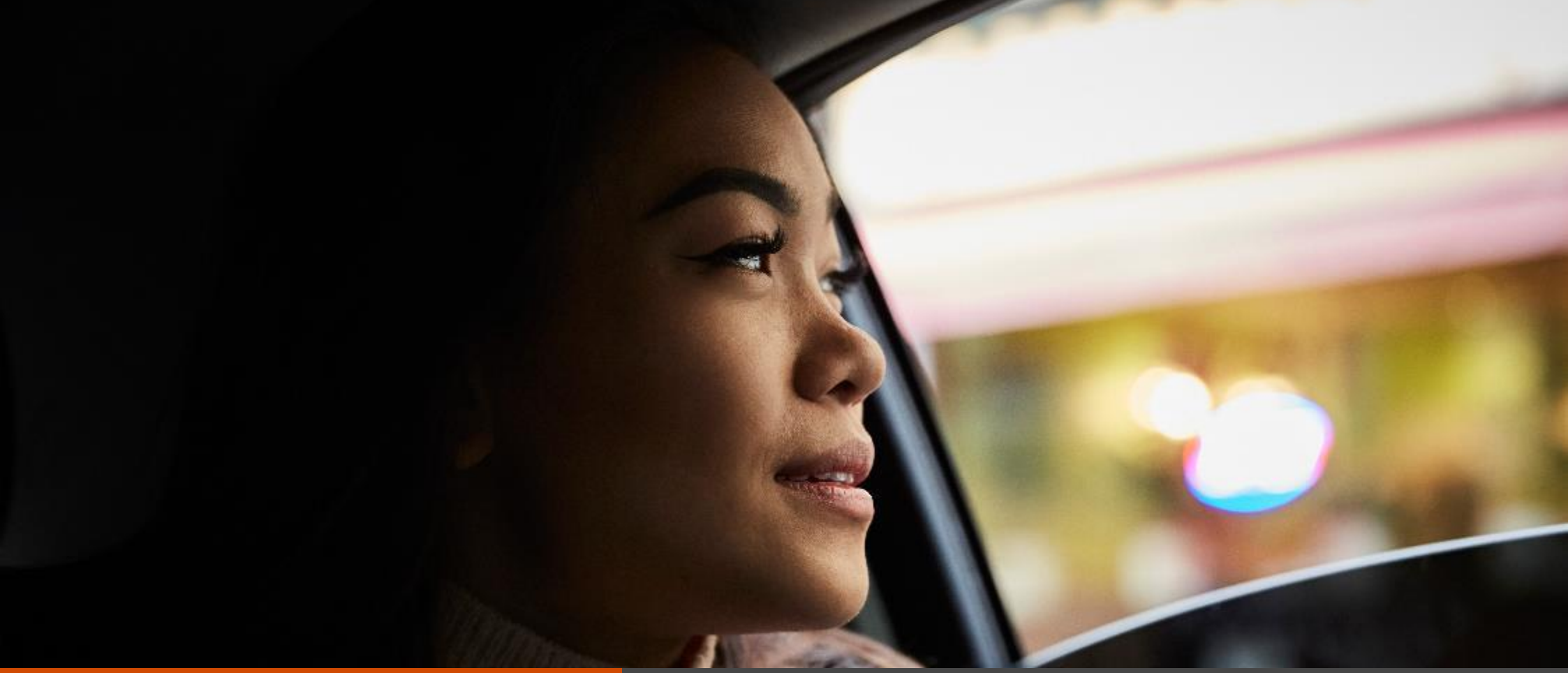
Non-EV Owners, are open to engaging in the energy market but tend to only be taking small steps to be more efficient

> It was my son who told me about my supplier and how it was worth signing up – he sent me a referral code and told me about the cheap rate. They emailed me about the 3 tiered approach and I was interested. I don't have an EV or electric heating – I was just interested in seeing if we could save on our costs.
>
> **ToU, North, No EV**

> My supplier offered me a tariff where the price fluctuates with the international market – you can use it to save money if you can use less energy at particular times.
>
> **ToU, South, No EV**

- Non-EV Owners, on ToU tariffs are **relatively engaged with energy** – open to switching tariffs and shop around for deals.
- They **take some measures to reduce their energy use** (e.g. switching off lights and appliances) but don't tend to invest in longer term energy-saving solutions in their home.
- **Open to trialling new energy offers** to save money, but tend to be less environmentally conscious than Energy Enthusiasts or Cost-Conscious EV Owners.

ToU tariff uptake is reactive – triggered by the supplier inviting the customer to trial the tariff, response to marketing comms or friends'/family recommendation.



5

Experiences of ToU tariff customers

EV owners mainly hear about ToU tariffs through EV forums and seek them out: Non-EV owners take-up is more reactive

Energy Enthusiasts

Cost-Conscious EV Owners

Energy Enthusiasts and Cost-Conscious EV Owners most commonly heard about ToU tariffs through EV forums.

Those mentioned included Facebook groups and communities such as Speak EV, Tesla forums. One EV Enthusiast found out about ToU tariffs through EV charging website Zap-Map.

- Other **Energy Enthusiasts** found out about ToU tariffs while researching battery storage systems on supplier websites.
- One **Energy Enthusiast** found out about ToU tariffs via a marketing email from their supplier.

Energy Enthusiasts and Cost-Conscious EV Owners recognise clear potential money saving benefit by charging at off-peak times, so proactively visit supplier sites directly and/or request to be put on tariffs that require an invitation.

> “I heard about it on the Tesla groups, so I contacted [supplier] on Twitter and they sorted it out.
>
> **ToU, EV Owner, South**

Non-EV Owners

Non-EV Owners most commonly heard about ToU tariffs from their own supplier (email inviting them to take part in a trial).

- One found out about ToU tariffs from a feature in the Martin Lewis (Money Saving Expert) newsletter.

Non-EV Owners are open to trialling new tariffs to save money and willing to make some changes to shift usage into off-peak times.

> “[Supplier] actually sent me an email about changing to this tariff – I was already with them on the flat rate.
>
> **ToU, No EV, South**

Relatively few ToU tariff customers, in our sample, are comparing ToU tariffs to find the best deal

> ‘I think my tariff was the best option, but maybe I missed a better one. You have to do a lot of research, it’s almost like they don't want people using them!’
>
> **ToU, EV Owner, North**

> ‘It was the best tariff for me because of the longer [off-peak] hours. With the others I’d have to get up at midnight to turn the car on!’ (to start charging the car)
>
> **ToU, EV Owner, Wales**

- Often low awareness of the range of smart ToU tariffs available from different suppliers, even among Energy Enthusiasts.
  - Not felt to be easy to discover the full range available as often not searchable on comparison sites.
- Non-EV owners tend to be offered ToU by their current supplier, sometimes when in contract, and as such don’t shop around.
- EV owners confident that they will be saving money compared to their current deal due to off-peak rate, which similarly provides enough of an incentive.
  - Some do research EV forums to find out about others’ experiences before choosing a tariff/supplier.
- Some Energy Enthusiasts look at different suppliers and make assumptions about the best deal for them based on ability to fit off peak hours around lifestyle/cheapest off peak prices/other benefits such as discounted charge point installation.
  - But the most engaged ‘Energy Enthusiasts’ compare different ToU options using their own spreadsheets – e.g. they compare across the different tariffs offered by the same supplier.

Comparison of different smart tariffs made difficult by:

- **Low visibility –** Difficult to find the full range of smart ToU tariffs available; lack of availability on price comparison sites means that it can be difficult to find and difficult to compare with other offers.
- **Variety of tariffs available –** Different terms and pricing structures so not comparing like for like, difficult to assess against usage.

Most ToU tariff users in our sample are very satisfied with their tariff due to the perceived savings, although savings are hard to measure

Drivers of satisfaction include

1 **Saving money**

Energy Enthusiasts measure this using their own spreadsheets, while others assume they are saving, or use direct debit payments as a measure.

2 **Feeling innovative/environmentally friendly**

Many like being 'early adopters' and the feeling of being on an 'innovative' tariff. Energy Enthusiasts with awareness of capacity constraints like feeling that they are 'doing their bit' to reduce demand on the grid.

3 **Ability to make the most of the tariff**

Those with flexible routines (smaller households, people who work from home (WFH) and those who are retired) find it easier to adapt their energy use to maximise savings.

- **EV owners are most satisfied and see the biggest reduction in bills** – tariff enables them to make the most of the EV purchase by offsetting any increased electricity costs.
- Customers who had an EV prior to the tariff are best able to measure the savings – but others also monitor usage using their smart meter.

> "You'd always want a longer time at a cheaper rate. It's saved me money and it predicts the right usage. I compare my smart meter and my bill and it matches the prediction."
>
> **ToU, EV Owner, Midlands**

> "Ridiculously, my smart meter is by the side of my bed and I review it every day!"
>
> **ToU, EV Owner, Midlands**

EV ownership enables biggest and easiest saving, but some are also able to make other changes to get more from the tariff

Easiest savings for EV owners

- Ability to charge EV at off-peak times is a big saving.
- It's also easy to make – many EV owners already charge their EV overnight, or it's an easy behaviour to adapt.

But, other changes require a concerted effort

- Most commonly changing time of washing machines/tumble drying, and dishwashers.
- More extreme behaviours such as charging power banks to charge devices throughout the day less common.

Enthusiasts have strategies in place to take advantage of the tariff

- **Smart Tech:**
  - EV owners set timer through their car/smart charge point so it automatically charges at off peak times.
  - Smart plugs linked to devices.
- **Other solutions:**
  - Use of integral timers for washing machines/dishwashers.
  - Setting alarms when off-peak period starts and manually turning everything on.

Changes to behaviour are easier for some:

- **Tariff** – Longer off peak times – e.g. over the weekend as more flexibility over when to do things/less planning involved.
- **Circumstances** – Flexible working patterns/not working, no children in the home.
- **Understanding** – Increased knowledge of energy usage of different appliances.

> "I set an alarm and at 8.30pm I jump up and turn everything on… the chargers, the dishwasher if it's full, the washing machines. If I'm not home I'll text my girlfriend and she'll do it instead.
>
> **ToU, EV Owner, Midlands**

> "I can't put the wash on at night because my wife's a very light sleeper and it would wake her up.
>
> **ToU, EV Owner, North**

Indications that there's potential to help customers understand savings they could make by changing behaviours so they can judge if the effort is worthwhile.

Satisfaction was generally lower among non-EV owners as they struggled to adjust behaviours and save money

Drivers of dissatisfaction include

Hard to change energy use

- Without an EV, difficulty working out which appliances use more energy means it's hard to make effective changes.
- Some can't or unwilling to flex their energy use around peak times.
- Customers of one supplier reported that they found the off-peak pricing was too high for them to save even when adapting their use.

Issues understanding tariff

- Can be difficult to work out if the tariff is saving them money – particularly those without an EV who haven't made changes to their behavior.
- One was under impression that that it takes 15 minutes from the official off-peak start time for the rates to 'kick in', having been advised this by their energy supplier.

Operational issues

- A few reported issues/were charged more when tariff didn't update from BST to GMT.
- Some needed smart meters to get on the tariff and had teething issues with installation.
- Instances of issues trying to link up to installations (e.g. solar panels, storage batteries).

One non-EV owner did notice they were saving money (£7 per month) in comparison with previous tariff, despite claiming to not have changed behaviour. Part of her household's peak energy period coincidentally overlapped with off-peak, leading to a reduction in her direct debit costs.

Indications that longer off peak periods at ‘sociable’ times are more appealing

Most appealing tariff features help ToU customers to make the most use of their tariff

- Cheap off-peak rate and reasonable peak rate.
- Longer off-peak periods – more time in which they can make use of the tariff.
- ‘Sociable’ peak period timing - e.g. outside high energy use periods, such as 4pm to 7pm – helps non-EV owners make use of the tariff.
- Choice of off-peak window – ToU customer can pick what suits them best.

Less appealing tariff features make it harder to save

- High peak prices – even if the off-peak rates are very cheap, as high peak prices are felt to offset off-peak savings.
- Peak periods falling at ‘anti-social’ times, e.g. early evening – hard to avoid using energy at these times.

Other appealing features include:

- Perceived ‘innovative’/newer brand;
- Strong reputation in EV community;
- Free or discounted charge point;
- Trial period to see if can save.

Most ToU customers plan to stay on the tariff, and even the less satisfied are open to the concept in the future

Satisfied customers plan to stay on a ToU tariff and recommend them to others

- Satisfied customers plan to stay on a ToU tariff when their contract ends, but look forward to reviewing what other ToU tariff options are available.
- ToU customers are open to a wide range of suppliers – but reputation and recommendations are important (e.g. on EV forums).
- ToU customers are loyal to suppliers they feel meet their needs or go out the way to deliver good service. Those with smaller suppliers like supporting new/innovative players.
- Satisfied customers recommend ToU tariffs to their friends/other EV drivers on forums.

Less satisfied ToU tariff customers are unlikely to stay on their current tariff, but are open to trialling a ToU tariff again in the future.

> I recommend it to everyone I know, it's so easy to use – the only downside is that the people I know usually don't have a smart meter… that puts people off.
>
> **ToU, EV Owner, Midlands**

> I've already recommended my tariff on my EV Facebook group, for people who want a longer off-peak period.
>
> **ToU, EV Owner, Midlands**

> The 4-7pm peak price was too high, but I would definitely consider a different one of these tariffs in the future if it could save me money.
>
> **ToU, Non-EV South**

6

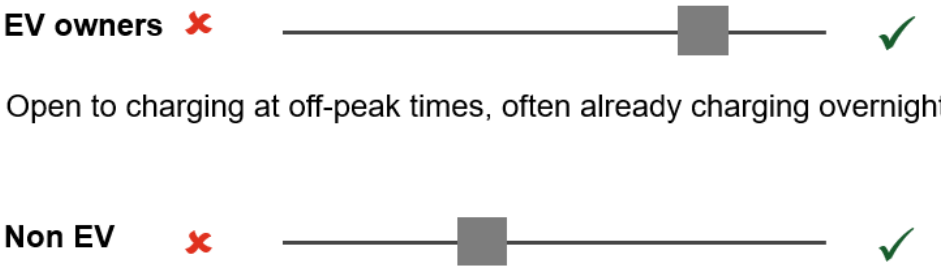
Non ToU customer perceptions of ToU tariffs

There is openness to ToU tariffs, but most non ToU customers aren't sure how they would be able to integrate the tariff with their lifestyle

ToU tariff description used in the research

A tariff where the price you pay for energy changes throughout the day. At busy (peak) times, you pay more for the electricity you use, but at less busy (off peak) times you get cheaper electricity.

Appeal



Initial reactions

- New idea for most, although some familiar with Economy 7. A couple of EV drivers had heard about this sort of tariff from friends with EVs or on EV forums.
- Interesting idea due to the perception that there is the potential to save money by using more at off peak times.
- Some also saw potential environmental benefits through incentivising the reduction of energy use or easing pressure on the grid – some question marks whether the latter is good.
- But, there are questions over if it is 'right' for them – unsure whether they could use more energy at off-peak times, and feel it may work out more expensive.
- Assumption that peak times will be when they need to use the most energy (i.e. early evening), or cheaper electricity will be overnight when they don't use it (those familiar with Economy 7).

A number of barriers to adoption of a smart ToU tariff emerged, but for EV owners most of these can be overcome

Key

Definite barrier | Potential barrier | Not a barrier

Barriers to adoption include	Non EV Owners	EV Owners
Low awareness Smart ToU not always visible on supplier websites/price comparison sites.	Barrier for non-EV owners	Barrier as not all engage with EV forums
Available savings unclear Headline benefit but difficult for consumers to see how much potential there is to save.	Barrier – Unsure of relative costs of appliances	Potential barrier – EV charging a clear use case but cost saving unknown
Complexity Complicated tariff and unclear how to compare with other fixed and ToU tariffs to understand if it's the right tariff for them.	Barrier – More straightforward to have one fixed rate	Potential barrier – EV saving reduces need for detailed comparison due to perception of clear saving to be made
Changing behaviours Not fitting with lifestyle, not being able to adapt behaviour or not knowing what is needed to change.	Barrier – Unsure of relative costs of appliances	Not a barrier – Most charge EV at night so no change needed

Smart meter non-ownership was not perceived to be a barrier to ToU uptake as consumers in our sample were open to getting a smart meter[1] and assume they could get installation arranged as part of signing up to a ToU tariff.

[1] N.B. Outright rejecters of smart meters were excluded from the research.

Only some behaviours are seen as flexible and able to be moved to an ‘off-peak’ time

Behaviours that could be changed are not time critical or part of fixed routine

- Washing machine/dryer;
- Dishwasher;
- Batch cooking;
- Charging devices (to an extent).

Behaviours that can’t change as they would cause too much disruption to routine or are unfeasible

- Cooking and meal times;
- Kettle;
- Heating (including electric);
- Lighting;
- TV/home entertainment.

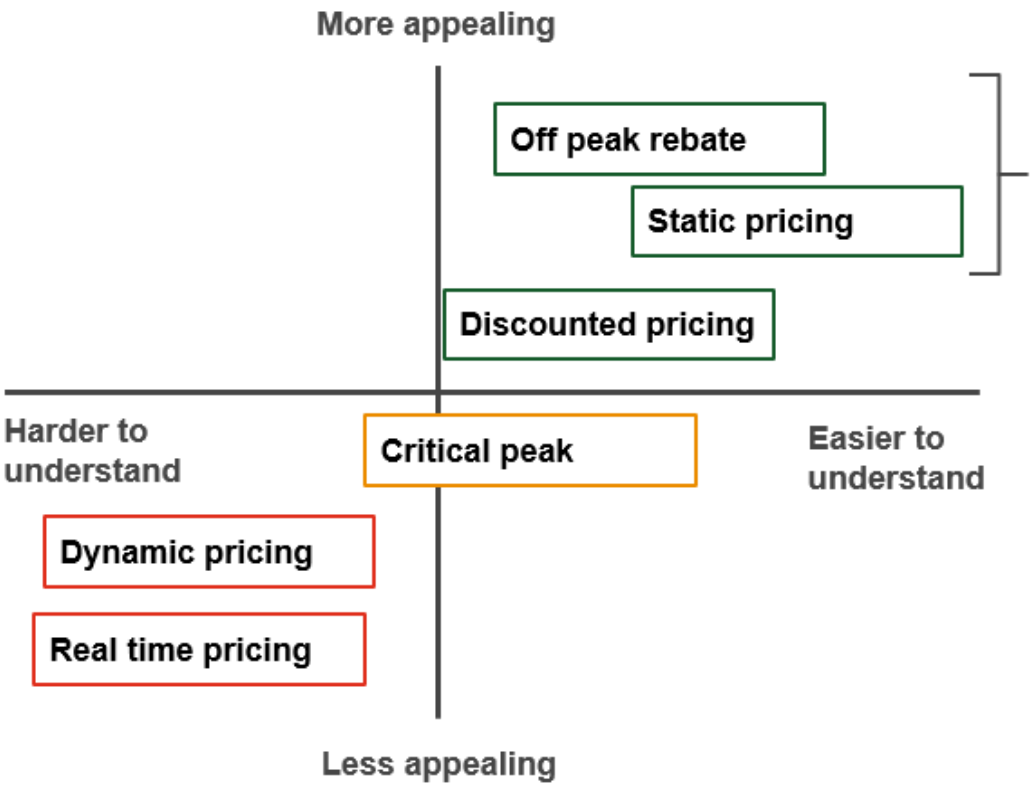
- Most only feel able to change one or two behaviours, which non EV owners don’t think would make a significant difference overall to their bills.
- Perception that they are only able to save on energy costs if they can complete whole task in the off peak time (e.g. do not think about how running the dishwasher across peak and off peak time could give net savings.

If consumers are to be more flexible and change their consumption behaviour on ToU tariffs, they will need help understanding the possible benefits and savings for them.

Attitudes to six ToU tariff types tested

Tariff name	Description
Static Time of Use	Prices vary during the day but the time is fixed, and it is regular. For example, off peak prices are between 12am and 4am every day.
Dynamic Time of Use	Price points are fixed but the time at which they apply varies day to day. You would be notified in advance at what times you will pay higher, medium and lower rates for your energy. There are low, medium, and high prices, but the times you pay these prices vary. For example, on day 1 you pay higher rates between 5.30pm and 7pm and on day 2 you pay higher rates between 4pm and 5.30.
Real-Time Pricing	Electricity prices go up and down throughout the day, depending on the current cost of electricity to your supplier. For example, prices could change every 30 minutes.
Critical Peak Pricing	Pricing mostly stays the same, but there are occasional high price ‘events’ where electricity costs more. You would be notified in advance when this will happen.
Off-Peak Rebates	The amount you pay stays the same most of the time, but at certain times (which you would be told about in advance) you are rewarded for reducing the amount of electricity you use to a certain amount.
Discounted Pricing	When demand is very low, your energy supplier would pay you to use electricity. They would let you know in advance when this is.

Consistent reactions to tariff types with simplicity, low effort and framing in terms of rewards most appealing



[1] More detailed reactions to different ToU tariffs can be viewed in appendix.

Overview of more appealing tariff types

Off peak rebate

- Popular due to 'reward' framing, as opposed to being penalised for using energy when they need to at peak times.
- Customers like to feel in control of their energy use – would only need to change energy use when they want to.

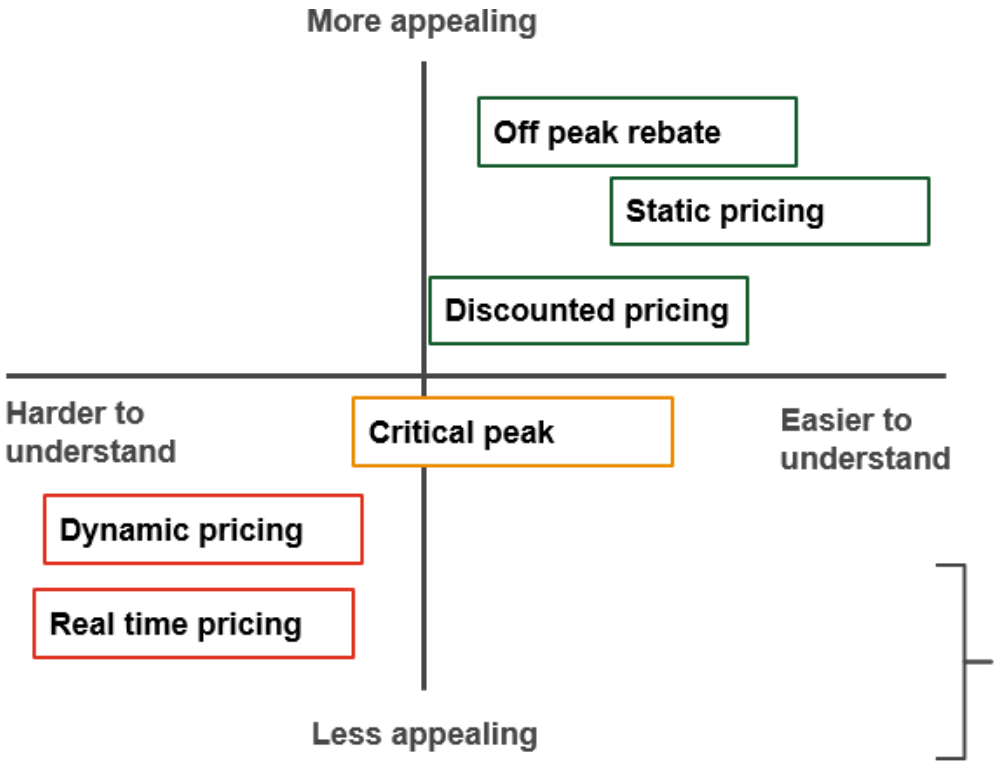
Static pricing

- Simple terms that are familiar to existing tariffs such as Economy 7.
- Customers were shown contrasting off-peak periods and showed a preference for longer off-peak periods, as well as a desire for 'personalisation' of these periods to suit their own routine.

Discounted pricing

- Interesting idea that appeals to EV drivers as they could see a clear cost benefit from the tariff and were already set up to take advantage e.g. smart charger.
- Non-EV drivers feel the effort to take advantage of these events will outweigh the reward.

Dynamic tariffs that make it more difficult to predict impact of energy use on monthly bills are less appealing



Overview of less appealing tariff types

Critical peak pricing

- Concerns about how high the peak price could be and how often the price event occurs – some have a feeling of being 'penalised' by energy companies.
- For some, an interesting way to encourage households to change energy behaviour.

Dynamic pricing

- Day to day rates that vary are less appealing as it makes it hard to predict and budget for monthly bills.
- Hard for customers to compare to non-ToU tariffs and dislike lack of transparency on why rate periods change.

Real time pricing

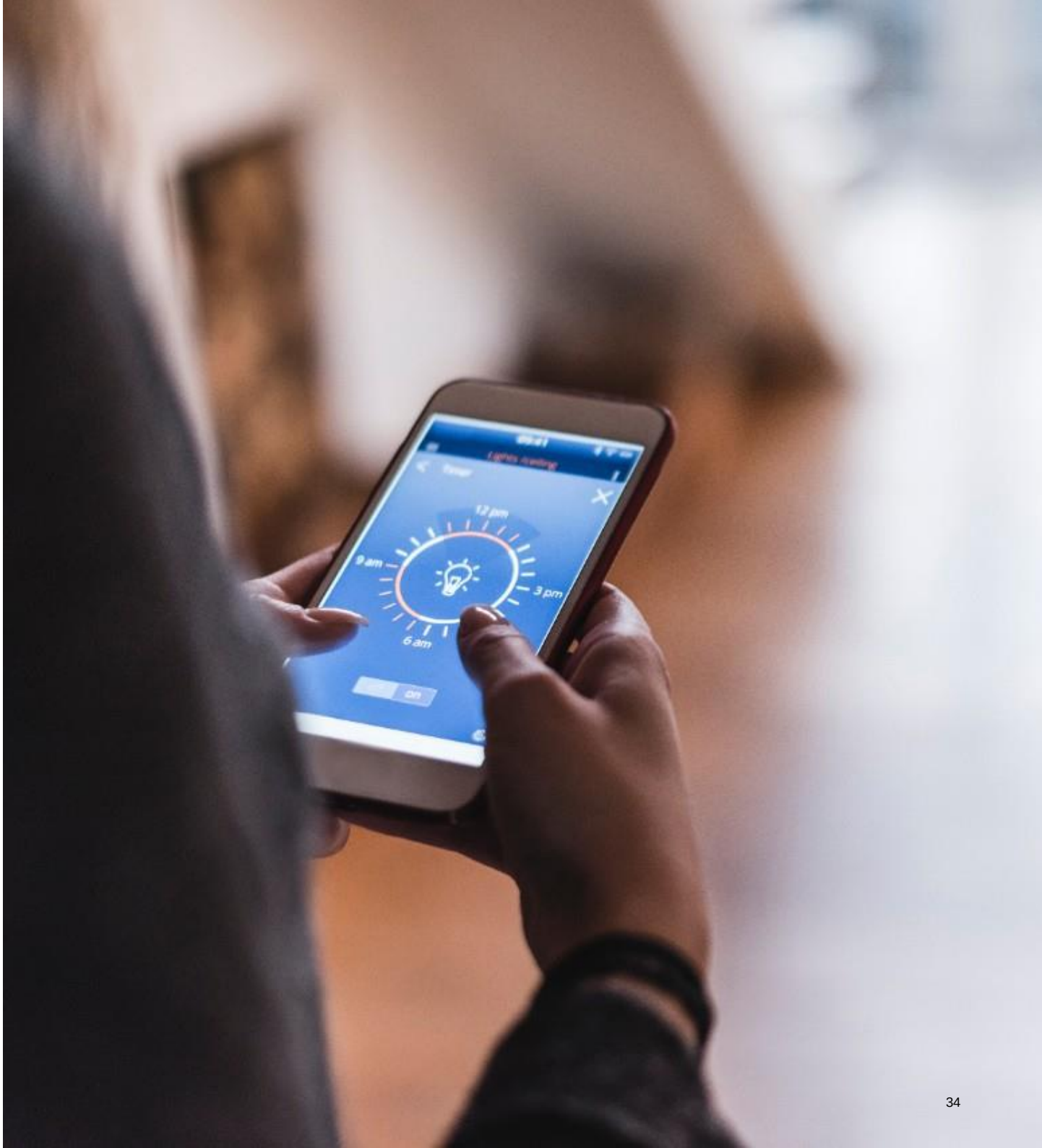
- Those without EVs and smart tech don't understand how they would take advantage and worry about lack of consistency in bills.
- Some perceive this tariff as a way for suppliers to pass on high prices to consumers and want more transparency.
- For EV drivers more engaged with energy, they worry this tariff would 'drive them crazy' i.e. checking phone every 30 minutes.
- Appeal and understanding slightly increases once automation is introduced and customers see how smart technology would interact with tariff.

7

Smart technology and automation

Automation

- **Automated smart technology** will tell smart appliances to do a task e.g. turn on, if a certain condition is met, which could help customers get the most out of their smart time of use tariff.
- For example, if energy prices drop below a certain amount the dryer will turn on, or turn on the water heater at certain times.



Similar use of smart technology across ToU and non-ToU customers, but low awareness of automated solutions

Both ToU and non-ToU customers in our sample already use a range of smart technology in their homes

- Smart meters
- Smart TVs
- Smart speakers/voice assistants
- Wearables, e.g. Fitbits and smart watches
- Remote heating controls
- Smart plugs and bulbs/smart lighting

> I have an Alexa that I'm sure I could do lots of clever things with, but I usually just use it for music and radio.
>
> **ToU, EV Owner, North**

> I love the Hive – it's got a thermometer so I can see when my boyfriend puts the heating up to 30.
>
> **Non-ToU, No EV, North**

However, none were currently using automated smart technology solutions and there was low awareness across the board that these existed

- Many ToU tariff customers have developed their own systems to ensure they use appliances during off-peak hours – these include:
  - Using integral timers on dishwashers, washing machines and tumble dryers
  - Setting alarms for off-peak times
  - EV owners set times on charge point.
- Timers are used by ToU customers to take advantage of their tariff, but not exclusive to them – non-ToU customers also use appliance timers/EV charger timers for convenience.

ToU customers are open to using smart tech or automation with their tariff, but only if it offers something new

Engaged ToU customers have already set up their own systems to make use of off-peak periods, and generally feel their needs are already being met

- There is a feeling amongst some that automation may be complicated and could create more drawbacks than benefits.
  - Many engaged ToU customers enjoy monitoring their energy use – automation feels like a loss of control.
  - Energy Enthusiasts are not necessarily tech-enthusiasts – their interest is in energy rather than smart homes/automation.
- However, it is felt that automation would enable them to take advantage of the cheapest energy prices on dynamic tariffs.

Some less engaged users of the tariff open to automation, as it takes effort out of engaging with the tariff

- Linking tech to tariff means fewer changes to behaviour needed to save money.
- Can work off-peak times into routine better.

> “
>
> I suppose I could programme things to come on when electricity was the cheapest, but I have my integral timers on the washing machine and our set routines so I don’t really see the point.
>
> **ToU, EV Owner, North**

For non-ToU customers, automation increases appeal of dynamic tariffs, but there are concerns about cost and safety

Automation helps consumers see themselves adopting different behaviours

Makes it easy to turn things off and on and take advantage of off-peak times.

Provides control over what is turned on and off when.

Automation particularly appealing for dynamic pricing tariffs so consumers can take advantage of reduced pricing.

But, consumers also had a number of concerns

Cost: are the savings worth the investment?

Safety concerns – appliances that are fire risks.

Loss of control –makes decisions for you, could go wrong as it might not charge car/phone if there was a high price event.

Doesn't work if something is time critical.

Potentially difficult to install/set up.

Ownership of smart tech doesn't necessarily increase appeal

Most own smart tech and are comfortable using it.

Owners of Alexa or Hive not using full functionality/connecting with other devices.

Similarly, those with integral timers on appliances not currently using.

But, open to using in the future if there was a benefit to do so.

> "Sounds like you would be able to get all the benefits of the tariffs without needing to disrupt your schedule.
>
> **Non ToU, EV owner, North**

> "I suppose I could put a smart plug on the fire and warm it up… but it's too complicated, I can't see myself doing it
>
> **Non ToU, No EV, South**

8

Conclusions

Four key insights / takeaways

ToU tariffs work well for existing EV owners

- Charging at off-peak times = clear cost saving is perceived but exact amount saved is hard to know.
- Tend to be more engaged so willing to actively seek out energy/cost saving solutions.
- Open to choice and working out the best deal, but recognise relatively complex.
- EV forums a key source of awareness and information about ToU tariffs.

Consumers without high consuming loads e.g. EVs are uncertain whether ToU tariffs could benefit them

To enhance appeal would need to provide:

- More relevant off-peak time slots (during sociable hours).
- Greater ability to compare with flat rate tariffs.
- Clarity around behaviours which can lead to the greatest cost savings.
- Trials to offer reassurance
- Simplicity – Static timeslots feel more manageable.
- Framing in terms of rewards.

Increasing awareness among EV owners without ToU tariffs key to increasing take-up

- EV owners without ToU tariffs see a clear use case but had low awareness of the tariffs
- Promotion on EV forums, at point of purchase, charging stations and/or other money saving forums could be helpful.
- Present savings that can be made by charging at off-peak times, as not all EV owners are aware of their costs.

Automation has potential to enhance appeal, but some concern about loss of control

- Automation technology increases understanding as to how dynamic/ real-time pricing could work, but concerns about loss of control.
- Existing ToU tariff customers often feel existing set-ups (using timers etc.) work just as well and so are unsure of additional benefit.

9

Appendix

Detailed research objectives

Detailed research need and objectives

The overarching purpose of this research was two-fold:

1 To understand consumer experiences of and preference for 'smart time of use' tariffs amongst consumers who are currently enrolled

1. What initially prompted the customer to sign up to the tariff?
2. To what extent did the tariff meet their expectations?
3. How easy or how difficult has the customer found it to live on their tariff.
4. To what extent has being on the tariff changed the way they use energy?
5. Has their behaviour changed in any other way since being on the tariff?
6. How the customer describes their energy usage pattern before and after adopting the tariff.
7. Does the customer own, or have they subsequently purchased a smart thermostat or integrated home appliance with automation functionality? If not, explore what tech would help them make the most of their tariff?
8. Do they plan to stay on a Time of Use (ToU) tariff in future?
9. How would they promote ToU tariffs to other consumers – what do they see as the key benefits?
10. Do perceptions differ by electricity supplier, tariff type, attitudes and behaviours and demographics?

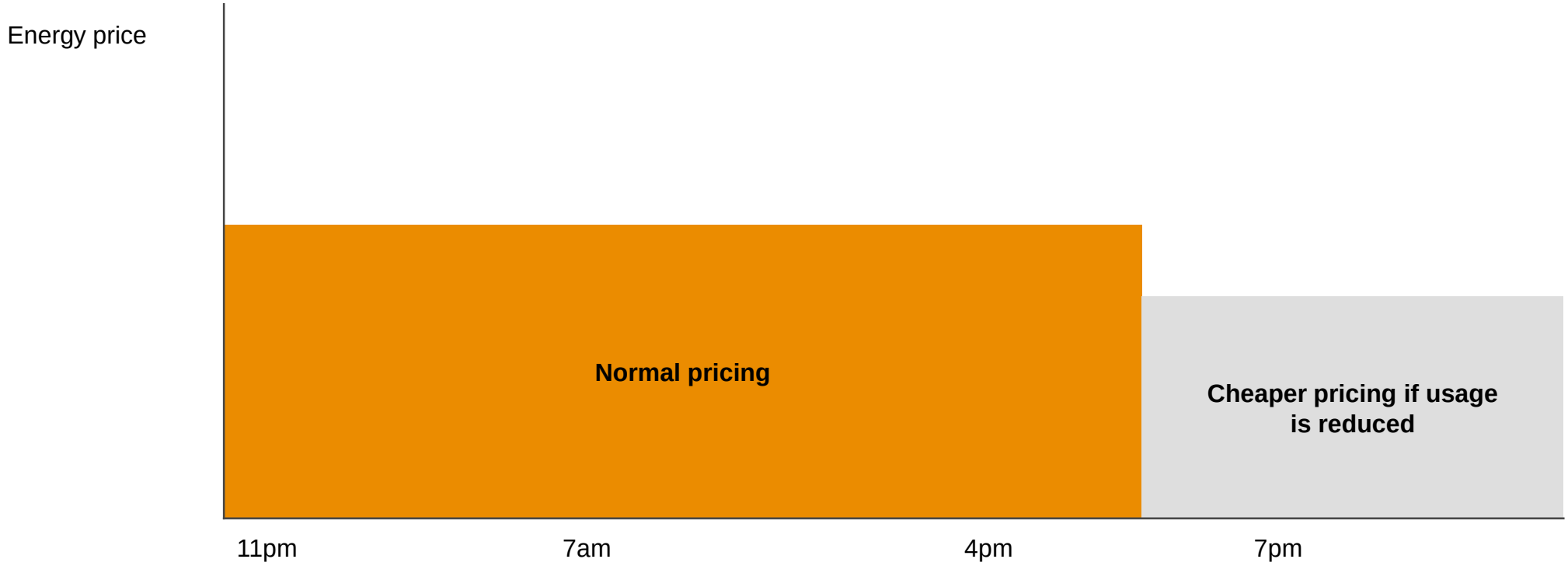
2 To understand user needs, attitudes and preferences for 'smart time of use' tariffs amongst non users

1. Explore awareness of technology such as smart meters/monitors amongst customers.
2. Explore awareness of 'smart time of use' tariffs amongst customers.
3. Explore extent to which customers can see themselves adopting these technologies and tariffs.
4. Understand barriers to take-up and how they could be overcome.
5. Ask customers to describe their electricity usage throughout the day/week.
6. Understand how the customer makes predictions about why they need to change their usage pattern. What makes it worthwhile for the customer to adopt a 'smart time of use' service.
7. Understand how ToU tariffs should be promoted to consumers in order to maximise uptake.
8. Do perceptions differ by electricity supplier, tariff type, attitudes and behaviours and customer demographics.

Detailed reactions to ToU tariffs among non Non-ToU customers

Off-peak rebate

The amount you pay stays the same most of the time, but at certain times (which you would be told about in advance) you are rewarded for reducing the amount of electricity you use to a certain amount.



Off-peak rebate: Most appealing as users would feel more in control and had a perception they are being ‘rewarded’

Benefits

- Easier to understand – simple, reward concept.
- More control, gives user a choice of whether to take advantage of this period.
- Encourages people to use less energy, could have environmental benefits.

Perceived ease of making the most out of tariff is high

- Feeling of being ‘rewarded’ reduces feeling of being constrained by peak periods.
- Easy to understand.
- For some, feeling remains that times between 4-7pm are peak for a reason and it will be difficult to shift energy use.

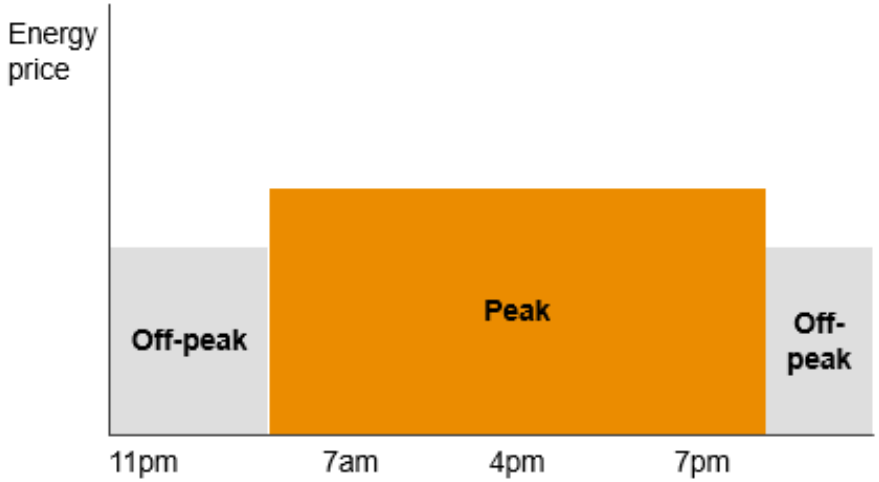
Concerns

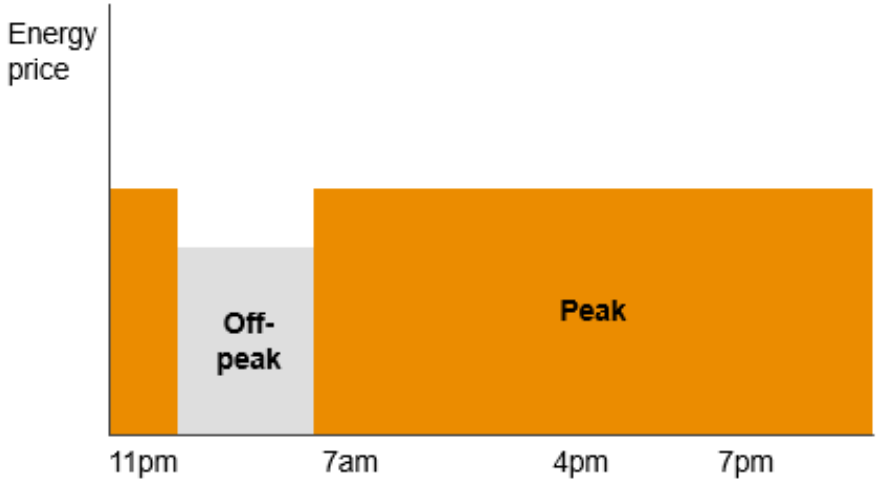
- Uncertainty if they could receive the benefits from this tariff as they want to use energy at peak times.

Static ToU

A tariff where the price you pay for energy changes throughout the day. At busy (peak) times, you pay more for the electricity you use, but at less busy (off peak) times you get cheaper electricity.

E.g. you pay more to take a train at peak times and less at off peak times





Static ToU: Easy to understand, with a preference for longer off-peak periods

Benefits

- Easy to understand.
- Set periods which consumption can be planned around.
- Longer off-peak framing preferred as it provides greater opportunity to adapt behavior.

Concerns

- Being penalised for using energy at peak periods, which is when they want to use energy.
- Not being able to take advantage of smaller off-peak window.
- Peak period is inflexible.

Perceived ease of making the most out of tariff is medium

- Large appliances top of mind e.g. washing machine, dishwasher which can be used with tariff using timers, but certain activities are often set in stone e.g. cooking, heating.
- Among non-EV drivers, those with storage heaters and familiar with Economy 7 or 10 more likely to see potential in tariff.

> I don't know many people that are doing anything between 12-4am, unless you are coming home from a night shift
>
> **– Non ToU, Non EV Owner**

Discounted pricing

When demand is very low, your energy supplier would pay you to use electricity. They would let you know in advance when this is.

Discounted pricing: Intriguing idea but concerns centre on practicality of tariff and effort required to take advantage

Benefits

- Getting paid for using energy is attractive.
- EV drivers see a clear benefit from charging their EV during this period.

Concerns

- Effort needed to track the pricing events and the notice given.
- If everyone uses electricity at this time, would it still be discounted?
- Non-EV drivers can struggle to see how they could take advantage.

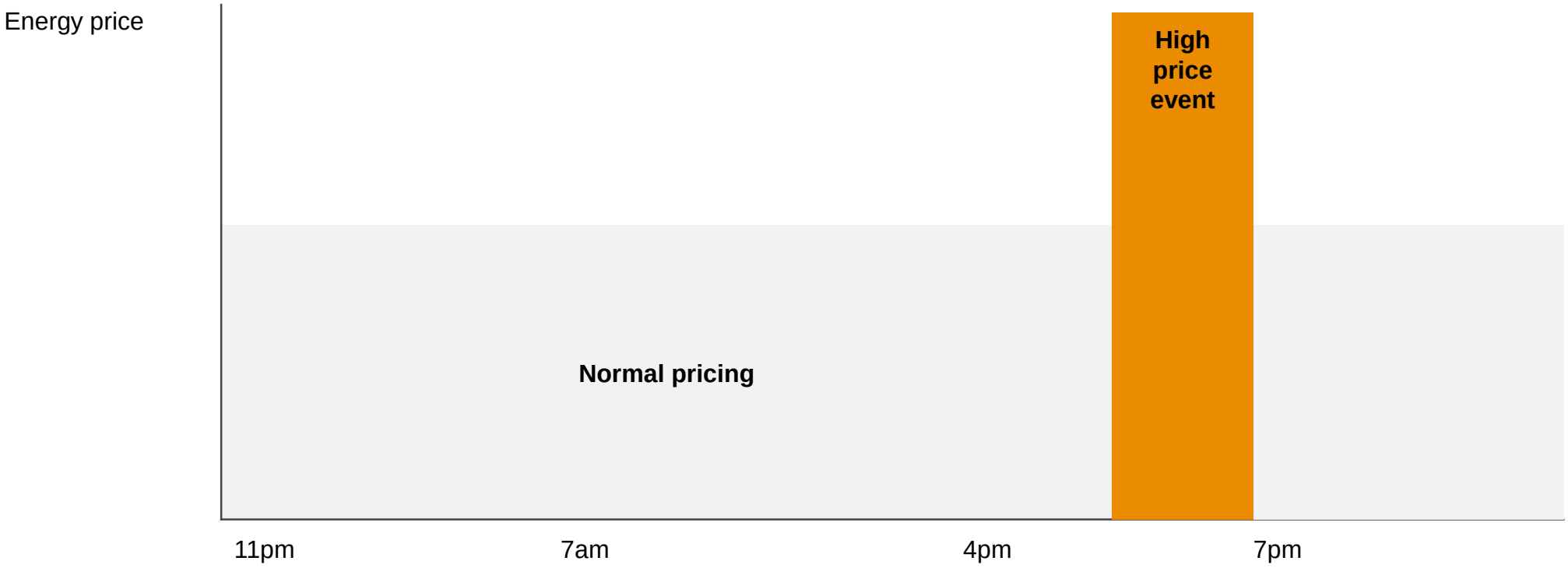
Perceived ease of making the most out of tariff is medium

- Easy to understand.
- EV drivers that use smart chargers perceive this tariff as easy to use.
- Non-EV drivers could not imagine making use of this tariff.

> I mean I can put the wash on in the afternoon instead of at 9am, but I'm not going to do it at 3am!
>
> **– Non ToU, EV Owner**

Critical peak pricing

Pricing mostly stays the same, but there are occasional high price ‘events’ where electricity costs more. You would be notified in advance when this will happen.



Critical peak pricing: Easier to understand, but there are concerns around the final impact on bills

Benefits

- Simple idea and easy to understand.
- Could encourage households to change behavior.
- More flexibility compared to other tariff features.

Concerns

- How often and how high is the price event?
- A feeling of being ‘penalised’ by energy company.
- Some worry about not being prepared or unable to shift behaviour when event occurs.

Perceived ease of making the most out of tariff – Medium

- With enough notice, participants have a general idea of the habits they would change to shift energy use away from high price events.
- Habits they would change centre around white appliances and heating.
- Some habits would not be changed – Cooking, TV and this creates concern around impact on bills.

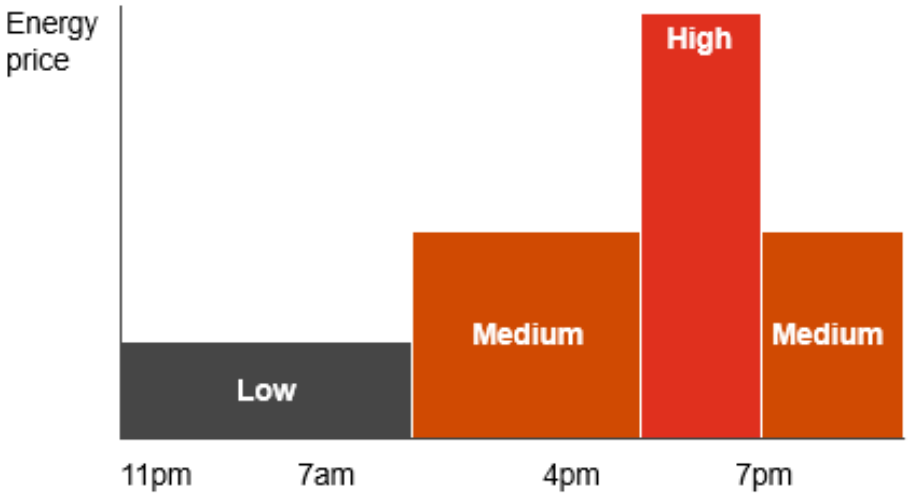
> That’s more appealing, it seems a bit easier to control, like you just keep away from the high price window if you can.
>
> **– Non ToU, EV Owner**

Dynamic tariff

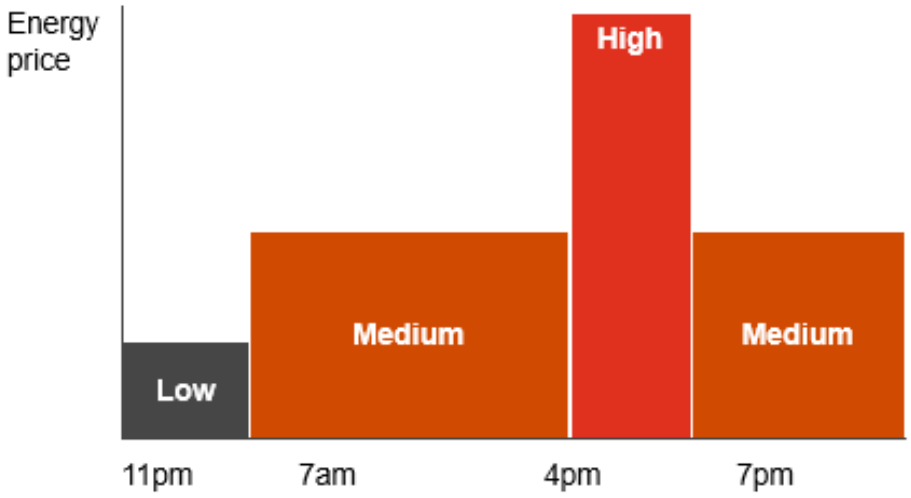
Price points are fixed but the time at which they apply varies day to day. You would be notified in advance at what times you will pay higher, medium and lower rates for your energy.

There are low, medium, and high prices, but the times you pay these prices vary. For example, on day 1 you pay higher rates between 5.30pm and 7pm and on day 2 you pay higher rates between 4pm and 5.30.

Day 1



Day 2



Dynamic tariff: Confusing and non-ToU holders were unwilling to invest time in monitoring rate periods

Benefits

- Shorter ‘high’ peak period gives more flexibility and greater opportunity to adapt.

Concerns

- Varying day to day rates gives no consistency – makes it hard to predict and budget for bills.
- Confusing as difficult to compare to non-ToU tariffs.
- Would take too much effort to keep track of rate periods.

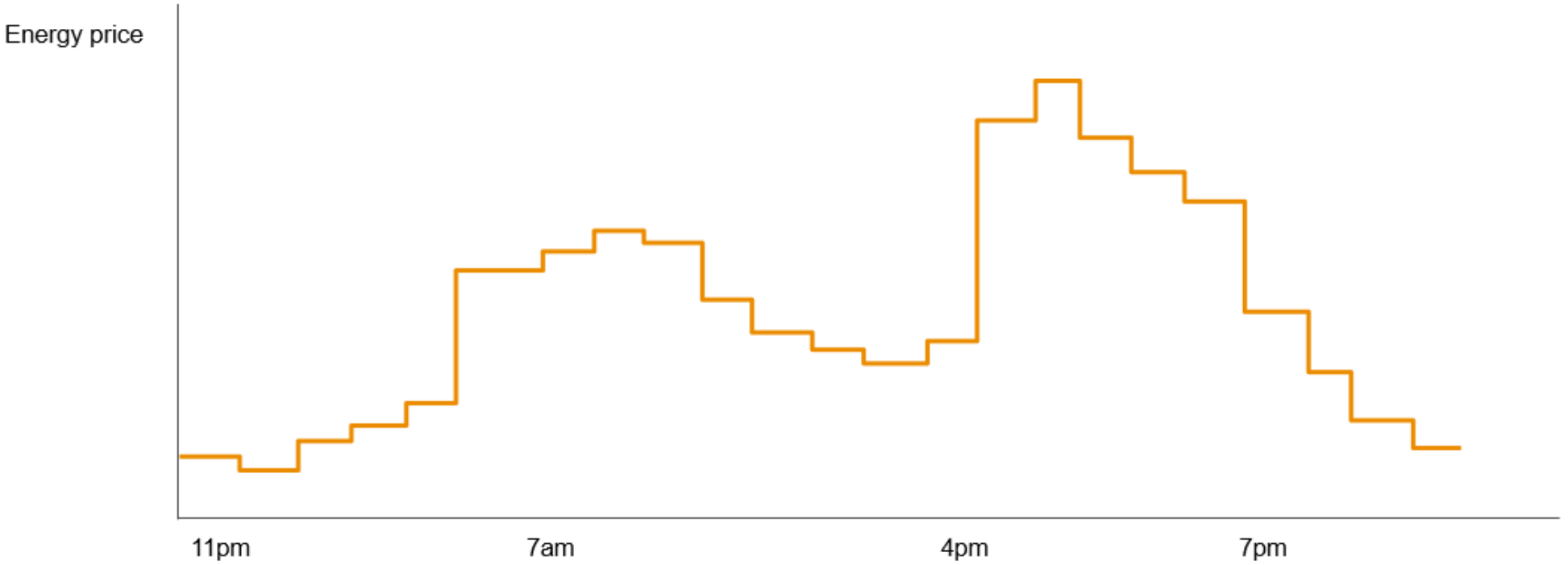
Perceived ease of making the most out of tariff – Low

- Some consider this tariff easier to use than static due to longer periods of off-peak energy.
- Many find the tariff description overwhelming and would not put in effort on a daily basis to take advantage.

> That’s awful, it looks so difficult and overcomplicated. I’d much prefer a simplified, cheaper tariff with tips on how you could reduce your usage.
>
> **– Non ToU, EV Owner**

Real time pricing

Electricity prices go up and down throughout the day, depending on the current cost of electricity to your supplier. For example, prices could change every 30 minutes.



Real time pricing: Least appealing as most are unsure how this would impact their monthly bill

Benefits

- For those who own EV's and are aware of ToU tariffs, they see potential cost savings by using smart tech and chargers.

Concerns

- For those more engaged with energy, they worry this would 'drive them crazy' i.e. checking phone every 30 minutes.
- Need more transparency on why prices are changing.
- Would be difficult to budget for energy bill each month.
- Some perceive this to be companies passing on high prices to consumers.

Ease of making the most out of tariff

- Ease of making the most out of the tariff is low.
- Difficult for non-EV drivers as they don't understand how they would take advantage of real time pricing.
- General lack of knowledge of how smart tech could interact with this type of tariff.
- Once automation was introduced, non-EV drivers can start to understand how smart tech could interact with this tariff and began to see more potential.

"I like to know how much I have to pay and when, but this would change everyday.

– Non ToU, Non EV Owner

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