Insight paper

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Integrate to Zero:

Rewarding consumers for energy flexibility: global market highlights

CORNWALL INSIGHT

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1. About Cornwall Insight

Getting to grips with the intricacies embedded in energy and water markets can be a daunting task.

There is a wealth of information to help you keep up-to-date with the latest developments, but finding what you are looking for and understanding the impact for your business can be tough. That's where Cornwall Insight comes in, providing independent and objective expertise.

You can ensure your business stays ahead of the game by taking advantage of our:

- **Publications** – Covering the full breadth of the GB, Irish, and Australian energy industries, our reports and publications will help you keep pace with the fast moving, complex and multi-faceted markets by collating all the "must-know" developments and breaking-down complex topics
- **Market research and insight** – Providing you with comprehensive appraisals of the energy landscape helping you track, understand and respond to industry developments; effectively budget for fluctuating costs and charges; and understand the best route to market for your power
- **Training, events and forums** – From new starters to industry veterans, our training courses will ensure your team has the right knowledge and skills to support your business growth ambitions
- **Consultancy** – Energy market knowledge and expertise utilised to provide you with deep insight to help develop and implement winning business strategies
- **Research** – Creating new knowledge and insight in markets that are rapidly evolving, leveraging our in-depth knowledge and expertise in the energy sector to design thought leadership campaigns to suit your needs.

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2. Table of contents

3. Executive summary

This report explores the highlights, insights, and themes that are characterising household flexibility markets around the world. We carried out our desk-based research using an initial review of different energy markets to evaluate and highlight the flexibility-focused propositions that were present.

Of the propositions that we have reviewed, some of the highlights include:

Service provider	Overview
Looop Denki	The utility participated in a VPP trial project in Japan to charge and discharge household battery storage units, with electricity supply offerings linked to low carbon technologies
Octopus Energy	In the GB market, it offers dynamic time of use, export, and vehicle to grid tariffs. Includes an import and export tariff for solar and storage with fixed rates at different times of day
OhmConnect	The flexibility service provider rewards customers in the USA for reducing consumption, including via automatically connected devices, in response to electricity grid requirements
Reposit Power	The service offers customers in Australia seven-year 'no bills' arrangements, with customers paying for combination of technologies, which Reposit Power optimises in various ancillary markets

Our research identified the following key insights and themes across global energy markets:

- Flexibility market offerings exist in both liberalised and centralised electricity markets
- Flexibility is consistently seen as a way of mitigating intermittency, balancing demand and renewable supply, and managing network constraints
- New policy approaches and network management tools can present new and valuable opportunities to household flexibility, which can struggle to access existing options
- Most flexibility offerings come from the utility serving the customer. However, examples exist of consumers being able to access separate flexibility offerings from third-party providers. This creates more choice for consumers and encourages competition and innovation in the market
- Partnerships facilitate propositions that cross several elements of the value chain, with specialist providers at each juncture
- Propositions are often presented in a standardised and simple format, focusing on financial benefits
- Payment plans can offer low upfront costs for technologies, improving accessibility to savings and payments for flexible response

Looking forwards, we think that the evolution of the flexibility markets will be driven by:

- Designing flexibility into buildings and infrastructure
- Policy changes to electricity market structures to facilitate market access for (aggregated) household consumers
- Linking electricity markets with electrification of transport
- Integrating more smart devices into whole-home systems

4. About the report

4.1. Summary of research objectives

This report sets out the findings of a global scan of progressive flexibility-focused propositions for household consumers, considering the structure of benefits for consumers and identifying themes that are characterising this emerging market around the world.

Where we refer to flexibility, we are using this as a catch-all term to capture the range of customer activities and market mechanisms that can deliver value to domestic customers, flexibility service providers, and the wider electricity systems. In this report, "flexibility" is therefore also used to cover analogous activities and terms like demand side response, demand management, and energy services. Where a market offering is specific to a technology or customer action (e.g. an export tariff for solar PV and a battery) we highlight these characteristics. Where relevant, we also note the role of virtual power plant (VPP) operators as part of the value chain in delivering the flexibility services to customers.

This independent research paper has been prepared by Cornwall Insight and forms part of a wider initiative, Integrate to Zero, funded by The Climate Emergency Collaboration Group.

4.2. Our approach

Our research of global flexibility propositions aimed to put a spotlight on innovative market offerings in multiple different energy markets around the world. Countries and companies that we chose to include in this research paper were those that we identified through preliminary desktop assessments of market conditions, market design, commercial offerings, and flexibility capabilities. All of the markets feature novel and innovative market offerings on the national or global platform, which take steps towards managing domestic energy to the benefit of the individual as well as the relevant country's electricity system. Alongside delivering value directly, these propositions may also provide pathways to support similar market offerings in other geographies.

We have identified a range of companies across Germany, United States of America (California state), Australia, Chile, Japan, South Korea, Kenya, and the United Kingdom offering or developing flexibility propositions to households. The 21 offerings that we highlight in the report can be categorised into three main groups:

- Value for exporting power to the grid (export rate)
- Value for shifting consumption to a different time of day (Time of Use (ToU) import tariff)
- Value for aggregated export or import actions as part of a Virtual Power Plant (VPP)

As a baseline, many countries offer a financial incentive for households exporting electricity (typically from solar PV) to the networks and we have therefore not included these offers in our

research. We have done this to focus on the additional benefits that can be delivered at a system level when flexibility is rewarded[1]. Deploying low carbon technologies at scale in homes without engaging with the opportunities from flexibility-focused services (e.g. net metering) can create system level challenges, even whilst delivering payments to end customers. While several of the companies identified offer services in multiple regions, we have focused on country specific examples in the case studies provided.

4.3. Report structure

The remainder of the report is structured as follows:

- Section 5 outlines the headline insights and observations from the desktop research
- Section 6 summarises our global review of flexibility propositions for household consumers, highlighting the different approaches taken in different regions
- Section 7 provides a thematic analysis of propositions, identifying trends and providing case study examples
- Section 8 considers the potential future evolutions for the emerging household flexibility sector, as many global energy markets transition to net zero

1 For an example of the scale of benefits on offer and the barriers to achieving them in the GB energy market, our previous paper with Integrate to Zero on the carbon and cost reduction opportunities from integrated energy in GB is available here

5. Headline insights

In this section, we highlight key learnings from the research for policy makers and market practitioners exploring the development of flexibility and virtual power plants. These are presented here across three over-arching themes of:

1. Energy system structures
2. Key provider capabilities
3. Engaging and rewarding customers

1. Energy system structures

Our research highlighted several characteristics of energy systems that influenced household flexibility offerings, also explored further below:

Flexibility market offerings exist in both liberalised[2] and centralised electricity markets

Flexibility is consistently seen as a way of mitigating intermittency, balancing demand and renewable supply, and managing network constraints

As electrification and renewable deployment increase, opportunities for flexibility markets grow

New policy approaches and network management tools can present new and valuable opportunities to household flexibility, which can struggle to access existing options

Some geographies have regulated minimum requirements for energy supply which provide a price floor and can protect customers

Most flexibility offerings come from the utility serving the customer but opportunities are increasing for third-party flexibility service providers

[2] We use liberalised in this report to refer to markets where levels of competition in domestic energy services are possible

- **Flexibility market offerings exist in both liberalised and centralised electricity markets**
  - Markets with more liberalised energy supply and services structures generally presented a greater number and variety of flexibility-focussed services. These ranged from competitive export rates for households with solar PV to virtual power plant (VPP) asset management services
    - For example, the Californian market has comparatively high levels of import, export, and VPP proposition penetration. The market sees significant (and rising) levels of renewable generation deployed, high levels of demand electrification, and associated network management requirements whilst being designed around a competitive market structure
  - Flexibility-focused services were also present in more centrally-operated electricity supply markets, from technology-specific time of use tariffs delivered for electric vehicle (EV) users in Kenya to developing on-site industrial demand response and VPP capabilities in Chile and delivering VPP policies and functions in China
- **Flexibility is consistently seen as a way of mitigating intermittency, balancing demand and renewable supply, and managing network constraints**
  - These energy system dynamics were raised across markets by parties in our review, with domestic flexibility offering a relatively novel tool to manage these rising system challenges
- **As electrification and renewable deployment increase, opportunities for flexibility markets grow**
  - Changes in market design open opportunities for new and developing propositions, particularly as new network stability tools are developed in the face of growing levels of renewables deployment and demand electrification. Across markets in the USA, Great Britain and South Korea, these network management mechanisms are presenting value streams that service providers and VPP operators are commercialising with demand-focused flexibility services
- **New policy approaches and network management tools can present new and valuable opportunities for household flexibility, which can struggle to access existing options**
  - Engaging with (sometimes multiple) revenue streams that are intended for centralised generators or large businesses can present complexity for flexibility propositions aimed at households. For example, technical metering and response requirements for participation in network stability and management services are outside the capabilities of many current domestic low carbon technologies. Adapting current services and developing new tools that can accommodate and reward household flexibility can unlock benefits for customers and energy systems
- **Some geographies have regulated minimum requirements for energy supply which provide a price floor and can protect customers. However, overly simplistic floors can limit opportunities for flexibility, impacting overall system costs. In all geographies that we studied with a floor in place, the market offerings we highlighted all exceeded that floor**
  - For example, in the GB market the Smart Export Guarantee (SEG) places a requirement on energy suppliers to offer an above-zero rate for electricity exported from a household, e.g. via surplus solar PV. Those suppliers identified as presenting competitive services, including

Octopus Energy and OVO Energy, all offered export rates of at least 20p/kWh, materially above the minimum mandated level

- However, accessing the best rates under these propositions were contingent on meeting exclusivity requirements or linked to customers taking and/or already having combinations of multiple assets
  - The leading SEG tariffs identified above were all exclusive to the suppliers' existing customers and offer around five times the p/kWh value of the open market propositions from suppliers with SEG tariffs at the bottom of the market

- **The majority of flexibility offerings come from the utility serving the customer. However, examples exist of consumers being able to access separate flexibility offerings from third-party providers. This creates more choice for consumers and encourages competition and innovation in the market**
  - Across highly liberalised and more centralised energy markets, prevailing market structures which focus on providing customers access to electricity via relationships with utilities mean that consumer access has typically been delivered through these utilities with existing relationships and established billing arrangements. This is often in the form of time of use import tariffs or export tariffs (either fixed-rate or time of use) for those customers with solar PV. This provides a competitive advantage to parties with these relationships in place. The ownership of the customer relationship is commonly steered by market regulations
  - However, several markets that we explored are opening up to new types of services and companies that can offer innovative aggregation services for households (e.g. VPP development in Shenzhen and Guangdong, China, or new regulations to allow non-supplier flexibility services for households in GB). Frequently, these are third-party providers (i.e. not the household or site's provider of import electricity rates) delivering asset management and aggregated VPP services for low carbon asset(s)

2. Key provider capabilities

There are several core elements from service providers that underpin different flexibility propositions and are emerging as pre-requisites for offering flexibility benefits to a broader range of households, including:

Complete time stamped measurement of import and export actions

in order to accurately take demand-side flexibility into wholesale and network management opportunities and to demonstrate and reward customers for those actions

Maintain sufficient customer relationship management and billing capabilities

in the software, systems, and communications used by the service provider. This is especially important where propositions include both import and export elements, with the benefits of varying flexible responses collated and delivered through easy-to-understand energy bills

Deliver smart connectivity between different low carbon technologies

to facilitate aggregated home energy management and VPP functions that characterise household flexibility propositions. Connectivity and interoperability are vital for offerings that combine multiple low carbon technologies. This can present a barrier to service providers accessing information across multiple different asset manufacturers within product categories such as solar inverters or domestic-scale battery storage can be challenging

Interface with electricity market and third-party systems in a secure way

to ensure that energy system benefits can be realised whilst maintaining security of customer and system data and communications

Understand and coordinate customer requirements, the impacts of flexibility actions, and revenue stream dynamics

to deliver a flexibility service that can reward customers without negatively impacting customer comfort, convenience, and confidence

- **Flexibility propositions are often developed with large users with high electricity demand first**
  - With capabilities and structures developed with larger-scale industrial and commercia users, some service providers then adapt these propositions for participation by households, potentially with a third-party aggregating responses from multiple households. This enables the structure of services to be developed with the simplicity of a small number of users initially before involvement from a larger group of households
- **Partnerships facilitate propositions that cross several elements of the value chain, with specialist providers at each juncture**
  - The value chain for delivering demand-focussed flexibility services can be long, extending from manufacture of assets, installation and maintenance, optimisation and control, and provision of benefits through proposition design. Among the markets and propositions that we explored; it was rare for a single party to be vertically integrated all along the value chain
    - For example, sonnen's "sonnenConnect" battery management and VPP service in California is delivered alongside partners such as Baker Electric Home Energy, with the latter providing solar and storage installation services to expand sonnen's standalone VPP and asset management proposition

3. Engaging and rewarding customers

In many situations, consumers prefer reliable, predictable actions and associated rewards from flexibility services. we saw this manifest in several different ways.

- Offering recurring fixed-rate payments (e.g, Powershop's VPP in Australia)
- Lump sum upfront payments or discounts to assets (e.g. Sunrun in California)
- Enduring discounts to utility bills (e.g. Looop Denki in Japan)
- Variable-rate rewards to customers through export tariffs, time of use import rates, and utilisation-based payments[3]
- Although fixed or predictable structures can be attractive to customers, there can be misalignment with the value streams and price signals that service providers and VPPs are using to commercialise customer flexibility[4]

[3] Cost schedules were set at least a day in advance under these time of use structures, albeit typically retaining a degree of predictability or certainty to customers, for example through cost estimates and fixed payment schedules

[4] For example, wholesale market arbitrage and utilisation-based payments can be variable at an individual customer level. Providers must also consider how to structure participation rates and rewards for each customer within a broader VPP. This requires management from service providers and considered communication to customers looking to understand how their actions have translated to rewards

- **Customer benefits from flexibility are typically financial, ranging from beneficial rates under their utility contract to fixed payments for participating in VPPs**
  - The level and nature of these benefits are informed by local and national requirements, depending on the energy market. Financial benefits are delivered through both competitive market services as well as centrally procured network management mechanisms depending on the nature of the requirement
  - Several VPP services stack multiple different value streams within a proposition to build more robust, reliable and rewarding opportunities for themselves and their customers. In markets with more mature flexibility-focused network management mechanisms, it is important for providers to be able to 'jump' between the different opportunities that comprise the overall 'stack' of opportunities they take part in
    - This agility in dispatch and management decisions places additional importance on optimisation software to balance customer demand requirements and varying price signals across different opportunities
  - Policy and regulatory changes often impact revenue streams and create challenges in understanding the risks and impacts on value stacks, requiring service providers to have active involvement in market change processes
- **Flexibility services can require customer authorisation for third-party control, which in turn requires high levels of trust in the brand presenting the service**
  - Propositions across geographies use pre-determined requirements around technology 'comfort' levels (e.g. the level of charge left in your battery after optimisation) or guaranteed 'opt-out' functionality to help build customer comfort with these types of service (e.g. the Boost Charging option under OVO Energy's Charge Anytime smart charging proposition for electric vehicles)
  - The requirements surrounding customer authorisation, consent, and technical characteristics of applicable assets vary across providers and technologies. Just as common technical standards and approaches can open up energy service propositions, standardised elements of customer communications and comparisons can help build confidence and engagement in this relatively nascent, but increasingly important, part of energy sectors worldwide
- **Partnership-led routes to market can broaden customer access to low carbon technologies, with integrated offerings important in simplifying the customer experience**
  - As well as simplifying the overall experience for customers, these integrated offerings can also provide opportunities for premium benefits to customers that are accessing multiple services through a single proposition (whether delivered by a single party or collaborative consortium of providers)
  - Customer benefits can be delivered via incrementally greater payments, ranging from
    - Flat payments (e.g. sonnenConnect in the USA),
    - Improved export rates (e.g. Nano Green in the Czech Republic),
    - Stacking fixed discounts (e.g. Looop Denki in Japan)
  - Meanwhile, service providers can also potentially benefit from increased customer retention and larger revenue opportunities from increased capacity under management

6. Summary of global review

In this section, we summarise the results of our scan of international flexibility propositions, categorising the parties that are delivering the propositions and their structures in the table below.

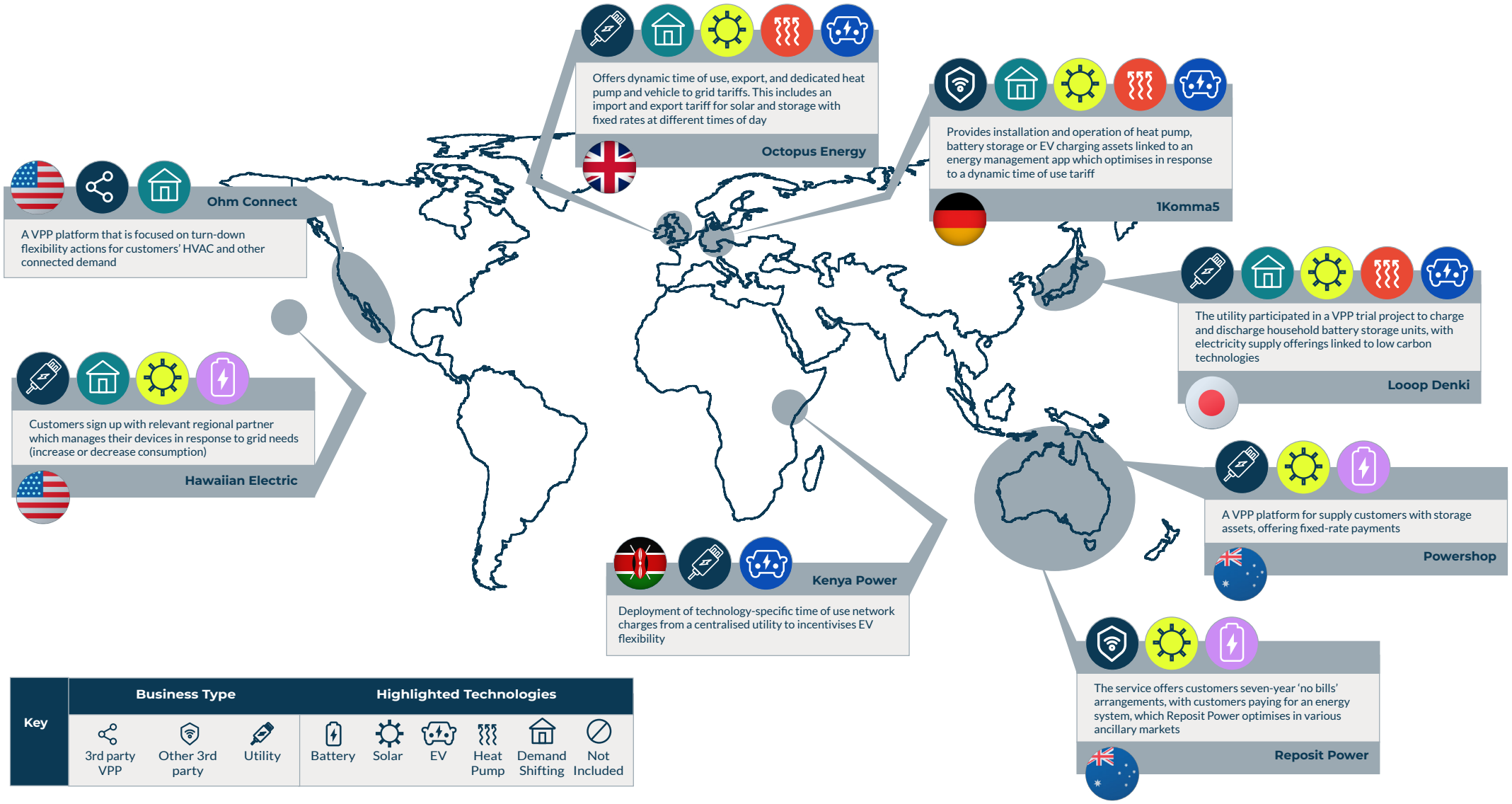
Our research of global demand-side propositions aimed to put a spotlight on innovative market offerings in multiple different energy markets around the world. We conducted desktop research to assess the market dynamics, policy and regulatory structures, and identification of demand flexibility services present in multiple different geographies. Through this process, we have used examples from a broad range of geographies and market types, selected based on desktop research of flexibility propositions available. The service providers and propositions considered through this research are summarised in the table below, with propositions and activities identified from a range of parties across Germany, United States of America (California state), Australia, Chile, Japan, South Korea, Kenya, and the United Kingdom.

Table Key			
Customer benefit structure	Utility Bill (UB)	Cash (Ca)	Vouchers (V)
	Unknown		
Type	Business to business (B2B)	Business to consumer (B2C)	
Target technology	Solar and storage (S&S)	Heat pump (HP)	Electric vehicle (EV)
	Tech neutral (TN)	Demand shifting (DS)	Battery (B)

Company	Country	B2B or B2C	Proposition detail	Target technology	Hardware proposition	Customer benefit structure
Chilquinta	Chile		An early-stage trial of demand side management at industrial sites and development of an associated VPP		No hardware proposition found	
CPower	USA		A VPP optimising behind the meter assets for businesses and households, responding to grid imbalances of varying degrees and durations		No hardware proposition found	
Energy Locals	Australia		Partners with Enosi to offer option to purchase excess solar export from community at lower rates than grid electricity, and to sell or gift excess solar produced to family and friends. Partners with Tesla to offer a VPP service		Community solar and storage	
GivEnergy	Great Britain		A VPP offering customers responsive battery export to grid and optimisation of solar/storage/EV charging with smart tariffs		Through partner installers	
GloBird Energy	Australia		A time of use tariff offering free electricity between 12:00 and 14:00 each day. A range of export rates linked to regional import rates		No hardware proposition found	
Hawaiian Electric	USA		Customers sign up with relevant regional partner which manages customer device in response to grid needs (increase or decrease consumption)		No hardware proposition found	
Kenya Power	Kenya		Deployment of technology-specific time of use network charges from a centralised utility to incentivise EV flexibility		No hardware proposition found	
Looop Denki	Japan		Participated in a VPP trial project to charge and discharge 5,300 household battery storage units		Yes, capex not covered	
Nano Green	Czech Republic		Household export offering for solar PV with associated VPP capabilities		No hardware proposition found	
Octopus Energy	Great Britain		Offers dynamic time of use tariff, export tariff, vehicle to grid tariff. Includes an import and export tariff for solar and storage with fixed rates at different times of day		No hardware proposition found	

Company	Country	B2B or B2C	Proposition detail	Target technology	Hardware proposition	Customer benefit structure
OhmConnect	USA	B2C	Rewards customers for reducing consumption in response to grid requirement in a 24 hour window, or for automatically connected devices with a 15min warning	Home	No hardware proposition found	Bill credit
Origin Energy	Australia	B2C	A VPP offer for import customers, with financial reward for exporting during an event, alongside standard feed in tariff	Battery	Capex covered	Bill credit
Ostrom	Germany	B2C	Time of use tariff with dynamic pricing	Battery, Heat pump, EV charger, Home	Capex not covered (partnership)	Bill credit
Ovo Energy	Great Britain	B2C	Export tariffs with higher rates for existing customers purchasing technology	Home	Capex covered	Bill credit
Powershop	Australia	B2C	Time of use tariff and VPP offering with third party optimisation of the battery in response to price signals. Monthly cash reward applied to electricity bill	Battery	No hardware proposition found	Bill credit
Reposit Power	Australia	B2C	Offers 7 years no bills. Customer pays for a combination of technologies, Reposit Power optimises in various ancillary markets	Battery	Capex not covered	Bill credit
SonnenConnect	Australia	B2C	A VPP proposition including a sign up bonus. Rewards for export in additional to solar feed-in tariff with a retailer	Battery	Capex not covered	Bill credit
Sunrun	USA	B2B	A VPP operating in a wholesale capacity market, exporting during peak demand periods	Battery	No hardware proposition found	Cash
Tesla	USA	B2B, B2C	Optimises battery consumption and export to import time of use rates. VPP option to receive financial benefit for exporting in response to “an event”	Battery	Capex covered	Cash
1Komma5	Germany	B2C	Heat pump, battery storage or wallbox linked to an energy management app which optimises in response to a dynamic time of use tariff	Battery, Heat pump, EV charger	Capex covered	Bill credit
SKTelecom	South Korea	B2C	Innovation trial alongside Soft Berry and 60Hertz to develop integrated VPP offering		No hardware proposition found	?

In the graphic below, we highlight several market offerings that are indicative of the range of proposition types, innovative developments, and different markets we have seen where flexibility is being rewarded.



7. Thematic analysis

In this section, we outline the findings from our research, providing a thematic analysis detailing the various propositions and the benefits they may hold for participants. We have provided case studies to illustrate each of the themes.

- Propositions range from a simple export rate to additional regular payments from VPP revenues
    - Several markets are opening up to new types of services and companies that can offer innovative aggregation services for households. Frequently, these are third-party providers (i.e. not the household or site's provider of import electricity rates) delivering asset management and aggregated VPP services for low carbon asset(s), extending customer options beyond electricity-supply focused relationships. Across the propositions we observed:

Export rate

- Most export rates are offered as a p/kWh although there is some innovation in developing different payment structures

ToU tariff

- Time of Use import rates are typically static, offering different unit rates across two to three fixed time periods each a day, typically a lower rate at night or outside of peak hours. We identified two examples where hourly or half-hourly dynamic tariffs are voluntarily offered

Optimised export or import

- Some companies offer technology optimisation, typically for solar PV and battery storage solutions. This may involve optimising to reduce reliance on imported electricity at more expensive periods, maximising usage of renewable energy or exporting at peak times. We found one example of a ToU tariff paired with whole home optimisation (heat, EV chargepoint, and smart plugs)

VPP Accessing revenues

- VPPs typically target commercial customers with larger consumption loads to respond to price signals. However, there are several emerging offers for households, with aggregation across hundreds or thousands of properties into a VPP to access the frameworks for demand side response revenues

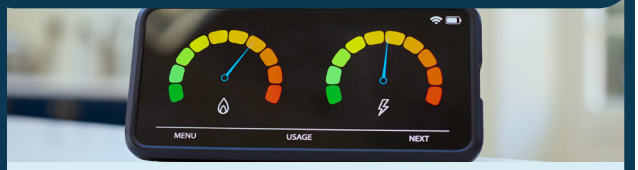
Case Study

Export Rate

UK-based GivEnergy has developed the GivBack offering that provides customers the ability to automatically export their excess stored battery electricity to grid, providing financial reward for exported kWh. This export is achieved via the market offering partner's (Axle Energy) software to connect the battery to electricity markets, paying them for their support of the grid.

Case Study

Time-of-Use

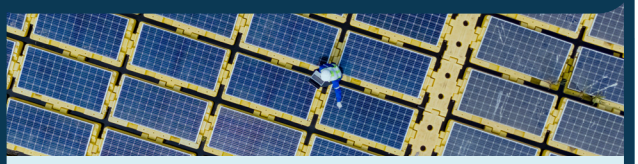


In the UK, Octopus Energy offers Agile Octopus, a dynamic time of use tariff offering access to half-hourly energy prices for customers with smart meters.

In Germany, Ostrom offers its SimplyDynamic tariff which offers a dynamic hourly tariff for smart meter customers. Ostrom's tariff offers savings of up to 35% on customers' annual electricity bill. This tariff can also be paired with Ostrom's Smart EV charging to charge electric vehicles during cheaper periods.

Case Study

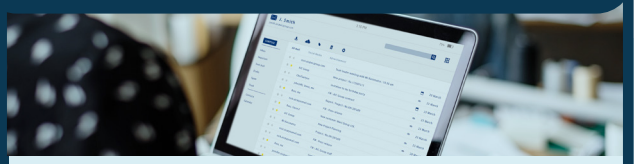
Optimised export or import



1Komma5 offers an energy management system, Heartbeat, to optimise household electricity import and export in response to price signals, using a dynamic tariff. The company, based in Germany, reports optimisation of a solar PV system using the Heartbeat system could see savings of €100/year.

Case Study

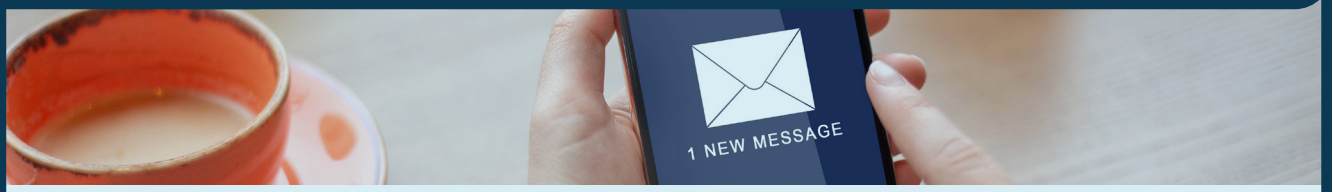
Virtual Powerplant



OhmConnect operates in the US market as a VPP. It notifies household customers of periods of high demand (and therefore high pricing), providing rewards for consumption reduction.

- **Benefits for consumers vary by proposition and range from cash to vouchers**
  - Flexibility activity is sometimes linked to non-cash rewards, including vouchers, competition entry or a points system
  - Many of the services have financial rewards provided through a customer's utility account, although some provide additional regular payments from a non-utility for VPP participation
  - We also found examples of cash discounts for signing up to VPP management services

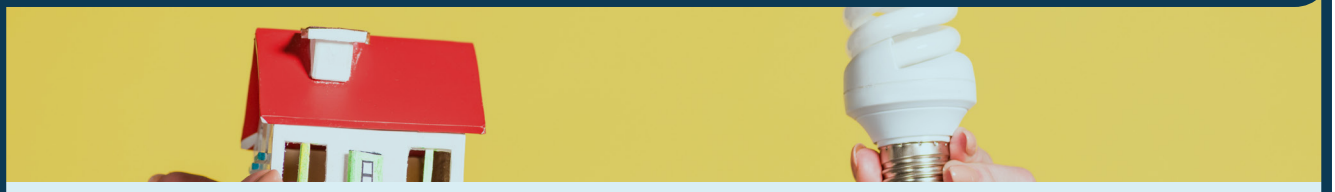
Case Study **Ohm Connect – VPP customer rewards**



California-based Ohm Connect notifies its customers (via email or SMS) of upcoming periods of increased demand. Customers automatically power down their smart devices during these periods. Successfully turning down their energy use earns them Watts credits which they can then use to win prizes, use as gift cards, or withdraw for use as cash.

- **Propositions are currently structured as separate options, although there are emerging examples of "joined up" solutions**
  - Export and import rates are commonly offered separately, and customers can choose separate providers for each
  - In Great Britain, companies offering export rates typically offer better value for their existing customers. Export rates commonly operate on a three-tier system, with the highest rates offered to existing import customers who purchase the technology (e.g. a solar PV and battery storage system) directly through the company, mid-level rates to existing import customers with existing technology and lowest rates to non-customers

Case Study **Customers of Octopus Energy can benefit from low rates based on wider system demand**



In the UK, Octopus Energy offers an 'Octopus Flux' tariff, a three rate (three price periods) 100% renewable electricity import and export tariff aiming to provide solar and battery owners with the best available rates for consuming and selling their energy and supporting the grid during peak periods.

- **Propositions are presented in a standardised and simple format, focusing on financial benefits**
  - Consumers are typically presented with a set of "standard" parameters to review, for example the predetermined baseline for electric vehicle charging or home heating comfort levels. In some circumstances consumers and service providers can develop more bespoke arrangements
  - The balance of automated optimisation vs consumer control is partially determined by the primary and secondary technology purposes. Greater levels of optimisation are typically seen across solar PV and battery storage propositions, compared to those where the primary purpose of the technology is heating or transport. For shifts in consumption patterns, most still involve manual change from a consumer, even if a notification is automated
  - Secondary benefits are often presented, including supporting grid balancing and intermittency, supporting renewable energy and reducing carbon emissions

Case Study **Giv Energy offers "hands off" energy savings**

GivEnergy in the UK produces home batteries that take agile tariffs and smart grid trading into consideration. They will therefore charge and discharge to take advantage of cheap rates automatically, without the customer needing to manually intervene to benefit.

In a similar vein, OVO Energy's EV ToU tariff operates separately to the customer's home import rate, enabling customers to use a smart charge schedule for their EV to automatically access a lower rate of 7p/kWh. This may be overridden should the customer require immediate charge, returning to their standard home electricity rate.

- **There are established utilities operating in most nascent household flexibility markets(s), with a wide range in more established markets, including "pure play" VPPs**
  - There are a range of company sizes, from those with millions of customers to small start ups
  - Third party partnerships provide a route to market for flexibility services, across VPPs, installers and asset manufacturers
  - Additional revenues are accessed through flexibility markets as well as balancing. The level of benefit may rely on the frequency of flexibility requirements across the electricity system

Case Study **Sonnen's rewards customers who sign up**

Australia's sonnen offers a cash bonus for signing up to its sonnenConnect VPP management service, as well as further daily and monthly cash rewards for customers with a >4kWh sonnenBatterie.

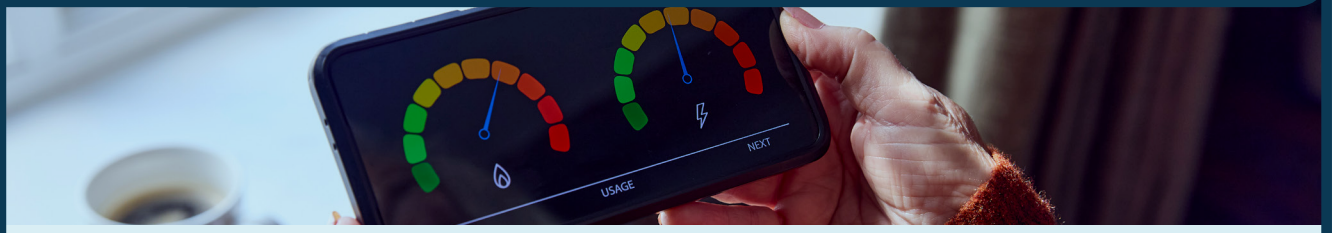
- **All services require the ability to meter consumption or export on a granular level**
  - This is typically achieved through a smart meter or asset level metering
  - Customers are then able to benefit from better electricity rates by monitoring their consumption and flexing their electricity accordingly
  - This can then be used to support other home devices and technologies (e.g. EV charging) to ensure the best rates are used

Case Study **ToU tariffs requiring smart meters, or smart technologies**

Many ToU tariffs require the installation of a smart meter, sometimes specifically a more recent generation smart meter with more granular functionality in reading and recording consumption data. This requirement is consistent across several propositions, including Globird Energy, Ostrom, Origin Energy, Octopus Energy, Looop Inc.

- **Payment plans can offer low upfront costs for technologies, improving accessibility to savings and payments for flexible response**
  - There are a range of payment plans available for the purchase of low carbon assets, from monthly instalments where the capex is paid for by the provider, to a full or partial deposit. Some providers offer improved export rates by purchasing assets and signing up for a value stream (e.g. an export rate) as a bundled service

Case Study **Monthly payments for renewable technologies**

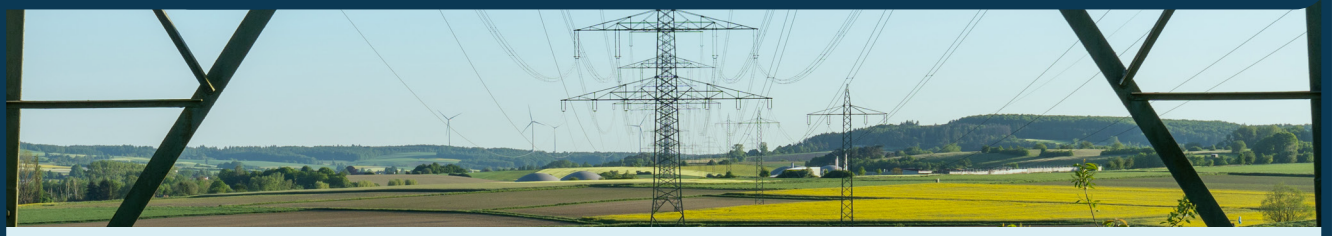


Origin Energy in Australia offers various packages that provide solar panels and inverters under monthly payment schedules. The packages require no initial deposit and include an initial interest-free period on the monthly repayments

- Partnerships offer attractive, and sometimes exclusive, benefits to customers
  - Some suppliers are establishing partnerships with other energy businesses in order to attract customers with exclusive offers, such as discount energy technologies or lower tariffs

Case Study

Partnerships financially benefitting customers



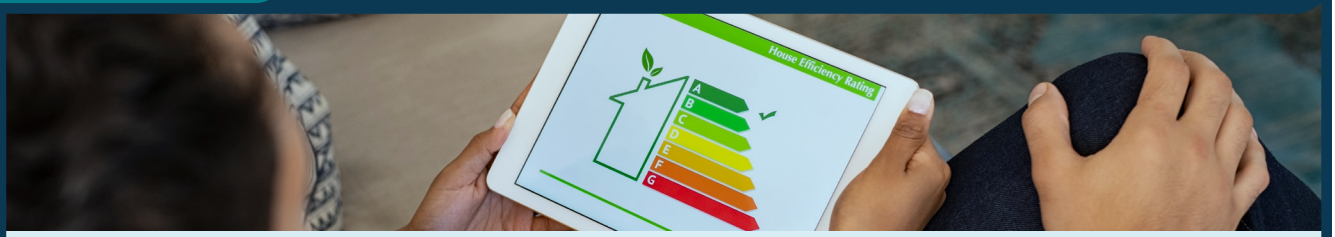
Giv Energy in the UK has partnered with energy flexibility tech company Axle Energy to introduce the GivBack scheme which offers customers the ability to earn money from their GivEnergy battery storage systems by exporting excess energy to the grid.

In Germany, Ostrom has partnered with solar energy company Soly where Ostrom will offer special tariffs to Soly's customers, while Soly will offer Ostrom customers exclusive conditions for the installation of a photovoltaic system as a complete package, including comprehensive advice, installation and maintenance.

- **Many recently established organisations have seen rapid growth**
  - The industry has seen some 'smaller' businesses that, despite becoming operational relatively recently, have seen a surge of popularity and growth of customers in a short period
  - Successes like these may point towards innovative proposals or business propositions that could gain greater attention from both customers and competitors as the energy demand and market engagement with new propositions grows, particularly in supporting decarbonisation efforts

Case Study

Ostrom's strong two-years of growth



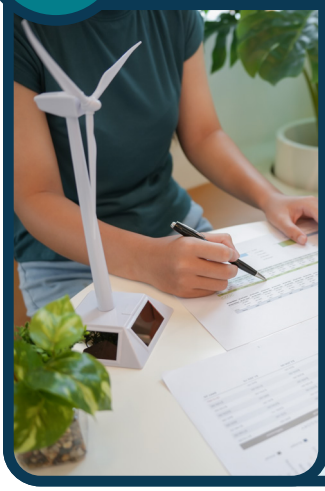
Ostrom launched in May 2021 offering a dynamic tariff that enables its customers to view their energy consumption in real-time. Since its launch, the company reports customers based across 3,000 German cities and towns.

8. Further evolutions of flexibility markets

Engaging households in flexibility services is a relatively new and emerging space in many energy markets around the world. Although there are common drivers to developments, requirements for delivery, and structures for customer interaction in different markets, there is no single solution that is universally applicable today or expected to be so in the future.

The four main drivers of further evolution we have identified are:

1. Policy changes to electricity market structures

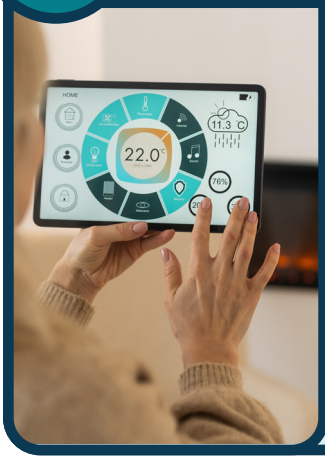


- As intermittent generation deployment grows, levels of new and existing electricity demand rise, and associated network constraints tighten, the importance of market structures and network management approaches that accommodate demand side flexibility to reward customers rises as well
- From the 2023 Demand Response Plus programme in South Korea, to the Alternative Energy Market innovation projects and Demand Response Service market trials in the GB market, traditional top-down, unidirectional market designs are developing supportive measures for demand side services

2. Designing flexibility into buildings and infrastructure

- Propositions to date are primarily focused on providing consumer-facing services for new or existing low carbon assets
- However, engagement earlier in the value chain is seeing low carbon propositions also develop in the new-build housing space. Installation and operation is being offered to consumers through ongoing energy bill discounts. These can be delivered through market policy and design, such as zero net energy homes requirements in California, and through commercial offerings such as Octopus Energy's Zero Bills initiative in GB

3. Integrating more smart devices into whole-home systems (e.g. water heaters and air-con)



- Service providers are currently delivering flexibility-focused services that cover multiple technologies, from heat pumps to electric vehicle charging and smart home controls
- These typically focus on asset optimisation, with service providers across European and US markets exploring as-a-service based propositions and whole-home energy management. These types of proposition integrate capabilities across energy, telecoms, manufacturing, and asset installation and maintenance sectors, via partnerships and/ or in-house development

4. Linking electricity markets with electrification of transport, including vehicle-to-X capabilities

- Many of the low carbon technologies that characterise the utility and VPP services examined are still comparatively new, particularly in the household market. Engagement with these opportunities is coming through focused innovation projects and pre-commercial trials that bring together stakeholders from across the energy value chain and beyond, from network operators to software providers and asset manufacturers
- This is especially apparent in vehicle-to-grid trials, with innovation projects underway from Japan and South Korea to the USA and GB

Early market trials have shown the potential flexibility in household energy usage and how that flexibility can be used to benefit both consumers and the energy systems in those markets. As more markets make progress against the four areas identified here, that potential will only increase.

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