



Sunshine Tariff Summary report



Western Power Distribution and Regen SW

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Energy generation, use and supply are going through a period of change. There has been a rapid increase in deployment of distributed and variable generation since the introduction of the Feed in Tariff. Therefore, new forms of flexibility are required to keep the power system stable in this new environment.

Traditionally, flexibility has been provided by turning power plants up or down to match demand. But new communication and big data technologies combined with smart meters are enabling smarter approaches to balancing supply and demand.

One form of flexibility is demand side response (DSR), which is when a consumer adjusts the amount of electricity they use at particular times in response to either a control or price signal. There have been a number of trials in the UK looking at the potential of DSR in supporting system balancing, a handful of which have looked at domestic DSR.

The Sunshine Tariff trial focuses on the role of domestic DSR in overcoming network constraints.

The challenge

There is an obligation on Distribution Network Operators (DNOs) to connect distributed generation, such as solar and wind farms, to the network in the most cost effective way. But the significant increase in distributed generation has resulted in constraints on the network and the cost of new connections going up.

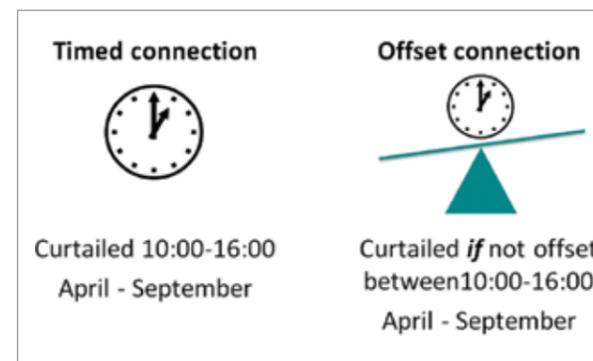
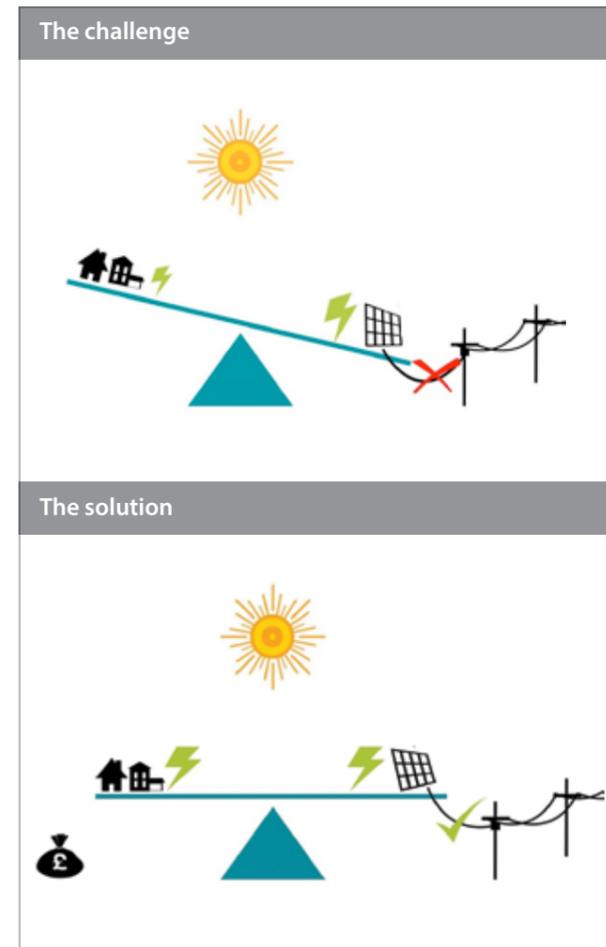
Western Power Distribution (WPD) has rolled out alternative connections to give developers a cheaper connection option that doesn't require network reinforcement. Consequently, the developer has to accept that their generator may be disconnected when the network is at capacity. The reduction in income and the uncertainty of how often generation will be curtailed can make projects unviable.

Wadebridge Renewable Energy Network (WREN), a community energy group in Cornwall, had plans to develop a megawatt scale solar farm but could not connect to the WPD network at an affordable price. The only alternative connection offer available at the time was a 'timed connection', which would curtail generation between 10:00-16:00 from April to September, which is a solar farm's most productive time.

The solution

This trial sought to develop and test the feasibility of an 'offset connection agreement', which would enable generation customers to connect to the grid on the basis that they could change the pattern of local demand on the network to offset the power generated. It would be based on the timed alternative connection agreement but would give the developer the opportunity to shift local demand to the time of peak output from their generation.

The incentive for customers to shift their demand to the middle of the day was provided by a time of use tariff – the Sunshine Tariff – which provided cheap electricity between 10:00-16:00 from April to September.



The trial

A partnership was formed between:

- WPD – the DNO and project lead
- WREN – the community energy group responsible for customer engagement
- Tempus Energy – the electricity supplier responsible for installing smart meters, billing customers and providing data
- Regen SW – the project manager also responsible for analysis.

The trial took place in Wadebridge, Cornwall, and used incentives and automated control technology to achieve a demand side response from domestic customers. All customers were given a smart meter and a cheaper tariff between 10:00-16:00 from April to September 2016. The customers were put into two groups:

1. Manual interventions

Customer directly turned on appliances based on the reward of a reduced tariff at a pre-arranged time of day.

2. Automated interventions

Customer either had a timer on their hot water immersion system or a number of remotely controlled switches in addition to manually shifting consumption.

In addition to the trial subgroups there was a further group which acted as a trial control. The control comprised of customers that resided just outside of the trial catchment area, but wanted to be involved in the trial. They received a smart meter and were put on a flat rate tariff.



Feasibility

A feasibility study was carried out early in the trial to explore whether a Sunshine Tariff would be commercially viable in current markets. See the 'Sunshine Tariff: Feasibility report' for more information.

The study concluded that such a tariff was viable, as existing time of use tariffs, such as Economy 7, already use a combination of increasing the peak tariff to compensate for a lower off-peak tariff with reflecting lower costs from both wholesale prices and distribution use of system (DUoS) charges. The supplier of the Sunshine Tariff, Tempus Energy, settled all of its customers on a half hourly basis, which enabled it to take advantage of fluctuating wholesale prices and DUoS charges.

The potential to access extra value streams could bring off-peak tariffs down further, making the Sunshine Tariff not only viable, but attractive and competitive in the current market.

Extra value streams identified were:

- Avoided network reinforcement costs to both the developer and DNO. Estimation of the potential contribution from the generator is a subsidy of 1p/kWh
- The value of being able to connect and generate for a developer that would otherwise find the reinforcement costs prohibitive is estimated to be worth 1p/kWh (depending on market conditions)
- The value to the supplier of customer acquisition through community-led promotion was estimated to be worth approximately £50 per household.

The study also looked at the Sunshine Tariff model in future markets and found that there was potential for further funding streams to support the reliability and sustainability of a Sunshine Tariff.

These future funding streams included:

- Bilateral contracts between either the supplier or generator and the future Distribution System Operator (DSO) to pay for system balancing services
- Lower DUoS charges where there is reduced pressure on the distribution network through local balancing and/or time of use that supports load flattening
- Reduced line loss factors (LLFs) where energy is balanced and used locally.

Tariff structure

Tempus Energy proposed three Sunshine Tariff options. These were:

Figure 1. Tariff options proposed by Tempus Energy

Time period	Option A	Option B	Option C
10:00-16:00	3	4	5
16:00-10:00	20	19.5	18

The three options were designed to be cost neutral with the Evolution Tariff of 13.4p/kWh, based on the assumption that customers would be able to use 37% of their electricity during the 10:00-16:00 period.

WREN chose option C, as the 5p/kWh in the Sunshine hours was closest to the income received by the solar generator through the Feed-in Tariff and therefore could create a greater sense of connection between the customer and the solar farm.

Recruitment

The marketing and promotion was carried out by the local community energy group, Wadebridge Renewable Energy Network (WREN), which had good local contacts and an existing network of members. This approach was chosen over the supplier, Tempus Energy, providing the marketing. It enabled WREN to use a wider range of marketing techniques and its reputation as a local trusted brand.

The target number of households was 240 plus a control group. However, recruitment proved more challenging than expected with 89 households attempting to sign up and a final number of 46 on the Sunshine Tariff (plus 15 in the control group).

Considerable learning was gained from the recruitment and switching process, which is set out in the 'Sunshine Tariff: Customer recruitment learning report'. Key learning included:

Timescales required – The timescale for recruitment was significantly reduced to eight weeks, which contributed to lower than hoped numbers of participating households. The increased time would have allowed greater impact by word of mouth and potentially reached a much wider audience. Furthermore, allowing more time for switching and installing technology would have enabled a number of households to remain in the trial.

Tariff attractiveness – It is, however, questionable that the extra time alone would have made a significant difference to the number of sign ups. There were several factors that made the tariff less attractive than hoped, which are set out below:

- **Tariff design** – The most common reason cited for choosing not to sign up to the tariff was that it didn't make financial sense for the customer, mainly due to having solar PV
- **Market changes** – The Sunshine Tariff was attractive when the project launched and sign up was high. However, after six weeks, the energy market conditions changed and the tariff was less competitive, which reduced sign-up significantly
- **Length of trial period** – The six month trial period put some households off, as they were concerned about switching again at the end of the trial period.

Value of trusted local advice - Almost three quarters of the households that signed up for the trial were WREN members, suggesting that those already bought into the organisation trusted their advice. Evidence suggests that trust is a significant contributing factor to customers' switching patterns.

Challenges with switching – There were a number of barriers that prevented customers from switching suppliers, such as objections from the existing supplier, which had an impact on the number of sign ups.



Recruitment recommendations

Recommendations for recruiting customers onto a domestic demand side response scheme include:

- Allow longer for recruitment and switching
- Consider providing a non-switching option, for example recruiting from within a supplier's existing customer base
- Test the tariff and marketing techniques before launching to get feedback on what was both attractive and unattractive about the tariff
- Monitor the market to check for competitiveness and either adjust the fixed tariff before launching or track against a variable rate to ensure the tariff reflects changes in the market
- Work with a trusted local organisation to provide information and advice to potential customers.

Looking more generally at the viability of domestic demand side response, learning from the Sunshine Tariff recruitment shows the importance of key external changes:

- High penetration of smart metering and domestic half hourly settlement
- Simpler and more efficient supplier switching
- Increases in domestic flexible loads
- Increased penetration of automation technology.

Some of the above issues are being addressed through government policy and others will change as the smart energy and storage market evolves.



Customer demographics

The Sunshine Tariff attracted more of the affluent population in Wadebridge: 92 percent owned their house; 67 percent were in active employment; and almost half of the households earned more than £30,000 per year, as shown in the pie charts.

This suggests that the more affluent were more engaged in energy issues, they had more flexible load to shift and were more willing to take the risk of signing up to a trial.

Figure 2. Bill payer employment status

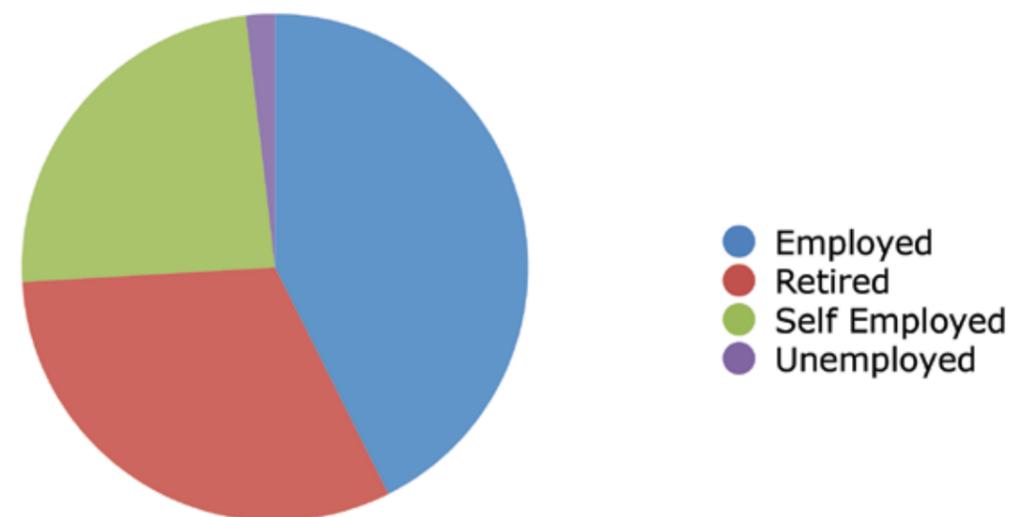
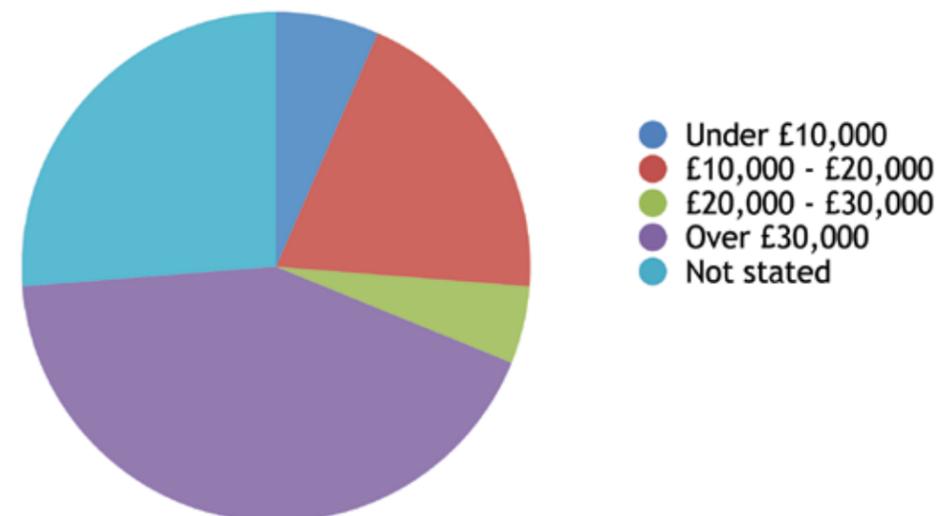


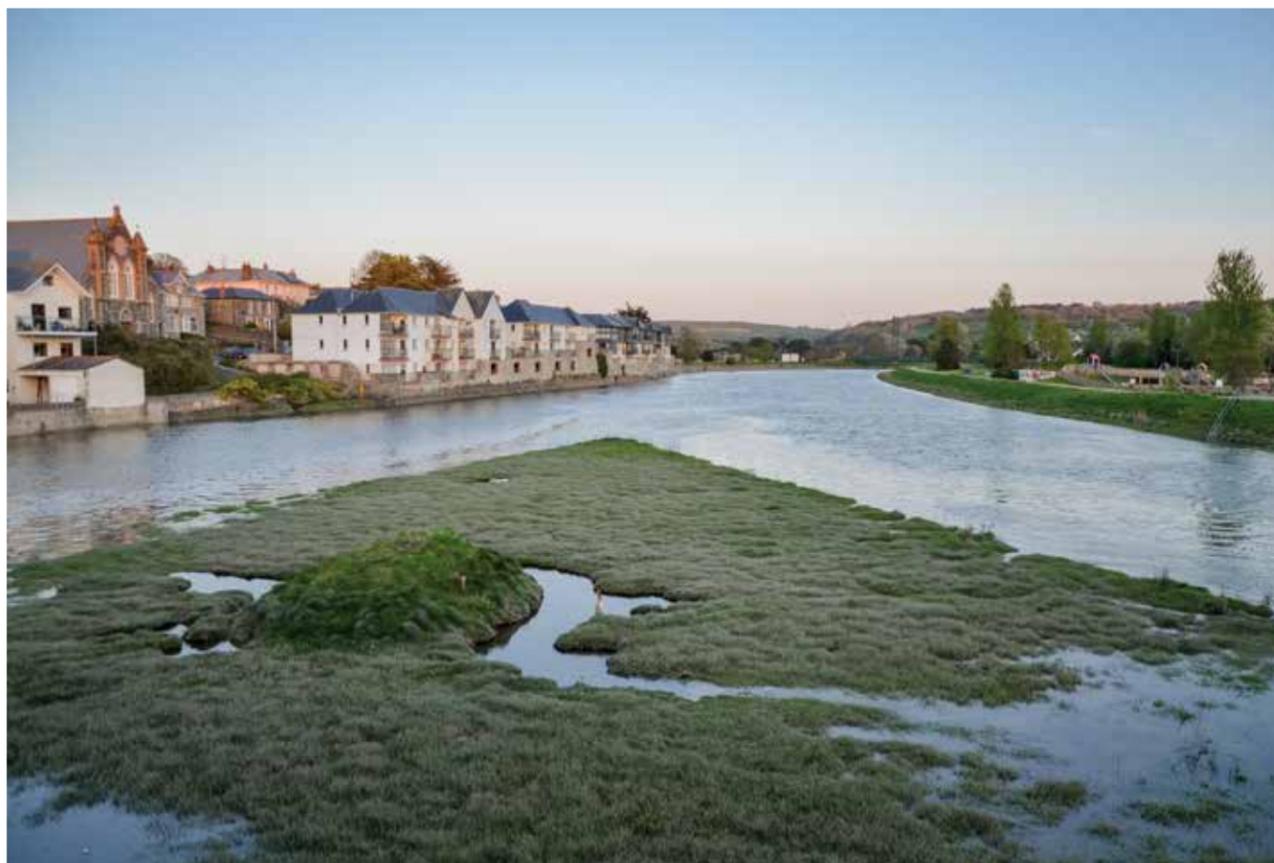
Figure 3. Household annual income



The customers

The high percentage of WREN members (73 percent) and those with solar PV (34 percent) signing up suggests once again that already being engaged in energy issues makes them more likely to sign up and accept a greater level of risk.

The participating households had a wide range of annual energy consumption figures and a variety of means of heating their homes, which indicates that a time of use tariff does not attract a particular type of energy user.



The response

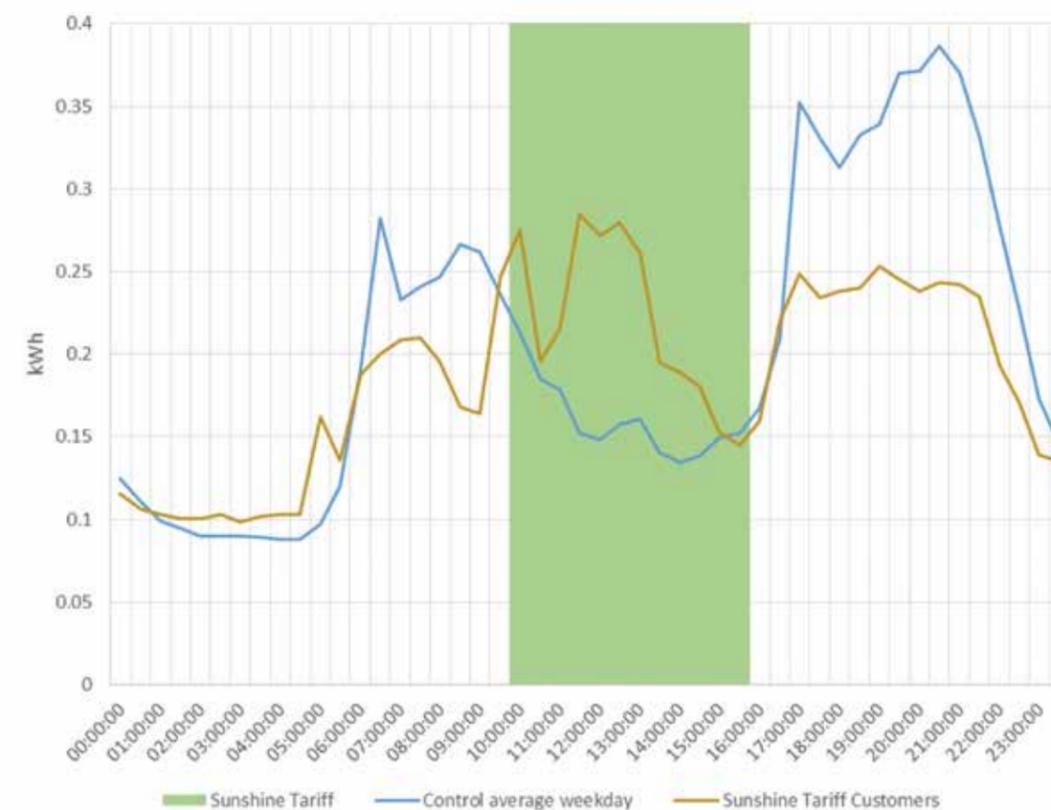
The 'Sunshine Tariff: The customer response' report sets out the findings from the trial in detail.

The key findings are summarised below.

Participants on the Sunshine Tariff on average shifted 10 percent of their demand into the 10:00-16:00 period.

The average household shifted a total of just under 150 kWh over the 10:00-16:00 period from April to September. In order to offset the generation from a 250 kW solar farm, approximately 650 Sunshine Tariff customers would be required.¹ This would be approximately 20% of the homes in Wadebridge.

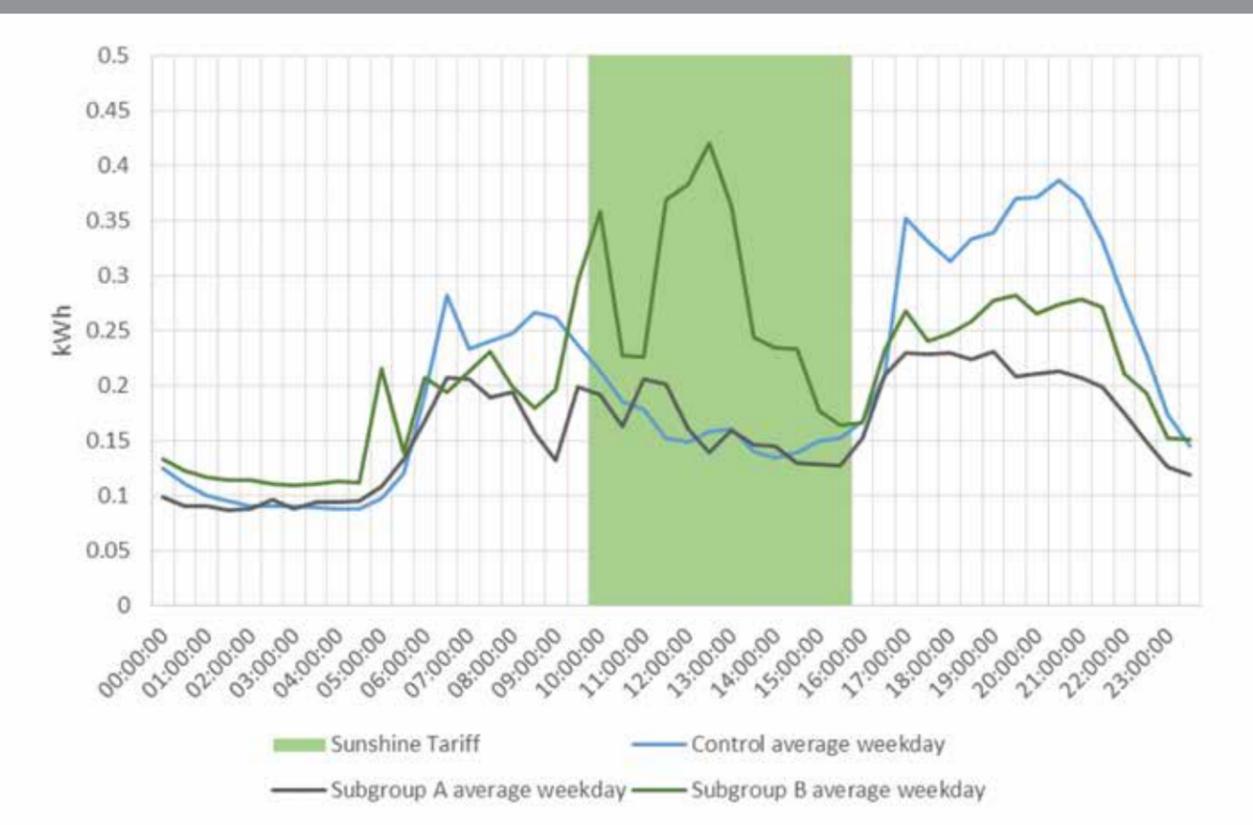
Figure 4. Comparison of the whole cohort average weekday demand during Sunshine Tariff trial against the control



The households with automation technology (subgroup B) were able to shift 13 percent of their consumption into the 10:00-16:00 period compared to five percent for those without automation (subgroup A).

¹ Based on an 11.1 percent load factor and 40 percent of the total annual generation taking place in the 10:00-16:00 period between April and September.

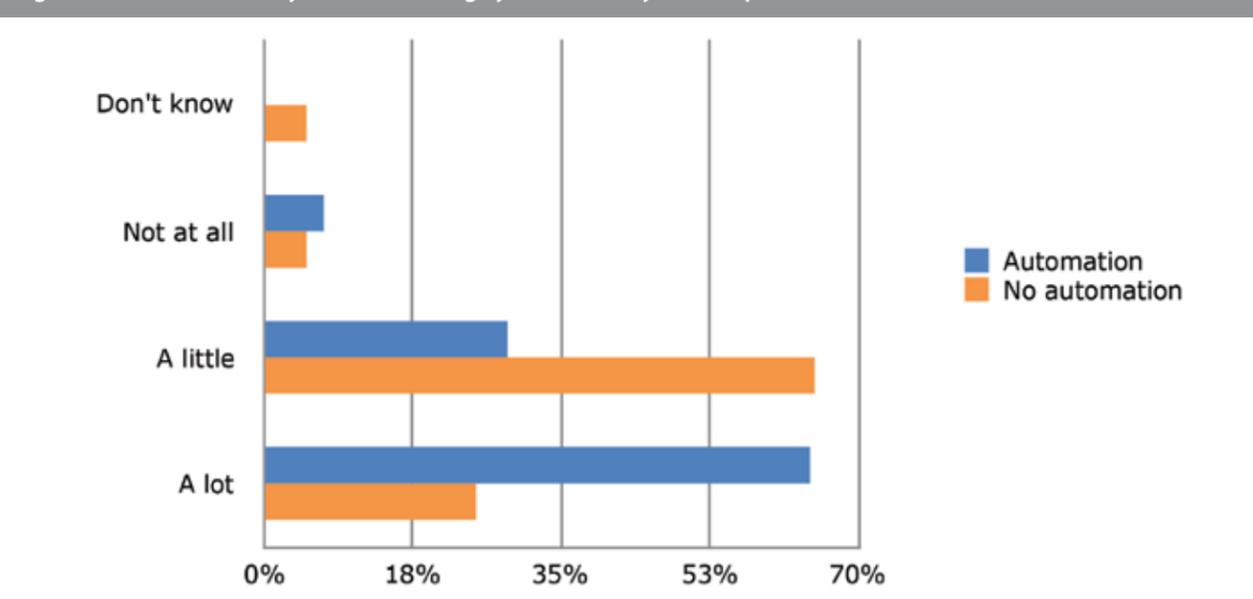
Figure 5. Comparison of demand profile for subgroup A and B against the control for the average weekday



The results of interviews with participants back up the data. Overall, automated control technology was perceived to be helpful in shifting electricity consumption to the middle of the day and the customers with automation were more likely to sign up to a time of use tariff again in the future.

The findings from the households with automation technology suggest that 360 Sunshine Tariff customers would be required to offset generation from a 250 kW solar farm, compared to 650 of a mix of customers with and without automation.

Figure 6. How much were you able to change your electricity consumption?



Other comparisons within the dataset indicated that:

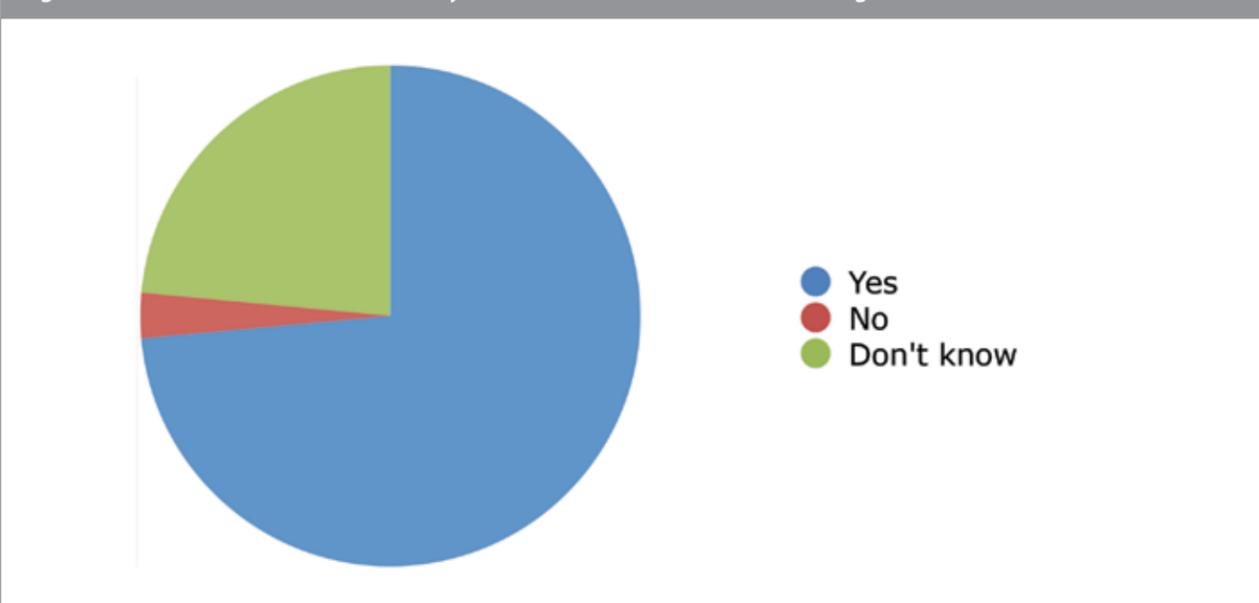
- The retired/unemployed group were able to shift seven percent more demand to the middle of the day than the employed/self-employed, potentially due to being at home more during the day
- High energy users were able to shift a greater proportion of their consumption (18 percent) into the Sunshine Tariff hours than the low and medium energy users. This is most likely due to having a larger flexible load, such as hot water immersion or an electric vehicle
- Although the sites with PV imported less power than those without PV, they tended to shift one percent more of their consumption into the 10:00-16:00 period than households without PV. The interviews and survey revealed that some customers with PV had already established habits of using more power during the middle of the day

- Wadebridge Renewable Energy Network (WREN) members shifted up to three percent less consumption than non-members. This is most likely due to a lower proportion of WREN members in subgroup B, which generally had higher loads and automation technology.

When customers were asked about how they changed their behaviour, their perception of how much they shifted was greater than the smart meter data indicated. This may be due to a lack of understanding of how much electricity individual appliances use. For example, it may require considerable effort to use a washing machine in the middle of the day instead of the evening, but the impact is relatively small.

Overall, customers reported a positive experience of taking part in the trial and when asked if customers would switch to a time of use tariff again in the future, nearly three quarters said they would.

Figure 7. Customer view on whether they would switch to a time of use tariff again



The conclusions

Government has set a clear policy aim to move to a smarter and more flexible energy system. The findings of the Sunshine Tariff trial provide an insight into the scale of flexibility that might be available from domestic demand side response and where it might provide value in the system.

A key finding of the trial is that time of use tariffs can produce a shift of domestic demand from evening peak to daytime. Customers with automated control technology were able to shift 13 percent of their daily demand into the 10:00-16:00 period. However, demand shifting is much smaller in those customers without automation of key loads who are relying on behaviour change alone.

Whilst a shift in demand can be achieved by some customers, the trial also found that persuading the average customer to switch to a time of use tariff and adjust consumption patterns is challenging. Currently, interest in such tariffs for domestic customers appears to be focused in the energy engaged and aware. This suggests that a price incentive alone is not enough and that education will need to accompany the introduction of time of use tariffs.

In terms of the value to the network, the evidence of the trial is that demand side response from domestic customers based on a time of use tariff is not yet a sufficiently sizable, predictable or robust response to overcome a specific local network constraint.

For domestic demand side response to become a significant provider of flexibility to the electricity networks, the learning from the Sunshine Tariff recruitment shows the importance of key market developments:

- High penetration of smart metering and domestic half hourly settlement
- Simpler and more efficient supplier switching
- Increases in domestic flexible loads
- Increases in penetration of automation technology.

More work is needed on what market design can be used to incentivise flexibility on local networks.



Project partners

