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Energy storage interview: Graham Kenyon

Director and Principal Consultant at G Kenyon Technology Ltd, Graham has established his reputation designing and implementing control and information management systems in the challenging environments presented by world-class construction programmes in the airport & railway industries. He serves on the IET's Wiring Regulations Policy Committee and CIBSE's Electrical Services Group Committee, and as Deputy Chair of Panel D of JPEL/64 (BS 7671, IET Wiring Regulations).

Graham is co-author of the forthcoming IET Code of Practice for Electrical Energy Storage Systems*, and author of the recently published IET Technical Briefing* Electrical Energy Storage: An Introduction*.*

We interview Graham to find out more about the energy storage market, developments in this area and the skills and experience electricians might need to work with energy storage installations.

What is the current maximum battery capacity?

Estimates of current levels of dedicated energy storage batteries range between 20 MW and 30 MW. Some reports have predictions that this could increase to above 1.5 GW by 2020, and conclude that energy storage is likely to see significant growth in the next few years.

Is this technology likely to be driven by non-domestic users first?

The technology is being driven in a number of ways, and research into storage systems is occurring for a number of reasons. Excluding mobile device technology, perhaps the biggest driver for development in battery storage at the moment comes from the automotive traction arena. However, the benefits of energy storage for various applications are already being realised with very large storage systems embedded in the grid, for reasons ranging from support of renewable generation technologies, to deferral of upgrades to networks as local demand peaks increase.

Do you believe this technology will drive the solar PV and other alternative energy markets?

It's probably true to say that there is a symbiosis of the energy storage and alternative energy markets. Renewable resources do not provide a constant stream of generation over a day, and their output may be seasonal. For example, solar PV provides its average highest output in the summer months and lowest in winter, because of both the number of daily sunlight hours, and the angle of the sun at the time of year. Energy storage can help optimise and maximise the more efficient utilisation of renewable resources.

What do domestic consumers need to be aware of before having an energy storage system installed? Will such consumers require much education once the storage system is installed?

The key awareness for consumers is:

- particularly where the system is used in conjunction with renewable generation systems, the selection of the system must be carefully analysed to ensure that any perceived benefits will be achieved, particularly where the system is required to optimise energy tariffs. The system must be compatible with renewable generation in the installation.
- where the system is intended to supply stored energy in the event of grid power being lost, there are limits as to the loads that can be serviced in this mode. For example, operation of electric showers, ovens, hobs etc. would be mostly impracticable, and the loads would be limited to very small power ones, such as energy efficient lighting, and certain other electronic devices. This type of system is likely to require installation of additional earth electrodes where there are none present in the installation, or where the earth electrodes that are present do not meet the needs of the energy storage system.
- energy storage systems require maintenance:
    - batteries have a limit to their usable life and will need to be replaced or refurbished in accordance with the manufacturer's instructions.
    - the load profile of the installation may change over time, and the system may require 'tuning' to ensure the users get the optimal benefit for the installation.

Overall, the above would be considered by a reputable, competent contractor.

How easy is it for an electrician to install an energy storage device – is specialist training required?

This depends on the design of the system, and how it is intended to operate. Packaged systems require less specialist knowledge, particularly where comprehensive installation and commissioning information is provided.

Skills and knowledge required to install electrical energy storage systems are addressed in the forthcoming IET *Code of Practice for Electrical Energy Storage Systems*, and may include:

- awareness of relevant battery types, safe battery installation, transportation, maintenance and disposal.

- safety and Building Regulations requirements for the safe location of components of the storage system.
- knowledge of the legislation and industry practices for embedded generation systems, and generators operating both in parallel with the grid, and as a switched alternative to the grid.
- awareness of the limitations of energy storage systems operating in island mode (i.e. as a switched alternative to the grid supply), relevant safety provisions, and the need for load shedding.

Where systems are installed in conjunction with solar PV or wind systems taking advantage of the Feed-In Tariff (FIT), MCS certification *[microgeneration certification scheme – visit http://www.microgenerationcertification.org/consumers/finance-incentives/fits to find out more]* will be required.

The provision of a new electrical energy storage system (EESS) in dwellings will often require new circuits, or changing protective devices, and in these cases the work is generally notifiable under the applicable Building Regulations. See the relevant Approved Documents (England & Wales) and Technical Standards (Scotland) for further details.
It is anticipated that training providers will make relevant courses available once the IET *Code of Practice for Electrical Energy Storage Systems* is published. Before then, manufacturers training and information should be consulted, along with the relevant parts of BS 7671 and related guidance.

What safety precautions are required with regards to the installation and maintenance of Lithium batteries used for energy storage?

Any energy storage medium has the property that, if there is a fault or failure of some kind, the release of energy may be extremely violent. With batteries, if they are charged in the wrong way, this may cause faults which may be caused by overheating or not managing the temperature. These faults change the physical or chemical arrangement in the cells of the battery, and release the stored energy. This is the case with most raw battery technologies, but methods have been developed in their manufacture, and in related charging and discharging control circuits, which permit their widespread use.

Certain Lithium battery types have come under scrutiny because of the way in which they can fail, causing thermal runaway, which may, dramatically, lead to fire, or burns with a hand-held device. The prevalence of Lithium batteries in an extremely large population of portable consumer products has brought the battery technology much media attention. Since such portable consumer products are designed to be ever smaller, the issue of managing heat within the batteries is a key consideration for designers and manufacturers. Learning from advances in the portable consumer electronics market, Lithium batteries from reputable manufacturers, which are intended for energy storage applications in electrical installations, should incorporate control and protection mechanisms within the battery itself.
All battery technologies require a charger compatible with the battery, and many of these additionally incorporate thermal monitoring.

The location of all batteries to take into account a more stable ambient temperature for charging and storage is extremely important, as extremes of temperature can impact the storage capacity and usable life of batteries. Certain battery technologies are must be located or adequately enclosed to ensure they are not exposed to water.

How much space does an energy storage device require?

The amount of space required depends on the storage capacity, power delivery rating of the system, and whether it is pre-packaged as a single manufactured unit, or a bespoke-designed system. It is anticipated that the smaller systems would typically be found in installations related to dwellings, with larger ones in commercial, industrial, infrastructure and grid-support applications.

At the smaller end of the scale, self-contained, complete, stand-alone units, suitable for wall-mounting in a garage in a domestic installation are already available. Vastly larger systems are already operating in industrial sites, or embedded in the Grid.