Clean Growth

Policy Exchange

How to boost business energy productivity

Joshua Burke

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Joshua Burke is a Research Fellow in the Energy and Environment Unit. From 2014 to 2017 he worked as a Project Manager in an AiM listed renewable energy project developer focussing on distributed generation. He has experience developing a variety of technologies such as biomass CHP, battery storage and flexible gas reciprocating engines. Prior to this he has worked in the public policy sphere at both Chatham House and The Overseas Development Institute contributing to reports on water, energy and food security. He has a BSc in Geography from the University of Nottingham, an MSc in Environmental Technology from Imperial College London.

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Acknowledgements

Policy Exchange would like to thank The Green Investment Group and Centrica Plc for their generous support for this project. The author would also like to thank Joanne Wade (Association for the Conservation of Energy) for providing comments on a draft of this report and also to Richard Howard for his assistance in the early part of this project. The author would also like to thank the large number of companies and individuals who provided input to the report. The views expressed in this report are those of Policy Exchange.

Published by
Policy Exchange, 8 - 10 Great George Street, Westminster, London SW1P 3AE
www.policyexchange.org.uk

ISBN: 978-1-910812-35-8

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Executive Summary

Interest in energy efficiency is not new. Successive governments have sought to fuel more with less; however, the untapped potential of energy efficiency remains. This report considers a new approach for government; an approach that encourages investment in business energy efficiency to reduce carbon emissions and improve business productivity. The focus is on both industry/manufacturing and service-based activities (including the public sector) but excludes the household/domestic sector.

Context

The way in which businesses across a variety of sectors use and consume energy is evolving rapidly. Partly, this reflects underlying structural changes in the UK economy – moving away from heavy industry to less energy intensive industrial activity. It is also a response to greater regulation, increasing volumes of embedded generation, fiscal policies and the implementation of demand side response and energy efficiency solutions. Understanding the different intensities, volumes and types of energy businesses consume is vital to ensure energy efficiency policy can be targeted to maintain competitiveness and reduce barriers to growth.

As it stands, UK energy policy is often framed as a trilemma of objectives - security of supply, affordability and sustainability. Improving energy efficiency is amongst the easiest and cheapest ways to decarbonise our energy system. Whilst carbon prices and low carbon subsidies tend to raise energy costs for end users, improving energy efficiency and cutting energy usage can reduce energy bills, reduce import dependency and reduce demand at peak times - both important aspects of the trilemma. It is also important to recognise the strong relationship between energy efficiency and productivity within industry and how energy efficiency investments can provide a significant boost to overall productivity. Therefore, improving energy efficiency is not only vital in order to achieve all aspects of the trilemma, it goes straight to the heart of the productivity challenges within the UK economy.

Size of the Opportunity

Energy efficiency is valuable in its own right, but it increasingly sits as part of a broader set of strategic actions and initiatives an organisation can take in order to create, maintain or improve a sustainable competitive advantage. These are enabled by improvements in

technology and provide scope to drive cost reductions and access new markets, which provides additional revenue streams. For companies that take an active role in managing their energy consumption and invest in energy infrastructure, there is ever-increasing value to be had. This value can be accessed through either demand reduction or demand shifting and the provision of grid services.

The evidence suggests that there is still significant potential to improve energy efficiency within businesses. A recent government report entitled The Business Energy Efficiency Survey (BEES) highlighted the potential for businesses to reduce overall energy demand by a further 39 per cent. One third of this identified saving relates to measures that have a payback period of 3 years or less. The identified measures with a less than 3-year payback would result in bill savings of £1.3 billion per year in total. Energy efficiency measures that reduce the burden of energy bills have the potential to drive profitability. This is vital so that UK businesses continue to be internationally competitive. As such, **this presents a natural synergy between energy efficiency, productivity and the wider Industrial Strategy.**

Whilst much of the focus has been on projects with a less than 3-year payback, there is also a need to look deeper into projects with a longer payback. This is where a much bigger opportunity lies; projects with payback periods of greater than 3 years represent total energy cost savings, carbon savings and consumption savings twice as large as those with less than 3-year payback period. This is often overlooked in favour of the 'low hanging fruit'.

Moreover, analysis of the BEES survey shows that the emergency services, the health sector and the military communities offer the best value for money in terms of potential energy savings measured on Terawatt hour (TWh) per £Billion spent. **This presents a clear opportunity for public sector leadership to drive the non-domestic market.**

Barriers

Given the apparent cost savings and productivity gains from energy efficiency, it is sensible to ask why businesses have not already realised these energy saving opportunities. This report focusses on and is structured around four key barriers:

- Information
  - Lack of information or imperfect information
  - Lack of awareness or time to investigate opportunities
- Project Economics
  - High up-front costs
  - High discount costs
  - Uncertainty about future revenues
  - Transaction costs
  - Fiscal Polices
  - Performance risks, service and quality of workmanship

- Access to Capital
  - Difficulty securing external capital
  - Competing investment opportunities
  - Risk of stranded investments
- Split Incentives
  - Split incentives between person responsible for making investment and person who benefits (e.g. landlord/tenant or developer/building owner)
  - Failure of businesses to internalise environmental or other external costs

Current State of UK Energy Efficiency Policy

A number of policies have sought to overcome these barriers but their impact has been mixed. This report looks at the current policies across these four key barriers, providing a critique and identifying recommendations to overcome any policy shortfalls.

Informational Barriers

One of main barriers to the uptake of energy efficiency schemes occurs when there is an asymmetry or a lack of information about what measures need to be taken and how they should be implemented. A number of informational policies exist to overcome this such as ESOS (Energy Saving Opportunity Scheme) and mandatory carbon footprinting.

Combined, these measures help to ensure that the largest, most well-resourced companies look into opportunities to become more energy efficient. However, quantifying the extent to which ESOS has been successful is very difficult as publicly available information on the scheme is limited. What evidence is available concludes that as little as 5 per cent of companies are fully acting upon recommendations set out in ESOS. This does little to improve confidence in the impact and efficacy of energy efficiency investments, something that ESOS was intended to do.

Furthermore, only 32 per cent of companies said that senior management within the organisation discussed the ESOS results. Further up the decision chain only 24 per cent of companies stated that the board of directors within the organisation discussed the results of the ESOS assessment. This supports research[1] that suggests the inability to access key decision makers is a key barrier to investment in energy efficient measures.

As it stands, public sector organisations do not usually comply with ESOS. If there is to be strong public sector leadership, then **ESOS needs to be extended to cover public sector institutions** where the energy saving potential is large and cost effective such as the Health Sector or Military Communities. Broadening the scope of ESOS to include these institutions could capture an additional 13TWh of energy savings per year.

1 www.research.ncl.ac.uk

Recommendations

- There is a clear need to increase the transparency of ESOS to understand how well it is working. Administrators of the scheme should begin collating and publicising key ESOS metrics such as what proportion of recommendations are acted upon (implementation rates) and quantifying the financial, environmental and energy benefits derived from ESOS recommendations.
- Financial penalties already exist for companies that do not submit their reports on time. The scope of the sanctions should be increased so that mandatory reporting on progress in implementing ESOS recommendations is also covered.
- The use of ESOS should be expanded so that the definition of 'large undertakings' includes more companies and public sector institutions where large and cost effective energy savings can be made.
- ESOS already requires board level sign off but this doesn't translate in to board level action. This should go further and require board level action on energy efficiency recommendations by either rejecting or accepting them.

Project Economics

Over the years public policymakers have introduced a complex package of fiscal policies in order to stimulate and encourage energy efficient behaviour. These policy instruments include the Climate Change Levy (CCL), Climate Change Agreements (CCAs), the Carbon Price Support (CPS), EU Emissions Trading Scheme (EU ETS) and Enhanced Capital Allowances (ECAs). The effectiveness of this jumble of policies is mixed and particular attention should be paid to the use of CCAs and the CPS

Evidence[2] suggests that fiscal policies have been a weak driver of action on energy efficiency. Protection for the most energy intensive industries should remain but only where there is clear evidence that the absence of CCAs would drive industry abroad. Economic analysis illustrates[3] that any worries about the adverse effects of CCL on economic performance are unsubstantiated. Therefore, **contrary to the government's decision to increase the CCL discount available to Climate Change Agreement (CCA) participants from April 2019, this report recommends that CCA discounts should become more stringent** in order to drive further energy efficiency within the industrial sectors.

Government indecision over the level of the Carbon Price Support (CPS) has the potential to destabilise energy efficiency investment rather than encourage it. Whilst longer term questions remain about what level the CPS should be - and this is outside the scope of this report- if government wants to leverage investment in energy efficiency, businesses need a stable investment environment.

2 Martin, R., de Preux, L. B., & Wagner, U. J. (2011). The Impacts of the Climate Change Levy on Manufacturing: Evidence from Microdata. National Bureau of Economic Research Working Paper Series.

3 www.eprints.lse.ac.uk

Attention should also be drawn to how the complex layering of all fiscal policies has lead to substantial variation in carbon prices across different users and fuel types. The overall effect of such inconsistent pricing is that the most cost effective pathways to carbon reduction become hard to identify.

Recommendations

- **Further work needs to be done to understand the effectiveness of CCAs and whether they lead to offshoring of industry. Voluntary targets should be made more stringent and tied to sector deals that focus on increasing energy productivity and sharing best practice.**
- **Long term certainty over the CPS should be provided beyond 2020.**

Access to Capital

According to the BEES, access to capital and low capital availability is the most frequently perceived barrier to energy efficiency across most businesses, irrespective of their size.

Energy efficiency projects that have a greater than 3 year payback have the potential to make significant energy, cost and carbon savings. These tend to rely on third party external finance; therefore, there is a need provide access to this capital. Using third party finance can also have the added advantage, depending on the project and its structure, of taking energy efficiency investment off-balance sheet. To some businesses this may be preferable.

In order to develop off-balance sheet finance models, accounting treatment must be carefully considered so that it is compliant with relevant accounting standards and regulations. This applies to both the private sector and public sector. This is **vital as the interpretation of accounting rules is one of the main reasons that energy efficiency remains an area of significant under-investment.**

Further consideration should also be given to how the risk allocation changes with third party financing. Third party finance will incur significant development costs for structuring, legal work, feasibility studies and due diligence. If finance was secured via an Energy Services Agreement, it will also require a high quality Investment Grade Audit. Who pays for these high development costs represents a major barrier to energy efficiency projects.

So how can complexities around accounting rules and the barriers posed by high development costs be overcome? The success of the Heat Networks Delivery Unit (HNDU) suggests that it could be adapted to deliver energy efficiency projects. We propose that the government **establishes a new Energy Efficiency Delivery Unit (EEDU) that parallels Heat Networks Delivery Unit but for Energy Efficiency.** The EEDU should focus specifically on the development stage of projects and broaden its scope to include the private sector. Finance should be offered for development work and it could match – up to a maximum

of 50 per cent - the cost of conducting feasibility studies or investment grade audits. This will help close the gap between projects and the development risk needed to take them forward. Moreover, lessons can be learnt from the Investor Confidence Project (ICP). This certification scheme is based on best practice and has been successful in reducing the cost of due diligence incurred by the lender. Expertise within EEDU could also provide third party certification to enable lenders to reduce their transactional costs even further. **Given that the remit of the EEDU is to provide guidance as well as finance it should also engage with industry stakeholders to disseminate information on the complexities of accounting rules.**

Recognition should also be given to the role of devolved government programmes in driving energy efficiency. Notable examples include the Scottish Energy Strategy which has focussed on delivering energy efficiency projects through an energy efficiency loan scheme. Resource Efficient Scotland has also been affective and provides free and impartial advice to businesses and public sector bodies who wish to improve the energy efficiency of their buildings.

Recommendations

- **The government should establish an Energy Efficiency Delivery Unit (EEDU) that can bridge the gap between viable projects and available capital. The unit should mirror the Heat Network Delivery Unit and offer expertise, certification and development finance to both public and private institutions where the qualifying criteria are achieved.**

Split Incentives

The report has focussed on two types of split incentive- Landlord vs. Tenant and Procurement vs. Energy Manager. Despite both being classed as split incentives, the policies that currently affect them and indeed the ones that need devising to correct these market failures differ somewhat.

In the UK, as much as 50 per cent of all commercial properties and 60 per cent of Small and Medium Enterprises (SMEs) are rented from commercial landlords, which can limit their ability or desire to implement energy efficiency measures. This market failure usually arises when one party is responsible for the investment costs while the other party takes advantage of the cost savings. To address the Landlord vs Tenant split incentive, government intervention should focus on landlords rather than tenants and utilise a combination of tighter regulations and fiscal incentives. The government should be more ambitious on targets for energy efficiency within buildings, as measured by the Energy Performance Certificate (EPC) metric. Linking EPC standards to business rates will provide a fiscal incentive for landlords to further increase the efficiency of their buildings. This can be done by allowing business rates to decrease with increasing building efficiency.

Split incentives can also occur within businesses when there are competing departmental objectives such as those between energy managers and procurement teams. It is not always clear which department is best equipped to deal with energy and this can lead to a divergence in the way energy efficiency projects are valued. Energy managers may look for actions with the greatest energy savings but procurement teams may look for the cheapest measures and the two aren't always compatible. The competing objectives and lack of clarity as to what should drive energy efficiency makes it difficult to gain internal traction, particularly with key decision makers such as Chief Financial Officers (CFOs).

Research suggests that profitability is not the main driver of capital investment decision-making, rather the strategic nature of investments carriers a heavier decision weight. As such, reframing energy efficiency in the context of strategic investment and recognizing the myriad of benefits that derive from it is not limited to just increased revenue but also includes increased customer and employee satisfaction, well-being and health, and increased productivity. Therefore, when energy efficiency opportunities are identified, they should be presented and communicated in the context above, making explicit reference to how an energy efficiency project contributes to the strategic aims of the organization and identifying and calculating co-benefits.

Recommendations

- The government should be more ambitious and increase the minimum standard for private rented properties to D by 2023.
- Fiscal incentives to improve energy efficiency should be directed towards landlords by linking – but not fully basing - business rates to EPC.
- Energy managers should reframe energy efficiency in the context of strategic investment, recognizing the myriad of benefits that derive from it aren't limited to increased revenue but also include increased customer and employee satisfaction, well-being and health, and increased productivity.

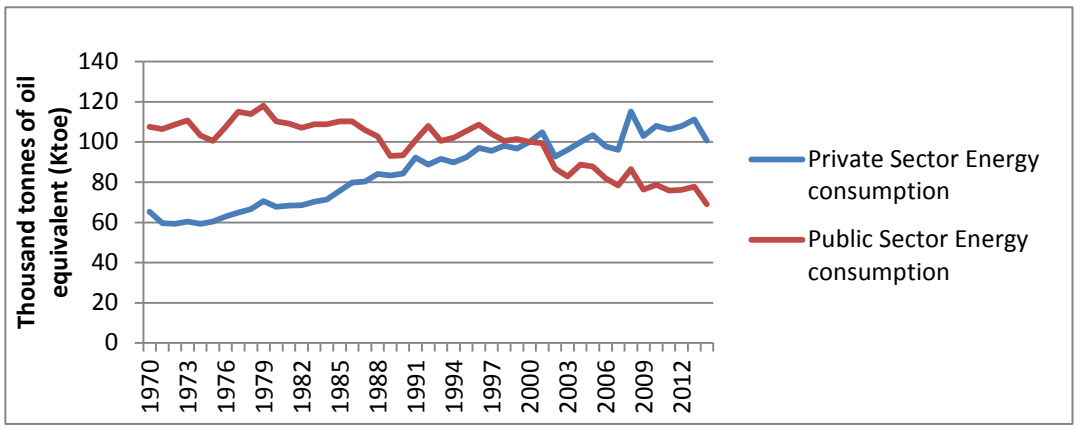
Introduction

How is Energy Used?

The way in which both public and private businesses across a variety of sectors use and consume energy is evolving rapidly. Partly, this reflects underlying structural changes in the UK economy – moving away from heavy industry to less energy intensive industrial activity- but it is also a response to greater regulation, increasing volumes of embedded generation, fiscal policies and the implementation of demand side response and energy efficiency solutions.

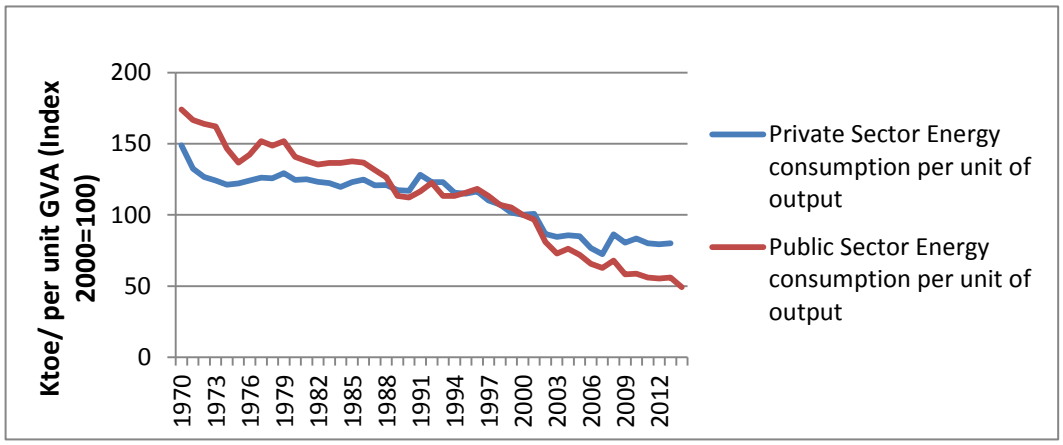
Historically, public sector energy consumption has been considerably higher and less efficient per unit of output than its private counterparts. However, the opposite is now true as figure 1 and 2 demonstrate. More importantly, both sectors have significantly improved energy productivity.

Figure 1: Public vs Private Energy Consumption[4]



4 Energy Consumption in the UK- Overall data tables. Publication URN 15D/382

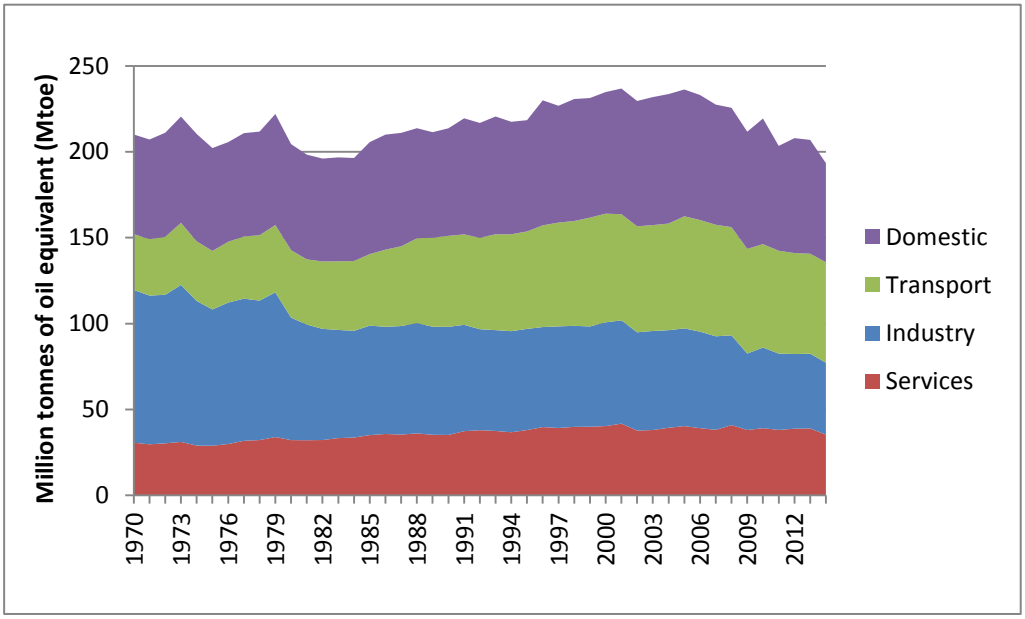
Figure 2: Public vs Private Energy Consumption Per Unit of Output[5]



The concept of energy productivity represents a new paradigm that seeks to align energy efficiency more directly with business growth by maximising the economic benefits of every unit of energy we consume - in other words, using less energy and emitting fewer greenhouse gases per unit of output. **The key question is how can businesses further increase energy productivity and how can this be replicated across all sectors of the UK economy?**

In order to answer this question, it is important to understand that energy consumption within sectors of the UK economy is mixed. There has been an overall decline- albeit very minor- in final energy consumption in total. But this doesn't reflect the changes within individual sectors, such as increases in both transport and service sector consumption. The latter is somewhat unsurprising, given its share of UK GDP has grown from 46 per cent in 1948 to 79 per cent in 2013[6].

Figure 3: Final Energy Consumption by Sector [7]



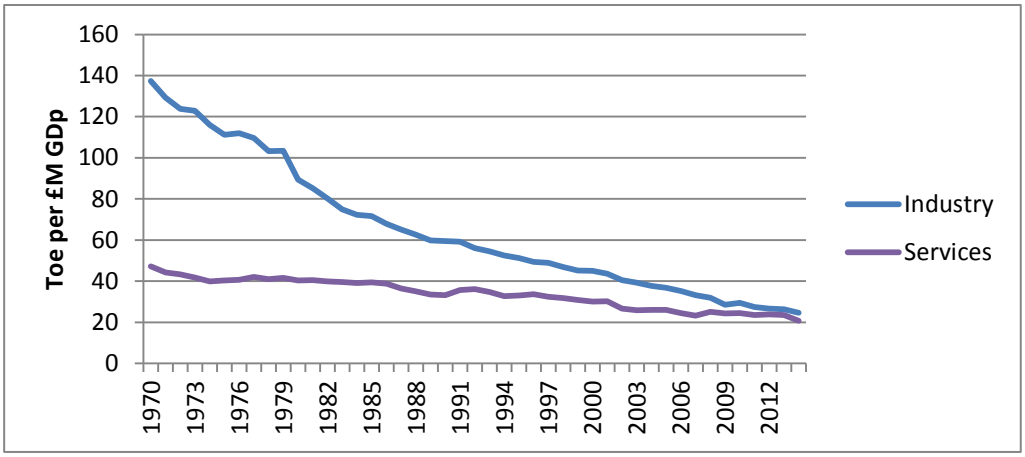
5 bid- GVA is the value generated by any unit engaged in the production of goods and services

6 visual.ons.gov.uk/five-facts-about-the-uk-service-sector/

7 Energy Consumption in the UK- Overall data tables. Publication URN 15D/382

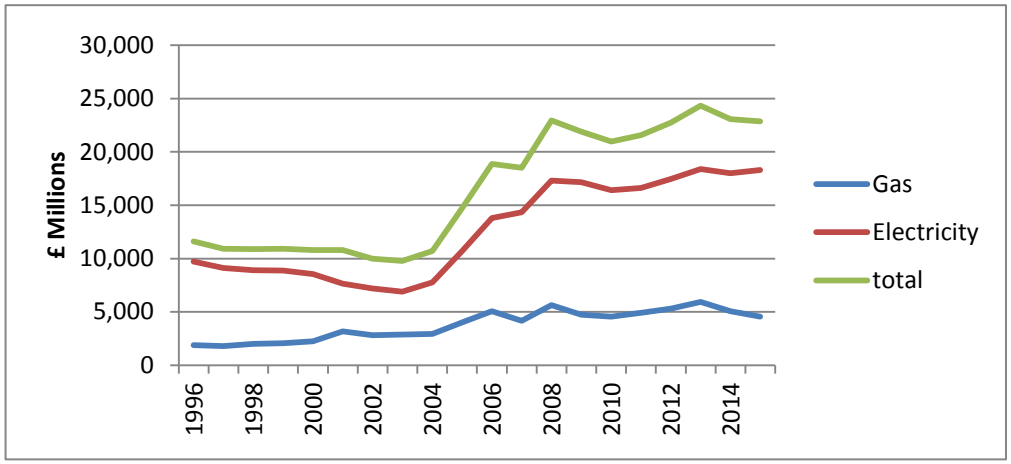
Irrespective of these changing patterns of consumption, both the service sector and the industrial sector are now consuming energy in a much more efficient manner, to the point where they have almost reached parity in terms of energy productivity.

Figure 4: Tonnes of Oil Equivalent Per £m GDP by Sector[8]



Alongside the changes and the different ways businesses use and consume energy, has been increasing quantities of money spent on energy procurement. In 2015, the total spend on energy by 'Industrial Sectors' and 'Other Sectors' (comprising of agriculture, commercial, transport, and public) in the UK was £22.5 billion, (comprising £4.5 billion on gas and £18 billion on electricity) an increase of 49 per cent since 1996.[9] Overall, this represents nearly 5 per cent of GDP.

Figure 6: Amount Spent on Energy[10]



Despite falling energy consumption and efficiency gains by the industrial sector, the quantities of money spent on electricity have risen considerably. In comparison, increases in the amount spent on gas have been much more modest, supporting the assertion that "electricity

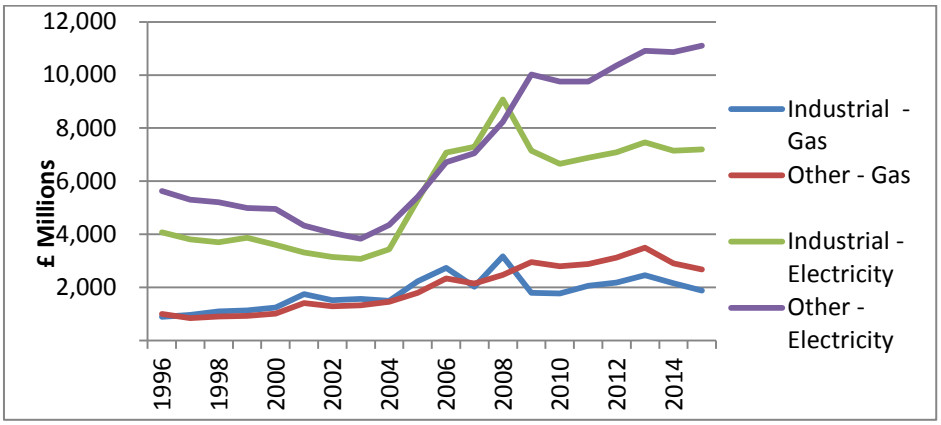
8 Ibid

9 www.gov.uk

10 Digest of United Kingdom Energy Statistics (DUKES)

costs have moved out of line with other European countries", as set out in the Industrial Strategy Green Paper[11] and demonstrated in Figure 8.

Figure 7: Gas and Electricity Spend by Sector[12]



Why Energy Efficiency?

UK energy policy is often framed as a trilemma of objectives - security of supply, affordability and sustainability. Improving energy efficiency within houses, businesses and the public sector presents a large and often overlooked opportunity to tackle all aspects of the trilemma. It is also important to recognise the strong relationship between energy efficiency and productivity within industry and how energy efficiency investments can provide a significant boost to overall productivity. Given that the UK has an increasing productivity gap, energy efficiency projects should be viewed as means to close this gap as well as helping to achieve all aspects of the energy trilemma. Whilst there is a degree of overlap between meeting the trilemma and achieving productivity gains, using the latter to frame the need for energy efficiency may give it greater traction with the wider business community.

Productivity Gains

Energy productivity is about improving total productivity, focussing on how to increase the amount of economic output per unit of energy consumed. The UK has seen low productivity growth relative to its European counterparts, particularly Germany, where it takes a German worker four days to produce what a UK worked makes in five. [13] It is important to recognise the role energy efficiency can play in driving productivity. The increasing amounts spent on energy by businesses – as illustrated below- goes right to the heart of the business productivity debate.

Energy efficiency measures that reduce the burden of energy bills have the potential drive profitability. This is vital so that UK businesses continue to be internationally competitive. **This presents a natural synergy between energy efficiency, productivity and the wider**

11 beisgovuk.citizenspace.com

12 Digest of United Kingdom Energy Statistics (DUKES)

13 www.theguardian.com

Industrial Strategy. Indeed – the government's Industrial Strategy green paper intends to set out a long term road map to reduce business energy costs and has prioritised support for energy efficiency measures in order to reduce the cost of achieving the UKs decarbonisation goals in the power and industrial sectors. This parallels many of the issues surrounding affordability, a key component of the energy trilemma discussed in more detail below.

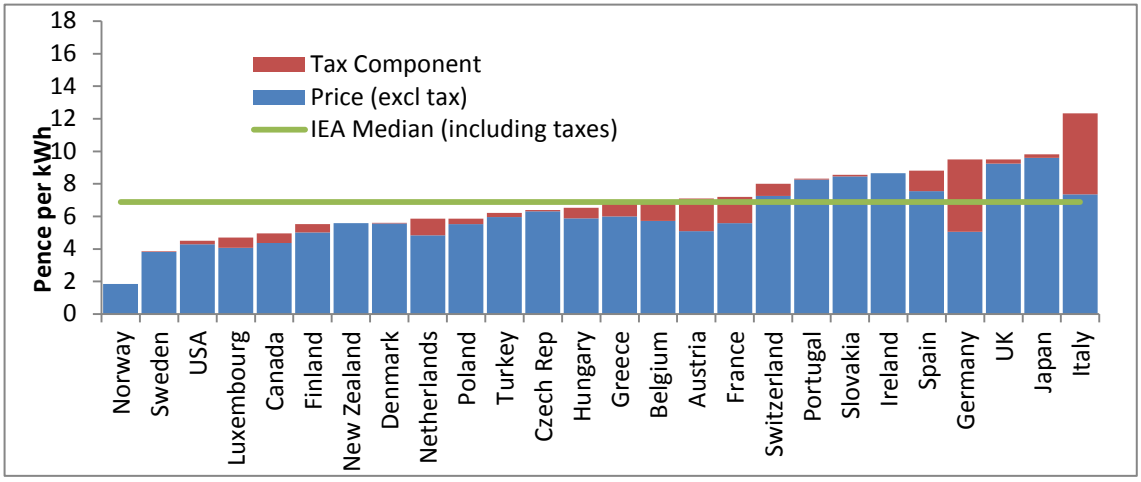
The Energy Trilemma

Looking first at **affordability**, improving energy efficiency is amongst the easiest and cheapest ways to decarbonise our energy system as identified in our report, *The Customer is Always Right*[14]. This applies to households and businesses, and to electricity and other forms of energy. Whilst carbon prices and low carbon subsidies tend to raise energy costs for end users, improving energy efficiency and cutting energy usage can reduce energy bills because they are a function of both *volume* and price. Consequently, as both business energy prices and consumption have steadily risen, this increase has partly been offset by energy efficiency policies. Given that current prices are increasing and future policy could exacerbate this further, reinforces the need for energy efficiency. Irrespective of whether prices are high or low, energy efficiency is an important means to reduce bills.

Estimates suggest that UK businesses are paying out between £1.3-£1.6 billion too much on their energy bills every year [15] because they are not implementing energy efficiency measures.

When looking at the relative cost of energy in the UK versus the rest the other members of the International Energy Agency (IEA), the requirement to lower bills becomes more pressing in the context of maintaining competitiveness and reducing barriers to growth.

Figure 8: Industrial Electricity Prices in The IEA 2015[16]



14 policyexchange.org.uk

15 www.carbontrust.com

16 Industrial electricity prices in the IEA- https://www.gov.uk

In 2015, average UK industrial electricity prices including taxes were the third highest in the IEA and third in the G7, and were 38 per cent above the IEA median. Prices in the UK excluding taxes were the second highest in the IEA, second highest in the G7, and were 63 per cent above the IEA median. [17] Interestingly, the tax element only includes the Climate Change Levy (CCL) which makes up a very small component of industrial energy prices. The impact of policy costs on prices will be discussed later in this report.

At the non-domestic scale in the UK, the cost of energy varies significantly between type of fuel - gas and electricity - and size of business. This is partly due to lower carbon prices for gas in comparison to electricity, a point looked at later in the report. The graphs below examine gas and electricity prices over time and for different size businesses.

Figure 9: Electricity prices for non-domestic consumers (incl CCL) [18]

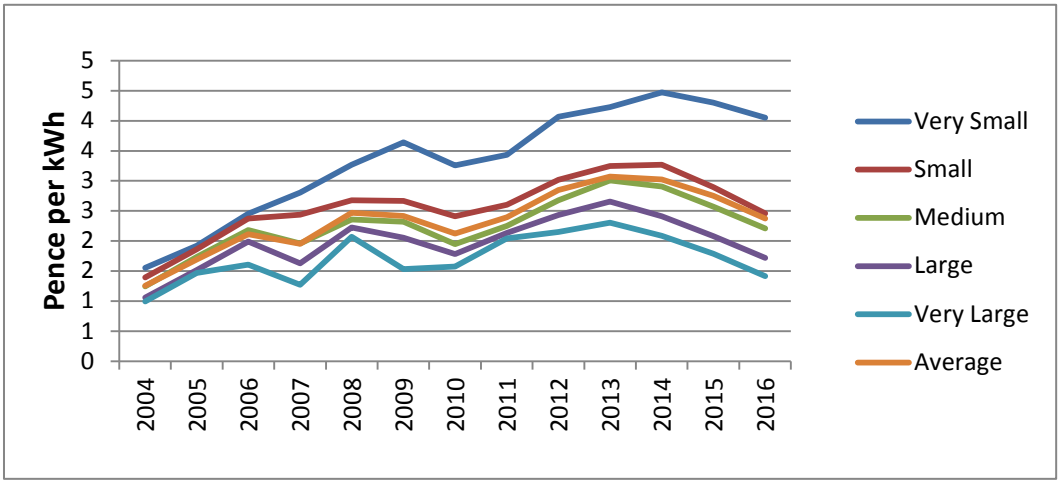
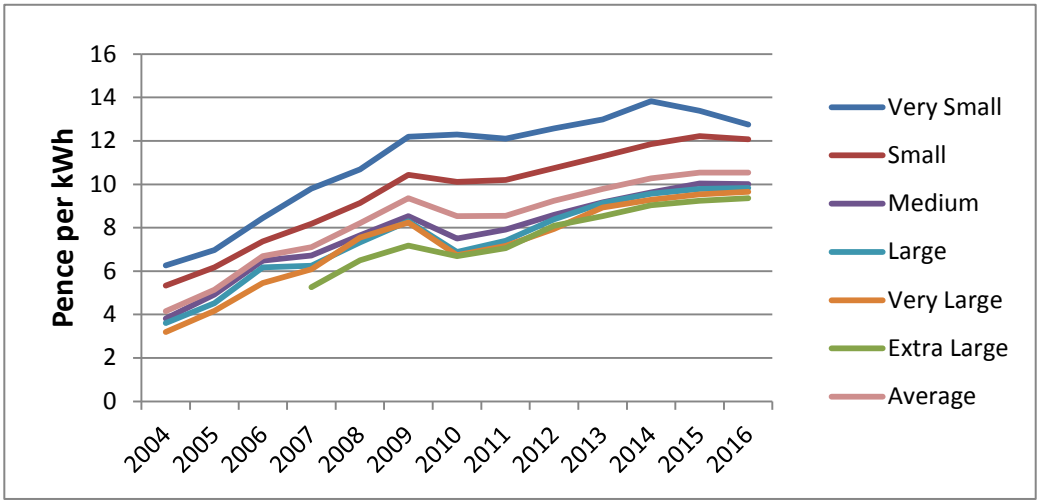


Figure 10: Gas Prices for Non-Domestic Consumers (incl CCL) [19]



17 www.gov.uk

18 www.gov.uk

19 Ibid

The graphs demonstrate that smaller non domestic consumers pay much more per unit of energy (kWh) for both gas and electricity. Table 2 examines price increases over time. On average the greatest increases in cost are associated with electricity prices, rising by 153 per cent compared to an 89 per cent increase in gas prices. When looking at which size of consumer has fared worse, there is no clear pattern.

Table 2: Non Domestic Gas and Electricity Price Rises[20]

Fuel type	Size of consumer	% Increase
Electricity	Very Small	103
	Small	126
	Small/Medium	154
	Medium	162
	Large	171
	Very Large	20
	Extra Large	77
	Average	153
Gas	Very Small	160
	Small	76
	Medium	77
	Large	62
	Very Large	42
	Average	89

[for extra large businesses data is only available from 2007]

For electricity, large businesses have experienced the greatest increase (171 per cent), closely followed by medium (162 per cent) and small/medium (154 per cent). With regard to gas prices, very small consumers have experienced the greatest price rises (160 per cent) alongside medium (77 per cent) and small (76 per cent) consumers.

With this amount of flux in energy prices, it is timely that the government has announced a Cost of Energy Review[21], headed by Professor Dieter Helm of Oxford University, keeping a promise in the manifesto to examine how to achieve competitive and affordable energy costs.

All aspects of the trilemma are intrinsically linked; for example, the growth in renewables (decarbonisation) and reduction in capacity margins (security) has resulted in greater price volatility (affordability), reflected by price spikes in the balancing mechanism, as well as negative pricing. This can be mitigated to an extent through greater interconnection, storage and demand side flexibility as discussed in Policy Exchange's previous report, Power 2.0. [22]

Energy efficiency in businesses fits into a wider narrative of energy security at the national scale. Reducing energy consumption will improve the UK's energy security as well as lower exposure to international energy market price rises, volatility and blackouts.[23]

Second, **security of supply** in the UK has been a focal point for domestic energy policy to ensure there is sufficient capacity on the

20 Adapted from www.gov.uk

21 www.ft.com

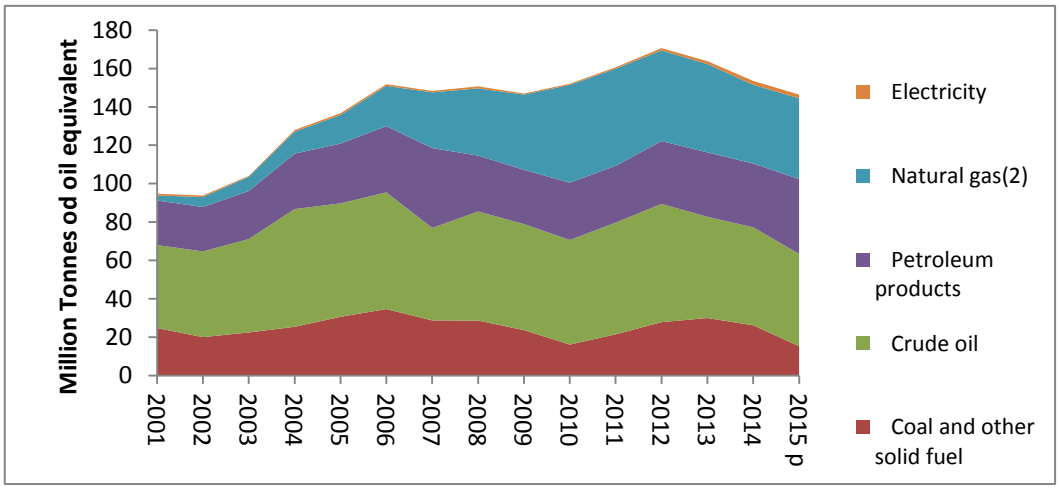
23 www.policyexchange.org.uk

24 www.gov.uk

power system to meet peak demand and avoid blackouts and brownouts. The UK Government has developed a Capacity Market to secure additional power supplies and reduce demand at peak times (either temporarily or permanently) - vital tool in balancing supply and demand. Import dependency and capacity adequacy are two metrics that can be used to examine security of supply.

The quantity of energy imports has been rising since 2001, particularly the amount of natural gas as North Sea reserves dwindle. Energy imports are projected to increase even with slower demand growth. It is expected that UK oil imports will rise to 40 per cent of consumption by 2020, up from 32 per cent in 2012. The UK's gas import dependency is likely to rise to 53 per cent of total consumption by 2020[24], up from 49 per cent in 2012.

Figure 11: Total UK Energy Imports[25]



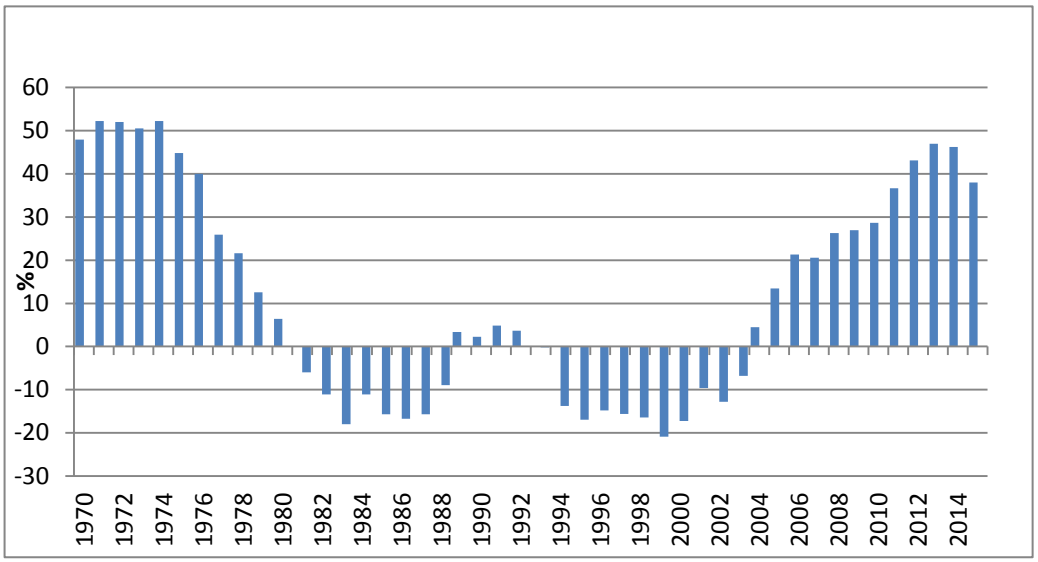
Despite the overall fall in UK energy consumption and the increasing use of renewable and waste sources, the UK's reliance on imported energy has returned to levels last seen around the mid-to late-1970s[26]. Although in recent years the UK's reliance on imported fuel has increased, it has now fallen from its peak in 2013. This is largely due to the increase in indigenous oil and gas output.

24 www.gov.uk

25 www.gov.uk

26 (Ref).

Figure 12: UK Energy Import Dependency[27]



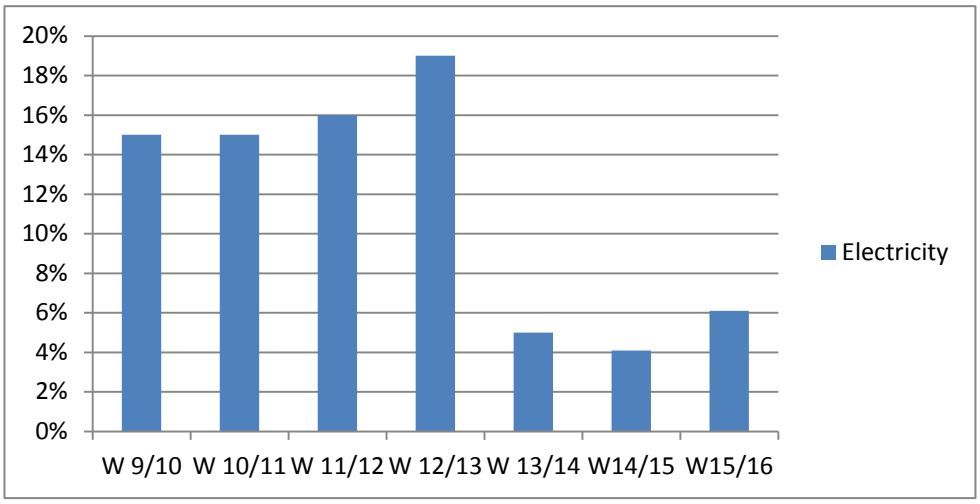
Import dependence is often seen as an indicator of reduced energy security. However, this is not always the case. Being self-sufficient in energy does not guarantee protection from domestic shocks, such as protests and accidents, or from internationally-driven price spikes.[28]

From 2012- 2015 Office of Gas and Electricity Markets (Ofgem) published a Capacity Assessment, looking at Great Britain's capacity adequacy but since the inception of the Capacity Market, the obligation now falls on National Grid (although Ofgem still publish a version), This takes the form of the National Grid's summer and winter outlook reports which include an analysis of the supply and demand of the electricity and gas systems over both summer and winter periods, and anticipates the generation margin for both periods. Figure 12 below looks at the electricity capacity margin during winter periods from 2009-2016. Forecast surpluses are based on declared generation availability and normal demand (excl. Interconnectors). Winter (W) 15/16 includes additional balancing services procured, without this inclusion the capacity margin would decrease to 5.1 per cent.

27 www.gov.uk

28 Houses of Parliament – Measuring Energy Security (2012)

Figure 13: UK Electricity Capacity Margin[29]



Electricity margins have decreased considerably over the last few years. The effects of the Large Combustion Plant Directive legislation and economic pressure, have caused older gas and coal fired power stations to cease or mothball. The capacity margin would have been even smaller had it not been for the partial offset caused by the fall in peak demand, increasing wind generation and the procurement of additional balancing services via the Capacity Market. A tightening capacity margin could put upward pressure on forward power prices as a result of the increased value of securing future electricity supply, rather than trading closer to the time.

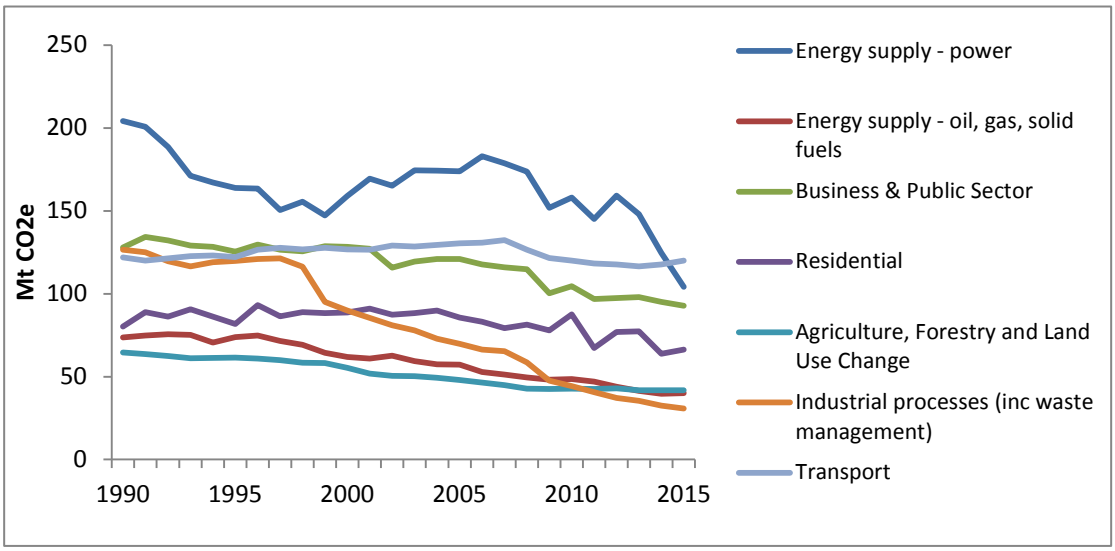
The third aspect of the trilemma is **decarbonisation.** As of 2015, businesses accounted for 17 per cent of all UK GHG emissions[30]. The overarching emissions trend within business is one of decline, as much as 38 percent from 1990-2015. Whilst the overall trend is one of decline, particularly within the industrial sector, a number of sub sets have increased, such as chemicals, food and drink and motor manufacturing. [31]

29 Adapted from National Grid's forward looking outlooks

30 www.gov.uk

31 www.theccc.org.uk

Figure 14: UK GHG Emissions Per Sector[32]



This microcosm illustrates that variation in emissions exists within the industrial sector. Energy efficiency measures will vary significantly depending on the processes that exist within each business and therefore, with this level of complexity, there is no single silver bullet.

There is a long way to go in order to meet the 5th carbon budget and the required 57 per cent reduction of annual emissions by 2030 compared to 1990 levels. As of 2015, UK emissions were 38 per cent below 1990 levels.[33] The first carbon budget (2008 to 2012) was met and the UK is currently on track to outperform on the second (2013 to 2017) and third (2018 to 2022). However, it is not on track to meet the fourth (2023 to 2027) or fifth carbon budgets (2028 to 2032). The Clean Growth Plan - which is urgently needed- is due for publication after the summer recess in 2017 and will outline how the UK can meet the fourth and fifth budgets.

Links between elements of the trilemma need to be recognised and this is particularly true when considering affordability and decarbonisation. Much of the UK's industry competes in international markets, so while it is essential that industry decarbonises as quickly as possible, this needs to be done in a way that doesn't jeopardise a business' ability to compete in markets.

Despite a compelling case, widespread adoption of energy efficiency measures has been limited. It is clear that there is not a universal solution and policies need to recognise the complex and different ways in which businesses use and consume energy in order to quantify the scale of the opportunities.

32 www.gov.uk

33 www.theccc.org.uk

Energy Efficiency in Business

Nature and Scale of Opportunity

Energy efficiency is valuable in its own right, but it increasingly sits as part of a broader set of strategic actions and initiatives an organisation can take in order to create, maintain or improve a sustainable competitive advantage. These are enabled by improvements in technology and provide scope to drive cost reductions and access new markets that provide additional revenue streams. For companies that take an active role in managing their energy consumption and invest in energy infrastructure, there is ever-increasing value to be had. This value can be accessed through either demand reduction or demand shifting and the provision of grid services.

Demand Reduction

A recent Business Energy Efficiency Survey (BEES) conducted by the Department for Business, Energy and Industrial Strategy (BEIS) looked at and quantified the opportunities for demand reduction within businesses rather than a wider suite of measures such as demand shifting and grid services. All potential energy cost savings identified, irrespective of the length of the payback have been determined to be cost effective. The evidence from the survey suggests that there is still significant potential for 'business' to reduce overall energy use by a further 39% from current energy consumption. This abatement potential represents a 63,160 GWh/year (or 14,630 ktCO2e/year) total energy saving. One third of this identified saving relates to measures that have a payback period of 3 years or less and the largest savings (GWh/year) can be found in carbon & energy management, lighting and building instrumentation and control measures, together representing 55 per cent of the total abatement potential.

Table 3: Scale of the Opportunity[34]

Payback period	Energy Cost Saving (£ Bn pa)	$MtCO_2e$/year	TWh/year Saving	Reduction from current consumption (%)
<3 years	1.3	4.9	22	13
> 3 years	2.6	9.7	41.1	26
Total	3.9	14.6	63.1	39

A third of the total abatement potential has a payback of three years or less and the corresponding bill savings from these measures is £1.3bn a year. This has often been the main focus of policymakers, businesses and the finance community, but there is a need to look deeper into projects with a longer payback. This is where a much bigger opportunity lies; projects with payback periods of greater than 3 years represent total energy cost savings, carbon savings and consumption savings twice as large as those with a less than 3-year payback period is often overlooked in favour of the 'low hanging fruit'.

The BEES survey highlighted a number of technologies and strategies that can achieve these savings. The greatest savings result from carbon and energy management, lighting improvements and building instrumentation and control.

Carbon and energy management - measures associated with organisational policy, users of the building and the capacity of the core delivery teams - often takes the form of a strategic report and route map, detailing how business proposes to reduce its carbon emissions by using a range of policies, education initiatives and technologies. It provides an overarching framework for businesses to improve their carbon and energy management.

Lighting improvements such as switching to energy efficient lighting is one of the fastest and easiest ways to reduce energy bills. Measures to improve lighting efficiency include retrofitting existing lighting and the controls that govern them as well as regular maintenance. In practice, this means changing Compact Fluorescent Lamps (CFL) and Tubular Fluorescent Lighting (TFL) to Light Emitting Diodes (LEDs) and installing automatic controls on them.

Finally, building instrumentation and control are measures associated with improving the controls and monitoring of standard building services. For example, when equipment becomes faulty it is difficult for a maintenance person to do the in-depth tests required to rectify the problem and deliver the performance needed without lengthy service calls. Such calls are often prohibitively expensive. Automated fault detection and diagnostics (FDD) systems address these issues by identifying when building systems are performing sub-optimally. If faults occur and if they are of sufficient severity, this is communicated to the owner or maintenance personnel. [35] These

34 Adapted from www.gov.uk

35 http://ashraephilly.org

systems are often associated with heating, ventilation and air conditioning (HVAC).

Another example of building instrumentation and control is wireless sensor networks (WSN). These are based on the idea of collecting real-time energy information about using various wireless devices to measure temperature, humidity and pressure. The measurement of these variables is then picked up by FDD systems. Integrating WSN and FDD allows real time monitoring and diagnostics tools to feed in to a 'knowledge and information services' platform to support energy management.[36] Granderson et al[37] looked at the building instrumentation and control actions that were taken by businesses in order to improve energy efficiency. For example, using FDD in combination with WSN, the University of California identified issues of excessive ventilation, over illumination and excessive overnight gas use and enabled them to achieve a 30 per cent reduction in whole building energy use and a 30 per cent reduction in average daily gas use, amounting $4,500/month of avoided costs. Box 1 provides a further example.

Box 1: Building Instrumentation and Control Case Study[38]

In 2013, Demand Logic, a London-based clean tech start-up, launched a cloud-based system that works in conjunction with Building Management System (BMS) and quickly identifies instances of inefficient energy management. These include rooms being heated and cooled at the same time, or faulty equipment being left on. As there are often high volumes of data being processed, finding faults is very challenging. However, Demand Logic's software records and analyses the data from the BMS, in real time highlighting the equipment to focus on.

Results show that Demand Logic systems can deliver average energy cost savings of 10 to 30% with an average payback of less than nine months. The Better Buildings Partnership (BBP) estimated that Demand Logic's tools save 11,800 tonnes of CO_2 each year and help deliver £1.8 million energy cost savings annually for BBP's members and occupiers. Benefits also extend beyond financial savings and include occupational and productivity benefits evidenced by a 50% reduction in help desk complaints about temperature discomfort.

Demand reduction measures can be applied across a variety of sectors and the scale of the opportunity is large. Table 4 looks at the size of the demand reduction opportunity by sector. This includes lighting, building instrumentation and control and energy and carbon management strategies.

36 www.itcon.org

37 Granderson, J, Piette MA, Ghatikar, G. and Price, P. 2009. Building Energy Information Systems: State of the Technology and User Case Studies. Lawrence Berkeley National Laboratory, LBNL-2899E. Available from http://eis.lbl.gov

38 www.ukace.org

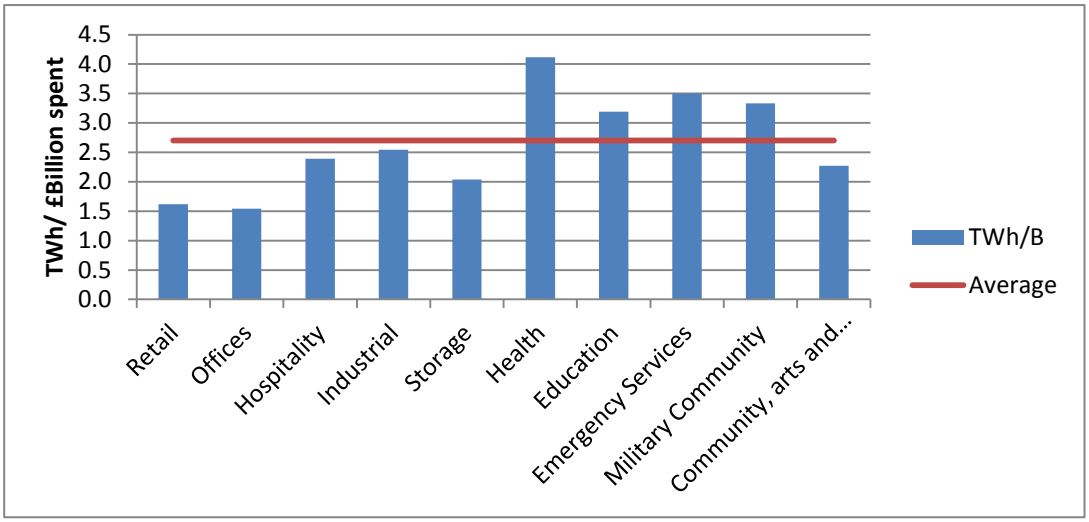
Table 4: Scale of the Opportunity by Sector[39]

Sector	Total TWh/year Saving	< 3 years payback (TWh/year Saving)	> 3 years payback (TWh/year Saving) *	Total Reduction from current consumption (%)	CAPEX Required to deliver abatement potential (£B)	Energy Cost Saving : < 3 years payback (£B per annum)
Retail	9.4	2.2	7.2	34	5.8	0.2
Offices	10.5	2.1	8.4	38	6.8	0.1
Hospitality	4.3	1.6	2.7	25	1.8	0.1
Industrial	11.7	7.3	4.4	46	4.6	0.4
Storage	5.1	0.2	4.9	39	2.5	0
Health	7	3.9	3.1	41	1.7	0.2
Education	6.7	2.1	4.6	45	2.1	0.1
Emergency Services	2.1	0.7	1.4	51	0.6	0
Military Community	1	0.5	0.5	54	0.3	0
Community, arts and leisure	5	0.9	4.1	43	2.2	0.1
Total	63.1	22	41.1	39	28.4	1.3

As table 1 illustrates, across all ten sectors the total potential energy savings are 63.1Terrawatt Hour (TWh/year and it will require 28.4 billion of Capital Expenditure (CAPEX) to achieve this. Neither the energy saving potential nor the CAPEX requirements are evenly spread across the sectors. **The biggest energy savings can be made in the industrial sector (11.7 TWh), offices (10.5 TWh) and retail (9.4 TWh)** and the biggest CAPEX costs are also associated with these sectors. Using these metrics allows a comparison of the relative cost of TWh energy savings/billion spent per sector.

39 www.gov.uk

Figure 15: TWh/ Billion spent[40]



Whilst retail, offices, and the industrial sector offer the biggest opportunities for energy savings, the cost associated is amongst the most expensive on a TWh saved per billion spent. **The health sector, emergency services and the military communities offer the best value for money** but in the case of the latter two, they have the smallest potential for energy savings, just 2.1 and 1 TWh respectively. **Although the energy savings are small, they are the most cost effective which suggests there could be scope for a public sector energy efficiency strategy in these areas,** an idea that Stern[41] has been a proponent of, concluding that the public sector has a crucial role in energy efficiency improvements. This is also about public sector leadership and its ability to set standards and drive a sense of social normality within the wider market. This may help to overcome a lack of interest from industries that are not consumer facing.

The greatest cost saving potential (£B per annum) for projects with less than 3 years is in the industrial (0.4£B), health (0.2£B) and retail (0.2£B) sectors. In comparison to other sectors, the industrial sector also has the biggest energy saving potential (TWh) for projects with a less than three-year payback. Therefore, on paper, **industrial energy efficiency projects of less than a 3-year payback can save more money and more energy than any other sector**. Clearly, this provides a large opportunity for the industrial sector to save considerable sums that can Furthermore, the health sector provides the potential for the most cost effective energy efficiency measures and also the second largest potential for energy savings (for projects of a less than 3 year payback). **Energy efficiency measures in the health sector would cost the least per TWh saved and it could generate one of the highest savings in terms of (£B) per annum.**

There are two other important things to consider from table 4. First, the energy savings for projects with a greater than 3-year payback (TWh/year saving) are significantly larger than projects with a smaller payback and this is true for almost all sectors. Yet the focus has been on

40 Adapted from www.gov.uk

41 Stern, N (2007)

quicker payback. Interestingly, only in the industrial and health sectors does the biggest opportunity lie with projects with a payback of less than 3 years. This distinction is useful so that policies can be effective and targeted.

Second, the BEES survey only publishes the energy cost saving potential (£B) per sector for projects of less than 3-year payback and not for longer payback periods, despite the latter being a much bigger opportunity. There is a clear disconnect between the information available and where the biggest opportunity lies. This highlights a key issue around the availability of information and how this can be a barrier for the adoption of energy efficiency measures.

Recommendations

- **There is a clear opportunity for public sector leadership in the health sector, emergency services and the military communities. They offer the best value for money and in the case of health also the cheapest (per TWh saved) and the largest energy saving potential (£B per annum). The NHS should commission an assessment of energy efficiency opportunities and lead in its implementation.**
- **When considering energy efficiency projects with a payback of less than three years, Government should focus on big wins, which can be found in the industrial sector. It has the biggest energy saving potential (TWh) and the largest cost saving potential (£B per annum) in comparison to any other sector.**
- **Overall, energy efficiency projects with a payback of more than 3 years offer the greatest energy cost savings (£B per annum), emissions savings ($MtCO_2e$/year) and consumption savings (TWh/year Saving). Future BEES surveys should include more information about projects with payback periods greater than three years and about where the most cost effective energy efficiency opportunities lie.**

Scale of Opportunity by Business Size

The abatement potential in large organisations (30,800 GWh) is only slightly greater than potential in Small and Medium Enterprises (26,840 GWh). While large organisations often represent the low hanging fruit, evidently Small and Medium Enterprises (SMEs) also present an opportunity for significant savings.

However, one important factor in translating abatement potential into actual savings is the application of clear energy management strategies and the personnel to implement these. Energy management resource and energy management ambition differed significantly between large enterprises and SMEs. For large enterprises, 65 per cent of premises had active policies on energy management and dedicated energy management resources (i.e. specialist or non-specialist). In contrast, this was the case for only 44 per cent of SME premises.

SMEs were also far less likely to have access to dedicated energy management resources - 23 per cent of energy used in premises occupied by SMEs had no energy management resources, in comparison to 8 per cent of energy used in premises in large enterprises.[42]

Large organisations accounted for the majority of energy consumption in emergency services (89 per cent), military (100 per cent), health (91 per cent), storage (61 per cent) and offices (61 per cent). SMEs consumed more energy in industrial (69 per cent), education (65 per cent), community, arts & leisure (62 per cent) and hospitality (62 per cent). Retail had a comparatively even split between large enterprises (54 per cent) and SMEs (46 per cent).

Evidently, large organisations and SMEs are both responsible for consuming large amounts of energy. There are opportunities across all sizes of business but policy approaches will have to be different for different sizes of businesses.

Demand shifting and grid services

In conjunction with the demand reduction measures identified in the BEES report, demand shifting and grid services offer additional means of increasing energy productivity. These form part of a Demand Side Response (DSR) continuum, ranging from price signals such as avoiding grid charges at peak times to procured services such as capacity or frequency regulation.

Transmission Network Use of System (TNUoS) demand payments, known broadly Triads are a penal charge levied on consumer demand at peak time. Avoiding or reducing demand during these periods is an example of large industrial consumers responding to, and indeed saving money from price signals such as grid charges. Triads are the three half hourly periods where electricity demand across the UK is at its greatest, generally falling between November-February. Companies requiring power during these times get charged significantly more and, conversely, consumers who reduce their energy during Triad periods will receive lower bills.

It is possible to get alerts when Triad periods might occur, which enables companies to turn down non-essential equipment or to use on site stand by generation to produce their own power during Triad windows. This can save huge amounts of money: 1MW of Triad avoidance in London can save a company approximately £35,000.[43]

Triad avoidance helps maintain the capacity margin between supply and demand and is a key tool in mitigating security of supply risk. It has the additional benefit of reducing the need for new generation, which is often paid for by higher consumer bills. Evidently, this is a key policy to achieve affordability and security of supply - both key elements of the energy trilemma.

However, recent changes to embedded benefits are likely to make this a far less attractive proposition. Ofgem have confirmed that the Triad benefit, currently £45/kW will be reduced to £2/kW over three years, starting in 2018. These changes are widely seen as a move to prevent

42 Ibid

43 www.ft.com

smaller embedded generators from undercutting larger Combined Cycle Gas Turbines (CCGTs) so that their economics remain competitive in a bid to ensure more CCGTs get built. It could also deter industrial manufacturers, hospitals, and local authorities from generating their own power and reduce the ability of public and private businesses to maximise energy productivity.

A further price signal opportunity that business can capitalise on arises in the Wholesale Market, which allows businesses to trade and arbitrage power. For example, businesses can buy electricity in advance at £40-£50 per megawatt hour, and once they have identified flexibility in their electricity consumption they can also make money by selling this back to the market - in either day ahead or intraday trading - at premium prices instead of consuming it themselves.[44] This only remains an opportunity if a small number of organisations participate. The wider application of energy arbitraging will inevitably erode the value that can be extracted.

At the other end of the DSR continuum, a number of procured services exist that businesses can tap into such as Reserve, Frequency and the Capacity Market.

Demand Turn Up (DTU) is one potential source of revenue within the Reserve Market. It has been developed to allow demand side providers to increase demand (either through shifting consumption or reducing embedded generation) as a solution to managing excess renewable generation when demand for electricity is low. In order to harvest opportunities in this market, it is vital that these opportunities are communicated clearly and as close to real time as possible.

Greater use or the expansion of building instrumentation and control could be used as a mechanism to communicate DTU opportunities or embed the requirements of smart networks within businesses. This illustrates an example of the synergies between greater utilisation of energy efficiency measures, such as building instrumentation and control, as a means to increase revenues and productivity.

The frequency market has developed in response to National Grid's continuously changing system frequency, which is determined and controlled by the difference between system demand and total generation. When demand is greater than generation, the frequency falls but if generation is greater than demand, the frequency rises. Instances of increased power fluctuation, caused by intermittent sources of renewable energy, have in part driven the frequency response market.

National Grid is obligated to maintain frequency within stringent limits - ±1 per cent of the system frequency (50.00Hz). To ensure that the frequency operates within the parameters set, it needs sufficient generation and / or demand. This presents an opportunity for business to manage and utilise their generation and demand in accordance with National Grids' frequency needs and get paid to do so. Examples suggest that in return for a permanently flexible 3 megawatt (MW) load, companies can earn £210,000.[45]

44 smartestenergy.com

45 www.telegraph.co.uk

Lastly, businesses can participate in the Capacity Market. Businesses that can identify flexibility in their energy consumption can get paid by National Grid by reducing their consumption at times of high demand.[46] It is estimated that a typical participating business can expect to see an annual return of around £20,000 a year from Capacity Market DSR. [47] This amounts to approximately 2 per cent of its annual energy bill.

The opportunities for business to capitalise on the numerous flexibility markets should, in theory at least, become easier to access. The National Grid has recently published its System Need and Product Strategy (SNAPS), which responds to the inherent complexities of DSR and rightly seeks to rationalise, standardise and improve the number of products on offer. Industry feedback has often sighted complexity and a lack of transparency as a barrier to entry and SNAPS aims to reduce the 20 plus products on offer down to just five clear areas[48]:

- Frequency Response
- Reserve
- Blackstart
- System Inertia
- Reactive

This should go some way to reducing the different technical requirements required for each market and harmonise markets that are either over or under subscribed.

46 www.smartestenergy.com

47 www.thewp-group.co.uk

48 www2.nationalgrid.com

Barriers to Energy Efficiency Investment

Given the apparent cost savings from energy efficiency, it is sensible to ask why businesses have not already realised these energy saving opportunities and what barriers to energy efficiency investment exist. Barriers can be defined as a mechanism that inhibits investment in technologies that are both energy efficient and economically efficient.[49]

A previous Policy Exchange report entitled 'Efficient Energy Policy', highlighted the typology of barriers and market failures holding back investment in domestic energy efficiency, namely financial barriers, hidden costs/risks, informational barriers, misaligned incentives, and behavioural barriers. Non-financial and behavioural factors that inhibit businesses from investing in energy efficiency measures serve to strengthen the case for government intervention.

49 Weber L (1997) Some reflections on barriers to the efficient use of energy. Energy Policy 25(10):833–835

Table 5: Typology of Barriers[50]

Categories	Examples
Financial	• High up front costs • Lack of finance/access to capital • High discount rates • Risk of stranded investments
Hidden costs/risks	• Transaction costs • Hassle Factor (e.g. time spent clearing a loft in order to have insulated • Time taken to evaluate and implement energy efficiency investments • Performance risks, service and quality of workmanship
Information	• Lack of information or imperfect information • Lack of awareness or time to investigate opportunities
Misaligned incentives	• Split incentives between the person responsible for making investment and the person who benefits (e.g. landlord/tenant or builder/homebuyer) • Failure to internalise environmental or other external costs
Behaviour and motivation	• Traditions, sticking to 'defaults', reluctance to alter lifestyle • Values, preferences, social norms • 'Bounded rationality' – households systematically underestimating benefits of energy efficiency, and ignoring small opportunities

Whilst there is a degree of overlap between the domestic barriers described above and the barriers facing businesses, this report will focus on a more specific set of barriers to energy efficiency investment that government research has explored in more detail.[51] The barriers most frequently cited by businesses are capital availability, competing priorities, and a lack of time; whilst the most impactful barriers are seen as divergent interests, split incentives, insufficient financial return from investment, complexity, and capital availability.

However, there are some apparent anomalies: whilst businesses often identify *capital constraints* as a barrier to investment in energy efficiency, banks and other finance providers often identify a shortage of bankable *projects* as the barrier to investment in energy efficiency. This may be in part due to unwillingness on both parts to invest the time and money to identify and develop energy efficiency projects to the point of investment readiness. As such, what appears to result is a piecemeal and incremental approach whereby some businesses take small steps to improve energy efficiency, but larger scale, more transformational projects are frequently overlooked. This breakdown in the flow of projects may in part be due to a lack of 'developers' of

50 policyexchange.org.uk

51 www.gov.uk

energy efficiency projects (e.g. by contrast there are many companies who actively develop renewable energy projects).

Financing

In terms of access to capital, a number of options exist such as internal, external and hybrid finance. There is an important distinction to make between internal and external finance - the former tends to focus on projects with a less than three-year payback, but has to compete internally with other projects - whilst the latter will take a longer term view with more of a focus on the Internal Rate of Return (IRRs). The length of payback period often determines what type of project finance is suitable.

To date access to capital is often viewed as being contingent upon getting internal investment, but creating investment grade external funding opportunities also provides an important route to market. Where internal capital constraints prevail, external capital or third party capital has a role to play. It can also have the added advantage, depending on the project and its structure, of taking energy efficiency investment off-balance sheet. To some businesses this may be preferable in order to free up corporate borrowing for other projects or to exclude liabilities on its balance sheet.

Two popular methods of off-balance sheet financing are Operating Leases and Energy Service Agreements. In an operating lease, the lessor – typically the landlord – maintains ownership of any energy efficiency equipment and the lessee – typically the tenant – has a right to use it. Payment from the tenant to the landlord is considered an operational expense and therefore the leased asset does not sit on the tenant's balance sheet. An ESA is slightly different and usually involves an Energy Service Company (ESCO) that will fund the installation and maintenance of an asset and retain ownership. The customer then pays a fixed price to the ESCO for the energy they consume and this price will be lower than what they currently pay for energy. In addition to this, depending on the commercial arrangement, the ESCO can keep any subsidy payments that accrue. For example, in the UK an ESCO might fund the installation and operation of a biomass boiler to provide heat to a school The customer (the school) would pay a fixed price for the energy they consume but as this equipment is eligible for a government subsidy under the Renewable Heat Incentive the ESCO might also keep these additional payments.

Whilst these funding models are increasingly being used to delivery energy efficiency projects, there are challenges. In order to develop off-balance sheet finance models, accounting treatment must be carefully considered so that it is compliant with relevant accounting standards and regulations. This applies to both the private sector and public sector, with both needing to be cognisant of the evolving regulatory landscape. An appreciation of this is vital as the correct interpretation of accounting is one of the main reasons that energy efficiency remains an area of significant under-investment. [52]

52 www.e3g.org

The challenges that accounting rules pose is illustrated by the way in which the European Union (EU) has recently interpreted International Financial Reporting Standards (IFRS). IFRS were developed to provide a single set of high quality and enforceable standards so that company accounts are comparable across international boundaries. EUROSTAT recently confirmed[53] that despite energy efficiency investments being fully financed by the private sector, capital expenditure is required to cover their cost. Applying this rule means that investment in energy efficiency is treated as being on balance sheet and in the case of the public sector it will count towards public sector debt. Given that the public sector would like to limit this, it makes it very difficult for local authorities or public institutions to develop energy efficiency projects with the private sector and it could even act as a disincentive.

Therefore, for the public sector in particular, the EUROSTATS interpretation of the accounting rules is a significant barrier to the development of energy efficiency schemes. This leaves private financing options for the public sector under-developed and potentially the wider ESCO market as well.

Moreover, new lease standards such as IFRS 16 could have significant implications for off balance sheet funding of energy efficiency projects. The new standard, which will be mandatory from 1 January 2019, will require lessees - usually tenants - to bring all leases back on to their balance sheet, including those previously deemed as operating leases.[54] This could include leases of biomass boilers or other energy efficiency equipment.

This would have the potential to further inhibit the deployment of energy efficiency technologies. It is crucial that installers, financiers and customers review the potential impact of IFRS 16 on existing and future energy efficiency schemes. **Government should convene a series of workshops and roundtables so that the implications of IFRS are fully understood by all industry stakeholders.** How this could be delivered will be explored later in the report.

Further consideration should also be given to how the risk allocation changes with third party financing. Third party finance will necessarily incur significant transaction costs for structuring, legal work and due diligence. If finance was secured via an Energy Services Agreement, it would also require a high quality Investment Grade Audit, which may be avoided through some internal funding routes. This combination of factors present further financial barriers.

Focusing on projects with 3-year payback tends to limit financing to internal, on balance sheet funding, which then has to compete internally with other projects. As table 3 shows, the biggest opportunity in terms of TWh, CO_2 emissions and energy cost saving (£B) lies with projects of greater than three-year payback. Therefore, the role of, third party finance can be a key enabler and must not be overlooked.

53 www.ec.europa.eu

54 www2.deloitte.com

Split Incentives

Split incentives are frequently cited as a barrier to the deployment of energy efficiency measures within buildings, often occurring when those who pay the bills (usually the tenant) are not those making the investment decisions (usually the landlord/building owner). This assertion is supported by a report by the Department for Business Innovation and Skills (BIS) BIS[55] that found interviewees who leased or rented their premises were reluctant to invest in building improvements, particularly where the payback periods extended beyond their lease periods.

An often overlooked split incentive - and one that poses a significant barrier to energy efficiency - occurs within business procurement practices. For example, different procurement teams look after different cost items (e.g. energy cost vs. facilities management). It is not always clear which department is best equipped to deal with energy and this can lead to a divergence in the way energy efficiency projects are valued. Energy managers may look for measures with the greatest savings but procurement teams may look for the cheapest measures. Often they are mutually exclusive. This misalignment makes it difficult to take a holistic view and when opportunities arise to spend Capital Expenditure (CAPEX) in order to save Operational Expense (OPEX) they aren't always taken as the benefits are not accrued evenly to the departments.

This is also evident in building retrofits which are often driven by cost, rather than quality or efficiency. This is exacerbated by the fragmented nature of building value chains which increases retrofit costs, a view supported by a European Commission report looking at energy efficiency in the context of building renovation challenges. [56]

There is a difference between low cost and best value but the competing drivers of different procurement teams fail to take a long term, holistic view in separating these out. Should best value be viewed in terms of CAPEX or Net Present Value (NPV)? Different teams and indeed different personnel might not agree on what metric should define 'value'.

But whilst procurement systems are often a barrier, examples from the United States demonstrate that procurement systems can also drive change and encourage companies to be as comprehensive as possible on energy efficiency. However, this can only happen when there is a clear mandate. For example, in 2013 and again in 2015, Obama gave clear instruction that federal buildings must increase energy efficiency. This formed the basis to double energy efficiency investment by 2030. It also gave federal agencies the certainty to increase Energy Performance Contracting (EPC) by providing up to $4 billion of investment[57], which in turn helped to scale up the EPC market.

This demonstrates that procurement systems may also be a way to drive efficiency if there is a clear government mandate. This isn't about government underwriting energy efficiency investment; rather it is that procurement teams will react positively if they have an overarching objective – such as the one Obama set – that isn't justified as end in

55 webarchive.nationalarchives.gov.uk

56 www.ec.europa.eu

57 www.energy.gov

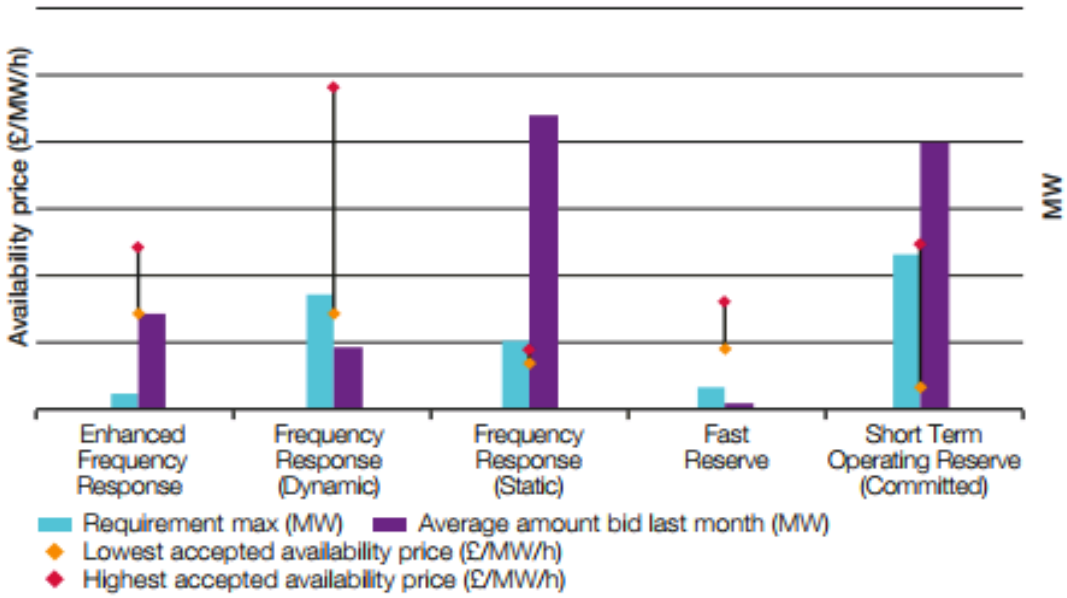
itself, but as a means to achieving greater energy productivity. This approach can be replicated by businesses if senior decision makers make investment in energy efficiency projects a priority for procurement teams.

Project Economics

A number of factors affect project economics such as high up-front costs, cost of capital, uncertainty about revenue streams and ensuing high discount rates.

High cost of capital will be acutely felt by smaller businesses, predicated on a small balance sheet and poor credit worthiness. Clarity around revenue streams impacts businesses of all size. For energy efficiency schemes, it is often more difficult to make a financial case. This is because they usually make estimates of savings rather than having the long term revenue visibility that government backed subsidy payments provide. Having said this, revenues from renewable energy subsidies are not immune to uncertainty, especially as Renewable Obligation Certificates (ROCs) have ended and Contracts for Difference (CfD) auctions continue to be held so sporadically. Moreover, the economic opportunities arising from demand shifting and grid services outlined earlier in the report are inherently complex and market pricing is chaotic.

Figure 16: Oversubscribed and Undersubscribed Markets[58]



Figuring out optimal bidding strategies and the interfaces between revenue streams present a big challenge for businesses. Inability to quantify this makes it hard to present a compelling case for the implementation of these schemes and a lack of confidence in future

58 National Grid - System Needs and Product Strategy (2017)

revenue streams can result in unnecessarily high discount rates, which can have a negative impact on a project's economics.

Information

Information - or the lack of it – should not be looked at in isolation; rather, it is intrinsically linked with all other barriers and exemplified by its ability to affect project economics. Lack of awareness, expertise and understanding presents a significant barrier to the uptake of Energy Efficiency schemes. This is perhaps more acute in SMEs. According to the BEES report, SMEs have less active management policies on energy and fewer dedicated energy management resources, which would support this assertion. Other competing priorities often take precedent when the cost savings are negligible. Without sufficient information, the ability to quantify both the problems and the opportunities to improve energy efficiency and to make economically efficient decisions is limited.

Factors affecting barriers

The barriers to energy efficiency investment are quite nuanced, and vary according to the sector and size of the business. According to the BEES survey, the issues facing larger organisations and SMEs were largely similar. For example, most organisations highlighted allow capital availability and a lack of time as being key issues.

The areas where they differed were that SMEs were far more likely to believe that other priorities were a concern, often taking the view that there was a risk of customer or building user dissatisfaction from energy efficiency measures. The barriers in SMEs were slightly more behavioural in nature and the barriers in large organisations were organisational.

This is true for non-manufacturing SMES. Evidence from a BIS 2010[59] report found that none of the financial metrics (cost savings, capital cost or payback period) were shown to be statistically significant for implementation rates, supporting the assertion that less tangible factors, such as ambience and customer experience, were likely to drive energy efficiency improvements in this sector. In contrast, for large organisations there was a tendency to perceive complex decision chains as the main barrier to implementing energy efficiency measures.

The main differences in the nature of barriers between sectors are driven to some degree by the underlying structural differences between them. A lack of access to capital was the most frequently perceived barrier across every sector. It was the only barrier that was noted by respondents in every sector.

Sectors with smaller premises or a high reliance on volunteers, such as community, arts and leisure, retail and industrial often identified capacity constraints. In the education and emergency services sectors key internal stakeholders were believed to have 'other priorities', which significantly undermined the organisation's ability to implement

59 webarchive.nationalarchives.gov.uk

energy efficiency measures. Other priorities were also noted in the hospitality, industrial and retail sectors.

Complex decision chains were believed to have the greatest impact in the community, arts and leisure, hospitality, education and military sectors. Sectors, such as hospitality and community, arts and leisure with older and potentially listed, building stock often require external approval from planning authorities for further energy efficiency projects. In other sectors, such as education, third parties were involved in the funding and operation of premises which was felt to introduce additional approval complications.

Larger organisations tend to exacerbate the problems of complex decision chains as there are more levels of management for decisions to pass through and the flow of information becomes increasingly fragmented. This poses a barrier to energy efficiency projects. What will ultimately drive energy efficiency projects are the perceived strategic and productivity benefits rather than energy and carbon savings. This is how energy efficiency projects should be presented to ensure traction across all management levels in businesses. A number of examples demonstrate this approach:

- Data centres – when implementing energy efficiency schemes the main driver is concern around availability.
- Supermarkets – food quality, price and customer service experience drive energy efficiency.

In the case of supermarkets, reducing food waste makes good business sense as well as reductions in CO_2 emissions. The World Resources Institute evaluated cost and benefit data from 1,200 business sites across 700 companies in 17 countries. They found that for those companies, for every 1 dollar invested in training staff to limit food losses during production, 14 dollars or more was saved.[60]

There has been a failure of policymakers and energy management professionals to state the business case for energy efficiency and to make clear the ability of energy efficiency measures to drive improvements in company productivity and profitability. One way in which businesses can realise this potential, is by looking at how **synergies between energy efficiency, process optimisation and digitalisation can lead to productivity gains** as set out in the Industrial Strategy. A number of case studies exemplify this.

60 www.wri.org

Box 2: Energy Efficiency and Process optimisation within business[61]

Google Data Centres

Google is responsible for 0.01% of global electricity use. As such, it has attempted to cut energy consumption in its data centres by using AI. Data centres require significant energy for cooling, as well as constant adjustments to air temperature, pressure and humidity, to run as efficiently as possible. The level of complexity and number of variables meant the job of managing data centres was one where an algorithm could outperform a human. Deepmind is an algorithm that can more accurately predict the incoming computational load and match that prediction very quickly to the cooling load requirement. It has helped reduce energy use for cooling by 40% and total energy use by 15%.

Box 3: Energy Efficiency and Process optimisation within business[62]

Ikea Super Markets

Ikea have implemented a smart scale solution where food waste is measured and reported in the IKEA restaurants, bistros and Swedish Food Markets. The system is based on a tablet linked to scales and a bin, with which IKEA staff are able to list what food product is being weighed and calculate how much its wastage has cost in terms of both money and CO_2 emissions. The data can then be linked to the store's overall profit margins. The overall goal is to cut food waste in the IKEA food operations by 50% by the end of August 2020. By May 2017, 84 stores, over 20% of all IKEA stores, have implemented the food waste system, so far resulting in a reduction of 79.200 kg food waste, equal to 341.000 kg CO2 saved. They have a seen a 30% food waste reduction after a few months.

61 www.theguardian.com

62 www.newsroom.inter.ikea.com

Policy Analysis and Recommendations

Information

One of main barriers to the uptake of energy efficiency schemes occurs when there is an asymmetry or a lack of information about what measures need to be taken and how they should be implemented.

A number of informational policies exist to overcome this such as ESOS (Energy Saving Opportunity Scheme) and mandatory carbon foot-printing. ESOS was established to implement article 8 of the EU energy efficiency directive, which states:

… "'energy audit' means a systematic procedure with the purpose of obtaining adequate knowledge of the energy consumption profile of a building or group of buildings, an industrial or commercial operation or installation or a private or public service, identifying and quantifying cost-effective energy saving opportunities, and reporting the findings."[63]

ESOS is a mandatory energy assessment scheme, administered by The Environment Agency[64] for organisations that are deemed 'large undertakings'. The qualification criteria depends on the number of employees and a company's turnover. A 'large undertaking' is any UK company that meets either one or both of the conditions below[65]:

- it employs 250 or more people
- it has an annual turnover in excess of 50 million euro (£38,937,777), and an annual balance sheet total in excess of 43 million euro (£33,486,489)

ESOS is also mandatory if any company is part of a corporate group which includes another UK company that meets either of these conditions. Where a group participates in ESOS, it is usually the highest UK parent that will act as a 'responsible undertaking' and be responsible for ensuring the group as a whole complies. Organisations that qualify for ESOS must carry out assessments every 4 years. These assessments are audits of the energy used by their buildings, industrial processes and transport to identify cost-effective energy saving measures.[66]

In order to comply, ESOS audits need to be completed by a 'Lead Assessor' as part of a ESOS compliant energy audit.

63 http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52013SC0447

64 Ref

65 www.gov.uk

66 www.gov.uk

Alternatively, ESOS can also be complied with by adhering to:

- ISO 50001
- Green Deal Assessments (GDAs)
- Display Energy Certificates (DECs)

In addition to ESOS reporting, mandatory carbon foot-printing exists for FTSE companies. The UK government has announced that under the Companies Act 2006 (Strategic and Directors' Reports) Regulations 2013, quoted companies are required to report their annual greenhouse gas (GHG) emissions in their directors' report. [67]

Combined, these measures help to ensure that the largest, most well-resourced companies look into opportunities to become more energy efficient. However, as mentioned earlier in the report, SMEs consume as much energy as large enterprises. Therefore, by only requiring large enterprise to use ESOS reporting, a significant proportion of the opportunities are overlooked. The number of companies required to undertake ESOS reporting should be increased in order to capture this missed opportunity. Extending this to the smallest companies may not be appropriate due to the increased administrative burden. But before extending the scope of ESOS it is important to understand how affective it has been

Quantifying the extent to which ESOS has been successful is very difficult. Information that is publicly available on government websites, such as the ESOS compliance register[68] only looks at the methods of ESOS compliance - ISO 50001, GDAs and DECs – rather than the CO_2 and GWh saved as a result of ESOS, which would be far more useful.

The small amount of data that does exist regarding the methods of compliance highlights some interesting statistics. For example, 0 per cent of energy consumption was covered by ISO50001 in 89 per cent of all companies, 0 per cent of energy consumption was covered by DECs in 83 per cent of all companies and 0 per cent of energy consumption was covered by GDAs in 82 per cent of all companies. The use of ISO 50001, GDAs or DECs by businesses in order to comply with ESOS is clearly not widespread, nor does it cover a large amount of energy consumption within businesses. Conversely, 90 per cent or more of energy consumption was covered by energy audits compliant with ESOS in 82 per cent of all companies.

Whilst it is interesting to see which methods of compliance companies use, the data doesn't provide much indication as to the effectiveness of ESOS and the subsequent implementation of its recommendations. Of more significance is that only 32 per cent of companies said senior management within the organisation discussed the ESOS results. This gets worse when this is looked at further up the decision chain with only 24 per cent of companies stating that the board of directors within the organisation discussed the results of the ESOS assessment. This supports the assertion by Walsh et al [69] who highlighted the inability to access key decision makers as a barrier to investment in energy efficient measures.

67 www.carbontrust.com

68 www.data.gov.uk

69 www.research.ncl.ac.uk

This may explain why uptake of ESOS is so small. Third party research has tried to dig a little deeper. Research conducted by Utilitywise [70], who undertook 275 audits - the equivalent of approximately 5 per cent of those firms that met the 31 January 2016 deadline, concluded that as little as 5 per cent are fully acting upon recommendations.

The failure to properly measure key metrics such as implementation rates and what proportion of recommendations have been acted upon seriously undermines the ability of policymakers to develop sensible and well targeted policies – after all, you can't manage what you don't measure.

It also undermines public confidence in the whole exercise of improving business energy efficiency. Increasing transparency across the entire energy efficiency supply/value chain, be it finance or certification schemes, is critical to build trust and accelerate uptake. This view is echoed by research conducted by the energyst [71] which shows that almost three quarters (72 per cent) of respondents said there was a lack of trust or understanding of third party finance for energy efficiency projects, while a similar level (69 per cent) said there was a lack of trust or understanding of using energy performance contracts (EPCs) for energy efficiency measures.

This certainly chimes with recent industry rhetoric, claiming that government is failing to enact areas of the legally binding EU Energy Performance of Buildings Directive[72] and has struggled to deliver minimum energy performance requirements in rented properties. A further question remains about whether the EU Energy Performance of Buildings Directive will be transposed into UK law after we leave the European Union. This has serious implications for the future of ESOS if the directive is discarded. Irrespective of the outcome, the UK must keep ESOS reporting in one form or another so that informational barriers to energy efficiency do not persist.

As it stands, public sector organisations do not usually comply with ESOS. If there is to be strong public sector leadership – as outlined earlier in this report – then **ESOS needs to be extended to cover public sector institutions where large and cost effective energy efficiency savings can be made.**

70 www.theenergyst.com

71 www.theenergyst.com

72 www.businessgreen.com

Recommendations

- After the UK leaves the European Union the objectives of the EU Energy Performance of Buildings Directive must continue in UK law. This can either be done by fully transposing it into UK law during the repeal process or establishing a new UK directive that continues to make ESOS reporting mandatory after Brexit.
- There is a clear need to increase the transparency of ESOS in order to understand how well it is working. Administers of the scheme should begin collating and publicising key ESOS metrics such as what proportion of recommendations are acted upon (implementation rates) and quantifying the financial, environmental and energy benefits derived from ESOS recommendations.
- Financial penalties already exist for companies that do not submit their reports on time. The scope of the sanctions should be increased so that mandatory reporting on ESOS progress is also covered.
- The use of ESOS should be expanded so that the definition of 'large undertakings' includes more companies and large public sector institutions where large and cost effective energy savings can be made.
- ESOS already requires board level sign off but this doesn't translate into board level action. This should go further and require board level action on energy efficiency recommendations by either rejecting or accepting them.

Project Economics

A number of factors affect project economics - energy prices, cost of capital, technology cost and performance and indeed government policies. Over the years, public policymakers have introduced an array of fiscal policies - both the application of subsidies and taxes - in order to stimulate and encourage energy efficient behaviour. Government intervention in the energy markets has sought to internalise environmental costs, driven by the overarching policy objectives of decarbonisation and the commitment to reducing economy wide emissions by 80 per cent by 2050, security of supply, energy efficiency and affordability.

The government has created a complex package of policy instruments to achieve these objectives such as the Climate Change Levy (CCL), Climate Change Agreements (CCAs), the Carbon Price Support (CPS), EU Emissions Trading Scheme (EU ETS) and Enhanced Capital Allowances (ECAs). Whilst they all intend to promote energy efficiency, some measures seek to promote certain technologies and others affect the uptake of energy efficiency measures.

The Climate Change Levy (CCL)

The CCL is a tax on electricity, gas, and solid fuels such as coal, lignite, coke and petroleum coke and is designed to encourage businesses to reduce their energy consumption or switch to energy from renewable sources. It has led to initial improvements in energy efficiency and following its inception the NAO[73] has suggested that it could save as much as 5.4 MtC (million tonnes carbon) annually. However, to what extent is the CCL still driving energy efficiency within businesses?

Research from the Centre for Economic Performance [74]concluded that if the CCL had been implemented without discount for businesses, even further cuts in energy use and carbon emissions could have been achieved without jeopardising economic performance or competitiveness.

The recent commitment to scrap the Carbon Reduction Commitment (CRC) [75] by 2018/19 - as suggested by Policy Exchange's 'Boosting Energy IQ' [76] - has meant that the CCL will be further increased from 2019 in order to compensate for the lost CRC revenue as well as further incentivising energy efficiency within CCL eligible business.[77] This increase in CCL rates should enable it to be more effective, as discounts for business limit cuts in energy use and research[78] shows that a strong CCL price incentive can lead to greater reductions in energy consumption. This shouldn't negatively impact businesses and research[79] and suggests that worries about adverse effects of the CCL on economic performance are unsubstantiated.

73 www.nao.org.uk

74 www.eprints.lse.ac.uk

75 A mandatory carbon emissions reporting and pricing scheme to cover large public and private sector organisations in the UK

76 policyexchange.org.uk

77 www.cibse.org

78 www.eprints.lse.ac.uk

79 www.eprints.lse.ac.uk

80 www.gov.uk

Table 6: Main Rates of CCL[80]

Commodity	Rate from 1st April 2016	Rate from 1st April 2017	Rate from 1st April 2018	Rate from 1st April 2019
Electricity	0.00559 p/kwh	0.00568 p/kWh	0.00583 p/kwh	0.00847 p/kwh
Gas	0.00195 p/kWh	0.00198 p/kWh	0.00203 p/kwh	0.00339 p/kwh
Petroleum gas or other gaseous hydrocarbon in liquid state	0.01251 p/kg	0.01272 p/kg	0.01304 p/kg	0.02175 p/kg
Any other taxable commodity	0.01526 p/kg	0.01551 p/kg	0.01591 p/kg	0.02653 p/kg

Climate Change Agreements (CCA)

It is possible to get a reduction on the main rates of CCL if you're an energy intensive business and have entered into a Climate Change Agreement (CCA)[81] with the Environment Agency. A CCA is a voluntary agreement between UK industry and the Environment Agency intended to reduce energy use and carbon dioxide emissions. In return, operators receive a discount on the Climate Change Levy (CCL)[82]. That said, the evidence is mixed with respect to the effectiveness of this policy instrument.

Research[83] has found that the CCL has been more effective than the CCAs in reducing emissions, and without any significant impact on output or jobs. CCAs were introduced and indeed justified on the grounds of competitiveness, but the research implies that the application of the CCL to all businesses could induce additional energy savings at little cost. Indeed, as figure 8 illustrates, CCL only contributes a very small proportion of industrial electricity prices. This suggests that the CCL as a policy is not directly responsible for higher electricity prices.

Table 7: Percentage Discount for Holders of A CCA[84]

Taxable commodity	Rate from 1 April 2016	Rate from 1 April 2017	Rate from 1 April 2018	Rate from 1 April 2019
Electricity	90%	90%	90%	93%
Natural gas	65%	65%	65%	78%
LPG	65%	65%	65%	78%
Any other taxable commodity	65%	65%	65%	78%

This builds on a body of literature including Martin et al (2011) that criticises CCAs. The authors concluded that the CCA caused plants to decrease their energy intensity by approximately 20 per cent less than plants subject to a CCL[85] and reduce their emissions between 8 and 22 per cent less than businesses subject to the CCL.[86] Moreover, Martin el al concluded that those businesses participating in the CCA had a statistically significant positive impact on growth in energy intensity, energy expenditure and electricity consumption.

Evidently, CCAs have been a weak driver of action on energy efficiency. With this in mind, this report recommends that **CCA discounts are made more stringent and tied to elements of sector deals that prioritise energy productivity.** Protection for the most energy

81 www.gov.uk/climate-change-agreements--2

82 Ibid

83 www.personal.lse.ac.uk

84 www.gov.uk

85 Martin, R., de Preux, L. B., & Wagner, U. J. (2011). The Impacts of the Climate Change Levy on Manufacturing: Evidence from Microdata. National Bureau of Economic Research Working Paper Series.

86 Ibid

intensive industries should remain but only where there is clear evidence that the absence of CCAs would drive industry abroad.

Carbon Price Floor (CPF)

The Carbon Price Support (CPS) was a UK government policy first announced in the 2011 autumn statement and later introduced in 2013. It aimed at increasing certainty for investors in low carbon technology by stating a minimum price on the greenhouse gases emitted by the power sector. The challenge as always is to reduce GHG emissions whilst being conscious of the impact policy interventions can have on energy prices and economic competitiveness. But why was it needed?

The EU Emissions Trading System (EU ETS)

To date the EU ETS alone has not provided enough of a market stimulus to have a material impact on investment of low carbon technology and indeed as the White Paper on Electricity Market Reform puts it "the carbon price resulting from this cap has not been stable, certain or high enough to encourage sufficient investment in low-carbon electricity generation in the UK"[87]. This has largely been as a result of too many allowances in the market, relative to demand, which has kept prices low.

The UK government recognised that depressed ETS permit prices were stifling carbon abatement behaviour so it introduced the CPS in 2013 in order to give some certainty to businesses when making new low carbon investments. The CPS set a minimum carbon price of £18 per tonne in the UK that large emitters would have to pay in addition to the current ETS price. The price floor was supposed to escalate to £30 per tonne in 2020 and £70 per tonne in 2030. However, the certainty that this was supposed to give to businesses was undermined when the planned escalations in the carbon price were cancelled, just a year after it was introduced. There is currently a cap of EU ETS + £18[88] per tonne, which is legislated to stay in place until 2020/21.

However, the implementation of the CPS has raised a number of concerns:

1) The CPS and the ETS only covers fuels used to generate electricity and not those used for industrial process or gas-fired heat.s . This is often cited as an undermining factor in its ability to fully decarbonise all aspects of the non-domestic UK economy. Despite this, it is widely agreed[89] [90]that the CPS has been a key reason for the decarbonisation of the power sector, in particular the decommissioning of coal fired power stations.

2) Higher costs under the ETS and CPS have the potential to competitively disadvantage some manufacturing sectors.

87 www.gov.uk

88 www.gov.uk

89 www.timera-energy.com

90 researchbriefings.files.parliament.uk

Enhanced Capital Allowances (ECAs)

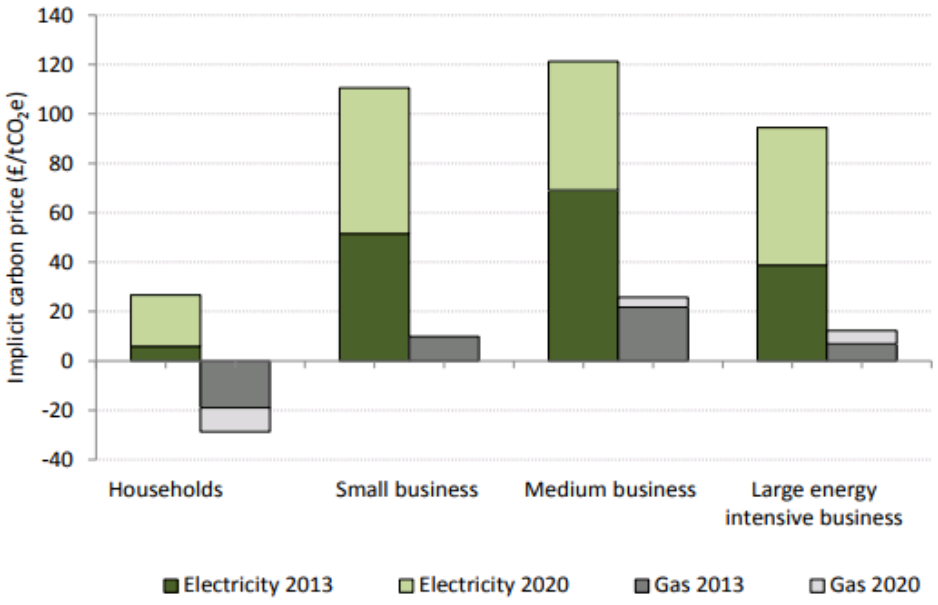
Whilst most fiscal policies take the form of taxes, ECAs allow profit or loss-making businesses to benefit from tax breaks when investing in eligible energy-saving equipment. They have an important role to play in facilitating this transition to increased energy efficiency within business and towards a subsidy free renewable energy market as well.

ECAs encourage businesses to invest in energy-saving plant or machinery specified on the Energy Technology List (ETL) [91] and the ECA scheme allows businesses to write off the whole cost of the equipment against taxable profits in the year of purchase. This can provide a cash flow boost and an incentive to invest in energy-saving equipment that normally carries a price premium when compared to less efficient alternatives. The ETL specifies the energy-saving technologies that are included in the ECA scheme.

Summary of Fiscal Policies

The UK has a complex layer of taxes and levies that aim to drive decarbonisation energy efficiency and ensure affordable and reliable fuel. They have been effective in targeting certain fuel types such as coal. However, they have also lead to substantial variation in carbon prices across different users and fuel type, as Figure 17 below illustrates.

Figure 17: Carbon Prices by end- user and fuel type, 2013 and 2020[92]



91 www.gov.uk

92 www.lse.ac.uk/

The inconsistency in prices had lead to low carbon prices for gas in comparison to electricity, businesses paying higher carbon prices compared to residential consumers and within businesses, less energy intensive firms paying higher prices in comparison to large energy intensive businesses. These variations in energy prices are desirable in certain contexts such as protecting energy-intensive industries. The overall effect of such inconsistent pricing is that the most cost effective pathways to carbon reduction become hard to identify.

Other factors affecting project economics

Factors that affect project economics should not only be solely examined through the lens of fiscal policies. There are also a number of informational factors that have a bearing on the economic viability of energy efficiency projects, which suggests that there is a limit to what can be done through fiscal measures alone. There is also a fundamental challenge in maintaining industrial competitiveness whilst increasing environmental taxes. This should be central to any thinking about increasing the fiscal burden to businesses.

As discussed, informational barriers and uncertainty around revenue streams and technology can increase costs. This is often reflected in the cost of sales for energy efficiency measures, particularly in the DSR and the Capacity Market. To overcome this, there needs to be readily available off the shelf tools for analysis of energy efficiency opportunities. These can benchmark opportunities within the wider market or against offers from aggregators to see if they are commercial. With continued complexity there is a risk markets aren't created. A spreadsheet tool could be used to input assumptions and calculate what kind of revenue could be expected from 1MW of Demand Side Response (DSR) or other products offered by National Grid. Comparison against offers from aggregators could then be benchmarked.

Recommendations

- **Further work needs to be done to understand the effectiveness of CCAs, particularly around offshoring of industry. Voluntary targets should be made more stringent and tied to sector deals with a focus on increasing energy productivity and sharing best practice.**
- **Long term certainty over the CPS should be provided beyond 2020.**
- **Government should publish central policy guidelines or tools that help quantify the scale of opportunity for businesses that can be used as a basis for comparison within the wider market.**

Access to capital

Barriers that affect the implementation of energy efficiency projects are intrinsically linked and this is certainty true of project economics and access to capital; without bankable revenue streams it is often difficult to raise project finance. According to the BEES report, access to capital and low capital availability is the most frequently perceived barrier to energy efficiency across most sectors - but is there really a shortage of finance for energy efficiency projects? Project sponsors identify a shortage of capital and banks identify a shortage of projects; so how can we bridge the gap?

First it is important to make the distinction between the various financing options that exist such as internal vs external capital and for SMEs, large enterprises and public and private organizations.

Internal v external

To date the focus has often been on projects with a payback period of less than 3 years but this can limit financing to on balance sheet, internal funding which then has to compete internally with other projects resulting in a capital shortfall. This is often compounded where CSR and sustainability goals are not embedded within a company's strategy.

As discussed earlier, the larger opportunity lies in linking projects that have longer than 3 year paybacks with third party finance. These tend to focus on projects with higher capital expenditure, longer time horizons and lower Internal Rates of Return (IRR). If structured in the right way, this has the added advantage of taking investments off balance sheet, which may be of interest to companies who wish to free up internal capital. However, with third party finance the risk allocation changes with a greater emphasis towards the lender and this may pose further difficulty in securing finance. External finance will necessarily incur significant transaction costs for structuring, legal work and due diligence. If finance is secured via an Energy Services Agreement, it will also require a high quality Investment Grade Audit. This is just one in a number of risks faced by third party capital.

Industry experts have identified the following risks:

- volume risk
- length of development cycle
- cost of investment grade audit/feasibility study
- poor credit quality

Policy interventions can be targeted to mitigate some but not all of these risks. Inherent risks such as poor covenant quality and volume risk should be borne by businesses but feasibility costs and investment grade audits – particularly if finance is provided through an Energy

Service Agreement (ESA) - present a barrier to securing finance. Policy has sought to address some of these barriers through the Investor Confidence Project (ICP)[93] which is a certification scheme based on best practice. It offers a series of protocols that define industry best practice for developing energy efficiency projects. It also goes further by developing a credentialing system that provides third party validation. When a project receives its credentials, it creates confidence for investors and enables lenders to achieve reduced due diligence costs. Many of these risks and challenges parallel those faced by the roll out of district heating networks - so what can we learn from the Heat Network Delivery Unit and the Investor Confidence Project?

As part of the government's decarbonisation strategy, a delivery unit to support local authorities exploring heat network opportunities was established in 2013. The Heat Networks Delivery Unit (HNDU) combines grant funding for development work with guidance from commercial and technical specialists. [94] According to government research,[95] the HNDU has had a number of successes. Overall, it has been critical in helping local authorities to progress their development of heat networks and since its inception in September 2013, it has awarded support to 200 projects across 131 local authorities.[96]

More specifically, it has been successful in increasing the number of feasibility studies local authorities have undertaken. To date, this has constituted the primary direct output of HNDU. Moreover, the evidence strongly suggests that when local authorities obtained funding it brought added value in the form of enhanced credibility, which was seen as being helpful in securing internal support. Many of the barriers that inhibit the development of heat networks mirror those faced when deploying energy efficiency measures such as access to capital and information and securing internal support. Therefore, could a similar approach be used to deliver energy efficiency projects?

The successes of the HNDU suggest that it could be adapted to deliver energy efficiency projects. We propose that the government **establishes a new unit that parallels Heat Networks Delivery Unit but for Energy Efficiency** which focuses specifically on the development stage of projects and broadens its scope to include the private sector.
Evidence from the HNDU approach showed that feasibility studies constituted the primary output. This evidence from HNDU suggests that the Energy Efficiency Delivery Unit (EEDU) should focus on financing development work such as feasibility studies. It could match – up to a maximum of 50 per cent – the cost of conducting feasibility studies or investment grade audits. This will help close the gap between projects and the development risk needed to take them forward. It will also compress the time it takes for projects to progress. The money would only be available if a set of pre conditions had been met. These include meeting the qualifying scale, demonstrating upfront availability of project finance and acknowledging that if successful the money would be repayable at financial close. This is defined as the point at which all financing agreements have be signed and the conditions contained in them have been met.

93 www.europe.eeperformance.org

94 Ref

95 www.gov.uk

96 www.gov.uk

Moreover, the Investor Confidence Project was successful in reducing the cost of due diligence or IGAs incurred by lenders. If the EEDU used its expertise to provide third party certification - based on best practice - it could enable lenders to achieve reduced due diligence costs on the 50 per cent they are liable for. Using the expertise of EEDU to reduce investor risk could boost the uptake of energy efficiency projects.

Box 4: Feasibility Study Policy Cost

The overall cost of this policy recommendation would be relatively small. Assuming a feasibility study Investment Grade Audit costs £100,000 and only half of this would be eligible for Energy Efficiency Delivery Unit support. Using the number of projects the Heat Network Delivery Unit has supported since 2013 as an example the costs are as follows:

200 Projects * £50,000 = £10,000,000 over 4 years. This is assuming no projects get to financial close; therefore, no money is paid back.

Even if this was scaled up by an order of 10, as it has been broadened out to the private sector, the total cost would be:

2000 projects * £50,000 = £100,000,000 over 4 years. Assuming 25 per cent of projects get financial close and the money is paid back, the total policy cost would only £75,000,000 over four years.

As alluded to earlier in the report, the different interpretations of accounting rules are one of the main reasons energy efficiency remains an area of significant under-investment. This poses significant challenges to both the public and private sector. Furthermore, upcoming accounting changes such as IFRS 16, which will bring operating leases on balance sheet from 2019, will have significant implications for those seeking off balance sheet finance. **Given that the remit of the EEDU is to provide guidance as well as finance, it should engage with industry stakeholders to:**

- **Provide third party certification to reduce due diligence costs incurred by lenders.**
- **Highlight opportunities for energy efficiency to be funded through Energy Service Agreements and Energy Service Company (ESCO) funding arrangements.**
- **Disseminate information on the complexities of current accounting rules and the implications of future changes driven by International Finance Reporting Standards (IFRS) 16.**

Public vs private

In addition to the financing options outlined above, a number of other options exist for the public sector and private sector to access capital. For example, Salix finance provides interest free loans to the public sector specifically for projects that improve energy efficiency, reduce carbon emissions and lower energy bills.[97] It was established in 2004 in order to make public sector energy efficiency projects economically viable by offering interest free loans as well as providing more flexible borrowing in comparison to other public sector loans.

Table 8: Impact of Salix Finance[98]

Number of projects committed	15,564
Value of projects committed	£ 563.5 million
Value of annual financial savings	£ 136.7 million
Value of annual carbon savings	694,414 tonnes of CO_{2e}

For the private sector, the Green Deal was introduced to help finance energy efficiency improvements in domestic properties, commercial properties and SMEs. It was structured so that up front investments were initially provided by the Green Deal provider, and later paid back by the firm. What distinguished the Green Deal from other products was that it allowed the loan to be paid back through energy bills[99]. It was hoped that it would overcome some of the informational and financial barriers that inhibited energy efficiency upgrades. Unfortunately, due to limited uptake by both domestic and non-domestic customers[100], the flagship policy was effectively disbanded in 2015 with government no longer providing finance. The loan book was sold to private companies and the Green Deal Finance Company formed as a private alternative to the original Green Deal. The Green Deal Finance Company has begun to offer loans again for energy efficiency improvements and this provides an alternative source of financing.

SMEs vs Large Enterprises

The Business Energy Efficiency Survey highlighted that financial barriers facing larger organisations and SMEs were largely similar. For example, most organisations highlighted low capital availability. The reasons behind low capital availability differ. For large organisations, competing with internal projects for finance may be a more significant challenge, whereas for SMEs it is more likely to be constrained by limited balance sheet resources.

There are a number of avenues organisations of either size can pursue in order to overcome capital constraints. For SMEs that don't usually have the financial resources to internally fund energy efficiency

97 www.salixfinance.co.uk

98 Ibid

99 DECC (2010) The Green Deal: A summary of the Government's proposals

100 www.gov.uk

projects ESCO or operating lease funding models are increasingly being offered. For larger companies seeking to take energy efficiency assets off balance sheet these funding models provide a route to market. If this isn't suitable, a number of alternative policies exist and tend to be more focussed towards SMEs. Examples include the rebooted Green Deal and the Carbon Trust's Green Business Fund, which provides support for energy efficiency measures within small and medium-sized companies in England, Wales and Scotland.[101] It offers capital contribution of up to 15 per cent of the project cost (up to a max of £5,000) to small and medium sized businesses. This can be put towards lighting upgrades, better building instrumentation and control or Heating Ventilation and Air Conditioning (HVAC) improvements. This still leaves a shortfall of 85 per cent of project costs; therefore, it may not be sufficient to overcome access to capital barriers.

Recognition should also be given to the role of devolved government programmes on energy efficiency. Scotland in particular has been proactive in establishing policies to develop energy efficiency within SMEs. For example, the Scottish government established the Scottish Energy Strategy[102] - a 15 to 20-year programme aimed at delivering energy efficiency projects. The strategy includes non-domestic SME Loans to support business investment in energy efficiency.

Resource Efficient Scotland[103] also falls under this umbrella strategy aiming to help organisations reduce costs by saving energy. It also provides free and impartial advice to businesses and public sector bodies who wish to improve the energy efficiency of their buildings or decarbonise their heat supply. The ability of government to give free and impartial advice is vital to promote opportunities for energy efficiency measures. This is why providing expertise will be a central tenet of the Energy Efficiency Delivery Unit.

Recommendations

- **Third party funders, businesses and government should place increasing emphasis on projects with a greater than 3-year payback. Forthcoming Business Energy Efficiency Surveys by government should look to quantify the scale of these opportunities in more detail in order to provide a starting point for funders and businesses.**
- **The government should establish an Energy Efficiency Delivery Unit (EEDU) that can bridge the gap between viable projects and available capital. The unit should mirror the Heat Network Delivery Unit and offer expertise, certification and finance for development work to both public and private institutions where the qualifying criteria are achieved.**

101 www.carbontrust.com

102 beta.gov.scot

103 www.resourceefficientscotland.com

Split Incentives

The report has focussed on two types of split incentive - Landlord vs. Tenant and Procurement vs. Energy Manager. Despite both being classed as split incentives, the policies that currently affect them and indeed the ones that need devising to correct these market failures differ somewhat.

Landlord vs. Tenant

In the UK, as much as 50 per cent[104] of all commercial properties and 60 per cent[105] of SMEs are rented from commercial landlords and can limit their ability or desire to implement energy efficiency measures. This market failure usually arises when one party is responsible for the investment costs while the other party takes advantage of the cost savings. Tenant split incentives represent a market failure and subsequent barrier to energy efficiency that needs fundamentally addressing. Given the prevalence and such frequent citing of split incentives as a major obstacle, and the inherent misalignment, one has to ask if this strengthens the case for government intervention and if so, where should it be directed: landlord or tenant?

The government has rightly directed policy at the former, building on research from Department for Energy Climate Change (DECC)[106] that suggests supporting landlords to improve the energy efficiency of their building stock may help to redress the misaligned incentives experienced by tenants. This has been reflected by recent changes in regulation, specifically directed at landlords and which states that from the 1st April 2018 there will be a requirement for any properties rented out in the private rented sector to have a minimum energy performance rating of E on an Energy Performance Certificate (EPC).[107] The regulations will come into force for new lets and renewals of tenancies with effect from 1st April 2018 and for all existing tenancies on 1st April 2020, making it unlawful to rent a property which breaches the requirement for a minimum E rating, unless there is an applicable exemption.[108]

This is a step in the right direction but could it go further? **Could the government be more ambitious and increase the minimum standard for private rented properties to D by 2023?**

Clearly, in order to overcome landlord tenant split incentives, policies directed at landlords present the optimal solution. In addition to the regulatory drivers outlined above, there is also an opportunity to use fiscal incentives to instigate change by linking – but not fully basing - business rates to EPC. Since there will be a legal requirement for the private rented sector to have a minimum energy performance rating, this will overcome some of the criticism of such an approach, which focussed on the limited number of EPC in commercial buildings. Allowing rates to decrease with increasing building efficiency will further incentivise landlords (and businesses where they own the property) to implement energy efficiency measures, an approach supported by the British Retail Consortium.[109]

104 publications.jrc.ec.europa.eu

105 www.theguardian.com

106 www.rcimag.co.uk

107 www.rla.org.uk

108 www.rics.org

109 www.acireports.co.uk

Procurement vs. Facilities Management

Split incentives can occur across numerous divisions within business where there are competing objectives. In the case of improving business energy efficiency, or the barriers to it, split incentives across procurement teams and facilities management may best exemplify this misalignment.

Different people are responsible for facilities management and procurement and it is not always clear which team is best equipped to deal with energy. The competing objectives can also be seen as a threat to people in organisation. To some extent this depends on what outcomes are trying to be achieved and this is often contingent upon an overarching company strategy. But in the absence of one or when energy is not a big part of overall spend, understanding where energy should sit in the corporate structure compounds this. It makes it even more difficult to have a holistic view because roles are so fragmented.

Having a holistic view is key so that best value can be defined properly, whether it is Capital Expenditure to save Operating Expense, Net Present Value or even non-financial strategic options. But how can this best be achieved?

Part of the solution is the ability to make a compelling businesses case for energy efficiency and central to this is convincing a Chief Financial Officer (CFO) to invest in an energy efficiency project. This will undoubtedly differ from business to business but it is about how you communicate. For example, one way to sell energy efficiency to low margin business (e.g. retail) is to put the savings in the context of impact they have on earnings – and the corresponding increase in sales that would be required to achieve same increase in earnings.

However, the misalignment between procurement teams and energy managers can make this difficult. In the case of energy managers, more often than not they will speak a different language to a CFO, one of Megawatt hours and tonnes of CO_2 abated rather Capital Expenditure, Internal Rates of Return and Net Present Value. This goes back to the point raised earlier about how to define value and harmonising wider business objectives across different departments. Converting the language of an energy manager into something a CFO will understand is key and in a cost-competitive market, no business can afford to lose out in operational efficiency against their market peers, but they will if opportunities are not communicated in the right way. Improving communication with CFOs can reduce the misalignment between energy managers and procurement teams as it will help to align organisational priorities.

Catherine Cooremans of the University of Geneva has researched the decision making processes that drive actions towards energy efficiency. Contrary to public perception, Cooremans concludes that profitability is not the main driver of capital investment decision-making[110], rather the strategic nature of investments carries a heavier decision weight. Strategic investments are those that help create, maintain or improve a sustainable competitive advantage and the more strategic an investment is, the more likely it is to be pursued.

110 link.springer.com

Part of the problem to date is that energy efficiency projects are typically non-strategic – focused mainly on cost-savings, rather than their ability to increase productivity and competitive advantage.

As such, reframing energy efficiency in the context of strategic investment and recognising the myriad of benefits that derive from it aren't limited to just increased revenue. It also includes increased customer and employee satisfaction, well-being and health, and increased productivity. Examples from Marks & Spencer and the World Green Building Council [111] underline how improvements in revenue and increased customer and employee satisfaction with the building environment are factors that are transcend simple cost saving.

Therefore, when energy efficiency opportunities are identified, they should be presented and communicated to CFOs in the context above, making explicit reference to how an energy efficiency project contributes to the strategic aims of the organisation and identifying and calculating co-benefits. Strategy is a language they understand, far more so than the technical language more often associated with energy managers. In order to achieve this, companies need to clearly set out their strategic organisational objectives and provide a framework that employees can use to illustrate how these are being met.

Recommendations

- **The government should be more ambitious and increase the minimum standard for private rented properties to D by 2023.**
- **Use fiscal incentives to instigate change by linking – but not fully basing – business rates to EPC.**
- **Businesses should harmonise the definitions of 'value' within their organisational strategy and give this greater visibility in order to eliminate competing objectives between different management teams.**
- **To gain greater traction with senior management, energy managers should reframe energy efficiency in the context of strategic investment, recognising the myriad of benefits that derive from it aren't limited to just increased revenue but also include increased customer and employee satisfaction, well-being and health, and increased productivity.**

111 www.2degreesnetwork.com

Policy Exchange

Improving energy efficiency is amongst the easiest and cheapest ways to decarbonise our energy system. It can also reduce energy demand and improve business productivity. Yet despite such a compelling case the untapped potential of energy efficiency remains. This report provides a picture of recent trends in business energy use and seeks to quantify the size of the opportunity for different sectors- from private sector retail and industrial to public sector emergency services. The report examines the different barriers facing small and large businesses in each sector and argues that public sector leadership on energy efficiency could save the taxpayer billions, while the private sector should focus on funding energy efficiency projects, particularly those that have longer payback periods. What will ultimately drive energy efficiency projects are the perceived strategic and productivity benefits rather than energy and carbon savings, and this is how it should be framed and communicated to ensure traction across all management levels of businesses.

ISBN: 978-1-910812-35-8

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