4th September 2020

Question 1

“Apart from the products listed in Table 2 and in sections 2.1.1 – 2.1.8, are there other energy-related products that could save additional energy and resources through better minimum energy performance standards and/or resource efficiency requirements? Please provide evidence and/or data.”

“Affordable and Clean Energy” is the title of the United Nations (UN) 7th Sustainable Development Goal. This is one of 17 such goals, of which 5 other goals can only be achieved if the 7th goal of affordable and clean energy is delivered. In the same way as water or food, whether it is used to provide light or heat, keep goods fresh, or get around, energy is a necessity.

It is estimated that 850 million people still do not have access to affordable clean energy and that 600 million will never get access to a national grid as it is not viable to do so. Power has been generated in large power station as and distributed to consumers as alternating current (AC). In the absence of a power grid locals generation solutions become an option. This could be photovoltaic (PV) panels on the roof of a building, solar farms, wind and other sustainable generation sources come into play. These naturally generate direct current (DC).

United Kingdom

In the UK rectification converts sustainable current to AC. However, when we switch our TV on, charge our phone, use smart tech etc, we rectify this to DC via adapters plugged into the walls or rectifiers inbuilt into products. The loss of current and heat generated each time this happens is an inefficient use of the power.

Bath University researchers converted one of the University’s library computer laboratories to a DC rather than AC supply. During a six-month trial, 50 modified computers and monitors were installed and powered from a specially created DC network relying on a central localised converter. They halved their annual electricity running costs. A study by electricity watchdog Ofgem said their ideas could save £200m in long-term development costs.

LED lighting has contributed to a reduction in demand. It’s difficult to calculate using a 1p per bulb per hour in electricity cost – could be as much as £4billion per annum. LED’s nevertheless rectify AC to DC in order to operate. Based on the logic of the Bath Uni project, there is further potential for energy efficiency here if we were to move from multiple rectifiers in the light bulbs to a single rectifier for a building.

By ensuring that assets operate as specified we can expect further efficiencies. e.g. HVAC systems compressors frequently don’t have regular inspections and leaks contribute to a lack of efficiency. Similarly, if homes changed the way they maintained operated their gas boilers they too could save cost and produce less carbon.

In the UK we benefit from a power standardised infrastructure that delivers such that consumers easily benefit from products that ‘will do what it says on the cover’. This standardisation means that it is very difficult design and develop buildings to DC distribution. Our estimates are that use DC in a building could save between 10 and 15% of the energy build. The UK needs to develop number of exemplars f DC buildings. In the Netherlands,
ABNAMRO bank has configured a new build development to use DC\textsuperscript{ii}. The UK has no substantial LVDC demonstrator and it is our view that we are lagging.

The Active Building Centre\textsuperscript{iv} has proven the ‘every building is a power station concept- Active Buildings can produce and store enough renewable energy to meet their own needs or more.

The UK’s strong drive to retrofit residential and commercial buildings with the aim of reducing carbon, will lead to more buildings generating sustainable energy for their own consumption without rectification.

Electric vehicles (EV) will place increasing demands on the grid. There is a logic that suggests the more sustainable generation sources, such as PV, that are implemented the stronger the case for DC becomes. A DC distribution grid for DC cars in becoming standard practice in the Netherlands. This strategy was adopted when they realised their AC grid would not cope with the charging demand.

Rapid charging hubs are expected to be an important part of the UK’s EV infrastructure, but network upgrade costs to accommodate them are prohibitive. DC Share\textsuperscript{v}, a project supported by OFGEM, will trial a Method to provide rapid charging facilities where they are required by users. DC Share Method will use an equalisation network to provide an alternative, cost effective solution for rapid EV charging demands, more flexibly than a traditional AC reinforcement solution and has potential to support the grid at times of peak demand.

There is a football stadium in the Netherlands that uses recycled car batteries to store 3 megawatts of power – that’s equivalent to 700 homes usage for an hour\textsuperscript{vi}.

An update to BS 1363, the standard for UK’s national electrical power plug and socket outlet system would further drive adoption\textsuperscript{vii}. This is configured for AC only and if updated to allow it to cover a DC related electrical power plug and socket outlet system it would facilitate the adoption of DC. There are a variety of USB and power over ethernet connections too.

Appliance manufacturers need to be encouraged to offer DC compatible products at competitive prices. An alternative strategy could be to legislate for all products to be useful whether using AC or DC power. The Indian government has suggested that it wants to see price parity between AC and DC powered appliances.

**International**

The IET is the publisher of BS 7671 - Requirements for Electrical Installations, IET Wiring Regulations\textsuperscript{viii} which is also a standard that has been adopted in many other countries. In addition, we have published other guidance on the use of DC distribution in buildings.\textsuperscript{ix} These publications are predicated by the assumption that there is a stable of power at a constant voltage.

In the off-grid world, no such standardised supply exists. In countries such and India, Bangladesh, Ghana and Kenya it is possible to purchase PV kits and do self-installation. There is no standardisation of kits and the voltages generated which when coupled with a lack of standardised energy related products leads to a high rate of failure of both kits and appliances.

However, it is clearly impossible to test every possible appliance with every possible variation of off-grid electricity supply, and we are there supporting work of an IET member to deliver an International Electrotechnical Commission establish a system to help the consumer easily establish the compatibility of product and generation systems.
Recommendation

DC is widely used in products, sustainable energy generation is growing, therefore adoption of DC in buildings and products can further enhance energy efficiency of those products.

The UK is at the forefront of the sustainability agenda. We need to capitalise on this for the benefit of the global environment. This will reap strong financial rewards for the UK.

Greater adoption of DC energy and DC enabled technologies will help us all achieve this

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iv https://www.activebuildingcentre.com/


vii https://shop.bsigroup.com/ProductDetail?pid=00000000030365272

viii https://electrical.theiet.org/bs-7671/
