Title: Energy Saving Opportunity Scheme **IA No:** DECC0142 **Lead department or agency:** Department for Energy and Climate Change **Other departments or agencies:** Department for Transport	**Impact Assessment (IA)** **Date:** 01/05/2013 **Stage:** Consultation **Source of intervention:** EU **Type of measure:** Secondary **Contact for enquiries**: Sarah Meagher 0300 068 5121

Summary: Intervention and Options

RPC Opinion: Green

Cost of 'least cost' Option (compared against 'no directive' baseline)				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year** (EANCB on 2009 prices)	**In scope of One-In, One-Out?**	**Measure qualifies as**
£1.9bn	-£223m	£19m	No	zero net cost

What is the problem under consideration? Why is government intervention necessary?

The market for energy efficiency is characterised by a number of market failures. Enterprises typically lack access to specific tailored advice on how to reduce costs through energy efficiency. Article 8 of the Energy Efficiency Directive requires Member States to establish an energy audits regime under which all non-SME enterprises conduct an audit once every four years. Energy audits will need to include a detailed review of the energy consumption of an enterprise and identify the scope for improving the energy efficiency of its operations. The UK proposes to meet this requirement through introduction of the Energy Savings Opportunity Scheme (ESOS).

What are the policy objectives and the intended effects?

The objectives of the policy are to promote the take up of cost effective energy efficiency measures whilst minimising the cost to business of complying with the mandatory auditing requirements. By providing enterprises with tailored information about how they can make cost-effective savings ESOS should increase the take up of cost effective energy efficiency measures. This will support higher economic growth, reduce carbon emissions and improve security of supply.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

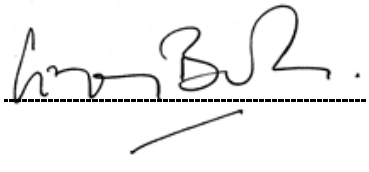
The Government is consulting on the best way to implement the minimum requirements of Article 8 of the Directive. The Impact Assessment includes four options which represent different approaches to implementing the minimum requirements of Article 8, and is seeking stakeholder views on what the costs and benefits to businesses would be of the different options. The Impact Assessment also includes two options that go beyond the minimum requirements of the Directive, but may lead to higher benefits to the UK.

Implementing this article is an EU legal obligation. An analysis of existing policies has concluded that they do not adequately meet the UK's legal obligations under the Directive, and hence a do nothing option is not available. Nor does the Directive allow for transposing via self-regulation.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 2016

Does implementation go beyond minimum EU requirements?			N/A		
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.	**Micro** No	**< 20** No	**Small** No	**Medium** No	**Large** Yes
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:** 8.7	**Non-traded:** 3.4	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible minister:  Date: 9 July 2013

Summary: Analysis & Evidence

Policy Option 1

Description: Minimum requirement (scheme administration through central body, ex-post evaluation of take up)

FULL ECONOMIC ASSESSMENT

Price Base Year 2013	PV Base Year 2013	Time Period Years 16	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High:** Optional	**Best Estimate: 0**

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate	0		0	**0**

Description and scale of key monetised costs by 'main affected groups'

The costs of implementing this option policy package will be borne by large enterprises, energy assessors and Government. Around 7,300 large enterprises will face assessment costs estimated at £0m (£100m when measured against a no directive baseline), the administrative burden estimated at £0m (£120m) and the capital cost and hassle cost of implementing measures estimated at £0m (£990m). Energy assessors will incur the cost of obtaining accredited status £0m (£5m). The Government will face the scheme administration cost estimated at £0m (£36m).

Other key non-monetised costs by 'main affected groups'

One of the knock on effects of improving an enterprises' energy efficiency is that some of the financial savings may be spent on energy consuming goods and services: the rebound effect. This means that the overall impact on energy consumption is smaller (although businesses will benefit from the additional energy consumption). This reduction in benefits (cost) has not been quantified.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate	-		0	**0**

Description and scale of key monetised benefits by 'main affected groups'

The main groups benefiting from the policy will be large enterprises and wider society. The large enterprises will benefit from energy savings estimated at £0m (£2.5bn), which will lead to lower energy bills.
The wider society will benefit from resulting improved air quality estimated at £0m (£380m); non-traded carbon savings estimated at £0m (£170m); and traded carbon allowance savings estimated at £0m (£160m).

Other key non-monetised benefits by 'main affected groups'

Cost-effective energy efficiency measures will reduce energy bills. For companies this translates into financial savings that can be reinvested for different purposes such as growing the business, leading also to enhanced competitiveness. This bolsters productivity, increasing growth and reducing inflation. ESOS will also stimulate growth in the energy efficiency sector.

Key assumptions/sensitivities/risks **Discount rate (%)** 3.5

The analysis is significantly affected by the energy saving assumption used to estimate the benefits, as demonstrated by the sensitivity analysis. Other key sensitivities are the capital costs and the duration of the energy savings. A key risk is that the installation of energy efficiency measures results in a rebound effect, which will potentially decrease energy savings and reduce the benefits.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: 0	**Benefits:** 0	**Net:** 0	Yes	IN

Summary: Analysis & Evidence

Policy Option 2

Description: Minimum requirement (scheme administration through central body, with notification of compliance)

FULL ECONOMIC ASSESSMENT

Price Base Year 2013	PV Base Year 2013	Time Period Years 16	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High:** Optional	**Best Estimate:** -1

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate	0		0	**1**

Description and scale of key monetised costs by 'main affected groups'

The costs of implementing this option will be borne by large enterprises, energy assessors and Government. Around 7,300 large enterprises will face assessment costs estimated at £0m (£100m when measured against a no directive baseline), the administrative burden estimated at £0m (£120m) and the capital cost and hassle cost of implementing measures estimated at £0m (£990m). Energy assessors will incur the cost of obtaining accredited status £0m (£5m). The Government will face the scheme administration cost estimated at £0m (£36m).

Other key non-monetised costs by 'main affected groups'

One of the knock on effects of improving an enterprise's energy efficiency is that some of the financial savings may be spent on energy consuming goods and services: the rebound effect. This means that the overall impact on energy consumption is smaller (although businesses will benefit from the additional energy consumption). This reduction in benefits (cost) has not been quantified.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate			0	**0**

Description and scale of key monetised benefits by 'main affected groups'

The main groups benefiting from the policy will be large enterprises and wider society. The large enterprises will benefit from energy savings estimated at £0m (£2.5bn), which will lead to lower energy bills.
The wider society will benefit from resulting improved air quality estimated at £0m (£380m); non-traded carbon savings estimated at £0m (£170m); and traded carbon allowance savings estimated at £0m (£160m).

Other key non-monetised benefits by 'main affected groups'

Cost-effective energy efficiency measures will reduce energy bills. For companies this translates into financial savings that can be reinvested for different purposes such as growing the business, leading also to enhanced competitiveness. This bolsters productivity, increasing growth and reducing inflation. ESOS will also stimulate growth in the energy efficiency sector. There may be potential benefits (reduced enforcement costs) from notification of compliance.

Key assumptions/sensitivities/risks **Discount rate (%)** **3.5**

The analysis is significantly affected by the energy saving assumption used to estimate the benefits, as demonstrated by the sensitivity analysis. Other key sensitivities are the capital costs and the duration of the energy savings. A key risk is that the installation of energy efficiency measures results in a rebound effect, which will potentially decrease energy savings and reduce the benefits.

BUSINESS ASSESSMENT (Option 2)

Direct impact on business (Equivalent Annual) £m:						In scope of OIOO?	Measure qualifies as
Costs:	0	**Benefits:**	0	**Net:**	0	Yes	IN

Summary: Analysis & Evidence

Policy Option 3

Description: Minimum requirement (scheme administration through central body and public disclosure)

FULL ECONOMIC ASSESSMENT

Price Base Year 2013	PV Base Year 2013	Time Period Years 16	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High:** Optional	**Best Estimate:** -40

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate	0		3	**40**

Description and scale of key monetised costs by 'main affected groups'

The costs of implementing this option will be borne by large enterprises, energy assessors and Government. Around 7,300 large enterprises will face assessment costs estimated at £0m (£100m when measured against a no directive baseline), the administrative burden estimated at £40m (£160m) and the capital cost and hassle cost of implementing measures estimated at £0m (£990m). Energy assessors will incur the cost of obtaining accredited status £0m (£5m). The Government will face £0m (£36m) of the scheme administration cost.

Other key non-monetised costs by 'main affected groups'

One of the knock on effects of improving an enterprise's energy efficiency is that some of the financial savings may be spent on energy consuming goods and services: the rebound effect. This means that the overall impact on energy consumption is smaller (although businesses will benefit from the additional energy consumption). This reduction in benefits (cost) has not been quantified.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate			0	**0**

Description and scale of key monetised benefits by 'main affected groups'

The main groups benefiting from the policy will be large enterprises and wider society. The large enterprises will benefit from energy savings estimated at £0m (£2.5bn), which will lead to lower energy bills.
The wider society will benefit from resulting improved air quality estimated at £0m (£380m); non-traded carbon savings estimated at £0m (£170m); and traded carbon allowance savings estimated at £0m (£160m).

Other key non-monetised benefits by 'main affected groups'

Cost-effective energy efficiency measures will reduce energy bills. For companies this translates into financial savings that can be reinvested for different purposes such as growing the business, leading also to enhanced competitiveness. This bolsters productivity, increasing growth and reducing inflation. ESOS will also stimulate growth in the energy efficiency sector. In addition, public disclosure could provide a reputational incentive and a tool to raise the profile of energy efficiency within an enterprise, which will make it more likely that measures are implemented. There may be potential benefits (reduced enforcement costs) from public disclosure.

Key assumptions/sensitivities/risks **Discount rate (%)** 3.5

The analysis is significantly affected by the energy saving assumption used to estimate the benefits, as demonstrated by the sensitivity analysis. Other key sensitivities are the capital costs and the duration of the energy savings. A key risk is that the installation of energy efficiency measures results in a rebound effect, which will potentially decrease energy savings and reduce the benefits.

BUSINESS ASSESSMENT (Option 3)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: 3	**Benefits:** 0	**Net:** -3	Yes	IN

Summary: Analysis & Evidence

Policy Option 4

Description: Minimum requirements with cost recovery (notification with administration and compliance costs recovered from businesses)

FULL ECONOMIC ASSESSMENT

Price Base Year 2013	PV Base Year 2013	Time Period Years 16	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High:** Optional	**Best Estimate:** -1

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate	0		0	**1**

Description and scale of key monetised costs by 'main affected groups'

The costs of implementing this option will be borne by large enterprises, energy assessors and Government. Around 7,300 large enterprises will face assessment costs estimated at £0m (£100m when measured against a no directive baseline), the administrative burden estimated at £1m (£120m) and the capital cost and hassle cost of implementing measures estimated at £0m (£990m). Energy assessors will incur the cost of obtaining accredited status £0m (£5m). The Government will face £0m (£9m) of the scheme administration cost estimated and businesses the remaining £0m (£27m).

Other key non-monetised costs by 'main affected groups'

One of the knock on effects of improving an enterprise's energy efficiency is that some of the financial savings may be spent on energy consuming goods and services: the rebound effect. This means that the overall impact on energy consumption is smaller (although businesses will benefit from the additional energy consumption). This reduction in benefits (cost) has not been quantified.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate			0	**0**

Description and scale of key monetised benefits by 'main affected groups'

The main groups benefiting from the policy will be large enterprises and wider society. The large enterprises will benefit from energy savings estimated at £0m (£2.5bn), which will lead to lower energy bills.
The wider society will benefit from resulting improved air quality estimated at £0m (£380m); non-traded carbon savings estimated at £0m (£170m); and traded carbon allowance savings estimated at £0m (£160m).

Other key non-monetised benefits by 'main affected groups'

Cost-effective energy efficiency measures will reduce energy bills. For companies this translates into financial savings that can be reinvested for different purposes such as growing the business, leading also to enhanced competitiveness. This bolsters productivity, increasing growth and reducing inflation. ESOS will also stimulate growth in the energy efficiency sector. There may be potential benefits (reduced enforcement costs) from notification of compliance.

Key assumptions/sensitivities/risks **Discount rate (%)** 3.5

The analysis is significantly affected by the energy saving assumption used to estimate the benefits, as demonstrated by the sensitivity analysis. Other key sensitivities are the capital costs and the duration of the energy savings. A key risk is that the installation of energy efficiency measures results in a rebound effect, which will potentially decrease energy savings and reduce the benefits.

BUSINESS ASSESSMENT (Option 4)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: 2	**Benefits:** 0	**Net:** -2	Yes	IN

Summary: Analysis & Evidence

Policy Option 5

Description: Central reporting of comprehensive auditing results to scheme administrator

FULL ECONOMIC ASSESSMENT

Price Base Year 2013	PV Base Year 2013	Time Period Years 16	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High:** Optional	**Best Estimate:** -19

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate	0		1	**19**

Description and scale of key monetised costs by 'main affected groups'

The costs of implementing this option will be borne by large enterprises, energy assessors and Government. Around 7,300 large enterprises will face assessment costs estimated at £0m (£100m when measured against a no directive baseline), the administrative burden estimated at £19m (£140m) and the capital cost and hassle cost of implementing measures estimated at £0m (£990m). Energy assessors will incur the cost of obtaining accredited status £0m (£5m). The Government will face £0m (£36m) of the

Other key non-monetised costs by 'main affected groups'

One of the knock on effects of improving an enterprise's energy efficiency is that some of the financial savings may be spent on energy consuming goods and services: the rebound effect. This means that the overall impact on energy consumption is smaller (although businesses will benefit from the additional energy consumption). This reduction in benefits (cost) has not been quantified.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate			0	**0**

Description and scale of key monetised benefits by 'main affected groups'

The main groups benefiting from the policy will be large enterprises and wider society. The large enterprises will benefit from energy savings estimated at £0m (£2.5bn), which will lead to lower energy bills.
The wider society will benefit from resulting improved air quality estimated at £0m (£380m); non-traded carbon savings estimated at £0m (£170m); and traded carbon allowance savings estimated at £0m (£160m).

Other key non-monetised benefits by 'main affected groups'

Cost-effective energy efficiency measures will reduce energy bills. For companies this translates into financial savings that can be reinvested for different purposes such as growing the business, leading also to enhanced competitiveness. This bolsters productivity, increasing growth and reducing inflation. ESOS will also stimulate growth in the energy efficiency sector. There are potentially wider benefits to society that could be gained for effective use of the information collected thought ESOS assessments. There may be potential benefits (reduced enforcement costs) from central reporting.

Key assumptions/sensitivities/risks **Discount rate (%)** 3.5

The analysis is significantly affected by the energy saving assumption used to estimate the benefits, as demonstrated by the sensitivity analysis. Other key sensitivities are the capital costs and the duration of the energy savings. A key risk is that the installation of energy efficiency measures results in a rebound effect, which will potentially decrease energy savings and reduce the benefits.

BUSINESS ASSESSMENT (Option 5)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: 2	**Benefits:** 0	**Net:** -2	Yes	IN

Summary: Analysis & Evidence

Policy Option 6

Description: Mandatory site audits with display energy certificates for buildings and notification to scheme administrator

FULL ECONOMIC ASSESSMENT

Price Base Year 2013	PV Base Year 2013	Time Period Years 16	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	**High:** Optional	**Best Estimate:** -670

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate	0		44	**670**

Description and scale of key monetised costs by 'main affected groups'

The costs of implementing this option will be borne by large enterprises, energy assessors and Government. Around 7,300 large enterprises will face assessment costs estimated at £590m (£690m when measured against a no directive baseline), the administrative burden estimated at £70m (£190m) and the capital cost and hassle cost of implementing measures estimated at £0m (£990m). Energy assessors will incur the cost of obtaining accredited status £13m (£19m). The Government will face £0m (£36m) of the scheme administration cost.

Other key non-monetised costs by 'main affected groups'

One of the knock on effects of improving an enterprise's energy efficiency is that some of the financial savings may be spent on energy consuming goods and services: the rebound effect. This means that the overall impact on energy consumption is smaller (although businesses will benefit from the additional energy consumption). This cost has not been quantified.

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate			0	**0**

Description and scale of key monetised benefits by 'main affected groups'

The main groups benefiting from the policy will be large enterprises and wider society. The large enterprises will benefit from energy savings estimated at £0m (£2.5bn), which will lead to lower energy bills.
The wider society will benefit from resulting improved air quality estimated at £0m (£380m); non-traded carbon savings estimated at £0m (£170m); and traded carbon allowance savings estimated at £0m (£160m).

Other key non-monetised benefits by 'main affected groups'

Cost-effective energy efficiency measures will reduce energy bills. For companies this translates into financial savings that can be reinvested for different purposes such as growing the business, leading also to enhanced competitiveness. This bolsters productivity, increasing growth and reducing inflation. ESOS will also stimulate growth in the energy efficiency sector. The requirement to visit all sites is likely to lead to more opportunities being identified and more detailed recommendations being made, therefore this may result in higher energy savings.

Key assumptions/sensitivities/risks **Discount rate (%)** 3.5

The analysis is significantly affected by the energy saving assumption used to estimate the benefits, as demonstrated by the sensitivity analysis. Other key sensitivities are the capital costs and the duration of the energy savings. A key risk is that the installation of energy efficiency measures results in a rebound effect, which will potentially decrease energy savings and reduce the benefits.

BUSINESS ASSESSMENT (Option 6)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs: 56	**Benefits:** 0	**Net:** -56	Yes	IN

Evidence Base

1. Summary

Article 8 of the Energy Efficiency Directive requires Member States to establish an energy audits regime under which all large enterprises conduct an audit once every four years. The Government is introducing the Energy Saving Opportunity Scheme (ESOS) to meet this requirement. An ESOS assessment will need to cover an enterprise's buildings, industrial processes and transportation operations, and include recommendations around what the enterprise can do to reduce its energy consumption.

This intervention is expected to address a number of market failures that prevent enterprises investing in energy efficiency. These include a lack of detailed information on the opportunities for energy efficiency, an underdeveloped market and information asymmetries within enterprises.

The objectives of ESOS are to:

- Provide large enterprises with enterprise-specific information about how they can make energy savings,
- Stimulate the take-up of cost-effective energy efficiency measures,
- Minimise the cost to businesses of complying with the Directive, and
- Maximise the synergies with existing policies.

The Government is conducting an open consultation on the most appropriate way to implement the minimum requirements of Article 8. Options 1-4 presented in this Impact Assessment represent different approaches to implementing the minimum requirements. Option 5 and 6 go beyond the minimum requirements, but may result in higher overall benefits to the UK.

There is a significant level of uncertainty around the costs and benefits of implementing the requirements of the Directive. The analysis conducted for this Impact Assessment suggests that around 7,300 enterprises are likely to fall within the scope of the policy. These enterprises occupy between 170,000 and 200,000 buildings (of which 8,000 to 10,000 are industrial plants) and consume about a third of UK energy demand.

The development of ESOS will need to take into account a number of existing policies already in place. As Section 6.1 sets out, between 4,400 and 6,400 large enterprises are already measuring and reporting on their energy consumption under existing policies. However, given that the energy audits requirement in the Directive goes beyond measurement of consumption to include detailed recommendations for improvements, the policy is expected to have an additional impact on top of existing policies.

The evidence base on the impact of energy audits is limited. The analysis therefore uses a range of illustrative assumptions to estimate the benefits from ESOS assessments, which have been informed by a review of the evidence available. These assumptions suggest that ESOS will generate annual savings of around 3.3TWh per year, of which 2.5TWh from buildings and industrial processes and 0.8TWh from transport (which is equivalent to an average energy saving per enterprise of 0.7%). These energy savings are estimated to generate benefits to the UK worth between £1.6bn and £4.8bn over the period 2015 to 2030.

This estimate of energy savings delivered in buildings and industrial processes has been compared with the technical potential for energy efficiency in these sectors. The analysis presented in Section 6 suggests that there are 43TWh of potential savings with a payback of less the 2 years in scope of the policy (about 13% of energy consumption in these sectors). An annual saving of 2.5TWh in these sectors is therefore equivalent to around 6% of ESOS assessment recommendations being implemented.

The most significant elements of the costs of the policy are the capital and hassle costs of implementing assessment recommendations (£1bn over the period). For options 1-5, the cost of conducting ESOS assessments themselves is around £100m and in addition the administrative burden to enterprises in scope of the policy is £120m - £160m. The accreditation and scheme administration regime is estimated to cost £41m over the period.

In addition to the monetised cost and benefits, there are a number of wider costs and benefits discussed in Section 7. These include:

- The impact of energy efficiency on economic growth, productivity and competitiveness,
- The direct and indirect rebound effect (which can reduce the energy savings delivered),
- The impact of some policy options on the information asymmetries within enterprises, and
- The social benefits of applying the information collected by ESOS assessors to a wider range of uses.

The consultation is seeking evidence on calculating the impact of the options set out in the consultation document and this Impact Assessment.

2. Problem under consideration

The EU Energy Efficiency Directive (2012/27/EU) entered into force on 14 November 2012.[1] Article 8 of the Directive requires Member States to establish an energy audits regime under which all non-SME enterprises conduct an ESOS assessment by December 2015 and, thereafter once every four years. The ESOS assessments will need to include a detailed review of the energy consumption of an enterprise and identify the scope for improving the energy efficiency of its operations. An exemption to the auditing requirement is available for enterprises that have implemented certain energy or environmental management systems. EU member states are required to transpose the majority of the Directive's provisions into national law by June 2014.

3. Rationale for intervention

The Government's 2012 Energy Efficiency Strategy[2] outlines four categories of market failures that prevent firms making otherwise cost effective energy efficiency investments; information failures, misaligned financial incentives, embryonic markets and undervaluing energy efficiency. These market failures are interrelated and work together to reduce investment in energy efficiency. Solving one area of market failure would not be enough on its own to realise the full potential for cost-effective energy efficiency. The main market failure that will be addressed by the introduction of ESOS assessments is the information failures, although the impact of the other market failures will also be reduced.

[1] 14.11.2012 OJEU L315/17 Volume 55

[2] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65602/6927-energy-efficiency-strategy--the-energy-efficiency.pdf

One of the characteristics of the energy efficiency market is a lack of access to trusted and appropriate information. Where information is available, it may be generic, and not tailored to specific circumstances, which means that enterprises are not able to properly assess the benefits of an energy efficiency investment. Acquiring information, especially of the specific and tailored type, is costly and businesses may not recognise it as a valuable use of time and resources. While information is available about overall energy consumption, it is often difficult to relate that to individual activities in order to identify opportunities to make energy efficiency improvements.

The informational market failure contributes to the embryonic state of the current energy efficiency market. Without detailed, accurate and specific information it is difficult for firms to know what kinds of investments they can make in energy efficiency, and therefore they do not demand these services. For example, this has meant that the market, for advice has not developed. Without a catalyst to promote greater interest in energy efficiency investments, there is the risk of a continued cycle of underinvestment where neither the demand nor supply side develops.

The lack of tailored information means that energy efficiency opportunities are often poorly or misunderstood by decision makers within companies. As a consequence energy efficiency is undervalued relative to other investment options and not prioritised. Outside of the energy intensive industry sectors, energy bills are only a small proportion of business costs. If the relative gain is small, then the hassle costs can act as a significant barrier, especially if there is uncertainty around the benefits of the investment. While hassle costs are not in themselves a market failure, they compound the impact of other barriers, reducing investment in energy efficiency.

In addition, research has highlighted that the size, structure and sector of an enterprise affects its approach to energy efficiency.[3] For example, giving energy management responsibilities to staff lower down in the hierarchy from senior executives can create information asymmetry and principal-agent issues within enterprises. Energy consumption will be less salient to senior managers when they are not responsible for it, yet these individuals will make the strategic decisions that influence its consumption.

4. Policy objective

The objectives of ESOS are to:

- Provide large enterprises with enterprise-specific information about how they can make energy savings,
- Stimulate the take-up of cost-effective energy efficiency measures,
- Minimise the cost to businesses of complying with the Directive, and
- Maximise the synergies with existing policies.

As set out in the Governments Energy Efficiency Strategy, there are a wide range of benefits from improving the energy efficiency of the UK economy.

- Cost-effective energy efficiency measures will reduce energy bills. For companies this translates into financial savings that can be reinvested for different purposes such as growing the business, leading to enhanced competitiveness. This bolsters productivity, increasing growth and reducing inflation. For example, one study of the

[3] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65601/6925-what-are-the-factors-influencing-energy-behaviours.pdf

Government's energy efficiency policy between 2000 and 2007 estimated that existing policies increased the annual rate of economic growth by around 0.1 percentage point within that period.[4] The study also estimated that these policies resulted in roughly 270,000 additional jobs in 2010 owing to the cumulative impact of higher growth.

- Improving energy efficiency is a cost effective way to reduce carbon emissions.Energy efficiency will need to play a significant role in meeting the Government's long term carbon emission reduction targets. The Carbon Plan 2050 Scenarios show that meeting our 80% emissions reductions could require per capita energy savings of between 21% and 47% between 2011 and 2050.
- Reducing energy demand through energy efficiency also improves security of supply. It reduces the UKs exposure to volatile international energy markets and means less energy infrastructure is required, lowering the overall costs of the energy system. Energy and climate change policies (including energy efficiency measures and a larger share of nuclear and renewables) could reduce the UK's sensitivity to spikes in global oil, gas and coal prices by 30% in 2020 and 60% in 2050.[5]

4.1. Requirements of the Directive

Article 8 and Annex VI of the Energy Efficiency Directive set out the requirements of the ESOS regime. All non-SMEs will be required to have an ESOS assessment by 5 December 2015, and thereafter every four years. The directive defines an SME as an enterprise with less than 250 employees and either annual turnover of less than €50m or an annual balance sheet less than €43m (or both). This includes private and non-profit sector enterprises, but not the public sector.

The ESOS assessment itself should be:

- Based on measured operational data on energy consumption,
- Comprise a detailed review of the energy consumption of an enterprise's buildings, industrial processes and transport operations,
- Be proportionate and sufficiently representative to permit drawing a reliable picture of overall energy performance and the reliable identification of the most significant opportunities for improvement, and
- Should allow detailed and validated calculations for proposed measures to provide clear information on potential savings.

The UK is required to define a minimum standard based on these requirements, and put in place quality assurance processes to check the ESOS assessments conducted meet it. The ESOS assessments will need to be carried out in an independent manner by qualified, accredited experts (who may be in-house staff of the enterprise concerned). Enterprises may be exempt from the ESOS requirement if they have implemented certain energy or environmental management systems. The requirements apply UK wide. Under Article 24 of the Directive, the UK is also required to report every three years on the number of enterprises in scope of the ESOS requirement and the number of ESOS assessments conducted.

4.2. Non-regulatory approaches

[4] Barker, T., Ekins, P., & Foxon, T. (2007). The macro-economic rebound effect and the UK economy. Energy Policy, 4935-4946.

[5] 2011. Oxford Economics: Fossil fuel prices and a low carbon economy Dec 2011

There is a small existing market for energy assessment services, suggesting it could be possible to capture the benefits of the policy by relying on large enterprises conducting energy assessments voluntarily (either independently or through industry led self-regulation). However, the Directive places a legal obligation on the UK to make it a legal requirement for non-SMEs to undertake energy audits and to put in place an enforcement regime to ensure compliance. The Directive also sets out very clear prescriptive requirements that must be transposed in law setting out, amongst other things, the elements that audits must contain.

An analysis of existing policies, presented in Annex F, has concluded that they do not adequately meet the UK's legal obligations under the Directive. Nor does the Directive allow for transposition through self-regulatory means. There are therefore no do-nothing or self-regulatory options available.

Attempting to transpose the requirements of Article 8(4) of the Directive by means of a non-regulatory approach would give rise to an infraction risk for the UK. It would not lead to a legally binding requirement for non-SMEs to conduct an energy audit and there is a considerable risk that some large enterprises would not voluntarily implement the requirements. Were the Commission to instigate infraction proceedings in such circumstances, there is a high risk of it being successful. Clearly defining which enterprises are required to comply with the auditing requirement in secondary legislation (supported by guidance developed with industry) would give greater certainty to businesses and ensure the UK fully complies with its obligations under EU law.

5. Description of options

As noted above, an analysis of existing policies has concluded that they do not adequately meet the UK's legal obligation under the Directive (see Annex F to this document, and chapter 2 of the Consultation Document, for details). The requirements of Article 8 of the Directive are mandatory for the UK and must be transposed before 5 June 2014. The options appraisal focuses on the least cost way of implementing the requirements of the Directive, and then the costs and benefits of any additional elements that could improve the net benefit to the UK.

We are consulting on a number of policy decisions on the exact details of the ESOS. The analysis has focused on the aspects of the policy that are judged to have a significant impact of the costs and benefits (given current evidence). The directive applies to the UK and the current working assumption is that the same policy framework will be adopted by the Devolved Administrations.

5.1. Description of ESOS

The Government will set out in legislation and supporting guidance what enterprises are required to do to comply with the ESOS.
Article 8(6) of the Directive provides an 'exemption' from the energy auditing requirement for 'enterprises that are implementing an energy or environmental management system (EMS) certified by an independent body according to the relevant European or International Standards'. This only applies where Member States 'ensure that the management system concerned includes an energy audit on the basis of the minimum criteria.'
This means there will be at least two routes firms could use to comply; conducting an ESOS assessment or implementing an EMS.

- For the ESOS compliance route, enterprises will have an assessment conducted by a suitably qualified or accredited ESOS assessor.
- For the EMS compliance route, enterprises will need to ensure the implementation of their EMS has been certified in accordance with relevant European or International standards and that as part of their EMS they are carrying out a qualifying energy audit.

ESOS assessment compliance route

- An ESOS assessment will be a detailed analysis of an enterprise's energy consumption and potential for making energy efficiency improvements. The energy consumption will need to be based on operational data (and cover the load profile where appropriate). The assessment should:
- Be proportionate but sufficiently representative to identify the cost effective opportunities to improve the energy efficiency of the enterprise,
- Provide robust, quantified estimates of energy savings available from implementing recommendations,
- Be conducted by a sufficiently qualified assessor and cover the enterprise as whole. This does not preclude the assessment being conducted by a team, with one professional approving the assessment as a whole but using specialists for different elements of the work.

Some more detailed advice for enterprises on interpreting the requirements of ESOS will be set out in non-statutory guidance. But significant elements of the ESOS assessment will be left to the discretion of the professional assessor. These include:

- The number of sites the assessor/team needs to visit,
- The actual recommendations that are made, and
- The level of detail that different elements of the enterprises energy use are afforded (for example, the assessment of a firm's transport energy use should be proportionate to transports' share of total energy use).

EMS compliance route

The Directive states that enterprises that have implemented an EMS certified by an independent body according to relevant European or International Standards may be exempted from the separate mandatory auditing requirement created by the Directive.[6] As set out in Chapter 4 of the Consultation Document, Government is consulting on which standards meet these requirements. Existing standards that are expected to meet the requirements include ISO 50-001 (which has been implemented by around 40 companies in the UK)[7] and ISO 14-001 (where undertaken with an energy efficiency audit). The consultation will also seek to establish the extent to which UK-specific initiatives, such as the Carbon Trust Standard, meet the requirements. The Carbon Trust Standard has been adopted by nearly 1,000 enterprises, around two thirds of which have more than 250 employees.

In cases where enterprises use such relevant existing standards, they will still be subject to enforcement and compliance checks, in line with the options outlined in this Impact Assessment. The Government may choose to designate existing or new EMS standards

[6] Note the definition of EMS is broader than simply a computer based energy use in information system and includes having in place wider organisational energy management procedure and processes.

[7] British Standards Institute

as compliant with the Directive requirements. It may also provide the flexibility to accredit other suitable organisations to certify individual EMS. This would allow the market to bring forward a range of EMS' that could be used by large enterprises to comply.

There is currently no robust data on the cost of implementing an EMS, or the number of enterprises that may choose to use the EMS compliance route. The cost analysis is therefore based on the assumption that all large enterprises meet the legal requirement by hiring an external ESOS assessor. In reality many enterprises may use accredited internal staff, or use an Energy Management System instead. Enterprises will adopt which ever compliance route is best suited to their circumstances. The assumption that all firms adopt the same compliance route is therefore a conservative one; some firms will be able to meet the requirements at a lower cost.

It should be noted that some enterprises may choose to go beyond the minimum requirements of the directive when conducting their assessment. Given this would be voluntary, the costs have not been included in the analysis.

Qualification and Accreditation of ESOS assessors

The Directive requires the Government to ensure that ESOS assessments are conducted by experts who are qualified and/or accredited or alternatively are implemented and supervised by independent authorities. The Government will therefore consult on implementing an accreditation and quality assurance regime to ensure ESOS assessments are of a sufficiently high standard. The accreditation of ESOS assessors will ensure they are qualified to conduct an assessment of complex enterprises. This is likely to include random checks of a sample of assessors' reports to ensure that assessments are conducted to an adequate standard (this function may be conducted by the scheme administrator or another organisation).

The Government is consulting on what regime would be most effective at enforcing the requirements of the Directive in line with better regulation principles. Options 1, 2, 3 and 4 below represent alternative options for implementing the minimum requirements of Article 8. Options 5 and 6 go beyond the minimum requirements of the Directive, but potentially give rise to larger net benefit to the UK.

Option 1: Minimum requirement (scheme administration through central body, ex-post survey of take up)

The scheme administration body will monitor large enterprises (as defined by the Directive) to ensure they have carried out an assessment; or have implemented an EMS. A random sample of firms will be checked each year to ensure they are compliant with the requirements, with penalties applied to those that have not. It is likely that the scheme administrator body would take a risk-based approach to targeting large enterprises. The compliance check could take the form of a letter from the scheme administration to the large enterprise under consideration requesting confirmation of their compliance (for example – a copy of the ESOS assessment, or a letter of confirmation from an accredited ESOS assessor). It is also likely that, in line with better regulation principles and as required by the Directive, the scheme administrator would focus on bringing participants into compliance, with formal enforcement action (including penalties where appropriate) being used only as a last resort.

Under this option, the initial compliance requirement placed on each large enterprise is that they undertake the assessment. The burden for any subsequent enforcement action is that they respond if asked by the scheme administration, to confirm that they are compliant with the Directive. For the UK to meet its legally-binding reporting requirements, it would also have to gather data on the number of ESOS assessments conducted under the policy, which is likely to be collected through surveys of large enterprises.

Option 2: Minimum requirement (scheme administration through central body, with notification of compliance)

Option 2 has the same enforcement requirement as Option 1, with a central scheme administrator checking the compliance of a random sample of large enterprises. It also includes a requirement that each large enterprise notify the scheme administrator if they are in scope of the Directive, and that they have undertaken an assessment. This data would be used to meet the UKs reporting requirements under the Directive.[8] Under this option, the initial compliance requirement placed on each large enterprise is that they undertake the assessment and notify the scheme administrator that they have done so.

Option 3: Minimum requirement (scheme administration through central body and public disclosure)

This option has the same enforcement requirement as Option 1, with a central scheme administrator checking the compliance of a random sample of enterprises. It differs from Option 1 by including a requirement for enterprises to publish a narrative summary of each ESOS assessment they have undertaken. This could consist of a short summary of the results of each assessment and any actions taken in the Directors Report (or Strategic Report) or corporate annual report (or via another route if such reports are not routinely published).

The scheme administrator will take the same risk-based approach to targeting large enterprises as for Option 1. In the first instance, the scheme administrator can confirm whether a targeted large enterprise is compliant by checking their publically available information. In cases where this information is not available, the administrator would seek to promote compliance; but *in extremis*, penalties could be imposed.

Under this option, whilst the initial compliance requirement placed on a large enterprise is increased by the need for public disclosure, the burden for any subsequent enforcement action is reduced. This is because the scheme administrator can check publically available documents (for instance a company's annual report) to confirm whether an enterprise is compliant.

Option 4: Minimum requirements with cost recovery (notification with administration and compliance costs recovered from businesses)

This option has the same enforcement requirement as Option 1, with a central scheme administrator monitoring the compliance of a random sample of enterprises. This option also has the same reporting requirements as for Option 2, with each large enterprise reporting that they have undertaken an ESOS assessment.

[8] The UK is required to provide data on the number of companies covered by the policy and numbers of ESOS assessments conducted.

This option differs from Option 2 in that administrative and compliance costs incurred by the scheme administrator are either from the affected enterprises or from their ESOS assessors. In line with HMT rules, certain costs cannot be recovered from businesses and will be funded by HMG (these include start-up costs and enforcement costs).

Large enterprises or their ESOS assessors would inform the scheme administrator that they are in scope, have undertaken an ESOS assessment and pay an administration fee (The administration fee could be paid annually, and at the same time as notifying the scheme administrator). The scheme administrator will continue to sample large enterprises (through a risk-based approach) to check whether they are compliant with the Directive (as for Option 1).

Option 5: Central reporting of comprehensive auditing results to scheme administrator

This option has the same enforcement requirement as Option 1, with a central scheme administrator checking the compliance of a random sample of large enterprises. This option retains the requirement of Option 2 for the large enterprise to notify the scheme administrator that they have undertaken an ESOS assessment.

This option differs from Option 2 by including the requirement to report on the actual results of the ESOS assessment (for example, the quantity of energy savings identified and the recommendations made) to a central authority (such as the scheme administrator), rather than just core minimum data (for example, confirmation that an assessment has been conducted). Following the assessment, the enterprise would be required to submit information on its findings to a central authority using a standardised template (this reporting may be carried out by the assessor on the enterprise's behalf).

With respect to ex-post administrative burdens for businesses, the scheme administrator can confirm whether a large enterprise chosen by random sampling is compliant, by checking if the appropriate information has already been supplied. This could be done without notifying the large enterprise. This would reduce the subsequent administrative burden on enterprises in scope of the policy.

Option 6: Mandatory site audits with display energy certificates for buildings and notification to scheme administrator

This option extends what is required within an ESOS assessment under Option 1 to include a mandatory visits to all sites and the production of a Display Energy Certificate (DEC) for all buildings over 250 m^2. The scheme administrator would check compliance with the Directive in the same way as described in Option 1, by ex-post monitoring of a random sample of large enterprises. Each large enterprise would be required to notify the scheme administrator that they are in scope for the Directive and have undertaken an ESOS assessment, as described in Option 2.

Box 1: Enforcement, qualification / accreditation and market incentives

The implementation of ESOS will create different incentives for firms and assessors. There is a risk that the structure of the scheme creates incentives that undermine the intention of the policy to help firms identify cost effective energy efficiency opportunities.

For example, firms will have an incentive to comply with the auditing requirements at least cost. Some assessors may respond by decreasing the quality of their work and charging lower prices. Similarly, EMS providers certified to an adequate standard might seek to increase their market share by providing lower quality services and charging lower fees.

Firms that did want to hire a high quality assessor may not be able to distinguish them from lower quality assessors. This could trigger a 'race to the bottom' in the sector, as higher quality assessor would be unable to charge higher fees. This issue is exacerbated by the under developed energy efficiency market, in which firms lack reliable information on the services available.

The qualification and/or accreditation requirements and the enforcement regime will mitigate this to some extent. The scheme administrator will check the compliance of a sample of enterprises. A body (the qualification / accreditation body or the scheme administrator) will be will be responsible for checking the quality of the ESOS assessments, with possible sanctions including potentially loss of accreditation to punish poor ESOS assessors. A greater number of checks will increase the probability that such an assessor will be discovered, therefore reducing his incentive to provide low quality services.

In a properly functioning market, firms should be able to demonstrate or advertise the quality of their services to prospective customers. The qualification and/or accreditation regime will therefore need to ensure assessment are of an adequate minimum standard, whilst also providing space for a differentiated market to grow to serve those firms wanting to go beyond the legal minimum.

There is also a risk that in the absence of clear information on the costs of assessment, and what needs to be included, that some assessor may have an incentive to overcharge for their services, given the increase in demand created by the policy. However, a competitive assessment market will drive out of business assessors who overcharge for ESOS assessments. The publication of guidance by the Government or a delivery partner will also help firms understand what standard is required to comply.

Were the Government ultimately to require some level of public disclosure then this will also affect incentives. For example, requiring firms to publically declare what action they had taken following an ESOS assessment may create a reputational incentive to implemented more recommendations. However, public disclosure may also create an incentive for assessor to provide a smaller number of recommendations, and enable firms to declare they have done all they can to improve their energy efficiency.

6. Cost benefit analysis of the options

There is limited evidence available of the likely impact of the ESOS. The Impact Assessment therefore uses a combination of quantitative and qualitative analysis, with the

latter being used when there is insufficient evidence to provide robust quantitative estimates. The quantitative analysis of the costs and benefits is structured as follows;

1. Quantify scope of policy, in terms of energy, enterprises, buildings, industrial processes and vehicle fleets.
2. Identify the overlaps with existing policies; which affect both the costs and benefits of the policy.
3. Estimate the benefits using a high level assumption, supported by the evidence available.
4. Estimate the costs, including the cost of conducting the ESOS assessments, the administrative burden to businesses and government, and the cost of implementing recommendations.
5. Use breakeven analysis to estimate the additional energy savings that would be required to cover the additional cost of each option.

The quantitative analysis is supported by a qualitative assessment of the non-quantified costs and benefits, and a multi-criteria analysis which assesses each option against the key objectives of the policy.

Time period for the appraisal is 2015 (when the first round of assessments will be implemented) to 2030. Cost and benefits incurred beyond 2030 are therefore not included in the analysis. This is likely to underestimate the Net Present Value (NPV) of the policy, as some energy efficiency measures will last for a number of years and so continue to deliver savings beyond 2030.

6.1. Scope of the policy

The requirements of the Directive go beyond the measurement of energy use to include a detailed analysis of the scope for energy efficiency improvements. Depending on the enterprise, this may require information to be collected on:

- Building fabric, lighting and heating systems,
- Energy efficiency of different element of industrial processes,
- Vehicle types and fuel efficiency of vehicle fleets, and
- The enterprise's energy management practices.

This section sets out the estimated number of enterprises, buildings, industrial processes and vehicles that are in scope of the policy, and the energy they consume. It also considers the extent to which these enterprises and the energy they consume is already covered by existing policies, which will affect both costs and benefits of ESOS assessments.

6.1.1. Enterprises in scope of policy

Chapter 3 of the Consultation Document discusses the definition of enterprises for the purposes of the ESOS. For the purposes of this analysis an enterprise is assumed to be in scope of the policy if it employs more than 250 people and has an individual VAT / PAYS registration number. In 2012 there were **7,265 large enterprises** that meet these criteria. These enterprises employed around 10.7m people and had a turnover of over £1.6tr.[9]

[9] *BIS Business population statistics, 2012,* https://www.gov.uk/government/publications/bis-business-population-estimates

Table 1 presents the breakdown by sector, which is assumed to remain constant from 2015 to 2030.

Table 1: Number of enterprises in scope of the ESOS, by sector

	Number of large enterprises
Commercial	4,780
Industrial	1,330
Transport	345
Non-profit	810
Total	7,265

Source: Business population statistics, 2012

6.1.2. Buildings and industrial processes in scope of policy

The Consultation Document sets out that, for options 1 – 5, ESOS assessment is likely to require a visit to some of an enterprise's sites. The number of buildings occupied by large enterprises has therefore been used as a proxy for the complexity of carrying out an ESOS assessment. It is estimated that in 2010, around 170,000 – 200,000 buildings were occupied by large enterprises. The majority of these (55%) were shops smaller than 500m^2 and around 11% were offices. Around 8,000 – 10,000 (5%) were classified as factories, which is used as proxy for the number of industrial processes in scope of the policy. Table 2 sets out the breakdown of significant sites owned by large enterprises. This Impact Assessment uses the assumption that the number and breakdown of buildings occupied by large enterprises remains constant over the period to 2030.

Table 2: Indicative breakdown of buildings in scope of policy, by type and size

	Number of buildings in each size Band (m^2)							
	<100	100 to 250	250 to 500	500 to 1,000	1,000 to 5,000	5,000 to 10,000	>10,000	Total
Industrial sites	0%	1%	1%	1%	1%	0%	1%	5%
Offices	2%	3%	2%	1%	2%	1%	0%	11%
Shops	16%	27%	12%	7%	6%	1%	0%	70%
Other	1%	2%	4%	3%	3%	1%	1%	15%
All buildings	19%	32%	19%	12%	13%	3%	2%	100%

Source: DECC VOA Non Domestic Ratings File & analysis of ExperianPH modelled company data, 2010

6.1.3. Fleets of vehicles in scope of policy

In addition to covering an enterprise's buildings and industrial processes, an ESOS assessment will need to include an assessment of energy efficiency of its transportation operations. Given the assessment will be proportionate and relevant to the enterprise, the extent to which transport is covered at all will depend on the size of the enterprise's transport operations. There is little data available on the number of large enterprises that run significant transport operations. The cost analysis therefore uses the assumption that all large enterprises in the following sectors operate fleet of vehicles (particularly HGVs) which will require an ESOS assessment:

- Wholesale and Retail Trade
- Transportation
- Construction
- Mining and Quarrying
- Electricity, Gas, Steam and Air Conditioning Supply
- Water and sewerage
- Waste Management
- Agriculture, Forestry and Fishing
- Motor Vehicles Repair

These assumptions suggest there are **1,805 fleets** in scope of ESOS (of which 345 are in the transport sector). The extent to which this figure accurately represents the number of fleets in scope is unclear. Many of these enterprises will subcontract their transport operations to SMEs, which are exempt from the directive requirements. However, there

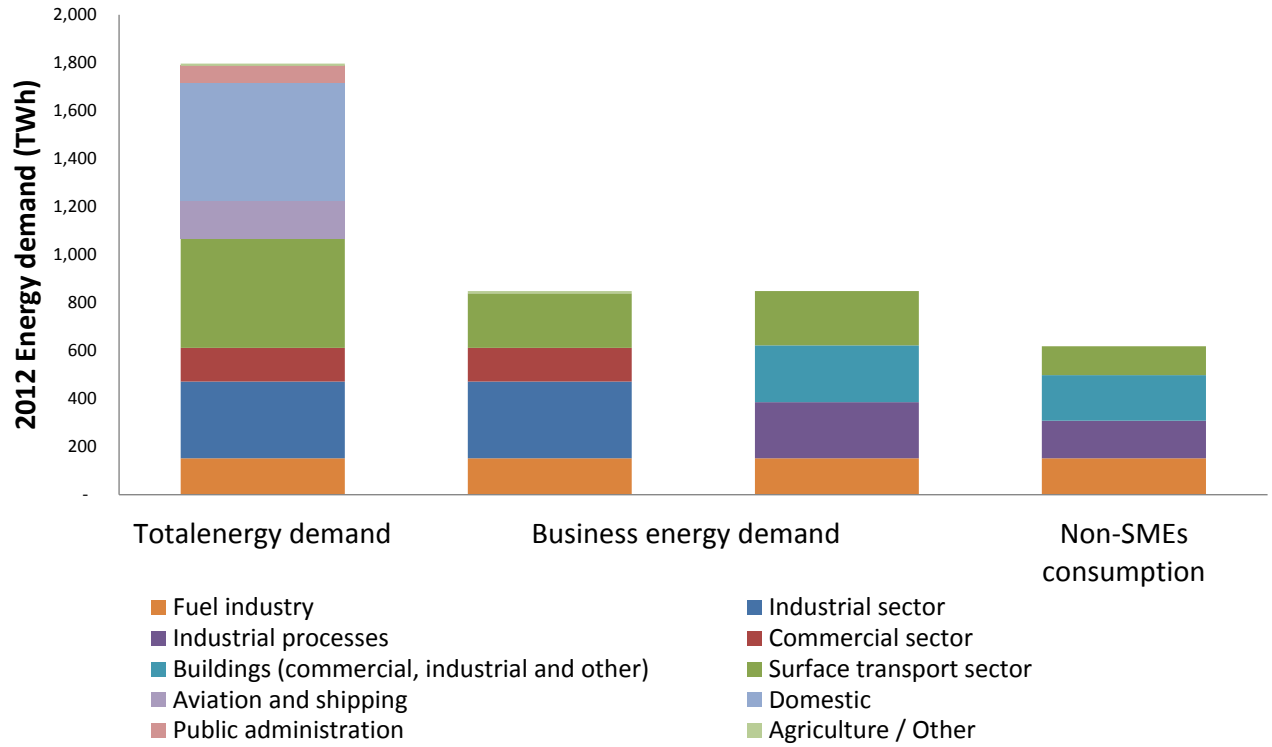
are also likely to be enterprises in other sectors which may operate fleets which would require an ESOS assessment.

6.1.4. Energy consumption in scope of policy

It's estimated that around one third (618TWh) of UK energy demand in 2012 is consumed by large enterprises and therefore falls within the scope of ESOS. Figure 1 illustrates the relationship between total UK energy demand in the industrial, commercial and business transport sectors and the proportion that is covered by the policy.

- The first column shows the total UK energy demand in 2012.
- The second column shows the share of total demand that is estimated to be consumed by businesses (excluding aviation and shipping). The business sectors share of surface transport has been estimated using a number of assumptions described in detail in Annex E.
- The third column shows the same energy use but with the industrial sector energy demand split between energy use in buildings (27%) and in industrial processes (73%).[10] The energy use by industrial buildings is grouped with the energy use by the commercial and other sectors, assuming that they are constituted entirely by buildings.
- The final column shows the amount of business energy demand that is used by non-SMEs. Details of how these estimates were developed can be found in Annex F.

Figure 1: Comparison of total industrial, commercial and transport energy consumption with energy in scope of policy



Source: DECC analysis of DECC Energy and Emissions Projections 2012 and the National Energy Efficiency Dataframework (NEED)

Total transport energy consumption 2012 was 615TWh, of which 456TWh was used by surface transport (road and rail transport) and 160TWh by aviation and shipping.

[10] Energy Consumption in the UK 2012, Table 1.14a, http://www.decc.gov.uk/en/content/cms/statistics/publications/ecuk/ecuk.aspx. Industrial sector energy use from buildings is assumed to include space heating, lighting, refrigeration and other.

We have assumed that ESOS will not lead to energy savings in the aviation and shipping sectors, although they do incur costs. Aviation is highly energy intensive and so is likely to have made cost effective efficiencies already. There are a number of complex policy issues relating to how shipping energy use should be included in scope of the ESOS, and there is currently very limited evidence on the potential for energy efficiency improvements in the sector. Business Innovation and Skills (BIS) statistics suggest there are no large shipping freight businesses which would be affected by the policy but that ten sea and coastal passenger transport businesses would need to be assessed. Chapter 4 of the Consultation Document discusses the issues relating to aviation and shipping in more detail.

6.1.5. Energy efficiency potential in scope of the policy

The Energy Efficiency Strategy identified 196TWh of socially cost effective energy savings that could be delivered through energy efficiency by 2020. Analysis of the same datasets indicates there is around 47TWh of potential savings from non-domestic buildings and industrial processes in scope of the policy in 2015 (once the impact of existing policies has been accounted for, see Annex B for details). For the non-domestic building sector the majority of the savings are from improved lighting and heating systems and controls, but also include building fabric improvements and more efficient products and appliances. In the industrial process sector, savings can be made from a wide range of measures such as installing more efficient machinery in industrial plants or using waste heat more effectively.

For the building sector, the estimate of technical potential is based on the Non-Domestic Energy and Emission Model (N-DEEM) dataset, which provides data on the total potential in non-domestic buildings and the associated capital costs. The costs are incurred upfront, and have been adjusted to include the cost of replacement for measures with a lifetime of less than 15 years (the time period of the cost benefit analysis). For industrial processes, cost and potential estimates are based on a number of datasets from AEA and Arup. Further details of the data sources can be found in Annex B.

These estimates are based on the assumption that technical potential is distributed between SME and Non-SME firms in proportion to their energy use. This will overestimate technical potential in scope if large enterprises have implemented more energy efficiency measures than SMEs.

In addition to this physical technical potential, there is often considerable scope for energy efficiency improvements to be made using equipment already in place. For example, better management of building space and water heating systems using existing controls or turning off electric systems overnight can often significantly reduce energy consumption. The potential energy saving from these behavioural and energy management measures has not been included in the analysis as there is currently little robust evidence of the scale of the contribution they can make to improving energy efficiency in large enterprises.

There is currently no comprehensive data on the potential for further energy efficiency improvements in the transport sector, or the proportion of this that might be in scope of existing policy. However, there are actions that could be taken to reduce fuel consumption for different vehicle types. These may involve changes in fleet policy, driving behaviour or operations as well as the uptake of technology measures to reduce fuel consumption.

The Energy Savings Trust's (EST) work carrying out Green Fleet Reviews gives us an indication of what types of recommendations could be made by ESOS assessors in relation to cars and vans (see box 2). These measures range from changes to fleet management and policy to the purchase of low emission vehicles. There may also be recommendations aimed at improving the energy efficiency of a company's grey fleet (cars or vans owned by employees used for business purposes) through changing how the business reimburses employees for travel or fuel costs. Other recommendations might focus on driver behaviour and incentives to reduce fuel consumption.

For HGVs, research for the Department for Transport and the Low Carbon Vehicle Partnership by Ricardo and AEA[11] suggests that there are a number of technologies that could deliver fuel efficiency savings. In addition, industry bodies such as the Freight Transport Association (FTA) and the Road Haulage Association (RHA) have identified other measures relating to driver training and performance monitoring, logistics efficiency and modal shift which may reduce fuel consumption.

As with road vehicles, there are a number of measures that may be implemented to improve the fuel efficiency of trains. These range from technologies such as regenerative braking on electric trains to behavioural measures such as eco-driver training. However, as discussed in Section 6.4.5, the Impact Assessment assumes there are no significant energy savings from the rail sector.

Box 2 Energy Saving Trust – Green Fleet Consultancy

The Energy Saving Trust receives funding from DfT to carry out a number of activities including Green Fleet Consultancy. EST carries out Green Fleet Reviews, essentially tailored audits of a business's car or van fleet. These involve detailed scrutiny of the available data on the fleet, including:

- Vehicles in the fleet
- Mileage
- Drive cycles
- Fuel consumption

As part of the Review, EST makes a suite of recommendations tailored to the individual business and its fleet. The recommendations made will depend on the payback period faced by a particular firm. For example, exemption from the congestion charge for ultra low emission vehicles in London may make buying such cars for a London-based fleet a cost-effective choice. Other recommendations include changes to fleet policy or fleet management such as the types of vehicles purchased, the lifetime of those vehicles or the ability of users to choose their own vehicles; the use of fuel cards for recording fuel purchases; and technologies such as telematics and speed limiters.

Analysis of Green Fleet Reviews carried out in 2011/12 suggest that measures taken up led to a saving of 58 litres of fuel per vehicle per annum across the 8500 vehicles covered by the review.

EST have identified several barriers that may prevent recommended measures being taken up from the Fleet Reviews including the upfront cost faced by business, the operational requirements of the business, lack of engagement from senior management

[11] Review of Low Carbon Technologies for Heavy Goods Vehicles, Ricardo Plc (2010)
Technology Roadmap for Low Carbon HGVs, Ricardo Plc (2010)
Market Background Study, AEA Technology Plc (2010)

and employee attitudes

Q1: Do you have any evidence that could improve the estimate of scope of the ESOS set out above (in terms of the number of enterprise, buildings, industrial processes and vehicles, and energy consumption covered)?

6.2. Policy context

There are a number of other policies which will interact, and in some cases overlap, with ESOS. These include the:

- CRC Energy Efficiency Scheme (CRC),
- Climate Change Agreements (CCAs) and the Climate Change Levy (CCL),
- Mandatory Greenhouse Gas reporting,
- Non-domestic Green Deal,
- Display Energy Certificates (DECs),
- Energy Performance Certificates (EPCs),
- Smart Meters
- Enhanced Capital Allowances (ECAs),
- Products policy (including EU minimum standards and energy performance labelling),
- Building regulations,
- EU Emissions Trading Scheme (ETS),
- the Carbon Price Floor (CPF),
- EU new car and van CO_2 regulations,
- Green Bus Fund,
- Energy Efficiency Design Index for new ships, and
- Industry-led action to reduce emissions in the freight sector.

A key uncertainty is what the additional impact of ESOS will be over and above these policies. The analysis assumes that the impact of the ESOS will be smaller where an existing policy is already acting to improve energy efficiency. However, the requirements of Article 8 go beyond the scope of existing policies; they will cover a larger proportion of energy demand than existing comparable policies and require the production of detailed recommendations for improving energy efficiency, which existing policies do not. The introduction of ESOS is therefore expected to have an additional impact on energy efficiency, even for enterprises already covered by existing policies.

The analysis in Annex F sets out in detail how the ESOS will fit into the existing policy landscape. This section focuses on how the interaction with existing policies will affect the costs and benefits of ESOS. The analysis focused on the overlaps with the CRC, CCA and GHG reporting, as these are the most comparable policies in terms of scale, and types of enterprises affected.

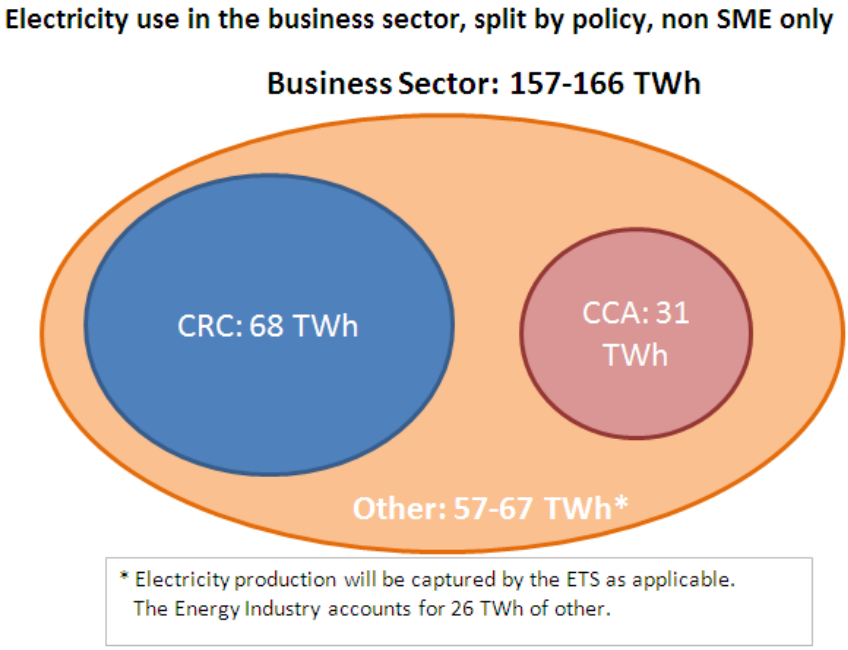
A number of existing policies already require firms to measure some of their energy use, as part of the reporting process (for example, CRC, CCAs and mandatory Greenhouse Gas reporting). Given that ESOS assessment should be able to rely on these existing data collection systems and results, these enterprises should face lower data collection costs. **Analysis of 2010-2011 CRC reporting data suggests there are between 4,400 and 6,400 large enterprises that are already reporting on their energy use under existing**

policies (with a central estimate of 5,400). This estimate is based on the following assumptions:

- All enterprises in the CRC are large enterprises (when in reality some may be SMEs that use large amounts of energy),
- For the low estimate, each Significant Group Undertaking[12] is a large enterprise
- For the high estimate, the average number of large enterprises per Significant Group Undertaking is 1.47[13], and
- All enterprises reporting under mandatory Greenhouse Gas reporting are also covered by the CRC[14].
- all large enterprises reporting under CCAs but not CRC will still face additional data collection costs (the data collected for CCA will not necessary be sufficient given it focuses on specific plants)

The central estimate has been validated using a comparison of Environment Agency CRC data collected in 2006 with Companies' House data on enterprise employment.

The Venn diagrams below illustrate the proportion of energy used by large commercial and industrial enterprises in 2010 (excluding transportation energy use) that is currently being measured and reported on under the CRC, CCA and ETS. The details of how these estimates were made can be found in Annex F.

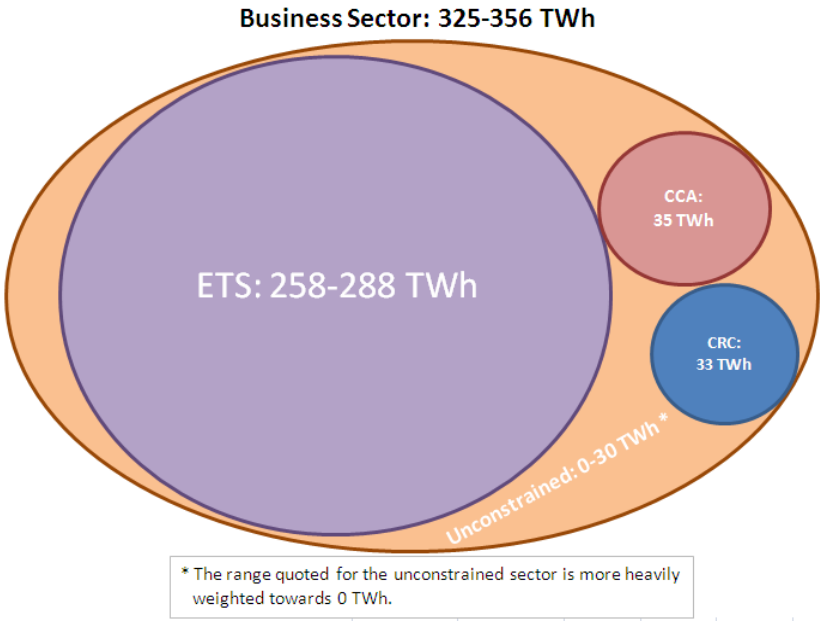


[12] A Significant Group Undertaking (SGU) is an subsidiary of a CRC participant that would be eligible to participate in their own right were they not part of a group .

[13] The CRC database includes data on the number of CCA facilities owned by CRC participants. Of firms that own at least one CCA facility, the average number is 1.47. The estimate of 6,400 large enterprises in the CRC is based on the assumption that each CCA facility is a large enterprise., and that the same ratio holds for the rest of the CRC SGUs,

[14] Annex C of the Final Impact Assessment of Mandatory Greenhouse gas reporting stated that 60 large organisations which were not already reporting under the CRC, CCAs or voluntarily would be covered by the GHG reporting requirements. That assessment was based on the assumption that 2017 firms are covered by the CRC. This Impact Assessment estimates there are between 4,400 and 6,400 large enterprises reporting under the CRC, and so has assumed a full overlap between CRC and GHG reporting.

Other energy use in the business sector, split by policy, non SME only



There are a number of policies in the transport sector aimed at reducing fuel consumption. EU regulations have set targets for improved fuel efficiency for cars and light goods vehicles (vans) out to 2020. The energy consumption baseline forecast used in this Impact Assessment takes account of the improvement in average fleet fuel efficiency out to 2020, and assumes that, post-2020, continued improvement is seen across the fleet due to fleet turnover.

The energy consumption baseline forecast also assumes that voluntary action by the road freight industry leads HGVs to improve their fuel efficiency by 5% between 2010 and 2015 with diminishing impacts thereafter. Schemes like the FTA's Logistics Carbon Reduction Scheme, in which businesses monitor and report their fuel consumption, vehicle fleet data and fleet operations, are estimated to cover around 8.5% of UK HGVs and the FTA estimates that around a third of the schemes members are non-SME businesses. For these businesses in particular, any additional impact of being assessed is expected to be small.

For buses, the Green Bus Fund provides funding to bus operators to support the purchase of low-emission buses. The baseline energy consumption forecasts used for the analysis already assume that the fund drives uptake of low-emission buses out to 2030, and as a result there may be less scope to reduce emissions further.

Q2: Do you have any evidence that could improve the estimate of size of the overlaps between the ESOS and existing polices?

6.3. Counterfactual

The UK is required to comply with the Energy Efficiency Directive, meaning there is no 'do nothing' option. The NPV and Cost to Business presented on pages 2-7 of the Impact Assessment uses the 'least cost' minimum requirement option (Option 1) as the counterfactual. However, the Impact Assessment also includes an assessment of the costs and benefits of the minimum requirements option to inform the consultation. This

option is compared against a 'no directive' baseline and provides an estimate the net impact of the A8 requirement on the UK (in line with Impact Assessment guidance).[15]

There is already an existing market for energy auditing services, although little data is available on it scale. The Green Deal business survey, published in 2011,[16] asked a number of questions about energy efficiency and included a sample of 277 businesses with more than 250 employees. It found that;

- 26% of these firms had sought advice from a specialist energy consultant or auditor,
- 33% had requested advice from the Carbon Trust,
- A further 11% had sought advice from both
- 49% of these businesses reported having an energy audit or assessment (although these were likely to have been less extensive than will be required under the Directive).

The most appropriate comparison with the requirements of the Directive is seeking advice from specialist energy consultants. However, it's not clear whether the energy assessments these firms refer to were conducted within the last four years, or if they covered the whole enterprise (as opposed to an individual building or industrial process). As mentioned above in Section 5, 40 enterprises already have ISO 50,001 and around 660 large enterprises (9%) have the Carbon Trust standard.

Given the absence of clear data on the current take up of comparable audits by large enterprises, the 'no directive' counterfactual scenario uses the illustrative assumption that 25% of firms (around 1,500) in scope of the policy will already have conducted an energy audit. These enterprises are assumed to conduct an audit or implement a qualifying EMS irrespective of the whether the policy is implemented. The cost and benefits of the policy have therefore been adjusted down by 25% (with the exception of the cost of the accreditation and enforcement regime and the administrative burden of demonstrating compliance, which will be incurred by all large enterprises). This 25% reduction is applied evenly to all energy and enterprises, irrespective for whether they are covered by existing policy.

Q3: Do you have any evidence on the extent to which large enterprises are already conducting energy audits that are comparable to the proposed ESOS assessments?

6.4. Benefits

The introduction of the ESOS will have a number of benefits. By addressing the information market failures, the policy will lead some firms that had previously not considered investing resources in improving their energy efficiency (as they were unaware of the opportunities) to reduce their energy costs (and increase profits). There will also be a range of wider social benefits. Improvements in the energy efficiency of UK businesses will increase productivity, economic growth and international competitiveness. Reductions in energy consumption will also lead to lower non-traded CO2 emissions, better air quality, and reduce the number of EU ETS allowances UK businesses need to buy. These are all **indirect benefits** as they result from the implementation of assessment recommendations, rather than the assessments themselves.

[15] IA Toolkit: How to do an Impact Assessment, August 2011, para 172, http://www.bis.gov.uk/assets/biscore/better-regulation/docs/i/11-1112-impact-assessment-toolkit.doc

[16] Green Deal Business Survey; https://www.gov.uk/government/consultations/the-green-deal-and-energy-company-obligation

There is limited evidence available of the impact of ESOS assessments on enterprises' energy consumption. The estimated benefits presented in this Impact Assessment are based on an illustrative assumption of what the average impact of ESOS assessments will be on energy consumption. This assumption is informed by a range of evidence sources including a review of the academic literature and research into comparable schemes. This section reviews the evidence available and sets out how the high-level assumption has been used to estimate the energy saving under ESOS (taking into account the existing policy landscape).

The evidence is base insufficiently robust to enable the additional benefits that may result from the different options to be quantified. This Impact Assessment therefore provides a monetised estimate of the benefits of ESOS as a whole, and then uses a breakeven analysis to illustrate how much larger the benefits would need to be for options 2-6, to deliver the same NPV as option 1. This is set out in Section 6.6.

6.4.1. European Commission Impact Assessment

The European Commission Impact Assessment published in June 2011 presented an estimate of the energy savings resulting from energy audits.[17] The Impact Assessment first estimated the share of energy use that would fall within the scope of this measure. It then used a number of illustrative assumptions to calculate the energy savings delivered, depending on the extent to which businesses within Member States were already conducing energy audits, and the level of policy support provided for implementing recommendations. **This analysis suggested the saving would be between 0.4% and 5% of total energy demand, with a central estimate of 3%.** Given the UK already has a number of policies in place to tackle the market failures in this sector, it is reasonable to assume that the impact in the UK will be towards the lower end of the range presented by the Commission.

6.4.2. Review of academic literature

DECC published a literature review of non-domestic sector interventions in 2012.[18] This highlighted a number of studies into the impact of existing energy auditing policies in other countries. The programmes studied are all different and the studies themselves use a variety of different methodologies. Significantly, the programmes were all voluntary, meaning the results are likely to be affected by self-selection bias; firms that chose to take part would already have been interested in improving their energy efficiency, and so would have been more likely to implement recommendations than under a mandatory scheme. The programmes were also typically targeted at SMEs, which face slightly different barriers to energy efficiency than the large enterprises within the scope of this policy.

However, the studies do provide some evidence of the impact of energy auditing policies, including the number of recommendations typically adopted, the required payback period for energy efficient projects and the energy savings that were delivered. The key finding are summarised below:

- Anderson and Newell (2004)[19] show a **53%** uptake of measures among the sample of 9,034 SMEs which took part in a US Government reporting project that ran from

[17] http://ec.europa.eu/energy/efficiency/eed/doc/2011_directive/sec_2011_0779_impact_assessment.pdf , page 48

[18] https://www.gov.uk/government/publications/factors-influencing-energy-behaviours-and-decision-making-in-the-non-domestic-sector-a-rapid-evidence-assessment

[19] Anderson, S.T. & Newell, R.G., 2004. Information programs for technology adoption: the case of energy-efficiency audits, Resource and Energy Economics.

1981 to 2000. They found that the average cost of implementing an energy efficiency project was $7,400 and the average payback period was 1.29 years.

- Harris et al (2000)[20] found a take up rate of **81%** among a sample of 100 typically large firms who took part in an Australian Government audit programme which ran for 6 years until 1997.
- Thollander et al (2007)[21] found a take up rate of **22%** for actual implemented measures (44% for actual and planned measures) among 47 SMEs who took part in the evaluation of the Swedish free audit programme. Recommendations actually implemented led to a **3.8%** energy saving (which rises to 8.8% when both actual and planned measures are counted).
- Bradford and Fraser (2008)[22] report that **53%** of a sample of 112 SMEs in Leeds adopted energy efficiency measures.

More details on these academic studies can be found in Annex G

6.4.3. Review of Australian energy auditing programme

The Australian Government launched an audit programme called "Energy Efficiency Opportunities" in 2006. The programme was mandatory and covered large private sector energy users.[23] By 2011, the audits covered 92% of total energy used by businesses captured by the programme. The recommendations made as part of the audit process were very specific, focused on measures with a payback of less than four years and included a cost-benefit analysis.

The end of the cycle review, published in 2013[24], found that, in the period up to 2011, firms had committed or already implemented around 54% of the identified energy opportunities.[25] The review suggested the average savings were around 5% of energy covered, although these savings were unadjusted, meaning they were not corrected for the possibility that some of the savings may have been achieved even in the absence of the programme. Out of these savings, the programme review concluded that approximately 41% of the total energy efficiency improvements were additional benefits driven by the EEO programme, suggesting **the total additional savings were around 2%.**

[20] Harris, J, Anderson, J. & Shafron, W., 2000. Investment in energy efficiency: A survey of Australian firms, Australian Bureau of Agricultural and Resource Economics, GPO Box 1563, Canberra, ACT 2601, Australia.

[21] Thollander, Patrik, Danestig, M. & Rohdin, Patrik, 2007. Energy policies for increased industrial energy efficiency: Evaluation of a local energy programme for manufacturing SMEs.

[22] Bradford, J. & Fraser, E.D.G., 2008. Local authorities, climate change and small and medium enterprises: Identifying effective policy instruments to reduce energy use and carbon emissions, University of Leeds, Sustainability Research Institute, Leeds, United Kingdom.

[23] Energy use greater than 0.5PJ/year (139 GWh/year)

[24] http://eeo.govspace.gov.au/files/2013/05/EEO-Program-Review-Final-Report.pdf [accessed 11 June 2013]

[25] In 2011, 89PJ out of 164PJ identified were implemented or committed to be implemented.

6.4.4. Research into Display Energy Certificates

DECC commissioned a qualitative research project on Display Energy Certificates in 2012, which will be published alongside the Consultation Document[26]. The research involved in-depth qualitative interviews and case studies with 23 public sector organisations and 15 private sector organisations. The research found that one of the more significant benefits of DECs was the actual process of data collection required to acquire a DEC. This raised awareness of energy use and encouraged monitoring among organisations that had not previously given much thought to energy efficiency.

For organisations already trying to improve their energy efficiency DECs were useful for pointing out there worst-performing buildings. The information provided was also a useful tool for facilities managers to use internally when making the case for investing in energy efficiency measures. However, while the advisory report should provide detailed recommendations with a range of timescales, organisations did not consider that in their experience this was the case. They wanted information and guidance that was more readily useable with advice that was tailored to the building and the budget available, recommendations that were achievable according to the level of investment the organisation was willing to make, and an explicit and an accurate discussion of the costs and benefits of the recommended changes.

DECC has also published statistical analysis of the impact of DECs[27]. The analysis used data on DECs logged at 48,000 unique premises up to December 2012. **The analysis found that energy intensity (energy consumption per meter squared of floor space) fell by 2% more between 2008 and 2009 for public sector offices with a DEC than comparable private sector offices**. This comparison provides tentative evidence to suggest that DECs in particular have had a slight impact on the energy performance of a property. But is not able to control for a large number of other factors affecting public sector building use over this period. Nor does it control for the different drivers of energy efficiency between private and public sector organisations.

6.4.5. Estimated energy savings from ESOS assessments

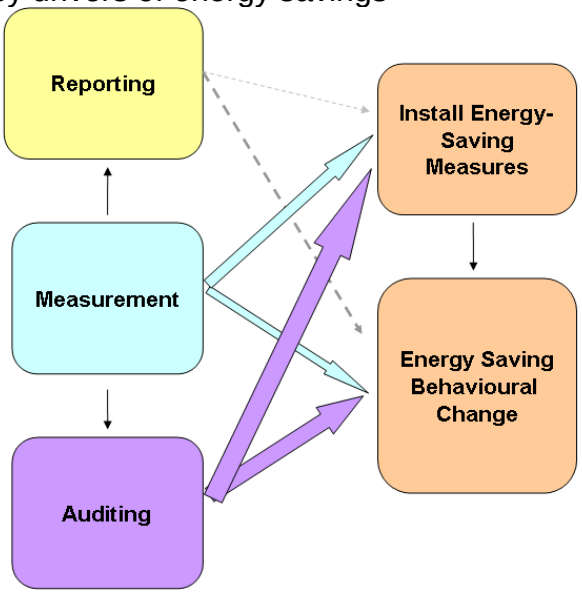
As set out in the Energy Efficiency Strategy, there are a range of complex factors that lead enterprises to improve the energy efficiency of their operations. For the purposes of this Impact Assessment, a simple conceptual framework has been used to model the impact of the policy on the take up of energy efficiency measures. Three broad drivers of energy efficiency take up have been identified (as illustrated in Figure 2 below):

- Measurement, which improves firms understanding of how much their energy use is costing them
- Auditing, which combines measurement of energy use with clear recommendations on actions to take
- Reporting, which creates a reputational driver to implement recommendations for consumer facing enterprises

[26] https://www.gov.uk/government/publications/

[27] https://www.gov.uk/government/publications/energy-trends-june-2013-special-feature-articles-display-energy-certificates

Figure 2: Illustration of key drivers of energy savings



For the purposes of this Consultation Stage Impact Assessment, the estimates of energy savings are calculated using 3 illustrative assumptions.

- For enterprises that are currently not measuring their energy use in detail, an ESOS assessment will result in an average energy saving of 1% of consumption from measurement alone.
- In addition, the presentation of detailed recommendations on what enterprises could do to improve their energy efficiency will lead to an additional energy saving of 1%.[28]
- ESOS assessment will have a lower impact on energy intensive enterprises as the information market failures are likely to be less significant in these sectors.

These illustrative assumptions are informed by the evidence available, but not directly based on them, given that the ESOS is unlikely to be directly comparable with the examples set out above.

6.4.5.1. Buildings and industrial processes

The analysis of coverage of existing policies has been used to estimate the energy savings from the implementation recommendations in buildings and industrial processes. ESOS assessments are assumed to:

- **Have no impact on energy covered by CCAs or used by the fuel industry.** [29] These firms are typically energy intensive (meaning energy is a higher proportion of their costs) and so less likely to be affected by information market failures. The CCAs and the EU ETS are also expected to capture most of the savings that would have been delivered as a result of an ESOS assessment.
- **Lead to 1% reduction in demand for energy covered by another policy instrument.** These firms are already measuring their energy use and so will only benefit from being presented with tailored recommendations.

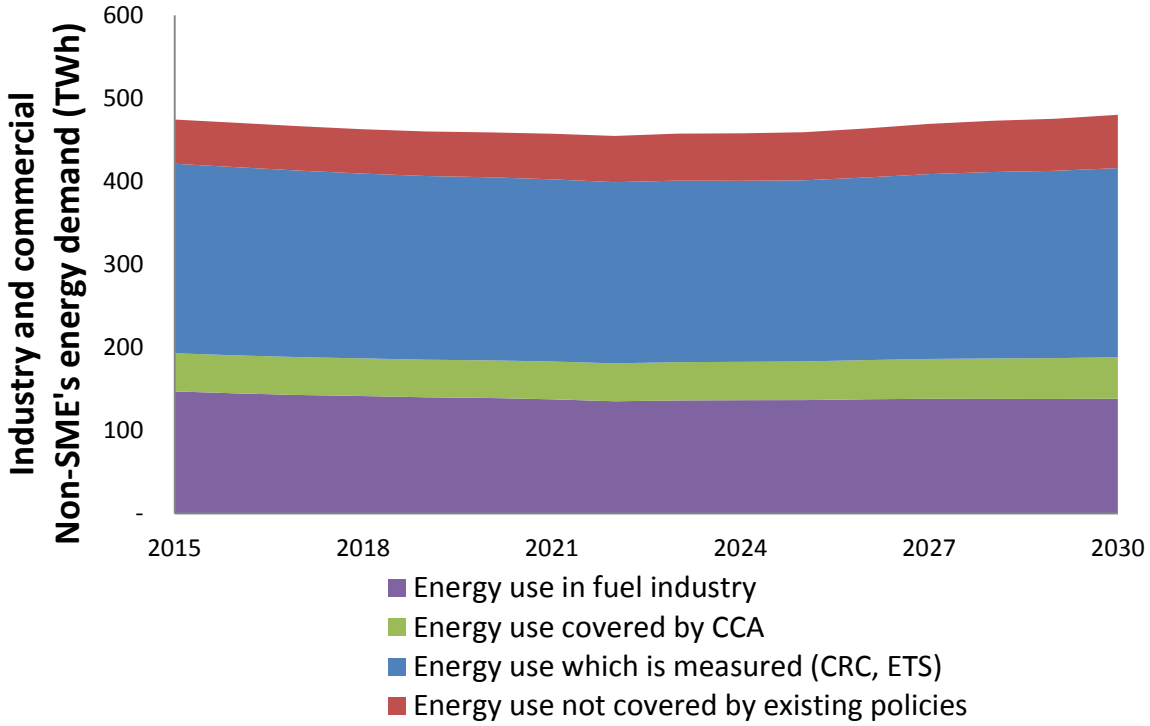
[28] This is equivalent to 1 in 10 organisations implementing recommendations that reduce their energy consumption by 10%

[29] This only accounts for the energy used by plants covered by CCAs. Energy used by the wider organisations that own these plants (for example, in there HQ) is assumed to be affected by ESOS assessments.

- **Lead to 2% reduction in demand for energy not covered by existing policy instrument.** These firms will benefit from ESOS assessments providing them with both accurate information on how much energy they are using, and detailed recommendations on how to reduce consumption through energy efficiency measures.

Figure 3 shows the proportion of projected energy demand that is covered by existing policy in the counterfactual scenario (based on the assumption that the share remains constant over time).[30] Based on the assumption set out above, the average reduction in energy consumption in scope of the policy is **0.7%** in 2015.

Figure 3: Proportion of non-domestic buildings and industrial process energy consumption in scope of the policy



Source: DECC Energy & Emissions Projections 2012 *baseline projections adjusted to account for energy in scope of policy*

Table 3 sets out the estimated energy savings from buildings and industrial processes as a result of ESOS assessments, based on the assumptions set out above, which is 2.5TWh in 2015 in the buildings and industrial processes sector.

This 'top down' estimate of the total savings has been compared against a 'bottom up' analysis of the potential for energy efficiency. As discussed in Section 6.1.5, the cost effective potential for energy savings from physical measures (for example, more efficient lighting systems or industrial equipment) is estimated to be around 47TWh in 2015 in the buildings and industrial processes sector.

Research suggests that firms typically require short payback periods in order make energy efficiency investments. The bottom up analysis therefore excludes all the potential savings with a payback of more than 2 years (leaving around 43TWh), on the basis that assessors will focus on only the most cost effective opportunities when making recommendations.

[30] The projections are based on DECC Energy & Emissions Projections 2012, and so include the impact of existing policies

This is equivalent to assuming that ESOS assessments identify cost effective savings of 13% of energy use on average (i.e. an average saving of 13% would be delivered if all assessor recommendations were implemented). This analysis excludes the considerable potential for energy savings from behavioural measures (including better energy management) which may be recommended ahead of physical measures. It also excludes potential savings from new technologies developed over the period 2015 to 2030.

The comparison suggests the annual 2.5TWh energy saving estimated using the high level assumption is equivalent to 6% the potential energy savings identified actually being implemented in the buildings and industrial processes sector. This take-up rate is generally lower than what has been observed in other auditing programmes.

The energy saving assumption has a significant impact on the overall results of the cost benefit analysis. The analysis therefore uses a range (+/- 50% of the central scenario) to test the sensitivity of the final results to this assumption. The total energy saving under the high and low 'take-up rate' scenarios are also shown in Table 3. These scenarios have been used to provide the range of impacts presented in the Consultation Document.

Table 3: Comparison of top down estimate of energy savings with bottom up estimate of potential in buildings and industrial processes

	Low take-up scenario	**Central scenario**	**High take-up scenario**
Energy saving in 2015 (TWh)	1.3	2.5	3.8
Technical potential for energy savings in 2015 (TWh)	47	47	47
Technical potential likely to be included in recommendations (TWh)	43	43	43
Indicative take up rate of recommendations	3%	6%	9%

Source: DECC analysis

6.4.5.2. Energy savings in transport sector

Further work is needed to understand how enterprises will respond to recommendations made by ESOS assessors in relation to their transport energy consumption, particularly in relation to whether owning or leasing vehicles makes a difference to estimated savings. However, for transport intensive industries (rail, bus and coach, road haulage), fuel costs make up a significant proportion of total costs meaning businesses in these sectors are likely to have already taken steps to make efficiencies and reduce costs. For transport services[31] as a whole, energy cost is estimated to be 9% of total expenditure, compared to 14% for the Iron and Steel sector, 3% for other industrial sectors and 1.5% for other services. Enterprises are more likely to have invested in gathering information on how energy efficiency improvement can be made, meaning the information market failures will be less significant in these sectors (and therefore the impact of ESOS assessments will be

[31] DECC analysis of Office for National Statistics data. Data for the non-domestic sector sourced from secondary analysis of the 2009 Supply Use Tables produced by the Office for National Statistics (ONS) as part of the National Accounts. The transport services sector is defined as organisations which identify their primary business activity as transportation. This is experimental analysis and as such each sector has an associated margin of error. Total expenditure is defined as final consumption expenditure plus the compensation of employees and non deductable VAT. Gross capital formation has been excluded from this definition of expenditure.

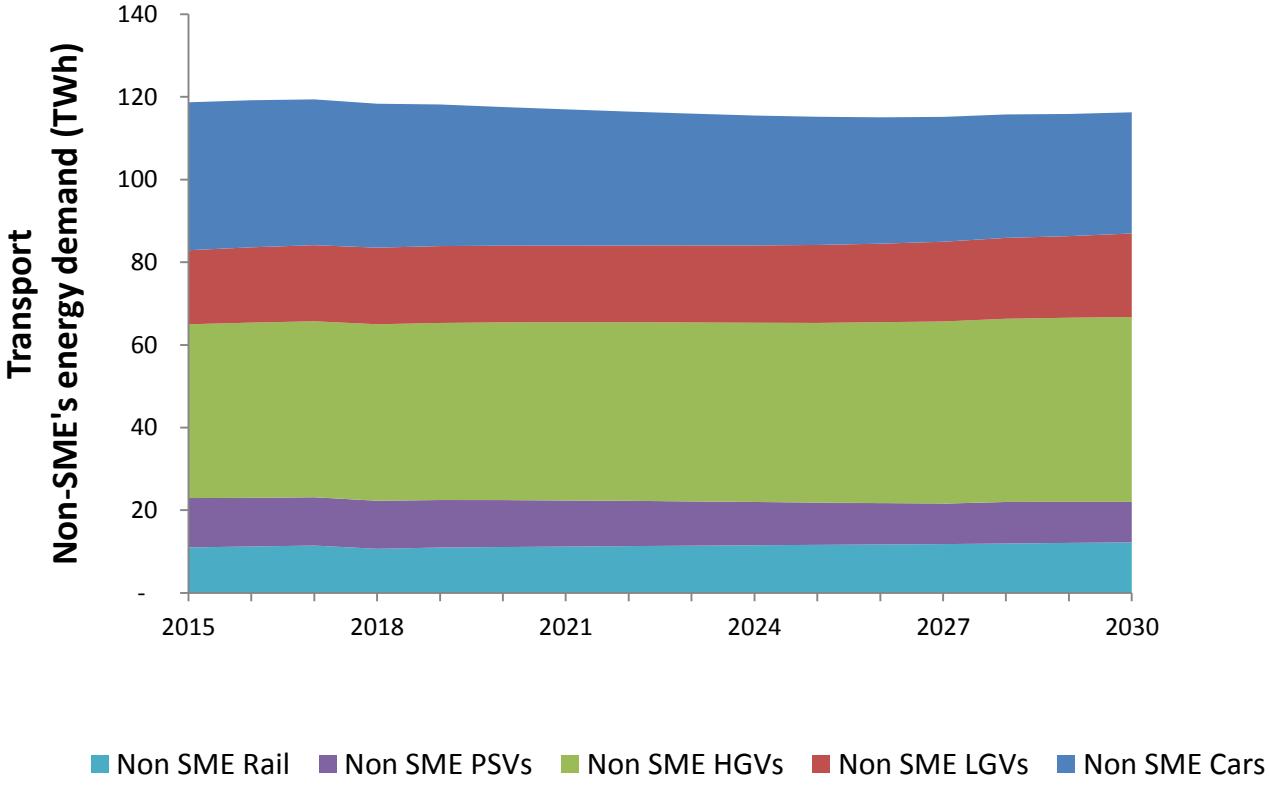
proportionally smaller). In addition, the rail industry in particular is highly specialised and it seems very unlikely that an independent assessor would be able to make new recommendations to the industry that have not already been considered and/or implemented.

For this consultation stage Impact Assessment, illustrative assumptions have been used to estimate the energy savings from ESOS assessments, which vary depending on the mode of transport. Figure 4 illustrates the estimated surface transport energy use of large enterprises broken down by mode of transport (see Annex E for details).

In the transportation sector, ESOS assessments are assumed to:

- **Have no impact on energy consumption by rail, buses and coaches or business travel in household-owned cars,**
- **Lead to 1% reduction in energy consumption by heavy good vehicles,**
- **Lead to 2% reduction in energy consumption by company car and van fleets.**

Figure 4: Proportion of transport energy consumption in scope of the policy



Source: DfT analysis of DECC Energy & Emissions Projections 2012

6.4.5.3. Summary of benefits

Table 4 presents the estimated energy saving in 2015 calculated using the assumptions set out above, along with the average saving in each sector.

Table 4: Total energy saving from buildings, industrial processes and transportation in the central scenario

	Energy	Energy in scope in 2015	Average %

	savings in 2015 (TWh)	(TWh)	saving of energy in scope
Buildings	1.4	183	0.8%
Industrial processes	1.1	155	0.7%
Transport	0.8	119	0.7%
Total	3.3	456	0.7%

Given the level of uncertainty around the savings that will be delivered by ESOS assessments, scenario analysis has been used to illustrate the impact of different saving assumptions on the final results. Another significant uncertainty is the duration of the policy savings delivered, and the impact of the second or third ESOS assessment an enterprise has.

It is reasonable to assume that some of the recommendations that are implemented as a result of the ESOS assessment would have been implemented in the future anyway (as a result of rising energy prices or another government policy). In this respect the counterfactual will be catching up, meaning the additional savings from ESOS assessments will fall over time.

On the other hand, future rounds of ESOS assessments are likely to deliver further energy savings. Some enterprises may have limited financial resources to allocate to energy efficiency which prevent them from implementing all the recommendations following the first assessment. Others may be more likely to implement recommendations when they are at an appropriate stage in their capital replacement cycle (which will be different for different businesses). Innovation and technological developments may also increase the potential for energy savings in the future.

For this Impact Assessment, we have assumed that the energy savings are constant over time; there are no additional savings from future ESOS assessments, but savings delivered in 2015 persist until 2030.[32] We have included a sensitivity scenario to illustrate the impact of this assumption on the final results (see Section 8 for details).

Q4: Do you have any evidence on likely impact of the ESOS assessments on energy consumption by large enterprise (either from buildings, industrial processes or transportation) that could improve our analysis?

6.5. Costs

The implementation of the ESOS will create a number of costs to business and government. The direct costs include:

- **Assessment costs**: the cost of employing an ESOS assessor to conduct the assessment itself, including conducting any site visits necessary and producing the recommendations.
- **Administrative burden**: the cost to business of complying with the regulations, including the time taken by staff to understand the requirements, work with the assessor on site and review any recommendations made.
- **Accreditation and scheme administration cost**: the cost of managing the accreditation and scheme administration regime.

[32] Note the savings are constant *percentage* of energy in scope, meaning there are slight differences in the annual energy savings driven by changes the underlying demand projection.

The indirect costs are:

- **Capital cost**: the cost of any physical measures that are installed as a result of the ESOS assessment (e.g. lighting controls or more efficient motors).
- **Hassle cost**: the cost of the business managing the implementation of recommendations, including the time taken working with contractors to install measures and halting operations in order to make improvements.

6.5.1. Assessment costs

The cost of conducting the assessment will depend on the number of enterprises in scope of the policy, the size and complexity of their operations and the cost employing an ESOS assessor. Under option 6 all sites are surveyed by the ESOS assessor. In options 1, 2, 3, 4 and 5 the actual number of buildings visited will be decided by assessor on a case by case basis. The survey should be proportionate, but large enough to enable a robust assessment of the energy efficiency of the enterprise. For the purposes of the Impact Assessment we have assumed this will be:

- At least one site visit per enterprise, and
- 5% of all other buildings
- 10% of all other industrial plants (given these are less homogenous than buildings in the commercial sector and so will require a larger number of visits).

The cost of each ESOS assessment is based on daily cost of an assessor multiplied by the number of days it takes to assess the sites. The ESOS assessor qualified to conduct assessments of buildings are assumed to cost **£500 per day**. ESOS assessments of industrial processes are expected to both take longer and require specialised ESOS assessors, which are assumed to cost **£1000 per day**. These cost assumptions are based on discussions with a range of industry stakeholders including the Carbon Trust, ABB, Siemens, ESTA, CIBSE and members of the Expert Advisory Panel on Energy Efficiency Audits.

Table 5 shows the assumed number of days an ESOS assessment takes for different sized buildings. Table 6 shows the duration of ESOS assessments for those sites that include an industrial process.

Table 5: Duration and cost of building ESOS assessments, by site size

Size of site (m2)	**<100**	**100 to 250**	**250 to 500**	**500 to 1,000**	**1,000 to 5,000**	**5,000 to 10,000**	**>10,000**
Days on site	0.5	0.5	1	1	2	4	4
Days off site	0.5	0.5	2	2	4	8	8
Total cost (£)	500	500	1500	1500	3000	6000	6000

Source: Discussions with industry stakeholders

Table 6: Duration and cost of industrial process ESOS assessments, by site size

Size of site (m2)	**<100**	**100 to 250**	**250 to 500**	**500 to 1,000**	**1,000 to 5,000**	**5,000 to 10,000**	**>10,000**
Days on site	1	1	2	2	4	8	8
Days off	1	1	3	3	8	8	8

site							
Total cost (£)	2000	2000	5000	5000	12000	16000	16000

Source: Discussions with industry stakeholders

The time needed to assess a company's transport operations will depend on the availability and quality of the data on its transport operations. This may vary from expenses claims for fuel purchases to detailed data on fuel consumption of the fleet in litres. EST experience of auditing car and van fleets suggested that the availability of data and the overall quality of fleet management, tends to depend on the size of the fleet rather than the size of the company.

The EST estimate that an audit of a fleet takes around five days**.** This assumes the assessment is tailored to a business's fleet operations; a more standard auditing process might be less time-consuming. The ESOS assessment of a standard sized fleet is expect to require a similar level of expertise as building ESOS assessment, and so is assumed to also cost £500 per day. For enterprises in the transport sector (i.e. whose main business is transportation) the cost of assessing the fleet is expected to take longer (10 days), and require a higher level of expertise (at a cost of around £1,000 per day).

The assumptions outlined above are used to estimate to the total cost of conducting ESOS assessments, which are presented in Table 7 for the different options.

Table 7: Cost of conducting ESOS assessments (PV £m)

	Options 1, 2, 3, 4 and 5	**Option 6**
Commercial sector	41	496
Industrial sector	43	172
Transportation operations	16	16
Total cost of conducting ESOS assessments	**100**	**685**

Source: DECC analysis

Q5: Do you have any evidence on likely cost of conducting the ESOS assessments of buildings, industrial processes or transportation?

6.5.2. Administrative burden

The analysis has used the standard cost model approach to estimate administrative burden to businesses. Tables 3 and 4 in Annex C set out the tasks business will have to complete in order to comply with the regulations. Some of these costs (Understanding the requirements and Educating the organisation) are transition costs, whilst others are recurring. Most of the differences in the overall costs between Options 1 and 5 are primarily driven by the tasks that will fall to businesses. Table 8 below set out what these tasks are for each option.

Table 8: Description of administrative burden to affected enterprises under each option

Option	**Administrative tasks**
All options	- Develop an understanding of what the enterprise needs to do to comply - Recruit an ESOS assessor - Gather data on energy consumption - Accompany the assessor on site visits

	- Read the ESOS assessor's report or attend a presentation - Some enterprises will go on to request and consider quotes for cost of implementing measures[33]
1	- A proportion of affected enterprises will need to demonstrate compliance to the scheme administrator when asked
2	- All enterprises will need to register with the scheme administrator and provide certain basic information (they are in scope and have conducted an ESOS assessment) - A proportion will need to demonstrate compliance to the scheme administrator when asked
3	- All enterprises will need to prepare and publish a short narrative summary of the assessment finding. - Only a small proportion will have subsequent compliance discussions with scheme administrator.
4	- All enterprises will need to register with the scheme administrator and provide certain basic information - All enterprises will also need to process the scheme administration charge. - A proportion will need demonstrate they have complied when asked
5	- All enterprises will need to register with the scheme administrator and report on the ESOS assessments' findings to a central body using a standardised template. - A proportion will need to demonstrate compliance to the scheme administrator when asked.
6	- All enterprises will need to register with the scheme administrator and provide certain basic information - A proportion of enterprise will need demonstrate compliance to the scheme administrator when asked. - The requirement to visit all sites will also increase the administrative burden as ESOS assessors will need to be accompanied to a larger number of sites.

Where the tasks are comparable, the estimates are based on the cost of complying with the CRC.[34] This is likely to overestimate the cost as the CRC is more complex for businesses to administer than the ESOS will be. Where comparable cost data is not available we have used illustrative assumptions.

ESOS will be developed to fit with existing energy use reporting requirements. As discussed in Section 6.2, many enterprises already collect a large proportion of the data that will be required for ESOS assessments in order to comply with existing policies (CRC, CCAs, GHG Mandatory reporting). These enterprises will therefore face lower data collection costs. Table 9 shows the average administrative burden per enterprise (split between transition and recurring costs) and the total burden for the six options.

Table 9: Administrative burden on enterprises, by option

	Transitional costs per enterprise	**Average recurring cost per enterprise (incurred every 4 years)**			**Total administrative burden (PV**
		Enterprises	Enterprises	Enterprises	

[33] Cost based on the assumption that half of all organisations will go on to investigate the cost of implementing recommendations

[34] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/42934/4759-kpmg-assessing-admin-costs-crc-scheme.pdf

		covered by existing policy	not covered by existing policy	with an audit in the counterfactual	**£m)**
Option 1	7,400	3,200	6,300	140	120
Option 2		3,200	6,300	180	120
Option 3		5,000	8,100	1,900	160
Option 4		3,200	6,300	190	120
Option 5		4,100	7,200	1,000	140
Option 6		6,400	9,500	3,300	190

Source: DECC analysis

The cost of conducting an ESOS assessment for an individual enterprise will vary according the size and complexity of its operations. The average cost per enterprise for the first round of ESOS assessments is estimated at around £17,000, with subsequent assessments costing around £10,000 (including the cost of the assessors' visits and the administrative burden, but excluding the cost of implementing recommendations). Box 3, below, provides some illustrative examples showing how much an ESOS assessment could cost different enterprises.

Box 3: Illustrative costs of ESOS assessments

The costs of conducting an ESOS assessment will vary according to the size and complexity of an organisation's operations. The table below shows some illustrative examples that demonstrate how much an ESOS assessment might cost different types of organisation.

	Estimated cost of first round of assessments per organisation
Distribution company with a 5 large warehouses and a small fleet of vehicles	£23,000
Estate Agent with 50 small offices	£15,000
High street retailer with 100 small shops	£16,000
Manufacturing company with one large site	£25,000
Road haulage business running a large fleet of vehicles	£23,000

Q6: Do you have any evidence on potential administrative burden to enterprises of complying with the ESOS, and how this might vary between the different policy options?

6.5.3. Capital and hassle cost of implementing recommendations

The capital cost of installing the energy efficiency measures required to deliver the energy savings are set out in Table 10. For building and industrial processes, these costs are combined with the estimate of energy savings presented in Section 6.4.5 with the estimate of technical potential discussed in Section 6.1.5. The additional hassle cost of installing measures in building and industrial processes is assumed to be 20% of the capital costs.

Hassle costs have not been included for transportation measure as the capital costs are based on enterprises upgrading to more efficient vehicles as part of their fleet replacement cycle.

As mentioned in Section 6.1.5; the analysis excludes the considerable potential for energy efficiency from behavioural measures. If measures recommended by the ESOS assessment do not require capital expenditure (for example, making better use of existing controls or optimising systems) then the costs of achieving energy savings will be lower.

Table 10: Estimated capital and hassle cost of implementing recommendations

	Buildings	**Industrial processes**	**Transportation**
Total savings 2015 – 2030 (TWh)	22	18	17
Capital costs (£m PV)	63	230	650
Hassle costs (£m PV)	13	45	-

Source: DECC analysis

As discussed in Section 6.1.5, there are a number of different actions which businesses may take to reduce transport energy consumption in response to ESOS assessments. For the purposes of this Impact Assessment, simplifying assumptions have been made about the measures which businesses take up in order to generate an estimate of costs.

For cars and vans, it has been assumed that businesses change their fleet vehicle purchasing decisions, switching from the most common fleet vehicles to comparable vehicles which are more fuel efficient. In reality, it is expected that there would be a number of possible recommendations that ESOS assessors could make in relation to a business's fleet policy and management, not all of which would involve significant capital expenditure. It is also not clear the extent to which the additional cost premium associated with more fuel-efficient cars and vans might be passed through to businesses which lease rather than buy vehicles. Therefore this estimate of costs is likely to represent the higher end of the range of possible costs.

For cars, the additional cost and the fuel savings associated with switching within the lower medium size segment are used to calculate a unit cost (£/GWh saved over the lifetime of the vehicle) which is then applied to the total estimated fuel savings from cars. Based on forecast fuel prices, and assuming current vehicle excise duty bands remain in place in 2015 and beyond, the payback period associated with this capital expenditure is reasonably consistent with the usual life of a vehicle in a company fleet – around four years.

For vans, vehicle specification data from the VCA database on Van CO_2 and Fuel Consumption[35] has been used to find comparable van models with significantly different CO_2 emissions and, as with cars, data on vehicle prices used to estimate a unit cost for the energy savings over the lifetime of a vehicle. The payback period has been estimated at just less than three years.

This analysis assumes that the unit cost associated with reducing fuel consumption stays constant over time. As average vehicle fuel efficiency improves over time in response to EU regulations, it is unclear how the additional cost associated with more efficient vehicles

[35] http://vanfueldata.dft.gov.uk/

will change and this assumption may lead to either an overestimate or underestimate of costs out to 2030.

In considering technological options to deliver fuel consumption savings from HGVs, different vehicle types and operations have been taken into account. Previous DfT analysis of potential emissions has drawn on the findings of two research reports commissioned by DfT in conjunction with the Low Carbon Vehicle Partnership:

- Technology Roadmap for Low Carbon HGVs (Ricardo PLC, 2010)[36]
- Market Background Study (AEA Technology PLC, 2010)[37]

These reports were used to develop cost-benefit analysis for the government's Carbon Plan[38] in which a number of technology measures were assumed to be taken up as a result of industry-led action to reduce HGV emissions. The baseline projection of energy consumption used in this Impact Assessment already assumes that a number of the most cost-effective technologies to reduce HGV fuel consumption have been taken up to varying degrees across the HGV fleet.

The information about available technologies, fuel savings and costs only apply to some HGV vehicle types: rigid city delivery; rigid inter-urban delivery; utility vehicles; and articulated HGVs >33t gross vehicle weight. These vehicles account for about 60% of total HGV mileage. In the absence of other evidence, this cost analysis assumes technologies applied to these vehicles provide all the estimated fuel savings.

In estimating costs associated with the take up of additional measures to reduce HGV fuel consumption, consideration has been given to the potential for additional take up beyond what is assumed in the baseline, as well as to the estimated payback period for individual technologies. As with cars and vans, a unit cost has been calculated for energy savings for each vehicle type listed above, and an assumption made that the estimated savings are made by the different vehicle types in proportion to their share of HGV kilometres. There is no reason to assume that savings would be made in this manner across the HGV fleet, but is an illustrative assumption designed to allow an estimate of potential costs to be made.

Q7: Do you have any evidence on potential capital and hassle cost of implementing energy efficiency measures?

6.5.4. Scheme administration and administration

The costs of the scheme administration framework will be determined by the choice of scheme administration option chosen, and will hence only be known once decisions have been taken following analysis of the consultation responses. For the purposes of this consultation IA, the ESOS administration costs are based on the cost of administering the CRC, as this is the most comparable policy in terms of scale and type of enterprises covered. The average cost of administering the CRC for the period 2009 to 2012 was roughly £3.1m. This cost is incurred by the taxpayer in options 1, 2, 3, 5 and 6. In option 4, £2.5m of this is charged to enterprises in scope of the policy from 2016 onwards.

6.5.5. Accreditation and certification

The cost of accreditation will be determined by the number of ESOS assessors needed and the level of qualification and expertise they need. Our initial discussions with

[36] http://www.lowcvp.org.uk/resources-library/reports-and-studies.asp?pg= 2

[37] http://www.lowcvp.org.uk/resources-library/reports-and-studies.asp?pg= 2

[38] https://www.gov.uk/government/publications/the-carbon-plan-reducing-greenhouse-gas-emissions--2

industry stakeholders have suggested that there are a large number of individuals who already have the expertise to conduct energy audits and for whom it should be relatively straightforward to be accredited to conduct ESOS assessments.

There have been over 400 active advisors registered with the Carbon Trust, providing a range of audits, advice and loan assessments. At the time when free Carbon Trust audits ceased, there were 271 active consultants remaining.

The Energy Institute has over 200 members working in energy consultancy and over 90 have so far applied to join the EI/ESTA Register of Professional Energy Consultants.

There are around 600 CIBSE Low Carbon Consultants and around 1000 CIBSE Low Carbon Energy Assessors. These individuals all have expertise in buildings audits and some may also have expertise in other aspects of auditing, such as transport and/or industrial processes.

There is likely to be significant overlap between these figures.

The Government is consulting on the level of qualifications and experience that ESOS assessors will need to conduct an ESOS assessment. For the purposes of this Consultation Stage Impact Assessment it is assumed that the accreditation process involves:

- 5 days training per year for each ESOS assessor, with examination, and
- Quality assurance testing of the ESOS assessments conducted.

The process is estimated to cost at £615 for each assessor and £33 per year for each assessment conducted (see Annex C for details). For Options 1-5, the number of ESOS assessors required to assess all the enterprises in scope in one year is around 340. To deliver Option 6, around 2,120 ESOS assessors would be needed. The costs of the accreditation scheme are likely to be passed on by ESOS assessors to the enterprises that hire them.

Q8: Do you have any evidence on potential cost of accrediting the ESOS assessors?

6.6. Comparison of cost and benefits

The analysis of the cost and benefits of the different options is summarised in Table 11 below. The Table shows the net present value (NPV) of each option when compared against a) the hypothetical 'no directive' baseline, and b) the lowest cost option.

The comparison against the no directive baseline provides an estimate of the net impact of mandatory auditing requirement on the UK, in line with Better Regulation guidance.[39] The overall cost of the audits requirement is estimate to be £1.4bn. The total benefits are estimated to be £3.2bn, meaning the net benefit is estimated at £1.8bn.

The majority of the costs (68% in Option 1) are the capital cost of implementing the measures. The differences in the costs are primarily driven by the administrative burden to business of the different options. For option 3, the additional costs are around 2% of total costs, due to the additional cost of public disclosure. The cost of Option 6 is 37% higher, which reflects the additional cost of requiring ESOS assessors to visit all sites.

[39] IA Toolkit: How to do an Impact Assessment, August 2011, http://www.bis.gov.uk/assets/biscore/better-regulation/docs/i/11-1112-impact-assessment-toolkit.doc

Table 11: Costs and benefits of Options 1 – 6, from 2015 to 2030

(£m PV)	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Energy saving	2,480					
Non-traded carbon savings	170					
Avoided EU ETS allowances	160					
Air quality benefits	380					
Total benefits	3,190					
Assessment costs	100	100	100	100	100	690
Administrative burden on businesses	120	120	160	120	140	190
Capital costs	930	930	930	930	930	930
Hassle costs	60	60	60	60	60	60
Scheme administration costs	36	36	36	36	36	36
Accreditation costs	5	5	5	5	5	19
Total cost	1,250	1,250	1,290	1,250	1,270	1,920
NPV (compared against 'no directive' baseline)	1,940	1,940	1,900	1,940	1,920	1,270
NPV (compared against 'Option 1' baseline)	**0**	**-1**	**-40**	**-1**	**-19**	**-670**

Source: DECC analysis

As set out in Section 6.4, there is currently insufficient evidence to quantify the different benefits of the policy options. The Impact Assessment therefore presents the estimated benefits of the minimum requirements and uses a 'breakeven' analysis to illustrate the additional savings that would be required to offset the additional cost of each option. Table 12 shows the average saving required to deliver the same NPV as Option 1 (the least cost option), given the additional cost of Options 2-6. It shows that, when estimated to 2 decimal places, Options 1, 2 4 and 5 require the same level of savings, while Option 3 requires an extra 0.01 percentage point average saving and Option 5 requires 0.18 percentage point average savings. To place this in context, Table 12 also shows the additional annual energy saving that would needed to deliver the same NPV for all options.

Table 12: Breakeven analysis of Options 1 – 6

	Option 1	**Option 2**	**Option 3**	**Option 4**	**Option 5**	**Option 6**
Average energy saving needed to deliver same NPV as Option 1	0.73%	0.73%	0.74%	0.73%	0.73%	0.95%
Additional energy saving required per year to deliver same NPV as Option 1 (GWh)	-	0.0	0.4	0.0	0.2	7.4

Source: DECC analysis

Q9: Do you have any evidence which can support us in assessing how the benefits may differ between the options?

6.7. Distributional impact

The cost to an individual enterprise is likely to vary depending on how large and complex their operations are and how easily their energy management data is to collect and analyse. The benefits in terms of lower energy costs are also likely to vary according to the number of recommendations they implement. Some enterprises may simply conduct the assessment but not implement any recommendations. The benefits will therefore be concentrated in those enterprises that implement recommendations, while the costs will be more evenly spread across all enterprises in scope of the policy.

6.8. Costs to business

The direct cost to business are summarised in Table 13. The majority of the costs of the policy will fall on business, the exception being the scheme administration costs that are funded through taxes. The capital and hassle costs of implementing recommendations are not included as these are indirect (second round) effects. All the benefits of the policy are also indirect, and so have been excluded from the net cost of businesses calculation. The majority (98%) of the cost to business is the cost of the assessments themselves and the administrative burden. Table 13 also presents the Equivalent Annual Net Cost to Business (EANCB). The analysis shows the EANCB of mandatory auditing requirement is £19m.

Table 13: Costs to business

(£m PV)	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**	**Option 6**
Assessment costs	100	100	100	100	100	690
Administrative burden	120	120	160	120	140	190
Scheme administration	0	0	0	27	0	0
Accreditation	5	5	5	5	5	19
Total cost	220	220	260	250	240	890
NPV (£m, compared against 'non directive' baseline)	-220	-220	-260	-250	-240	-890
EANCB	19	19	22	21	20	75
NPV (£m, compared against 'Option 1' baseline)	-	-1	-40	-28	-19	-669
EANCB	-	0	3	2	2	56

Source: DECC analysis

6.8.1. One In Two Out

The Better Regulation Framework Guidance on One In, Two Out (OITO)[40] sets out that in the case of EU legislation, the cost to business in scope of the OITO policy is the additional cost to business over and above the EANCB of implementing the minimum requirements.

The Government is consulting on the best way to implement the minimum requirements, so for the purposes of this Impact Assessment the cost in scope of OITO is measured against the least cost option (Option 1). These additional costs are set out in the final row of Table 13.

This open consultation does not propose a preferred option and so an appropriate 'out' has not been identified at this stage.

[40] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/31616/11-671-one-in-one-out-methodology.pdf

6.8.2. Small and Micro-businesses Assessment

The mandatory auditing requirement only applies to large enterprises. Small and Micro-business are therefore fully exempt from the regulations. Some ESOS assessors may operate as small businesses and may voluntarily choose to become accredited in order to benefit from the increased business opportunities the policy will create.

7. Qualitative analysis of the options

This section presented the qualitative analysis of the policy options. Section 7.1 discusses the costs and benefit that are included in the qualitative analysis. Section 7.2 presents the multi-criteria analysis of the different options, assessed against the policy objectives set out in Section 4.

7.1. Non-quantified costs and benefits

7.1.1. Economic growth, productivity and competiveness

Energy efficiency increases economic growth. Energy efficiency investments reduce business costs, meaning they can deliver more for less. Firms can then increase output and profits. Capital spending on energy efficiency creates jobs for installers and manufactures of energy efficient equipment. Making firms more efficient also makes them more competitive in international markets, which can improve the UK's trade balance. Reducing energy cost also reduces the UK's exposure to high and volatile international energy prices. Finally, investment in the energy efficiency sector can also increase innovation, which has wider benefits to UK.

ESOS will also stimulate growth in the energy efficiency sector. The process of conducting the ESOS assessments themselves will provide employment for auditors and auditing companies. A range of other energy efficiency product and service businesses may also benefit from supporting large enterprises in implementing ESOS assessors' recommendations. The growth in the sector will help the supply side of the market mature, and enable the sector to promote the contribution it can make to a range of enterprises more effectively.

7.1.2. Direct and indirect rebound effect

One of the knock on effects of improving an enterprises' energy efficiency is that some of the financial savings may be spent on energy consuming goods and services: the rebound effect. This means that the overall impact on energy consumption is smaller (although businesses will benefit from the additional energy consumption, for example, through expended production). The nature of rebound effect will vary depending on the energy efficiency measures adopted. For example, if a firm installs a more efficient motor in its production line, the direct rebound effect would be an increase output from the plant (which would increase energy consumption). An example of the indirect rebound effect would be using the financial savings to increase shareholders' profits, who then spend more on energy using products and services. There is currently limited evidence on the scale of the rebound effect in the non-domestic sector, although the evaluation of the policy may provide an opportunity to improve the evidence on this effect.

7.1.3. Tackling organisational failures

As discussed in Section 3, research suggests that the structure of an enterprise affects its approach to energy efficiency investments.[41] Options that raise the profile of the ESOS assessments so that the opportunities for cost reduction are recognised at board level are more likely to deliver energy savings. Requiring enterprises to publically disclose that they have conducted an ESOS assessment, and to a lesser extent requiring them to centrally report on the results, is likely to raise the profile of the ESOS assessments within enterprises and so make it more likely the recommendations are implemented. Public disclosure could also provide a reputational incentive for an enterprise to implement assessment recommendations.

7.1.4. Wider benefits of information collected

There are potentially wider benefits to society that could be gained for effective use of the information collected through ESOS assessments. Some of this information is a non-rival public good, meaning once it has been produced by the assessor it can be put to multiple uses for relativity low cost to society.

The assessment findings could be used to reduce the cost to business of existing policies. For example, the CCA target setting process required industry to provide detailed information on the potential of energy efficiency improvements. ESOS could reduce the cost of this process by reusing data already collected.

The data collected could also be used to strengthen the evidence base underpinning all energy efficiency policies. This would reduce information asymmetries between policy makers and business that hamper the development of effective public policy. Provided all commercially confidential information was redacted, the aggregated results could also be made public, which would support wider analysis and debate around the role of energy efficiency policy in meeting the overall objectives of increasing economic growth, reducing carbon emissions and securing reliable energy supplies. Robust information on the potential for energy efficiency would also provide a strong signal to the energy efficiency market of the business opportunities available.

Finally, effective central reporting on the information gathered by the ESOS assessments would enable a more robust evaluation of the policy in 2016, and enable any adjustments to be made to make the policy more effective. The results could also be fed into the wider European Commission evaluation of the Directive.

7.2. Multi-criteria analysis of policy options

Given the challenges in quantifying some of the key benefits, this Impact Assessment also presents a multi-criteria analysis of the different options, illustrated in Table 14. This assesses each option against the key policy objectives. The criteria used are:

- **Maximise benefit to the UK**
    - The policy addresses the information market failures by providing tailored recommendations about an enterprises opportunities to save energy efficiency.
    - The policy addresses organisational barriers that prevent the energy efficiency measures being implemented.
    - The policy captures the wider benefits to the UK of the information created.

[41] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65601/6925-what-are-the-factors-influencing-energy-behaviours.pdf

- **Minimise cost to business**
    - The process of complying is simple for business to understand and implement.
    - The scheme administration of the requirements imposes minimal costs to businesses.
- **Meet EU reporting obligations**
    - The policy ensures that the UK is able to accurately report on the number of audits conducted (as required by Article 24 of the Directive).

Address information market failures

Options 1-5 are expected to perform adequately against this criteria. The requirement within the Directive is that ESOS assessments be proportionate and sufficiently representative to enable recommendations to be made. Taking a proportionate approach inevitably means some energy efficiency opportunities might be missed. However, under Options 1-5 ESOS assessments are still expected to provide enough detail to significantly improve the information available. Option 6, which requires a visit to all sites, is likely to lead to more opportunities being identified and more detailed recommendations being made. This option will therefore be more effective at tackling the information market failures and is likely to lead to a higher energy saving than the other options.

Address organisational barriers

As set out above, policies that raise the profile of energy efficiency within enterprises are more likely to overcome the organisational barriers to the take-up of measure, and lead to higher energy savings. Options 1, 2 and 4 are least likely to address the organisational barriers; ESOS assessments are more likely to be viewed as a compliance issue by senior managers than as an opportunity to reduce costs and increase profits. Option 5, by requiring central reporting of assessment findings, is more likely to raise the profile of the ESOS assessment within enterprises as senior managers are more likely to be involved in the process. Options 3 and 6 will most effectively tackle the organisational barriers. The public disclosure elements of these policies mean senior managers are significantly more likely to review the recommendations made. These options may also create reputational incentive for some enterprises to ensure they are implementing cost effective recommendations.

Capture the wider benefits of the information

Options 1, 2 and 4 are unlikely to result in the wider benefits (set out above in Section 7.1) being realised as the assessment results would not be reported outside the enterprises concerned. For Options 3 and 6, making some element of the assessment public will enable third parties to collect the information and put it to alternatives uses. Option 5 is most likely to result in the wider benefits being captured, as it would enable a detailed evidence base to be developed on the potential for cost effective energy efficiency improvement and the impact of ESOS assessments on the enterprises in scope of the policy.

Simple compliance process

The complexity of the compliance processes is determined by the number of tasks enterprises are required to do. Options 1 and 2 are simplest, because enterprises are only required to conduct the assessment and, in the case of option 2, notify the scheme administrator they have done so. Options 3, 4 and 5 are more complex because they require enterprises to do a number of further tasks: make a public disclosure, pay (and budget for) the scheme administration charge, and report on the assessment results centrally. Option 6 is the most complex for firms to implement as it requires a large coordination exercise to ensure all sites in scope are assessed and the appropriate buildings have Display Energy Certificates in place.

Light touch enforcement process

The impact of the enforcement process on the cost to business would depend on the level of interaction they are required to have with the scheme administrator. In this respect, Options 1, 2, 4 and 6 are likely to lead to the most intrusive enforcement for businesses. The central reporting element of Option 5 means that the scheme administrator will be able to use existing data to check compliance, meaning its interaction with individual business will be less intrusive. Option 3 represents the lightest touch enforcement, as the scheme administrator would be able to use publicly available information to check compliance, and reducing the need to contact enterprises directly.

Enable accurate reporting to the European Union

The UK will have to report on the policy's operation to the European Union. Option 2, 3, 4, 5 and 6 are judged to provide more robust administrative data, which will ensure the UK is fully able to meet its reporting requirements. Option 1 would rely on ex-post survey data to fulfil reporting obligations. This would lead to less robust data being available to meet the UK's EU reporting obligations than would be the case with the other options.

Table 14: Multi-criteria analysis of Options 1 - 6

Option	1	2	3	4	5	6
Maximise benefit to the UK						
Address information market failures						
Address organisational barriers						
Capture the wider benefits to UK						
Minimise the costs to business						
The process of complying is simple						
The enforcement process is light touch						
Meet EU reporting obligations						
Enable accurate reporting to EU						

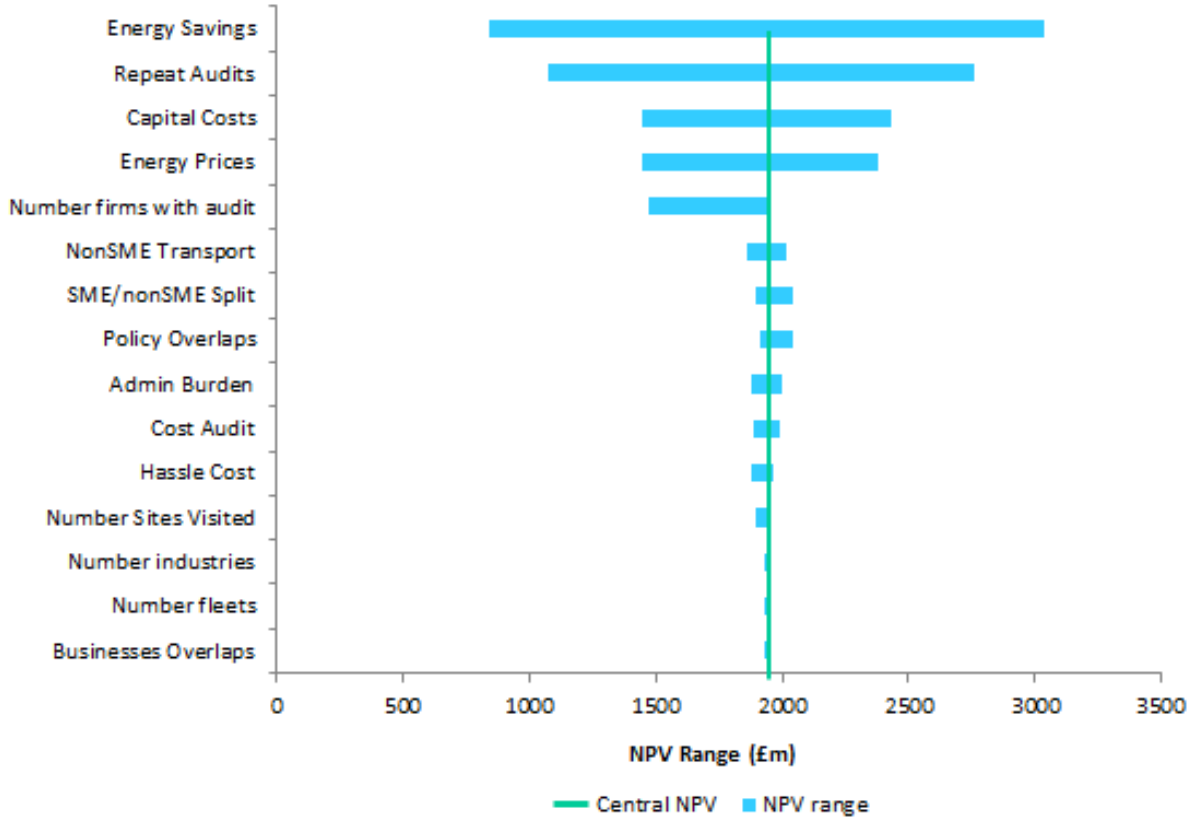
8. Sensitivity analysis

The analysis presented in Section 6 is based in a number of assumptions that have a significant impact on the results. This section presents a sensitivity analysis to illustrate the level of uncertainty around the result. The input assumptions that have been tested in this analysis are:

- The energy savings resulting from ESOS assessments
- The impact of future ESOS assessments on total savings
- The capital costs of implementing recommendations
- Future energy prices
- The number of firms already conducting audits in the no-directive baseline
- The proportion of transport energy consumption used by large enterprises
- The proportion of energy consumption used by large enterprises that own buildings and industrial processes
- The proportion of energy in scope that is covered by existing policies
- The size of the administrative burden imposed on businesses
- The cost of conducting assessment
- The hassle costs of implementing recommendations
- The number of sites visited by ESOS assessors
- The number of industrial process in scope of the policy
- The number of vehicle fleets in scope of the policy
- The number of enterprises covered by existing policy
- The number of buildings in scope of the policy

Figure 5 below illustrates the NPV of Option 1 measured against the ‘no directive’ baseline in the different sensitivity scenarios. In the worst case scenario the NPV of Option 1 is 103% lower at –£48m. In the best cases scenario the NPV is 284% higher at £7bn. The analysis suggests that four variables (energy savings delivered, capital costs, the duration of savings and energy prices) have a very substantial impact on the final results. By comparison, 6 assumptions tested in the sensitivity analysis have a small (less than 10%) impact on the final NPV. Table 15 presents the details of the sensitivity scenarios used.

Figure 5: Illustration of sensitivity analysis results



Source: DECC analysis

Table 15: Details of sensitivity analysis inputs and results

Sensitivity	Description	Low NPV (£m)	High NPV (£m)
Worst / best case	A combination of the worst and best case scenarios below.	-18	7,060
Energy Savings	Assumptions made to estimate additional energy savings from ESOS are increased or decreased by 50%.	840	3,040
Repeat Assessments	Additional savings from ESOS assessments are increased or decreased by 0.05% every year.	1,070	2,760
Capital Costs	Capital costs increased or decreased by 50% (which in turn affects hassle costs).	1,440	2,430
Energy Prices	IAG low and high energy prices are used instead of central ones.	1,450	2,380
Number firms with audit	The number of firms already conducting audits in the no-directive baseline is increased from 25% to 50%.	1,470	-
Transport SME/non SME Split	Proportion of transport energy consumption used by large enterprises.	1,860	2,020
Industry & buildings SME / non SME Split	Proportion of energy consumption used by large enterprises that own buildings and industrial processes. In the central scenario large enterprises consume 79.3%, in the low scenario 78.6% and in the high scenario 82.5% of total energy demand.	1,890	2,040
Policy Overlaps	The amount of uncovered energy in the central scenario is 84% and it is increased to 85% in the low case scenario or decreased to 78% in the high case scenario.	1,910	2,040
Administrative Burden	The administrative burden from carrying out an assessment is increased or decreased by 50%.	1,880	2,000
Cost Assessment	The cost of ESOS assessments are increased or decreased by 50%.	1,890	1,990
Hassle Cost	Hassle costs increased or decreased by 50%.	1,880	1,970
Number Sites Visited	The proportion of sites visited by ESOS assessors is increased or decreased by 50%.	1,900	1,960
Number of Industrial enterprise in scope	The number of industrial enterprises in scope is increased or decreased by 50% (although the total number of remains constant).	1,930	1,950
Number of Fleets in scope	The number of fleets in scope is increased or decreased by 50% (although the total number of remains constant).	1,930	1,950
Businesses Overlaps	The number of firms in CRC is reduced from 6,423 to 4,362 (which is the number of significant group undertakings in CRC).	1,930	1,950
Number Buildings	The number of buildings is increased from 170,000 to 200,000.	1,930	-

Source: DECC analysis

9. Evaluation plan

The government has committed itself to reviewing ESOS in 2016 (see chapter 2 of the Consultation Document). This review is likely to include an evaluation of both the

quantitative impact of ESOS and a qualitative understanding of the process through which ESOS assessments affect the energy efficiency of different enterprises.

The details of how the evaluation will be conducted are being developed alongside the policy to ensure the two are integrated effectively. The key metrics used to assess the impact are likely to include the energy and carbon savings delivered, the number and cost of ESOS assessments conducted, the cost-effective savings identified and the proportion of recommendations taken-up. The process evaluation would focus on how effective the accreditation regime is at ensuring that appropriate recommendations are being made, how enterprises are using the information provided and how ESOS assessments are interacting with the wider policy landscape. The evaluation will draw on a combination of administrative and survey data (the amount of administrative data available will depend on which option is implemented).

ESOS Consultation Stage Impact Assessment Annexes

Annex A – Summary of analytical questions

Annex B – Technical potential in buildings and industrial processes in scope of the policy

Annex C – Structure of cost benefits analysis

Annex D – Number of buildings in scope of ESOS

Annex E – Detailed transport sector analysis

Annex F – Fit with the UK policy landscape

Annex G – Literature review

Annex H – Extract from Energy Efficiency Directive EED

Annex A – Summary of analytical questions

Q1: Do you have any evidence that could improve the estimate of scope of the ESOS set out in this Impact Assessment (in terms of the number of enterprise, buildings, industrial processes and vehicles, and energy consumption covered)?

Q2: Do you have any evidence that could improve the estimate of size of the overlaps between the ESOS and existing polices?

Q3: Do you have any evidence on the extent to which large enterprises are already conducting energy audits that are comparable to the proposed ESOS assessments?

Q4: Do you have any evidence on likely impact of the ESOS assessments on energy consumption by large enterprise (either from buildings, industrial processes or transportation) that could improve our analysis?

Q5: Do you have any evidence on likely cost of conducting the ESOS assessments of buildings, industrial processes or transportation?

Q6: Do you have any evidence on potential administrative burden to enterprises of complying with the ESOS, and how this might vary between the different policy options?

Q7: Do you have any evidence on potential capital and hassle cost of implementing energy efficiency measures?

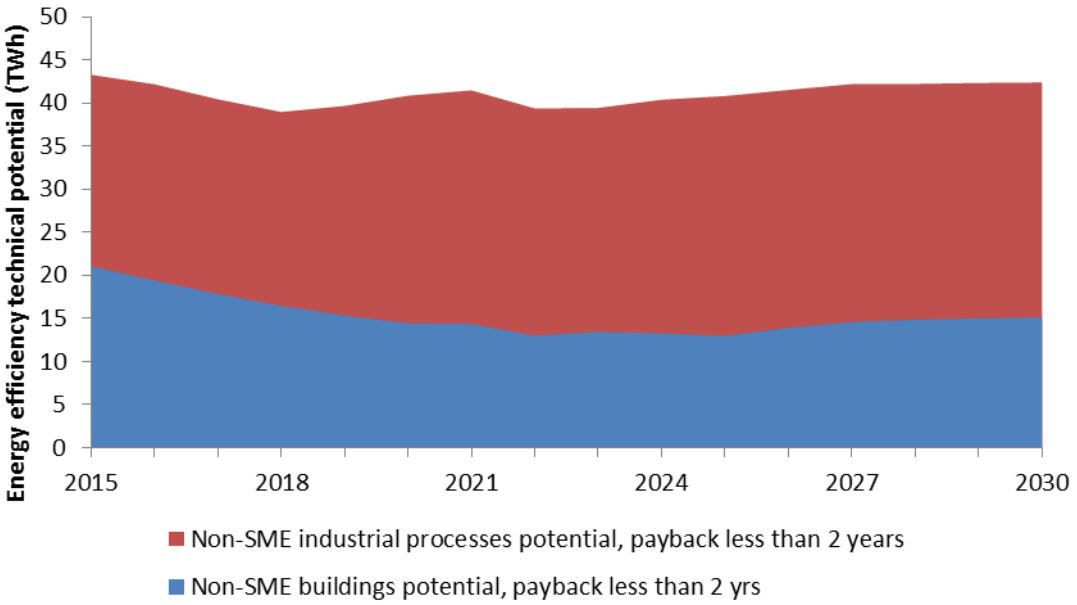
Q8: Do you have any evidence on potential cost of accrediting the ESOS assessors?

Q9: Do you have any evidence which can support us in assessing how the benefits may differ between the options?

Annex B –Technical potential in buildings and industrial processes in scope of the policy

Figure 1 shows the estimated technical potential in buildings and industrial processes in scope of the policy. This annex summarises how this has been estimated.

Figure 1: Projected technical potential for energy efficiency within scope of ESOS



1. Technical potential in buildings

The estimate of the technical potential for energy efficiency improvements available in buildings used by non-SMEs is based on a combination of two datasets, namely: the Small Emitters Model (SEM) and the DECC Energy and Emissions Projections. The SEM uses data from the National Non-Domestic Buildings Energy and Emissions Model (N-DEEM). N-DEEM was developed by the Building Research Establishment to provide an insight into energy use and abatement potential within the country's non‑domestic properties. Technology penetration rates estimated by Element Energy[42] are used to estimate the remaining potential over time. The N-DEEM project ran between the mid-1990s to mid-2000s.

The SEM includes data on the technical potential in the building sector for the period 2015-2030. This has been adjusted to make the scope of the potential match the scope of the policy. The steps were;

1. Remove technical potential in public sector buildings (this split was included in the SEM).
2. Split the remaining technical potential into SME and non-SME sectors, using the same ratio as used to estimate the energy in scope of the policy. This implicitly requires the assumption that technical potential is distributed between SME and Non-SME firms in proportion to their energy use.
3. The technical potential taken up as a result of policies not already included in the SEM has been removed. Only policies which covered the relevant sectors were

[42] Element Energy – Uptake of Energy Efficiency in Buildings – 2009. http://downloads.theccc.org.uk/docs/Element%20Energy_final_efficiency_buildings.pdf

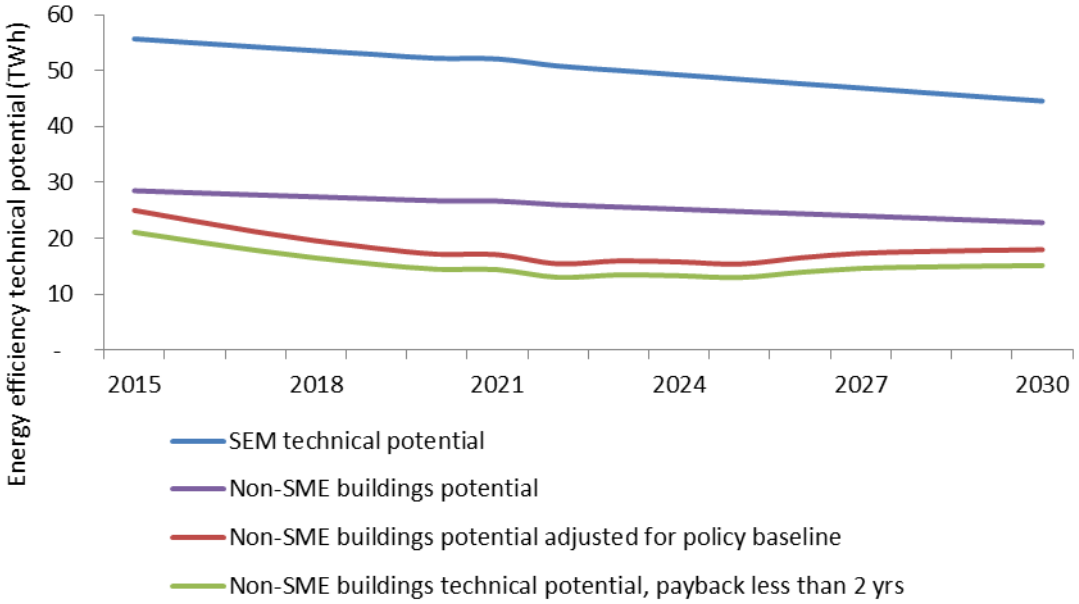
considered (ETS, CRC, Building Regulation Part L 2010, non-domestic Green Deal).

4. Finally, measures with a payback period longer than 2 years have been removed to simulate the propensity to take up measures with a quicker return.

Results

The technical potential in non-SME buildings is estimated to be a total of 21TWh in 2015. Figure 2 shows the impact of removing the technical potential assumed to be within SMEs and the technical potential delivered by policies not already included in the SEM baseline.

Figure 2: Analysis of technical potential in buildings sector



Source: DECC analysis of Small Emitters Model data

Limitations

All measures with a zero or negative capital cost have been removed. Without these measures being installed it is likely that the remaining potential would deliver higher energy savings, however, we have not made this adjustment, but this effect is likely to be small. We are slightly underestimating the technical potential for energy savings through installing physical measures.

2. Technical potential in non-SME industrial processes

The evidence on the potential for energy efficiency in industrial processes is based on the analysis carried out in the Energy Efficiency Strategy Marginal Abatement Cost Curve (EE MACC)[43].

The potential is derived from three principal sources. The Energy End-Use Simulation Model (ENUSIM) is a technology based, bottom-up industrial energy end-use simulation model which projects the uptake of energy-saving and/or fuel-switching technologies

[43] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65603/6928-the--energy-efficiency-strategy-statistical-strat.pdf

taking into account the cost effectiveness of technology options under future carbon and fossil fuel prices scenarios.[44] Further detail on future abatement potential has been derived from work undertaken by AEA Technology.[45] The major sources of abatement covered within this work focus on six major sectors: cement, refineries, glass, chemicals, food and drink, and iron and steel. DECC commissioned further analysis to assess abatement potential beyond that considered in the AEA work.[46] This project is based on top-down energy and abatement projections for 17 wider groups of light manufacturing.

This potential identified in the EE MACC has been adjusted for the scope, to cover non-SME industrial processes excluding those owned by the fuel industry, as we have assumed that ESOS assessments will deliver no additional savings in the fuel industry. Moreover, measures with a zero or negative capital cost have been removed for consistency with the rest of the analysis.

Results

The technical potential in non-SME industrial processes is estimated to be a total of 22 TWh in 2015.

Limitations

The evidence on capital costs is not strong. For some measures capital costs are a top-down estimate of the willingness to pay, whereas for others they are based on a bottom-up estimate of the cost necessary to deliver the identified potential.

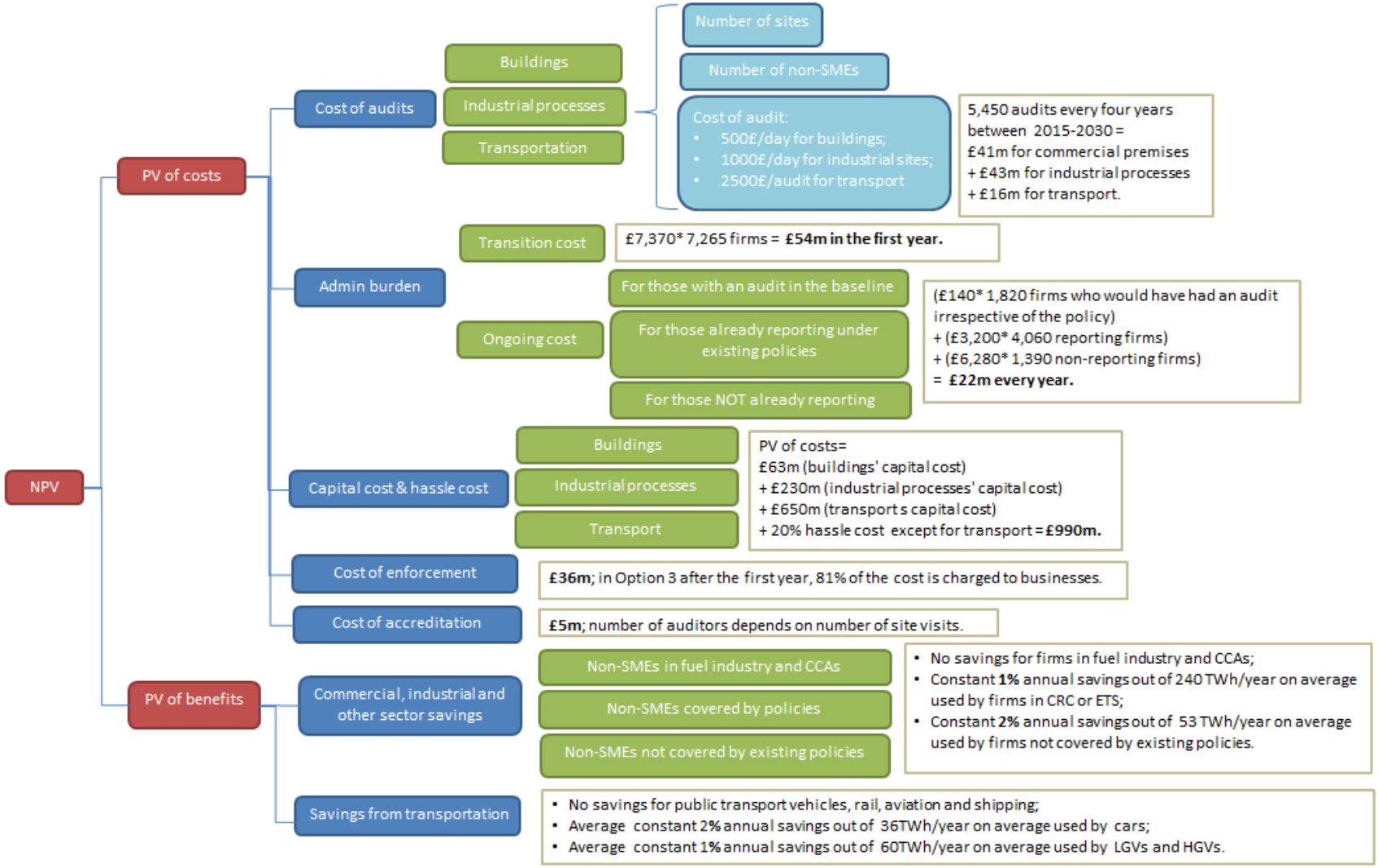
[44] Industrial Energy End-Use Simulation Model ENUSIM. DATABASE, DECC. (Updated: March 2010 and September 2002 [Original Version: March 2001] Entec UK Limited and Cambridge Econometrics).

[45] Analysing the Opportunities for Abatement in Major Emitting Industrial Sectors. Report for The Committee on Climate Change AEAT/ENV/R/Industrial Energy Efficiency ED56369 Issue Number 1, 8th December 2010.

[46] Understanding the Industrial Sector Abatement Opportunities for the 4th Carbon Budget Carbon Abatement Potential within the 'Tail End' Industries . Report for DECC. Arup. Ref: 81/11/2010 – Issue June 2011.

Annex C – Structure of cost benefits analysis

The figure shows the structure of the cost benefit analysis used to assess the impact of ESOS (the figures below refer to Option 1).



1. Details of the standard cost model analysis of administrative burden and accreditation

This section sets out the details of the assumptions used to estimate the administrative burden to enterprises of complying with the mandatory ESOS requirements and the cost to ESOS assessors of complying with accreditation regime. The analysis combines a) a breakdown of the tasks that need to be done, b) an estimate of how long each will take and c) estimates of the hourly wage of the individual required to complete the work (based on the Standard Cost Model).

Accreditation costs

Table 1 sets out the tasks that will need to be completed to ensure ESOS assessors are accredited and they are conducting audits of an adequate standard.

Table 1: Standard Cost Model analysis of cost of accreditation

	Directors and Department Heads (£61/h)	Senior Manage-ment (£45/h)	Middle Manage-ment (£26/h)	Administra-tors (£10/h)	Total Cost (£)
	Number of days spent on each task (FTE)				
5 days annual training (per ESOS assessor)		1	5	5	£1,435
4 annual evaluations (per ESOS assessor)			4	4	£1,023
Quality assurance testing (for 1 in 10 ESOS assessments)		0.1	5	5	£1,310

Source: Discussions with stakeholders

Administrative burden

Tables 3 and 4 below set out the number of days it takes to complete the process each organisation will need to go through in order to comply with the ESOS requirement. For the administration burden, data from a survey of CRC participants collected by KPMG in 2011 has been used as an estimate of the time taken for some tasks (for example, the time taken to understand the regulations and or gather data).[47] Where data is not available, illustrative assumptions have been used.

Some tasks (Understand the requirement and Educate the organisation) will only need to be conducted once. Others will need to be completed each time an ESOS assessment is conducted. Table 3 sets out the task that organisations will need to complete for all options and Table 4 shows the tasks specific to each option.

[47] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/42934/4759-kpmg-assessing-admin-costs-crc-scheme.pdf

As discussed in Section 6.3 of the Impact Assessment, some enterprises will already be conducting some of the required tasks (either because of existing policies or because they are already conducting an audit in the counterfactual scenario). Table 2 provides a breakdown of which enterprises are assumed to incur the costs of which tasks.

Table 2: Breakdown of which tasks different organisations will need to complete

	Organisations covered by existing policy	Organisations not covered by existing policy	Organisations with an audit in the counterfactual
Understand the requirement (once)	X	X	X
Educate the organisation (once)	X	X	X
Recruit an ESOS assessor	X	X	
Gather data		X	
Gather data (transport)	X	X	
Evidence Pack		X	
Accompanying ESOS assessors on site visit	X	X	
Attend presentation on recommendations	X	X	
Investigate ESOS assessment recommendations	X	X	
Option specific tasks (enforcement activity, reporting, public disclosure)	X	X	X

Table 3: Breakdown of ESOS tasks per organisation, for all policy options

	Directors and Department Heads £61/h	**Senior Management** £45/h	**Middle Management** £26/h	**Administrators** £10/h	
ESOS tasks	**Number of days spent on each task (FTE)**				**Cost (£)**
Common costs of all options – upfront (incurred once)					
Understand the requirement	**2.3**	**4.9**	**11.0**	**4.4**	4,857
Educate the organisation	**1.1**	**3.1**	**5.0**	**2.1**	2,512
Common costs of all options – ongoing (per round of ESOS assessment)					
Recruit an ESOS assessor[48]			*2*		365
Gather data	**0.4**	**1.5**	**6.3**	**5.9**	2,205
Gather data (transport)			*2*	*2*	512
Evidence Pack[49]	**0.3**	**0.8**	**2.9**	**1.6**	1,011
Accompanying ESOS assessors on site visit[50]			**1** X number of days on site		716
Attend presentation on recommendations[51]		*2*	*2*		991
Investigating ESOS assessment recommendations			*1.5*	*1.5*	384

Note: **numbers in bold come from the KPMG report on CRC costs to businesses**; *numbers in italic are assumptions based on discussions with stakeholders*.

[48] A middle manager will spend 2 days researching which ESOS assessor the company should hire.

[49] Based on CRC data on number of days Compiling and submitting your annual report evidence pack.

[50] A middle manager will accompany the ESOS assessor for the duration of each site visit.

[51] Two senior managers and two middle managers will attend a half-day presentation and spend half a day reading the report.

Table 4: Breakdown of administrative tasks per organisation, specific to policy options 1-6

	Directors and Department Heads £61/h	**Senior Management** £45/h	**Middle Management** £26/h	**Administrators** £10/h	
ESOS tasks			**Number of days spent on each task (FTE)**		**Cost (£)**
Additional cost of Option 1					
Enforcement activity[52]	**0.0**	**0.1**	**0.4**	**0.2**	143
Additional cost of Option 2					
Registering with the enforcement body			*0.2*		36
Enforcement activity[11]	**0.0**	**0.1**	**0.4**	**0.2**	142
Additional cost of Option 3					
Light touch enforcement activity[53]	**0.0**	**0.0**	**0.1**	**0.0**	29
Public disclosure of ESOS compliance[54]	*2*	*1*	*4*		1,897
Additional cost of Option 4					
Registering with the enforcement body			*0.2*		36
Processing enforcement charge				**0.1**	7
Enforcement activity[11]	**0.0**	**0.1**	**0.4**	**0.2**	143
Additional cost of Option 5					
Report results to enforcement body[55]	**0.3**	**0.8**	**2.9**	**1.6**	1,011
Additional cost of Option 6					
Accompanying ESOS assessor to all sites			*1 X number of days on site*		4,085
Enforcement activity[11]	**0.0**	**0.1**	**0.4**	**0.2**	143

Note: **numbers in bold come from the KPMG report on CRC costs to busine**sses; *numbers in italic are assumptions based on discussions with stakeholders*.

[52] Based on CRC data on 'liaising with EA' and 'reporting' but only 10% of firms incur these costs.

[53] Based on CRC data on 'liaising with EA' and 'reporting' but only 2% of firms incur these costs.

[54] A middle manager will spend 4 days and a senior manager 1 day preparing the report for directors and preparing for publication. The 8 directors will meet and consider the proposals for a half-day. [This is consistent with the cost of GHG reporting]

[55] Based on CRC data on 'reporting'

Annex D: Number of buildings in scope of ESOS

1. Introduction

This annex sets out how the estimate of the number of buildings in scope of ESOS was developed. This analysis was used to estimate the cost of conducting ESOS assessments and the size of the administrative burden to businesses.

2. Data sources

The analysis uses a variety of data sources matched within the developmental non-domestic National Energy Efficiency Data-framework (NEED). In summary these were:

2.1 Non-domestic Rating File (NDR, Valuation Office Agency)

File contains 1.8m “hereditaments” (rateable units) in England & Wales for which business rates are paid. This will include the vast majority of business and public sector premises. There are a few exceptions (such as MoD sites). The data from this source provide type of premises (e.g. office, shop and factory) and floor area. About 5% of these sites may have not buildings e.g. phone box, advertising board and these have been excluded from the analysis. It is possible to have multiple buildings within a rateable unit, for example an industrial site but the extent of this is not known.

2.2 ExperianPH Megafile

The Experian data provide details on the number of employees modelled from a range of business records / surveys at each site and aggregated to company level. The accuracy of aggregation to parent company is not known but would appear to aggregate fewer businesses together than Official Business Statistics from the IDBR. This will lead to the count of sites being under-estimated as some enterprises will be classified below the employment threshold as not all sites have been captured (see Table 2 for more details). The extent to which this data covers public sector buildings with Display Energy Certificates (DECs) is thought to be minimal. Experian data are available for about half the premises in the NDR.

2.3 Display Energy Certificates

Large public sector buildings are outside the scope of ESOS. There are about 30,000 buildings captured. These have been removed from the NDR total before grossing up the Experian results.

2.4 IDBR Business Statistics

The data contained in these tables are produced from a snapshot of the Inter Departmental Business Register (IDBR) taken on 12 March 2012. The main administrative sources for the IDBR are VAT trader and PAYE employer information

passed to the ONS by HM Revenue & Customs under the Value Added Tax Act 1994 for VAT traders and the Finance Act 1969 for PAYE employers; details of incorporated businesses are also passed to ONS by Companies House.

2.5 Business Population Statistical Estimate

This is compiled based on a range of sources including the IDBR with the objective to better capture small and medium sized business not captured by the IDBR. The counts presented include not for profit organisations over the size threshold but public sector activity has been excluded.

3. Summary of businesses in the UK

Table 1: Number of enterprises with >=250 employees

Data source	Number of businesses
BIS 2012 business population estimates[56]	7,265
ONS 2012 IDBR statistics[57]	8,775
Experian 2012 data	14,490

It is not possible to fully-aggregate premises information to parent company identities, due to data coding issues, therefore the Experian estimates of the number of buildings within large enterprises is an underestimate. Sensitivity analysis was carried out using different thresholds for employee number to provide an estimated range to account for the uncertainty.

Table 2: Experian number of businesses by employment size: United Kingdom

Company employment	**Number of business**	**Number of sites**
>= 250	14,490	170,750
>= 200	18,050	183,180
>= 150	23,500	200,575
>= 100	34,835	232,435

The sensitivity analysis in Table 2 shows there are a relatively small number of business sites assigned to enterprises classified with 100 to 249 employees and therefore even if some sites have fallen below the threshold the number of sites will be small but reflected in the uncertainty range.

Given the sensitivity highlighted in Table 2 regarding the aggregation of premises and that some hereditaments will have multiple buildings an appropriate **range for modelling the total number of business premises in enterprises with >=250 employees in the UK would be 170,000-200,000.**

[56] https://www.gov.uk/government/publications/bis-business-population-estimates

[57] http://www.ons.gov.uk/ons/rel/bus-register/uk-business/2012/stb-uk-business--activity--size-and-location---2012.html

Annex E – Detailed transport sector analysis

1. Introduction

This annex identifies the transport energy consumption baseline for non-SME businesses. Surface transport (road and rail) and aviation and shipping are treated separately in this analysis. This work fed into the cost benefit analysis of ESOS in the transport sector.

2. Sources

Transport energy consumption forecasts are taken from DECC's 2012 Updated Emissions Projections. This provides energy consumption in million tonnes of oil equivalent split by mode. For the purpose of this Impact Assessment, units have been converted to GWh using conversion factors taken from Digest of UK Energy Statistics, a DECC statistics publication (DUKES) 2012[58].

3. Surface transport

3.1 Estimating all business transport energy consumption

The first step in creating a business transport energy consumption baseline is to estimate what proportion of energy consumption can be attributed to business-related travel, for both SMEs and non-SMEs. For some modes, this is relatively straightforward – for example, it seems reasonable to assume that all transport fuel purchased for HGVs, rail, and bus and coach travel is purchased by business.

For cars and vans, energy consumption attributable to both company car and van fleets and household cars completing trips for business purposes needs to be taken into account. DfT transport statistics identify the proportion of the vehicle stock which is licensed to companies rather than private individuals[59]. National Travel Survey statistics also show that average annual mileage for company cars is considerably higher than for privately owned vehicles (19,200 miles/annum vs 7900 miles/annum), so this information is used to weight the proportion of car fuel consumption allocated to business company car fleets. Together these assumptions suggest that 18% of car energy consumption is attributable to company car fleets. In generating this estimate the simplifying assumption has been made that average fuel efficiency across privately owned vehicles and business owned vehicles is the same, although this may not be the case as businesses are likely to replace vehicles in their fleets more regularly and newer models tend to be more fuel efficient.

The National Travel Survey (NTS) also provides information about trip purpose for household cars. DfT analysis of the NTS suggests that 81% of total car CO_2 emissions are generated by households, and by implication, 19% of car emissions are generated by business-owned cars. This figure is very close to the 18%

[58] 1 mtoe = 11630 GWh

[59] DfT Vehicle Licensing Statistics, tables veh0202 and veh0402, https://www.gov.uk/government/publications/vehicle-licensing-statistics-2011

estimated above, and is a useful sense-check. Analysis of the NTS suggests 11% of household car CO_2 emissions are generated by trips for business purposes (this excludes commuting). Translating these figures to energy consumption suggests 9% (11% *81%) of car energy consumption can be attributed to cars owned by households travelling for business.

For vans, vehicle licensing statistics show that 46% of vehicles are owned by businesses. However, business van mileage is higher than van mileage in privately owned vehicles (22,000 miles/annum vs. 13,200 miles/annum) and energy consumption is weighted appropriately.

Table 1 below summarises the assumptions made in the process of allocating a proportion of total transport energy consumption to business.

Table 1: Surface transport – assumptions made in estimating business energy consumption

Transport mode	**Proportion of energy consumption attributable to business**	**Underlying assumptions**
Cars - company car fleets	18%	Based on % of car stock licensed to business, weighted for average mileage
Cars - household car business travel	9%	National Travel Survey data on trips by purpose
Light Goods Vehicles	58%	Based on % of van stock licensed to business, weighted for average mileage
Heavy Goods Vehicles	100%	All HGVs owned by business
Public Service Vehicles	100%	All public service vehicles (buses and coaches) owned by business
Rail	100%	All trains owned by business

3.2 Assigning business energy consumption for surface transport to non-SME businesses

Assumptions have been made for each mode in order to generate estimates of energy consumption by non-SME businesses. Different approaches have been taken to estimating transport energy consumption in transport-intensive industries (covering rail, bus and coach and a proportion of HGV energy consumption) and for non-transport related industries.

3.2.1 Rail, bus and coach energy consumption

Business Population Estimate (BPE) statistics[60] have been used to generate assumptions on the proportion of rail and Public Service Vehicles (PSV) energy consumption attributable to non-SMEs. These statistics provide numbers of non-SME businesses by industrial sector, as well as details of turnover and employment by business size in those sectors.

Table 7 in the BPE statistics gives a detailed breakdown of businesses in the transport sector and enables the identification of non-SME businesses in the passenger rail, rail freight and other passenger land transport sector. The statistics also provide data on the proportion of turnover and employment in a particular sector attributable to different sizes of business. Table 2 below summarises the relevant data and shows the assumptions made about the relevant mode for each industrial sector:

Table 2: Business population estimates for transport sector industries

3 digit SIC breakdown	Description	Number of non-SME businesses	Employment (%)	Turnover (%)	Mode assumed
491	Passenger rail (interurban)	15	98	98	Rail
492	Freight rail	5	100.0	99.6	Rail
493	Other passenger land transport	80	64.8	69.9	Buses, coaches, taxis

The BPE statistics suggest three ways of generating a non-SME business energy consumption baseline as a proportion of total business energy consumption:

i) Taking the number of non-SME businesses as a proportion of the total number of businesses in a sector,

ii) Taking the proportion of employment associated with non-SME businesses in a sector, and

iii) Taking the proportion of turnover associated with non-SME businesses in a particular sector.

[60] BIS Business Population Estimates for the UK and Regions 2012, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/16402/bpe_2012_data.xls

The assumption made in this analysis is that turnover is likely to have the closest relationship to energy consumption for transport-intensive businesses, given that outputs in transport-sector industries will be proportionate to fuel consumption. Therefore the percentage of rail energy consumption attributable to non-SME companies is assumed to be 99% (average of passenger and freight rail non-SME turnover). The percentage of PSV energy consumption attributable to non-SME companies is assumed to be 70%.

To summarise, the following assumptions are made in assigning a proportion of rail and PSV energy consumption to non-SMEs:

- All rail and PSV energy consumption generated by transport sector industries, and
- The proportion of energy consumption attributable to non-SME businesses in these sectors (passenger rail, rail freight, and other passenger land transport) is based on the proportion of turnover in the sector attributable to non-SMEs.

3.2.2 HGV energy consumption

HGV energy consumption can be divided between transport-sector industries (road freight and removal companies) and non-transport sector industries such as retail where large companies may run their own HGV fleets. To estimate non-SME HGV energy consumption, information is needed about the following:

- Proportion of HGV energy consumption in transport sector industries i.e. road haulage businesses and removal services,
- Proportion of HGV energy consumption in other sectors (e.g. retail, waste),
- Non-SME businesses in road freight and removal services sector, and
- Non-SME businesses with HGV fleets in other sectors.

DfT road freight statistics provide percentage of tonne kilometres which are ‘mainly own account’ and ‘mainly public haulage’[61]. ‘Public haulage’ is freight carried by HGVs owned by businesses that carry goods for hire or reward, whereas ‘own account’ is freight carried by HGVs owned by businesses that use the vehicle to carry goods within their own business. This provides us with a proxy for estimating the proportion of HGV energy consumption in transport sector and non-transport sector industries.

[61] DfT Road Freight statistics, table rfs0108, https://www.gov.uk/government/publications/road-freight-statistics-2010

	Mainly own account	Mainly public haulage
% of tonne-kilometres	36%	64%

Using these figures suggests that 64% of HGV energy consumption might be attributable to businesses in the road freight and removals services sector. BPE statistics then provide data on the number of non-SME businesses in this sector (60 or 0.4% of the total) and the percentage of total turnover in this sector generated by these non-SME businesses (26.5%). As with the rail and PSV estimate, the percentage of turnover generated by non-SMEs is taken as a proxy for the proportion of energy consumption by non-SMEs. These assumptions suggest 17% (26.5% * 64%) of HGV energy consumption is attributable to non-SME road freight businesses.

36% of HGV tonne-kilometres are assumed to be generated by HGVs owned by non-transport sector businesses. However, no evidence has been found to suggest what proportion of businesses with their own HGV fleets would be classified as non-SME. For illustrative purposes, an assumption has been made that a high proportion of 'own account' tonne-kilometres are generated by HGV fleets associated with non-SME businesses. It seems reasonable to assume that larger businesses are more likely to run their own HGV fleets. The assumption made in the central case is that 80% of the remaining HGV energy consumption is attributable to non-SME businesses running their own HGV fleets. Therefore, 29% (80% *36%) of HGV energy consumption is assumed to be attributable to non-SME businesses in non-transport intensive sectors.

3.2.3 Car and van energy consumption

In the absence of evidence on the relationship between size of businesses and the size of their car and van fleets, illustrative assumptions have been made to assign a proportion of business car and van energy consumption to non-SME businesses.

It is assumed 50% of company cars and vans are owned by non-SMEs, and that this translates to 50% of company car and van energy consumption. The implicit assumption made here is that travel patterns and fuel consumption are similar for company cars and vans owned by both SME and non-SME.

3.3 Summary – non-SME transport energy consumption baseline for surface transport

In generating a baseline forecast of non-SME transport energy consumption, the above assumptions on splits between business/non-business and SME/non-SME across the different modes have been held constant over time. This is a simplifying assumption and does not take account of, for example, possible future changes to the proportion of the car stock owned by business, or other key drivers of business transport energy consumption.

Table 3 below shows total surface transport energy consumption, business surface transport energy consumption and non-SME surface transport energy consumption, given the assumptions outlined above.

Table 3 Baseline surface transport energy consumption (TWh)

	2015	2020	2025	2030
Total	448	435	417	411
All business	227	226	221	223
% of total	*51%*	*52%*	*53%*	*54%*
Non-SME	119	117	115	116
% of total	*27%*	*27%*	*28%*	*28%*

4. Shipping

BIS Business Population Estimates suggest that there are no non-SME sea and coastal shipping freight businesses, and that there are ten sea and coastal passenger transport businesses. It has not been possible to assign a proportion of forecast shipping energy consumption to these businesses.

Fuel costs are a significant proportion of a shipping firm's operating costs and therefore there is already a strong incentive for operators to minimise those costs in the course of their business through, for example, setting optimum speeds (sometimes described as 'slow steaming'). Energy efficiency is a high profile issue within the shipping industry and international negotiations in the International Maritime Organization have led to the development of the Energy Efficiency Design Index (EEDI) for new ships. The index requires new ships to meet a minimum energy efficiency level per capacity mile for different ship types and size segments. Given progress made in international negotiations, plus existing incentives for ship owners to reduce their fuel costs, it is not expected that ESOS assessments would lead to any affected shipping businesses taking up additional fuel saving measures.

5. Aviation

BIS Business Population Estimates suggest there are 20 non-SME passenger air transport businesses that will fall under the scope of ESOS assessments. It has not been possible to attribute a proportion of forecast aviation energy consumption to these businesses as energy consumption estimates are based on UK aviation fuel sales which includes sales to non-UK owned airlines.

There are a number of reasons to expect that ESOS assessments would not drive additional fuel savings in aviation energy consumption. As with other energy-intensive business, fuel costs make up a significant proportion of total operating costs in the aviation industry[62] and therefore there are clear incentives for airlines to undertake cost-effective actions to reduce fuel consumption, in order to improve their competitive advantage. DfT's most recent published aviation forecasts assume an improvement in fuel efficiency of 8% between 2010 and 2030 in the central forecast,

[62] IATA estimate fuel costs account for 30% of total operating costs, http://www.iata.org/pressroom/facts_figures/fact_sheets/Pages/fuel.aspx

driven largely by the current fleet being replaced in the 2020s by a future generation of more fuel efficient aircraft[63]. There are limited options to retrofit existing aircraft to improve fuel efficiency in the shorter term and given aviation's inclusion in the EU ETS, it is expected that any cost-effective actions to reduce fuel consumption and emissions would be undertaken in the counterfactual. Marginal abatement cost curves for the aviation sector developed for DfT in 2011 suggest that there are only limited actions to reduce fuel consumption that are less costly than purchasing EUAs[64]. A key measure is more efficient air traffic management which is not something that airlines themselves have control over. It therefore seems reasonable to assume that fuel efficiency improvements will be made as part of the natural fleet replacement cycle, as assumed in the aviation forecasts.

[63] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/183931/aviation-forecasts.pdf

[64] A Marginal Abatement Cost Curve Model for the UK Aviation Sector (AEA and EMRC, 2011) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/4209/mac-report.pdf

Annex F – Fit with the UK policy landscape

1. Introduction

This annex covers how ESOS fits with the existing UK policy landscape. It does so by looking at three aspects:

- The relationship between the requirements of ESOS and those of existing policies,
- The number of businesses in CRC which would fall under the ESOS requirement, and
- The energy consumption which is in scope of ESOS and is already being measured and reported on under existing policies.

2. Policy instrument overlaps

Table 1 shows how ESOS relates to existing policies. It illustrates that there is a gap between requirements of Article 8 and the requirements of existing domestic UK policies.

Table 1 – Nature of policy overlaps

UK policy	Nature of overlap / what is targeted?	What data are organisations required to report & store? Frequency?	Targets whole organisation?	Who enforces the instrument?	Requires audits identifying cost-effective energy efficiency opportunities?	Extent to which existing instrument data can be used
EU ETS	Focuses on large industrial installations. EU ETS includes some direct CO2 energy use emissions (e.g. from boilers). The carbon price aims to drive mitigation, including energy efficiency. In addition, electricity bills take account of the inclusion of power stations within the EU ETS. SMEs not specifically exempted.	GHG emissions from large industrial installations. Yearly reporting, against calendar year cycle Doesn't cover transport, with exception of aviation	No	Environment Agency, SEPA, Welsh body, DENI, and DECC (for offshore)	No – but requires independent verification of annual report to regulator of fuel use and process emissions, with the carbon price driving uptake of some EE opportunities	Low – only cover part of a firm's energy use
CCAs	Focuses on energy intensive sectors. CCAs require measurement of energy use, to help meet CCA energy efficiency targets. Includes some SMEs.	Fuel use from energy intensive sites. Reporting once every 2 years, against calendar year cycle Doesn't cover transport	No	Environment Agency	No – but requires some monitoring of energy use, with the targets driving uptake of some EE opportunities – audited by the EA or its contractors	Medium – a reasonable number of firms will already have energy data for their energy intensive sites

UK policy	Nature of overlap / what is targeted?	What data are organisations required to report & store? Frequency?	Targets whole organisation?	Who enforces the instrument?	Requires audits identifying cost-effective energy efficiency opportunities?	Extent to which existing instrument data can be used
CRC	Focuses on large energy users not covered by ETS or CCAs. CRC requires measurement of energy use and the CRC allowance price aims to drive energy efficiency improvement. Does not specifically exempt SMEs though the electricity inclusion threshold targets the scheme on large companies.	Annual reporting of CRC energy use emissions, against April to end March financial year cycle. Excludes transport, ETS and CCA sites	Yes	Environment Agency, SEPA, Welsh body and DENI	No - but requires some monitoring of energy use, with the carbon price driving uptake of some EE opportunities	High – a substantial number of audits firms will be covered by CRC, and could use this data to help audits compliance
Mandatory GHG reporting	Requires annual reporting of GHGs (including energy use CO2) of UK companies listed on the main market of the London Stock Exchange (and UK firms listed on other stock exchanges? Defra to clarify). SMEs not specifically exempted	Annual reporting of energy use CO2 and other GHGs in the Directors report, according to each individual company's reporting year	Yes	Conduct Committee of the Financial Reporting Council	No	Medium - a reasonable number of firms will already have energy data due to this policy
EPCs	Focuses on fabric of buildings.	The result of the EPC are required to be produced on sale of property	No	Trading Standards	Yes, but specific to the building	Low –only targets buildings

UK policy	Nature of overlap / what is targeted?	What data are organisations required to report & store? Frequency?	Targets whole organisation?	Who enforces the instrument?	Requires audits identifying cost-effective energy efficiency opportunities?	Extent to which existing instrument data can be used
DECs	Focuses on operational use of buildings. Only mandated on public sector	Result must be displayed in public place	No	Trading Standards	Yes, but specific to the building	Low – not mandated on business, only targets buildings
Non-domestic Green Deal	Voluntary, provides finance targeting EE in non-domestic buildings. Includes measurement of energy use and identification of EE opportunities	Uses similar methodology to EPCs. Results of assessment lodged with central body.	No		Yes, but specific to the building	Low – not mandated on business, and only targets buildings
ESOS(DECC)	Focuses on large companies (SMEs are exempt). Targets UK energy use within the whole organisation, including buildings, transport and processes	Energy consumption and potential for energy efficiency improvements. ESOS assessment required every 4 years, and data must be storable.	Yes	Questions included in consultation	Yes	N/A

3. Number of Businesses covered by CRC and CCAs

This section sets out the analysis done to estimate the number of non-SMEs in scope of ESOS that are also covered by existing policies. This analysis is used to estimate the number of organisations that are already collecting the data needed for ESOS assessments (and therefore face a lower administration burden).

3.2 Summary

This analysis shows that the number of firms covered by the CRC is very similar to the coverage of non-SMEs. The total turnover of the two groups is also very similar.

Based on data from 2010/11 a possible range of estimates of the number of non-SMEs in CRC would be:

- A low estimate of 4,400 firms based on the number of Significant Group Undertakings(SGUs) in CCA,
- A central estimate of 5,400 based on the number of non-SMEs who declared information for CRC in 2008, and
- A high estimate of 6,400 based on the number of SGUs and 1.47 ratio of VAT registrations to SGUs.

Given that most CRC participants are very large organisations,[1] it is likely that the same firms are covered by both schemes however this cannot be verified as:

- Results are not comparable using official statistics because organisations in the CRC report the main activity of the primary parent organisations, which in 20% of the cases relates to management of holding companies. This would fall into a large variety of activities in BIS Businesses Population Estimates.
- There are no employment figures in the CRC database that would allow a robust matching process.

The results should be treated with care and further research would be recommended to identify enterprises with large number of employees but low energy intensity. These organisations would be in the scope of ESOS but could fall out of the CRC.

3.3 Definitions of firms

In comparing statistics from BIS Business Population Estimates and the CRC it is important to understand the different coverage and definition of what constitutes a single businesses entity

BIS defines non-SME firms as those firms employing more than 250 full-time equivalent employees. In turn, a firm is defined as individual registration for VAT or National Insurance Contributions. A large part of the analysis in this paper is based on converting data from CRC organisations into VAT basis as reported in BIS Business Population Estimates.

The definition of a CRC organisation is based in top parent organisation registered in Companies House[2]. Most parent organisations in the CRC would own other firms. Therefore it is important to estimate how many large VAT registered firms with more than 250 employees are associated with each of the parent organisation registered in the CRC.

[1] The proportion of emissions from participants with a threshold electricity consumption above 10,000MWh is 98% based on phase I registration report.

[2] The scheme draws on the Companies Act 2006 definitions of parent and subsidiary undertakings to define the relationships within the Group, specifically using the definition of 'Group Undertaking' set out in section 1161(5) of the Act.

The CRC allows some reporting to be done at lower levels of disaggregation, breaking down large parent organisations into smaller units. This reporting has been used to estimate the equivalent number of CRC registered firms in VAT basis.

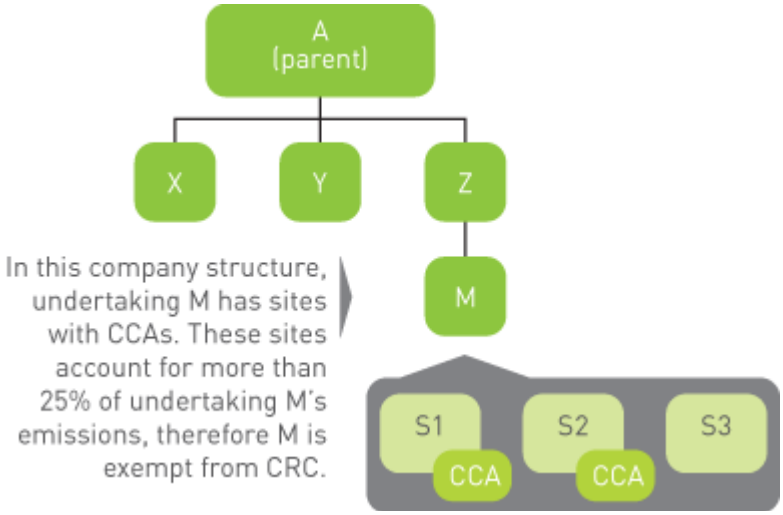
These are the main CRC definitions that have been used in this analysis.

CRC primary parent organisations (2,131 firms): This is a company at the top of the structure of a firm which could be a single entity or own other firms or groups of firms.

Significant Group Undertaking (SGU) (4,362 firms): Where an organisation has any subsidiaries that would be eligible to participate in their own right were they not part of a group, these large subsidiaries are known as SGUs. CRC parent organisations have the choice to disaggregate large subsidiaries to participate in CRC separately, but current rules do not allow them to disaggregate if what is left in the parent company would be below the 6000MWh threshold.

CCA applicable companies (estimated 6,423): This would be the equivalent to a VAT registered firm but it is reported only in specific circumstances. If a significant proportion of an organisation's emissions are covered by a CCA, they may be exempt from CRC altogether. Therefore, the CRC reporting covers the organisational structure in more detail when CCA exemptions are claimed. Figure 1 shows an example of an organisation which owns two CCA target units. Parent A owns 4 SGUs, X, Y Z and M. In turn M owns 3 independent firms, S1, S2 and S3 and two of them (S1 and S2) own a CCA facility. Using this example, the number of SGUs would be 4 and the number of independent companies would be 6 producing a ratio of 1.5 independent companies per SGU[3].

Figure 1 CRC Structure[4]



Company's structure below SGU level is only reported when there are CCAs. This example shows that it may not reflect the whole structure of the company but provides a better understanding of the equivalence between the number of VAT registrations and the ownership structure reported in the CRC.

3.4.1 Descriptive statistics of non-SME business from National Statistics

[3] Notice that there would not be data in the CRC reporting about company S3.

[4] Source: CRC Energy Efficiency Scheme guidance for participants in Phase 1 (2010-2011 to 2013-2014) Version 2 Published February 2013

According to BIS Business Population Estimates, in 2010 there were 6,320 Non-SME firms in the UK, with a turnover of £1.56 trillion. Note this figure is different to the 7,625 discussed in Section 6.1.1 of the Impact Assessment because it refers to private sector organisation only and is based on 2010 statistics, which are used here given because they are being compared to 2010 CRC reporting data.

The following section tries to identify how many of these businesses are covered by the CRC and CCAs. It uses CRC statistics because at organisational level there is a large overlap between the CRC and large CCA organisations[5].

3.4.2 Descriptive statistics of non-SME business from CRC

CRC, CCA and EU-ETS focus on large energy users[6]. This analysis uses the assumption that all CRC firms are non-SMEs. This is based on assuming that there is a correlation between large energy use (above 6000MWh) and number of employees.

Using the VAT registration definition, the analysis suggests there are potentially **6,423** firms covered by the CRC, with 2,455 falling into manufacturing sectors and 1,683 owning at least one CCA facility. The main source of data is the CRC annual and footprint report 2010-11 which contains detailed energy statistics of organisations participating in the CRC.

This estimate has been calculated as follows:

In the CRC 2010/11 annual report, there are 2,131 Parent Organisations and **4,362** Significant Group Undertakings SGU with an average of 2.05 SGUs per participant.[7] These organisations have a registered turnover of £1.67 trillion (slightly higher than turnover from non-SME firms). These figures should be considered robust; they are based on administrative data which is subject to audits and there are penalties associated with miss-reporting.

It is most likely that there is at least one large firm in VAT basis per every Significant Group Undertaking. This would generate a minimum of 4,362 firms in VAT basis.

However, as shown in Figures 1 and 2 it is likely that there would be other firms below SGUs that could also qualify as individual firms when using the VAT registration definition. The CRC data does not report the structure of each organisation at this level so it is uncertain how many firms there are per group undertaking.

However, when SGUs own CCAs they also report the company to which this CCA applies which may be another SGU or not. The CRC database can therefore be used to determine the number of single SGUs that that own at least one CCA facility (1143) and the number of individual companies that own these CCA facilities (1683). The average number of firms per SGU is therefore ~1.47 firms per group. If we apply the same ratio to the CRC, it suggests there could be a total of **6,423 firms covered by the CRC**.

However, there remains considerable uncertainty around this figure.

- It uses data from manufacturing which represents a small proportion of all CCA participants. The ratio of SGUs to VAT registrations could be higher or lower in other sectors.

[5] Internal research on CCAs qualification for the CRC carried out by AEA for DECC.

[6] CRC is based on parent organisations and CCA and EU ETS on installations.

[7] This analysis excludes the 633 public sector organisations in the CRC.

- It assumes that all the CCA company applicable are large firms.

This analysis results in 2 SGUs per primary parent organisation and 1.5 VAT registered firms per SGU. The results also show a close match between the number of large firms on employment basis (BIS Business Populations estimates) and the number of large firm in energy consumption basis (CRC database). These have to be interpreted carefully as there is no validation of the actual number of non-SME firms per SGU in the CRC. A possible range of estimates of the number of non-SMEs in CRC would be:

- A low estimate of 4,400 firms based on the number of SGUs, and
- A high estimate of 6,400 based on the number of SGUs and 1.47 ratio of VAT registrations to SGUs.

3.4 Information declarers

A sensitivity check on the number of non-SMEs in CRC was carried out by estimating the number of non-SMEs outside CRC, using 2008 data from the Environment Agency (EA).

When CRC was set up, organisations that consumed below 6,000 MWh of qualifying supplies of electricity in 2008 had to report their name and Company House number to the EA.

A systematic random sample of these information declarers was selected and their employment size was checked through their Company House number. This produced an estimate of around 1,900 non-SMEs out of around 11,500 enterprises and non-profit organisations that fell below the CRC threshold.

This estimate is compatible with the range of 4,400-6,400 non-SMEs in CRC. We have used this as a central estimate for overlaps, giving 5,400.

There is a degree of uncertainty around this estimate because the data refers to 2008.

3.5 Uncertainty

Ownership of large organisations is complex. Although aggregate figures seem to match in both data sets, it is quite hard to confirm this point at lower levels of disaggregation. It is possible that the CRC would include a larger number of energy intensive organisation and that BIS population estimates would include more employment intensive organisations. Both could cancel out producing spurious results.

The CRC reports SIC codes for parent organisations only. In 20% of the cases, the main SIC code of these large parent organisations correspond to activities related to management of holding companies. This could be anything, from real estate trust to large industrial conglomerations. As a result, it is not possible to disaggregate CRC data into energy intensive and employment intensive sectors and. In turn, it is not possible to do cross checks between BIS population estimates and the CRC for some relevant sectors.

4. Energy Overlaps

This section presents the analysis of the energy overlaps in the policy landscape, which was used in the quantitative analysis of benefits. The outputs of this analysis are the Venn diagrams presented in Section 6.2 of the Impact Assessment, which show how energy consumption in the business sector is split between policies and fuels for non-SMEs.

4.1 Inputs to cost benefit analysis

There are two proportions that underpin analysis in the Impact Assessment:

- It is estimated that 37-40% (or 57-67TWh) of non-SME electricity use is not covered by the CRC or CCA.
- It is estimated that up to 9% (or 30 TWh) of non-SME other energy use is not covered by the CRC, CCA or EUETS.

4.2 Key Assumptions and Methodology Choices

Due to a relative lack of evidence in this area, the overlaps analysis has to make some key simplifying assumptions and methodology choices:

1. Assumption - The energy use of SMEs in the **CRC** is very small compared to the energy use of non-SMEs and is therefore taken as zero. Therefore all consumption in the CRC is taken to be non-SME.

2. Assumption - If a site in the **CCA** belongs to a non-SME, the non-SME organisation will be part of the CRC. The CRC reporting data then allows the CCA energy use to be divided between SME and non-SME.

3. Methodology choice - There is uncertainty in how much non electricity energy the **ETS** covers. Therefore a range of values are used to reflect this uncertainty.

4. Methodology choice - A top down approach can be used to estimate the split of **total** energy use in the business sector between non-SMEs and SMEs.

4.3 Definitions

Business sector – The business sector has been defined to include: the commercial sector, industry (buildings and processes), the energy industry and agriculture. Transport and the public sector are out of scope of the energy overlaps analysis. This definition aligns with the DUKES[8] categories: energy industry, industry, commercial, agriculture, miscellaneous.

Other energy/fuel use - Energy use from all fuels other than electricity (e.g. gas, petroleum products, coal, bio energy, heat sold).

4.5 Methodology

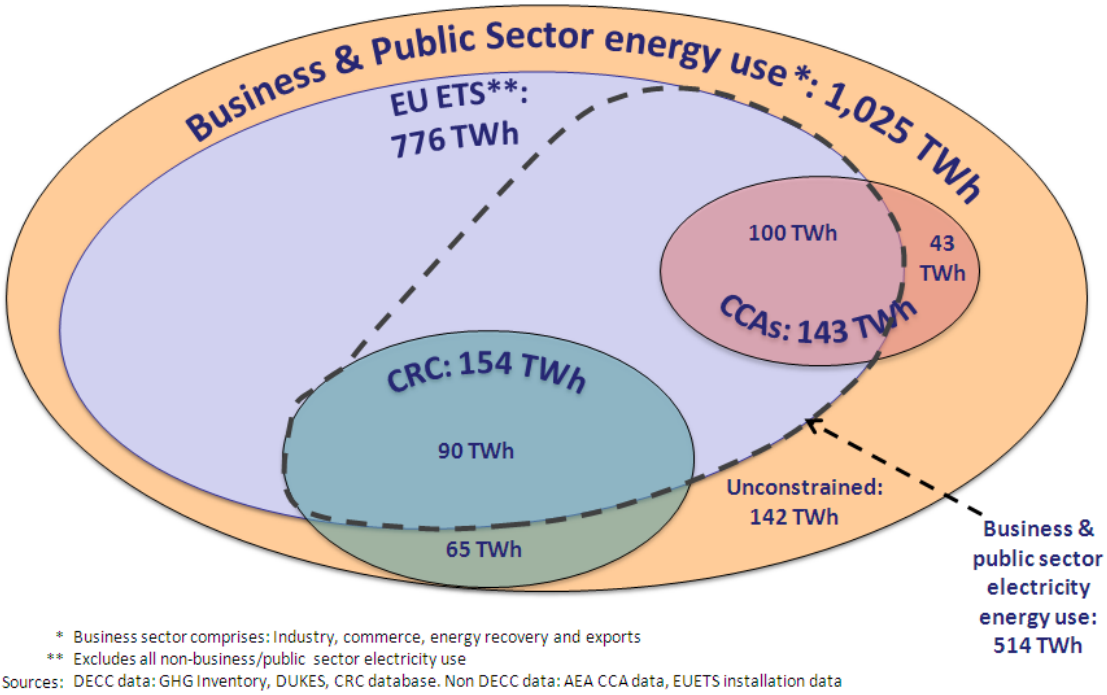
This section sets out the methodology used to produce the energy overlaps Venn diagrams in greater detail.

[8] https://www.gov.uk/government/organisations/department-of-energy-climate-change/series/digest-of-uk-energy-statistics-dukes

<u>Step 1</u> – Calculate energy overlaps for business sector in terms of final energy consumption

The primary energy consumption energy Venn diagram in the Energy Efficiency Strategy was the starting point, but additional analysis was needed to split into different fuels and remove the public sector.[9]

Primary energy use in the Business and Public sectors:[10]



This analysis is carried out on 2010 data as this is the latest year for which all the input data sources are available. A variety of sources were used to obtain the final energy consumption figures needed:

- DUKES gives the final energy consumption for the **overall business sector** split by fuel.
- **CRC** final energy use is available from the CRC reporting data.
- The **CCA** reporting data only contains primary energy use. To obtain final consumption, a conversion factor of 2.6 was used for electricity [11] and it was assumed that final is equivalent to primary for other fuels.
- **ETS** reporting data is less appropriate to this task as it is at site level and in terms of emissions. For electricity consumption this is not an issue, since the ETS is targeted at generators and not final users. So from a final user perspective, any electricity use that is outside the CRC and CCA is in a sense unreported and unconstrained.
  Other energy use captured by the ETS must be estimated and a range of values are used. The lower limit is set by including consumption which is known with certainty to be in the ETS and the upper limit is set by using a MtCO2 to TWh conversion factor (derived from the CCA – ETS overlap which is reported in terms of both emissions and energy).

[9] https://www.gov.uk/government/publications/energy-efficiency-opportunities-in-the-uk (see page 65)

[10] The CRC ETS overlap in the primary consumption Venn diagrams is actually in terms of final consumption and is therefore an underestimate. This is taken into account in the new analysis.

[11] As per the CCA interim guidance https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47819/6112-cca-interim-guidance-gp3-5.pdf

Step 2 – Calculate energy overlaps for non-SMEs

A number of simplifying assumptions have been used to split each section of the Venn diagrams into SME and non-SME energy use.

Split CRC into SME and non-SME:

The CRC contains any organisation which consumes over 6000 MWh of electricity per year on a half hourly meter. Although most of the organisations it contains will be non-SMEs, the policy does cover some SMEs. The simplifying assumption made is that the energy use of the SMEs in the CRC is negligible compared to the energy use of non-SMEs, and is therefore assumed to be zero. This assumption is consistent with those used in the analysis of the overlaps in terms of number of organisations.

Split CCA into SME and non-SME:

Any organisation that is in the CRC will also report emissions that are covered by the CCA. It is assumed that all non-SME CCA sites will be captured by the CRC, and therefore it is possible to obtain the proportion of CCA emissions which are non-SME. In reality there will be some non-SMEs sites in the CCA which are not part of the CRC but the expectation is that they cover a small fraction of CCA emissions. The energy split is assumed to be the same as the emissions split.

To split ETS into SME and non-SME:

The ETS record level data contains the name of the organisation owning the site. It also partially matches to Experian data, which contains information on company size and turnover. The record level data was filtered to exclude generators and the public sector. A sample of 60% of ETS sites was examined and split between SME and non-SME on the basis of this information. Based on this analysis, it is estimated that 1% of emissions (and hence 1% of other energy use) in the ETS belongs to SMEs.

To split unconstrained into SME and non-SME:

It is not possible to estimate this split directly, so the split for the total business sector is estimated and the unconstrained non-SME consumption can be taken as the residual of the total and policy results.

A top down approach was used to split business sector consumption between SMEs and non-SMEs. This approach made the following additional assumptions:

- All consumption in the energy industry is non-SME,
- Non CRC/CCA consumption can be split between SME and non-SME using a range of proportions based on NEED [12] analysis and business turnover analysis (this suggests that 39-51% of electricity and 31-51% of gas in this sector is non-SME), and
- Non metered fuels split between SME and non-SME in a different way to metered fuels.

This section of the analysis contains the most uncertainty. Sensitivity analysis was run for this top down approach to determine at which point assumptions broke down and produced inconsistent results. The range of values presented takes this into account.

[12] National Energy Efficiency Data framework, links non domestic business and property attribute data to consumption.

Annex G – Literature review

1. Introduction

This annex presents the literature review of energy efficiency audits, which is summarized in in Section 6.4.2 of the Impact Assessment.

2. Overview

A number of articles have been written on the impact of existing audit policies from across the world. The audit programmes examined are all different and the studies themselves use a variety of different methodologies. However, they do provide some evidence of the impact of energy auditing regimes, including the number of recommendations typically adopted, the required payback period for energy efficient projects and the energy savings that were delivered.

3.1 SMEs and energy audits evaluation in the US

Anderson and Newell (2004) carried out an analysis of 9,034 US small and medium-sized manufacturers who participated in IAC (the US Department of Energy's Industrial Assessment Centres energy audits programme), which was funded by the Government. The data was collected by IAC from 1981 to 2000. The IAC programme consists of a free assessment report that recommends opportunities to increase energy efficiency and of an ex-post analysis of the effects of the audit.

Their study has shown an average 53% uptake of measures and an average payback period of 1.3 years. In particular, over 98% of firms have estimated payback thresholds less than 5 years, and about 79% have payback thresholds less than 2 years. The average cost of implementing an energy efficiency project was $7,400 and they delivered estimated savings of $5,600 per year.[13]

3.2 Energy efficiency behaviour and preferred policy options of SMEs in Leeds

Bradford and Fraser (2008) produced a study based on 112 interviews to SME's carried out in 2005 in Leeds. They disaggregated the SME's into sub-sectors based on economic sector and employee size: manufacturing, construction, commercial and small/medium. Then they studied their different behaviours toward energy saving measures and preferred policy instruments. They report that 53% of their sample adopted energy efficiency measures.

3.3 Large enterprises and energy audits evaluation in Australia

Harris et al. (2000) researched an Australian Government audit programme, which ran for 6 years until 1997 and was taken up by 1200 firms. Auditing costs were subsidised for 50% of the cost up to a maximum amount. The paper investigates the rates of adoption of energy efficiency measures and the reasons why the recommendations are not taken up. The data used comes from a survey of 100 randomly selected (typically large) firms that took part.

They found an 81% take up rate, with an average cost of implementing all recommendations of about $85,000 per firm (the average cost of implemented recommendations was $61,000). They also reported an average 3.5 year payback period for their studied sample. The energy savings

[13] In 2000 US$.

per firm were worth about $300,000 for all recommendations and $255,000 for implemented recommendations.[14]

3.4 Energy audits evaluation in Sweden

Thollander et al (2008) evaluated free audit programme in Sweden, partly funded by the EU, that ran from 2003 to 2008 for SME's. 340 energy audits were carried out by a Swedish regional energy agency. The data used refers to the first 47 firms to take part to the evaluation, suggesting the sample may be biased due to self-selection.

They reported an average uptake of 22% for actual implemented measures, and an uptake of 44% for implemented measures and those measures that the firms were planning to implement. They estimated this lead to an average 3.8% energy saving as a consequence of implementing recommendations and 8.8% if both implemented and planned measures were implemented.

They estimate the average costs to government per firm of €1106 for the audit subsidy, €630 administrative cost and an investment cost to the firm of €198,575. Adopted measures covered space heating, ventilation, compressed air, lighting, production processes, educational and water.

4. Bibliography

Anderson, S.T. & Newell, R.G., 2004. *Information programs for technology adoption: the case of energy-efficiency audits,* Resource and Energy Economics.

Harris, J, Anderson, J. & Shafron, W., 2000. *Investment in energy efficiency: A survey of Australian firms,* Australian Bureau of Agricultural and Resource Economics, GPO Box 1563, Canberra, ACT 2601, Australia

Thollander, Patrik, Danestig, M. & Rohdin, Patrik, 2007. *Energy policies for increased industrial energy efficiency: Evaluation of a local energy programme for manufacturing SMEs*.

Bradford, J. & Fraser, E.D.G., 2008. *Local authorities, climate change and small and medium enterprises: Identifying effective policy instruments to reduce energy use and carbon emissions*, University of Leeds, Sustainability Research Institute, Leeds, United Kingdom.

[14] In 1991-1997 average US$, calculated using the following exchange rate from A$: 1A$1 was on average, equal to US$0.70 over this period.

Annex H – Extract from Energy Efficiency Directive EED

Article 8 Energy audits and energy management systems

1. Member States shall promote the availability to all final customers of high quality energy audits which are cost-effective and:

(a) carried out in an independent manner by qualified and/or accredited experts according to qualification criteria; or

(b) implemented and supervised by independent authorities under national legislation.

The energy audits referred to in the first subparagraph may be carried out by in-house experts or energy auditors provided that the Member State concerned has put in place a scheme to assure and check their quality, including, if appropriate, an annual random selection of at least a statistically significant percentage of all the energy audits they carry out.

For the purpose of guaranteeing the high quality of the energy audits and energy management systems, Member States shall establish transparent and non-discriminatory minimum criteria for energy audits based on Annex VI.

Energy audits shall not include clauses preventing the findings of the audit from being transferred to any qualified/accredited energy service provider, on condition that the customer does not object.

2. Member States shall develop programmes to encourage SMEs to undergo energy audits and the subsequent implementation of the recommendations from these audits.

On the basis of transparent and non-discriminatory criteria and without prejudice to Union State aid law, Member States may set up support schemes for SMEs, including if they have concluded voluntary agreements, to cover costs of an energy audit and of the implementation of highly cost-effective recommendations from the energy audits, if the proposed measures are implemented.

Member States shall bring to the attention of SMEs, including through their respective representative intermediary organisations, concrete examples of how energy management systems could help their businesses. The Commission shall assist Member States by supporting the exchange of best practices in this domain.

3. Member States shall also develop programmes to raise awareness among households about the benefits of such audits through appropriate advice services.

Member States shall encourage training programmes for the qualification of energy auditors in order to facilitate sufficient availability of experts.

4. Member States shall ensure that enterprises that are not SMEs are subject to an energy audit carried out in an independent and cost-effective manner by qualified and/or accredited experts or implemented and supervised by independent authorities under national legislation by [OJ:Please insert the date - three years after entry into force of this Directive] and at least every four years from the date of the previous energy audit.

5. Energy audits shall be considered as fulfilling the requirements of paragraph 4 when they are carried out in an independent manner, on the basis of minimum criteria based on Annex VI, and implemented under voluntary agreements concluded between organisations of stakeholders and an appointed body and supervised by the Member State concerned, or other bodies to which the competent authorities have delegated the responsibility concerned, or by the Commission.

Access of market participants offering energy services shall be based on transparent and non-discriminatory criteria.

6. Enterprises that are not SMEs and that are implementing an energy or environmental management system - certified by an independent body according to the relevant European or International Standards - shall be exempted from the requirements of paragraph 4, provided that Member States ensure that the management system concerned includes an energy audit on the basis of the minimum criteria based on Annex VI.

7. Energy audits may stand alone or be part of a broader environmental audit. Member States may require that an assessment of the technical and economic feasibility of connection to an existing or planned district heating or cooling network shall be part of the energy audit.

Without prejudice to Union State aid law, Member States may implement incentive and support schemes for the implementation of recommendations from energy audits and similar measures.

ANNEX VI

Minimum criteria for energy audits including those carried out as part of energy management systems

The energy audits referred to in Article 8 shall be based on the following guidelines:

(a) be based on up-to-date, measured, traceable operational data on energy consumption and (for electricity) load profiles;

(b) comprise a detailed review of the energy consumption profile of buildings or groups of buildings, industrial operations or installations, including transportation;

(c) build, whenever possible, on life-cycle cost analysis (LCCA) instead of Simple Payback Periods (SPP) in order to take account of long-term savings, residual values of long-term investments and discount rates;

(d) be proportionate, and sufficiently representative to permit the drawing of a reliable picture of overall energy performance and the reliable identification of the most significant opportunities for improvement.

Energy audits shall allow detailed and validated calculations for the proposed measures so as to provide clear information on potential savings.

The data used in energy audits shall be storable for historical analysis and tracking performance.

ANNEX XIV

3.3. Energy audits and management systems (Article 8)

National Energy Efficiency Action Plans shall include:

(a) the number of energy audits carried out in the previous period;

(b) the number of energy audits carried out in large enterprises in the previous period;

(c) the number of large companies in their territory, with an indication of the number of those to which Article 8(5) is applicable.