Bristol Energy

Smart System Transformation

BRISTOL energy

Innovate UK

regen transforming energy

Bristol has long led the way in the fields of energy, sustainability, digital and future start-up companies. It has the lowest carbon footprint of any of the UK's Core Cities and is moving forwards with innovative pilot schemes that will help build the city's future smart energy system. In November 2018, Bristol City Council declared a climate emergency and has formally adopted the goal of Bristol becoming a Carbon Neutral City by 2030. Bristol has an opportunity to build a citywide energy system that will protect the environment, improve quality of life and deliver something transformative.

The Bristol Energy Smart System Transformation was funded by Innovate UK, run by the following partners.

Introduction

The first phase of the Bristol Energy Smart System Transformation (BESST) project's objective was to design a customer-focussed way to deploy smart energy and digital technology at scale, to reduce energy system costs and deliver a radically new customer experience for local energy consumers and businesses.

Building on Bristol's track record as a green energy pioneer, as well as the UK's most creative city, the BESST investment project looked at how to create a cluster of smart homes and businesses across four wards in west Bristol including the Avonmouth and Severnside Enterprise area.

> *For truly transformative change in the energy system, the consumer needs to be at the heart of innovation. Social equity and energy justice are key considerations to deliver smart energy technology solutions that reduce carbon, pollution and fuel poverty for a healthier, more sustainable society.*
>
> Laura Penny, Bristol Energy

> *To really decarbonise our energy system, every home and business will need to play its part. Finding different ways of buying energy services that are not only low carbon, but also affordable and user-friendly is an important step in that journey.*
>
> Tamar Bourne, Regen

What's the best way to deploy low carbon and smart energy technologies to businesses and homes across the city? What do communities and businesses want from new, innovative service propositions? And how can the energy supplier find new sources of value to enable investment without having to increase prices for the end user?

These are some of the questions the BESST project team grappled with.

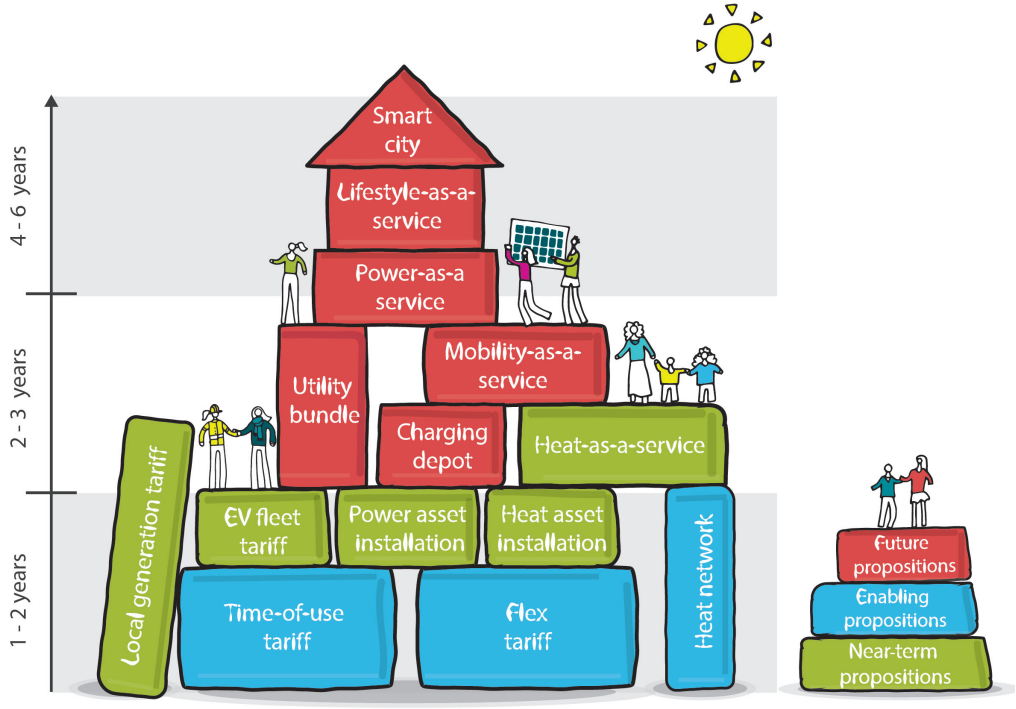
Fourteen different service propositions were identified, explored and consulted on with both communities and businesses. These included smart tariffs, installation of microgeneration technologies, virtual matching of demand with local generation, remote control of heating and appliances and a number of 'as-a-service' models.

Energy-as-a-service, for example, does away with charging customers for how much energy they use, focusing instead on how they use energy. Rather than paying for the number of kilowatt hours you consume, you will instead select a tariff such as 'Comfort' where you could pay a monthly subscription rather than a cost per kilowatt hour.

Through the process of exploring the different components of each proposition, the sources of value that could make it competitive, the potential regulatory barriers and whether it is replicable or not, the fourteen propositions were narrowed down to five. These five had the most potential in the near-term. Some propositions were identified as enablers and others were put on hold until a later date.

The illustration opposite sets out the different propositions and shows how some can provide a building block for a more advanced service. The five near-term propositions are shown in the green blocks and are explored in more detail in the following pages.

Where we have identified a potential regulatory barrier or enabler, these have been drawn out and summarised in the policy recommendations on the last page.



Over the following pages we will explore a number of propositions in a bit more detail, including;

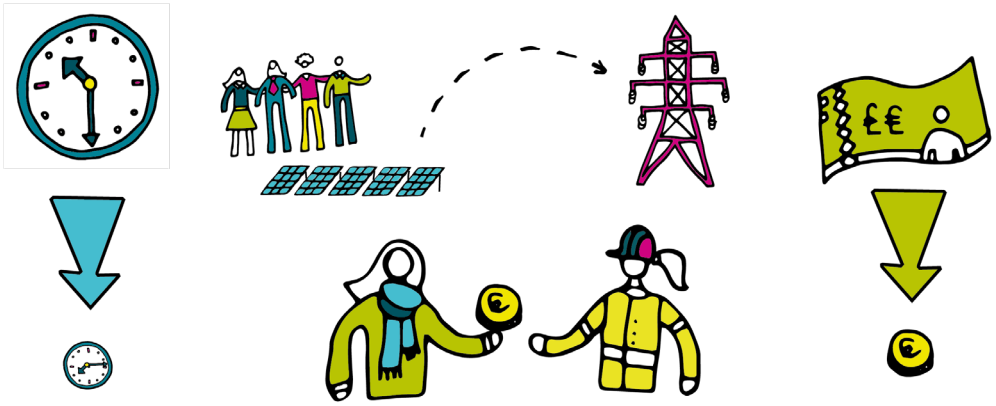
- Local generation tariff
- Power and storage asset installation
- Heat asset installation
- Heat-as-a-service
- EV fleet tariff

Local generation tariff

Consumers within a specified geographical area could sign up for a 'local generation tariff' to express a preference for renewable electricity generated locally. It would be a flat-rate tariff similar to the going market rate. The supplier would, in return, secure a minimum amount of local generation to meet the demand.

The tariff would have a discount or 'rebate' on the portion of demand that is matched to local generation. This would require regular reconciliation, either monthly or annually, to calculate the portion of local demand that is virtually matched to local generation. This can be achieved using half-hourly meter data to establish when power was used, with half-hourly settlement. The proposition would include light encouragement for timeshifting.

This could be directly linked to preferential Power Purchase Agreements (PPA) and/or an export tariff for locally-generated renewable energy.



Opportunities

1. Virtual link between generation and demand can enable some matching, which could have value implications e.g. lower network and supply imbalance costs
2. If marketing is successful, mass switching would enable the supplier to provide a PPA uplift, which could stimulate installation of more local renewables
3. No regulatory barriers

Challenges

1. Difficult to find enough value in current system to lower the tariff enough to make it attractive on a mass scale. It is unlikely to have a positive impact on fuel poverty
2. A reconciliation methodology is required to share local supply on a half-hourly basis between customers – this could be complicated and costly to set up
3. Successful roll-out of smart meters and half-hourly settlement are still one-two years off

Summary of value potential

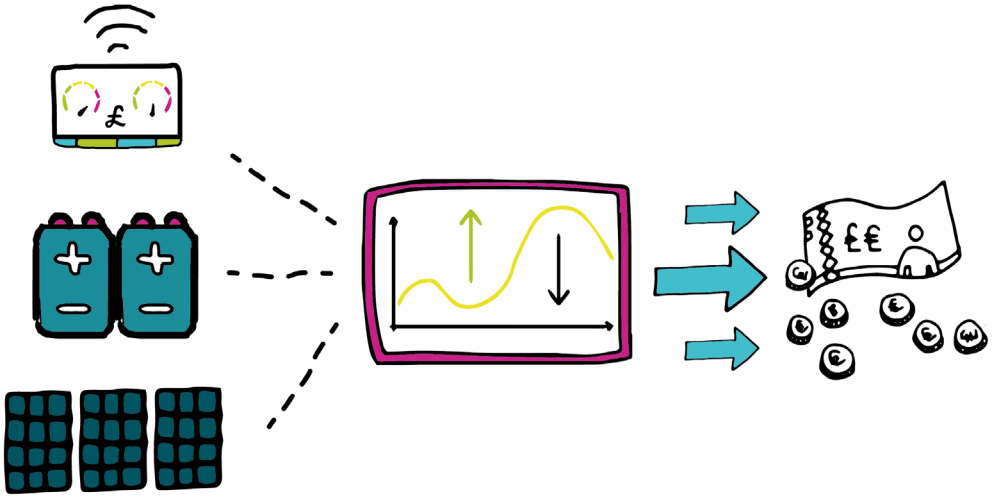
- Key source of value comes from potential to attract and retain customers, which the supplier can reflect in either: 1) a slightly cheaper tariff; 2) an uplift for the generator; or 3) payment into a community benefit
- Potential for customers to timeshift some demand to match local generation and reduce their energy bill
- Potential to encourage more local renewable installations through more attractive PPAs

Power and storage asset installation

The supplier could install a 'solar only' or 'solar plus battery' package for domestic or commercial properties. There would be a two-rate tariff: self-consumption of solar would be charged at a lower rate than grid purchased (residual) electricity. The battery would support more self-consumption and reduce any peak grid requirements.

The solar plus battery package would be installed as a hyper-local energy private wire and the consumer would be free to switch their residual supply to a different supplier.

Pricing would be index-linked and always be price-reflective, but would be kept lower than the retail price.



Opportunities

1. Rolling out solar PV across homes and businesses
2. Potential to relieve fuel poverty by providing a cheaper tariff to those in social housing
3. Battery management by the supplier provides the ability and flexibility to access different sources of value and keep the tariff low

Challenges

1. The 'solar plus battery' model currently only works for multi-occupancy buildings, which limits the market
2. Would need to lock the customer into a long-term contract, which may have acceptability issues
3. Adding a battery to a 'solar only' proposition requires a significant cost reduction to begin to be financially viable

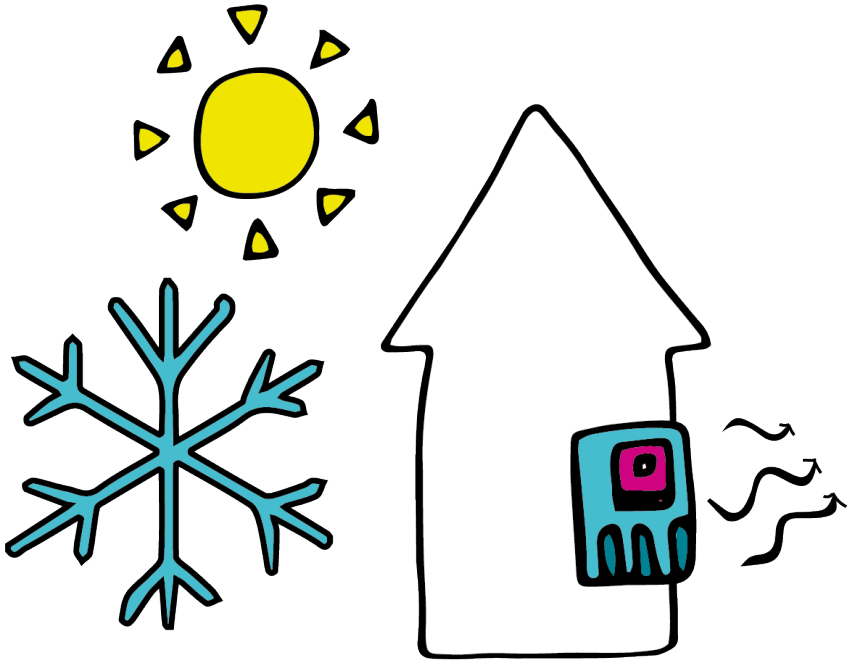
Summary of value potential

- For the 'solar only' proposition, modelling suggests that with an export tariff of 5.5p per kWh, the asset would pay back in 14-16 years which makes it a reasonable investement for a local authority
- At current battery costs, the 'solar plus battery' proposition is viable for properties with high electricity demand, or for multiple properties connected to a communal battery
- As more homes are added to a communal battery, the battery's usage is maximised and the rate of return plateaus. Therefore the battery must be sized appropriately
- Cost reductions are possible through economies of scale and/or council subsidies

Heat asset installation

The supplier could finance and install heat pumps, and then charge a monthly subscription for heating separate from the electricity bill. This would target both single properties with individual heat pumps and multi-occupancy properties with a common ground loop or heat network ground source system.

The charging mechanism could be based on a Heat Trust comparator basis, ensuring that customers receive a 5-10% savings to standard gas prices. If sensors were included, this could expand to a Heat-as-a-service model, being charged on heat hours delivered.



Opportunities

1. Onsite renewable generation of heat both reduces pressure on national generation assets and increases the use of green power
2. Potential for significant cost reductions for heat pumps. Also there are efficiency improvements with shared ground loops and integration with heat networks
3. Could provide a building block for a Heat-as-a-service model

Challenges

1. Would need to lock the customer into a long-term contract, which may have acceptability issues
2. The commercial viability of installing a heat pump is case dependent and limited to certain property types
3. Questions remain on how to bill for the heat separately from the remaining electricity bill

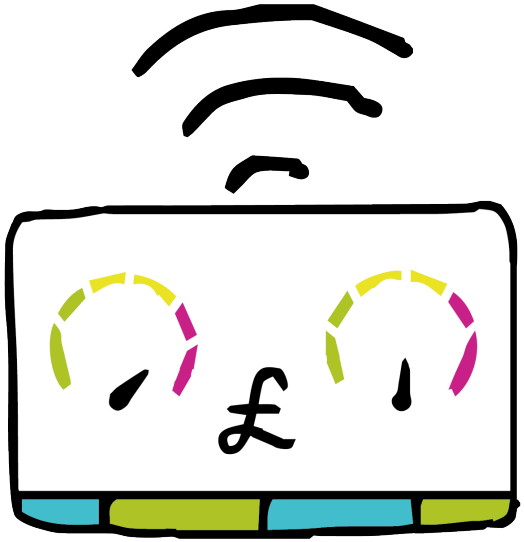
Summary of value potential

- At current costs, the proposition would be viable in the following types of home:
  - New build properties connected to a shared ground loop/heat network
  - Electrically heated homes with a high demand and/or can connect to a shared ground loop
  - On-gas properties that benefit from the use of waste heat and/or has a large area for cheaper horizontal ground source heat pump systems
  - Whole house retrofit projects e.g. EnergieSprong
  - Off-gas grid properties on expensive and high carbon oil and liquid petroleum gas
- The use of waste heat via Bristol's heat network would improve the heat pump efficiency and thus the value of the proposition
- There are significant opportunities for heat pump cost reductions, such as having an energy service provider market, install and manage the heat pumps, as well as mass deployment

Heat-as-a-service

The supplier could deliver a defined level of heat (temperature) to the home for a fixed price. This might be extended through add-ons, such as a higher price for higher room temperature or discounts for energy efficiency improvements. The customer would make their thermostats and zonal heating system controls available to the supplier's control so that the supplier could maintain temperatures while minimising costs. The supplier contains its risk of customers behaving inappropriately (e.g. leaving windows open in winter) through 'fair use' policies built into the contract.

The first iteration of this proposition would introduce the heat-as-a-service concept, gather data and target customers in fuel poverty, with an offer of energy efficiency measures if appropriate. An extension would introduce generation asset installation and encouragement for timeshifting of consumption and flexibility benefits.



Opportunities

1. Innovative proposition that could enable the supplier to introduce remote control and some timeshifting
2. Customer receives a defined level of service at a set price, which will appeal to those with a preference for a fixed price regardless of the weather or time of year
3. Could support those in fuel poverty if the fixed price is set lower than the standard cost

Challenges

1. Transparency in the billing and information provided to enable comparison with other tariffs
2. Energy savings can only be achieved if long-term investments are made in the property, which requires locking the customer into a long-term contract
3. Supplier takes the risk on fixed price, particularly in relation to 'fair use' of power, weather, wholesale price etc.

Summary of value potential

- Zonal heating controls can generate value by reducing overall consumption, but this would require a complex back office system that encompasses consumer preferences, historic heating profiles and weather forecasts
- The first step of introducing the proposition is useful for gauging interest and gathering data but the value proposition is small
- In the future proposition, where energy efficiency measures and heat assets are rolled out, the value starts to build up
- The supplier takes on weather risk and can lose out in the event of a cold winter

EV fleet tariff

The supplier could sell energy to an EV fleet owner to enable fleet drivers to charge their vehicles wherever it is convenient at charging points, the workplace or at home.

It could operate for public charging, allowing a driver to charge their vehicle at any public charge point, potentially operating across multiple charging networks. An app would store 'fuel card' details and link to a bank account.

It could also operate for home charging for business miles. When a charging session begins at home, it triggers a reimbursement. This could be done through the app, given an approximate calculation of energy usage, or more accurate measurement using a smart cable with metering. Alternatively, if MPAN regulations change, they could allow separate metering for EV charging in homes.

The supplier would operate a time-of-use scheme, probably three-tier, and the smart charger would calculate the most effective charging time for each vehicle. Supplier billing would need extending to enable pay-as-you-go services for public charge points and links between homes and business customers.

The proposition offers a first step into 'mobility-as-a-service'.

Opportunities

1. The ability for EV fleet drivers to charge at home and bill against a corporate tariff provided by a single energy supplier is an innovation and solves a current barrier to fleet electrification
2. Fleet owners will be the first to adopt EVs and so are a good early market to target. They are also large energy users
3. The three-tiered tariff will incentivise customers to shift consumption to off-peak times to reduce their bill

Challenges

1. Separate metering for business EV charging at home is not possible under current regulations
2. Need to explore size of the market of fleet businesses that are a mix of return-to-home and return-to-base
3. Need to investigate appetite for establishing partnerships across multiple charging networks

Summary of value potential

- The three-tiered tariff could incentivise customers to shift consumption to off-peak times to lower their energy bill and reduce strain on the network
- The use of a 'fuel card' gives the supplier the opportunity to offer other services around fleet management, such as e-billing, driver performance rating, mileage and CO_2 tracking
- Potential for fleet vehicles to provide distribution and transmission flexibility services

Next steps

It is an exciting time for Bristol as it transforms its energy system and works towards its goal of becoming a Carbon Neutral City by 2030. BESST is part of the City Leap strategic investment programme of £875 million that aims to build a citywide smart energy system. As Bristol City Council's energy company, Bristol Energy can play an important role in this transition.

Throughout the project, partners kept the longer-term vision in mind, along with links with the wider smart city concept. The prospect of empowering customers to take up new propositions that deliver energy saving and smart energy technology solutions is an exciting prospect for suppliers such as Bristol Energy.

The future of energy-as-a-service models provides exciting opportunities, especially as demand for electric vehicles, smart appliances and energy storage grow. But with it also comes uncertainty and disruption. Further analysis would look deeper into providing value to the customer, wider system benefits and carbon savings.

Some of the service offers could be introduced through pilots before the wider market is ready. This would enable the testing of back office functions and customer acceptance before wider roll-out.

Alongside more detailed design and pilots, continued effort is needed to address the regulatory and policy barriers that exist to smarter service propositions, which are set out opposite.

Policy recommendations:

- Local balancing of generation and demand can reduce pressure further up the electricity networks and should be rewarded through the charging structure, as proposed through 'shared access'.
- Meter splitting through Code Modification P379 could enable multiple suppliers and more innovative propositions, as customers would be able to switch between suppliers for their residual supply. This would make innovative propositions more competitive and acceptable.
- Decarbonisation costs should be incorporated into gas prices. This would make renewable heat propositions more competitive.
- Long-term certainty should be provided for the electrification of heat to enable investments to be made.
- Extension of the Renewable Heat Incentive is essential for enabling the installation of heat assets.
- Suppliers should be able to use remote control of flexible assets in their customers' properties to access lower use of system charges and/or flexibility market payments. Government should ensure that these incentives are available to aggregators of all scales.