

# ENERGY STORAGE

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How does energy storage work?

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# WHAT IS ENERGY STORAGE?

Energy storage is the capture of energy produced at one time for use at a later time.

The energy being stored can come in multiple forms, including pumped hydropower (which currently occupies a global energy storage market share of more than 95%), thermal energy, and compression technologies. This edie explains guide will focus on battery storage technology, which holds the most potential for current onsite business applications.

As demand for electricity increases at peak times, power plants need to ramp up energy production, and grid operators have the difficult task of ensuring that enough power is being transmitted to homes to meet demand, so as to avoid a brownout or blackout. This process often involves holding

power plants at low usage when they're not needed and turning them on during peak hours, which can be inefficient, and using fast-start generators to provide quick, limited power, which can be costly.

This is where energy storage comes in. The technology allows the electricity grid to operate more efficiently and cost-effectively as it lets the system consistently run at an average load rather than at a peak load. Energy storage also provides system stability during electricity outages and reduces the need to import electricity via interconnectors. For businesses, meanwhile, energy storage helps to maintain reliable supply, reduce wastage and reduce costs. ▶

## TOP TIP:

### WHAT'S THE BIG IDEA?

Before installing energy storage (or any onsite solution, for that matter), it's crucial that you and your team have a good understanding of exactly what it is you want to achieve. Are you trying to create a new revenue stream or is this part of a wider energy strategy? Knowing that from the outset will make sure you get the system you want.

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## How does energy storage work?

Commercial battery storage systems – those up to 49MW in size – are essentially scaled-up versions of the batteries found in mobile phones, wireless drills, and electric cars. These batteries use lithium-ion chemistry, which has a relatively high energy density and a very slow self-discharge rate when not in use. The batteries can be charged up by a variety of potential electricity sources; they will then store that power and can discharge it as and when required by the business. Some batteries will have quicker storage capabilities and discharge over a short period of time, while others will have longer charge and discharge rates, depending on the size of the storage units and the chemistry that is used.

Crucially, these batteries can be co-located with renewable energy systems, either to smooth the power supplied by the intermittent wind or solar output, or to shift the power output into other hours of the day when the clean energy plant cannot produce power directly. The on-and-off nature of renewable energy means that, to avoid unexpected blackouts and surges, it must be integrated into the national electricity grid alongside energy storage. These hybrid renewable-storage systems can help businesses move towards a state of self-sufficiency by generating and consuming all of their energy off-grid, whilst reducing the usage of fossil fuels, enabling a greener energy supply mix.

## Which organisations might be most suitable for energy storage?

Broadly speaking, any type and size of business could benefit from deploying energy storage, but the technology will be most appropriate for businesses that have particular concerns around energy prices or resilience, and those that undertake critical, energy-intensive industrial processes. Additionally, for businesses that already have on-site generation, energy storage will allow them to utilise more of their own generation and less energy from the grid.

## What are the benefits of energy storage?

The specific advantages of any energy storage system will of course depend on the type of business it is being installed for and the energy systems it is being developed with, but broadly the key benefits of energy storage are as follows:

### Increased energy resilience

Energy storage can provide instantaneous back-up energy for critical processes to improve power quality and protect against power cuts. This makes the technology particularly relevant and beneficial to energy-intensive businesses that carry out critical processes – manufacturing plants, for example, where a loss of power could result in a complete shutdown and wasted materials. In this regard, the battery can also act as an uninterruptible power supply (UPS), by providing emergency power to a load when the input power source or mains power fails – this could prove particularly beneficial to businesses where an unexpected power disruption could cause injuries, fatalities or data loss.

### Cost savings and revenue generation

A large portion of the return on investment in energy storage will come from **demand response** services – where the National Grid incentivises energy users to turn up, turn down or shift energy use when needed. Some demand response contracts can be very lucrative, especially if a business can be called upon at short notice by the grid to change or shift its energy use.

One example of this is the grid-balancing service known as **frequency response**. To cope with deviations in frequency caused by the loss of power, the National Grid will reward businesses for having the asset available through a balancing services agreement which is fixed over a two-year term. Additionally, there is the opportunity for businesses to tie an energy storage system into a **capacity market contribution** – at times when the grid is under capacity stress, the business could deploy its battery power back to the grid and be paid through the capacity market clearing. ▶

#### TOP TIP:

#### SHOUT ABOUT IT!

Raising awareness of your energy storage project is crucial. Not only will this help to drive engagement with your energy management strategy, but it will also ensure everyone understands the health and safety aspects of the new installation.

#### TOP TIP:

#### SUPPLIERS WILL MITIGATE RISK

Choosing to manage an energy storage project on your own may reduce costs in the short-term, but it's also a lot more work and could open you up to more risks and future costs. Using a reputable supplier to help deliver the project from the outset will ensure you are given an end-to-end solution – plus, they will operate and maintain the asset for you.

Some businesses that have installed energy storage systems have taken this a step further by carrying out **'energy arbitrage'**, which involves buying energy from the grid at a cheaper night time rate and then configuring the battery storage unit to discharge electricity back to the grid during peak periods, receiving a better price per kilowatt hour than it originally purchased the electricity for.

An additional way of utilising battery storage to reduce costs is to deploy the stored energy for use in your own business to **avoid 'Triad' charges**. Triads are the top three half-hour peaks of energy demand across the National Grid, each separated by at least 10 consecutive days, over the most energy-intensive period of the year: November to February. By using stored energy rather than energy from the grid, a business can avoid paying the Triad charge, potentially saving thousands of pounds on its energy bill.

## Emissions reductions

Renewable energy often comes under fire because it is deemed intermittent and unreliable, but battery storage provides a solution; allowing businesses to save any excess energy generated by renewable energy systems so that they can use that energy as and when they need it, rather than the energy being fed straight back into the grid. In this regard, the scaling up of energy storage technology will support the mass deployment of renewables which, in turn, will help to significantly decrease carbon emissions across the globe.

## What are the key considerations when installing energy storage?

Before considering energy storage, a business should develop a good knowledge of its current energy profile – where and how it is consuming electricity – and the site within which the energy storage unit would be installed. It should also consider whether or not it is operating within a low-voltage (LV) or high-voltage (HV) electrical network, and if there any potential energy resilience issues affecting the site (such as brownouts or blackouts). Having a good understanding across these areas will help the business work out its exact energy storage requirements and how it can make the most of the new system.

When embarking on an energy storage project, the business will be faced with a number of questions: should the system be purchased through a Power Purchase Agreement (PPA) or fully funded? Should it be an 'off-the-shelf' energy storage system or a bespoke unit? Should the project be carried out with the assistance of an expert solutions provider, or managed in-house? In all instances, the business should investigate the potential advantages and disadvantages of each option, always keeping in mind exactly what it is trying to achieve with the energy storage project – is the primary goal to create a new revenue stream or is the new system part of a wider energy strategy which has different long-term goals?

Another key consideration is the size of energy storage unit being installed. This will of course depend on the exact energy requirements of the business, but a general rule of thumb would be to match the battery capacity to the half-hourly load of the site it will be serving. The business should consider exactly how much usable energy the battery system would need to provide to meet its maximum daily electricity usage (kWh/MWh) and peak demand (kW/MW). Once decided upon, it should also be noted that there will be a lead time for any battery unit to be delivered and installed, which can be up to six months.

## What are the current costs and ROI for energy storage?

Broadly speaking, the price point for battery storage units has reached a sensible enough level for businesses to earn a reasonable return on investment from the technology. The exact costs of an energy storage system will depend on the size and type of battery being installed and the specific requirements of the business installing it. It is estimated that a complete energy storage system (including all of the additional equipment that is required such as a transformer, a ring main unit and additional meters) will cost in the region of £600-£650 per kW installed. Additional factors such as cabling and metering will further impact this cost.

A commercial energy storage unit usually has a minimum estimated lifetime of 15 years, and the return on investment is estimated to be around 14-15%, but again it is important to stress that this figure is dependent on a number of variables. ▶

### TOP TIP:

#### TAKE A JOINED-UP APPROACH

It is important that energy storage is treated as part of a broader sustainability solution rather than in isolation. Work out where the unit will have the biggest impact: for example, pairing up energy storage with an existing CHP plant could help to smooth the profile of that plant.

### TOP TIP:

#### A SMALL INTERRUPTION...

When installing a new energy storage unit, there will likely be a small interruption to the site's energy supply. It's worth thinking about exactly when might be best to make the installation so it does not to have a big knock-on effect.

### TOP TIP:

#### WHILE YOU WAIT...

Battery storage units often come with an 18-20-week lead time before being delivered. Use that time effectively: start the civil works and have all of the infrastructure put in place so that you're ready to install come delivery day.

Additionally, it should be noted that the return on investment for energy storage is likely to change over time as the financial incentives received through the grid balancing and demand response services fluctuate.

## How is the energy storage market developing?

The global battery storage market is currently experiencing huge growth – from an initial base of 0.34GW of installed battery storage capacity in 2012 and 2013, to more than 6GW today and an estimated 40GW by 2022. This market growth is due in part to the falling costs of energy storage technologies, which is being particularly felt within the electric vehicle (EV) market. The International Renewable Energy Agency (IRENA) recently estimated that the cost of battery storage could fall by up to 66% by 2030 from today's rates.

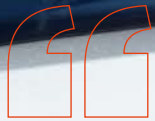
In the UK, the potential financial benefits of this growth in energy storage are vast – Imperial College London's Energy Futures Lab has estimated that energy storage technologies could generate savings of £10bn a year by 2050. The Government recently pledged £246m of investment into battery storage R&D to help break down some of the barriers to developing new battery technologies and introduce new business models to accelerate industry growth.

One particularly interesting energy storage development is currently being seen in the EV market, with manufacturers developing new 'vehicle-to-grid' technology which allows consumers to sell the energy stored by their batteries back to the grid for a profit. EVs could eventually form, as a collective entity, the largest energy storage system of all. The move towards mobile energy hubs and smart energy networks heralds an exciting era for energy storage in the UK, and further underlines the growing importance of this technology in the country's future energy system. ■

### TOP TIP:

#### TOO MUCH OR NOT ENOUGH?

When working out how much usable energy your battery system needs, go back through your last 12-24 months' electricity bills to get a good understanding of usage patterns throughout any given period.



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# VIEWPOINT: IAN HOPKINS DIRECTOR, CENTRICA BUSINESS SOLUTIONS



Energy storage activity is increasing rapidly, through grid-scale projects, commercial energy storage schemes and domestic batteries.

The rise of batteries is partly driven by the need for increased flexibility, and helped by the falling cost of materials. This has allowed organisations to reduce their energy bills, secure back-up power when necessary and even generate revenue by supporting the grid.

We are increasingly being asked by customers for advice on battery storage technology and have just recently completed the installation of a 3MW facility for Gateshead Council.

The battery project will store or release energy for the Gateshead District Energy Centre, which consists of a pair of 2MW combined heat and power (CHP) units which generate enough electricity to power 5,000 homes. The battery storage scheme will also be used to help meet peaks in local demand by supplying electricity through a private wire to council-owned buildings and local landmarks.

## Revenue streams

For larger businesses, two key functions provided by batteries are load shifting and grid balancing. Batteries should first be used to reduce peak energy consumption but after this, organisations might have 18-20 hours per day to make the asset available for grid balancing services.

Dynamic frequency response, which calls for two-second response times to meet grid requirements, can last for up to 30 minutes but typically an event is only around 15 seconds in duration.

This dynamic response is suited to battery assets, and is a service that National Grid pays a premium for as a balancing service, that sees providers push power onto or

absorb power from the grid to moderate frequency and keep the system stable.

## Smarter systems

It's likely that other revenue streams will come into focus as the energy market evolves. This will introduce more creative and innovative solutions to be supported commercially, whilst supporting network stability.

Businesses can see real benefits from energy storage. While it might be intended to provide energy resilience, it can do so much more than that. ■

**To find out more about how Centrica can help power your ambitions with intelligent, end-to-end energy solutions, go to [centricabusinesssolutions.com](http://centricabusinesssolutions.com)**

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