A new policy framework for business energy efficiency

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UCL Energy Institute

1 Introduction

On November 27th 2017 the UK Government published a new Industrial Strategy White Paper, setting out a framework for measures to "help businesses create better, higher-paying jobs with investment in the skills, industries and infrastructure of the future". To do this the strategy aims to increase the productivity of the UK through 5 "foundations": ideas, people, infrastructure, business environment and places.

The Industrial Strategy followed the publication of a Clean Growth Strategy on October 12th 2017 which has the objective of "growing [the UK's] national income while cutting greenhouse gas emissions". The Strategy contains the following commitment on business emissions:

The Government will develop a package of measures to support businesses to improve how productively they use energy and will consult on this in 2018, with the aim of improving energy efficiency by at least 20 per cent by 2030.

The Clean Growth Strategy marked a distinctive shift towards a policy model where energy efficiency delivers both carbon and productivity benefits for UK businesses and the economy as a whole. Although the political and market conditions are very different today, this mirrors the situation in the 1970s when industrial energy saving programmes were developed to help UK industry compete internationally in the aftermath of the 1973 oil crisis[1].

The Department for Business, Energy and Industrial Strategy (BEIS) asked UCL Energy Institute to develop a conceptual framework to underpin their work, drawing on the literature and international experience. The aim is not to make policy recommendations, but to outline how energy efficiency measures could be developed in the wider context of the emphasis placed on productivity and competitiveness in the Industrial Strategy.

This report covers business energy use, including energy use by all businesses as part of their buildings and process activities. Transport and the public sector are not explicitly covered.

2 Methodology

The objective of the work was to draw on international experience of energy efficiency measures to develop a set of basic policy design principles for the UK that reinforce the importance of energy productivity and competitiveness in the Industrial Strategy. A two-stage approach was used:

- A traditional bottom-up gap analysis where the most successful energy efficiency measures are identified and compared to the current UK policy mix. This "best practice" approach is well documented in the academic literature, drawing on policies and measures databases and in synoptic reports produced by international bodies such as the IEA.
- A more bespoke, top-down assessment of best practice in policy deployment, including, *inter* alia: how different policies interact, the influence of actors such as trade bodies and NGOs and the role of government, and how all this changes over time. This approach is important because it adds practicality and relevance to the analysis but is less well grounded in the literature.

[1] Mallaburn, P. & Eyre, N. (2014): Lessons from energy efficiency policies and programmes 1973-2013. Energy Efficiency 7, 23-41.

2.1 Best practice gap analysis

There are over 2000 measures listed in the main databases of which the best known is the EU's ODYSSEE-MURE database, the ACEEE's Energy Efficiency Scorecard and the Institute for Industrial Productivity policy databases. There are also several synoptic sources listing measures on a country-by-country basis such as the National Energy Efficiency Action Plans produced by EU Member States and IEA Country Reports.

Extracting exemplary measures from these sources involves a degree of subjectivity. Theoretical approaches compare measures to a theoretical ideal[2] or against a defined set of market circumstances[3]. More practical approaches build on the theory by assessing how well measures address the main barriers and drivers to energy efficiency[4], which can be summarised as follows:

- **Market** – misaligned incentives, fragmented supply chain and technology lock-out
- **Value** – marginality of energy cost savings and lack of senior management attention
- **Resources** – lack of finance, skills, technical information and benchmarking data

This "barrier-based" approach to energy efficiency policy is the basis for the design of measures during the early 2000s, many of which are still in use today[5].

In 2015 UCL conducted a review, funded by the Department for Energy and Climate Change, to identify lessons for the UK from international non-domestic energy efficiency policies[6]. From around 190 best practice measures, a shortlist of around 60 was identified as a good "fit" with UK market and regulatory conditions. This list, suitably updated, was used as the basis for this report.

The fact that energy efficiency can increase productivity has been known for some time, both in industry[7] and offices[8]. Indeed energy efficiency began a tool of industry policy[1]. The final stage in the selection process applied a productivity filter, based on the IEA's "multiple benefits analysis"[9] approach. This produced a final list of 70 measures (Section 3) against which the UK policy mix was compared in detail (Section 4).

2.2 Best practice in policy deployment

The above process should provide an indication of whether the UK has the right mix of policies and measures in place. However recent studies are showing that the interactions between policies are just as important as the policies themselves, for example:

- To connect barriers and drivers that operate in sequence, for example technical advice, finance and investment appraisal support**Error! Bookmark not defined.**.
- To exploit interactions or minimise conflicts between different measures[10].

[2] Warren, P. (2017): Transferability of demand-side policies between countries. Energy Policy 109, 757-766.
[3] Harmelink, M. et al (2008): Theory based policy evaluation of 20 energy efficiency instruments. Energy Efficiency 1, 131-148.
[4] Sorrell, S. (2011). Barriers to industrial energy efficiency: a literature review. UNIDO Working Paper 10.
[5] Mallaburn, P. (2018): Principles of successful non-residential energy efficiency policies. ECEEE Summer Study.
[6] Mallaburn, P. (2015): International non-domestic energy efficiency policies: lessons for the UK. UCL Energy Institute.
[7] Worrell, E. et al. (2003): Productivity benefits of industrial energy efficiency measures. Energy 28, 1081-1098.
[8] World Green Building Council (2014) Health, wellbeing and productivity in offices.
[9] IEA (2014): Capturing the multiple benefits of energy efficiency.
[10] Wiese, C. et al (2018): Interaction effects of energy efficiency policies: a review. Energy Efficiency, in press.

- To address non-energy efficiency drivers such as reputation and compliance risk that affect different companies in different ways[11].
- To account for behavioural and organisational variations such as management structure and decision-making processes [12].

Determining deployment best practice is still a new research field. But it is important to attempt because policies considered exemplary in one sector may have very little impact in another. This is key factor behind the failure of the domestic Green Deal[13] and also the Carbon Reduction Commitment[14], where reputation-based policies were seen as an administrative burden by companies where reputation was not a factor.

Measures were chosen from the list of 70 that had an evidence base that allowed the implementation to be analysed by policy systems[15] and *ex post*[16] analysis. This was used to produce a policy framework for the UK with three elements:

- A gap analysis comparing the UK to international best practice.
- The role of the government in policy implementation.
- An illustrative case study applying the framework to the office and retail sector

3 Best practice measures

The 70 best practice measures were sorted into one of the 5 productivity foundations based on which productivity outcome they delivered. Within each foundation the measures were grouped again according to the main energy efficiency barrier or driver they address, together with a brief description of what makes them exemplary. So, for example many cutting edge approaches deal with the energy performance applications of data and smart systems, so these were placed in the ideas foundation.

3.1 Ideas

ESCOs and energy performance contracting have considerable energy saving potential by using energy savings to pay for the up-front capital investment. However as a business model ESCOs have largely failed to take off.

Lack of timely and reliable energy performance data is a significant barrier. Semi-smart digital systems, sensors and devices are being used to make existing energy management systems more effective.

- Energy as a Service in buildings - Ørsted/Milton Abbey School in the UK
- Pay-for Performance ESCO models - New Jersey in the US

New digital technologies such as neural networks, AI and distributed ledgers are being used for a variety of applications including to streamline DSR and peer-to-peer energy trading and model the performance of new process technologies:

[11] DeCanio, S. (1998): The efficiency paradox: bureaucratic and organizational barriers to profitable energy saving investments. Energy Policy, 26, 441–454.
[12] DECC (2012): What are the factors influencing energy behaviours and decision-making in the non-domestic sector? A Rapid Evidence Assessment.
[13] Rosenow, J. & Eyre, N. (2016): A post mortem of the Green Deal: austerity, energy efficiency, and failure in British energy policy. Energy Research and Social Science 21, 141-144.
[14] DECC (2015b): CRC Energy Efficiency Scheme evaluation: final synthesis report.
[15] Rosenow, J. et al (2016): Energy efficiency and the policy mix. Building Research and Information 44, 562-574.
[16] Chai, K-H & Yeo, C. (2012): Overcoming energy efficiency barriers through systems approach – a conceptual framework. Energy Policy 46, 460-472.

- LO3 Energy in NYC, Electron in the UK and Grid Singularity in Austria
- Hammerson/Aston University Birmingham Bullring project
- "Digital Twin" optimisation systems e.g. IBM's Watson IoT

There is some evidence that distributed ledger technologies can save energy, but this is not usually their main objective. There is also concern that rebound might be significant in some cases. Blockchain can consume a lot of energy.

Many companies and governments are adopting "energy productivity" - doing more with less - as best practice rather than energy management *per se* because it connects energy efficiency to the company's core business. Industry bodies in several countries are consolidating this shift carrying out benchmarking programmes:

- ClimateWorks Australia's Energy Productivity benchmarking
- Association of Decentralised Energy (ADE) 2016 UK Energy Productivity Audit

In terms of policy best practice a small number of governments are developing energy productivity strategies to support industry and give an overall sense of direction:

- Australian National Energy Productivity Plan
- US Department of Energy's Energy Productivity Roadmaps

Lack of money to pay for energy efficiency is a significant barrier, especially in smaller businesses. Grants are the traditional policy response. However financial constraints are often less important than accounting and organisational barriers of which the most important is the inability to use the energy savings to offset the risk of the up-front capital.

A number of innovative fiscal measures are emerging, of which loans are the most common. These are considered best practice because they link the energy savings to the capital outlay, but they also connect the financial side of the organisation with the energy team, which can be a more important outcome because it embeds energy efficiency in the culture of the organisation.

- US Energy Efficiency Revolving Loans
- Microsoft's internal carbon trading programme
- India's EESL Energy Efficiency Revolving Fund
- Carbon Trust Green Business Fund and Scotland's SME loan fund

Technology acceleration is a concept developed by the Carbon Trust in late 2008. Accelerators are basically large pilots carried out in real companies to examine how government and business together can accelerate the deployment of low carbon technologies and practices to deliver significant carbon savings and market transformation. The first accelerator covered commercial buildings and was completed in 2009[17]. Two existing ones stand out:

- Design for Performance pilots in the UK (Verco, BBP, UBT)
- The Carbon Trust/BEIS Industrial Energy Efficiency Accelerator

3.2 People

[17] Carbon Trust (2009): Building the future, today. Transforming the economic and carbon performance of the buildings we work in.

There are three main sets of initiatives focusing on the company's workforce. The first is based on the assumption that an energy efficiency building is more productive because it produces a better, healthier working environment:

- Harvard study of green buildings and cognitive function and ForHealth programme
- Buildings 2030 research on productivity and health impacts
- The International Well Building Institute's Well Building Standard

Links between energy efficiency and health in households are well established[9]. In the early 2000s, researchers began to look for a relationship between energy efficiency and workforce productivity. The Harvard research shows an impact of indoor air pollution and LED lighting on cognitive ability. However there are very few studies that demonstrate a causal relationship, possibly because the benefits are so intangible and subjective.

However there is good evidence, for example from the wellbeing initiatives, that efficient offices are perceived to be better places to work, which raises staff morale and company reputation and enhances staff recruitment and retention. This could have a significant impact on productivity given that staff costs dominate office-based companies.

A second set of workplace initiatives engage staff directly in implementing company-wide behavioural change and staff feedback programmes:

- Carbon Trust Empower programme in the UK
- US DoE Better Buildings Workforce initiative
- Various US State and utility Gainshare programmes

Staff engagement initiatives can have a significant impact because they help embed behavioural measures (which are notoriously short-lived) and break down organisational barriers between different parts of the workforce. They were very popular around 5 years ago (especially the "Gainshare" programmes), but their popularity has waned, and the reason for this is unclear.

The third set of workforce initiatives focus on organisational barriers such as the disconnect that occurs between energy and facilities managers and senior directors. Energy managers are trained as engineers and tend to lack the skills to make the business case for energy efficiency when investment decisions are being made.

There are a number of countries that, in partnership with their professional and trade bodies, have expanded their energy management training and accreditation programmes to include business development and investment appraisal skills:

- US DoE Industrial Assessment Centres
- Energy Efficiency Council Australia
- NRCan programmes in Canada

3.3 Infrastructure

The early energy efficiency programmes in US States were based on the concept of "least cost planning"[1] where energy efficiency funding was counted as infrastructure spending when it was cheaper than building new generation capacity. This approach has several advantages:

- It allows the full societal costs and benefits of energy efficiency investment to be appraised in the same way as other social projects such as schools and roads.

- It allows energy efficiency to compete with supply-side investments on an equal footing both in wholesale energy markets but also in the capacity and auction markets.
- It could trigger a change in the State Aids rules to allow 100% aid intensity to apply to public/private investment – energy efficiency currently has the lowest at 30%.

The "Public Benefit Charge" model of US State energy markets work on this model, where the revenue from a small levy on energy bills is used to fund energy efficiency programmes. The concept is also now part of the EU's Energy Union 2030 strategy:

- Energy Efficiency Resource Standards in US States
- Future Energy Jobs Act in Illinois
- The EU "Energy Efficiency First" initiative

3.4 Business Environment

The common theme of measures that manipulate the business environment is they focus on energy productivity by linking energy efficiency to the company's strategic priorities where energy costs are marginal and/or hidden by organisational barriers. There are two main sets of measures.

The first are "market pull" measures that focus on changing the behaviour of energy-using companies.

Advanced reporting and disclosure schemes that both require companies to measure and disclose their energy performance and exploit the organisational drivers that result:

- Energy audit programmes for industrial SMEs in Germany
- Building control standards in Singapore
- Commercial Building Disclosure legislation in Australia

Non-carbon or "multiple benefits" approaches that link improved energy performance to strategic drivers such as reputation and investor confidence:

- Building performance standards such as NABERS in Australia and Energy Star in the US
- Sustainability standards such as BREEAM in the UK and LEED in the US
- Investor Confidence Project "Investor Ready Energy Efficiency" initiative

Reward-based incentives such as carbon pricing, tax reliefs or conditional grants that are offered in exchange for improved energy performance:

- Energy efficiency auctions (e.g. German "STEP up" programme)
- KfW incentive programmes in Germany
- Non-domestic Energy Efficiency Obligation Scheme in Denmark

The second set of measures focus on "technology push", i.e. working with the energy efficiency supply chain by making it easier for companies to procure new or established clean technologies to displace incumbent machinery and plant:

Performance standards and benchmarking initiatives remove poorly performing technologies and accelerate the deployment of efficient technologies:

- "Top Runner" technology benchmarking programmes in Japan and Germany

- The UK Enhanced Capital Allowance/Energy Technology List schemes
- Minimum Energy Efficiency Standards for rented properties in the UK

Development of rules and standards improve the operation of the market by removing technical and deployment barriers to new and emerging technologies, systems and approaches:

- ADE Code of Conduct for DSR aggregators
- BSRIA Soft Landings initiative in the UK
- RICS "Red Book" practice standards and CIBSE technical guides in the UK

3.5 Places

Place-based measures exploit the connections that exist between companies either as competitors for local trade and contracts, or members of local business groups, members of a supply chain or simply as peers.

Industry-led business-to-business networks use energy performance benchmarking to exploit reputational and competitive drivers:

- Real Estate Environmental Benchmarks in the UK
- German Energy Efficiency Networks (also in Canada, Austria, Switzerland, Sweden, Japan and China)
- Carbon Trust SME and public sector network programmes

City-wide decarbonisation projects exploit economies of scale and peer pressure to drive energy productivity improvements, often backed up with public procurement initiatives and minimum performance standards to accelerate the deployment of new technologies:

- New York State Energy Research and Development Authority (NYSERDA)
- Government of Singapore's energy efficiency programme
- London Mayor's low carbon buildings programme
- Carbon Trust Low Carbon Cities programme

Public sector technology procurement and leadership initiatives that set minimum standards to remove poorly-performing incumbent technologies and practices:

- Australian National Green Leasing Policy
- Swedish Technology Procurement Groups
- London RE:FIT framework

Several cities are exploiting the opportunities presented by district/decentralised heat and energy systems to enhance grid resilience and efficiency:

- UN District Energy in Cities Initiative
- EESL's district heating, cooling and trigeneration project

4 Benchmarking the UK policy mix

This section compares the current policy mix in the UK with the best practice examples listed in the previous section by using a "traffic light" or "RAG" marking system:

- Red means that the UK has no equivalent, or UK policy is significantly below best practice.
- Amber means that UK policy is considered to be good practice rather than best practice.
- Green means that the UK policy is at or significantly in advance of international best practice.

4.1 Ideas

Developing new digital technologies - green

The UK is probably significantly ahead of best practice in the development of wholly new digital technologies and approaches. Ofgem's "sandbox" work with digital start-ups puts the UK in a strong position to develop and exploit distributed ledger systems.

Several commercial companies are trying out b2b energy trading as a way of making money by using the balancing capacity of their building portfolios. However it is far from clear that streamlining trading and balancing will actually save energy.

A number of research groups are active in this area (such as the EPSRC Smart Meter Research Portal consortium) on which the government should keep a watching brief. If new digital technologies are going to have a significant impact on energy productivity this should become clear in the next 2-3 years.

Applying new technologies and business models to existing problems - red

Lack of, or asymmetric energy performance data is one of the main reasons why the ESCO market has not taken off for commercial buildings. Best practice, for example in Australia, arises when tenant and landlord energy use can be clearly delineated, and the subsequent savings apportioned by the energy services arrangement.

However this is model far more difficult to operate in the UK market. A particular problem is "shell and core" developments where the landlord paying the energy bill, but the tenant controls the HVAC system: the classic "landlord/tenant split". Another is where the landlord controls the energy services, but the tenant controls the energy meter.

Energy productivity business models – green/amber

From the few country reviews that are available the UK economy is performing well compared to the EU average on demand-side energy productivity[18]. Many UK companies are ahead of best practice in developing energy productivity as a business model. But the UK is not on track to deliver a 20% improvement by 2030, and supply-side energy productivity is poor[19].

The best countries are beginning to implement energy productivity strategies that set an overall energy productivity framework. Australia has a formal Energy Productivity Plan agreed at Federal level and the US has a number of sectoral energy productivity strategies.

Innovative fiscal measures - red

[18] Eurostat Energy Productivity dataset (2017).

[19] The 2017 UK Energy Productivity Audit, Association for Decentralised Energy.

The UK was a pioneer of private sector energy efficiency with the Carbon Trust SME loan programme 2004 and Salix Finance for the public sector in 2006. At the time the SME loan programme was considered to be highly cost effective[20] primarily because the cost to government was restricted to the cost of capital and a small default risk. Salix is still supported by BEIS but the Carbon Trust's publicly-funded loan programme was ended in 2012 when government funding was withdrawn. The Scottish government continues to support a small loan programme.

4.2 People

Staff productivity – insufficient evidence.

The UK's sustainability benchmark BREEAM includes productivity and welfare in its calculations. A BREEAM Outstanding rating is considered to demonstrate best practice in linking sustainability and staff welfare, such as the European headquarters of Bloomberg in London and the 4, St Pancras Square office development.

However actual evidence of a causal link between welfare and productivity is thin. The most cited reference on the subject is the World Green Building Council's 2014 report, which cites few reliable primary studies. The few impact studies that are available are too diffuse to be helpful. As a result it is not yet possible to define best practice, although this is expected to change as more peer-reviewed studies are published.

Engaging the workforce – amber.

These initiatives have considerable potential as behavioural change drivers but policies supporting them are uncommon in the EU and in the UK restricted to the Carbon Trust's relatively small Empower programme. However the leading companies, such as Nationwide and Coca Cola, often make use of staff engagement as part of wider sustainability programmes.

Professional development and capacity building – red.

The UK is significantly behind best practice in energy manager training and accreditation. The leading UK professional bodies are the Energy Institute and the Energy Managers Association. However none of their courses cover wider business development and investment appraisal, including the prestigious Chartered Energy Manager qualification offered by the EI. The same applies to the skills needed to be an ESOS lead assessor.

4.3 Infrastructure

Energy efficiency as an infrastructure priority – red.

The UK does not treat business energy efficiency as an infrastructure priority using the Least Cost Planning/Standards of Performance approach. The 1986 Gas Act and the 1989 Electricity Act make provision for this and this is the basis for the ECO scheme for domestic energy users where programmes are funded by a levy on energy bills.

At the time the government intended to cover business, with a new public agency, the Energy Saving Trust, funded by a similar levy on business consumption. However this was never realised because the gas regulator decided that the levy was a tax and therefore outside of her jurisdiction[1].

[20] National Audit Office (2007): The Carbon Trust: accelerating the move to a low carbon economy.

4.4 Business Environment

Market pull measures – red

The UK used to be a pioneer of market-pull energy efficiency measures. The original intention of the CCL was to use a small proportion of hypothecated CCL revenue (£50m pa) to fund a package of measures to support CCL-paying companies, primarily through Carbon Trust programmes and the ECA scheme. However public funding was withdrawn from the Carbon Trust's two most significant programmes in 2012 – business loans and the Carbon Management Programme of audits for large companies.

The UK requires audits under Article 8 of the Energy Efficiency Directive, and the UK's ESOS scheme is in line with most other Member States[21]. However best practice has moved on considerably from when the EED was agreed. The most advanced countries use "multiple benefit" measures to leverage the impact of reporting, as seen in the audit programmes of Germany and Sweden.

The CRC energy efficiency scheme was specifically designed to do this by leveraging finance drivers (through the tax and trading element) and reputation (through disclosure and league tables). However, given industry's concerns over its complexity and bureaucracy, these elements were progressively removed, and the scheme is now being abolished with the revenue-raising element being absorbed into the CCL.

UK commercial buildings are up to four times less efficient than best practice in Australia and the US[22]. The main reason for this is that the EU and UK regulatory regimes use predicted, rather than actual performance, with the result that the market focuses on supply-side compliance rather than demand-side productivity. Difficulties with defining and measuring "base building" performance in the UK make the problems worse.

These regulatory problems are also exacerbated by the fact that the UK construction industry is relatively conservative and slow to innovate[23]. The building services procurement and supply chain is also fragmented and with a number of weak points where energy performance is often overlooked, such as commissioning and handover.

The UK retains a lead in a few niche areas. The BEIS/Carbon Trust Industrial Energy Efficiency Accelerator is one of the most innovative programmes aimed at large organisations. The Better Buildings Partnership Design for Performance pilots are developing ways of implementing best practice performance labels in the UK commercial buildings market.

Performance standards – amber.

Most technology standards in the UK derive from the significant body of EU legislation, both product policy/labelling and Best Available Technology standards for large combustion plants.

The UK's MEES legislation is considered to be best practice because it sets minimum standards for rented properties whereas other countries focus their standards on

[21] Concerted Action (2016): Energy Efficiency Directive National Implementation Reports (NIR).

[22] Cohen, R. & Bordass, B. (2015): Mandating transparency about building energy performance in use. Building Research and Information 43, 534-552.

[23] Low Carbon Innovation Coordination Group (2016): Technology Innovation Needs Assessment (TINA) – non-domestic buildings summary report.

maintenance or refurbishment[24]. However its impact in use depends on how it is implemented by landlords, and particularly how the cost of energy efficiency measures is passed on to tenants. A particular concern is that the impact could be significantly lower if the landlord applies the riles at a portfolio rather than an individual property level[25].

Performance benchmarking – red

The UK used to lead on performance benchmarking with the Energy Efficiency Best Practice Programme, a comprehensive library of technology and energy management guidance developed in partnership with industry. The programme was transferred to the Carbon Trust in 2001 and ended in 2012.

Much of the guidance in the old EEBPP is available from other sources, such as sector guides, and the Carbon Trust still publishes high level opportunity assessments. But independent, authoritative advice on implementation and benchmarking is not freely available to UK businesses.

Deployment standards – amber.

The UK has a strong engineering culture and a rich history of energy efficiency technology deployment, and this is reflected in the support and guidance provided by the leading sectoral and professional bodies such as RICS, CIBSE, ADE and BSRIA. The development by the ADE of new standards for digital innovations is promising.

4.5 Places

Business to business networks – amber/red.

The Carbon Trust's business networks and support programmes are difficult to quantify because detailed financial information is not published, but they appear to be worth in the region of £10-12m and support 100-200 companies, including programmes funded by the Devolved Administrations.

However the networks operating in Germany are at least an order of magnitude larger. The pilot programme, funded by the government, comprised 270 companies. The programme is now primarily funded by industry and there are 176 networks in operation comprising 1600 companies. Detailed funding information is not available, but an impact assessment has just been completed[26].

City-scale initiatives – amber.

Many UK cities have innovative energy efficiency initiatives. However these are relatively small scale and programme based. The UK does not have anything approaching the city-wide programmes seen in the US and exemplified by New York State. These initiatives are funded by local energy taxation and involve a range of approaches including regulations, financial support, infrastructure and research and development.

[24] The Coalition for Energy Savings (2015): Putting energy efficiency first - addressing the barriers to energy efficiency. Analysis of the National Energy Efficiency Action Plans in the context of Article 19 of EU Energy Efficiency Directive.

[25] Bright, S., Patrick, J., & Janda, K. (2017): "Energy management, minimum energy efficiency standards, and the diversity of 'green lease' clauses". Chapter 4 in the *Handbook of Sustainable Real Estate*. Wilkinson, S., Miller, N. Dixon, T. J. & Sayce., S. (eds) 2017.

[26] IREES Working Paper 2/2018 (2018): Evaluation of Regional Learning Energy Efficiency Networks.

Replicating the NYSERDA model in the UK could involve a similar local hypothecated tax regime to the US Public Benefit Charge or significant public funding. But low carbon programmes operating in UK cities could be used to pilot new initiatives that would benefit from city features such as economies of scale and local networks.

Public sector procurement and leadership – amber.

Sustainable procurement and greening government initiatives at national and local level are technology-based and not as proactive as those found in Sweden and Australia, where government actively works with selected markets to deploy low carbon technologies and, in certain markets, uses procurement as a soft regulation to discourage poorly performing technologies.

For commercial buildings government procurement could make a significant difference because it occupies a large proportion of the office stock and tends to take longer than average leases, making it a high value client. The market would have to take notice if it only procured the best performing offices, for example by requiring A or B rated offices.

5 A UK policy framework

5.1 Point of departure

The UK was one of the first countries to implement energy efficiency policies after the 1973 oil crisis and has a rich history of developing innovative measures. The period 2000-2006 saw a proliferation of policies[1] in a deliberate attempt by the government to experiment with new approaches[27], show an international lead and to prepare UK businesses for global carbon targets under the UNFCCC. The 2002 UK Emissions Trading Scheme was designed on this basis, as was the Carbon Reduction Commitment[28].

The current government has been criticised for unwinding many of these measures[29], and the benchmarking analysis in Section 4 shows that to an extent this criticism is justified. But the policy landscape had been allowed to evolve with no attempt to learn the lessons of the policies developed in the early 2000s. Policies were underperforming, and the policy landscape had undoubtedly become overly complex. The UK was not alone in finding itself in this situation[30].

Nonetheless the range of UK measures in place to manipulate the "business environment" is no longer best practice, with some significant gaps and uncertainties[31]: particularly on reporting and disclosure, reputational drivers and capital finance for all company types and sizes.

The UK's policy legacy has, however, left a significant institutional capacity, much of which is still in place in business, trade bodies and NGOs. This legacy also explains, in part, why the UK has wide variety of business-led measures in place across all five productivity foundations, but particularly in "ideas" and "places".

- The UK probably leads the world in the application of distributed ledger and AI technologies for peer-to-peer energy trading.

[27] Henry Derwent CB (2015): Personal Communication.
[28] Carbon Trust (2005): The UK Climate Change Programme: potential evolution for business and the public sector.
[29] Committee on Climate Change (2018): Reducing UK emissions – 2018 Progress Report to Parliament.
[30] IEA (2016): Market-based instruments for energy efficiency – policy choice and design.
[31] Committee on Climate Change (2016). Next Steps for UK heat policy.

- At the company level the UK also has considerable potential in the application of new digital approaches to building energy management and process optimisation.
- The UK invented the technology "accelerator" and two have significant promise: energy performance in buildings (BBP/BSRIA) and industry (Carbon Trust/BEIS).
- UK professional bodies are developing innovative ways of smoothing and accelerating the deployment of low carbon technologies and practices.
- UK companies are pioneering energy productivity business models and the UK has a number of strong city-scale low carbon programmes.
- Workforce-based initiatives are not as common as they used to be but those that are running in the UK are best practice.
- New ESCO and energy-as-a-service business models are being developed in the UK, but often by overseas companies and utilities.

The UK policy landscape may not be best practice in many respects but there is plenty in place on which any new package of measures could build. The UK's key strengths are:

- The technical and regulatory infrastructure behind building regulations and the implementation of EPCs and DECs
- An extensive network of trained energy auditors developed under the ESOS scheme, building on previous programmes such as the Carbon Trust's Carbon Management programme.
- The Minimum Energy Efficiency Standards for commercial buildings.
- The ECA scheme which, though the Technology List effectively sets "best practice" standards for machinery and plant.
- The CCL and the CCAs, although the detailed impact of the CCL on energy efficiency is unclear - the CCAs are under review.

5.2 Best practice in policy implementation

Many of the measures considered here are cited as showing best practice in policy implementation:

- Energy efficiency networks in Germany and several other countries
- Auction, loan and fiscal incentive schemes in Germany
- Commercial building performance standards in Australia, Singapore and the US
- Industrial energy efficiency accelerators in the US and the UK
- Energy efficiency resource standards in US states
- Energy efficiency obligations in Denmark
- Technology minimum standards ("Top Runner") in Japan

Several – notably the NABERS programme in Australia – have been actively promoted overseas with some success: NABERS branded programme was implemented in New Zealand in 2013 and the methodology is recognised by wider sustainability benchmarks such as the Global Real Estate Sustainability Benchmark. The UK Better Building Partnership is running a pilot programme to see how a key element of NABERS – the Commitment Agreement – could be adopted in the UK.

Many studies have looked at the key success factors of these schemes, but the findings tend to be specific to the host country, making it difficult to draw reliable conclusions for other jurisdictions. A few meta-reviews have been done, notably the IEA's 2017 Market-

Based Instruments report[32]. But these tend to be too general to be useful for policy design purposes.

However it is possible to extract the following best practice features that are common to all successful programmes:

- **In-use performance metrics and norms** are the foundation of all successful demand-side measures. It is important for many reasons, but the main one is that it allows those making the purchase or investment to choose an energy efficiency option. This in turn allows the market, with suitable incentives, to do the "heavy lifting" of displacing the incumbent technology. This is the principle behind the successful "energy productivity" programmes.

  Properly configured performance-based measures can also be used to correct supply-side barriers such as the fragmentation or skills shortages seen in commercial building markets. The Australian experience shows that designers, architects, technology providers and commissioning agents are all motivated to ensure that the design of the buildings translates into real-world performance.

  Performance-based policies are also stimulating innovative digital approaches such as digital twinning for more accurate and precise facilities management and process optimisation. The shift to a performance culture in Australia has stimulated the creation of a number of start-up companies specialising in real-time monitoring and buildings energy management.

  Performance-based metrics also enable behavioural feedback and framing mechanisms to be exploited. Benchmarking is a particularly powerful psychological tool in low-margin, risk-averse competitive markets because it presents energy efficiency as an avoidable loss, which has a more tangible impact than a theoretical gain, which is the normal way of framing energy efficiency.

  Peer pressure is another strong feedback mechanism exploited by energy efficiency networks. Even when not in competition companies, like individuals, don't like to miss out on a benefit that their peers are enjoying. Peer pressure can also have a powerful reinforcement effect by demonstrating that an energy efficient option can be implemented without risk.

  The performance mechanism used should reflect whatever makes energy efficiency strategically important or "salient" to market actors making the investment: companies, customers, clients, tenants, governments or investors. Markets driven by reputation and risk can be driven by public disclosure whereas for other companies internal reporting is sufficient to trigger change by exposing performance to senior managers.

  Transparency on energy performance is also important for effective management of the measures, allowing governments to minimise undesirable effects such as rebound and maximise additionality and cost-effectiveness. Tracking performance also makes feedback measurement possible to government can track market penetration and adjust the measure accordingly.

- **Technology standards.** In the buildings market performance standards are often presented as a better solution than building regulations. But the two measures need to work together, with performance measures creating demand and aligning the market,

[32] IEA (2017): Energy Efficiency 2017.

and technology standards progressively removing the poorest performing buildings (fabric and HVAC) so that the market as a whole moves in the right direction.

Standards are particularly important for industrial companies. Some technologies are covered by EU legislation, but the bespoke nature of large process plant makes universal standards difficult except for components such as motors and drives. Technology accelerator measures show that performance benchmarking and optimisation by the manufacturer might be a more effective mechanism.

Technology best practice information is another powerful measure for smaller manufacturing companies who don't have the skills in-house to know about the various energy efficiency options and how to overcome technical barriers or how to procure the right option in the first place.

- **Deployment standards** are rules and norms that make the market operate more freely. They are generally provided by business-led market actors such as professional associations and trade bodies and include technical standards that form part of regulatory measures and guidance and norms that market actors use to gauge value and risk. The building performance labels described above are a specialised form of deployment norm.

  The problem with market-led standards is that they tend to respond sluggishly to changing markets, or even be deliberately reflective of markets rather than leading them, with property valuation in the UK being a good example[33]. This can help manage professional risk, but fast-moving markets such as digital and smart technologies may need government to step in with new standards to transform the market.

- **Public procurement** can play a significant transformative role where the government is a significant market player in its own right. This is particularly relevant in the commercial office market where central and local government occupies a significant proportion of the stock and are seen by developers as a tenant of choice given that they rarely default and tend to take longer leases.

  Procurement needs to be deployed with care: there is no point requiring something that the market is not ready to provide. The Australian experience is valuable here: the New South Wales government had to wait until the supply of low carbon buildings was strong enough before introducing minimum performance standards for government offices.

  The Australian experience shows that procurement can also be used to prepare the market for minimum standards regulations. The Commercial Buildings Disclosure regulations were implemented with very little opposition by the industry because, over a period of 10 years the NABERS scheme combined with government procurement had transformed the culture of the market.

- **Policy combinations.** Recent research is beginning to explore how different policies working together can have a greater impact than if operated singly. Research on the implementation of Article 7 of the EU Energy Efficiency Directive[15] reveal several basic principles of how these interactions occur:

  - Energy and CO2 taxes tend to increase the effectiveness of all other measures.
  - Information and benchmarking measures also help to reinforce other measures by operating on behavioural and organisational drivers.

[33] The Royal Institution of Chartered Surveyors (2017): The Red Book - RICS Valuation – Global Standards 2017.

- Purchase subsidies such as tax reliefs, grants and obligations lower the cost-effectiveness of access-to-capital schemes such as loans.
- Combinations of regulation, voluntary agreements and fiscal measures can have unpredictable impacts and need to be applied carefully.

Practical experience is reinforcing the importance of these interactions, and particularly how measures should be "sequenced" to sensitise the market and allow subsequent measures to work more effectively[10]. The provision of information is an important primer for many measures, for example investment appraisal advice to help companies use capital finance more effectively[12] and commissioning advice and feedback to support commercial building tenants[23].

- **Access to capital** is seen as a significant barrier to investment. But there are also many cases where it is not lack of capital that is the barrier, but how existing capital is deployed. For example, in larger organisations, raising the salience of energy efficiency results in resources being redeployed from other projects[12] of from other parts of the company group.

  For some companies (and especially the public sector) internal accounting rules prevent an investment case being made to use the operational energy savings to offset the up-front capital outlay over time. This "capex" barrier can be overcome with simple investment appraisal advice.

  However lack of capital is a serious barrier, especially in smaller companies. However public subsidy through grants and loans should be a backstop rather than as a vehicle of choice. The experience of the German energy efficiency networks shows that retail banking can step in to provide investment capital as long as the government primes the market properly[34].

5.3 The role of government

The single most important conclusion from this analysis is that running a successful package of measures is complicated. Different sectors and sub-sectors have different salience drivers and will therefore react best to different sets of measures. However the UK's experience with the CRC scheme suggests that the alternative "one size fits all" approach is inadequate except for the most universal measures like taxation and energy pricing.

This presents policymakers with a dilemma. The evidence is clear that the most effective packages of measures are tailored to meet the needs of specific sectors and companies. Also current constraints on public funding mean that market-led measures are very much the preferred option. But to be truly effective (and cost-effective) market-led measures need to be carefully managed. Governments cannot leave everything to the market.

This presents a number of problems. Programme management is expensive in administration cost terms. Market transformation programmes also need to operate in a consistent manner for long periods of time, which is difficult for civil servants who move jobs every 2 years or so[35]. The usual response is to use a specialist agency, but this approach has its own risks, particularly around loss of control and accountability. However the UK is unusual in having no publicly funded and accountable energy agency in place.

[34] Durand, A. et al (2018): Energy efficiency networks: lessons learned from Germany. ECEEE Summer Study.

[35] Public Administration and Constitutional Affairs Select Committee (2018): 5th Report - The Minister and the official: the fulcrum of Whitehall effectiveness. House of Commons HC 854.

In this context, there are a number of programme management issues that the government might want to consider:

- **The balance of risk** between government and business is often seen as fixed: measures are market-led or government-led. But in reality, the balance changes over time as the market transforms and the performance profile changes across the sector. The government needs to redeploy measures so that the market continues to the "heavy lifting" but to help overcome barriers as they emerge.

- **Direction setting** is an overworked phrase, but it remains crucial because it gives markets the clear signal that the government will act to transform the market, but enough time to allow capacity to be built and stranded assets to me minimised. Also simply setting targets is not enough – government must state that they will act to support or lead the market where necessary.

- **Government leadership** through procurement can have a strong impact in the commercial building sector because it is seen by developers as a favoured tenant, occupying a large proportion of the stock and tending to take longer leases. The evidence from Australia is clear: the market began to accelerate only after the NSW government introduced a minimum procurement standard.

- **Timing** is closely linked to direction setting. Measures designed simply to displace (as opposed to accelerate the removal of) incumbent technologies need to be in place over a similar time period to the sector's normal capital stock replacement cycle to make a significant impact.

- **Market actors and enablers** such as trade bodies, professional institutes and universities can all add considerable value by developing rules and guidelines, carrying out research, and helping their members build confidence, capacity and skills. The role of government is to make sure that everyone adds value at the right time.

  To do this governments need to use the measures available to them to play to the strengths of the market actors. A key element of the Australian NABERS is to reward good performance rather than penalising poor performance. This helps build a positive relationship with the sector before considering measures to remove the worst performers.

- **Focus** is important when packages of measures have multiple objectives. Energy efficiency and productivity normally go hand in hand. However they can conflict, for example if companies replace capital equipment too early or without considering the impact on other parts of the business. This is a particular risk for smaller companies with no access to technical support.

Several governments have tried to balance the role of government and the need to minimise spending and let business make the running. The German agency DENA is probably the most appropriate model given the UK's current priorities[6].

DENA is independent but sponsored by the German Federal government and the state bank, KfW. DENA's role to ensure that businesses and the energy efficiency industry have the capacity to use funding and support properly. DENA's activities fall into four categories:

- Researching and developing information tools that the market cannot provide, such as benchmarking and best practice standards.

- Support for professionals and traders using evidence reviews, developing new techniques and researching new markets and professional practices.
- Increasing transparency and impact of energy standards and certification (e.g. kite marks, energy labels, performance standards).
- Developing and promoting model projects to demonstrate quality standards, implement best practice, and develop regional knowhow.

DENA plays a crucial role as a conduit of information, expertise, and practical knowhow. However, unlike most energy agencies, DENA does not directly provide advice, deliver or fund projects. Instead DENA sets standards, provides information to businesses, supports the government and passes on market expertise and intelligence to local traders and professionals.

5.5 Case study: commercial offices and retail

It would be helpful to give a sense of how the policy framework described in this section might be applied in the UK given our specific market circumstances and existing policy landscape. This final section therefore attempts to do this for the commercial office and retail sector because this is where most evidence and practical experience can be found.

Opportunities

The potential benefits to the UK from a more efficiency commercial building stock fall into three categories:

- **Carbon and energy savings:** cost effective measures could cut the sector's carbon emissions by 45% for new and 15% for existing buildings by 2020. This translates into a 16% decrease in energy intensity per unit area and a £4.5bn net benefit to the UK by 2020[17].
- **Energy productivity benefits:** there is growing evidence that improved energy productivity improves business productivity more widely by improving the working environment. Other benefits of a more efficient building stock include reducing the cost and capacity of the energy supply infrastructure.
- **Wider economic benefits: t**he sector is particularly well-suited for smart building energy management systems to address the information barriers faced energy managers. The Australian experience shows that there is significant potential for new digital businesses and business models to fill this gap.

Barriers

There is a "Circle of Inertia" operating in the UK market: investors & occupiers have no visibility on the performance of the assets they are seeking to own/occupy and cannot therefore drive the market. Developers are unable to provide tenants with accurate data to be used to justify investment or quantify the benefits of improved performance. The sector is also notoriously risk-averse. In detail:

- On the demand-side there is a **lack of information and agency** to allow energy users to adopt low carbon options. The key gaps are a lack of meaningful in-use energy performance data, unclear non-cost benefits, lack of independent information on technology options and a lack of business development skills in energy managers.
- The supply-side is **complex and poorly co-ordinated** with a diverse stock and multiple players leading to a confusing "building journey". Regulations encourage a compliance culture at the expense of performance. There is also a lack of client management skills in developers, perverse incentives from fee structures, compliance (not performance) based modelling, poor commissioning, lack of post-occupancy feedback and lack of accountability for outcomes.

The UK also has a complex regulatory infrastructure in place: a “clean sheet” approach is not a practical option. Any new policy approach needs to take account of, and where possible, build upon the existing system of DECs and EPCs and building control and planning regulations. The separation of responsibilities between BEIS and MHCLG is another significant factor.

Best practice principles

Successful commercial building policies focus on accelerating demand using a balance of “market pull” measures backed up by intelligent “technology push” measures to smooth out supply-side barriers. Measures include:

- Leadership by government, through direction-setting and by stretching minimum performance standards for buildings occupied by the public sector and their own estate.
- A system of in-use performance ratings and metering that clearly distinguishes between landlord’s “base building” energy use and the energy used by tenants and establishes clear accountability.
- Sufficient resources and expertise to ensure that the ratings methodology is robust, effectively marketed and easy to understand by all market players.
- Benchmarking and demonstration activities to spread best practice between market leaders and to promote the benefits of improved performance to the rest of market. Emerging advanced data analytics offer large potential to provide these services at low cost, and to support development of new service industries
- When the market is ready, appropriate regulations to enforce minimum performance reporting and disclosure with the aim of removing the worst performing buildings.
- A flexible system of market evaluation and feedback that allows policy to adjust as techniques improve and adapt or be withdrawn as the market begins to transform.

The role of government

Building a long-term relationship with the sector is essential. A clear 10 to 15-year strategic plan is needed that sets emission and productivity targets, defines expectations and roles for all key players and identifies resource and capacity requirements.

This can, and should, be industry led, but there a clear and substantive program and system development and operational roles for government to accelerate development of equipment and services, ensure that the evaluation and review mechanisms are fit for purpose and that adequate resources are provided to correct market failures.