



Flexibility & Visibility

Investment and opportunity
in a flexibility marketplace

Supported by



Department for
Business, Energy
& Industrial Strategy

Preface

This report has been produced by Piclo as part of a project for the Department of Business, Energy and Industrial Strategy's (BEIS) Energy Entrepreneurs Fund (EEF).

It follows the conclusion of a trial of Piclo's Flex Marketplace in 2019.

This report is part two of the following series:

Energy On Trial: Piloting a flexibility marketplace to upgrade our energy system

Flexibility & Visibility: Investment and opportunity in a flexibility marketplace

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Foreword

The need for an independent and transparent marketplace for flexibility services was a central tenet of Piclo's hypothesis when launching the trial of our platform. We believe that this marketplace will catalyse investment and opportunities throughout the energy flexibility ecosystem.

We set out to prove that an open, online platform could play a fundamental role in supporting the efficient connection and operation of decentralised energy resources. The platform, called Piclo Flex, could, therefore, support the growth of renewable energy generation and catalyse the adoption of electric vehicles and other initiatives in the low-carbon economy - crucially while keeping costs down.

Additionally, Piclo sought to demonstrate that a tool with visibility and transparency at its heart would enable the efficient and fair procurement of flexibility from the rapidly growing number of providers. And would also stimulate demand and create new possibilities for businesses and even consumers to benefit from Britain's drive towards a low-carbon energy system.

Online trading platforms are not a new idea. They have become commonplace in e-commerce with the most successful customer-facing tools becoming household names. Yet the energy industry has been slow to embrace the digitalisation of procuring flexibility, and wary of building their own solutions.

By seeking to build an independent marketplace for energy flexibility trading in the UK - working with all six of the licensed distribution networks in the pilot phase - Piclo

overcame one of the biggest barriers: neutrality.

In creating a level playing field for buying and selling flexibility services at a local level, Piclo was able to demonstrate that an online platform could be used by System and Network Operators to help manage the grid nationwide, using existing decentralised assets for reinforcement deferral, planned maintenance and unplanned outages. But that was only the beginning.

From championing visibility and revealing location-specific grid constraints to the standardisation of data and increasing transparency in how flexibility services are procured, Piclo set out to tackle the challenges associated with trading flexibility online.

By breaking down these barriers, the Piclo Flex platform enables more flexibility providers to promote and provide their services online, as well as encouraging new initiatives and business models to spring up, fuelling investment and opportunity in a flexibility marketplace. A marketplace that helps Britain to deliver an energy system that's smart, flexible and clean, faster.

Flexibility and Visibility

Piclo signposted demand for more than 456MW of flexibility from six distribution companies in trials of our online platform in 2018/19. Though this represented only a fraction of Britain's total needs for flexibility in the same period, the platform demonstrated the power of visibility in the flexibility market.

The market for flexibility services is currently estimated to be worth more than £2.2bn¹ every year, with traditional procurement models typically used to contract large-scale, centrally-managed assets to dispatch their services on-demand to help balance the grid².

The market for local flexibility services is in its infancy, but it is already recognised that assets that can adjust their energy generation and/or patterns of consumption in response to external signals will become part of the drive for a more decentralised energy system. However, the potential size of this market is currently unknown and there exists no central database of assets that are available to respond to market signals.

To be an effective platform, Piclo identified visibility as a key deliverable of the pilot. The objective of this visibility was two-fold:

Visibility for Distribution Network Operators

Piclo Flex provides an independent platform to publish flexibility needs, based on the location of the demand. DNOs can see qualifying assets in the constraint management zones - the resulting map of competitions enables them to source flexibility with highly specific locational, technical and temporal requirements.

In simple terms, an open platform model allows DNOs to:

- Obtain data to support a business case for flexibility to balance the grid and support reinforcement deferral, or to demonstrate the need for infrastructure investment.
- Know the location of assets within their network areas, and inform infrastructure teams about potential future services (for instance, those in-planning or under construction).

¹ Ancillary services, balancing market, local flexibility markets and Capacity Market value.

² [Monthly Balancing Services Summary 2018/19](#), Published March 2019 by National Grid ESO.

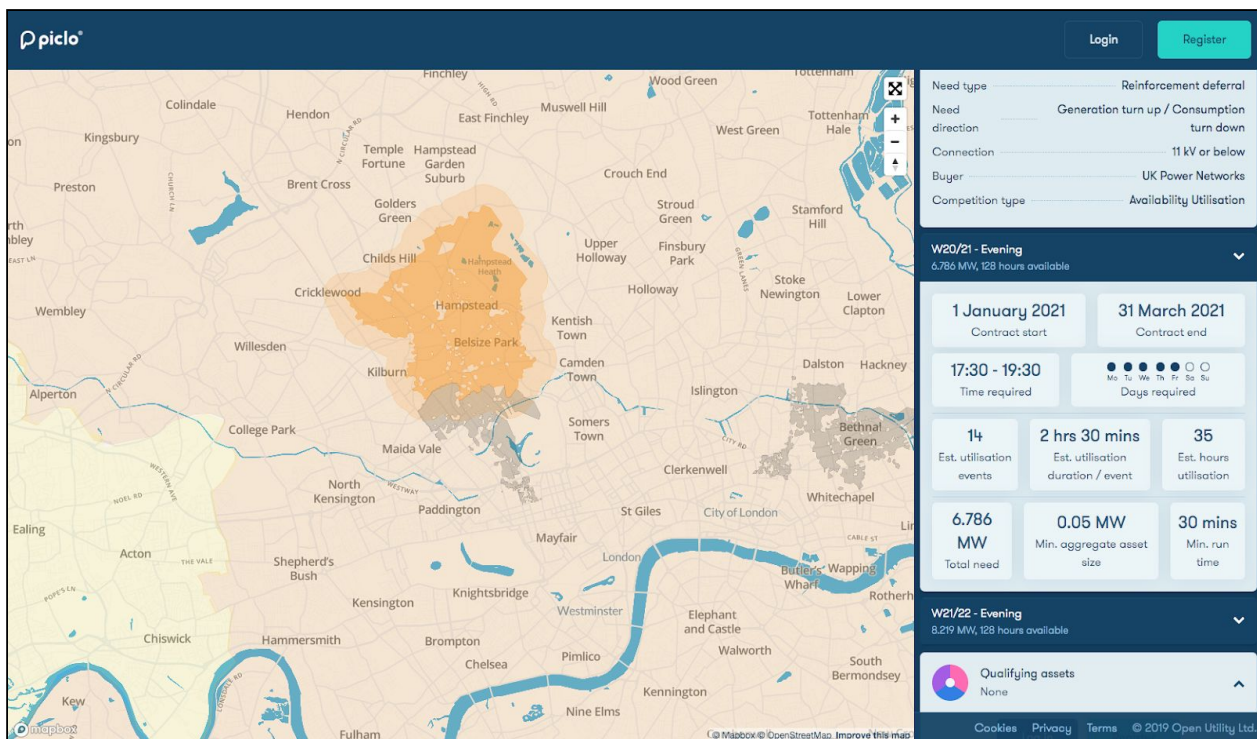


Fig 1. DNO flexibility needs as displayed on Piclo Flex (focus on the Lithos/UKPN need).

Visibility for flexibility providers

Piclo Flex enables flexibility providers (Flex Providers) to publish the location and connection voltage of their assets. The system matches active assets with new demand as it's published, creating ongoing opportunities for them to be leveraged to minimise bottlenecks across the network. This is particularly useful for providers with assets in multiple locations, saving time that would otherwise be spent proactively seeking out and reviewing invitations to tender from more than one DNO.

The platform also supports flexibility providers to:

- Determine if their assets are in a location that's likely to qualify for competitions in constraint management areas, now or in the future.
- Obtain data to support a business case for developing new assets.
- Earn income to supplement or replace government incentives to promote the uptake of renewable and low-carbon electricity generation technologies.

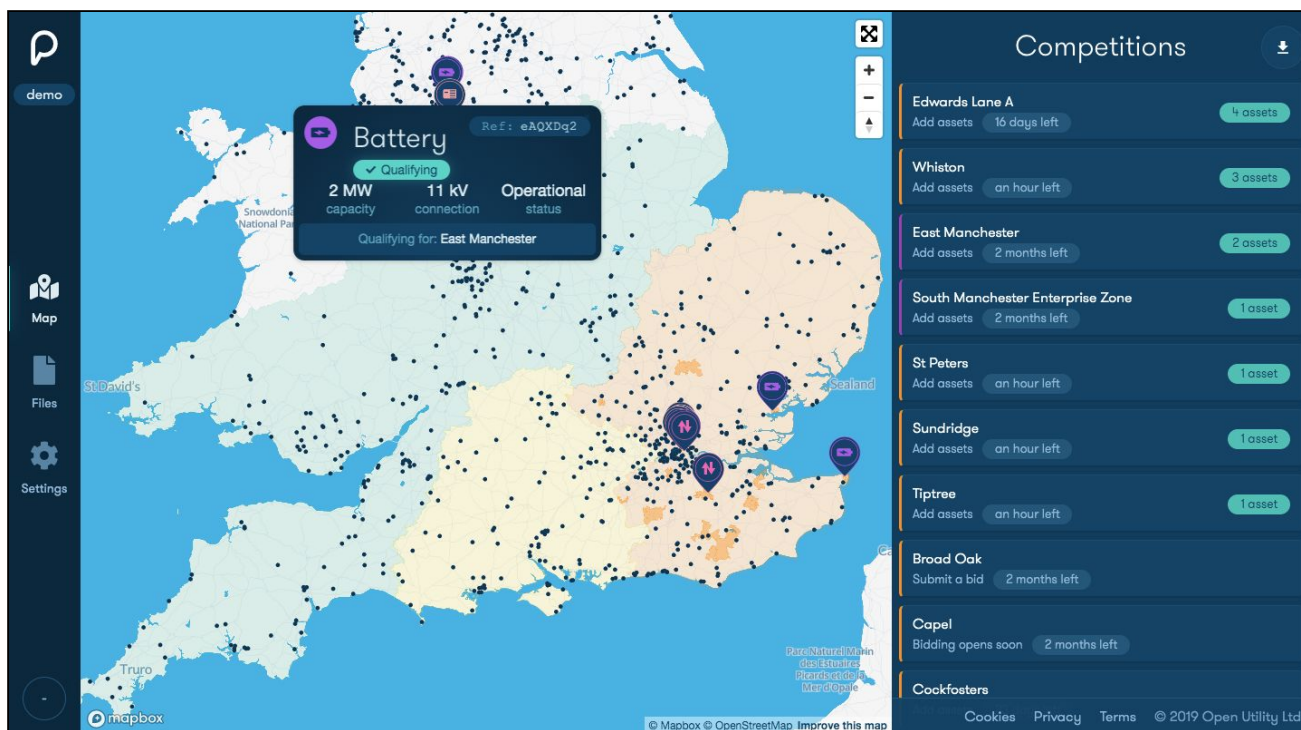


Fig 2. DNO flexibility needs matched with flexibility assets (demo data version).

Beyond the trial

Visibility of both sides of the market has the potential to stimulate debate in the energy industry and inform decisions that will support the transition towards a zero-carbon economy, shaping the energy system of the future.

However, it is currently only possible for flexibility providers and DNOs to view and interact with the data that accompanies competitions. Increasing visibility for interested parties who are not directly participating in live competitions is likely to become a feature of Piclo's product beyond the trial.

Piclo recognises the value of transparency in the energy flexibility industry and will support initiatives for more open data without compromising the privacy of its stakeholders. We believe this will be particularly important as the market starts to embrace a rapid transformation towards a zero-carbon electricity system.

Trust, transparency and independence

To deliver the benefits of visibility for buyers and sellers of flexibility, Piclo identified the challenges that needed to be overcome related to trust and transparency in the market.

Trust and transparency

To meet the varying needs of buyers and sellers in a flexibility marketplace - including network operators, aggregators and asset-management companies, small-scale generators, and even residential customers - Piclo set out to establish simple and open terms to manage the data and permissions of its users.

At the heart of the marketplace is a commitment that all users of the platform retain control of their information, can self-manage their assets and use the marketplace on an equal footing. The model means that even small-scale flexibility providers can access the same market opportunities as larger assets, regardless of their size.

Additionally, the platform set out to facilitate transparency between buyers and sellers by requiring DNOs to set clear parameters for assets to be eligible for competitions. The potential for existing flexibility providers, or even those with purely speculative assets, to judge their own eligibility before entering a competition will enable the market to evolve more intelligently with the benefit of data to support investment and business decisions.

During the pilot, Piclo automatically qualified assets based on a few simple criteria, which was then checked and approved by staff at the DNOs. Though a manual step existed during the trial, the principle of publishing requirements for competitions upfront is a key step in creating a level playing field.

Beyond the trial, Piclo anticipates that price transparency will play a role in helping the market to evolve. In the same way that wholesale electricity prices are shared at a national level via two power exchanges in Britain, supplying comparable data at a local level will encourage growth and dynamism in the local flexibility marketplace.

On the principle of 'presumed open' data (see below), Piclo is committed to working with its users to identify and publish the most useful data points, including historic pricing signals, in a standard and digestible format to inform market decisions and support efficient investment.

Data transparency

The [Energy Data Taskforce](#), commissioned by Government, Ofgem, and Innovate UK, has set out five key recommendations for the UK to move towards a modern, decarbonised and decentralised Energy System - and ultimately, towards a net-zero carbon future.

1. **Digitalisation of the Energy System** – The sector will be encouraged by Government and Ofgem to adopt the principle of digitalisation in the consumers' interest.
2. **Maximising the Value of Data** – Energy system data should be *presumed open*. Government and Ofgem will use a range of existing legislative and regulatory measures to require data to be 'discoverable, searchable, understandable', by adhering to common standards.
3. **Visibility of Data** – Government, the regulator, and industry will provide visibility through standardised metadata of energy system datasets, contained within a central database.
4. **Coordination of Asset Registration** – A strategy to coordinate the registration of energy assets will be established to simplify the experience for consumers. A user-friendly interface will increase registration compliance, improve the reliability of data and the efficiency of data collection.
5. **Visibility of Infrastructure and Assets** – A digital system map of the energy system should be established to increase the visibility of infrastructure and assets, and enable optimisation of investment and inform the creation of new markets.

It will take time for the industry to realise the ambition of the Energy Data Taskforce. Beyond the trial, the Piclo Flex platform can play a role in delivering key parts of the strategy for the electricity flexibility marketplace.

Independence

An important part of the BEIS-funded trial was to establish Piclo as a neutral platform, independent from both sides of the market. Piclo is neither an aggregator nor a system operator and remains agnostic about the outcomes of competitions that are hosted on the platform.

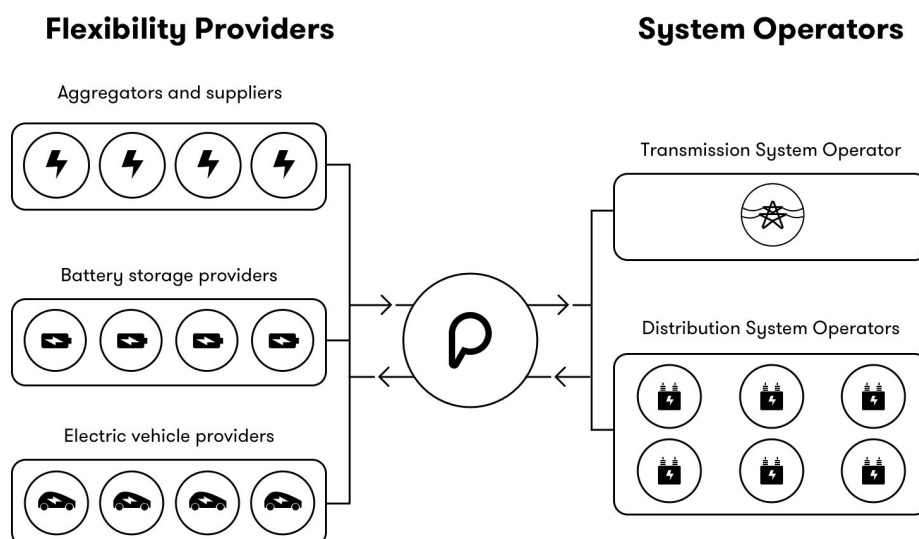


Fig 3. Piclo flexibility marketplace structure

This neutrality allowed Piclo to work with all six of the licensed distribution networks in the pilot phase of the project, supporting them to run competitions for a diverse range of demands, thus creating opportunities for flexibility providers nationwide to find a market for their service.

Gathering and responding to feedback from stakeholders on either side of the market in the flexibility ecosystem was considered crucial to the success of the pilot. This user-centred design approach is unusual in the energy industry and represented an opportunity for DNOs, Flex Providers and others to help create a marketplace that meets the many and varied needs of its different users. By remaining agile and responding to feedback, the Piclo platform hopes to accelerate the wider adoption of its platform, incubate the market for flexibility, and deliver the most value for all its users.

Reducing barriers to entry

In advance of the trial, Piclo's research revealed several challenges in the process of procuring flexibility services. On the whole, traditional methods for procurement that are optimised for buying large, expensive physical infrastructure (e.g. transformers) are not efficient for smaller short-term services like flexibility and can create additional barriers to entry.

Our hypothesis was that an alternative approach - using a digital procurement platform - could improve transparency and visibility, increase participation and reduce admin costs. To prove this, we started with an assessment of the four stages of delivering a flexibility service: procurement, operations, settlement and feedback. Each stage is made up of several sub-functions as outlined below.

Procurement

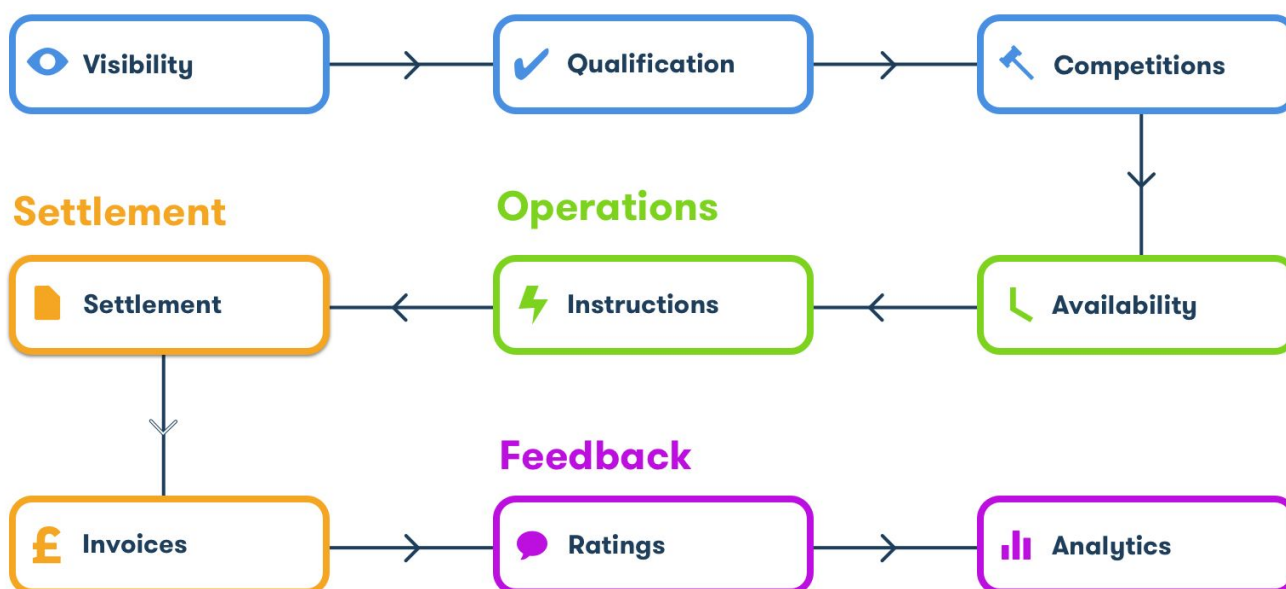


Fig 4. The stages of procuring flexibility services.

Understanding procurement processes

This report has already discussed the need for market visibility and a transparent process for qualification of eligible assets. However, a related function is the way that contracts for flexibility services are advertised and awarded by DNOs.

Framework agreements

The traditional process for procuring services uses a framework agreement to establish the terms governing a future contract. There are a number of variations in how the Framework Agreement process can be achieved, but a typical end-to-end process could be as follows.

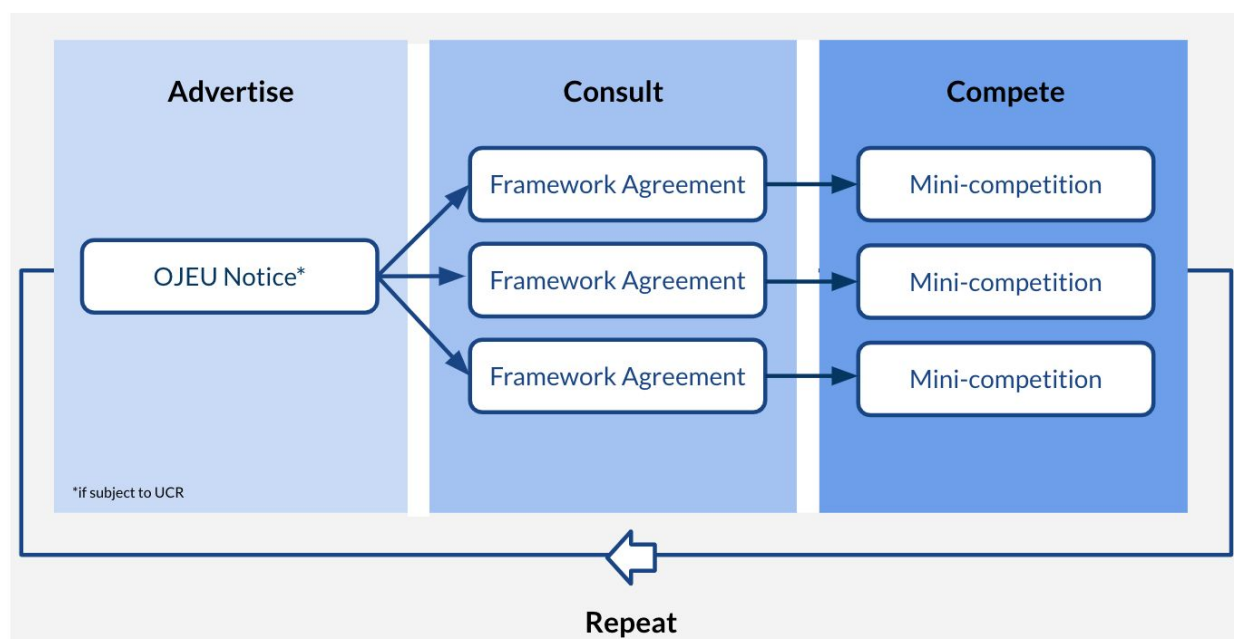


Fig 5. Typical Framework Agreement competition process.

To begin with, the DNO needs to advertise a specific time-bound opportunity. If the services sought were governed by Utilities Contracts Regulations 2016 (UCR), the advertisement would be placed in the Official Journal of the European Union (OJEU).

From there, a period of consultation on the terms of the Framework Agreement are carried out, and separate agreements are drawn up with one or more respondents. Once complete, a mini-competition is held, and a contract for flexibility services is awarded.

After contracts are awarded, the advertised opportunity lapses and even if similar (or even near-identical) services were required again at a later date, the whole process would need to be repeated. For flexibility service competitions, this means that a new framework agreement would be required for each flexibility tender.

Dynamic Purchasing Systems (DPS)

An alternative process is called a Dynamic Purchasing System (DPS) which allows for the contracting supplies, services and works that are commonly available on the market (i.e. there is no specific innovation required). It is an entirely electronic process.

Under a DPS competition, the process commences with a DNO advertising an open-ended or long-term opportunity. It's accompanied by terms, published upfront, which outline the service requirements, commercial conditions and terms of contracts that may be awarded.

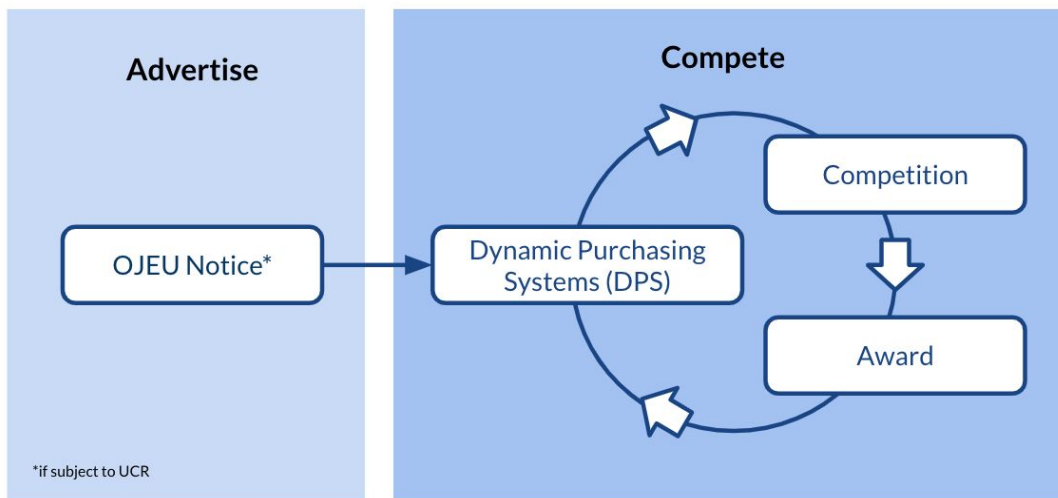


Fig 6. Typical Dynamic Purchasing Systems competition process.

Like a Framework Agreement, if it's governed by UCR, an advertisement under a DPS would be placed in the OJEU. However, unlike a Framework Agreement, the advert remains active for the life of the DPS. Respondents complete an online process to demonstrate eligibility e.g. financial stability, technical ability etc., but can then proceed directly to the competition stage. All those that pass are awarded a place on the DPS, with eligibility the only barrier to participation.

The DPS remains active for as long as the service is required. New flexibility providers can respond to the advert at any time in order to pre-qualify for future competitions.

Implications for Piclo

As a tool for procurement, Piclo Flex can support either procurement model. The contracting authority (the DNO) is responsible for choosing the required approach and Piclo Flex can be modified accordingly.

Piclo remains agnostic from a technical point of view about the methods of procurement. However, we anticipate that a DPS model - that is more flexible and entirely electronic - will become more commonplace.

For contracting large-scale, centrally managed assets to supply flexibility to the electricity system, a framework agreement makes sense; procurement teams can invest time in creating bespoke agreements and a suite of accompanying documents to finalise the terms of engagement. The conventional, paper-based contract negotiation represents 'business as usual' for traditional buyers and sellers of flexibility services.

However, we expect that the flexibility market will have hundreds, if not thousands, of participants in the near future. And reducing the barriers for entry, particularly in respect of procurement, for new and potential participants in a decentralised system will play a key role in increasing market liquidity. This dynamism in the market will not only drive efficiency but also enable more frequent transactions, perhaps even day-ahead auctions in the not too distant future.

Our trial in action

The key players for trading flexibility are already established, with aggregators, electricity suppliers and industrial and commercial users poised to take advantage of the opportunities presented by DNOs. However, Piclo's trial has revealed the new agents that are poised to join a more open and transparent marketplace for flexibility services.

Type of Flex Providers

During the Piclo marketplace trial, aggregators were the single biggest participants (39.2% of the total registered Flex Providers). However, aggregators, in fact, represent a diverse range of organisations, from those that aggregate and manage small-scale batteries on behalf of residential users to those that manage a smaller number of larger devices on behalf of industrial and commercial users. A similar number of participants (35.4% of registrations) represented speculative users of the platform, including potential investors in flexibility services.

Community & Municipality participants (8.5% of registrations) represent the growing number of community groups and local authorities that are taking control of their energy value chain. This readiness among local agents to join an online market reveals the potential for small-scale generators to compete on a level playing field with traditional users. Some large industrial customers have opted to sign up directly (4.2% of registrations). However, most prefer to devolve management of their flexibility assets to aggregators.

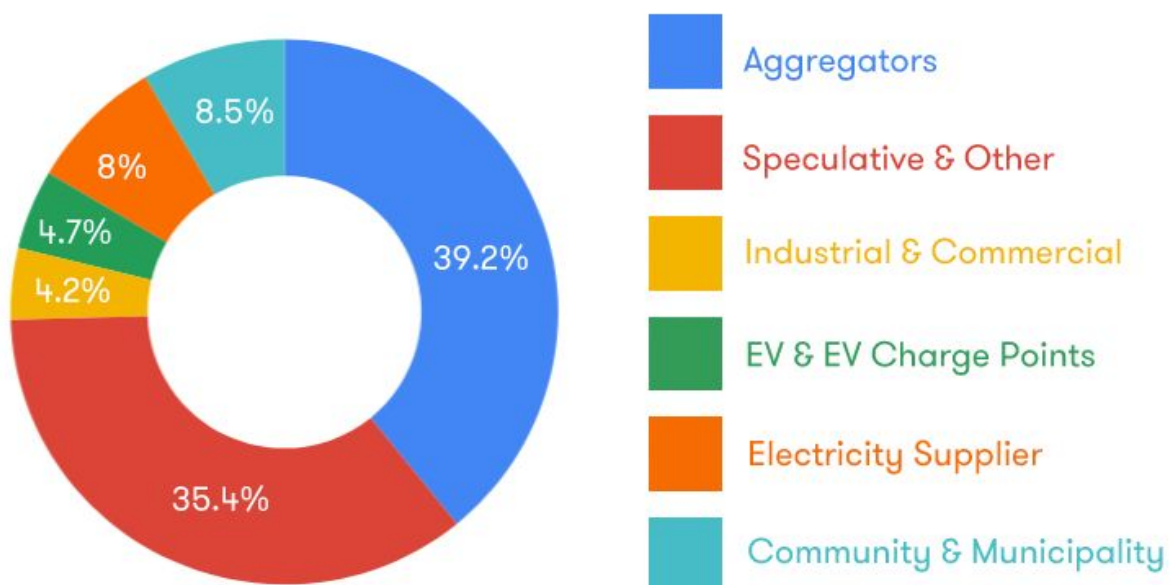


Fig 7. Flexibility Providers by type (registered on Piclo Flex by 25 June 2019)

Type of Flexibility Assets

Of the 4,442MW uploaded by the 12th June 2019, the most numerous flexibility assets were residential batteries. However, these represented a very small proportion of the total capacity for flexibility available on the platform (7.6MW or 0.17%). Larger batteries (1MW+) contributed significantly more to the overall capacity at 842MW or 19%. Generators contributed the most, with 3429MW or 77% of the total capacity.

Only 141MW of demand-response systems (on commercial and industrial sites) have been registered on Piclo to date. This is only 14% of the 1GW of industrial DSR currently in the UK ³.

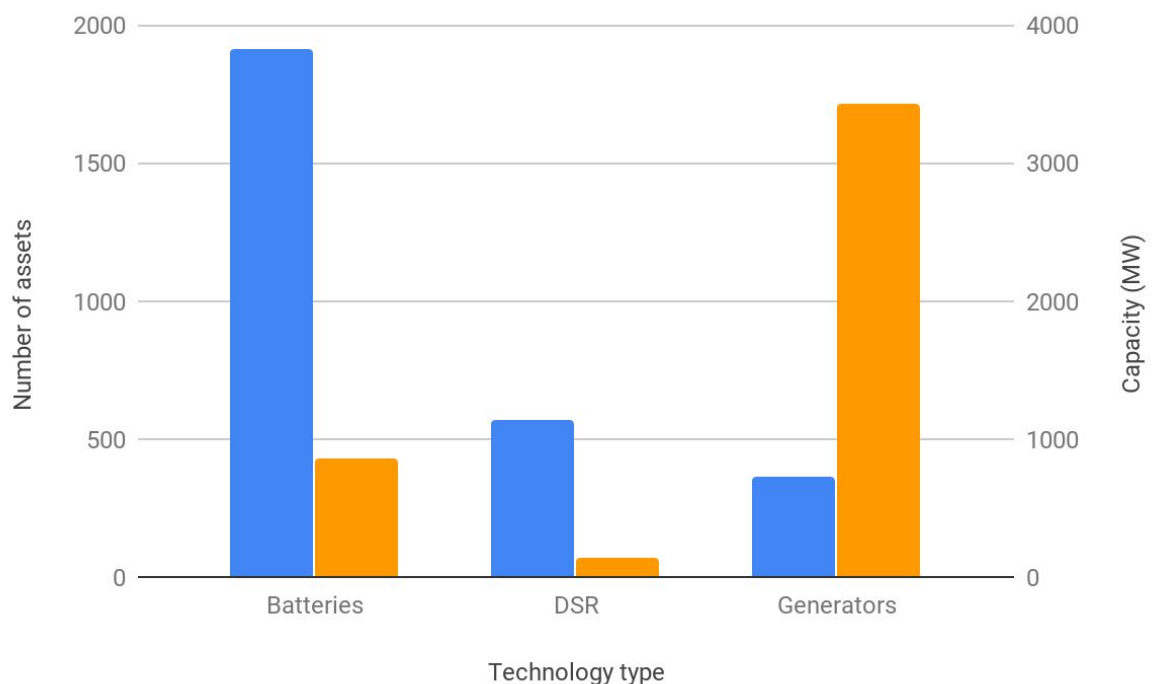


Fig 8. Capacity and number of assets by technology type registered on Piclo Flex by 12th June 2019 (excluding speculative assets)

The type of generator was not captured by Piclo in the trial data. However, many are likely to be traditional generators powered by gas or diesel, supplemented by combined heat and power (CHP) systems, waste-to-power systems and wind farms.

To meet low-carbon targets, these generators will have a reduced place in the flexibility ecosystem and will be increasingly replaced by lower-carbon sources over time. Capturing this data will be an important role for Piclo beyond the trial so that the industry can observe and measure the reduced role of fossil fuels in the flexibility market and the growth of low-carbon alternatives.

³ Future Energy Scenarios, published July 2019 by National Grid ESO.

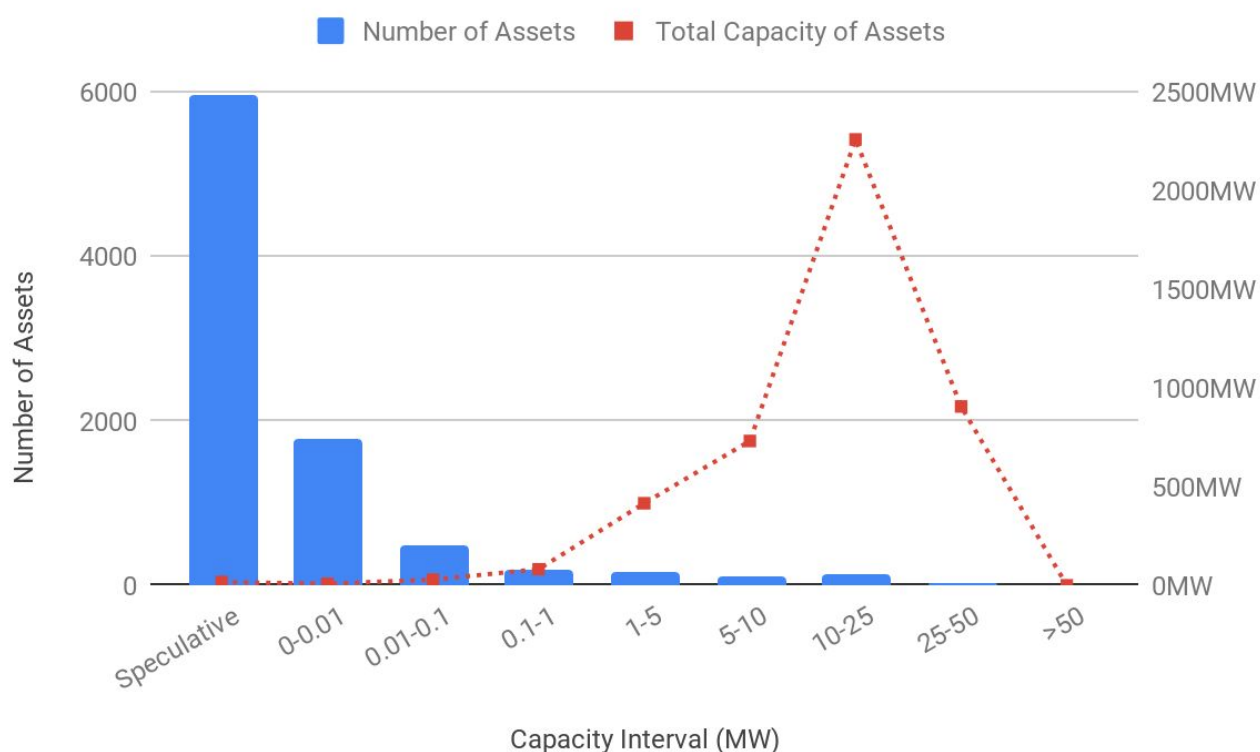


Fig 9. Capacity versus the number of assets (registered on Piclo Flex by 12th June 2019)

By digging into the data we can observe that small-scale assets - with a capacity of less than 10kW - were the most numerous but contributed little to the total aggregate capacity (7.6MW or 0.17%). Larger assets - those between 10-25MW - contributed the most to the overall capacity (2,257MW or 51% of total capacity).

The data also reveals the number of assets that were uploaded speculatively. These are likely to be examples of potential flexibility providers that own sites but have not yet activated any demand-side response capability, or marketing and sales teams for energy storage products for instance, that are seeking to recruit residential customers in a specific area, using Piclo Flex to test the market.

Status of Flexible Assets

In addition to the type of assets, Piclo observed an interesting trend where Flex Providers uploaded significant capacity from assets that were yet to be operational. Almost half of the total capacity (48.2%) uploaded during the trial was already operational, but the remaining capacity was split between assets that were 'planned' (23.3%) or 'in development' (28.2%).

The opportunity for assets to pass the 'pre-qualification' stage of flexibility competitions means that those that are in-planning, or even purely speculative, can gauge suitability for providing flexibility services for future needs and plan future any investment accordingly.

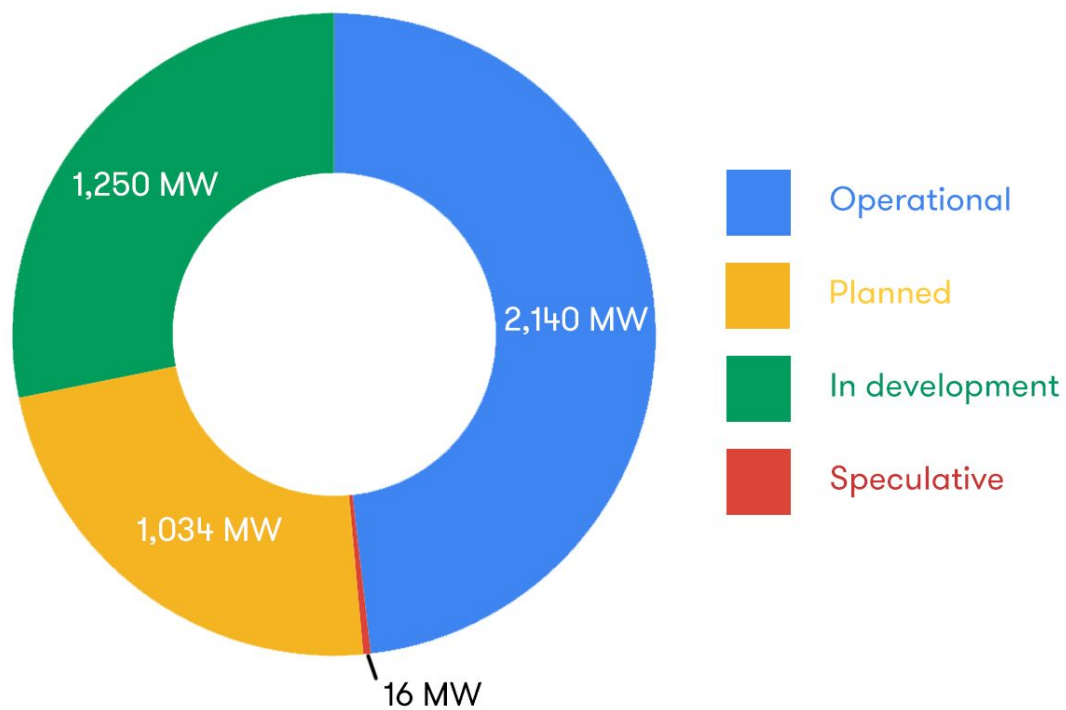


Fig 10. Status of assets by capacity (in MW) (registered on Piclo Flex by 12th June 2019)

Additionally, one asset was categorised as 'mothballed'. Though it was just one asset, it is possible that the mothballed assets will increase as plants that rely on burning fossil fuels are taken off-grid and retrofitted for clean-fuel use, or otherwise replaced by clean generation technology.

Actions beyond auctions

The pilot phase of Piclo's platform for flexibility services has revealed diversity in the buyers and sellers who will play a role in this emerging market. But above all, has shown the great potential for existing organisations and assets to invest to exploit the wealth of opportunities this new market creates.

The huge opportunity for providers of flexibility is best demonstrated by looking at the number of unmatched assets to adverts. This demonstrates that of 4,442MW of assets uploaded, just 116MW qualified for active competitions during the trial. And on the other side of the transaction, 340MW of advertised flexibility need were not matched with eligible assets during the same period.

As discussed in Part I of this report series, Piclo has shown the potential of creating a heat map of areas of network congestion around Britain. Many of these are likely to be met organically as the market matures, and as potential providers or generators start to identify and react to anticipated constraint management in specific locations.

As well as supporting reinforcement deferral, data gathered from the platform can be used to justify investment in specific locations. The role of Piclo will be to accelerate the process of matching assets with competitions, simply by increasing registration of existing flexible assets on the platform. Parsing the data from new competitions and automatically notifying owners whose fixed assets pre-qualify for new competitions will expedite the matching process and support those Flex Providers to extract additional value efficiently from underutilised assets.

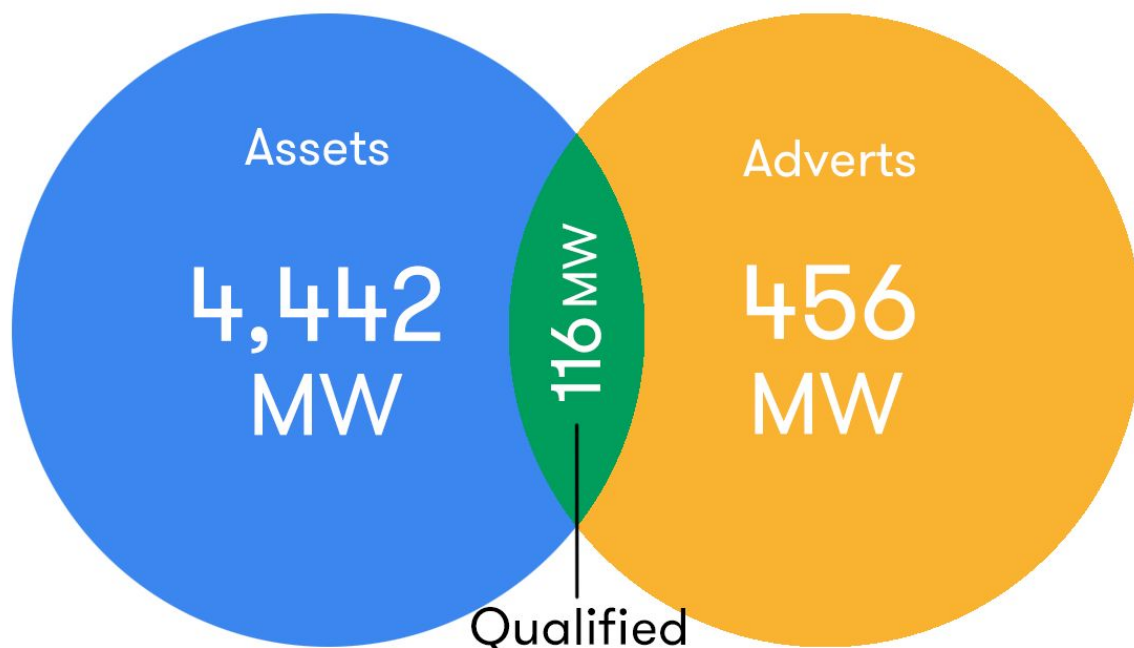


Fig 11. The capacity of assets uploaded and advertised for flexibility competitions from Piclo Flex trial, 2019.

Crucially, however, the gap can also be closed by proactive flexibility providers that understand the huge potential of the platform and locational flexibility competitions. The winners will be those that

seize upon the opportunities that the market reveals, investing in emerging business models or spinning out new ones to capitalise on the growth in demand for flexibility services.

Traditional demand-side response is expected to enjoy a significant role in the market for flexibility, but so too will assets that are mobile. Mobile generators and transport assets including electric vehicles have the potential to earn revenue from their capacity to store energy. 'Vehicle to grid' (V2G) technology, for example, enables electric vehicles to adopt smart-charging methods to utilise low-cost and renewable energy when it is available and earn revenue by feeding energy back into the grid to help balance the system.

Residential battery systems have similar potential and companies that effectively manage these assets on behalf of households can use flexibility and peak-time management payments to incentivise new customers. Households that produce and store their own energy can use payments from flexibility services to plug the gap left by regular feed-in-tariffs for solar generation.

The organisations that facilitate the unlocking of the potential of distributed generation from homes across Britain have much to gain. But consumers will benefit, too, as they support the growth of renewables while improving returns on their own smart energy technology investments, by becoming (by proxy) agents in the flexibility marketplace. Soon, a majority of homes will not just consume electricity, they will be generating, storing and selling it too, becoming part of a wider decentralised network of clean energy providers.

The future of our energy system relies on creating an electricity grid that's smart, flexible and clean. A flexibility marketplace can help to deliver that vision, faster.

Credits

Production & authoring team

Piclo (Author)

Piclo has been at the forefront of innovation in the fast-changing energy industry since 2013. Previously trading as Open Utility, Piclo's mission is to power the world with cheap, clean and abundant electricity and to accelerate the decarbonisation of our energy systems. [Read more about Piclo's story.](#)

Piclo project funders

Energy Entrepreneurs Fund, Department for Business, Energy & Industrial Strategy

The Energy Entrepreneurs Fund (EEF) is a competitive funding scheme to support the development of technologies, products and processes in energy efficiency, power generation and storage. The overall aim of the BEIS Energy Innovation Programme is to accelerate the commercialisation of innovation cheap, clean, and reliable energy technologies by the mid-2020s and 2030s.