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GREENING THE BUILT ENVIRONMENT

A review of British energy efficiency policy to reduce energy consumption and CO_2 emissions in the services sector

TNO student report

Greening the Built Environment: A review of UK energy efficiency policy to reduce energy consumption and CO_2 emissions in the services sector

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Summary

Energy efficiency policy has been on the agenda for a long time, along with the knowledge that there is a large potential for energy savings and many other multiple benefits to be gained from improving overall building efficiency. However, despite the opportunity there has been little progress in this area. In part this is because energy efficiency is complex cutting across many themes, relating to technical, financial and societal aspects. In this study the policy that influences energy consumption and carbon emissions of buildings in the services sector is evaluated. Whilst the residential sector has long received the majority of attention in the UK, the growing services sector and energy consumption in buildings such as offices, retail space and healthcare present a large opportunity for energy savings. There are however many barriers to overcome before energy savings can be realised. Split-incentives are examples of a major barrier to energy efficiency progress, one commonly discussed in the rented building sector is the ‘Landlord-Tenant dilemma’, which plays a large role in office sub-sector buildings. The UK has in recent years introduced a number of new policy measures in an attempt to overcome these barriers and enable greater energy efficiency progress. An analysis of the UK experience can provide insight for other countries. The Netherlands is facing a challenge to diversify its energy system and is looking to create new policies in order to reach energy efficiency goals for the future. Decisions for future policy making can benefit from learning about the successes and failures in UK energy efficiency policy.

Contents

1 Introduction

The UK has a comprehensive policy mix in place to improve energy efficiency in buildings in the services sector, which has been driven forward by ambitious climate targets. The characteristics of policy in the services sector shares many similarities with the residential sector, in that many mechanisms are market-based with a strong focus on creating competition and encouraging growth in the energy efficiency market through private-public partnerships. This prominence of market-based instruments has been typical throughout the history of the UK's energy market, dating back to the 1980s when the UK was amongst one the first countries to privatise energy markets. The underlying aim behind current policy is to create a framework to build markets and to encourage innovation and investment in energy efficiency projects, which will in turn drive down energy consumption in buildings.

Energy consumption of buildings in the residential and services sectors has increased to account for up to 40% of total final energy consumption in many developed countries (Perez-Lombard, Ortiz & Pout, 2008). With one of the oldest building stocks in the EU, the UK recognises that there is a need to retrofit buildings and improve energy usage on a large scale, placing energy efficiency as a main tool to achieve this (NEEAP, 2014). The link between building efficiency and human health and well-being in the UK was one of the first priorities for policies targeting energy efficiency and this continues to shape policy today, particularly when there is a resulting impact on energy prices. The services sector has received less attention, but with continuing growth and the priority of climate change on the political agenda this is changing (Scrase, 2000). More recent efforts have been made to reduce energy consumption in buildings in the services sector to internalise the negative effects of carbon emissions from intensive energy users, using taxes and carbon pricing in policies such as Climate Change Agreements (CCA), the interacting Climate Change Levy (CCL), and the Carbon Reduction Commitment (CRC).

It is beneficial for the Netherlands to learn if attempts have been successful, and if not why not, as these solutions and failures can help to inform the tasks of: retrofitting the existing Dutch building stock, the transition away from gas, and meeting energy saving and CO_2 targets set by the EU, in a way which best benefits the whole of society and the future environment.

1.1 Scope and design of the study

It is useful to know that this individual report which focuses on policy in the services sector, follows on from a similar study on the residential sector in the UK, which can be found in chapter 7 of Sipma et al. (2019). The previous study was commissioned by PBL, to carry out an international comparison of policies targeting energy efficiency in the residential sector, in four countries: the Netherlands, the UK, Germany and Denmark (hereby referred to as the 'study countries' in this report). This particular study is part of independent research carried out at TNO to produce a broader overview of policy and sectors within services sector buildings in the built environment, Paliouras (2019) covers a review of policy in the services sector of Denmark and Germany. Policy will overlap in some instances to cover more than one sector (e.g. residential and services, or services and industry), however the main

focus of this report will be reducing energy consumption and CO_2 emissions in services sector. Buildings in the industry sector present an area in which to carry out further study and to cover the energy consumption of all buildings.

This report analyses energy efficiency policy that aims to reduce energy intensity and CO_2 intensity in the UK's services sector. The main focus is placed on policies influencing existing buildings as many of these were built long ago when buildings were constructed less efficiently, and a majority are due to remain within the future stock (IEA, 2006). The qualitative review of the UK's services sector policies aimed at buildings, is related to important themes in the Netherlands energy transition. A quantitative comparison is also included as it is useful for a view on national energy trends and places the UK's performance in amongst the other study countries.

1.2 Objectives of the study and limitations

The UK makes an interesting case study for an analysis of the successes and failures in policy due to its wealth of experience with various measures, some of which in the past have been hailed as pioneering new approaches. The path which has been followed on the drive for innovation and investment in the UK can give insights that could inspire future decision making in the Netherlands and other countries. Alike the UK, the Netherlands relies heavily on a natural gas supply for energy consumption in buildings, and both countries are facing similar challenges to diversify their current energy systems away from this and reach common climate goals. When undertaking a study such as this it should be noted that national policies have been designed to work within specific cultural and societal contexts, so it is difficult to say whether the effectiveness of a policy in the UK when applied abroad would be the same.

The quality of national monitoring and evaluations of policy outcomes is another important component to consider when conducting a comparison study of countries. There is no standard procedure for national policy evaluations across EU member states and each country uses different methods for monitoring policy outcomes. It is uncertain to which extent 'free-riders' are present and this varies depending on the country in question. The UK conducts research related to these factors and includes these factors within its policy evaluations, whereas other countries do not (Rosenow & Galvin, 2013). This fact makes it difficult to compare the evaluated success of different countries as some national evaluations do not account for reducing effects. To a certain extent, differences in evaluation methods limit the level of quantitative comparisons on the effect of policies in this study. Furthermore, it is not always certain whether a particular policy instrument has led to reduced energy consumption, or if other non-policy factors have been responsible such as energy price changes, population growth and increasing building sizes.

1.3 Reading guide and methods

This study can be split into three parts: in **section 2** a quantitative overview and comparison of the UK's energy intensity and CO_2 intensity in the services sector building stock , **section 3** a qualitative analysis of national energy efficiency policy, and finally **sections 4 and 5** with recommendations in the context of the Dutch energy transition. The study makes use of the 'Odyssee-Mure' database on energy

efficiency. The quantitative part of this study uses data provided in Odyssee to calculate energy intensity and fuel consumption, whilst the qualitative section uses the Mure database. In Appendix A there is a brief overview of policy in the Netherlands.

Section 3 contains the qualitative analysis for an evaluation of policy effectiveness in the UK. Meta-studies were collected which relate to energy efficiency and the study countries. An understanding of the policy mix in the UK and its development over time was carried out using Mure. All policies influencing energy efficiency in the UK were identified in the MURE database. Literature relating to the UK and each policy measure is then collected, this consists of both qualitative research and semi-quantitative research, for example relating to policy outcomes and evaluations. A review of this literature into the barriers for energy efficiency, and the successes and failures of policy in the UK are complemented by case studies to give the qualitative results for the second part of the study.

In the final **sections 4 and 5**, the results of literature review and the quantitative results are discussed. This section also contextualises the findings in relation to key issues discussed in the Dutch negotiations for the draft climate agreement, particularly those in chapter 1 of the draft, which relate to the built environment (Klimaatakkoord, 2018). The ultimate aim is to gain insights to help in future decision making, which are outlined in section 5.

2 National overview of factors influencing energy and CO_2 intensity

This section will compare the UK's situation and energy trends in the services sector in comparison to the Netherlands and the other study countries. An overview of energy consumption and fuel share is given, followed by carbon emissions over the past 20 years. The services sector has a high diversity of energy consumption and fuel use as it has many sub-sectors with different services functions, which makes comparisons between countries more challenging than in the domestic sector. The characteristics of the Netherlands and UK's services sector share many similarities in terms of energy consumption and therefore make a good comparison case.

2.1 Energy consumption and CO_2 emissions in the services sector

Energy consumption and intensity in the services sector shows a high level of diversity, because there are many different sectors and sub-sectors in which buildings have different operating hours and floor spaces. There are also differences in the shares of fuels that are consumed in each sub-sector and different levels of emissions, because certain services sub-sectors such as offices consume more electricity (BEIS, 2016). Figure 1 and Figure 2 show that the services sector of the UK and the Netherlands is comparable in terms of sub-sector composition and type of fuel used. There are some small differences such as the higher proportion of office space in the Netherlands, higher education and research area in the UK, and a slightly higher heat and renewable energy share in the UK.

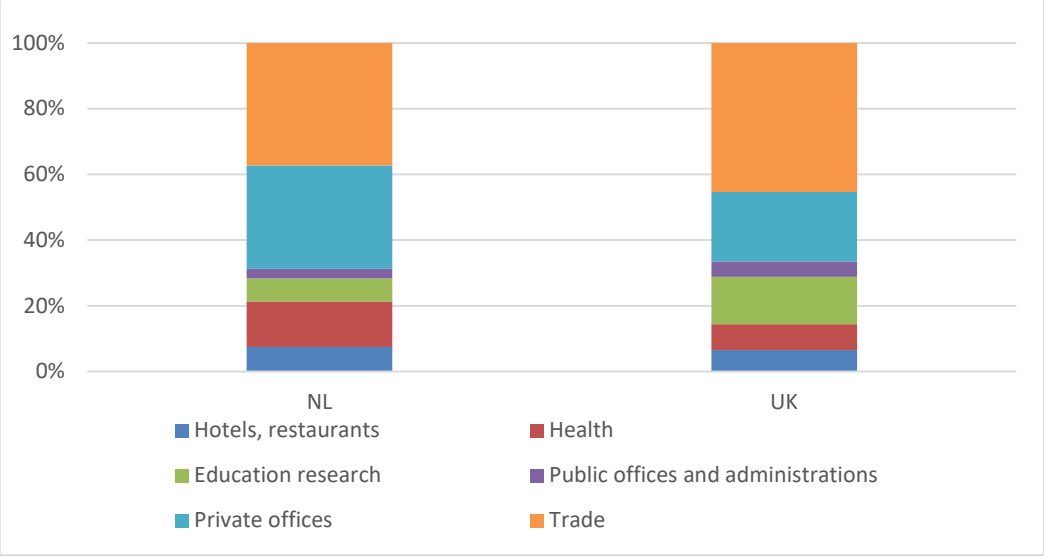

Figure 1. Floor area share by services sub-sector in NL and UK in 2015 (Odyssee, 2019)

In both countries gas and electricity are the dominant fuels used in the services sector. In the Netherlands the aim is to reduce the amount of natural gas consumed in buildings and to reduce the CO_2 intensity of buildings. The UK is also reducing its

reliance on natural gas through a strategy to expand district heat networks and introduce alternative fuel sources.

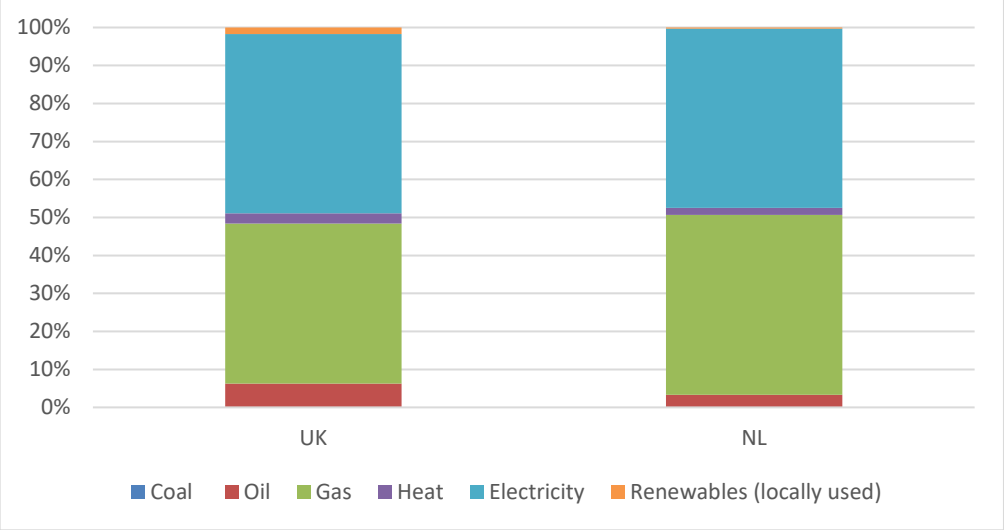

Figure 2. Share of total final consumption in services by fuel type in the UK and Netherlands in 2016 (Electricity and heat include renewables) (Odyssee, 2019)

Energy consumption for space heating in the services sector contributes a smaller amount to national final energy, than in the residential sector. There are also fewer studies focused on the services sector. Figure 3 shows that the main fuel used for space heating in services (left) is gas, which accounts for around 73% of the total energy consumed in 2016. Oil and electricity are the second highest fuel types for space heating, representing 11% and 10% respectively. The percentage of electricity used for space heating in the services sector is higher than that of the residential sector (see figure 3). A study by BEIS (2016) showed that in 2014-2015, Heat consumption for the services sector is 5%, much higher than the 0.2% consumed within the residential sector.

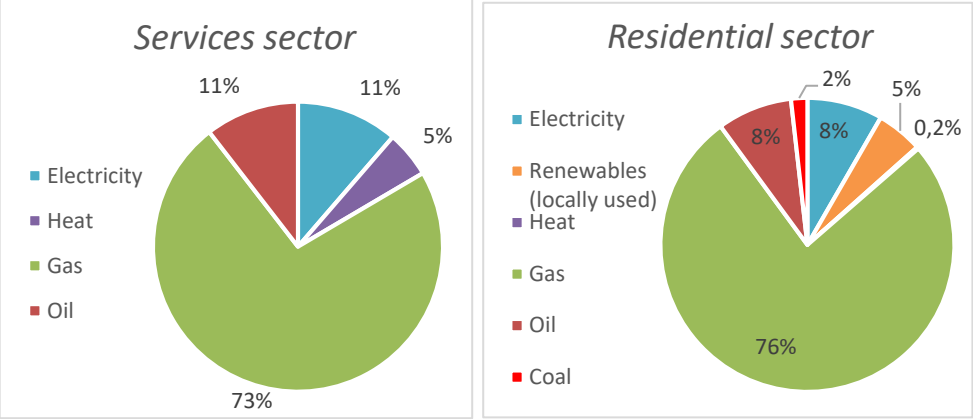

Figure 3. Share of consumption for space heating in the UK in 2016 by fuel type in the services sector (left) and residential sector (right). (Odyssee, 2019).

In the UK's services sector, electricity is responsible for 46% of CO_2 emissions (Figure 4). Gas is responsible for 42% of total energy consumption (Figure 2) and 45% of all carbon emissions (Figure 4). Heat consumption which has a larger share than in the residential sector, makes a small contribution to CO_2 emissions of the services sector. A similar fuel mix exists in the Netherlands which produces a similar share of CO_2 emissions, the only difference being the larger share of heat consumption in the UK.

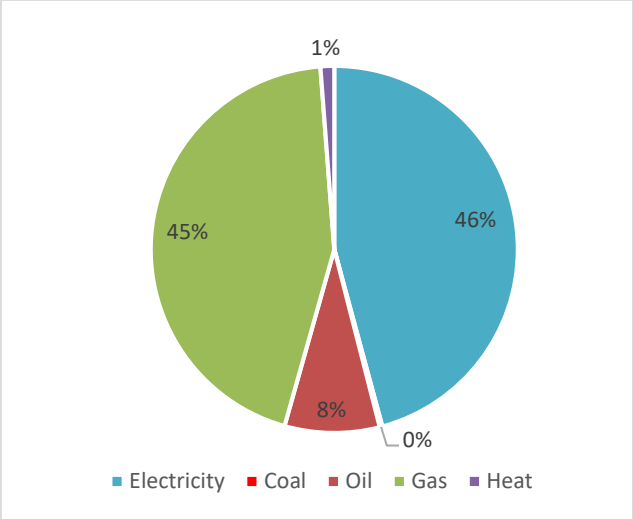

Figure 4. Share of CO_2 emissions (2016) in the UK's services sector (Odyssee, 2019).

2.2 Energy intensity in the UK

Energy intensity can be used as a proxy for energy efficiency, as reduced energy intensity can be a result of improved energy efficiency (EERE, 2019). To link energy efficiency to changes in energy intensity an appropriate metric for intensity must be used. To measure building energy intensity, commonly the measurement is energy consumption per area (m/2). In the service sector the amount of energy consumption per employee may also provide an appropriate level for interpretation. Other factors can influence energy intensity other than energy efficiency; these are structural and behavioural changes such as energy prices, new building area and weather.

The value added to the UK services sector has doubled since 1990, however despite higher outputs the energy intensity has decreased significantly. Figure 5 shows that in the ten-year period from 1997-2007 the UK has halved its energy intensity to become level with that of Denmark. Up until 2000 the Netherlands and the UK shared similar energy intensity levels, however after this time a gap emerges as the UK continues to decrease in intensity and the Netherlands slows down. In 2001, the UK implemented the CCL which has since been the main policy instrument to address emissions and improve energy efficiency, this is discussed further in section 2.3. In Figure 5 at the year 2015, the UK has one of the lowest intensities compared to economic output amongst the study countries.

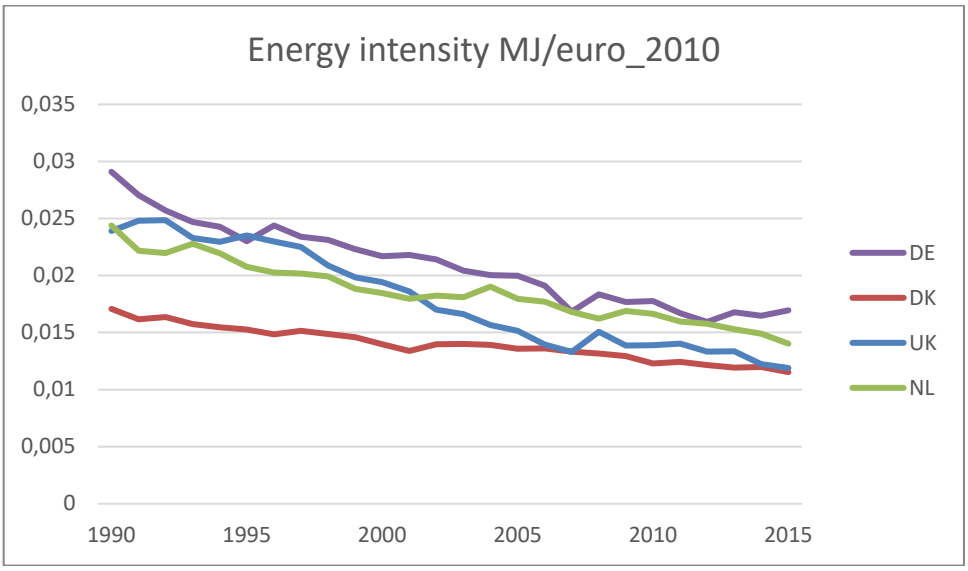

Figure 5. Energy intensity in the four study countries 1990-2015 (incl. electricity). (Odyssee, 2019).

Energy intensities can also be expressed by m^2 of surface area or by employee. This removes the impact of high value goods and shows more the impact of the building quality and the occupation rate (that relates at the same time to vacancy). The gas intensity is more dominated by the building quality and less by the occupancy rate, since it is mainly used for space heating. The electricity intensity vice versa, since besides a 'building related' share for lighting, cooling, ventilation, elevators and space heating in case of an electric heat pump, a large share of it relates relatively more to 'people-usage', such as computers and other IT usages.

Figure 6 shows that the UK's energy intensity measured per employee in the services sector is also the lowest amongst the study countries. Both intensity by economic output and employee indicate the UK is performing well and has reduced its energy intensity by a larger percentage than the other countries.

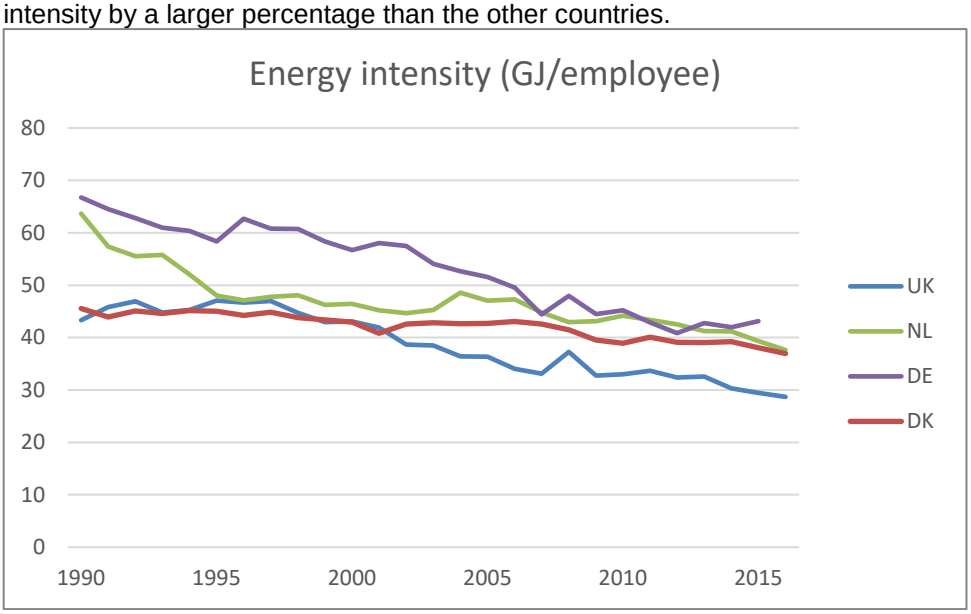

Figure 6. Energy intensity by employee (incl. electricity). (Odyssee, 2019).

However, in the UK, data on floor area in the services sector is less available so the study is presently defined to a broader comparison on energy intensity in the sector. The above intensity graphs still represent the trends of each country and that a reduction in energy intensity in the services sector is likely linked to improved energy efficiency (DECC, 2012).

The CO_2 intensity of the service sector as shown in Figure 7 shows in the UK there has been a decrease since 1990. Considering the similar share of fuels between the Netherlands and the UK, it is not surprising that they share similar CO_2 intensities. The CO_2 intensity in 2015 of the UK is close to 3ton of CO_2 per employee at the lowest point over the time period.

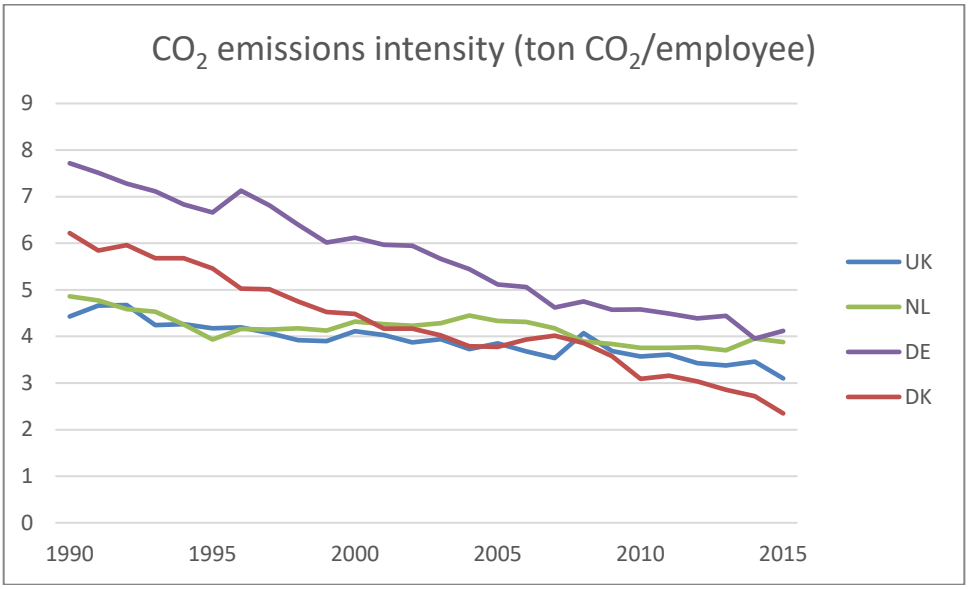

Figure 7. CO_2 intensity by employee (Odyssee, 2019).

2.3 Building stock quality and EPC labels

The building stock in the UK's residential sector is one of the oldest in Europe and in the services sector under one third is built after 1980 (Figure 8). The floor space of the residential sector is around 250% greater than that of the non-domestic sector in the UK (Kohler, Steadman & Hassler, 2009). Collecting detailed data on the total floor space of the services sector is more difficult, this is because in the UK often studies report on the area of the non-domestic stock, which also includes the industrial sector. Data availability for the service sector may be restricted, particularly for buildings in the private sector. Furthermore, in the UK there are different national bodies responsible for recording floor area in Scotland, England and Wales and Northern Ireland.

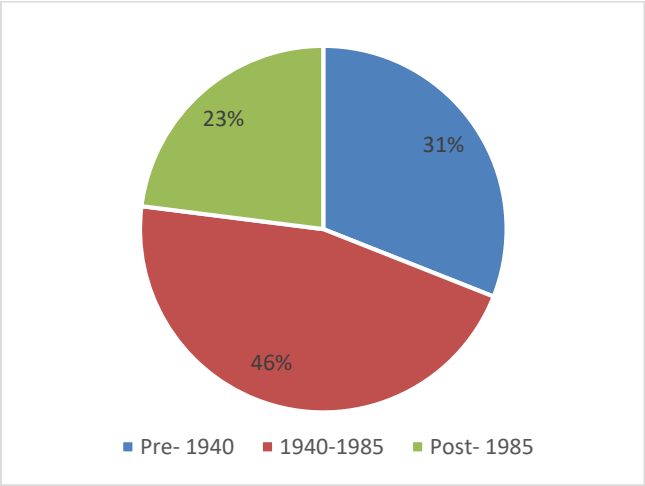

Figure 8. Age of non-domestic stock UK (CIOB, 2011)

Non-domestic properties make up only 4% of the Energy Performance Certificate (EPC) register and within this just over 15% of these properties are in the lowest bands F and G (DECC, 2014a). Figure 9 below shows the share of EPC and Display Energy Certificates (DEC) in the UK, the majority of EPCs and DECs are in band D followed by C and E. As of 2015, a DEC is mandatory for larger properties (over 250m^2) which belong to a public authority or those frequently visited by the public. The DEC must be placed in a position where it is easily viewable by the public to raise awareness on energy use and inform on the usage of public building energy performance (DCLG, 2015).

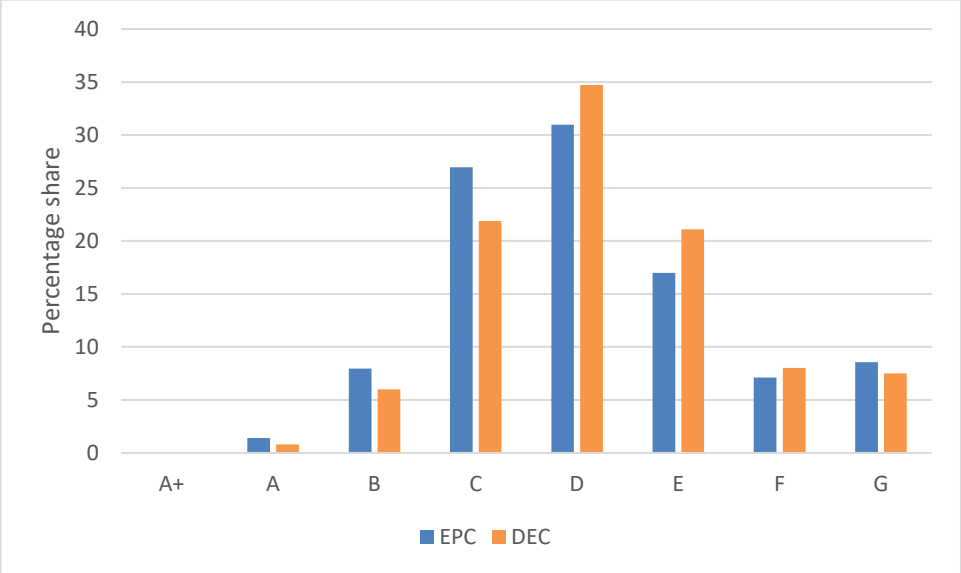

Figure 9. EPC and DEC shares in non-domestic properties in the UK

3 Current policies in the UK: National and EU-related

This section describes the policy mix within the UK and discusses the impact of individual policies. The policies in Table 2 are derived from the Mure database, which classifies policy into different types. Table 1 shows the different types of instruments and associated policy examples. The method for classification is unclear, but generally they seem to be appropriate. In some cases, classification is not detailed, for example the Energy Savings Opportunity Scheme (ESOS) requires mandatory auditing, so according to Table 1 should be a legislative/informative measure. Table 2 shows ongoing policy measures which target the energy consumption of buildings in the service sector. It includes EU-related and national policies, their impact and starting year.

Table 1. Types of policy measures according to Mure (link)

Level c1	**Level c2/c3 (examples)**
Legislative/Normative	Mandatory Standards for Buildings
	Regulation for Heating Systems
	Other Regulation in the Field of Buildings
	Mandatory Standards for Appliances
Legislative/Informative	Mandatory labelling
	Mandatory energy efficiency certificates
	Mandatory audits
Financial	Grants / Subsidies for investments
	Grants / Subsidies for audits
	Loans/Others
Fiscal/Tariffs	VAT Reduction
	Income tax reduction
	Linear electricity tariffs
Information/Education	Voluntary labelling
	Information campaigns
	Detailed energy/electrical bill
	Regional and local information centres
Co-operative Measures	Voluntary/Negotiated agreements
	Voluntary DSM measures of suppliers
	Technology procurement
Cross-cutting	Eco-tax on electricity/energy
	Eco-tax on CO_2 - emissions

In addition to these classifications there are ‘Market-based measures’ (link):

- energy efficiency obligations (EEO)
- energy efficiency auctions/tender systems
- emission trading systems, Clean Development Mechanism (CDM) and Joint Implementation programmes (JI)

The following main conclusions can be drawn from Table 2 on the type of policies that exist in the UK and the level of impact that these have on energy savings:

- **Dominant policy types:** Legislative policies are most dominant with a high impact. Informative policies are abundant (e.g. Carbon Trust programmes). There are a range of financial measures and two cross-cutting taxes (the CRC and CCL).

- **High impact policy:** The high impact measures come from a mix of different types including legislation, taxes, informative measures and one general measure, the ESOS, which requires mandatory auditing.

Table 2. UK policy measures in the services sector[1]

Code	Measure Title	Type	Qualitative Impact	Start year
TER-UK24	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - Building Regulations 2016	Leg/norm Leg/invest	High	1976
TER-UK5	EU-related: Community framework for the taxation of energy products and electricity (Directive 2003/96/EC) - Climate Change Levy	Tax*, Leg-inform/focus (label)	High	2001
TE2007R-UK15	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy Performance Certificates	Leg-inform/focus (label)	High	2007
TER-UK14	Smart metering and Billing for SMEs	Leg-inform/focus (label)	High	2007
TER-UK12	CRC Energy Efficiency Scheme (CRC)	Tax*, Leg-inform/focus (label),	High	2010
GEN-UK34	EU-related: Energy Efficiency Directive (EED) - Directive 2012/27/EU - Energy Savings Opportunity Scheme (ESOS)	General Energy Efficiency / Climate Change / Renewable Programmes	High	2015
TER-UK2	Carbon Trust programmes	Leg-inform/focus (label), Financial	Medium	2001
TER-UK11	Enhanced Capital Allowance Scheme	Fiscal/Tariffs	Medium	2001
TER-UK18	Public sector financing through Salix	Financial	Medium	2006

[1] As a comparison, in Appendix B a similar table is given for the Netherlands. In the Netherlands, the services sector is given more attention recently. The two most important measures are legislative / normative measures; the Environmental Management Act and the Minimum energy performance for utility buildings (minimum label C). The first one has recently been enforced, the second one is new and will come into place in 2023. These measures are supported by several fiscal and financial measures. One measure focuses directly on information and education, although the impact is rates as being low; we have the impression that this aspect has been organized better within the UK. A few subsectors have an agreement with the government.

TER-UK19	Greening Government Commitments	Co-operative, Leg-inform/focus (label)	Medium	2006
TER-UK7	Energy Saving Trust	Leg-inform/focus (label)	Low	1992
TER-UK22	Public sector procurement standards	Co-operative	Low	2003
TER-UK21	Building Schools for the Future	Leg-inform/focus (label)	Low	2005
TER-UK20	Sustainable Schools Action Plan	Leg-inform/focus (label)	Low	2006
TER-UK25	RE:FIT (public sector energy efficiency improvements)	Co-operative, Leg-inform/focus (label)	Low	2014
GEN-UK36	Private and Social Sector Regulation (England and Wales)	General Energy Efficiency / Climate Change / Renewable Programmes	Low	2016

**Cross-cutting with sector specific characteristics in this table are referred to as taxes*

3.1 Savings per policy instrument

This section goes into more detail on the individual ongoing policies in Table 2. The policies that have had the highest impact on energy savings are:

- Climate Change Levy (CCL)
- Energy Efficiency Scheme (CRC)
- Smart metering and billing for SMEs
- Energy Savings Opportunity Scheme

The CCL works in combination with voluntary Climate Change Agreements, although targeting mainly industry they also extend to the service sector and included in the discussion.

3.1.1 Climate Change Levy

In 2000 the government introduced a 'levy package' which consisted of two major new climate policies: the Climate Change Levy (CCL) and Climate Change Agreements (CCA), which required the non-domestic sector to set energy efficiency and carbon reduction targets (Li, 2018). The CCL is an energy tax introduced in 2001 that applies to industry, commercial, public sector and agricultural businesses that use electricity, gas and solid fuels. The revenue is recycled through cuts to national insurance contributions (a tax on employment), and to support the Carbon Trust in delivering energy efficiency schemes (MURE, 2017a). There are two rates that can be paid. The main rate and the carbon price support rate that taxes gas and coal used by electricity suppliers and CHP owners. The carbon price support rate is a

carbon price floor that was introduced in 2013 to support the EU emissions trading scheme (EU ETS). It ensures carbon is priced at a higher level than in the EU ETS to encourage the use of low carbon technology (Hirst, 2018).

The CCL is part of a policy package together with voluntary CCAs. The rate of the CCL can be reduced for energy intensive businesses by 90% for electricity and 65% for other fuels, if the business chooses to enter into a CCA. CCAs were created to reduce the competitive disadvantage imposed by the CCL on UK industry. A range of energy intensive businesses and industrial sectors can enter into a CCA and in fact all those eligible did so (de Muizon & Galchant, 2011). However, many targets set in different sectors were not stringent enough as targets were exceeded by two times the amount set (Martin, de Preux & Wagner). Martin, de Preux & Wagner present evidence that the CCL produces a stronger incentive than voluntary CCA agreements. Ekins & Etheridge (2006) also show support, arguing that the CCL is more effective than a flat rate tax in raising awareness and encouraging support for efficiency. However, businesses also view CCAs as an effective incentive as they have raised awareness and engagement on the issue of energy efficiency (Bassi et al., 2013).

The CCL is viewed as the UK's main tool for reducing energy consumption, reducing carbon emissions and encouraging improvements to energy efficiency of buildings. However, it is not without flaws, one of which being the uneven carbon pricing of fuels which places a higher tax on electricity than on other more polluting fuels (Bassi et al., 2013). The higher charges on electricity use ultimately acts as a disincentive. The CCL applies to many organisations in the service sector and also SME's as it has a relatively low exemption threshold compared to the EU ETS and the CRC, which only cover larger energy users (Hampton & Fawcett, 2017). However, some services and SME's are not included under CCA's and therefore are not included in the scheme. Hampton & Fawcett argue that this exclusion of SMEs to reduce the burden of compliance upon them, ultimately results in a policy gap as they are responsible for a significant proportion of energy use. Of all energy use in non-domestic buildings, SMEs are estimated to represent 57% of electricity and 50% of gas demand (DECC, 2015a). Some authors argue to introduce a flat rate carbon tax instead of the CCL, which would send a strong price signal and simplify the complicated policy landscape, whilst at the same time extending coverage to all sectors (Rooney et al., 2018).

3.1.2 Carbon Reduction Commitment Energy Efficiency Scheme (CRC)

The CRC (2010) is a mandatory carbon reduction scheme for all public and private organisations that use over 6000 MWh electricity per year on half-hourly meters. An allowance must be purchased for every tonne of carbon emitted, these are surrendered and traded on an annual basis. The organisation is responsible for reporting emissions annually (auditing for compliance). It covers less intensive, large energy users (hotels, supermarkets, government authorities) that are exempt in the EU Emissions Trading Scheme (EU ETS), or sign Climate Change Agreements (which gives a discount on the CCL). 5000 organisations were required to take part in the scheme in 2010, these accounted for around 10% of UK carbon emissions (DECC, 2015b).

The CRC is more visible than the CCL, because carbon reporting helps raise awareness, however it is unpopular and has been highly criticised (Bassi et al.,2013). Criticisms are that the design of the CRC is overcomplicated, that is has increased administration costs, and that it is inconsistent as many changes to its design have occurred over the years (Bassi et al., 2013). Originally the scheme included reputational incentive by means of a performance ranked lead table. This was removed, leading to a reduction in the effectiveness of the policy. Furthermore, the revenue recycling element was removed during the introductory phase and now it is seen as a tax that hinders low-carbon investment (Mallaburn & Eyre, 2014; Bassi et al., 2013). Due to criticism and overlaps with other policies, the CRC will end in March 2019 and will be replaced by an increase in the Climate Change Levy.

3.1.3 Smart metering and billing

Smart metering is one of the main tools underlying the governments long-term heat decarbonisation plan, it aims to ensure flexibility, increase innovation through smart technology and to enable a demand-side response (OFGEM, 2017). Energy companies are required to offer all small-medium sized enterprises (SMEs) a smart meter, along with all domestic customers by 2020. 1.01 million smart and advanced meters had been installed by the large energy suppliers in SMEs at the end of March 2018 (BEIS, 2018a). In total, the non-domestic roll-out will cover around two million sites up to 2020. In the residential sector, smart-meters are required to be fitted with in-home-displays. These may be an unnecessary expense as technology is now advancing e.g. towards the use of apps on smart phones

In the non-domestic sector, smart meters and increased data availability is assumed to reduce energy consumption by 2.8 % for electricity meters and 4.5% for gas meters (MURE, 2017b). The policy is focused on SMEs as the majority of larger enterprises have already installed smart meters (BEIS, 2018a). The primary source of evidence for this is a trial of advanced metering in 538 SME sites carried out by the Carbon Trust in 2007. Energy suppliers are required to install smart meters but do not have to provide advice and information to customers should use smart meters to improve energy management, increased engagement will increase the impact of smart meters (BEIS, 2017a).

The Non-Domestic Smart Energy Management Innovation Competition was launched by the government in November 2017. This will help to create a market for energy efficiency services in the retail, schools and hospitality sectors (BEIS, 2018b). The government wants to update the energy system and places the development of a smart meter network as the basis for creating new markets, technologies and services (OFGEM, 2017).

3.1.4 Energy Savings Opportunity Scheme

The ESOS requires large enterprises to conduct mandatory energy audits every 4 years. It is listed as an EU-related measure in Table 2 as it is required under Article 5 of the EED. Large enterprises must use assessors to calculate energy consumption, identify large areas of energy consumption and then identify

opportunities to save energy. Overall, compliance with the scheme is good and it has stimulated energy efficiency in around 79% of the enterprises involved in the scheme (MURE, 2018). The scheme was intended to increase awareness and involvement at board level with energy efficiency and did identify new areas for improvements (BEIS, 2017b). Complying with the scheme was cited by managers as important for reputational and regulatory reasons, however differences in views on the priority of energy efficiency resulted in different levels of action (BEIS, 2017b).

The ESOS shares some similarities with the CRC in that it is mandatory and requires audited reporting, the difference being the CRC covers carbon emissions and ESOS energy consumption. Those that were subject to the CRC were better prepared for the ESOS, suggesting there is some positive interaction between the measures (BEIS, 2017b). The removal of the CRC leaves a gap for a new carbon and energy reporting and the government is introducing a simplified policy structure for both (BEIS, 2017b).

3.2 Design of UK policy

Early schemes for energy efficiency in buildings were driven by public concern over fuel poverty levels and the related adverse effects on human health (Grey et al., 2017). In more recent years other issues such as climate change and energy security have influenced policy decision making. However, reducing energy poverty, continues to be a main priority of many policies and with rising energy prices it is increasingly important that this is incorporated into policy design. One example is the deliberate exclusion of the residential sector from the CCL to ensure that low-income households are not subject to price increases (Pearce, 2006). The uneven carbon pricing of the CCL charges, which charges higher rates for cleaner fuels is in part designed to reduce the impact on industries but has also had influence from the strong lobby groups of the coal industry (Pearce, 2006). Policy design is influenced by a number of interests, which has impacted the ability of market-based instruments to reduce energy consumption and carbon emissions.

3.3 Financial mechanisms

Finance is one of the main barriers that prevents the uptake of energy efficiency projects. In recent years there have been a number of solutions in the UK that demonstrate how this can be overcome. The key approaches being used in the UK that will be discussed in this section centre around the energy services market and includes examples of public-private partnerships, recycling funds, energy performance contracts and the involvement of Energy Service Companies (ESCOs). The UK has been able to develop a competitive market for energy services by focusing on projects to develop the energy service market in the public sector with support from local and national government (Boza-Kiss et al., 2017). Support for innovation is a major component for future success and flexibility, as are financing programmes such as Salix, the Green Investment Bank and public programmes, such as RE:FIT.

3.3.1 Salix public sector financing

The government financed company Salix Finance Ltd provides two forms of funding for energy efficiency improvements in the public sector:

- The Salix Energy Efficiency Loans Scheme (SEELS) provides interest-free loans over a 8-year period, which are paid back from the predicted energy savings.
- The Recycling Fund (RF) is a 'revolving fund' that requires the public body to contribute funds for energy efficiency and then Salix provides matched funding (MURE, 2017c). The revenue savings made by each project are repaid into the RF until the original sum is repaid. Therefore, the RF can be continually used to fund further energy efficiency projects.

In total, Salix Finance has been involved with over 1,800 clients and 15,000 projects across England, Scotland and Wales during the period 2004 to 2017 (MURE, 2017c). Salix financing helps to reduce the high upfront costs of projects, removing the barrier to investment in energy efficiency in the public sector. Furthermore, it encourages investors to rethink the timescale of investments, encouraging longer-term projects which can achieve greater energy savings (MURE, 2017c). The availability of Salix financing supports energy efficiency in the public sector, however the private sector can also access funding through the Green Investment Bank (GIB). The GIB, which was initially government funded and is now a privately-owned bank, is showing significant support for energy efficiency projects, offering finance to public and private sector organisations, and ESCOs (DECC, 2015c).

3.3.2 Case study: The RE:FIT scheme

The RE:FIT programme is an example of a successful scheme involving service contracts and ESCOs, which started in London in 2010 and has now been expanded nationally (Greater London Authority, 2019). It is a framework involving public sector procurement contracts with ESCOs to guarantee energy savings through reducing consumption with energy efficiency improvements, and energy generation. Initially, the RE:FIT programme started with the collaboration of local London authorities in a single procurement competition.

The RE:FIT scheme has set a positive example of how public sector energy efficiency projects can be financed using energy performance service contracts in collaboration with local authorities and ESCOs. A key benefit of the RE:FIT programme is the ability of ESCOs to support contracts which deliver guaranteed energy savings, this reduces risk and ensures energy efficiency projects are financially secure for clients (Boza-Kiss et al., 2017). Another key to the success of the scheme is the additional support offered by the framework in helping to access finance, secure contracts and increase the delivery scale of the project (Nolden & Sorrel, 2016).

In April 2016, there were 16 ESCOs involved in the scheme including large service companies of larger utility suppliers British Gas, EDF and SSE (Kingston, 2017). Clients are supported in accessing a range of funds to finance RE:FIT projects, commonly used is the Salix loan scheme (Nolden, Sorrel & Polzin, 2016). The

scheme has so far carried out projects in over 500 buildings, including those in the service sectors of education, healthcare and public administration, with average energy savings in the range of 15-20% (Nolden, Sorrel & Polzin, 2016). The London RE:FIT scheme is one example of how private financing is being provided to the public sector to set a good example for the rest of the market, and to increase familiarity with ESCOs and performance contracts (Chmutina et al., 2012).

3.4 Informative institutions

Informative policies are also prevalent in the UK, these provide advice and information to the service sector. In the UK there are a number of institutions that are responsible for administrating schemes, in the service sector the most important is the Carbon Trust. There are also research institutions tasked with carrying out governmental research specifically related improving and monitoring climate goals, such as the Committee on Climate Change (CCC). Multiple publicly funded organisations give extra support and engage with consumers, but this can also lead to a more complex system of administration (Hampton & Fawcett, 2017).

The Carbon Trust has offered specific support for SMEs through an energy efficiency support service, and it also provides financial support through loans and a Green Business Fund. The Carbon Trust also helped to create the Salix financing scheme (Mallaburn & Eyre, 2014). The support provided by the Carbon Trust's management programmes successfully targeted higher level directors and shareholders to highlight the benefits of energy efficiency to businesses (Mallaburn & Eyre, 2014).

3.5 Specific measures for the private-rented sector

The Private and Social Sector Regulation (England and Wales) which began in 2015 is listed as a low impact measure in Table 2, part 2 of the regulations will apply to private buildings in the residential and services sector. In April 2018, the **minimum energy efficiency standards (MEES)** were introduced under this regulation, requiring all privately rented properties to be of EPC level E or higher upon signing new tenancy agreements. In 2020 this will tighten further so that all existing private rented buildings will need to be EPC E or higher. As illustrated in Figure 9 there are a large proportion of buildings within the lower F and G bands, in which the MEES will help to gradually raise standards to a minimum E band. In the higher energy intensive service sub-sectors such as office and retail, there are a higher proportion of privately rented buildings, in which it is more difficult to implement energy efficiency measures due to split-incentives such as the landlord-tenant dilemma (where landlords must pay, but tenants benefit). The MEES is one such measure used in the UK to overcome this barrier through the enforcement of mandatory standards.

3.6 Evaluations of policy in the UK

In general, one of the successes of energy efficiency policy in the UK is considered to be the evaluation and efforts to include reducing effects such as free riders. Data availability strengthens evaluations and allows for research into reducing effects (Dixon et al., 2014). In an effort to increase data availability the UK has introduced

the ND-NEED framework which contains observed data based on energy consumption readings and information on building characteristics, which when used for ex-ante evaluations will factor in the effect of double-counting and free-riders. In addition, there are strong institutions responsible for conducting evaluations such as BEIS, OFGEM and the Committee on Climate Change (IEA, 2006).

However, compared to the residential sector, the database for the service sector is more difficult to compile and monitor due to the large size of the sector and variation of energy use within individual buildings and sectors. The ND-NEED needs to match meter consumption with buildings, however commercial addresses do not always match correctly, so evaluating and monitoring energy policy becomes more difficult in this sector compared to the residential sector (DECC, 2014b). However, even though gaps in data remain, the creation of the ND-NEED has allowed for a more detailed analysis of specific sectors through matching metered consumption to buildings (DECC, 2015a).

4 Conclusion

Within the EU national policy landscapes differ and there must be consideration of how policies in one country would work in another, because cultural factors may differ or there may not be the regulatory structure in place to support them. During the time of this study the Netherlands is in the process of negotiating a new climate agreement, in which attention is given to the retrofit of existing buildings. The relevance of this study has prompted a number of questions to be raised over whether the UK has had experience with the upcoming challenges facing the Netherlands.

The Netherlands want to upscale the renovation rate of buildings, and a key theme is new policy to stimulate renovation in a cost-effective way (Klimaatakkoord, 2018). Reflecting upon experience in the UK there is also effort to enable renovations through providing financial support mechanisms. Support from the government includes funding, policies targeted at the public sector and involvement of local authorities. This strategy has shown to have success in the UK and is demonstrated by the RE:FIT scheme. There is also a strong structure of informative and trusted institutions in the UK such as the Carbon Trust. These institutions engage energy consumers with energy efficiency, whilst also providing financial support and carrying out research to improve policy and energy efficiency in buildings. Finally, the UK in the past has made efforts to introduce carbon price mechanisms in combination with agreements on energy efficiency, however effort should remain consistent and stronger price signals need to be sent to encourage cleaner energy use and reduce carbon emissions.

5 Recommendations

This section includes a summary of the successes and failures experienced in the UK's energy efficiency policies analysed in Section 2, along with some recommendations.

Type of policy:

- Economic measures such the CCL and CRC can be effective, however overly complex packages can reduce effectiveness and increase administrative burden. Furthermore, it is clear from experience in the UK that attention must be given to ensure the correct carbon price signals are created to ensure effective carbon emission reductions.

- The UK has set ambitious targets which exert pressure to reduce energy consumption and emissions. Economic measures need to be part of a package of diverse measures which address the diverse nature of energy efficiency. The UK's market-based policies and government commitment allow for a strong control to push forward growth.

- Institutions in the UK provide informative advice, research and financial support targeted at SMEs

Financing mechanisms:

- Stimulating energy efficiency markets is being achieved through the use of existing policy tools and investment in innovation. Public and private partnerships are reducing pressure on government budgets and giving more responsibility to co-operative community scale energy efficiency markets. The government is supporting the move away from subsidy-based schemes and towards encouraging private partnerships.

- Innovative financial measures can overcome the barrier of funding efficiency projects, for example Salix financing offers interest-free loans as an alternative to the subsidy route and operates a revolving fund which can support long-term projects.

Upscaling markets and full-sector coverage: The UK is moving away from policies that rely on subsidy and which pressure government funding. To achieve this, it is using public sector projects to engage with private investors to build an energy market that is sustainable. Innovate projects involving local councils and the private sector, such as the London RE:FIT scheme, are expanding nationally and are creating positive impacts on the market. It is also important to recognise the potential of energy savings in SMEs and find solutions to overcome the multiple barriers faced in smaller organisations, most of whom have less finances and a lower capacity to implement management systems. The UK has targeted policies at this area to overcome barriers, as it has done with targeting EEO policy at low income households in the residential sector. Government should continue to support for the development of smaller innovative projects as with growth these have the potential to influence the market on a larger scale. As a result, the UK's energy efficiency market has experienced significant growth in recent years. Policy efforts which currently focus

mainly on public sector buildings should also be expanded to target commercial and private organisations.

Evaluations and monitoring: The UK includes the impact of reducing effects in the evaluation of policies. Ex-ante evaluations are carried out using ND-NEED, a large database of combined information that factors in free-riders and removes double-counting. The difficulties of evaluations within the service sector highlights the need for greater transparency and availability of data for use in monitoring and research.

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Appendix A – National policy measures of the services sector in the Netherlands (by J.M. Sipma, ECN.TNO)

The services sector versus the industrial sector

In the Netherlands, the International Standard Industrial Classification (wiki) is used to determine to what sector a company belongs. The below table shows 21 distinguished classifications. The classification 'Manufacturing' forms the industrial sector by itself. The services sector consists of companies and buildings belonging to classifications of G until U.

Table 3. International Standard Industrial Classification

A. Agriculture, forestry and fishing
B. Mining and quarrying
C. Manufacturing
D. Electricity, gas, steam and air conditioning supply
E. Water supply; sewerage, waste management and remediation activities
F. Construction
G. Wholesale and retail trade; repair of motor vehicles and motorcycles
H. Transportation and storage
I. Accommodation and food service activities
J. Information and communication
K. Financial and insurance activities
L. Real estate activities
M. Professional, scientific and technical activities
N. Administrative and support service activities
O. Public administration and defence; compulsory social security
P. Education
Q. Human health and social work activities
R. Arts, entertainment and recreation
S. Other service activities
T. Activities of households as employers; undifferentiated goods- and service-producing activities of households for own use
U. Activities of extraterritorial organizations and bodies

Policy measures versus sectors, enterprises and buildings

Policy measures that have been designed to reduce the energy consumption in a building and/or within an organisation or an enterprise, do not always make the same distinction in terms of sectors. It might even be easier to speak about measures that target non-residential buildings. This could include the agricultural, forestry and fishing sectors. Still, we try to focus as much as possible on the services sector.

Some measures are designed to target a commercial enterprise or public organisation. That enterprise or organisation could have several individual buildings in use. Other measures could (at the same time) target the individual buildings.
Some measures are designed to target enterprises with a certain size. A size could relate to the number of employees working at the organisation, and/or to the yearly turnover it makes. Besides the large organisations, often small and medium size enterprises are involved (SME's):
'The criteria for defining the size of a business differs from country to country. According to the European Commission the SME are the enterprises that meet the following definition of staff headcount and either the turnover or balance sheet total definitions:

Company category	Staff headcount	Turnover	Balance sheet total
Medium-sized	< 250	≤ €50 million	≤ €43 million
Small	< 50	≤ €10 million	≤ €10 million
Micro	< 10	≤ €2 million	≤ €2 million

Most important policy measures in the Netherlands
The below table shows the policy measures according to Odyssee in the Netherlands that target the services sector (also at the same time the industrial sector to a certain extent).

Table 4. Policy measures in the Netherlands services sector

Code	Title	Status	Type	Starting Year	Qualitative Impact
TER-NLD1	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Building Decree and Energy Performance Standard	Ongoing	Legislative / Normative	1995	High
TER-NLD25	Environmental Management Act (Wet Milieubeheer)	Ongoing	Legislative / Informative	1979	High
TER-NLD28	Minimum energy performance for utility buildings (minimum label C)	Not started	Legislative / Normative	2023	
TER-NLD29	Long term agreements Services sector, third phase (MJA3)	Ongoing	Co-operative Measures	2008	Medium
TER-NLD27	Energy Saving Expertise Centre (Expertisecentrum Energiebesparing)	Ongoing	Information / Education / Training	2015	Low
TER-NLD31	Energie Tax (Energiebelasting)	Ongoing	Fiscal/Tariffs	1996	Medium
TER-NLD30	Sustainable Energy Surcharge (Opslag voor Duurzame Energie)	Ongoing	Fiscal/Tariffs	2013	Low

TER-NLD14	The Vamil Scheme: Accelerated Depreciation on Environmental Investments	Ongoing	Fiscal/Tariffs	1991	Medium
TER-NLD3	Energy Investment Tax Deduction (EIA)	Ongoing	Fiscal/Tariffs	1997	High
TER-NLD26	Investment Subsidy for Sustainable Energy (Investeringssubsidie Duurzame Energie (ISDE))	Ongoing	Financial	2016	Low
TER-NLD16	Subsidy schemes (IRE, MEI, UKR, Clean and Efficient Demonstration Projects) Subsidies (IRE, MEI, UKR, Demonstratieprojecten Schoon en Zuinig)	Ongoing	Financial, Cross-cutting	2007	High

Table 5. A short description of the most important policy measures for the Netherlands:

TER-NLD25	*Environmental Management Act* Every building within the services sector that consumes at least 25.000 m^3 gas and/or 50.000 kWh electricity each year needs to implement all energy savings (technical and behaviour) measured, that are payed back within 5 years' time. Since a few years this measure finally gets more attention and is more strictly enforced. Before, enforcers had to visit the building owners/user themselves which was an enormous task. This now has changed. There is a more legal obligation for the building owner/user to inform the local government themselves, through on online system, that they comply to this law.
TER-NLD28	*Minimum energy performance for utility buildings (minimum label C)* Utility buildings that are newly built, sold or rented are required to have an energy label. As part of the further intensification of the measures agreed in the Energy Agreement, it was agreed in 2017 that offices are required to have a minimum energy label C by 2023. The measure is published in 2018.
TER-NLD29	*Long term agreements Services sector* As in the industrial sector, large and medium-sized companies and institutions within some services-subsectors have a long term agreement with the government to save energy over the years within their subsector. Examples are universities, medical centres, banks, insurance companies and ICT datacentres. Although the agreement is voluntary, attendees can apply for certain incentives that are not available outside the agreement.
TER-NLD27	*Energy Saving Expertise Centre* The new Expertise Center for Energy Saving supports and connects. On 12 January the website of the Expertise Center for Energy Saving (ECE) went online. The ECE wants to be a growing network of entrepreneurs, governments and sector and market parties that share their experiences and network. Together the ECE works on an online environment, which is an independent guide to network, knowledge and experience.

TER-NLD26	*Investment Subsidy for Sustainable Energy* As of 1 January 2016 a new subsidy scheme was launched for the installation of small renewable heating sources. Through this new subsidy scheme private persons and commercial users that wish to generate their own sustainable energy receive financial support when purchasing an installation. Households and small commercial users can receive an allowance for the purchase of heat pumps, biomass boilers, solar water heaters, pellet stoves and small wood-fired boilers. This results in energy saving and the reduction of CO_2 emissions.

The interaction of measures and their target sector, building or enterprise size

The following section is a direct translation of a chapter from a report in which ECN describes the role of the province of Noord-Holland in energy policy for the industry sector (link). It gives insight in the interaction of measures, and their target sector, building or enterprise size.

Emissions trading EU ETS

Not mentioned so far in this appendix, is the Emissions trading of CO_2 emission rights. The emissions trading system starts with the establishment of an emissions cap. The total number of allowances available in the system within Europe is equal to this ceiling. Companies participating in emissions trading must surrender an allowance for every tonne of CO_2 they emit. This is a European system and is therefore often referred to as the EU Emissions Trading System (EU ETS).

Companies that have fewer allowances available than they have emitted must buy additional allowances, while companies that have emitted less than they have allowances may sell their surplus allowances. The demand for and supply of emission rights results in a price for emission rights.

The rules on which companies are required to participate in the EU ETS are laid down in Annex I of the European Emissions Trading Directive. These activities include the burning of fuel in installations with a total rated thermal input of more than 20 megawatts, oil refining, production of metals, aluminium, paper and board, cement clinker, lime, glass, plaster, ceramics, mineral wool and chemicals with a certain minimum production capacity. Companies under the ETS include power plants, refining industry, chemical industry, metal industry, paper industry and building materials industry, but a Dutch university and its hospital that is located within the services sector as well (source). The Dutch Emissions Authority (NEa) publishes a list of ETS participants in the Netherlands.

This EU policy often targets relatively large enterprises and organisations. An estimate by an expert within ECN.TNO is that approximately 3% of the energy consumption within the services sector falls under the ETS system. For the industrial sector this is about 80%.

Energy Efficiency Directive (EED)

Not mentioned so far in this appendix, but mentioned in the UK policy Table 2 in section 3, is the EU-related Energy Efficiency Directive (EED) - Directive 2012/27/EU. In the context of the European Energy Efficiency Directive (EED), large companies are obliged to carry out (or have carried out) an energy-saving study, an energy audit, every four years. In this context, the Dutch government published the "Temporary Regulation on the implementation of Articles 8 and 14 of the Energy Efficiency Directive" on 15 July 2015. This regulation follows the EED and indicates that large companies with more than 250 employees or an annual turnover greater than 50 million euros and/or a balance sheet total greater than 43 million euros must carry

out or have carried out an energy audit. Transport management is part of the energy audit.
It also covers a relatively large number of companies within the Services sector, including, for example, the banking sector, other financial institutions and retail chains.
A company is exempt from this audit requirement (see also figure below in Dutch):

1. If they actively participate in MJA3 or MEE covenant;
2. If it operates a certified energy management system (ISO 50001 or 14051);
3. If they have an energy audit that is more recent than 2011 and meets the minimum criteria.

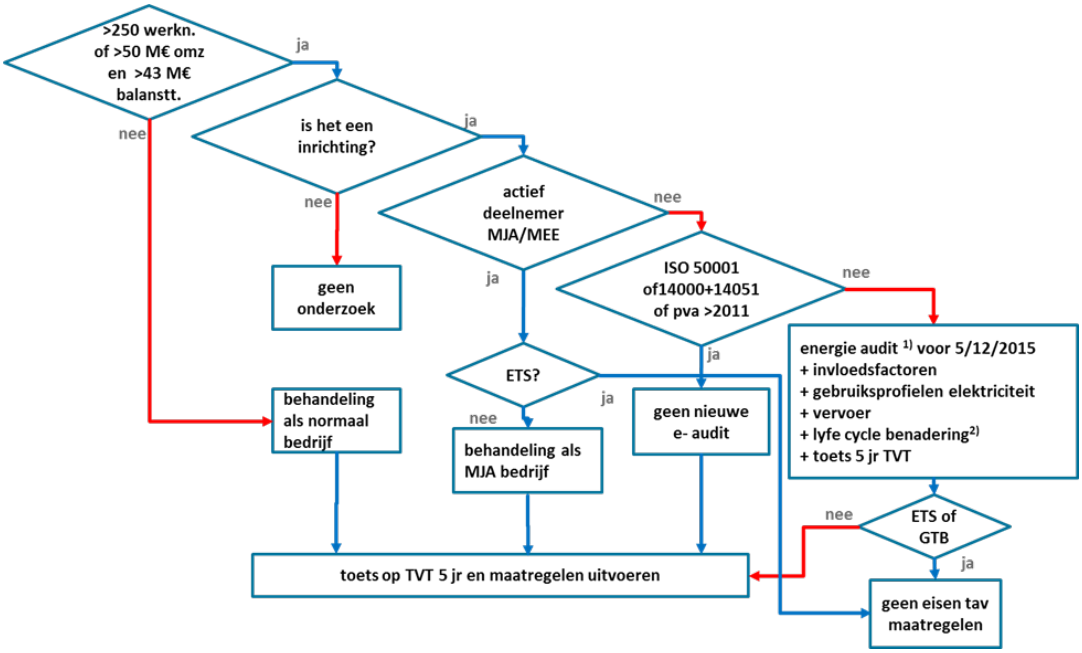

Figure 10. Review of EED company

EED Keurmerken

- Green Key
- Milieuthermometer Zorg
- Erkend Duurzaam
- BREEAM-NL In-Use
- CO2 Prestatieladder

In addition, some quality marks are seen as full or partial fulfilment of the EED audit obligation, such as the CO_2 performance ladder. Whether and to what extent this is carried out, is at the discretion of the government. In order to stimulate the use of quality marks in relation to the EED, a fact sheet has been drawn up for a number of quality marks, whereby the requirements for a certain quality mark are compared to the requirements of an EED audit.

The energy audit provides a detailed overview of all existing energy flows within the company, including transport. An energy audit also consists of a description of the main factors influencing energy consumption, a quantified overview of the energy savings potential of the company for the next 4 years and a description of possible cost-effective energy savings measures.

Energy covenants MJA3 and MEE

Dutch companies have agreed with the government how much energy they will save until 2020. The starting points for this are laid down in the Long-Term Agreements on Energy Efficiency, the Energy Covenants MJA3 and MEE. The aim of the covenants is to reduce the energy required per unit of product or services, with an average

annual energy efficiency improvement of 2% per year. This can be done by improving the process efficiency at the company itself or efficiency improvement in the production chain, reducing energy consumption over the entire life cycle of a product. Chain efficiency in the production chain is achieved through material savings, on-site collaboration, optimisation of distribution and optimisation of disposal and reprocessing. Chain efficiency in the product chain is achieved by reducing energy consumption during product use and by optimising the lifespan.
The MJA3 participants includes a diverse group of companies, ranging from foundries, concrete factories, coffee roasters, transporters, ICT companies, financial service providers, cold stores, universities and hospitals. It therefore also includes sub-sectors covered by the services sector. Often these are relatively large organisations.
The EEE covenant is intended for large, industrial companies that are obliged to participate in the emission trading system.

Every company that participates in MJA3 or MEE draws up an Energy Efficiency Plan (EEP) every 4 years. In this plan, companies describe which energy saving measures will be implemented. In 2016/2017 all participants must submit a new EEP for the period 2017-2020. The MJA3 and MEE covenants will end after 2020. For the period after 2020 it is not known if and if so what will happen.
Environmental Management Act
The Environmental Management Act states that all companies that consume more than 25,000 m^3 of gas or 50,000 kWh of electricity per year must take energy-saving measures with a payback period of 5 years or less. The law reaches many companies and buildings, which are not already reached by the aforementioned measures, from which most of them belong to the services sector.
Coherence of various measures

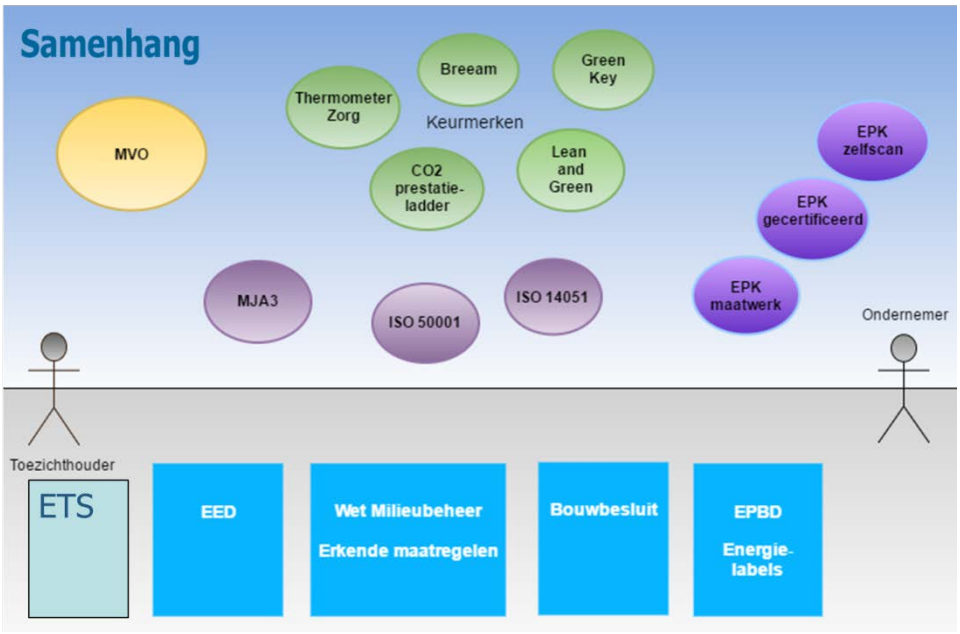

Figure 11. Coherence of various measures

The figure above sketches in a different way the relationship between the various measures and the working method during enforcement. Companies are given the opportunity to take responsibility themselves and get to work, before steps are taken

in the sphere of enforcement or modification of permits. A company will always first be encouraged to work with labels such as the CO_2 performance ladder, ISO 50001 and the MJA3 covenant. This is sketched at the top of the figure. The so-called "frontrunners" do not therefore require any use of the regulations to take measures in the field of energy conservation. The middle group needs a relatively small push and is the largest in size. The latter group of "laggards" must be set to work through enforcement, using regulations such as the EED and the Environmental Management Act at the bottom of the figure.

Examples of quality marks

- ISO 50001 is the international standard for energy management systems. The standard focuses specifically on reducing an organisation's energy consumption. The basis for the energy management system is the 'plan-do-check-act' cycle (PDCA).

- The CO_2 performance ladder encourages companies to get to know and reduce their own energy consumption and CO_2 emissions. Companies are encouraged to reduce CO_2 because a higher step on the ladder results in a fictitious discount (award advantage) in the tendering process of clients. The ladder provides insight into the extent to which a company is actively working on CO_2 reduction. The CO_2 Performance ladder has five steps or five levels, rising from 1 to 5. The higher the step on which a company is certified, the more mature the company in CO_2 management, the greater the benefit in a project tender. The CO_2 Performance Ladder requires the company to set up a structured process that leads to continuous improvement via the 'plan-do-check-act' cycle