



Bringing Energy
Together

2016 UK Energy Productivity Audit Methodology note

Context

This note provides an overview of the underlying data and methodology behind the 2016 UK Energy Productivity Audit, produced by the Association for Decentralised Energy and supported by:

- Association for the Conservation of Energy
- Chartered Institution of Building Services Engineers
- Confederation of Paper Industries
- Energy Institute
- Energy Services and Technology Association
- Greenpeace
- Royal Society for the Protection of Birds
- Institution of Mechanical Engineers

The 2016 UK Energy Productivity Audit was published in November 2016 and [is available here](#).
All of the data sources used in the report can be found in Table 1 at the end of this document.

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Infographic 1: Cost of energy

This infographic presents the total UK cost of energy in billions of pounds sterling (£bn) for 2005 and 2015, and its proportion of the total UK economy in 2015.

The total cost of energy comes from the Digest of United Kingdom Energy Statistics (DUKES) 2016 (references are provided in Table 1 at the end of this note), and it consists of the value of energy supply from traded energy sources, including taxes and margins. It excludes the value of energy supply for non-energy use.

The total cost of energy (£140bn 2015) includes:

- Energy consumed by the energy sector itself (£26bn 2015), such as energy losses incurred in the transformation process (for example, from oil to electricity) and transport; and,
- Final energy consumed by end-users (£114bn 2015), which are industry, transport, domestic, commercial and agriculture.

The size of the UK economy is measured by the Gross Domestic Product (GDP) (2013 prices) and comes from the DUKES 2016.

Energy is a significant and growing cost, increasing by 26% from 2005 level (£111bn), to reach £140bn in 2015. Over the same period, the UK's primary energy consumption fell by 14%, from 240.4 million tons of oil equivalent (Mtoe) in 2005 to 197.6 Mtoe in 2015.

This cost increase is mainly due to the rise of fossil fuels imports (+54% in cost terms) between 2005 and 2015, such as imports of coal, petroleum and natural gas. The UK's energy import dependency grew from 13.5% in 2005 to 38% in 2015 (in volume terms).

The UK GDP amounts to £1,833bn in 2015. The cost of energy represents the equivalent of 7.6% of the UK GDP in 2015.

Infographic 2: From energy to production

This infographic shows the economic activity produced from a unit of energy used in production processes in 2010 and 2015, specifically measured in million tons of oil equivalents (Mtoe) of final energy. Final energy refers only to energy used by end-users.

Energy is used to fuel economic activities and an efficient use of this input can help boost the productivity of the UK's economy.

With a Mtoe of energy, the UK produced £11.4bn worth of goods and services in 2010 and £13.1bn worth of goods and services in 2015. The UK made £1.7bn more per million ton of oil equivalent of energy used in 2015 compared to 2010, which is partly due to a more efficient use of energy.

Infographic 3: Productivity gains from end-users

This infographic shows the impact of energy efficiency improvements from industry, services and households on final energy consumption in 2010 and 2015.

We chose to focus on energy savings derived from energy efficiency improvement by end-users. An indication of energy productivity performance is given by the changes in final energy consumption due to improved energy efficiency between 2010 and 2015. Therefore, the impact of energy efficiency on final energy consumption has been isolated from the effect of another factor, the output factor.

Final energy consumption decreased by 19 Mtoe between 2010 and 2015 (or 220 TWh), as a result of improved energy efficiency in the domestic, service and industrial sectors:

- 12 Mtoe reduction in the domestic sector (yellow),
- 5 Mtoe reduction in the service sector (green),
- 2 Mtoe reduction in the industrial sector (red).

The interplay of energy efficiency and changes in levels of activity effects on final energy consumption resulted in a net decrease of 13Mtoe (or 155TWh) in final energy used between 2010 and 2015. Final energy consumption in the domestic, service and industrial sectors amounted to 96Mtoe (1,116TWh) in 2010, compared to 83Mtoe (961TWh) in 2015, which is shown in the blue area of this graph.

Changes in outputs, specifically economic activity in the industrial/service sectors and the growth of the number of households in the domestic sector, had an opposite effect on final energy consumption. Final energy consumption increased by 5.6 Mtoe between 2010 and 2015 (or 65 TWh), as a result of a growth of activity in the domestic and service sectors.

Infographic 4: Productivity of the electricity sector

This infographic shows the productivity of the electricity sector in 2010 and 2015. Energy efficiency hasn't improved significantly on the supply side between 2010 and 2015. In the electricity sector, the amount of wasted energy remains roughly at the same level. Energy is lost in the process of transforming fuels in electricity and in the transportation of electricity from power plants to end-users.

The efficiency of electricity supply was 38% in 2015, which means that for each unit of fuel used to produce electricity; only 38% was conveyed to end-users and the rest was lost. Conversion and transport losses amounted to 496TWh in 2015, compared to 597TWh in 2010. The electricity delivered to end-users reached 306TWh in 2015, compared to 333TWh in 2010.

Infographic 5: Carbon dioxide equivalent (CO₂e) emissions reduction

This infographic presents the UK greenhouse gas emissions that would be emitted without any policy to curb emissions, the emissions which should be abated as a result of existing policies, and the gap which needs to be filled if the UK wants to remain on track to meet the fifth carbon budget by 2032.

The Committee on Climate Change (CCC) analysis of the government's projection of energy use and emission forecasts that previous and existing policies will contribute to only 50% of the 5th carbon budget emissions reduction target (57% reduction in carbon emissions by 2032 compared to 1990 levels). Previous policies including for example the Carbon Emission Reduction Target which ran between 2008 and 2012, which was later replaced by the Energy Company Obligation (ECO) policy.

The breakdown into emissions abated as a result of energy efficiency policies and emissions abated as a result of renewable policies is worked out by the ADE by analysing government's Energy and Emission Projection 2015.

ADE worked out the percentage of emissions abated from energy efficiency policies for each sector from the government's forecast of total emissions abated and translated it on to the CCC's forecast of total emissions abated by sector.

The shortfall is worked out from the CCC's data, and will need to be addressed by government's proposals or policies.

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UK experts survey of energy efficiency policies

This infographic shows how a panel of UK's energy efficiency experts view recent policy progress, based on a survey performed by the EU Energy Efficiency Watch group. Over 80% of UK experts see very little progress in energy efficiency policies or few additional policies in the three year period between 2012 and 2015.

A main concern expressed by the UK experts is that present policy and decision makers do not see energy efficiency as an opportunity and focus on the supply side. They are also worried by the lack of systematic approach in energy efficiency policies. On the positive side, they observe that the implementation of the Energy Performance in Buildings Directive is improving and the energy certification is being taken up. At the time of the survey, new legislation was under discussion which would place penalties on landlords of buildings with low energy performance.

The carbon budget policy gap

This infographic shows the cumulative emissions which need to be abated over the period 2016-2030 in the power, building and industrial sectors to meet the UK's carbon reduction commitment compared to a 'do-nothing' scenario.

We worked out the total target emissions reduction by sector for the period 2016-2030 (including both emissions covered by policy and the policy gap). The relative contribution expected from each sector varies from 1.626 MtCO₂e from the power sector, 272 MtCO₂e from the building sector and 92 MtCO₂e from the service sector.

Then, we worked out the proportion of the target emissions reduction which should be delivered through energy efficiency policies.

- For the industrial sector, this is based on the CCC's fifth Carbon Budget industrial emission reduction cost-effective pathway, for the building sector this is based on the CCC's direct abatement in 2030 in buildings, central scenario.
- For the power sector, this is based on the ADE's high level analysis of the potential for additional gas CHP by 2030. We estimated that half of the 6GW of additional gas generation capacity needed by 2030 identified in government's energy and emission forecast can be met by CHP. We derived the carbon emission abatement potential from energy efficiency policies of 47 MtCO₂e by multiplying the 3GW of additional CHP capacity by 1.11MtCO₂e, which is the ratio of carbon emissions savings for each GW of installed CHP capacity compared to the total UK generation based on DUKES 2016 data, and multiplying this again by the number of years comprised between 2016 and 2030.

Then, we worked out the proportion of the target emissions reduction from energy efficiency policies which is already covered by previous or existing policies. We did the same for the target emissions reduction from other policies, such as renewable policies.

Finally, we worked out the policy gap for energy efficiency policies and the policy gap for other policies.

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Table 1: Data sources

Infographic	Data source
Cost of energy	Digest of United Kingdom Energy Statistics (DUKES) 2016 "Value balance of traded energy", "Primary energy consumption, GDP and the energy ratio" and "Comparison of net imports of fuel with total consumption of primary fuels and equivalent"
From energy to production	Digest of United Kingdom Energy Statistics (DUKES) 2016, "Primary energy consumption, GDP and the energy ratio" Energy Consumption in the UK (ECUK), "Final energy consumption by sector 1970 to 2015"
Productivity gains	Energy Consumption in the UK (ECUK), "Output and intensity factors affecting changes in industrial energy use between 2000 and 2015", "Domestic Final Energy Consumption by fuel 1970 to 2015", "Domestic Energy Intensity 1990 to 2015", "Output and intensity factors affecting service sector energy consumption between 2000 and 2015"
Productivity of the electricity sector	Digest of United Kingdom Energy Statistics (DUKES) 2016, Electricity chapter
Carbon dioxide (CO ₂) emissions	Meeting Carbon Budgets - progress report to Parliament, Committee on Climate Change, 2016 Exhibits 0,2,3,4,5,6 DUKES 2016, CHP chapter
Expert survey of energy efficiency policies	Progress in energy efficiency policies in the EU Member States - the experts perspective, Energy Efficiency Watch, 2015 report
Carbon Budgets by sector to 2030	Meeting Carbon Budgets - progress report to Parliament, Committee on Climate Change, 2016 Exhibits 0,2,3,4,5,6