

# Making the commercial case for battery storage

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An overview of the challenges and opportunities for the UK's battery storage pioneers

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All photographs in this report provided by UK Power Networks



## Foreword

Electricity storage is one of the hottest topics in the energy sector at the moment.

I have personally been involved with battery projects since 2013, when I began working with UK Power Networks to develop a commercial agreement with SmartestEnergy for their 6MW battery in Leighton Buzzard.

This was the largest battery project in Europe at the time and our agreement was the UK's first. The development of a commercial end-to-end process for the battery was pioneering and laid the groundwork for the sectors' ongoing development and growth.

Since then, the potential for battery storage has rapidly progressed as a result of falling technology costs and a greater than ever need for a smarter energy network in the UK.

The current pipeline of proposed battery projects stands at >1GW - staggering when you consider there was almost no commercial deployment only a couple of years ago.

We are now speaking to developers on a weekly basis about new battery projects and the mood is similar across the board - real excitement about the potential for battery storage but an underlying uncertainty of the scale of the opportunity.

With issues including a limited availability of contracts for schemes such as Enhanced Frequency Response (EFR), short contract lengths, and the charging of environmental levies which limits the profitability of arbitrage, most are still fine-tuning the investment cases they need to secure funding.

With the EFR auction now underway and contract winners to be announced imminently, it won't be long before we have some clarity about just how many of those projects in the pipeline will actually get built.

I am optimistic that more service mechanisms will follow EFR and as always, this entrepreneurial sector will continue to find ways to get their projects off the ground and make their valuable contribution to our smarter energy future.

**James Graham**  
Head of Direct Sales  
SmartestEnergy

**THE CURRENT PIPELINE STANDS AT >1GW - STAGGERING WHEN YOU CONSIDER THERE WAS ALMOST NO COMMERCIAL DEPLOYMENT ONLY A COUPLE OF YEARS AGO**



## Executive summary

Storage, along with demand side response and interconnection to other countries, is one of the three key innovations recently identified by the National Infrastructure Commission as being able to drive a "smart power revolution" and make the UK a world leader in sustainably meeting energy needs.

With around two-thirds of existing power stations expected to reach the end of their working lives by 2030, battery storage can reduce the investment needed in replacement capacity. By being able to react quickly to demand needs, it can also help minimise spending on upgrades to the network to be able to cope with the significant peaks and troughs in the flow of electricity.

As well as benefits to the network, successful development of commercial battery storage is seen as the missing link to help accelerate the shift to a low-carbon economy and offers huge potential to integrate more intermittent generation such as wind and solar in the energy mix.

Following the interest shown in batteries after the launch of our Energy Entrepreneurs Report in May 2016, we conducted our own survey throughout June and July.

We received 45 responses from storage innovators planning to develop battery projects in the next 12 months.

It is clear from the response to our survey that there is significant appetite and excitement around the potential opportunities battery storage offers to energy entrepreneurs.

Developers are looking at a number of different revenue streams to make storage projects economically viable but the detail of how they will stack up for individual projects and operators is still unclear.

The research also highlights that there are some challenges that will need to be addressed to ensure the sector reaches its full potential. These include the limited availability and short length of grid services contracts, and double-charging of renewable levies on batteries.

Given the sector is still at the early stages of development, it is also critical that suppliers work closely with investors and operators to ensure they have access to the flexible solutions and services needed to take advantage of commercial opportunities.



**WE RECEIVED 45  
RESPONSES FROM STORAGE  
INNOVATORS PLANNING TO  
DEVELOP BATTERY PROJECTS  
IN THE NEXT 12 MONTHS**

# Opportunity and optimism driving the sector

Perhaps the most encouraging finding of our survey is the strength of optimism which energy entrepreneurs have in the potential of battery projects.

A total of 45 developers completed our survey based on the fact they are considering a project within the next 12 months. This in itself indicates a significant interest in batteries and shows that these industry experts have a desire to make it work - which will be critical in maintaining the sector's current momentum.

Almost nine out of ten said they had high levels of confidence that their battery projects were viable and they see storage playing an important role in contributing to a secure electricity future.

This resonates with the commercial conversations we are having. Despite the current business case challenges, developers are still pioneering the development of commercial solutions for their projects.

## Opportunity attracts diverse market players

Our research and commercial discussions have identified four types of market players interested in the potential of battery storage. The potential revenue streams and challenges associated for these different project types are covered in the next section of this report.

Specialist developers seem to be thinking about setting up standalone batteries which exist solely for the purpose of charging and discharging electricity, either as part of a grid support scheme or for profiting from the wholesale market.

The key challenge for this group is the limited availability of grid contracts which may mean that they cannot secure the revenue stream to justify investment.

Owners of renewable generation projects are also keen on the possibility of co-locating a battery on the same site as their existing project. Currently this is most popular with solar developers but would potentially apply to all types of intermittent renewables.

Having a battery on-site would enable them to charge it at their peak generation time (when all other projects are also generating and prices are therefore lower) and release the electricity to the grid later when they would receive a higher price. They could also use their stored electricity to benefit from triad payments.

With the shift towards businesses taking more responsibility for their consumption and looking at ways to reduce their energy costs, many are also interested in the battery opportunity.

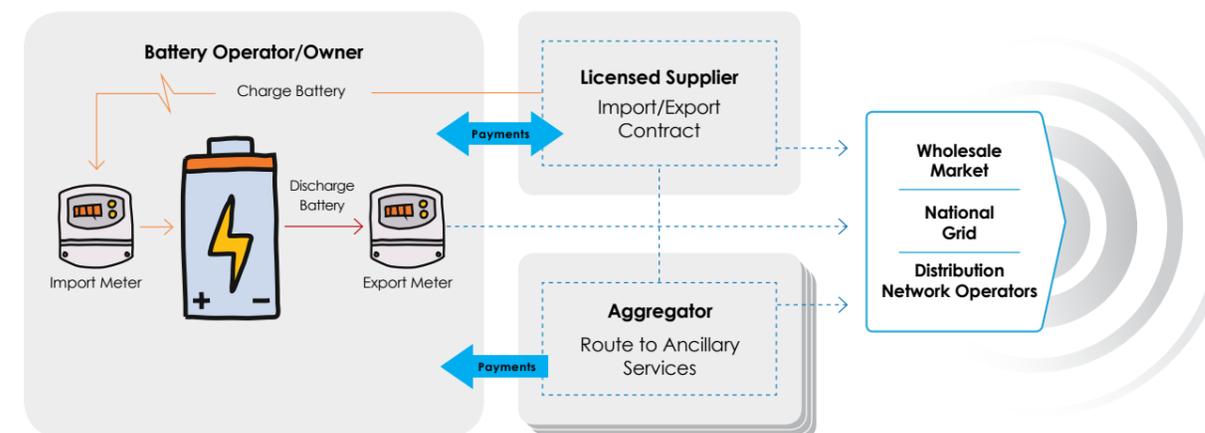
The battery also provides supply security because it could be used for back-up power instead of traditional diesel generation. By placing a battery on-site, they have the option to charge it by purchasing power from the grid at cheaper times and using that power on-site at peak times to avoid charges.

**The diagrams on the following page show how each of these use cases could work in practice.**

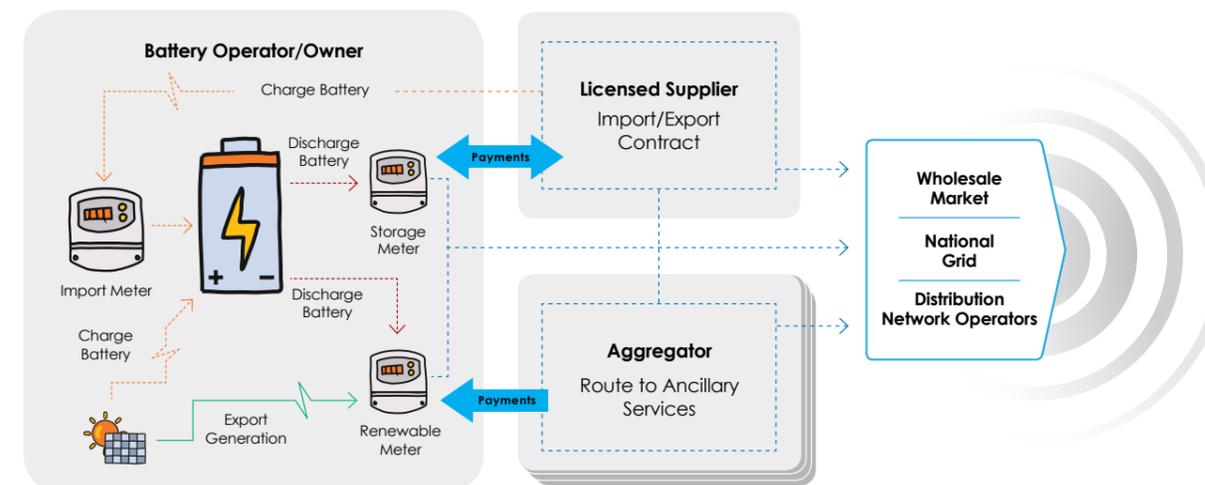
There is also much of discussion about how batteries can be implemented into the core network infrastructure. Whether owned by the Distribution Network Operator (DNO) or by independents on behalf of the DNO, there is considerable value to batteries being used to balance the network at very short notice and for short periods of time. Where the battery is fully available to the DNO, then it cannot be used for other commercial activities.

**ALMOST NINE OUT OF TEN SAID THEY HAD HIGH LEVELS OF CONFIDENCE THAT THEIR BATTERY PROJECTS WERE VIABLE**

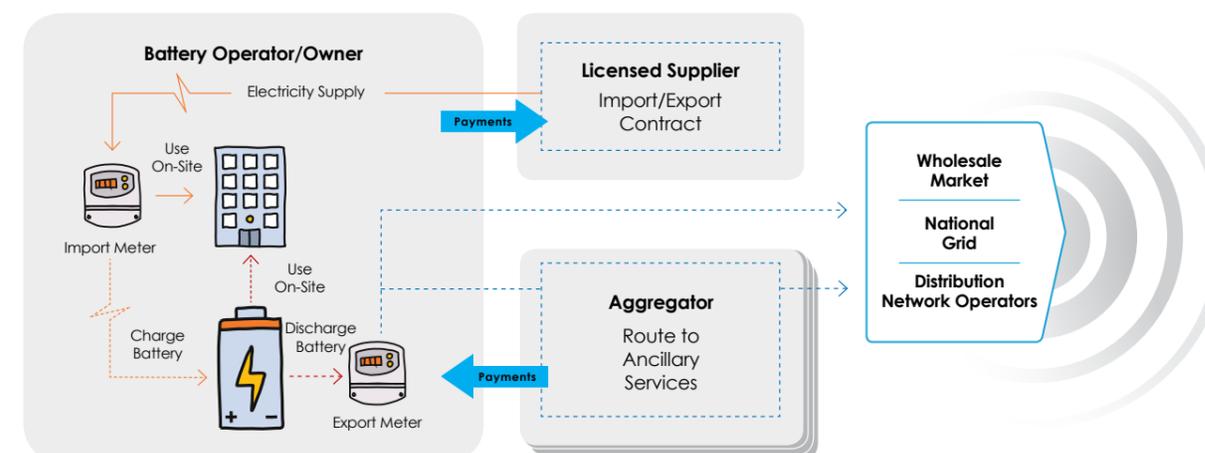
## Standalone Battery



## Renewable Co-Located Battery



## Consumer "Behind the Meter" Battery



# Multiple revenue streams being discussed

The challenge for these market players appears to lie in translating confidence into commercial reality.

Because the technology and opportunities are so new, there is lack of clarity around the payback timelines that are required. These projects are all 'proof of concept' at this stage, so requirements and expectations will differ significantly across different funding models and lenders.

Our survey results show that the line in the sand seems to be five years for project payback, although some are more optimistic than others. Some 36% of respondents expect payback on their investment within five years, while 49% expect it to be achieved within 5-10 years.

Interestingly, 16% don't predict payback for at least 10 years - this could be because they are just looking to use batteries behind the meter to offset energy costs which will result in a slower payback.

Whatever the payback time required, there are a multitude of revenue streams available, so project developers need to work out how to best combine them all to meet their specific targets. What is clear already is that multiple revenue streams will be needed to achieve payback but quite how they will work in practice requires clarification.

## Grid services core revenue for many

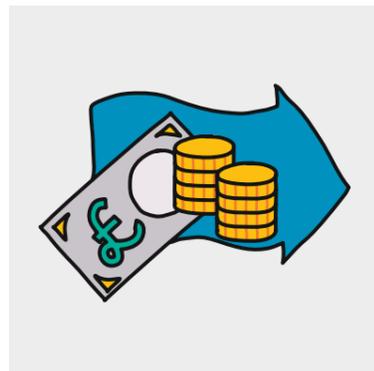
The biggest revenue opportunity available in the near-term will be from providing grid services such as frequency response to quickly supply the grid at a critical time, such as in the event of a major power station shutdown. Almost 70% of survey respondents indicated this was the main revenue stream they were investigating.

The latest auction to secure this capacity for the grid, the Enhanced Frequency Response (EFR) scheme, is taking place now. The results from this auction will have a significant impact on the sector, making projects a reality for winners and sending others back to the drawing board.

The short term nature of frequency response means it is regarded as being the current best fit for battery storage compared to other applications. But the short contract length for grid services is also seen as the biggest single challenge in monetising battery projects, with 31% of respondents citing it.

There is also a lack of clarity on future frequency response opportunities, with no detail yet available on whether the EFR scheme will continue after this current auction and how other schemes such as Firm Frequency Response (FFR) can support the battery ambition.

Clear timelines and capacity requirements are needed from National Grid for the various frequency response and demand response schemes that battery operators will look to benefit from.



ALMOST 70% OF SURVEY RESPONDENTS ARE INVESTIGATING GRID SERVICES AS THEIR MAIN REVENUE STREAM



### Demand response revenues also of interest

Demand response services such as the Capacity Market and Short Term Operating Reserve (STOR) were identified as other likely services to tap into by developers of battery storage. Almost two thirds of respondents stated that they are likely to look to benefit from these schemes.

Recent changes to the Capacity Market rules have marginally improved the position of storage, although the duration requirement will make it difficult for individual battery projects to compete.

### Energy trading could top up revenue

Battery owners can also secure a route to market agreement for their project to give them access to the wholesale market. This allows them to conduct arbitrage - charging the battery from the grid when prices are low and selling the power back when prices are higher. Just under half of our survey respondents (42%) are interested in securing revenues from energy trading.

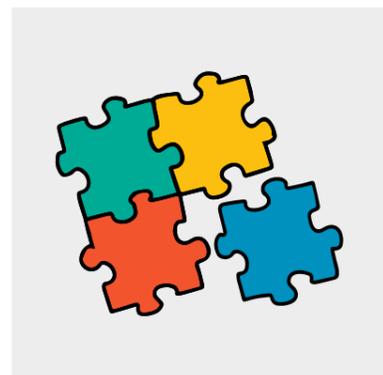
However, there are challenges that could limit this revenue option - peak and off-peak price spreads are not currently attractive enough and non-commodity charges also limit profitability.

Battery storage would also enable active triad management. By releasing stored electricity in a predicted triad period, generators could potentially secure significant revenue - up to as much as £46,000/MW for each triad half hour (based on winter 2015/16 prices for a London-based generator).

However this isn't a reliable revenue stream to build a business case on - triad periods are only confirmed at the end for the winter period and with changing demand patterns, are becoming increasingly difficult to predict.

For business consumers looking to use a battery to avoid triads by using stored electricity at possible triad times rather than taking it from the grid, the potential savings could be significant.

As well as avoiding the high triad charge, other peak costs such as Transmission Use of System (TNUoS) and Red Band Distribution Use of System (DUoS) can be reduced.



### Double-charging issues limiting profitability

The commercial case for batteries is further complicated by the charging of environmental levies such as the Renewables Obligation (RO) and Feed-in Tariff (FIT) to electricity consumers. As things currently stand, suppliers have to pass on the full charges for the energy supplied to charge batteries and when the energy is eventually exported, the end consumer is charged again.

This double-charging adds a significant cost for battery operators and would likely make the difference between them being able to profit from energy trading or not. With most projects being dependent on the ability to access multiple revenue streams, this issue could prevent many projects from being commercially viable.

Regulatory change is required to recognise the transitional role played by batteries - they are only storing the electricity rather than actually using it. SmartestEnergy, along with other industry stakeholders, have been working with Ofgem and DECC, now BEIS, to drive a review of these charging arrangements.

### Revenue streams complicated for renewable projects

As well as all the above considerations for securing revenue, renewable generators looking to co-locate a battery with an existing generation project face another barrier.

If the generation project receives a subsidy for being renewable, only green power can be used to charge the battery if it shares the same meter. If the battery were to be charged straight from the grid and then discharged, the generator could put their subsidy at risk by mixing brown power into their export.

The solution is to run the battery through a separate meter which in principle is achievable, but adds another layer of complexity for generators to overcome.

## WHY IS ENHANCED FREQUENCY RESPONSE (EFR) SO IMPORTANT FOR THE BATTERY STORAGE SECTOR?

**EFR is a new scheme operated by National Grid to maintain the system frequency in times of peak demand or decreased generation. Participants must be able to respond within 1 second, meaning battery storage is the main technology suited to this scheme.**

**The first EFR auction is currently underway, with National Grid looking to secure 200MW capacity. Projects must be fully operational by July 2017.**

**Over 60 developers have pre-qualified to participate in the auction, where they will submit bids for how much there are willing to be paid for providing capacity from their asset.**

**Auction winners are due to be announced on 26th August 2016 and experts expect around 20 projects to receive contracts.**

# Partnerships to take advantage of commercial opportunities

With so much uncertainty about the commercial viability of battery projects, developers are keen to keep their options open and look for new ways to generate revenue.

There are only a few operational batteries in the UK, so experience is limited. The key to getting projects off the ground will be partnering with commercial, legal and financial stakeholders who can help put the pieces of the puzzle together to unlock revenue.

## The role of suppliers

Most battery projects will need a route to the wholesale market in order to charge and discharge electricity.

Operators with grid services contracts will need to be able to buy power to ensure the battery is charged when they are called on to release it to the grid. Co-located batteries could also need to charge from the grid and sell back this power along with their own export.

This service will need to be provided by a licensed supplier through an import/export agreement.

If a battery operator is combining their storage activities with other projects, such as a generation portfolio or a large business electricity demand, partnering with a supplier can be the easiest way to reduce administration. Power Purchase Agreements (PPAs) and supply contracts can all be coordinated with the battery activities to simplify contract management and payments.

## The role of aggregators

Developers might also decide to partner with aggregators to support their project. An aggregator would provide their route to the grid services, as well scheduling and dispatch of services, and wholesale energy optimisation.

Knowing when to charge and discharge to ensure availability to the grid can be daunting, so outsourcing this responsibility to an aggregator will be very attractive for some developers.

Our survey results indicate a range of views on the value of using aggregators to support the commercial management of battery projects.

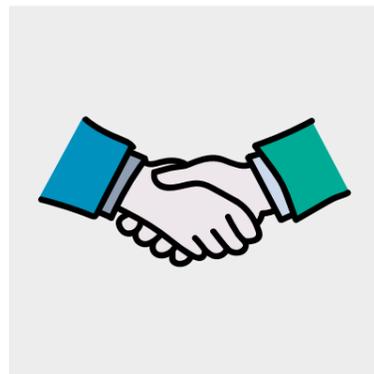
Just under half of respondents expect to use a partner to provide access to demand response (47%) and frequency response (44%) schemes, and to manage scheduling and dispatch of services (40%). This means that around half of developers surveyed currently feel they will have the expertise and infrastructure in-house to manage this themselves.

However, we expect this to shift as the complexity of operating batteries becomes more apparent. The regulatory, trading, operational and financial environment will continue to be complicated even once some of the initial challenges are ironed out, so the value of outsourcing this to an experienced partner will become clearer once projects go live.

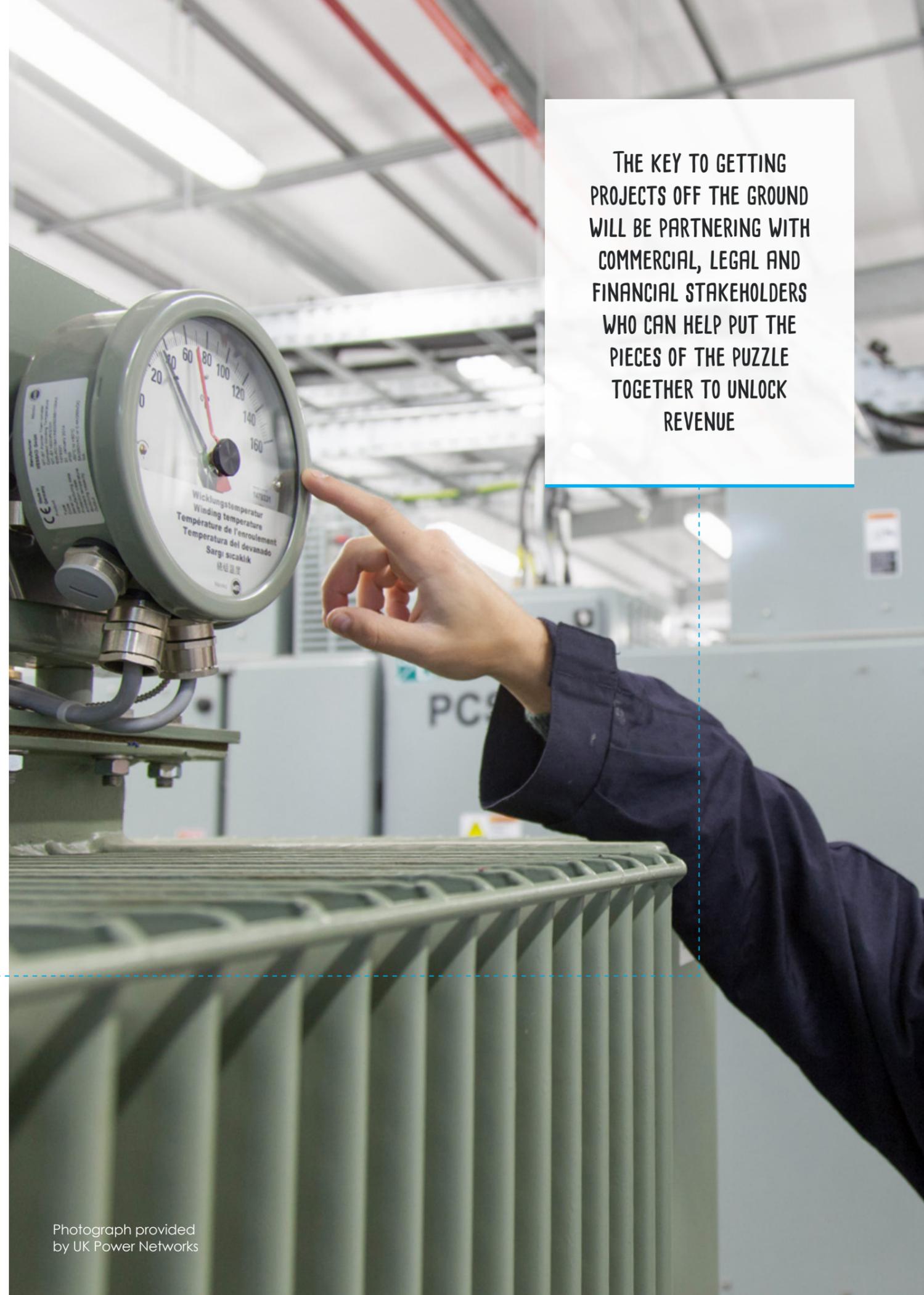
## Evolving partnerships key to optimising batteries

Working with a commercial partner can bring many more benefits than just streamlining operations. With battery technology and the energy market developing so quickly, there will always be new and different ways to monetise storage assets.

By establishing a framework with an aggregator, developers can put themselves in the best possible position to be able to identify and take advantage of new opportunities. While they are focusing on their day-to-day business, their partner can be focused on innovation and creative ways to optimise revenue streams.



THE KEY TO GETTING PROJECTS OFF THE GROUND WILL BE PARTNERING WITH COMMERCIAL, LEGAL AND FINANCIAL STAKEHOLDERS WHO CAN HELP PUT THE PIECES OF THE PUZZLE TOGETHER TO UNLOCK REVENUE



# Conclusion

Battery storage presents a significant opportunity for the UK energy sector and stakeholders across the industry are excited about the potential. Developers are at the forefront of this, with their high confidence levels and entrepreneurial spirit driving the agenda to commercialise batteries.

However, there are clearly many uncertainties undermining the business case for a lot of these projects. Once the results of the current EFR auction are released, many projects will move into development, but for those that are unsuccessful, new plans will need to be made.

In order to provide clarity for these developers that are trying to pioneer battery storage, we believe the following developments are required:

1. CLARITY ON FUTURE GRID SERVICES - MORE DETAIL MUST BE SHARED, INCLUDING TIMINGS AND CAPACITIES, ON THE FUTURE OF FREQUENCY RESPONSE SCHEMES AFTER THIS EFR AUCTION
2. EXEMPTING STORAGE FROM RENEWABLE CHARGES ON IMPORTED ENERGY - REMOVING THE REQUIREMENT FOR BATTERIES TO PAY THESE LEVIES WOULD BE A SIGNIFICANT STEP IN HELPING ENCOURAGE INVESTMENT IN THE SECTOR
3. CONTINUED COLLABORATION AND KNOWLEDGE-SHARING - THE INDUSTRY IS STILL LEARNING ABOUT BATTERIES, SO SHARING THIS EXPERIENCE WILL HELP CREATE SUCCESS FOR EVERYONE INVOLVED

**We will continue to play our role in supporting developers with commercial solutions and championing this valuable sector to ensure batteries are able to make their much-needed contribution to the UK's energy landscape.**

# Methodology

The statistics included in this report have been derived from an online survey conducted in June and July 2016, which received 45 responses.

Further insight has also been gained from our commercial interactions and relationships across the independent generation market. Trends and opportunities highlighted in this report have

been tested with a range of industry stakeholders and through additional research conducted at energy events, sales meetings and internal research.

It is not our intention to attribute any comments to specific customers and no commercial confidences have been breached in the production of this report.

# About us

SmartestEnergy was launched in 2001 as a generation aggregator and by 2008, we were also supplying industrial and commercial organisations.

We now have a diverse and growing portfolio, with over 600 generation customers ranging from communities to blue chip companies, and over 1,000 business electricity customers from high-street brands to major manufacturers.

To discuss how we can work with you on your projects, please contact the Generation Sales Team on:

**Phone: 01473 234157**  
**Email: [storage@smartestenergy.com](mailto:storage@smartestenergy.com)**

