Development of decentralised energy and storage systems in the UK

A report for the Renewable Energy Association

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1 Executive summary

This report has been prepared by KPMG LLP at the request of the Renewable Energy Association (REA). The report assesses the key trends relating to the development of decentralised energy and storage, the key benefits, and the barriers to its introduction. It sets out some potential opportunities for the deployment of decentralised energy systems, using a number of decentralised energy scenarios. We identify some policy and regulatory measures that could assist the efficient development of decentralised energy, as part of a potential implementation strategy.

The cost of decentralised energy technologies is falling rapidly. Recent technology innovation and production enhancements mean that the costs of solar power and wind power are falling. The greatest cost reduction has been experienced by solar, and some forms of energy storage are expected to follow a similar cost reduction path. With tools for customers to manage their energy use, decentralised energy systems could help lower energy costs for consumers, and contribute to decarbonisation and security of supply objectives.

For example, when solar photovoltaic (PV), storage and energy demand management are combined into decentralised energy systems, they offer the potential for greater benefits to be realised. Such integration of other energy components such as electric vehicles, heat pumps or Combined Heat and Power (CHP) may be realised at a domestic, business, or local level. Decentralised energy solutions are likely to have an increasingly important role to play in the national energy landscape, especially if they become more commercially attractive to consumers and businesses than their current energy services.

The continued growth of decentralised energy solutions may potentially transform the GB energy industry from a national energy market administered by government, regulator and utilities, to where this encompasses a new market where local integrated energy solutions are determined by consumers, businesses and communities. This is already underway, fuelled by the rapid penetration of distributed solar PV. A further boost to decentralised energy markets could occur if storage installations become more economic and can be effectively integrated into the energy system.

However, uncertainty surrounds how these new solutions may participate in energy markets, particularly in combination. Existing energy market rules and regulations have been largely created with large scale generation in mind and are complex for smaller participants. While work to enable the growth of this new complementary market sector is in progress, barriers still exist. Enabling new distributed energy and storage to participate in existing energy markets should allow benefits to be realised, and offer a ‘no regrets’ approach. Clear market rules and innovation incentives should help new technologies make the difficult jump from pilot projects to commercial operation.

Decentralised energy and storage trends

Cost reductions – Since 2012 the costs of domestic-scale solar PV costs have fallen by 40% \(^1\), with global wind costs falling by 60% since 2009\(^2\). Further cost reductions are expected. Lithium ion battery storage costs are currently falling rapidly.

Variable renewable generation – Currently, there is estimated to be well in excess of 20 GW of wind and solar generation connected to the GB energy system. According to analysis performed for the Committee on Climate Change, this is forecast to increase significantly over coming years causing

\(^1\) Source: KPMG analysis

\(^2\) Source: Lazard's, 'Levelised Cost of Energy Analysis v9.0'
increased requirements for new storage, demand response, and interconnectors to provide balancing and reserve services. This will fill the periods when variable generation is not available, and to supply energy at peak demand periods when electricity prices may be more volatile.

**Opportunities for deployment**

**Benefits** – Increased deployment of decentralised energy and storage offers important benefits to the national energy sector, including:

- Lower overall energy costs as the risk of potentially high peak energy prices is reduced;
- New generation and network investment for peak capacity is not required;
- Reducing the risk of negative prices at times of low demand, when the energy system is dominated by ‘must run’ nuclear and renewables;
- Consumer or local energy management helps balance local demand and supply, thereby contributing to security of supply;
- Reduced UK dependence on imported fossil fuels, at a time when North Sea oil and gas production is declining (a trend that may accelerate give current low prices); and
- An increased contribution to decarbonisation by enabling greater penetration of variable renewable generation within the energy system.

**Revenue sources** – There is potential for decentralised energy and storage to earn revenues from three main sources, namely:

- National system energy balancing, reserve and capacity services, contracted by the national System Operator, including the Capacity Market.
- Grid investment deferment, contracted by network companies.
- Energy supply revenues, through participation in national energy markets, probably contracted through an energy supplier or aggregator.

**Economic case studies**

We have analysed the following alternative business models for deployment of decentralised energy and storage:

**Small scale** – Where domestic or business prosumers producing their own power develop their own decentralised energy and storage systems.

*Our analysis shows that these may soon be economic for both domestic and business prosumers in certain circumstances, allied with an appetite for early deployment due to non-financial buying criteria*. For example, we expect that it may become economic for households with existing generation assets to ‘retrofit’ storage from around 2017.

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3 For example, some consumers may gain value from owning a technology that is ‘cutting edge’, or from being self-sufficient in energy.
Large scale – where decentralised energy and grid level storage resources participate in national energy markets, either directly or as city scale energy schemes.

Our analysis shows that large scale decentralised energy resources, especially demand response and storage, are already economic in certain circumstances, although barriers to securing funding may remain.

Payback periods on initial capital investment, grid scale lithium ion battery

- Low capex, low revenue
- Low capex, high revenue
- High capex, low revenue
- High capex, high revenue
Challenges and barriers to be addressed

Our analysis shows that decentralised energy systems are already approaching the point where they can participate in existing national energy markets, including markets for energy, reserve capacity, and other grid services such as investment deferral and frequency response. However, there are a number of barriers to market participation for decentralised energy and storage resources, including:

■ Existing energy and reserve markets are generally designed around incumbent generators and their historically defined operating characteristics. These generators may already have recovered their capital costs, and are able to compete on a marginal cost basis.

■ The market rules, industry regulations, charging arrangements, and institutional framework are complex and generally designed for large sophisticated market participants. Many decentralised energy systems will be much smaller scale and may be deterred by this complexity and cost.

There are a number of market and regulatory changes that should encourage decentralised energy resources and give storage simple and fair access to energy and reserve markets. These include:

■ Enhancing potential participation in existing national energy, reserve and grid support markets through long term contracts that support and encourage decentralised energy investment and associated changes to mechanisms such as the Capacity Market (see section 7.1).

■ Enabling new local energy market arrangements that encourage small scale storage, demand response, solar, and other energy components to combine and add value for consumers. A range of alternative market arrangements may be required as consumer preferences emerge.

■ Ensuring price signals are sufficiently strong to encourage investment, for example by making changes to settlement arrangements in order to charging more reflective of customers’ actual usage, or through time of use tariffs.

■ Ensuring rules and regulations are simple and proportionate to enable integrated energy solutions at a consumer and community level to both realise benefits and protect consumers.

■ Setting out a clear definition for energy storage and changes to the grid system to create a new licence category for storage.

■ Making sure energy networks continue to receive sufficient funding if Distribution Use of System (DUoS) revenues decline as prosumers opt to go ‘off grid’.