Powering Britain's public sector

A Centrica Policy Paper to support the public sector energy challenge

centrica
Business Solutions

Contents

Foreword

> “Energy technology has the potential to maximise resources for frontline services, deliver better value for money and reduce carbon emissions”

The public sector is fundamental to our lives. It looks after our health, defends us against internal and external threats and educates our children. In doing so, it also enables the rest of the UK economy to function properly.

Powering the public sector costs in the region of £3.4bn[1] every year. Such public expenditure has come into sharp focus over the last decade, alongside ambitious goals to reduce its carbon footprint.

Faced with these pressures, it is critical to take decisive action in order to safeguard front line services. I believe that the UK public sector can use energy technologies to ease the burden and achieve these goals. Distributed energy solutions can enable schools, hospitals and other vital public services to optimise their resources while delivering value for money for taxpayers and reducing carbon emissions.

These solutions include more efficient ways of using energy, local power generation and demand side response – which can help balance the grid and alleviate network constraints. Harnessing such new technologies alongside Big Data would give the public sector real insight and control over their energy use.

This report shows the savings that three sections of the UK public sector – defence, healthcare and universities - could make if they adopted these solutions. In some places it’s already happening, such as Poole Hospital NHS Trust on the south coast of England. Working in partnership with our team, the hospital has cut its energy demand by nearly one third, saving the Trust £420,000 every year and delivering a carbon reduction of 23 per cent.

The projects and savings within the report represent the start of the journey. Newer technologies, that we are already installing for some customers, will create even greater opportunities. These include battery technology, EV charging, and optimisation and flexibility services to the grid, through demand side response. Importantly, we have the technology to bring them together through our Integrated Solutions Platform, Power Radar, which can incorporate both proprietary products from Centrica and third-party applications.

In addition to cost savings and carbon emissions reductions, distributed energy solutions also improve the resilience of the public sector. We have seen run-down energy centres in NHS hospitals refurbished through funding created by the savings attributed to distributed energy solutions.

At Centrica, we are committing hundreds of millions of pounds over the next few years to invest in distributed energy solutions. To demonstrate our commitment, we have set an ambition to deliver £300 million in energy efficiency savings to public and essential services by 2030 as part of our Responsible Business Ambitions. In the last century, Britain led the world in the provision of public services. We hope this report will show that taking steps to tackle energy waste and harness new energy technologies can help to maintain that proud tradition in the 21st Century.

Jorge Pikunic, Managing Director,
Centrica Business Solutions

Executive summary

For key services, such as hospitals and universities, energy is not just a cost issue, it is an environmental one too. Using energy more effectively can help public sector bodies tackle both challenges.

Although the public sector is funded by our taxes, it also makes a huge contribution to the UK economy, employing around one sixth of the workforce.

But since the global financial crisis in 2008, UK public sector expenditure has experienced the longest real term funding freeze in the last 50 years, as successive governments have attempted to reduce the deficit between tax revenue and public spending. Although this period is now over, running public services is a significant cost and money from the public purse must be spent wisely. The annual public sector energy bill is an estimated £3.4 billion, with the NHS alone spending £1.1 billion annually on energy[2].

The UK public sector has also been charged with leading the transition to a low carbon economy. Emission reduction targets have been set for central government, and the Government's Clean Growth Strategy introduced a voluntary target across the public sector and higher education of a 30 per cent reduction in emissions by 2020/21. Since then, the Government has committed to a net zero target, which will require further action. We believe there is a great opportunity for the UK public sector to contribute to our energy system transition, while saving money for public services. A broad range of solutions, including energy efficiency, monitoring, optimisation and on-site generation, can help larger energy users take control of their energy and turn it into an opportunity.

In this report we:

- Explain distributed energy solutions and what they can deliver
- Estimate the potential benefits of distributed energy solutions for the public sector
- Provide recommendations to help unlock the benefits of distributed energy

We have looked at the potential opportunity in just three areas of the public sector, the NHS, Defence and Universities, which represent approximately 55 per cent of public sector energy use. By deploying a range of distributed energy solutions in just 50 per cent of these sites, we have estimated a potential annual saving of £375 million, with a linked carbon saving of 658,000 tCO_2e, while also improving on-site energy resilience. Investment in this area would drive an additional positive impact for the UK economy, supporting 25,000 jobs and creating £1.7 billion in additional gross value added (GVA). Most importantly, this can be done today, using widely available technologies. Emerging technologies not included in the analysis offer additional upside.

the estimated annual public sector energy bill

estimated annual carbon footprint

Helping our armed forces, hospitals, universities and other key services to use energy more effectively will be critical in ensuring that the UK can care for the community, maintain a strong economy and achieve a cleaner environment.

With a renewed spotlight on climate change, it is important that government drives a focus on energy efficiency and decarbonisation. It is not only good for the environment but also saves money; money which could be reinvested in frontline services. The Government has the opportunity to pave the way for the public sector to lead in the energy transition. To ensure we maximise the opportunity of these distributed energy solutions we identify three key barriers around priority, understanding and policy:

- the low **priority** of energy projects due to budgetary competition from frontline services, which rightly take priority under the current system
- lack of **understanding** of the opportunities presented by decentralised energy and the complexity of procurement
- the uncertainty in the **policy** landscape

We are making the following recommendations, Government should:

1. Enable and encourage the public sector to deliver energy savings by:
   - Setting a public sector emissions reduction target for 2030 in legislation to lead the way in achieving net zero emissions
   - Creating energy specific capital spending allowances. Currently, all public sector projects must compete for capital. Energy specific capital spending allowances would ensure that energy projects could be undertaken during a spending period
2. Extend funding to the Modern Energy Partners project to enable installation of energy technology at over 1,000 high energy demand sites in the public sector by 2030.
3. Simplify public sector procurement frameworks.
4. Ensure a stable and long term regulatory environment and commit to leading on the delivery of flexibility markets by 2023.

Our findings

Potential annual savings:

The NHS	Universities	Defence
£187m	£146m	£43m

Associated benefits to the public sector:

658,000 tCO_2e	25,000 jobs supported	£1.7bn in additional GVA

Chapter 1:
Introduction

The public sector is a major contributor to the UK economy, employing over five million people[3] - one in six UK workers. Current spending within the sector is around a third of the UK's GDP[4] and the public sector also accounts for around 3% of the UK's emissions.

£6.5bn

NHS annual spending on maintaining its estate and facilities

In June 2019, the UK became the first major economy in the world to pass laws to end its contribution to climate change, resulting in a 2050 net zero target, which all sectors will need to contribute to. Running public services is expensive, with an estimated bill of £3.4 billion on energy alone. The public sector has the opportunity to use energy technology to reduce the running costs, therefore delivering better value for money for the taxpayer and releasing money that could be spent on frontline services, whilst also reducing carbon emissions. We believe that distributed energy can play an important role in meeting both. For example, the NHS spends £6.5 billion annually on maintaining and running its estate and facilities[5] with around 20% of this spent on energy. Distributed energy technology can bring down energy costs across estates, while contributing to a cleaner energy future.

The financial budget

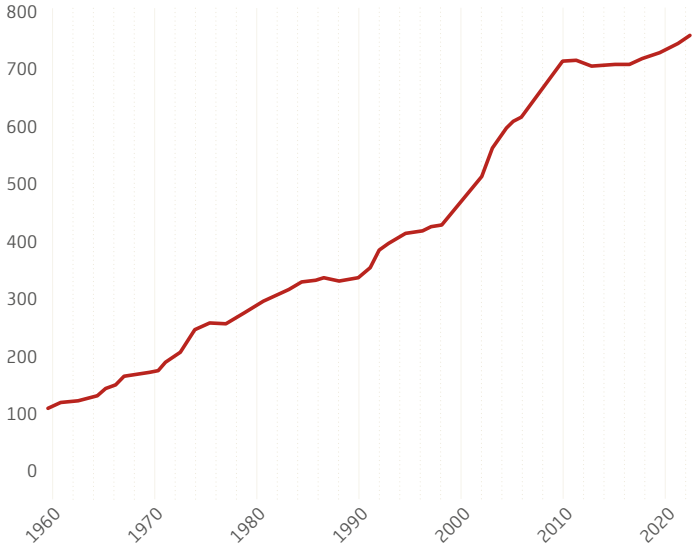
Following the 2008 financial crisis, the Government's focus on cutting the UK's fiscal deficit led to a squeeze on public sector budgets. Although this is now over, between 2010 and 2018, public sector expenditure experienced the longest real terms funding freeze in the last 50 years, with many parts of the public sector having to do more with less (see graph below left).

The carbon budget

The public sector has been charged with leading the transition to a low carbon economy. There has already been some success. Having met its original emissions target three years early, central government has increased its target for 2019/20 to a 43% reduction compared to 2009/10 levels[6].

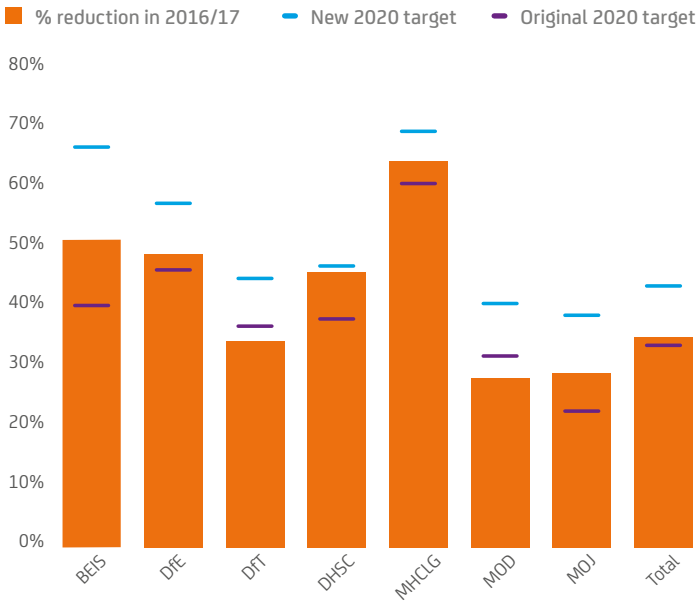
Beyond central government, the Clean Growth Strategy includes commitments to a voluntary target of a 30 per cent reduction in emissions across the public sector and higher education by 2020/21, against a 2009/10 baseline. This is matched with a commitment to provide £255 million of additional funding for energy efficiency improvements in England and to assist public bodies in accessing other sources of funding. With the new 2050 net zero target, all sectors, including the public sector will need to go even further to drive carbon savings.

Day-to-Day public sector spending



Real terms annual spending (£bn, 2017-18 prices)
Source: HMT PESA 2018

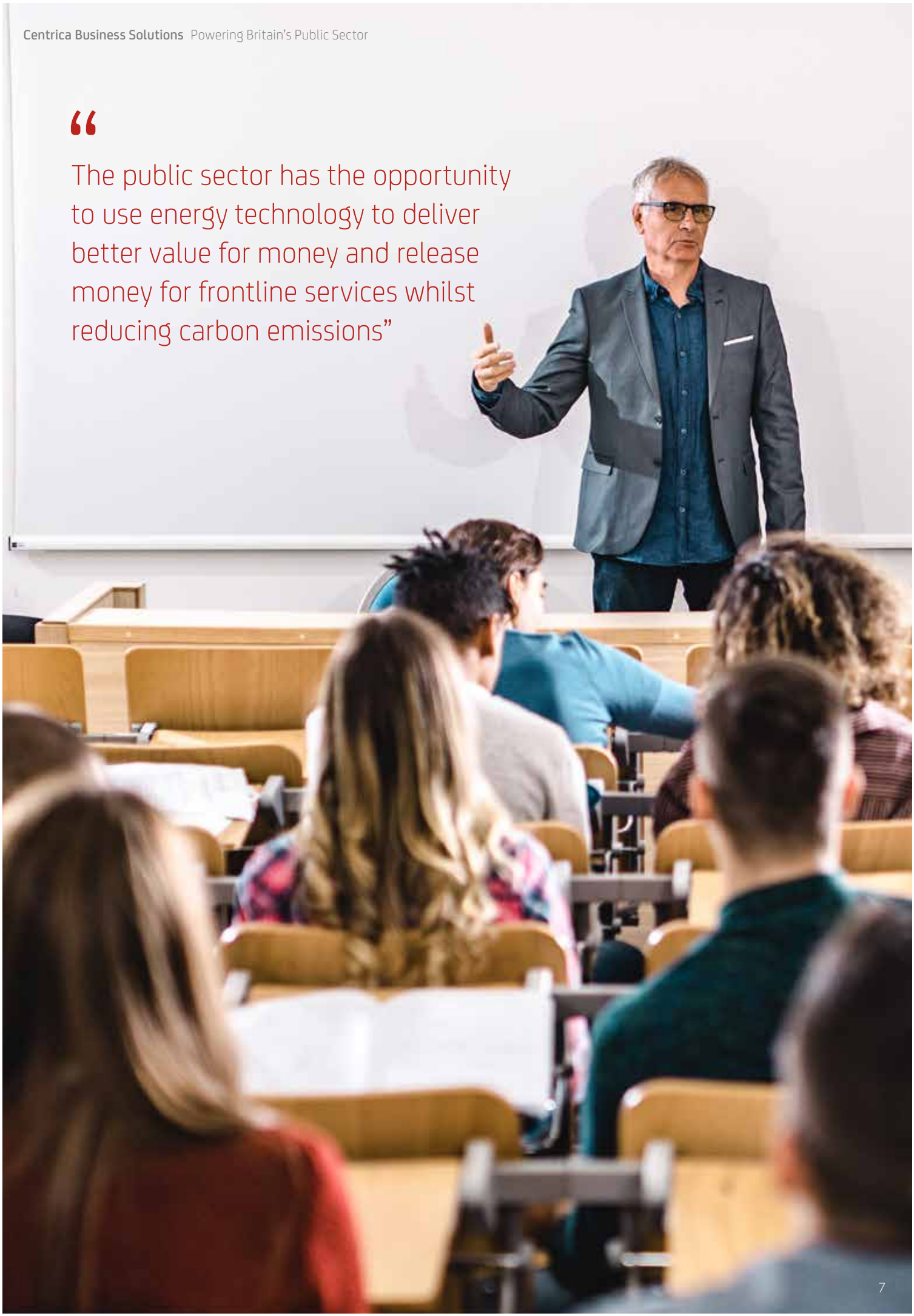
Departmental emissions reduction targets



Departmental targets based on 2009/10 emissions baseline
Source: Cabinet Office, DEFRA[7]

"

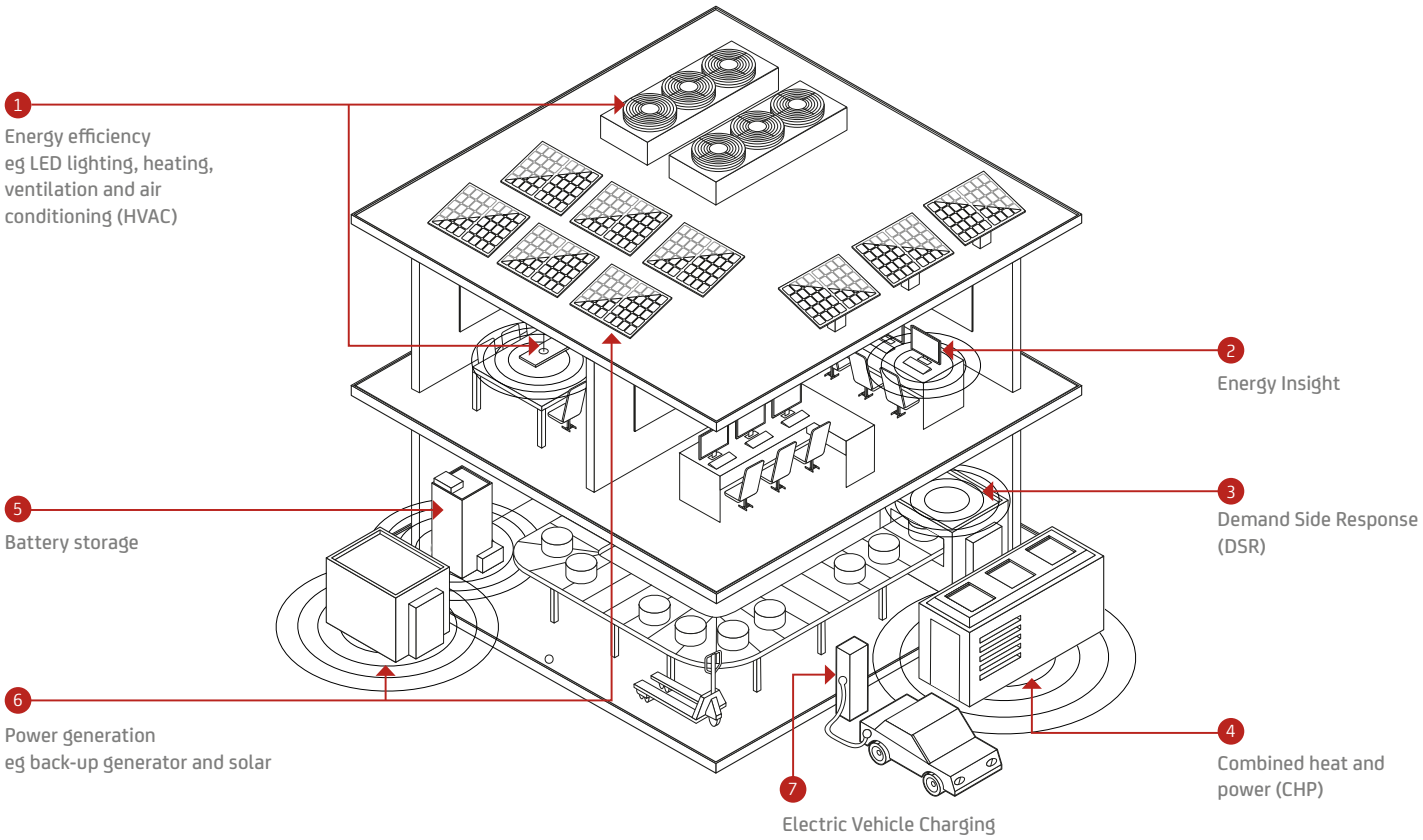
The public sector has the opportunity to use energy technology to deliver better value for money and release money for frontline services whilst reducing carbon emissions"



Chapter 2:
What is distributed energy?

Distributed energy includes a broad range of solutions, including energy efficiency, monitoring, the optimisation of energy assets (eg demand side response), on-site generation and new digital technologies, that can help larger energy users - public organisations, commerce and industry - to take control of their energy and turn it into an opportunity for reducing overheads.

We believe an important principle of distributed energy is that not every energy user will need the same solution. In fact, the real benefit derives from the ability to tailor energy technology that best fits the individual needs of the consumer.



Distributed Energy Solutions

This diagram shows the different technologies that could benefit large energy users. These are all readily available for use in the public and private sectors.

The selection of deployed technologies, depends on a number of factors including: (i) the objectives for the customer, eg site resilience, energy bill reductions, emissions reductions (ii) the economics of investment requirements and payback periods including revenues and savings that can be generated, (iii) additional services required on site, such as EV charging.

1. **Energy Efficiency**
   The ability to reduce costs across a range of energy consuming processes, including lighting, building management systems, insulation, and heating and cooling systems, by upgrading or improving the way they operate

2. **Energy Insight**
   New technology is available that allows larger energy users to monitor their energy use with greater accuracy across all equipment and devices. For example, Centrica's Panoramic Power uses self-powered, wireless sensors that transmit real-time data from energy using equipment to an analytics programme, allowing businesses to respond to issues, undertake predictive maintenance and uncover opportunities for cost reductions

3. **Demand Side Response (DSR)**
   Additional revenue streams are available to energy users who reduce their energy consumption at times when national demand is high. New technology provides the ability to respond to these changes in demand quickly and easily, whilst maintaining resilience

4. **Combined Heat and Power (CHP)**
   CHP works by converting gas into both electricity and heat in a single process. It's one of the most efficient sources of energy production and allows an organisation to produce a significant amount of its energy on-site - improving the resilience of supply and reducing costs

5. **Battery Storage**
   Battery storage systems can provide energy to buildings and vehicles. They can be charged at cheaper times and then used when prices are higher, enabling better management of energy costs. They can also work alongside renewable technologies, which on their own are intermittent. Battery storage provides an additional revenue stream for businesses by allowing them to sell excess power back to the grid

6. **Power Generation**
   A range of small scale power generating technologies exist, including solar, wind, and gas generators, which can provide on-site generation, back-up power and create the capability to sell excess energy back to the grid at peak times. These technologies can also be co-located, for example combining solar panels and battery storage. They can also be combined to create more complex solutions, for example combining heat pumps with CHP to provide a hybrid heat pump, this is particularly useful when temperatures drop below zero and heat pumps alone are not effective

7. **Electric Vehicle Charging**
   On-site EV charging infrastructure is valued by employees, but can also represent an opportunity to access an additional revenue stream from providing services back to the energy system. To enable installation of EV charging infrastructure, power requirements are important with some sites needing capacity upgrades. This is where decentralised energy can play a role in ensuring capacity is met through energy optimisation in combination with on-site generation, for example solar and battery

Emerging Technologies

In addition to these proven energy technologies, a variety of solutions are rapidly approaching the mainstream.

Local Energy Systems and Microgrids

We are working on a pioneering £19m Local Energy Market trial in Cornwall that aims to help relieve grid constraints and support the further deployment of renewables in the region. The trial is testing the use of flexible demand, small-scale generation and storage across both the domestic and business markets. We are also developing a virtual marketplace that will provide participants with a platform to buy and sell energy and flexibility both to the grid and the wholesale energy market. The Government and National Grid both recognise the key role flexible, smart energy will play in supporting a secure, affordable and lower carbon system for the UK.

In addition to the Local Energy Market project, we are engaging in the design and delivery of microgrids to support cost-effective power generation and resilience for customers in North America.

Hydrogen

Following advice from the Committee on Climate Change, the need for hydrogen is likely to grow, with the likely domestic development of hydrogen from steam methane reformation and carbon capture usage and storage. This has the potential to enable near total decarbonisation of the gas network. We may also see adoption for a range of transport applications for example in commercial applications such as buses, ferries and trucks.

Green gas

Green gas is a virtually carbon neutral gas created from biodegradable material. It is produced through anaerobic digestion of biodegradable feedstock, creating biogas and natural fertiliser as a by-product. The biogas can then be purified into high quality biomethane, which can be injected into the national gas grid alongside traditional fossil fuel gas. In 2018, Centrica acquired a 50 per cent stake in Barrow Green Gas (BGG), the UK's largest biomethane supplier. BGG ships almost half of the green gas used by British homes and businesses. This new partnership will enable Centrica to offer customers a wider choice of renewable energy products.

Heat pumps

Heat pumps absorb heat from a variety of sources, including the ground, the air and water, and transfer it into a building. They supply more heat energy than the electricity they need to operate, giving them efficiencies above 100 per cent. Heat pumps are widely used in many other countries including Sweden and France.

Centrica is also testing High Temperature Heat Pumps with the aim of further increasing the efficiency of industrial processes by converting low-grade heat to high-grade heat. When combined with CHP, High Temperature Heat Pumps can provide higher efficiency and even lower carbon emissions.

Stationary fuel cells

Fuel cells are distributed-generation systems that produce electricity via a chemical reaction. The fuel they typically rely on is natural gas, which is then converted into hydrogen. Fuel cells can be used for either power-only generation or as CHP. Their main benefits include high efficiency, low emissions and high reliability. We are currently involved in the development of the Energy & Innovation Park in Connecticut, in which a 20-megawatt fuel cell system is planned.

Chapter 3:
The public sector opportunity

The public sector[8] uses around £3.4 billion[9] of energy and currently has a carbon footprint of 13.3 mtCO_2e[10], representing 3 per cent of the UK's carbon emissions.

This report outlines the savings that three areas of the UK public sector, which represent approximately 55 per cent of energy use – defence, the NHS and universities, could make if they adopted readily available energy saving solutions. Of course, there are opportunities throughout the public sector including, to name a few, local authorities, prisons and education more broadly. In each of the three sub-sectors, we profile a case study highlighting the experience of a customer who is already benefiting from a distributed energy approach.

Overall, we have estimated that if the opportunities from distributed energy solutions are taken up by just 50 per cent of the organisations in these three areas of the public sector, there is the potential to achieve an annual saving of £375 million and a linked carbon saving of 658,000 tCO_2e. This investment would additionally drive a positive impact for the UK economy, supporting 25,000 jobs and creating £1.7 billion in additional GVA[11].

The projected savings are based on real life examples of the measures implemented by representative Centrica customers. However, there is far more that could be done and further technologies that could be incorporated into projects.

Examples of additional technology that could be incorporated today in projects to increase the benefits calculated within this report, include those detailed in chapter 2, with the addition of several Centrica specific solutions, such as:

- **Centrica Integrated Solutions Platform 'Power Radar' -** this is a single portal that gives organisations full visibility and control of their energy estate including both proprietary products from Centrica and third-party applications. This platform is configured to the individual needs of customers and allows them to both interrogate data and control operations across their estate. It will also give users the ability to see what benefits the addition of new technologies and approaches could bring, using their own data to assess the opportunity and calculate return on investment
- **Installation of Electric Vehicles charging infrastructure –** as set out in chapter two, charging infrastructure is a well-documented barrier to EV uptake. Dealing with this contributes to the roll out of vehicles and decarbonisation of transport in the short-term but also the electric vehicles linked to the chargers could ultimately represent an opportunity to help balance electricity demand in the UK longer-term. The software that sits behind the chargers already enables on-site local energy management allowing organisations to optimise the supply to charging stations in line with site energy demand and costs
- **Virtual Power Plant –** technology that enables the aggregation of energy producing, generating and storage assets across numerous sites, our automated VPP uses advanced trading strategies and artificial intelligence to create an alternative to centralised power generation. By combining a diverse asset portfolio with flexible processes and sophisticated algorithms, we make more responsive energy available to the grid and enhance potential revenue generation for our industrial and commercial customers
- **Power Purchase Agreements (PPAs) –** Renewable PPAs can be created with energy generators such as wind farms, thereby reducing the carbon footprint of energy use.

What revenue streams could the public sector benefit from?

Because public sector organisations both use and generate large amounts of their own energy, they have the potential to gain additional revenue from a variety of sources:

- **The energy market –** selling electricity into the energy market
- **The capacity market**[12] **–** gaining a contract to provide electricity when needed
- **National Grid 'ancillary services' markets –** these are markets that serve a variety of purposes to support the Grid (such as providing power at short notice or reducing energy consumption at times of high electricity demand)
- **Future Markets –** Flexibility markets will be a key future revenue stream once designed and implemented, however at present there is a lack of clarity on milestones and delivery

How expensive are these distributed energy solutions to install and run?

The costs of energy technologies have fallen rapidly and, as such, have become commercially viable. An example is the cost of Lithium-ion batteries which has fallen globally from $3,000/kWh in 1990 to less than $200/kWh today. Likewise, solar costs have fallen by around 80 per cent since 2010 with some projects delivering $49/MWh[13]. Some businesses and organisations have indicated that return on investment and up-front capital costs can be a barrier to adoption. But with costs falling and financing options available that can mitigate up-front capital costs, these solutions are now more accessible than ever. To support this, revenue streams for decentralised assets will need more policy and regulatory certainty.

What are the financing options for public sector energy saving projects?

With public sector finances stretched and capital prioritised for frontline services, there are a number of flexible, transparent and simple-to-understand commercial options that can help meet the cost of implementing sustainability within the public sector. These options enable public sector organisations across England, Scotland, Wales and Northern Ireland to access 100% interest free capital to reduce energy costs and improve energy efficiency.

Salix financing is the lowest cost option. Available on a first come first served basis, the funding is interest free over a maximum of five years. Projects must meet carbon reduction parameters and can be either fully financed or part financed with funding from other streams.

Energy Service Agreements, or Energy Service Performance Contracts can be used to secure a suite of energy saving and generating technologies at zero capital outlay. This type of contract provides customers with guaranteed savings, so you simply pay for the equipment with the savings you make.

Similar to this, Discount Energy Purchase financing sees a technology supplier manage the installation, operation and financing of the energy generation technology at no cost to the organisation. The supplier then contracts the energy produced back to the organisation at a discounted rate, ensuring guaranteed capped energy costs for the duration of the agreement.

The NHS

The UK Government's 2015 financial settlement for the NHS to 2020/21 requires savings of almost £22 billion by 2020

450 $ktCO_2e$

Potential annual carbon savings

£187m

Potential annual savings

What that means in practice is a saving of 2-3 per cent every year, with the majority (£14.9 billion) of that to be delivered locally[14].

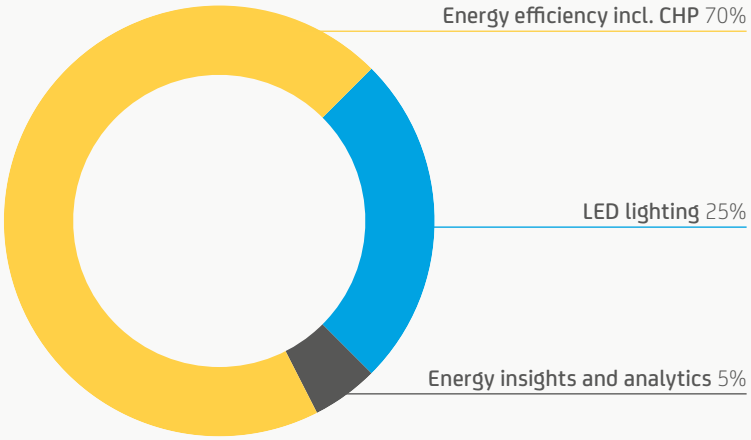
Hospital energy use currently accounts for around one third of energy use within the public sector, with an annual energy bill totalling ~£1.2 billion[15] and a carbon footprint of 5.4 $MtCO_2e$[16]. Distributed energy technology can help reduce both. Private and public sector finance options mean that technology can often be installed at no upfront cost, with guaranteed savings on both energy bills and carbon emissions.

We have a strong track record of working with the NHS, delivering projects that are already saving tens of millions of pounds at sites across England, Scotland and Wales. These projects are enabling investment in frontline services, and have been developed to deliver against the specific needs of hospitals. Key considerations include:

- Hospitals consume large volumes of energy in the form of heat and power
- 24/7 use means any energy changes deliver large savings
- Patient care relies on site resilience and conditions within the hospital. Distributed energy solutions improve resilience to ensure patients experience consistent lighting and temperatures
- Unlike many organisations, hospitals will require physical buildings even in the long term
- Budgets are prioritised for patient care, not new boilers/ CHP/lighting. Energy Performance Contracts that deliver guaranteed cost savings allow NHS Trusts to invest in infrastructure without any impact on patient outcomes

Our estimates suggest that just a 50 per cent uptake by NHS hospitals of a suite of decentralised energy solutions could achieve annual savings of £187 million [17], with a related annual carbon saving of 450 $ktCO_2e$, the equivalent of 9 per cent of the sector's current carbon footprint.

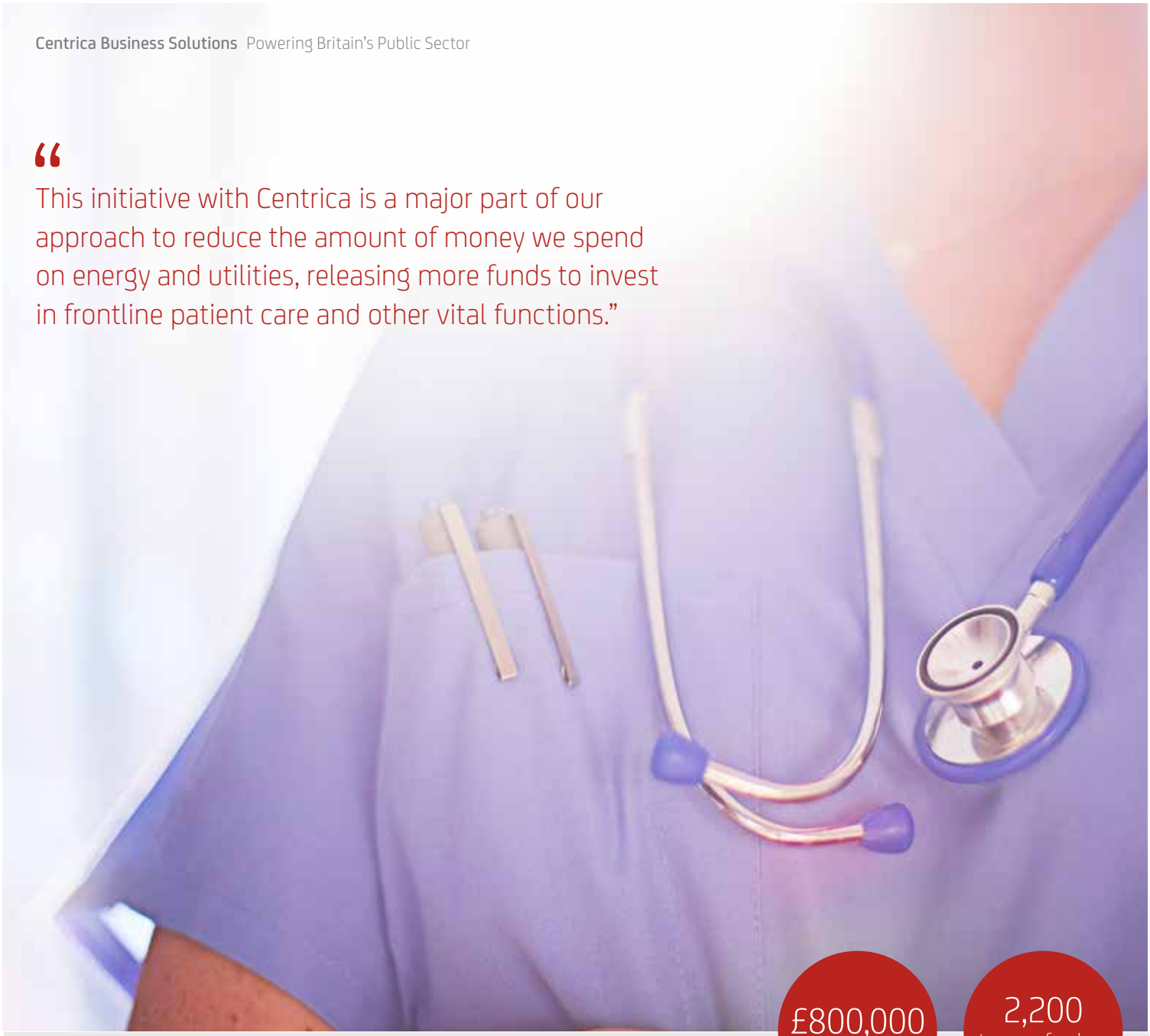
Assumed technology split



Technology used by a typical customer

Hospitals with ageing energy infrastructure and inefficient gas-fired generation equipment can benefit from a range of technology:

- **Energy efficiency:** including CHP, insulation and pipework upgrades. Transformative solutions to replace or update existing infrastructure in a cost-effective manner can deliver significant savings in carbon emissions and deliver improvements in site resilience
- **LED lighting:** Healthcare facilities require significant lighting installations, many in critical areas such as operating theatres. Utilising long lasting LED systems achieves energy savings and improves the wellbeing of staff and patients
- **Energy insights and analytics:** Provide an additional tool for ensuring patient safety with device and equipment level energy insight, which identifies faulty equipment and pre-empts repairs, highlights energy waste and identifies areas where efficiencies can be gained
- **Solar PV:** Utilise roof space for electricity generation with no carbon emissions. Although solar PV has not been assumed in the calculations as it does not represent the typical customer to date, this technology can and has been used by hospitals wanting to further reduce carbon emissions



> "This initiative with Centrica is a major part of our approach to reduce the amount of money we spend on energy and utilities, releasing more funds to invest in frontline patient care and other vital functions."

£800,000
annual savings

2,200
tonnes of carbon saved

Royal Devon and Exeter NHS Foundation Trust

The Royal Devon and Exeter NHS Foundation Trust (RD&E) is set to reduce its energy costs by £800,000 a year, following a £7 million investment in sustainable energy measures.

It includes the installation of a new 1.5MW combined heat and power unit that will generate power on-site at Wonford Hospital, as well as roof mounted solar panels at Wonford and Heavitree Hospitals and Mardon Neuro-Rehabilitation Centre in Exeter.

Wonford and Heavitree Hospitals will also benefit from new LED light fittings and improvements to the air conditioning systems, while Mardon Neuro-Rehabilitation Centre will profit from the installation of new energy-efficient boilers.

Once complete, the RD&E will reduce its energy costs by 17 per cent and will reduce annual emissions by more than 2,200 tonnes of carbon dioxide – the equivalent to taking more than 1,450 cars off the road.

Robert Steele, the Trust's Deputy Director of Strategic Capital Planning, said: "As a major hospital providing round-the-clock services, we consume large amounts of energy so we're committed to a range of measures to help us continuously improve energy efficiency. This initiative with Centrica is a major part of our approach to reduce the amount of money we spend on energy and utilities, releasing more funds to invest in frontline patient care and other vital functions."

Universities

Tasked with meeting the higher education needs of millions of students a year, the UK's universities have an annual energy bill of ~£397 million[18] and a carbon footprint of 1.8MtCO_2e[19].

160 $ktCO_2e$

Potential annual carbon savings

£146m

Potential annual savings

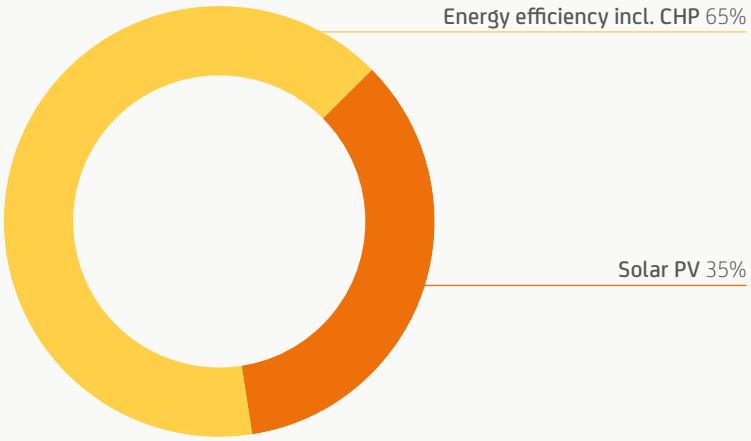
As with the NHS, there is a significant opportunity for distributed energy technology to deliver savings for the sector, with a variety of private and public sector finance options that could see the technology installed at no upfront cost.

Universities represent a good sector to focus on for a number of reasons, including:

1. Large campus sites - often made up of older, less efficient buildings. These consume large volumes of energy in the form of heat and power
2. Students want their universities to prioritise decarbonisation
3. Reduced operating costs allow universities to attract other partners onto the sites (eg research companies etc) and to host more events out of term by making the sites more attractive to tenants
4. Universities also offer a good testbed for developing new technologies and innovations in decentralised energy

Our estimates suggest that if 50 per cent of universities took up a suite of decentralised energy solutions, the sector could achieve annual savings of £146 million, with a related annual carbon saving of 160 $ktCO_2e$, the equivalent of 8 per cent of the sector's current carbon footprint.

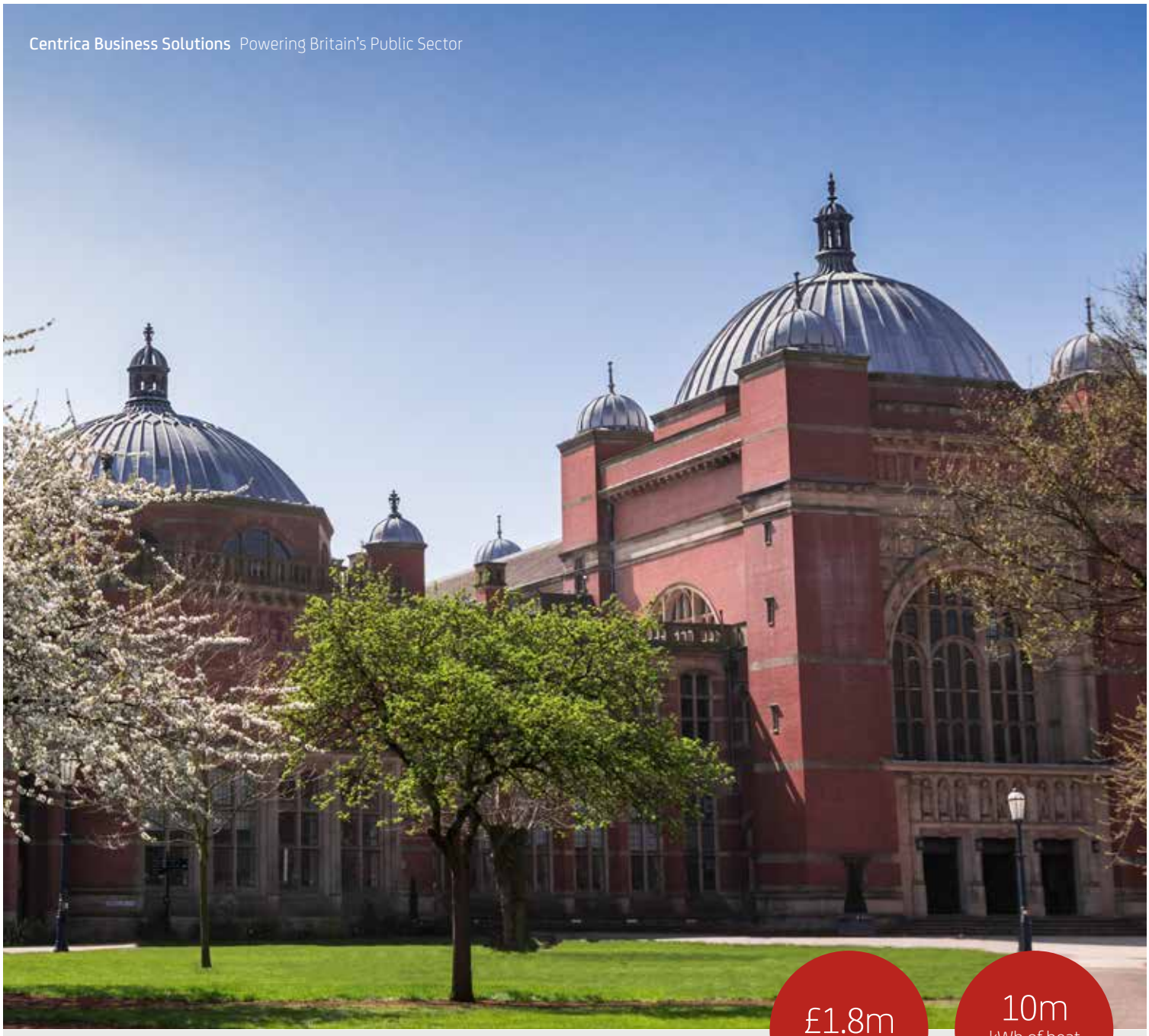
Assumed technology



Technology used by a typical customer:

The university sector, with typical needs for heating and lighting many large buildings would benefit from the following technology:

- **Energy Efficiency including Combined Heat and Power:** Efficient on-site generation of electricity, and the recovery and utilisation of heat within buildings
- **Solar PV:** Utilise roof space to generate on-site electricity with no carbon emissions and reputation support by demonstrating green credentials to students



£1.8m
saved to date

10m
kWh of heat generation

University of Birmingham

With over 30,000 staff and students on-site, the University of Birmingham has an annual turnover approaching £500 million, and is a member of the Russell Group of research-led UK universities.

Many of its activities are energy intensive, with an increasing focus on research to reduce carbon emissions and understanding the challenges of climate change. The University has produced an environmental strategy with core ambitions to reduce its carbon footprint and evaluate the environmental impact of all its activities.

In 2014 the university installed a new 4.4 MW gas turbine Combined Heat and Power (CHP) unit to deliver baseload heat requirements year round for the main campus. It has since added five further CHP generators. Since 2016, the University has been participating in the Capacity Market, selling excess generation back to the grid.

Defence

Responsible for protecting the security, independence and interests of our country at home and abroad, the UK's defence sector has an annual energy bill of ~£154 million[20] and a carbon footprint of 786 $ktCO_2e$[21].

48 $ktCO_2e$

Potential annual carbon savings

£43m

Potential annual savings

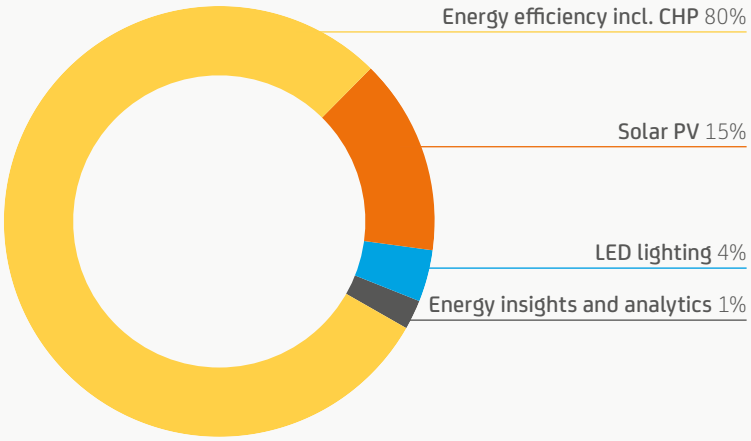
Considerations for investment include:

1. There are many sites consuming large volumes of energy in the form of heat and power
2. Consistent energy supply is critical and depends on good resilience and the performance of energy assets. Heating in barracks and offices is also important
3. These sites have a long-term importance being part of the Defence estate
4. Investment in new boilers/CHP/lighting is naturally not a priority for spend. Monetising future savings through an EPC allows the MoD to invest in infrastructure without any operational impact
5. Large sites requiring extensive heat networks can see great savings if action is taken centrally through a co-ordinated solution

Our estimates suggest that a 50 per cent uptake by the Defence estate of a suite of decentralised energy solutions could achieve annual savings of £43 million, with a related annual carbon saving of 48 $ktCO_2e$, the equivalent of 6 per cent of the sector's current carbon footprint.

As with the NHS and universities, distributed energy technology can be financed through private and public sector finance options allowing technology to be installed at no upfront cost, with guaranteed energy savings as well as carbon emissions reductions.

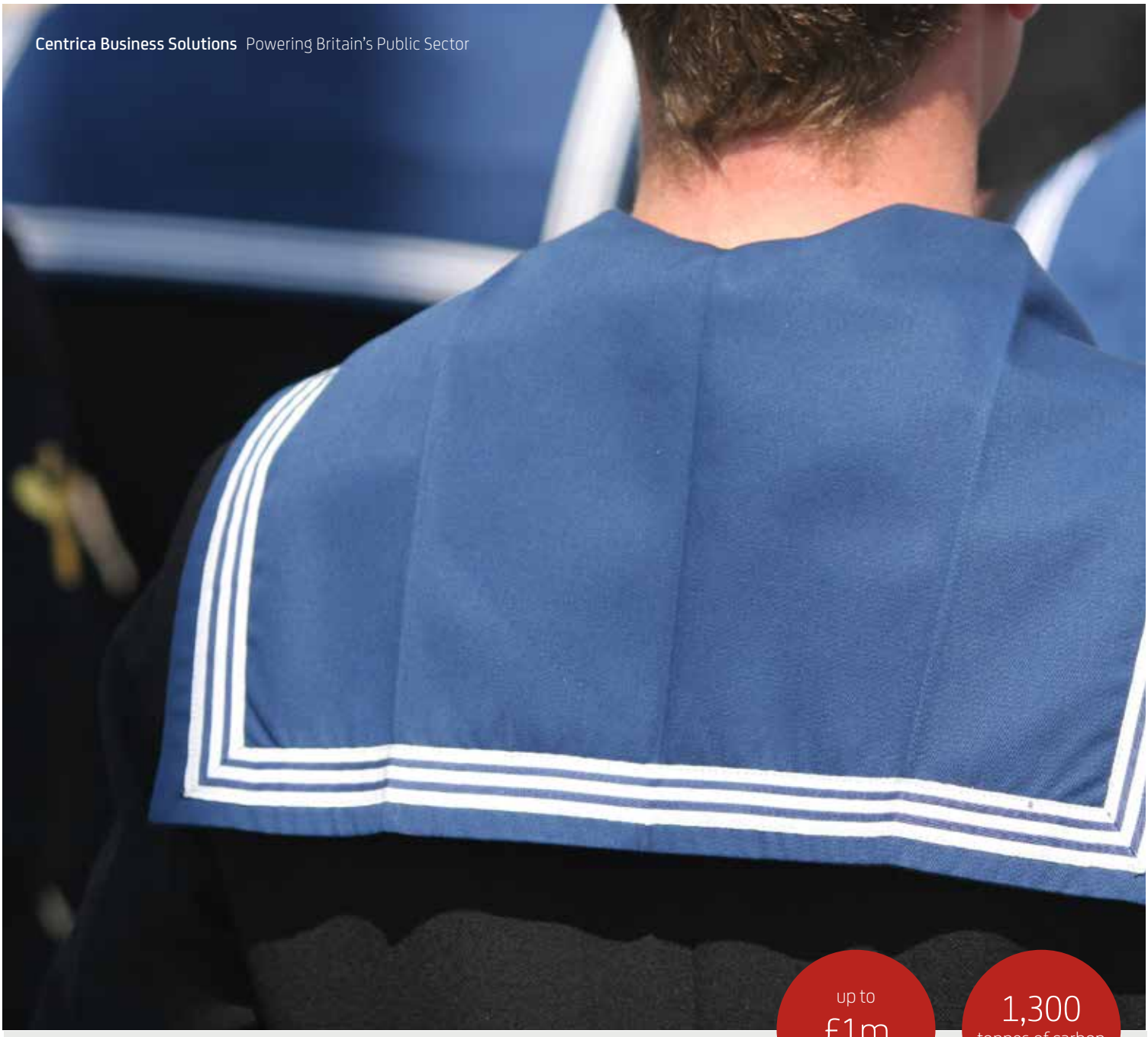
Assumed technology split



Technology used by a typical customer

With high demands for heat, a typical customer in the defence sector would benefit from the following technology:

- **Energy Efficiency including Combined Heat and Power:** Supports secure 24/7 operations with efficient on-site generation. Recovery of heat helps maintain an ambient working temperature and immediately reduces energy costs
- **Energy insights and analytics:** Equipment-level energy data and analytics tools identify energy waste and enable preventative action to repair malfunctioning equipment before it goes offline.
- **Solar PV:** Utilises large roof spaces to effectively generate on-site electricity for free with no carbon emissions, this can be combined with battery storage for enhanced flexibility
- **LED lighting:** Utilising long lasting LED systems achieves energy savings and improves the working environment for staff



up to £1m saving

1,300 tonnes of carbon saved

HMS Collingwood

Modern Energy Partners (MEP) is a ground-breaking collaboration whose vision is to accelerate the deployment of updated energy infrastructure across the public sector estate.

The initial phase of the MEP project ran between June 2018 and March 2019 with competitively selected partners from the UK energy supply chain, Distribution Network Operators (DNO) and energy managers at four campus-scale public sector sites: Catterick Garrison, HMS Collingwood, HMP Sheppey and Cardiff University.

Centrica, as part of the study, sought to identify low carbon energy efficiency solutions and strategic energy plans at HMS Collingwood, so that MEP could develop a generic methodology capable of supporting the roll-out of scalable integrated energy solutions across the public sector estate.

The project has identified an opportunity to introduce viable integrated low carbon energy solutions for each of the sites that fulfil immediate needs of the sites.

Centrica Business Solutions and WSP were appointed to develop a design for future energy systems at HMS Collingwood and identified an opportunity to design a new energy system at the site, involving the use of combined heat and power plants, solar panels, and energy-efficient lighting. If implemented, Centrica and WSP believe the new energy technology could help reduce HMS Collingwood's energy bills by around a third and carbon emissions by more than 1,300 tonnes annually – a 63 per cent carbon reduction against 1990 levels, with potential annual savings of up to £1,000,000.

Chapter 4:
Recommendations for unlocking the potential

We have worked with over 250 public sector sites to date and are now partnering with the Government and the Energy Systems Catapult in the Modern Energy Partners project, to help understand how the public sector can decarbonise and take advantage of decentralised energy. The main barriers we experience in the public sector are:

Priority: Low priority is given to energy projects compared to the requirement to deliver front line services.

Understanding: Many Energy managers and public sector leaders are not aware of the opportunities presented by energy efficiency and decentralised energy, coupled with the complexity of understanding the policy landscape and procurement frameworks, there are no longer term strategic plans for energy.

Policy: Long-term policy uncertainty and limited clarity on price signals for services delivered by decentralised energy assets, eg timelines for the delivery of flexibility markets and the timings of reforms such as the Targeted Charging Review. This affects the business case for larger and longer-term projects.

To unlock these barriers and release the potential for the public sector, we make the following recommendations for consideration:

Priority

1 **Government should enable and encourage the public sector to deliver energy savings by:**

- Setting a public sector emissions reduction target for 2030 in legislation to lead the way in achieving net zero emissions
- Creating energy specific capital spending allowances. Currently, all public sector projects must compete for capital, which is capped with a debt limit, leading to competition between frontline services and energy projects that save money and carbon. If we are to decarbonise, spending limits must help enable energy projects. Energy specific capital allowances would ensure that energy projects could be undertaken during a spending period

Understanding

2 Extend funding to the Modern Energy Partners project to enable installation of energy technology at over 1,000 energy intensive sites in the public sector sites by 2030

Modern Energy Partners (MEP), launched in June 2018, is jointly run by the Department for Business, Energy and Industrial Strategy (BEIS), the Cabinet Office, and Energy Systems Catapult. They announced eight partners, including Centrica, to work with four public sector sites to develop integrated energy solutions. The aim is to develop strategic energy plans for each site to 2032 that address the needs for energy resilience, deliver cuts to energy bills and carbon emissions, and also to develop methodologies that enable many more public sector organisations to install energy efficiency technology on their sites.

The project also aims to reduce the barriers within the public sector, which currently block Government Departments, their sites and respective energy managers procuring distributed energy solutions. We strongly support the work of MEP and an extension to the project funding. We see a great opportunity to revolutionise the way the public sector approaches energy efficiency and believe this can set a precedent that is repeatable in the private sector.

3 Simplifying public sector procurement frameworks

Currently, multiple framework providers exist that serve parts of the public sector, while some public sector institutions have no framework providers. This means there is a divergence of processes and standards for public sector customers and private sector solution providers seeking to serve these customers. Project governance requirements also differ widely and are often not communicated during the tender processes. This typically introduces delays during both the approvals and contracting timeframes. Such governance issues can become a distraction for the public sector energy & estates managers during the energy services tender process. To tackle these issues, we believe that:

- All frameworks should have a core set of consistent principles for contract and project delivery
- A review of current framework approaches should be undertaken to ensure consistency and transparency for Government and Authorities
- A clear set of governance principles relating to energy efficiency and decarbonisation projects should be communicated by the government and reinforced in tender processes

Policy

4 The Government should ensure a stable and long-term regulatory climate and commit to leading on the delivery of flexibility markets by 2023

Businesses and the public sector can make a positive contribution to a future decentralised energy system, provided the right incentivisation is included in the regulatory landscape – helping to clearly support the business investment case.

The development of distributed energy solutions is changing the way that we use energy across the economy. However, the potential impact is yet to be fully incorporated into policymaking.

The Government should set a stable and long-term regulatory climate to support the further development of the decentralised energy system.

Greater flexibility in the system is vital to delivering the low carbon future and supporting the intermittency of renewables. In particular, Government should be clear that Ofgem is expected to deliver local flexibility markets by 2023.

There is a real opportunity for the UK to be a world leader in this space, and we believe Government and industry should work together to ensure the timely formation of flexibility markets to create a value for local energy and flexibility services. This will allow decentralised energy solutions, such as onsite generation and demand side response, to contribute to the energy system, providing a lower cost alternative to network reinforcement.

Revenue from flexibility services, at both a local and national level via National Grid, will be key to the business case for decentralised energy. Ensuring the system value of flexible capacity is correctly remunerated through the development of local, liquid flexibility markets is key to the future energy system.

Appendix 1: About Centrica

The world of energy is changing and, with our chosen businesses, distinctive positions, strengths and capabilities, Centrica is well placed to deliver for its customers and for society.

We are focussed on satisfying the changing needs of our customers, delivering cash flow growth and returns for our shareholders and becoming the most efficient provider in all our markets.

We have shifted investment towards our customer-facing businesses – organised around two global customer facing divisions: Centrica Consumer and Centrica Business focused on the residential consumer and the business customer respectively.

Our areas of focus are Energy Supply, In-Home Servicing, Home Solutions, Centrica Business Solutions, and Energy Marketing & Trading.

We supply energy and services to over 26 million customer accounts mainly in the UK, Ireland and North America through strong brands such as British Gas, Direct Energy and Bord Gáis supported by around 13,000 engineers and technicians.

We are focused on delivering high levels of customer service, improving customer engagement and loyalty. We aim to be a good corporate citizen, employer of choice and to provide leadership in a dynamic and changing world, which is why we recently introduced our 2030 Responsible Business Ambitions.

Centrica Innovations was established in 2017 to invest in new technology and ideas that will transform the way we live, work and move. We plan to invest £100 million over a five-year period in incubation and acceleration programmes – as well as venturing in start-ups.

For more information: centrica.com

Ambition 2030

We recently introduced our 2030 Responsible Business Ambitions – 15 global goals which set out our commitment to build a more sustainable world. Supporting the United Nations Sustainable Development Goals, the Ambitions aim to address some of the most challenging issues facing society, as well as to help our customers to run their world in ever more sustainable ways. We have four key focus areas – Customers, Climate change, Colleagues and Communities.

Our Ambitions in relation to Communities and Climate change will have significant, positive impacts for the public sector.

Communities
We're committed to developing new and distributed energy technologies to help create stronger communities. As part of this commitment, we're aiming to deliver £300 million in energy efficiency savings to public and essential services. This means organisations can continue to invest in the things that really matter, so together we can build stronger, more resilient communities.

Climate change
Climate change is one of the biggest challenges facing the world today – and we believe that the energy sector is at the forefront of the response to creating a cleaner, greener world.

The greatest contribution we can make to tackling climate change is by helping our customers reduce their carbon emissions. That's why we're committed to helping our customers, such as public sector organisations, to cut their emissions by 25 per cent to be in line with the Paris Accord.

We also want to enable a cleaner energy system that supports renewables, reduces reliance on fossil fuels, and enhances grid flexibility. To this end, we want to deliver 7GW of flexible, distributed and low carbon technologies globally – that's the equivalent of 10 per cent of current UK peak demand.

Lastly, we want to lead by example and thus we're aiming to reduce our internal carbon footprint by 35 per cent by 2025 and develop a path to net zero by 2050.

For further information visit centrica.com/Ambition2030

Appendix 2: Devolution

We recognise that the devolved administrations in Scotland and Wales have their own targets for decarbonising the public sector and are developing their own policy agendas to ensure efficient use of resources.

Scotland

Scotland is already a leader within the UK in tackling climate change, underpinned by the most ambitious statutory targets in the world, committing the nation to reaching net-zero greenhouse gas emissions by 2045 at the latest – five years ahead of the UK as a whole. Having enshrined energy efficiency as a National Infrastructure Priority, the Scottish Government's ambitious energy and climate change route maps emphasise the substantial economic opportunity for businesses and public services from investment in efficient and flexible technologies like those illustrated in this report.

With Centrica's capabilities now deployed at more than 66 sites across Scotland – across a range of industrial, health and leisure sites – we are pleased to be part of this ambitious journey.

Considering the interaction of energy, emissions and GVA, we also welcome the Scottish Government's current review into how programmes which support investment to reduce emissions whilst developing economic growth can better support meeting climate targets.

Wales

We welcome the steps that Welsh Government is taking to realise its ambition for the public sector to be carbon neutral by 2030. With emissions down more than half since 1990 – largely as a result of energy efficiency and a switch to gas-fired heating across the public estate, there is much to build on. We were pleased to see actions to deliver this being set out in the recent policy statement, Prosperity for All: A Low Carbon Wales, with a reminder of the reasons why the public sector must take a leadership role in moving towards a low carbon future. As the plan states, "the public sector deals with the implications of poor health caused or exacerbated by poor air quality from transport or from poorly performing homes."

We see real opportunities for the Welsh Government to promote savings in the NHS, which is its biggest spending area. Our Powering Wales report indicated that a 50 per cent uptake of the kind of new energy solutions featured in this report would deliver savings of £9m per annum for the NHS in Wales. We look forward to seeing the Welsh Government promote action to realise these savings through a successor to the Carbon Reduction Commitment scheme and by encouraging public bodies to identify and implement more innovative solutions.

Appendix 3: Modelling, Inputs and Assumptions Explained

Methodology

Stage 1 – Identifying typical users

- Centrica Business Solutions took the energy usage profiles of typical, representative distributed energy customers in three sectors that play a key role in the UK Public Sector:
  1. The NHS
  2. Defence
  3. Higher Education
- The range of economically viable products which CBS offers were then theoretically deployed at a scale appropriate to each representative customer's usage profile.

Stage 2 – Determining financial & carbon savings

- To calculate the savings from the deployed products the change (in kWh) of grid electricity and gas usage for each representative customer was modelled. This resulted in an increase in gas use, due to CHP installation, and a decrease in electricity usage from the grid, with efficiency measures reducing overall consumption and the installation of CHP and/or solar PV reducing requirements from the electricity grid
- The changes in electricity and gas demand were assigned an appropriate cost and carbon intensity and summed to determine the overall impact on the carbon footprint annually

Stage 3 – Determining multipliers to scale savings across the sectors

- The scaling multipliers were formulated by comparing the energy use of the representative customers, prior to the deployment of Centrica Business Solutions goods and services, to the total energy use (within the UK) of their respective sectors

Stage 4 – Calculating total figures

- The financial and carbon savings for each representative customer were multiplied by the relevant scaling multiplier to provide potential savings across their respective sectors. This total was then halved, assuming only a 50 per cent up-take scenario

Assumptions

- Assumptions are conceptual or data points that are not known and therefore need to be assumed. This report uses two types of assumption:
  - General conceptual assumptions
  - Specific technical assumptions and modelling choices (not discussed below)
- Key general conceptual assumptions include:
  - 50 per cent up-take scenario

  A 50 per cent up-take scenario was used to be conservative. This accommodates the fact that the calculation methodology does not involve a thorough analysis of where the Centrica Business Solutions' goods and services are not required or appropriate. This would include customers with atypical energy usage for their sectors (insignificant heat demand for instance) or those where equivalent technology has already been deployed.
  - Typical users Centrica identified are 'representative'

  The typical users identified and used for this analysis are representative of the potential users of Centrica Business Solutions' technology in the sectors to which they relate.

Endnotes:

1 All energy commodity costs, calculated using BEIS, Energy consumption in the UK 2017 and BEIS Energy and emissions projections 2017

2 Building Energy Efficiency Survey, 2016
https://www.gov.uk/government/publications/building-energy-efficiency-survey-bees

3 Office for National Statistics
https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/publicsectorpersonnel/bulletins/publicsectoremployment/june2018

4 Office for Budget Responsibility
https://obr.uk/data/

5 NHS England
https://www.england.nhs.uk/five-year-forward-view/next-steps-on-the-nhs-five-year-forward-view/funding-and-efficiency/

6 Guidance note for public and higher education emissions reporting 2018-20
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/745003/Guidance_note_for_voluntary_reporting-final.pdf

7 Greening government commitments, July 2018
https://www.gov.uk/government/publications/greening-government-commitments-2016-to-2020/greening-government-commitments-2016-to-2020#fn:1

8 BEIS collectively uses the following SIC 2007 classifications: 84 Public administration and defence; 85 Education; 86 Human health activities; 87 Residential care activities; and 88 Social work activities without accommodation.

9 Calculated using BEIS, Energy consumption in the UK 2017 and BEIS Energy and emissions projections 2017
https://www.gov.uk/government/statistics/energy-consumption-in-the-uk
https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2017

10 Calculated using BEIS, Government conversions factors for company reporting
https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

11 The direct benefits we have identified multiply, as the benefits ripple throughout the economy. These are known as indirect effects (increased economic activity in the supply chain) and induced effects (increased economic activity due to successively higher income and employment). These were calculated using the output multipliers and employment effects data from the ONS across the relevant Standard Industrial Classification codes.

12 At the time of going to print the capacity market was suspended

13 *https://www.windpowermonthly.com/article/1580195/offshore-wind-batteries-lcoe-falling-sharply*

14 NHS, NHS Five Year Forward View, Chart 4.2, May 2016

15 Calculated using BEIS, Energy consumption in the UK 2017 and BEIS Energy and emissions projections 2017
https://www.gov.uk/government/statistics/energy-consumption-in-the-uk
https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2017

16 Calculated using BEIS, Government conversions factors for company reporting and Building Energy Efficiency Survey, 2016 (for district heating Carbon factor)
https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

17 Across England, Scotland and Wales

18 Calculated using BEIS, Energy consumption in the UK 2017 and BEIS Energy and emissions projections 2017
https://www.gov.uk/government/statistics/energy-consumption-in-the-uk
https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2017

19 Calculated using BEIS, Government conversions factors for company reporting and Building Energy Efficiency Survey, 2016 (for district heating Carbon factor)
https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

20 Calculated using BEIS, Energy consumption in the UK 2017 and BEIS Energy and emissions projections 2017
https://www.gov.uk/government/statistics/energy-consumption-in-the-uk
https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2017

21 Calculated using BEIS, Government conversions factors for company reporting and Building Energy Efficiency Survey, 2016 (for district heating Carbon factor)
https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

centrica
Business Solutions

centricabusinesssolutions.com