Centre for Sustainable Energy

Environmental and social levies

Past, present and future

Ian Preston, Centre for Sustainable Energy
Darryl Croft, Association for the Conservation of Energy
October 2012

Funded by Consumer Focus

Association for the Conservation of Energy

Centre for Sustainable Energy

3 St Peter's Court
Bedminster Parade
Bristol
BS3 4AQ

www.cse.org.uk
0117 934 1400
info@cse.org.uk
reg charity 298740

We are a national charity that shares our knowledge and experience to help people change the way they think and act on energy.

Contents

Executive summary

The principle of recovering the costs associated with UK environmental and social policies via consumer energy bills or taxes is not a new one. This paper seeks to quantify the historical costs and average cost per household associated with such policies from 1990 to 2010, and future forecast costs from 2010 to 2020. The input policy costs and fuel price assumptions used in the analysis are taken from a parallel study by the Association for Conservation of Energy (ACE) and the Centre for Sustainable Energy (CSE) for Consumer Focus.[1] In light of the recent controversy around the Government's proposal to reduce the support for small scale renewable electricity (Feed-in Tariff (FIT) rate for photovoltaics (PV)), this paper also explores the cost implications of two different tariff scenarios investigated by Government[2].

The range and total costs of policies aimed at delivering specific objectives within the UK energy sector have increased significantly over the years. In 1990, just one policy – the Non-Fossil Fuel Obligation (NFFO) – imposed a cost of around £52 per year on the average household energy bill. This cost on energy bills remained relatively constant between 1990 and 2000. However, in 2001 the cost of supporting nuclear power and decommissioning was moved to the public finances, to be recovered via taxation. Consequently, the amount contributed to policies via energy bills fell to an all-time low of £1 per year (for the Energy Efficiency Standards of Performance (EESOP)).[3]

Since 2001, the cost on bills has risen steadily to £68 on average in 2010, a cost attributable mainly to domestic energy efficiency (the Carbon Emissions Reduction Target (CERT)) - 29 per cent, renewables policy (the Renewables Obligation) - 28 per cent and carbon pricing (the EU Emissions Trading System (EU ETS)) - 32 per cent. The highest policy cost to householders between 2001 and 2010 can be attributed to nuclear power (with the exception of 2004 and 2008 when the costs of decommissioning were lower than the typical value). The costs of supporting nuclear power reached a peak in 2007, at £96 per household (the majority of the funding at this time was focussed on decommissioning). This equates to a total cost of £2.48 billion (the householders' contribution to the cost of nuclear power through taxation has been limited to the share of National Insurance and income taxation from total receipts). These costs have now fallen and are expected to stabilise at approximately £0.41 billion per year going forward.[4]

Looking to the future, in 2020, the suite of bill funded policies, including the Energy Company Obligation (ECO), Warm Homes Discount, Renewables Obligation, EU ETS, Carbon Price Floor, Electricity Market Reform (EMR) and Smart Meters, are expected to cost some £4.6 billion. This is an average cost to domestic consumers of around £130 a year (representing 11 per cent of the average dual fuel bill in 2020).

Over the period from 1990 to 2020, the cost to households of supporting nuclear power falls sharply, from around £86 per household in 2010 to an expected £14 in 2020 (which represents funds from taxpayers rather than FIT Contracts for Difference). The average annual cost of the Renewables Obligation rises from £19 in 2010 to an expected £37 in 2020 for a standard electricity customer i.e. one that does not use electricity for heating. The EU ETS sees a similar scale of increase, from around £22 to

[1] 'Impact of consumer bills of energy policy'. A report to Consumer Focus, by ACE and CSE, 2012

[2] 'Option A' and a 'do nothing' scenario from the Department for Energy and Climate Change (DECC) impact assessments.

[3] As an average across all gas and electricity customers

[4] Based on the average investment required in the timeframe identified by the Office of Budgetary Responsibility (OBR). The basis for the OBR data is the Whole of Government Accounts (WGA) for the year ended 31 March 2010, as published in November 2011

£27. The cost of supporting energy efficiency measures via CERT, and latterly the ECO and Green Deal, remains relatively constant at an average of around £29 per household.

The cumulative cost to taxpayers and energy customers of delivering a low carbon energy policy in the UK from 1990 to 2010, and projected costs from 2011 to 2020, are illustrated in Figure 1. Total cumulative cost in £billion of environmental and social levies to taxpayers and domestic energy customers from 1990 to 2010 and Figure 2. Projected total cumulative cost in £billion of environmental and social levies to taxpayers and domestic energy customers from 2011 to 2020 (under DECC's 'Option A' scenario for FIT). By 2020 (from 1990), nuclear power will have received funds of around £30 billion from both domestic energy customers and taxpayers, based on the household contribution described in section 6.2. Supplier-led investment in energy efficiency makes up the next highest proportion, with a cumulative cost of £17.8 billion followed by the Renewables Obligation at £13 billion. It is important to note that the supplier-led energy efficiency programmes will provide customers with a long-term benefit through reductions in their energy bills associated with efficiency improvements.

The cost of the FIT shown in Figure 1. Total cumulative cost in £billion of environmental and social levies to taxpayers and domestic energy customers from 1990 to 2010 (and the total policy costs in 2020 quoted previously) reflects the Government's 'Option A' scenario for reducing the rate of the PV tariff. If the tariff remains at the original (higher) rate (the 'do nothing' scenario), the cumulative cost to 2020 of the FIT to domestic consumers rises from £1.4 billion to £8.8 billion (see Annex I for further analysis). The impact of reducing the tariff rate is therefore significant, with a six-fold increase in the total cumulative cost to 2020 under the 'do nothing' scenario. The average cost per household associated with the FIT in 2020 is around £55 higher under this scenario.

Figure 1. Total cumulative cost in £billion of environmental and social levies to taxpayers and domestic energy customers from 1990 to 2010

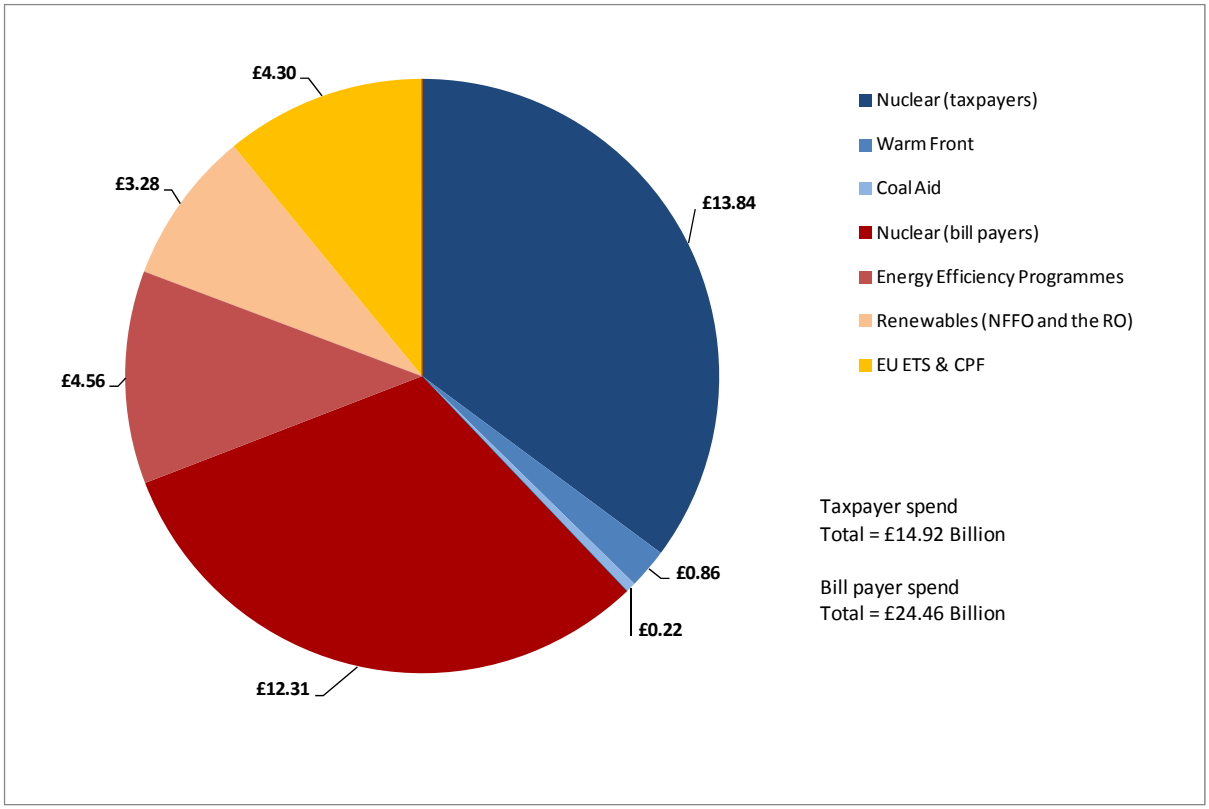
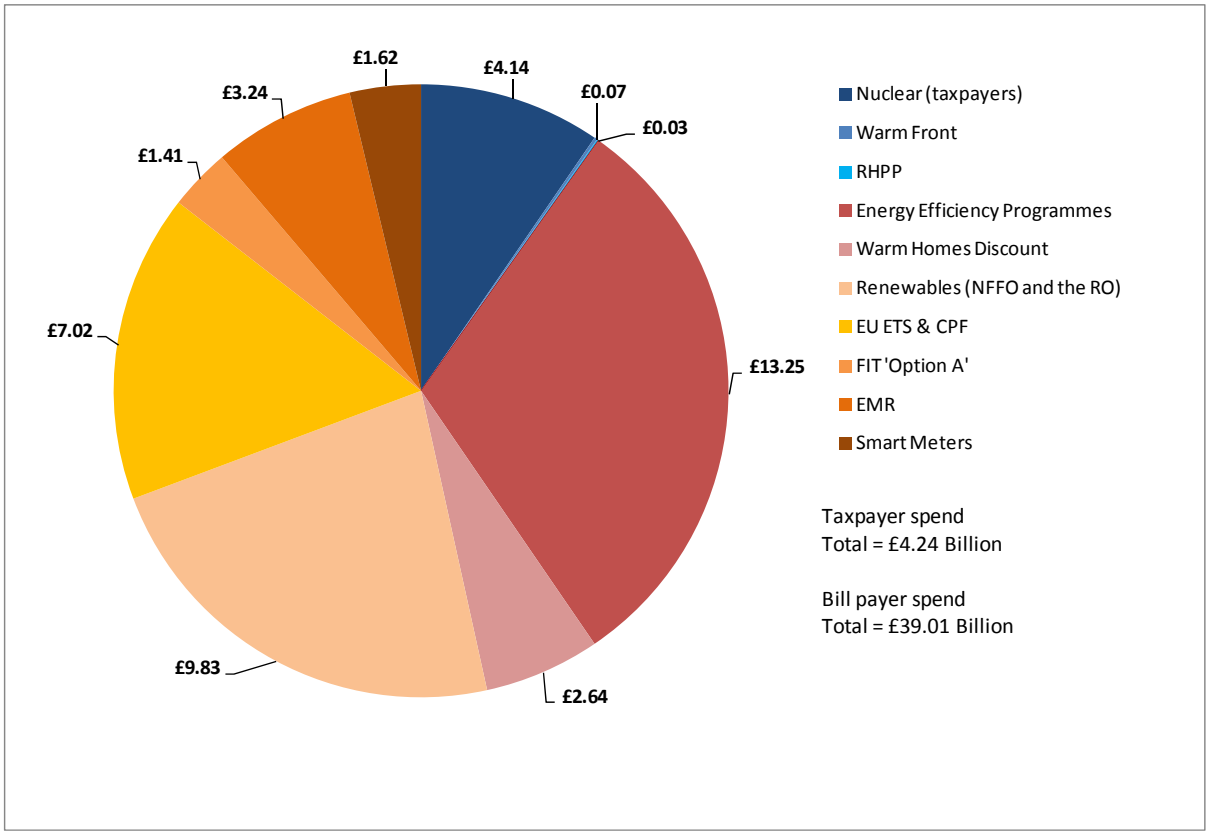


Figure 2. Projected total cumulative cost in £billion of environmental and social levies to taxpayers and domestic energy customers from 2011 to 2020 (under DECC's 'Option A' scenario for FIT)



However, this does not allow for the benefits of this policy experienced by those taking up the FIT (by way of reduced energy demand and payment from the tariff). In this instance, the average energy bill (across all customers) is around £51 lower under the 'do nothing' scenario (that is, assuming the energy payment is taken as net from their energy bill), suggesting an overall positive impact on consumer energy costs. However, the costs of FIT will be recouped from both domestic and non-domestic customers. The 'do nothing' scenario results in the non-domestic sector contributing an additional £3.9 billion to the policy in 2020. This equates to an approximate cost to Small and Medium Enterprises (SMEs) of an additional £186,000 per year, which means policy costs would represent 30 per cent of their total energy bill in 2020. For larger, energy-intensive businesses, the additional cost of the 'do nothing' scenario ranges from £678,000 to £2.7 million. This increases the proportion of their bill attributed to policies to 37 per cent from 25 per cent (as opposed to 16 per cent from 10 per cent). Non-domestic sector electricity consumers would not benefit from the deployment of domestic PV systems and, as such, would be subsidising the deployment of this technology. The costs of FIT at the non-adjusted tariff rate would therefore not only jeopardise the HM Treasury Levy Control Framework, but would also place an undue burden on non-domestic energy customers.

Whilst this paper does not seek to perform a cost-benefit analysis from a carbon or householder perspective (that is, the relative merits of a policy in terms of £ per tonne of carbon saved or the average change in a householder's bill), taking this high-level view of policy costs compared to benefits delivered shows that the two main policies that aim to significantly reduce householders' demand for energy (via insulation or more efficient heating, that is, the supplier-led energy efficiency programmes and Warm Front) receive considerably less financial support than those committed to renewable energy or nuclear power.

1. Introduction

The use of policy to deliver specific objectives within the energy sector has been commonplace for decades, from a requirement to buy British coal in the 1970s and 1980s, through the Non Fossil-Fuel Obligation (NFFO),[5] introduced in 1989, to the current mix of implicit and explicit support for renewables, energy efficiency and fuel poverty alleviation.

However, though the practice of policy support and the recovery of resulting costs through consumer energy bills is not a new one, the level of policy support and associated costs to consumers has grown significantly. For example, the UK's first energy efficiency programme, the Energy Efficiency Standards of Performance (EESOP), which ran from 1994 to 2002, cost just £1 per customer each year, whilst the Carbon Emission Reduction Target (CERT) alone now costs consumers around £24 annually, levied separately on gas and electricity bills. Climate change and energy policies currently cost UK energy consumers approximately £3.2 billion per year in total.[6]

Increases in household fuel bills over recent years have put a spotlight on the amount that households are paying towards energy and climate change policy. This increasing trend in fuel prices has caused fuel poverty to rise significantly, with the 2009 English Housing Survey (EHS) showing a total number of fuel poor households of 4 million.[7] These pressures have brought energy and climate change policy into conflict with the Government's requirement to alleviate fuel poverty; under the terms of the Warm Homes Act, no household should be in fuel poverty as far as reasonably practical by 2016.

Media reaction to rising energy bills has often been inaccurate,[8] exaggerating current consumer costs, wrongly attributing high fossil-fuel price scenarios to policies, and painting a doomsday scenario for the years to come. The Government has reacted. HM Treasury has placed a cap on the policy costs that the Department for Energy and Climate Change (DECC) can levy on bills. And, more recently – as a result of this cap – the Government announced a reduction in the level of solar subsidy through the feed-in tariff (FIT) from 43.3p to 21p/kWh, with further cuts to the rate at six-month intervals.

2. Scope of this paper

This short study seeks to quantify the costs of historic energy and climate change policies from 1990 to 2010, modelled costs between 2010 and 2020, and examine how the burden has shifted between taxation and energy bills (all costs are shown in 2010 prices). The study is looking to answer the following questions:

- What is the historic burden of environmental and social policies, and to what extent have these costs been recovered through consumer energy bills?
- Which policies have had the greatest impact on the price households pay for energy?
- What additional impact would the FIT have had on consumer bills in the absence of the recent cut in FIT rate?

The paper does not attempt to quantify the cost of energy efficiency delivered through product policies or regulations. It therefore excludes the extra costs of installing high-efficiency boilers, higher building

[5] Electricity Act 1989; www.legislation.gov.uk/ukpga/1989/29/contents
[6] Centre for Sustainable Energy (CSE) 'Distributional Impacts Model for Policy Scenario Analysis' (DIMPSA) 2011
[7] EHS 2009
[8] See Carbon Brief's challenge to the *Daily Mail*'s recent coverage www.carbonbrief.org/blog/2011/12/mail-makes-third-correction-to-energy-bills-coverage

standards or removing high-wattage tungsten filament light bulbs from the market. Of course, it is recognised that these also increase the cost to consumers and deliver overall lifetime savings through lower power use or fuel costs.

The report does not perform a cost-benefit analysis (CBA) of the individual policies from the householder or the economy's perspective. However, the Centre for Sustainable Energy's (CSE) 'Distributional Impacts Model for Policy Scenario Analysis' (DIMPSA) has been used to assess the impacts of measures-based polices on a consumer's energy demand, such as through the installation of insulation via CERT, or the generation of electricity from photovoltaics (PV) via the FIT.

The paper includes an Annex, which looks at the burden of costs the FIT poses to consumers in more detail. The costs of the FIT will be estimated for both the proposed rate and the previous rate, exploring the impact on bills if the industry had been free to expand at a higher rate.

3. Environmental and social levies, energy and housing policy

This study has identified the following policies, which have impacted on household energy use and emissions whilst raising finances from household energy bills or through taxation (see Table 1. Energy and climate change policies that impact on domestic energy bills and general taxation liabilities). Non-domestic customers will also contribute to the Climate Change Levy (CCL) via their energy bills; it is assumed that domestic customers do not contribute to the cost of this policy.

The majority of the social levies for technologies and policies covered in this report tend to remain fixed. Nuclear power is an exception, with the historical funding from 1990 to 2001 via our energy bills covering the deployment of the technology and the funding from 2004 to 2020 covering the costs of decommissioning. However, the funding itself relates to the same generating plant but has a different role and purpose. As such, where possible, a clear distinction is made between the use of taxation or energy bills to support nuclear power.

The policies that impact on consumers' bills are charged in two ways, either per household or per unit. The decision to charge is driven by the nature of the policies themselves. The CERT policy provides measures to households and as such is levied on a 'per household' (supplier account) basis. By comparison, a policy such as the Renewables Obligation is charged per unit of electricity sold. This is because the policy is based on support for technologies that generate a certain number of units of energy, such as defining the amount of revenue they raise through Renewable Obligation Certificates (ROCs).

Table 1. Energy and climate change policies that impact on domestic energy bills and general taxation liabilities

Policy	Timeframe	Fuels covered	Purpose
Taxation			
Nuclear decommissioning	2001 onwards	n/a	Support costs of nuclear decommissioning
Warm Front	2001 to 2012		Primarily heating for low-income households
Renewable Heat Premium Payment	2011 to 2012		Support for renewable heat (vouchers)
Coal aid	1997 to 2010		Support for coal generators
CLG Decent Homes	2001 to 2010		A government programme to increase efficiency standards of social housing
Energy bills as a fee per household			
NFFO (primarily supporting nuclear generation)	1999 to 2019[9]	Electricity	Support nuclear generation
Energy Efficiency Standards of Performance	1994 to 2002	Electricity/ (Gas 2000/02)	Support the installation of insulation
Energy Efficiency Commitment 1	2002 to 2005	Electricity/Gas	Support the installation of insulation (mainly lofts and cavities)
Energy Efficiency Commitment 2	2005 to 2008	Electricity/Gas	
Carbon Emissions Reduction Target	2009 to present	Electricity/Gas	
Community Energy Saving Programme	2010 to present	Electricity/Gas	Support the installation of a range of measures in areas of deprivation
Energy Company Obligation and Green Deal	2013 to 2022	Electricity/Gas	Support the installation of a range of insulation (including solid wall) and heating
Warm Homes Discount	2011 to 2014[10]	Electricity/Gas	Money off vulnerable households bills
Energy bills as a fee per unit consumed			
Renewables Obligation	2002 onwards	Electricity	Supporting large-scale renewables
EU ETS (Emissions Trading System)	2005 onwards	Electricity	Supporting emissions reduction for the largest emitters
Carbon price floor	2013 onwards	Electricity	Ensuring the EU ETS operates effectively
Small-scale renewable FITs	2010 onwards	Electricity	Supporting small and medium renewables
Smart meters	2012 to 2021	Electricity/Gas	Improving information on supply and consumer feedback
FIT CfD – Contract for Difference	2014 onwards	Electricity	Supporting low-carbon generation through price guarantee

[9] NFFO contracts are ongoing with some generators being paid until 2019
[10] Subject to approval for future funding in the next comprehensive spending review

4. Approach to estimating the cost of social levies covered

4.1 Energy bill impacts

The modelling of price impact on consumers' energy bills for policies operating between 2010 and 2020 has been undertaken as part of a sister project for Consumer Focus ('Impact on consumer bills of energy policy', Association for Conservation of Energy (ACE) and CSE, 2012). For the purposes of this study, we have taken the policy inputs for the 'central policy scenario' from this other project, which uses the low policy cost, central fuel price scenario. The sources for the additional inputs required for this study are summarised below.

Feed in Tariff (FIT)

This study has deployed two separate FIT scenarios to determine the impact on consumers' bills. For the current scenario of FIT impacts, the team opted to deploy DECC's 'Option A', which targets average rates of return of around 5 per cent to 8 per cent, with around 5 per cent for domestic installations. This produces a tariff of 13.6p for 4kW installations, to give a return on investment (ROI) ranging from 0.5 per cent to 10 per cent. The 'do-nothing' scenario assumes that the original plans for tariff rates and degression[11] are deployed. However, it is important to note that the FIT impact assessments do not provide data on the actual number of assumed PV installations per year, their size and the typical profile of householders taking up measures. Cumulative installations to date are taken from DECC's website (follow the link and open the weekly cumulative tables[12]).

The following reports have been used to help quantify these two scenarios:

- Energy and Climate Change and Environmental Audit Committee's response from DECC on the impact of the FIT on consumers' bills. This provides an explanation of the methodology needed to back calculate the assumed cost and per unit pass through to consumers from the figures presented in £/MWh for each year[13]
- DECC recently published an updated impact assessment,[14] to accompany the Comprehensive Review Phase 1: Consultation on FITs for solar PV. It uses the estimated cost to consumers, the revised tariff rates and the estimated total numbers of measures to 2020 to predict yearly installation rates

See Annex II for a more detailed breakdown of the numbers of installations.

Energy Efficiency Standards of Performance (EESOP) and the Energy Efficiency Commitment (EEC)

The cost of delivering EESOP 1 (1994-98) & 2 (1998-2000) is £1/household, EESOP 3 (2000-02) cost £2.40/household. EEC 1 was taken from the Oxera report to Defra,[15] with the costs for EEC 1 estimated at £4 per household and £9 for EEC 2[16].

[11] The degression rate represents the amount the tariff will reduce by each year for new entrants. The rate is designed to allow for reductions in cost associated with supply chain development
[12] www.decc.gov.uk/en/content/cms/statistics/energy_stats/source/fits/fits.aspx
[13] www.publications.parliament.uk/pa/cm201012/cmselect/cmenvaud/1605/1605we13.htm
[14] DECC, Comprehensive Review Phase 2a Consultation on FITs for solar PV, IA No: DECC0081
[15] Oxera, Policies for energy efficiency in the UK household sector, Defra 2006
[16] For further information, a better report can be found at www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/Documents1/4211-EESOP_report_July03.pdf.

Carbon Emissions Reduction Target (CERT), Energy Company Obligation (ECO) and the Green Deal (GD)
As discussed above the costs associated with the policies delivered between 2010 and 2020 are detailed in the sister project ''.

Renewables Obligation (RO) prior to 2010
The team's review of the Office of Gas and Electricity Markets' (Ofgem) Annual Reports,[17] to generate costs from 2002/03 to 2010/11, provides an indication of the obligation level in ROCs and the buyout price. It is then possible to derive the nominal Renewables Obligation subsidy by multiplying the level of obligation by the buyout price. The Renewables Obligation subsidy can then be divided by the total electricity supplied in the year in question to determine the cost to be passed on to consumers as a in pence per kWh.

EU Emissions Trading System (ETS) prior to 2010
The cost of the EU ETS to energy consumers can be determined from the average yearly price per tonne of CO_2 in Euros, the carbon intensity of UK electricity[18] and the exchange rate from Euros to pounds. The first phase of the EU ETS, which ran from 2005 to 2007, saw an over-allocation of permits to pollute and led to a collapse in the price of carbon from €33 to just €0.20 per tonne, meaning that the system had little impact on emissions.

The value of EU ETS permits fluctuates throughout the year and, as such, the average price is hard to determine. For example, the price of allowances increased more or less steadily to a peak level in April 2006 to about €30[19] per tonne CO_2 but fell in May 2006 to under €10 per tonne. This was a result of reports that several countries had given their industries generous emission caps that undermined the need to reduce emissions. Lack of scarcity under the first phase of the scheme continued through 2006, resulting in a trading price of €1.2 a tonne in March 2007, declining to €0.10 in September 2007. The carbon price within Phase II increased to over €20/tCO_2 in the first half of 2008. The average price was €22/tCO_2 in the second half of 2008, and €13/tCO_2 in the first half of 2009[20]. Table 2. Assumed yearly average costs of EU ETS permits (€ per tonne CO_2) shows the assumed cost of CO_2 in Euros per tonne over the years.

Table 2. Assumed yearly average costs of EU ETS permits (€ per tonne CO_2)

Year	Average price Euros per tCO_2
2010	23
2009	11.97
2008	23
2007	1.2
2006	17.5
2005	20

[17] http://www.ofgem.gov.uk/About%20us/annlrprt/Pages/AnnualReport.aspx
[18] We assume that, despite most of the emissions permits being distributed free of charge to generators, that the opportunity cost of these permits was passed on to energy consumers. Ofgem told the House of Commons Business and Enterprise Committee in 2007/8 that utilising this opportunity cost would create a £9 billion windfall to the UK electricity-generating sector over the lifetime of Phase 2, from 2008 to 2012. HoC Business and Enterprise Committee (2008) Energy prices, fuel poverty and Ofgem http://www.publications.parliament.uk/pa/cm200708/cmselect/cmberr/293/293i.pdf
[19] Analyse van de CO2-markt (in Dutch). Emissierechten. November 2007
[20] Committee on Climate Change, Meeting Carbon Budgets – the need for a step change. Progress report to Parliament Committee on Climate Change, 2009

Non Fossil Fuels Obligation (NFFO)

The NFFO was the first UK policy to support low-carbon electricity generation. NFFO represented a collection of orders requiring the electricity suppliers in England and Wales to purchase electricity from the nuclear power and renewable energy sectors up to certain levels. Similar mechanisms operated in Scotland and Northern Ireland.

The NFFO was put in place by the powers of the Electricity Act 1989, under which electricity generation in the UK was privatised. The original intention was to provide financial support to the UK nuclear power generators, which continued to be state owned, to cover their liabilities for nuclear waste management and decommissioning. The proposals were enlarged in scope before the Obligation was brought into operation in 1990 to include the renewable energy sector. Several contracts from the last rounds remain in place, with the generators receiving the agreed amount from the Non-Fossil Purchasing Agency (NFPA)[21] and the NFPA taking ownership of the ROC, which the generator is entitled to.

The costs associated with the NFFO from 1990 to 1996 split by sector (renewable or nuclear) were published in a report to the Council for the Protection of Rural England.[22] There are several generators that are still operating under NFFO contracts and will receive payments until 2019. For the purpose of this study, the team contacted the NFPA for further information on the costs of NFFO from 1990 to 2019. Unfortunately, the NFPA indicated that their records were predominantly in paper format and, as such, quantifying the cost of the policy would have been too arduous.

4.2 Impact on taxation

The costs to taxpayers of a number of additional policies relating to electricity generation and energy efficiency have been quantified here.[23] Whilst these policies do not impact on our energy bills, we are paying for them via general taxation. Therefore, any assessment of the burden of environmental and social levies on householders should include these policies.

It is also important to acknowledge that both people and businesses contribute towards the funds raised by general taxation. The Government does not earmark the use of particular types of taxation for individual services or policies ("hypothecation"). The determination of the share of general taxation that could be apportioned to the public (nominally householders) is difficult to calculate. The Institute of Fiscal Studies' 2011 briefing note 'A Survey of the UK Tax System' shows that income tax and national insurance contributions account for 49.6 per cent of total receipts.[24] If you make an allowance for the employee and employer contribution to national insurance,[25] this percentage falls to 34.8 per cent.

The next largest single contribution to public finances is Value Added Tax (VAT), which contributes approximately 17 per cent. The split between the amount of VAT paid by households and business is unclear as the data supplied by HMRC is reported by industrial Standard Industrial Classification code of the contributor rather than the payee. However, the majority of VAT is paid by householders, with a small contribution from non-VAT registered businesses with turnovers of less than £50,000. Indirect taxes

[21] The NFPA was set up in 1990 by the 12 RECs as their agent for the purpose of enabling them to enter into collective arrangements to discharge their obligations under the Orders

[22] Catherine Mitchell, Renewable Energy in the UK: Policies for the Future (London: Council for the Protection of Rural England, 1998)

[23] We do not include taxpayer-funded income transfers like cold weather payments, winter fuel payments and predecessor schemes, or emergency grants paid by local authorities for appliances or heating

[24] See page 4, http://www.ifs.org.uk/publications/1711

[25] Based on employees paying 12 per cent to national insurance contributions and business 13.8 per cent

make up a further 11 per cent of public finances, with the majority a result of householders' expenditure on road transport fuels, tobacco and alcohol.

Unfortunately, the contribution of householders and business to VAT and other indirect taxes is unclear. The collection of VAT and indirect taxes is also regressive when compared to the collection of income tax and National Insurance. For the purposes of this project, the team has therefore assigned 34.8 per cent of the costs of policies supported by taxation to householders. The cost per householder is then calculated by dividing this cost by the total number of households. The sources for the additional inputs required for this study are summarised below.

Nuclear decommissioning and the protection agency

The costs of supporting nuclear generation and decommissioning shifted from energy bills to general taxation in 2001 when the Renewables Obligation was introduced to replace NFFO. The costs associated with nuclear power can be split into two main aspects: BNFL/Magnox decommissioning and managing nuclear liabilities. The following annual reports were reviewed to determine the costs associated with these:

- 2003 DTI Annual Report
- 2004 DTI Annual Report
- 2005 DTI Annual Report
- 2006 DTI Annual Report
- 2006-07 DTI Annual Report and Accounts
- BERR Annual Report 2007-08
- DECC Resource Accounts 2009-10

The future costs of nuclear decommissioning are taken from the Office of Budgetary Responsibility (OBR) forecasts for future public expenditure.[26] The future costs of decommissioning represent additional funds from the taxpayer rather than a previously developed escrow[27]-type fund. However, it is difficult to follow the flows of funds over time as the responsibility for different aspects of managing our nuclear liabilities has shifted between various organisations over time.

The Nuclear Decommissioning Authority will receive the majority of this funding as part of the Lifetime Plan for designated sites. The figures are based on the latest available technical assessments of the processes and methods likely to be used in the future to manage our facilities. However, as recognised by the Whole of Government Accounts (WGA), these are the best possible estimates from the available information. "There remains a significant degree of inherent uncertainty in the future cost estimates. This uncertainty has led the Comptroller and Auditor General to include an Emphasis of Matter statement in their Audit Opinion on the Nuclear Decommissioning Authority's 2009-10 accounts."[28]

Renewable Heat Premium Payment

The costs associated with the Renewable Heat Premium Payment are taken from the latest Energy Saving Trust (EST) figures on installed measures and payments for 2011. The scheme has been continued in 2012 and, as such, the costs have been duplicated for the second year.

[26] Table 2.3: Provisions in WGA for 2009-10, Charts and tables from the Fiscal sustainability report July 2011
[27] An escrow fund is an arrangement, whereby an independent trusted third party receives and disburses money for the transacting parties
[28] HMT, Whole of Government Accounts: Year ended 31 March 2010, HC 1601

Warm Front
The costs associated with Warm Front have been collated by ACE over the last 5 years. The main sources for the costs are answers to Prime Minister's Questions (PMQs) and Eaga Plc's (now Carillion Energy Services) annual reports.

The Decent Homes Programme
The Decent Homes Standard was reviewed in a detailed report by the National Audit Office in 2010.[29] The Decent Homes Programme was overseen by the Department for Communities and Local Government (DCLG). It aimed to improve the condition of homes for social housing tenants and vulnerable households in private sector accommodation in England. DCLG set a 'decency' standard to which all social rented homes should be improved and, in some cases, allocated funding to enable that improvement. The programme aimed to improve these homes to the identified decency standard by 2010, which included the following thermal comfort criteria:

- The property must have efficient heating (A-rated gas/oil/LPG or solid fuel programmable central heating system or electric storage heaters)
- The property must have effective insulation (for properties with gas or oil programmable central heating a minimum of 50mm loft insulation; for other heating system types, a minimum of 200mm loft insulation)

DCLG did not attempt to calculate an estimate of the total cost to local authorities and Registered Social Landlords of meeting the Decent Home Standard on social housing stock up to 2010. It did, however, assess the scale of the challenge for local authority-owned stock, estimating that the total cost of improving such stock would be £19 billion. This estimate did not include the cost of improving homes that fell into non-decency during the programme or the cost of inflation.

The total cost of delivering the Decent Homes Standard is difficult to quantify as social housing providers only report the total investment rather than the sources of funding. Social housing providers typically used a range of funders to deliver their Decent Homes targets. The National Audit Office report does provide an indication of the funding provided in figures 8, 10 and 11 (covering total investment, department funding and the regional housing allocation). Based on the report's estimate of 65 to 69 per cent of the Major Repairs Allowance and the Regional Housing Pot being spent on Decent Homes, it is possible to determine a total expenditure on the programme. However, the costs associated with the thermal comfort criteria are unclear, with much of this work likely to be funded from other sources, such as Warm Front and supplier-funded programmes (EEC and CERT). The results in this report therefore exclude the Decent Homes Programme.

Coal aid
The costs associated with Coal Authority and Coal Investment Aid were collated from the Coal Authority's Annual Reports and summary tables from DECC's website.[30] Funds were provided to help potentially viable mines overcome short-term market problems and maintain access to viable reserves at 12 deep mines.

[29] National Audit Office Report (HC 212 2009-2010): The Decent Homes Standard, 2010
[30] www.decc.gov.uk/en/content/cms/meeting_energy/coal/industry/industry.aspx

5. Historic trends for fuel prices

The 1989 Electricity Act created a system of independent regulation, headed by the Director General of Electricity Supply (DGES) covering England, Scotland and Wales. The regulator's principal roles were to ensure that competition develops smoothly and effectively and to protect customers where competition is inappropriate. In 1999, the regulatory offices for electricity and gas (Offer and Ofgas) were merged to form Ofgem.

The deregulation of the UK's energy market began in the late 1980s, when the Government privatised British Gas through the sale of shares. In 1990, the Government privatised the UK electricity supply industry by separating generation from distribution. In England, transmission was owned by the distribution companies. However, full separation of distribution from supply was not enabled until 2001.

Residential markets were initially subject to price caps immediately after privatisation, and choice was gradually introduced. In the electricity market, choice for householders was planned as part of the privatisation legislation and was completed in 1999. Initially, privatisation of the gas market granted the incumbent supplier an indefinite monopoly for the household market. However, this was changed by legislation in 1994, and all consumers had a choice of energy supplier by 1998. As consumers started to switch supplier, regulation was gradually withdrawn, and the final markets were fully deregulated in April 2002. At the same time, reform of the wholesale electricity markets in 2000 replaced a spot market system, whereby suppliers were paid the marginal price, with one based on bilateral contracts, where generators were paid the price that they bid.

Figure 3. Fuel poverty in England and the RPI for gas and electricity from 1996 to 2011

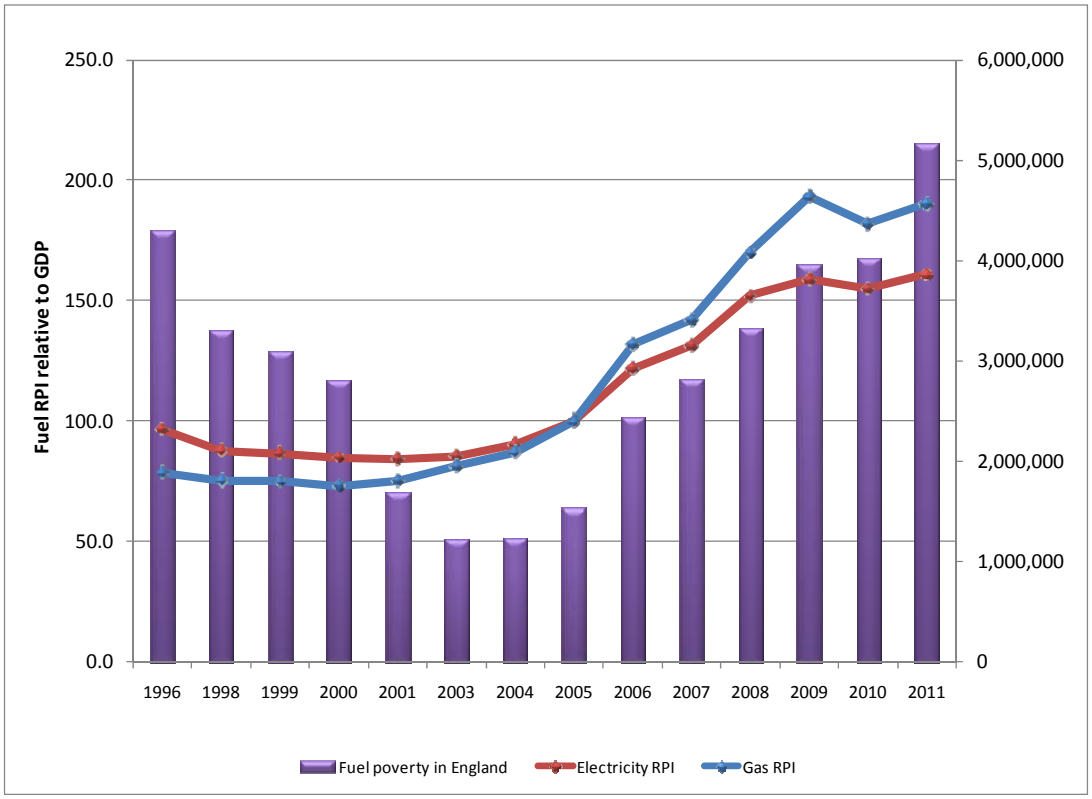


Figure 3. Fuel poverty in England and the RPI for gas and electricity from 1996 to 2011 shows the trends in fuel poverty and the RPI for electricity and gas from 1996 to 2011. The deregulation of the

energy market and expansion of consumer choice was designed to increase competition and drive down energy prices. Fuel prices initially fell, with electricity bills decreasing between 1998 and 2004 and gas bills falling slightly over the same period.[31] This is shown in Table 3. Average dual fuel bill and Economy 7 electricity bill by year (DECC UK averages in real terms - deflated to 2005), which tracks the change in the average UK energy bill between 1990 and 2011 (see annex II for gas and standard electricity bills).[32] This decline in energy cost and increased rates of uptake for energy efficiency measures led to fuel poverty falling from a high of 4.3 million in 1996 to 1.2 million in 2003. In subsequent years, energy prices have risen significantly, resulting in a high point for fuel poverty of 5.2 million in 2011.[33]

Table 3. Average dual fuel bill and Economy 7 electricity bill by year (DECC UK averages in real terms - deflated to 2005)

	Total dual fuel bill			Electricity Economy 7 bill		
Year	Standard credit	Direct debit	Pre-payment meter	Standard credit	Direct debit	Pre-payment meter
1990	£659	£614	£697	£330	£318	£341
1991	£715	£666	£757	£363	£350	£375
1992	£731	£683	£775	£382	£368	£394
1993	£716	£670	£759	£381	£366	£393
1994	£750	£700	£794	£393	£379	£406
1995	£768	£716	£813	£399	£384	£412
1996	£751	£698	£796	£397	£382	£410
1997	£724	£669	£764	£378	£364	£390
1998	£683	£627	£722	£361	£347	£373
1999	£652	£598	£688	£356	£343	£367
2000	£627	£578	£664	£349	£336	£360
2001	£604	£562	£640	£346	£333	£357
2002	£602	£559	£639	£347	£334	£359
2003	£597	£554	£629	£351	£338	£362
2004	£601	£564	£638	£372	£358	£384
2005	£671	£622	£705	£405	£383	£412
2006	£789	£716	£831	£462	£432	£477
2007	£862	£786	£911	£519	£485	£529
2008	£970	£898	£1,010	£599	£560	£595
2009	£1,043	£958	£1,080	£626	£580	£616
2010	£979	£909	£990	£596	£550	£582
2011	£1,042	£971	£1,048	£631	£583	£625

The energy market is now dominated by six large energy suppliers, which supply energy to 99 per cent of customers. The tariff differential between standard credit and direct debit stands at approximately £50 in 2011. Furthermore, despite efforts from Ofgem, pre-payment meters remain a significantly more expensive way of purchasing energy. The tariff differential between those customers that switch supplier

[31] See Figure 2.10 in the DECC Hills Review Interim Report, www.decc.gov.uk/en/content/cms/funding/Fuel_poverty/Hills_Review/Hills_Review.aspx

[32] Average bills for electricity taken from DECC Table 2.2.1, average bills for gas taken from DECC Table 2.3.2 with the electricity cost prior to 1995 and the gas cost prior to 1998 calculated by applying the Fuel RPI (DECC Table 2.1.1) to the earliest cost (www.decc.gov.uk/en/content/cms/statistics/energy_stats/prices/prices.aspx)

[33] Consumer Focus, Nowcast, CSE 2011

and those that use their former home supplier is approximately £30 for standard credit electricity.[34] The maximum range in electricity tariffs for a customer on a pre-payment meter with the home supplier compared to direct debit with a non-incumbent supplier is £65, based on DECC's figures (although in practice, price comparison websites and programmes to support switching suppliers typically quote maximum savings in excess of £200). Householders that have switched once or remain with the home supplier are often referred to as 'sticky' customers as they do not engage in the energy market. The continuing size of tariff differentials and the significant number of 'sticky' customers is symptomatic of a lack of competition in the market. Ofgem found that only 15 per cent of households switched gas supplier last year and 17 per cent for electricity, down from 20 per cent and 19 per cent in 2007.

The Climate Change Committee report on household energy bills examines the key drivers for changes in energy bills since 2004. The report found that the average dual-fuel energy bill for typical household had increased from around £605 in 2004 to £1,060 in 2010. The key driver for the £455 increase was found to be increases in the wholesale price of gas, which added around £290 to bills. The burden of energy policy costs was found to result in an additional cost of £75, which covered £30 to support investments in low-carbon power generation and £45 for the funding of energy efficiency improvements in homes. The remaining increase of £90 was attributed to increasing transmission and distribution costs and VAT.

The average cost of climate change policies to consumers in 2010 is therefore comparable to the maximum differential in energy tariffs from DECC's average UK energy bills tables, that is, £75 vs. £65.

[34] Based on an average bill of £418 for a householder on standard credit with the home supplier and £390 for those with a non-incumbent. The maximum range is the difference between pre-payment with the home supplier and direct debit with a non-incumbent

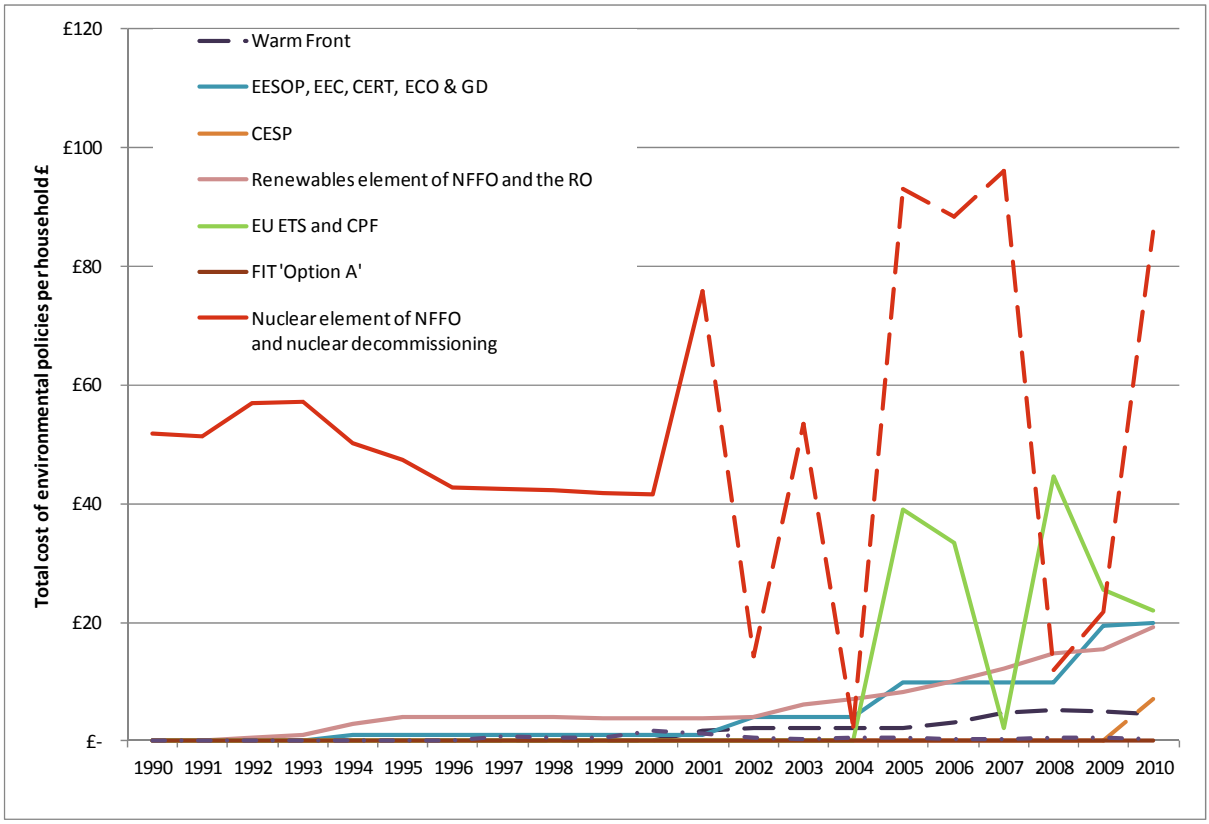
6. The cost of environmental and social levies

The cost of environmental and social levies to householders from 1990 to 2010 is derived from historical reports on policies, DECC data for consumption and supply, and CLG data on numbers of households (see section 4). The costs from 2011 to 2020 are derived from the central policy scenario in the sister report for Consumer Focus on the 'Impact on consumer bills of energy policy' (ACE and CSE, 2012).

6.1 The historical cost

Figure 4. Total cost of environmental and social levies between 1990 and 2010 on a per household basis including nuclear (covering Great Britain) shows the amount typical households contributed to environmental and social policies between 1990 and 2010 (see Annex Table 10. Average policy costs experienced by householders (energy bill impacts are based on average dual fuel consumption), 1990 to 2000 for a detailed breakdown of costs by year). The dashed lines indicate that the policy is supported by taxation. Figure 5. Total cost of environmental and social levies between 1990 and 2010 on a per household basis excluding nuclear (covering Great Britain) shows the costs without nuclear to allow the chart to use a smaller scale and, as such, show the trend for the lower cost policies. The policies that impact on general taxation are split across every UK household based on the contribution that National Insurance (employee aspect only) and income taxation make to the revenue raised from public finance (see section 6.2 for more detail). The costs of energy bills are based on an average dual fuel customer, that is, a customer using gas for heating.

Figure 4. Total cost of environmental and social levies between 1990 and 2010 on a per household basis including nuclear (covering Great Britain)

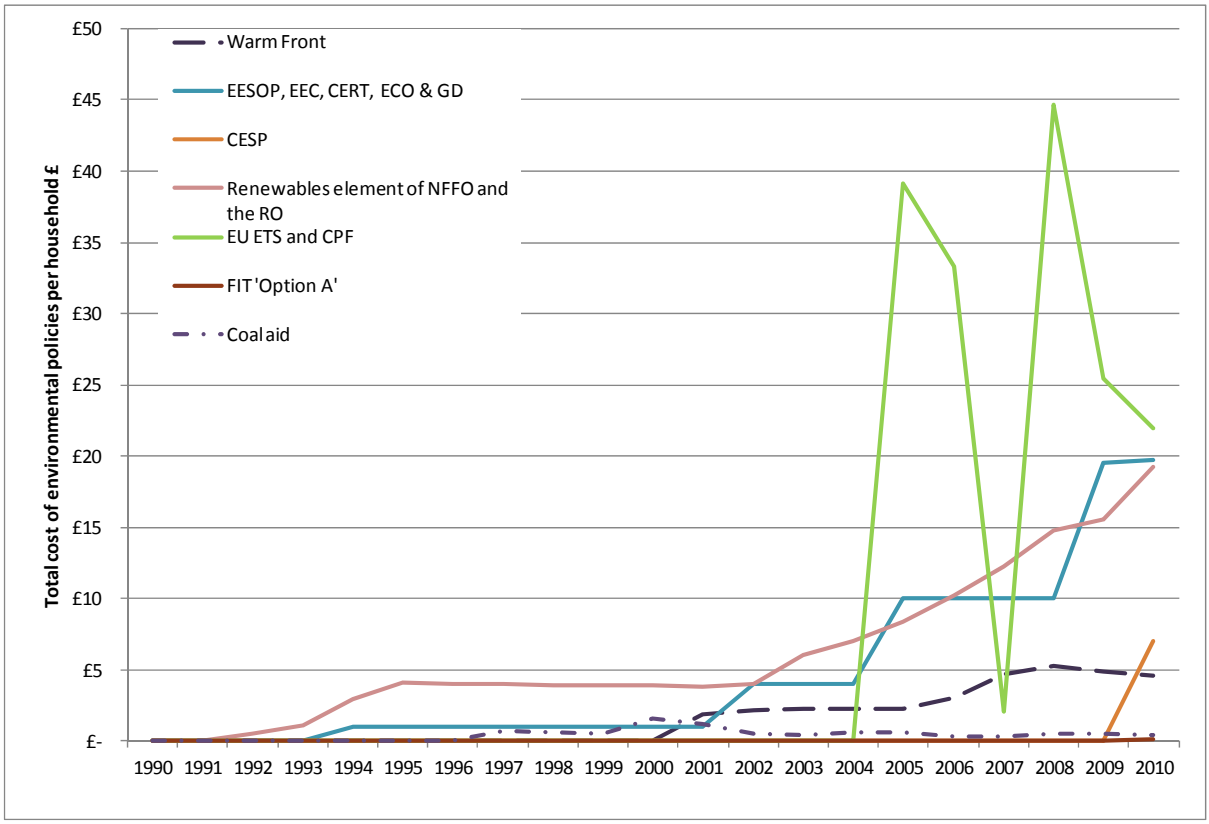


The costs of supporting policies via energy bills remained relatively constant at approximately £45 to £50 for NFFO between 1990 and 2000. In 2001, the costs of supporting nuclear power and decommissioning were then moved to the public finances via taxation. The amount contributed to policies via energy bills

then fell to a low of an average of £1 per year for EESOP in 2001. The scale of levies passed on to consumers via their energy bills steadily rose to £67 in 2010, representing 0.2 per cent and 7.1 per cent of a dual fuel customer's bill respectively (see Figure 7. Average dual fuel energy bill and the proportion spent on energy policies and Annex Table 10. Average policy costs experienced by householders (energy bill impacts are based on average dual fuel consumption), 1990 to 2000 and 11). In 2010, there were three key policies responsible for the majority of the costs passed on to consumers: CERT (29 per cent), the Renewables Obligation (28 per cent) and the EU ETS (32 per cent).

The highest policy cost to householders between 2001 and 2010 can be attributed to nuclear power (with the exception of 2004 and 2008, when the costs of decommissioning were lower than the typical value), an average of £1.4 billion per year between 1990 and 2010. The costs of supporting nuclear power reached a peak in 2007, at £96 per household, which equates to a total cost of £2.5 billion (£7.1 billion across all taxpayers and sources). These costs have now fallen and are expected to stabilise at approximately £0.4 billion (£1.2 billion across all taxpayers and sources) per year going forward, based on the average investment required in the timeframe identified by the OBR.

Figure 5. Total cost of environmental and social levies between 1990 and 2010 on a per household basis excluding nuclear (covering Great Britain)[35]



6.2 The future cost

Figure 6. Total cost of environmental and social levies between 2011 and 2020 on a per household basis shows the cost of environmental and social levies projected to 2020. The cost of supporting the renewable obligation becomes the largest single cost to householders, requiring £16.56 per household in 2011 and £36.98 in 2020 (see Annex Table 12. Average policy costs experienced by householders

[35] Decent Homes is not included as it is not possible to identify the proportion of spend on energy efficiency covered by social housing providers, that is, not supplier-funded

(energy bill impacts are based on average dual fuel consumption), 2011 to 2020for further detail). The EU ETS projects a similar scale of increase from £17.41 to £27.33. The cost of supporting energy efficiency measures via CERT, and then the ECO and Green Deal, remains relatively constant at an average of £28.64 per household. The EMR adds a further cost to householders' electricity bills from 2014, as low-carbon generators will receive price support if the wholesale price does not reach a guaranteed level.

Figure 6. Total cost of environmental and social levies between 2011 and 2020 on a per household basis

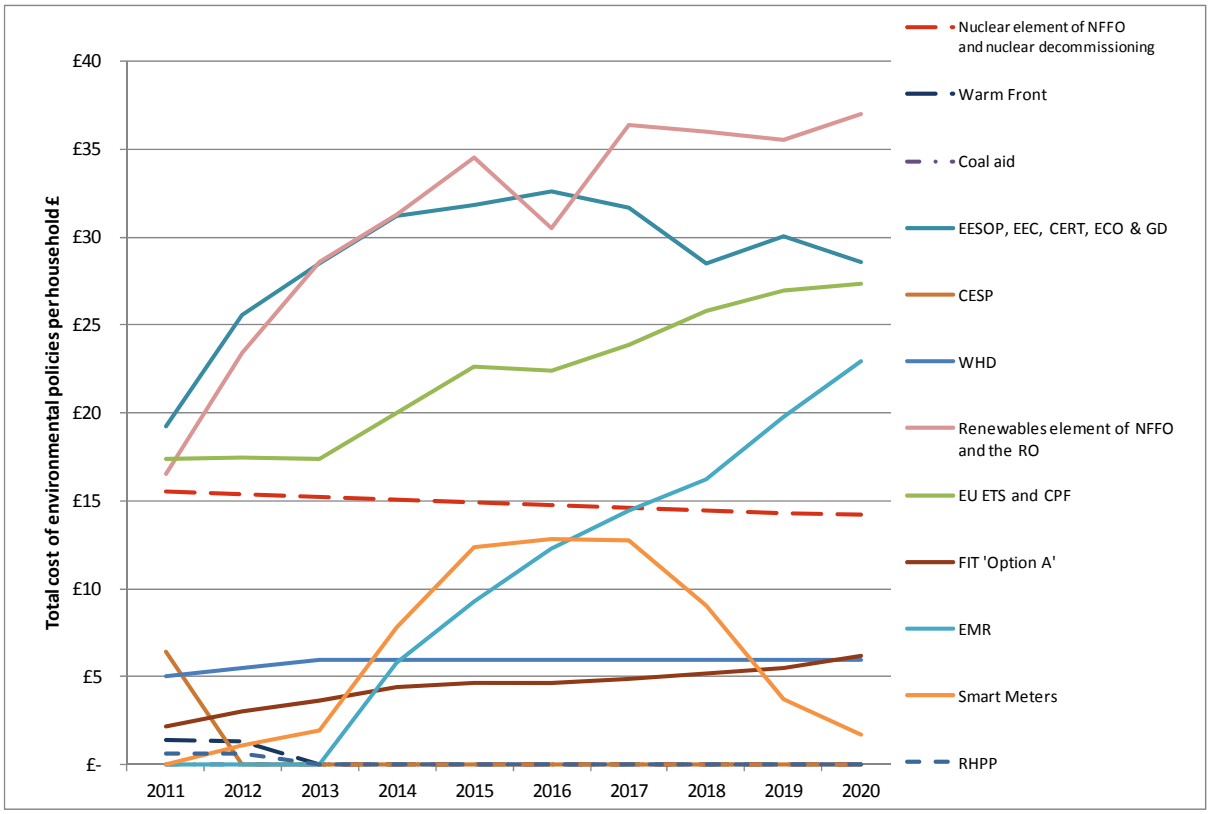


Figure 7. Average dual fuel energy bill and the proportion spent on energy policies shows the average UK dual fuel bill from 1990 to 2020 (left axis) and the proportion of this bill that contributes to policy costs (right axis). The proportion committed continues to rises from 5.7 per cent in 2011 to 10.8 per cent in 2020. However, as demonstrated in the sister report 'Impact of energy policy on consumer bills', 31 per cent of the unit costs of electricity (57 per cent for gas) in 2020 are related to wholesale costs. Further to this, in 2020, transmission and distribution costs are responsible for 22 per cent of the unit cost of electricity and 24 per cent for gas. In other words, the predominant driver for the future prices of energy supply is the wholesale and distribution costs associated with fuel.

Figure 7. Average dual fuel energy bill and the proportion spent on energy policies

6.3 The cumulative costs

Figure 8. Total cumulative cost of environmental and social levies to taxpayers and domestic energy customers from 1990 to 2000. Total cost = £13.35 billion , 9 and 10, and **Error! Not a valid bookmark self-reference.** demonstrates that by 2020 nuclear power will have received the majority of funding, with £17.98 billion from both domestic energy customers and taxpayers shown as 'Households cost'. The total cost of supporting nuclear power from 'All sectors' rises to £64 billion. Supplier-led investment in energy efficiency makes up the next highest proportion of 'Household costs', with a cumulative cost of £17.52 billion. The Renewables Obligation represents the third-highest proportion of domestic expenditure, with a total investment of £13.12 billion.

Table 4. Cumulative expenditure on policies from 1990 to 2020 split by householders and all sectors (including businesses) and Table 5. Cumulative expenditure on policies from 1990 to 2020 and total by decade (tax funded policies highlighted in grey) show the cumulative cost to taxpayers and energy customers of delivering a low-carbon energy policy in the UK from 1990 to 2020 (charts by decade) for the central policy scenario. **Error! Not a valid bookmark self-reference.** demonstrates that by 2020 nuclear power will have received the majority of funding, with £17.98 billion from both domestic energy customers and taxpayers shown as 'Households cost'. The total cost of supporting nuclear power from 'All sectors' rises to £64 billion. Supplier-led investment in energy efficiency makes up the next highest proportion of 'Household costs', with a cumulative cost of £17.52 billion. The Renewables Obligation

represents the third-highest proportion of domestic expenditure, with a total investment of £13.12 billion.

Table 4. Cumulative expenditure on policies from 1990 to 2020 split by householders and all sectors (including businesses)Table 5. Cumulative expenditure on policies from 1990 to 2020 and total by decade shows the costs to all sectors, both householders and business. In this instance, the costs of policies levied on electricity have been applied to the total supply of electricity, and the costs to taxpayers represent the full total, that is, they have not been apportioned to householders alone. The study does not include the total costs of the Carbon Reduction Commitment (CRC) and the CCL to business, which would increase the total further.

Error! Not a valid bookmark self-reference. demonstrates that by 2020 nuclear power will have received the majority of funding, with £17.98 billion from both domestic energy customers and taxpayers shown as 'Households cost'. The total cost of supporting nuclear power from 'All sectors' rises to £64 billion.[36] Supplier-led investment in energy efficiency makes up the next highest proportion of 'Household costs', with a cumulative cost of £17.52 billion. The Renewables Obligation represents the third-highest proportion of domestic expenditure, with a total investment of £13.12 billion.

Table 4. Cumulative expenditure on policies from 1990 to 2020 split by householders and all sectors (including businesses)

Policy	Households cost £billion 1990 to 2020	All sectors cost £billion 1990 to 2020
Nuclear (taxpayers)	£17.98	£51.65
Nuclear (bill payers)	£12.31	£12.31
Warm Front (£m)	£0.93	£2.68
Coal aid	£0.22	£0.63
RHPP	£0.03	£0.10
EESOP, EEC, CERT, ECO and GD	£17.52	£17.52
CESP	£0.30	£0.30
WHD	£2.64	£2.64
Renewables: NFFO and the RO	£13.12	£42.23
EU ETS and Carbon Price Floor	£11.32	£36.62
FIT ('Option A')	£1.41	£4.96
EMR	£3.24	£11.86
Smart Meters	£1.62	£1.62
Total cost	£82.63	£185.11

[36] The costs of decommissioning (Nuclear Decommissioning Agency and BNFL Magnox etc) and construction (Non-Fossil Fuel Obligation (NFFO)) are combined as this revenue supports the same infrastructure

Table 5. Cumulative expenditure on policies from 1990 to 2020 and total by decade

Policy	Cumulative cost £billion 1990 to 2020	Cumulative cost £billion 1990 to 2000	Cumulative cost £billion 2001 to 2010	Cumulative cost £billion 2011 to 2020
Nuclear (taxpayers)	£17.98	£-	£13.84	£4.14
Nuclear (bill payers)	£12.31	£12.31	£-	
Warm Front (£m)	£0.93	£-	£0.86	£0.07
Coal aid	£0.22	£0.08	£0.14	£-
RHPP	£0.03	£-	£-	£0.03
EESOP, EEC, CERT, ECO and GD	£17.52	£0.28	£4.13	£13.11
CESP	£0.30	£-	£0.16	£0.14
WHD	£2.64	£-	£-	£2.64
Renewables NFFO and the RO	£13.12	£0.68	£2.61	£9.83
EU ETS and CPF	£11.32	£-	£4.30	£7.02
FIT ('Option A')	£1.41	£-	£0.00	£1.41
EMR	£3.24	£-	£-	£3.24
Smart Meters	£1.62	£-	£-	£1.62
Total cost	£82.63	£13.35	£26.03	£43.25

Tax-funded programmes shown in grey. It is important to note that funding may have switched from bills to taxation or vice versa

This paper does not seek to perform a cost-benefit analysis from a carbon or householder perspective. The relative merits of a policy in terms of £ per tonne of carbon saved or the average change in a householder's bill have not been assessed here. However, the supplier-led energy efficiency programmes, Community Energy Saving Programme (CESP) and Warm Front, are the main policies that would significantly reduce householders' demand for energy via insulation or more efficient heating. Yet the combined support for these two policies is £18.8 billion, which is lower than that committed to renewable energy or nuclear power.

Figure 8. Total cumulative cost of environmental and social levies to taxpayers and domestic energy customers from 1990 to 2000. Total cost = £13.35 billion

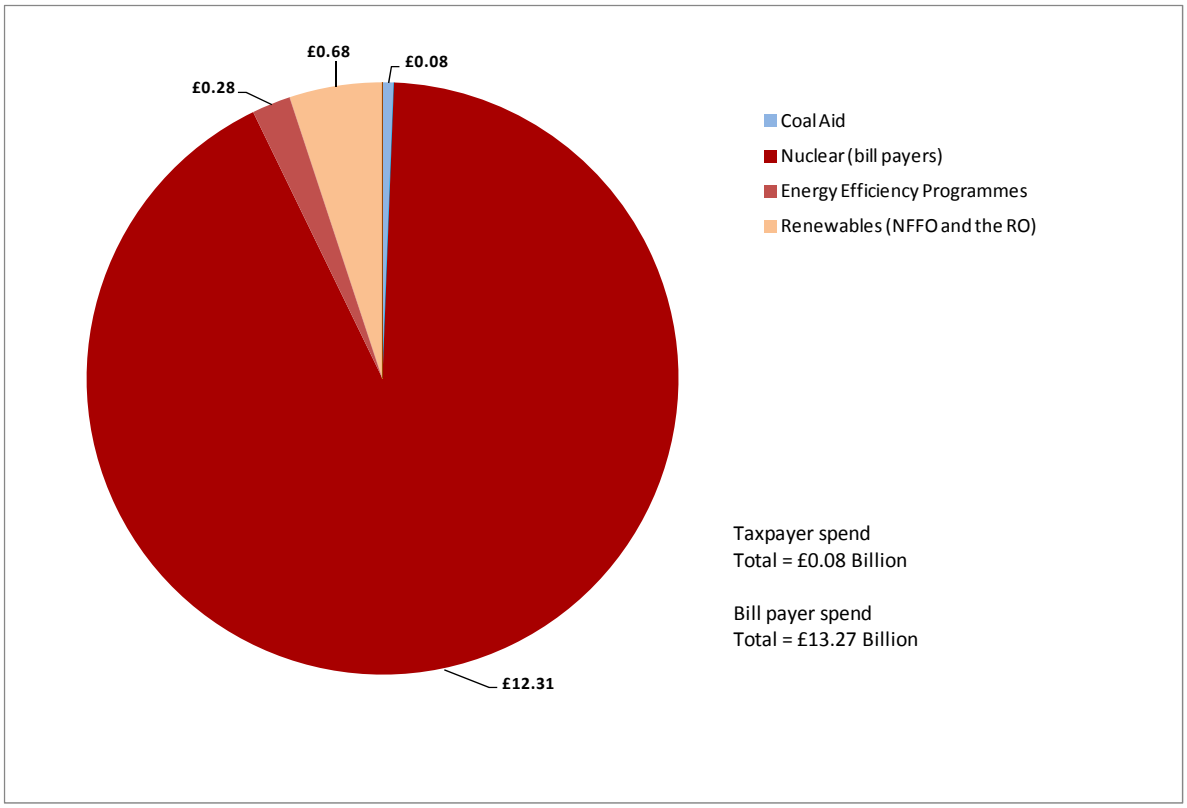

£0.68
£0.08
£0.28
£12.31
Coal Aid
Nuclear (bill payers)
Energy Efficiency Programmes
Renewables (NFFO and the RO)
Taxpayer spend
Total = £0.08 Billion
Bill payer spend
Total = £13.27 Billion

Figure 9. Total cumulative cost of environmental and social levies to taxpayers and domestic energy customers from 2001 to 2010. Total cost = £26.03 billion

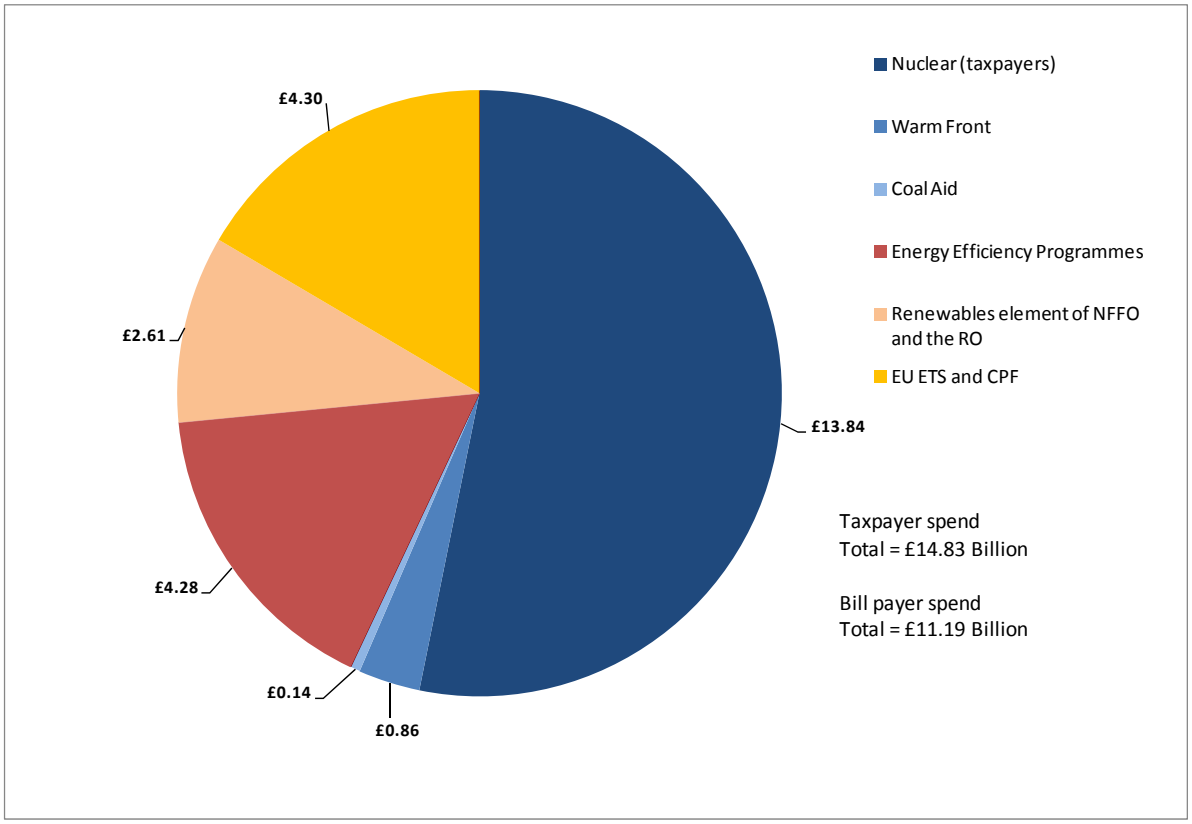


Figure 10. Total cumulative cost of environmental and social levies to taxpayers and domestic energy customers from 2011 to 2020 (under DECC's 'Option A' scenario for FIT). Total cost = £43.25 billion

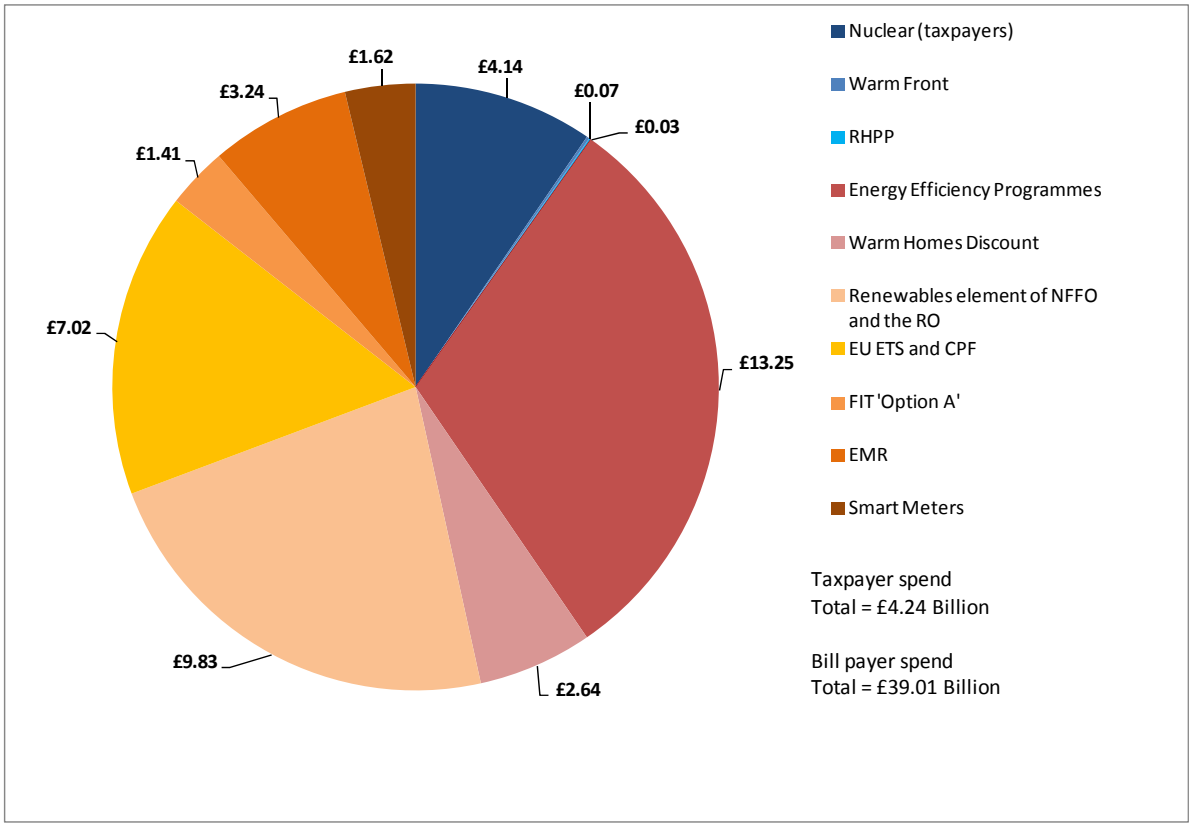


Figure 11. Total cost of environmental and social levies to taxpayers and domestic energy customers in 1990 (£billion) to Figure 13. Total cost of environmental and social levies to taxpayers and domestic energy customers in 2010 (£billion) show the total yearly cost of energy-related policies in 1990, 2000, 2010 and 2020 respectively. The charts show the diversification of energy policy overtime, from just one policy accounting for some £1.2 billion in 1990 to a mix of policies accounting for the £5 billion investment in 2020. The costs associated with nuclear decommissioning fall significantly from £2.3 billion in 2010 to £0.4 billion in 2020 (2020 based on a long-term OBR average rather than a planned forecast of expenditure).

Figure 11. Total cost of environmental and social levies to taxpayers and domestic energy customers in 1990 (£billion)

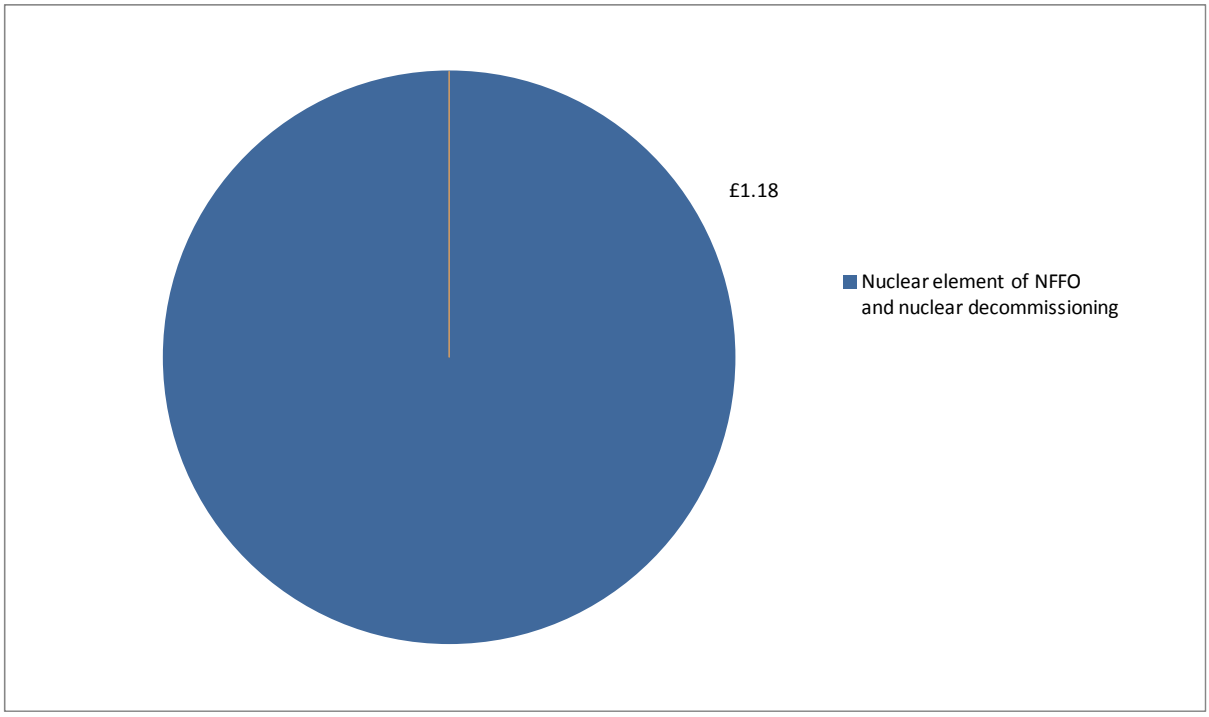


Figure 12. Total cost of environmental and social levies to taxpayers and domestic energy customers in 2000 (£billion)

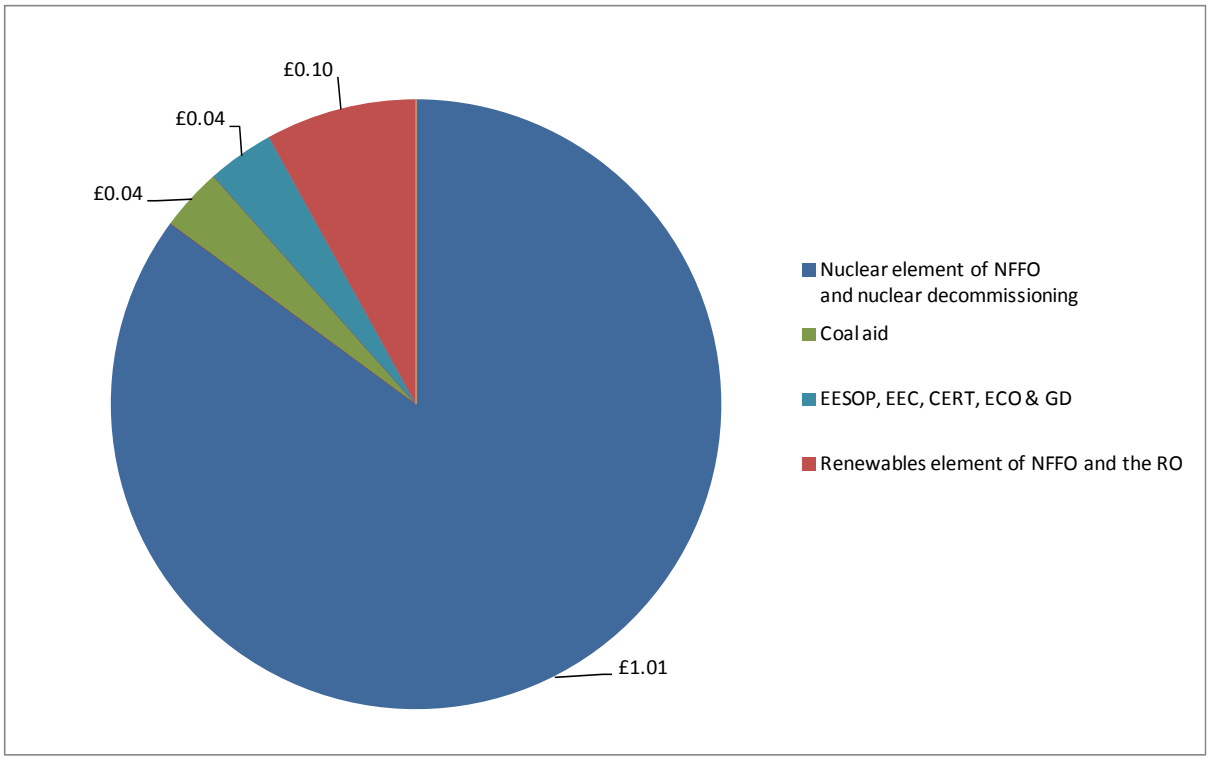


Figure 13. Total cost of environmental and social levies to taxpayers and domestic energy customers in 2010 (£billion)

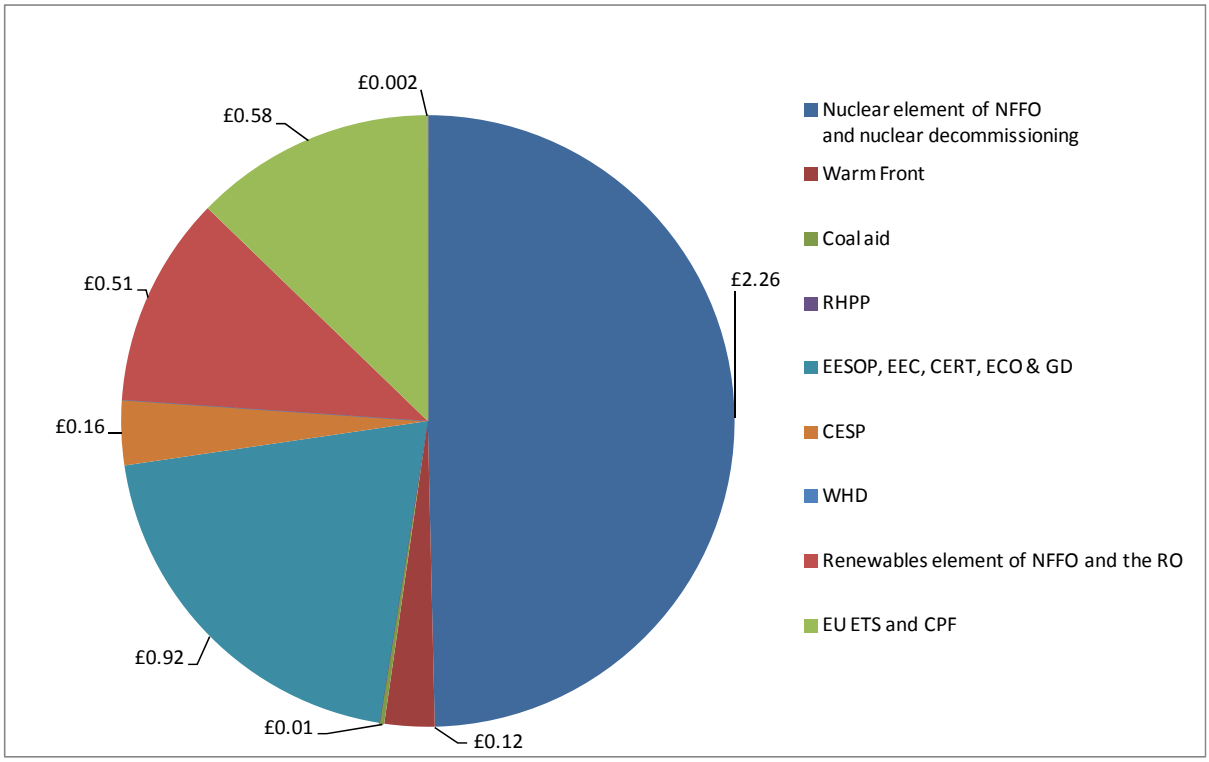
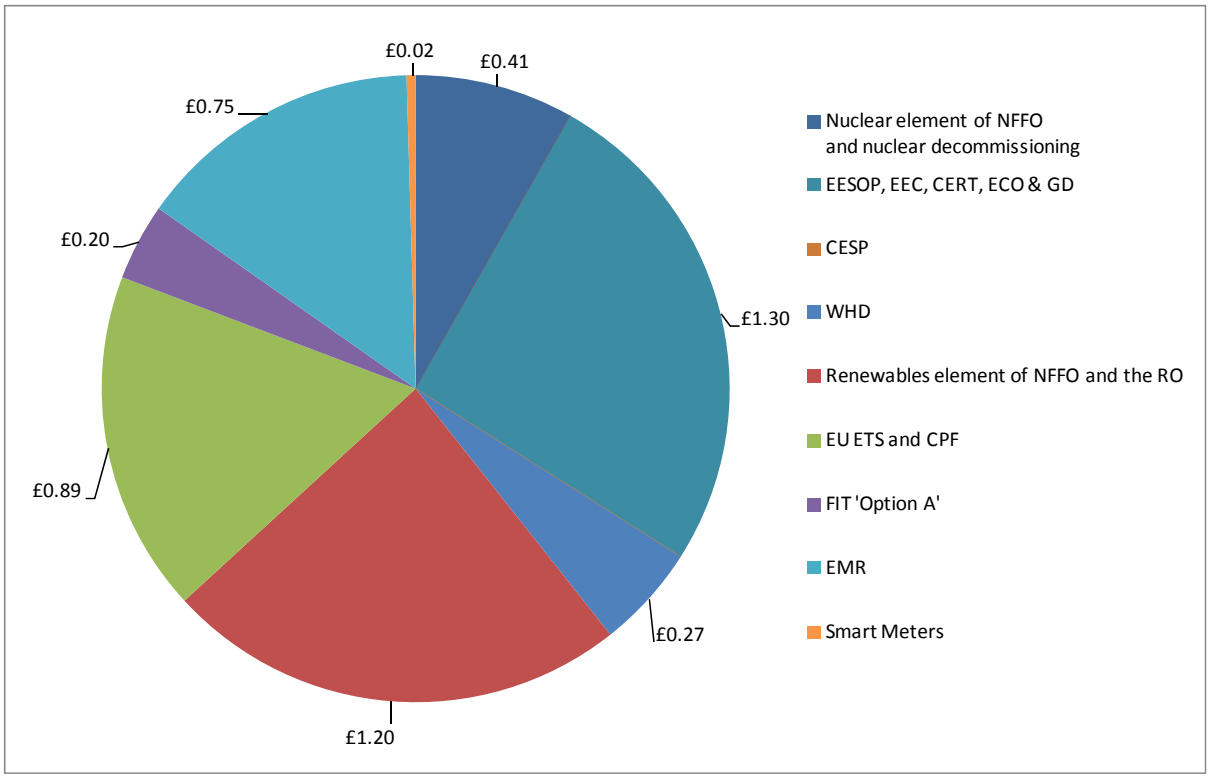


Figure 14. Total cost of environmental and social levies to taxpayers and domestic energy customers in 2020 (£billion)


£0.02
£0.41
£0.75
£0.20
£1.30
£0.89
£0.27
£1.20
Nuclear element of NFFO and nuclear decommissioning
EESOP, EEC, CERT, ECO & GD
CESP
WHD
Renewables element of NFFO and the RO
EU ETS and CPF
FIT 'Option A'
EMR
Smart Meters

6.4 The impacts of the FIT

On 7 February 2011, the Secretary of State announced the start of the first comprehensive review of the FITs scheme. In doing so, he confirmed that the review would assess all aspects of the scheme, including tariff levels, administration and eligibility of technologies. He also confirmed that it would be completed by the end of the year, with tariffs remaining unchanged until April 2012, unless the review reveals a need for greater urgency.

The review found that rates of growth derived from modelling of FITs were much lower than the observed installation growth rates for PV in 2011. The main driver for these significantly higher real take-up rates were the reductions in capital costs and the rent-a-roof delivery model, unforeseen by the Government but expected by sector experts. On 31 October 2011, as part of Phase 1 of the review, it was announced that the review would incorporate a further consideration of solar PV tariffs. This was in response to evidence of a significant fall in solar PV costs at all scales and higher than anticipated uptake, with a view to making any changes to tariffs on 1 April 2012.

Figure 15. Total cumulative cost of environmental and social levies to taxpayers and domestic energy customers under DECC's 'Option A' scenario for FIT and Figure 16. Total cumulative cost of environmental and social levies to taxpayers and domestic energy customers under DECC's 'do nothing' scenario for FIT show that the cumulative cost of FIT between 1990 and 2020 to domestic consumers falls to £1.41 billion under the 'Option A' scenario, from £8.83 billion for the 'do nothing' scenario. The impact of reducing the tariff rate is therefore significant, with a six-fold decrease in the total cumulative cost to 2020 relative to the 'do nothing' scenario.

Figure 15. Total cumulative cost of environmental and social levies to taxpayers and domestic energy customers under DECC's 'Option A' scenario for FIT

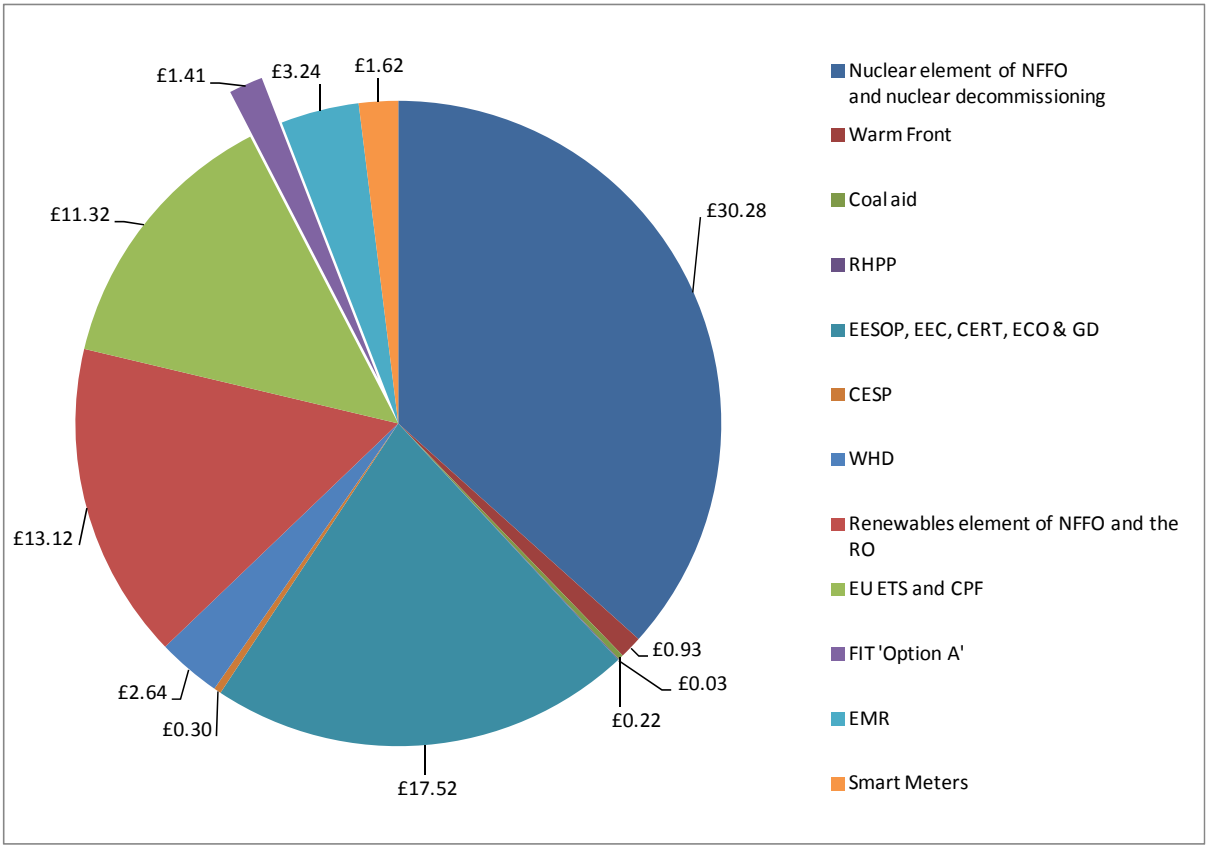
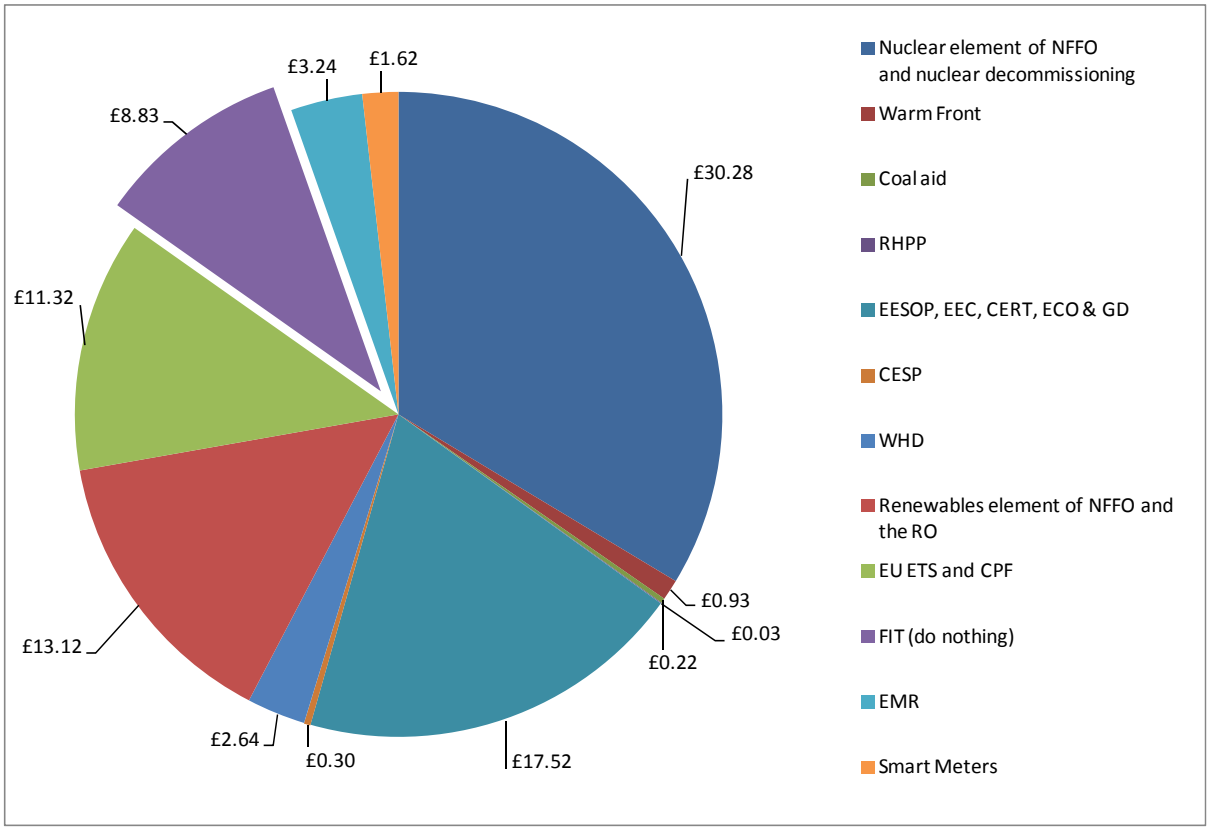


Figure 16. Total cumulative cost of environmental and social levies to taxpayers and domestic energy customers under DECC's 'do nothing' scenario for FIT



Annex I contains a more detailed analysis of the changes to the FIT.

7. Conclusions

Cumulative costs

The principle of householders paying for environmental and social policies via their energy bills or taxes is not a new one. Prior to this, the UK's energy sector benefited from additional non-financial support. For example, the UK coal industry benefited from guaranteed contracts for supply from the Central Electricity Generation Board. British Energy did well post privatisation, when wholesale prices were high.

The approximate cost of the levies on energy bills per UK household has more than doubled between 1990 and 2020, with average costs rising from £51.86 in 1990 for NFFO to a predicted £129.63 in 2020 for the Energy Company Obligation (ECO), Warm Homes Discount, Renewables Obligation, EU ETS, Carbon Price Floor, FIT, Electricity Market Reform and Smart Meters. The range of policies supported via our energy bills has notably increased and, as such, UK plc will benefit from increased levels of energy efficiency, diversity of supply and lower carbon emissions.

By 2020, nuclear power will have received some £18 billion from both domestic energy customers and taxpayers (£64 billion from all sectors and sources of taxation). Supplier-led investment in energy efficiency makes up the next highest proportion, with a cumulative cost of some £17.8 billion, followed by the Renewables Obligation at £13 billion. It is important to note that the supplier-led energy efficiency programmes will benefit customers through reductions in their energy bills associated with efficiency improvements.

The distribution of costs

This paper uniquely captures the way in which these costs have changed over time. **Error! Not a valid bookmark self-reference.** demonstrates that by 2020 nuclear power will have received the majority of funding, with £17.98 billion from both domestic energy customers and taxpayers shown as 'Households cost'. The total cost of supporting nuclear power from 'All sectors' rises to £64 billion. Supplier-led investment in energy efficiency makes up the next highest proportion of 'Household costs', with a cumulative cost of £17.52 billion. The Renewables Obligation represents the third-highest proportion of domestic expenditure, with a total investment of £13.12 billion.

Table 4. Cumulative expenditure on policies from 1990 to 2020 split by householders and all sectors (including businesses) shows that the cumulative cost to UK households will peak in the final decade (2011 to 2020), with the majority of costs being raised from energy bills, so £39.17 billion from the total of £43.25 billion. The majority of expenditure will be focussed on energy efficiency and large-scale renewables. The overall balance of policy costs has therefore shifted overtime, with the first decade raising revenue from bills, then a switch to taxation (2000 to 2010) and, finally, a shift to the use of energy bills in the final decade.

Following the end of Warm Front in 2012, nuclear decommissioning will be the only policy that remains as a tax liability. However, the policy continues to represent a significant cost per household (£14.19) and represents 11 per cent of the total amount contributed to all other policies via energy bills, so £129.63 for the average dual fuel customer. The recent press coverage of energy bills and policy costs fails to recognise the use of taxation to fund other low-carbon technologies such as nuclear power via taxation.

The balance of investment

The analysis of both expenditure per energy customer and the cumulative investment between 1990 and 2020 shows a greater emphasis on low-carbon generation compared to energy efficiency. For example, the combined support for Warm Front and supplier-funded energy efficiency programmes of £18.8 billion is lower than that committed to low-carbon generation over the same period, that is, £31 billion (£18 billion for nuclear power and £13.1 billion for the Renewables Obligation).

This paper does not seek to perform a cost-benefit analysis from a carbon or householder perspective (such as the relative merits of a policy in terms of £ per tonne of carbon saved or the average change in a householder's bill). However, taking this high-level view of policy costs compared to benefits delivered shows that the two main policies that aim to significantly reduce householders demand for energy (via insulation or more efficient heating, such as the supplier-led energy efficiency programmes and Warm Front) receive lower financial support than that committed to low-carbon generation.

The basic doctrine of the 'energy hierarchy[37]' and typical analysis of marginal abatement cost (MAC) curves suggests the following key steps:

- Priority 1. Energy conservation: changing wasteful behaviour to reduce demand
- Priority 2. Energy efficiency: using technology to reduce demand and eliminate waste
- Priority 3. Exploitation of renewable and sustainable resources

[37] Energy hierarchy refers to the most sensible prioritisation of interventions, described well by the Institute of Mechanical Engineers here www.imeche.org/knowledge/policy/energy/policy/the-energy-hierarchy

The Government should therefore introduce further funding for energy efficiency to address this imbalance. The current emphasis of raising revenue from energy bills would suggest the use of taxation to support additional measures.

Annex I: The domestic FIT

On 7 February 2011, the Secretary of State announced the start of the first comprehensive review of the FITs scheme. In doing so, he confirmed that the review would assess all aspects of the scheme, including tariff levels, administration and eligibility of technologies. He also confirmed that it would be completed by the end of the year, with tariffs remaining unchanged until April 2012, unless the review reveals a need for greater urgency.

The review found that rates of growth derived from modelling of FITs were much lower than the observed installation growth rates for PV in 2011. The original model for FIT take-up predicted market growth of 70 per cent per annum. This rate was significantly lower than the observed rates of growth in installations of 25 to 35 per cent per week (equivalent to annual growth rates of 1,300-1,820 per cent). The main driver for these significantly higher real take-up rates were the reductions in capital costs and the rent-a-roof delivery model, unforeseen by the Government but expected by sector experts.

On 31 October 2011, as part of Phase 1 of the review, it was announced that the review would incorporate a further consideration of solar PV tariffs. This was in response to evidence of a significant fall in solar PV costs at all scales and higher than anticipated uptake, with a view to making any changes to tariffs on 1 April 2012. Research carried out for DECC by Cambridge Economic Policy Associates Ltd and Parsons Brinckerhoff (PB) in September 2011, published alongside the consultation on the proposed changes to tariff rates, suggested that PV installation costs had fallen by at least 30 per cent between the launch of the scheme and autumn 2011. This meant that current tariffs were leading to typical rates of return for investors well in excess of the 5 per cent that the tariffs were intended to deliver, for example 15 per cent for the medium capex scenario for systems under 4kW in size.[38]

Additional evidence received by DECC during the consultation period, and updated research by PB for DECC in January 2012, suggests that PV installation costs have in fact fallen by an even greater extent. A typical domestic installation cost 45 per cent less to install in 2011 compared with the originally estimate in 2009. There has also been significant falls in larger scale PV, with latest cost estimates putting a 350kW installation at 70 per cent cheaper than original Element Energy estimates.

Following the FIT review, it was proposed in consultation that PV installations with an eligibility date between 12 December 2011 and 31 March 2012 would receive current tariffs in that period, and new tariffs thereafter. It was also announced that the review would consider an energy efficiency eligibility requirement for installations attached or wired to provide electricity to a building. A new tariff for multiple ('aggregated') installations would also be applied to any solar PV installation where the FIT generator or nominated recipient already owns or receives FITs payments from one or more other PV installations, located on different sites.

Following the announcement of the consultation on the tariff rate, the rate of PV deployment increased rapidly, with over 380 MW of small-scale (up to 50kW) PV registered on the MCS database over the six weeks to 12 December 2012 – more than was installed in the preceding 18 months of the scheme (375 MW). This greatly exceeded the scenario modelled in DECC's original Impact Assessment (115 MW).

The expansion of the market for PV, and the significant cost reductions associated with the technology, was regarded by many as an environmental success story. However, the policy's success has two key consequences. Firstly, it increases the amount that consumers contribute towards the costs of the policy,

[38] See Table 10 of the IA No: DECC 0073

via their energy bills. Secondly, it threatens to take DECC funding above the HM Treasury Levies Control Framework threshold (covering FITs, the Renewables Obligation and the Warm Home Discount). If forecasts suggest the latter is likely to become a reality, DECC will be forced to introduce a policy proposal to reduce spend back to within the cap. Whilst DECC has 20 per cent headroom across its policies to meet any overspend, the projected take-up of PV would have potentially led to the FIT policy using a significantly higher proportion of the cap than originally expected, for example £1.9 billion[39] in 2014 under the 'do nothing' scenario. This is significantly higher than the cap of £446 million (see Table 6. DECC Levy budgets by year).

Table 6. DECC Levy budgets by year[40]

Levy budgets £m	**2011/12**	**2012/13**	**2013/14**	**2014/15**
Renewables Obligation (adjusted)	1,750	2,156	2,556	3,114
FITs (adjusted)	94	196	328	446
Warm Home Discount (unchanged)	250	275	300	310
Total	2,094	2,627	3,184	3,870

Analysis of FIT bill impacts

Figure 17. Total cost of supporting FIT under the two deployed scenarios and the additional cost on aggregate bills (excluding benefits) shows that the total policy costs on consumer's bills by 2020 is likely to be in the region of £4.6 billion under 'Option A'. Under DECC's 'do nothing' scenario these costs would have risen further to £6 billion. If the assumed cost of FIT to consumers in p/kWh is applied to projections for average domestic electricity consumption, then the 'do nothing' scenario would cost consumers an additional £46 per year in 2020.

However, it is also important to consider the benefits of these policies, which are often overlooked in studies that focus on the cost implications of environmental and social levies. Table 7. Total mean energy bill by year under the two scenarios shows the mean total energy bill, by year, associated with the FIT 'do nothing' and 'Option A' scenarios (across all customers). The total energy bill has been calculated by DIMPSA[41] and, as such, accounts for the benefits (in the way of energy efficiency and renewable energy measures and associated savings on bills) to householders. The total bill column shows the average bill, with the application of higher policy costs and an allowance for the energy generated, that is, a reduction in demand. In this instance, the average energy bill under the 'do nothing' scenario is £10.91 higher in 2020. However, the householders that benefit from the policy will receive an energy payment (the tariff) and, as such, are likely to benefit from a reasonable ROI over time. The total energy bill (across all customers), less the energy payment, is £50.68 lower on average under the 'do nothing' scenario, suggesting an overall positive impact on consumers' energy costs. However, the costs of FIT will be recouped from both domestic and non-domestic customers.

[39] Based on £6.3 per MWh in 2014, IA No: DECC 0073

[40] Control Framework for DECC levy-funded spending, Questions and Answers www.decc.gov.uk/assets/decc/11/funding-support/fuel-poverty/3290-control-fwork-decc-levyfunded-spending.pdf

[41] CSE's 'Distributional Impacts Model for Policy Scenario Analysis'

Figure 17. Total cost of supporting FIT under the two deployed scenarios and the additional cost on aggregate bills (excluding benefits)

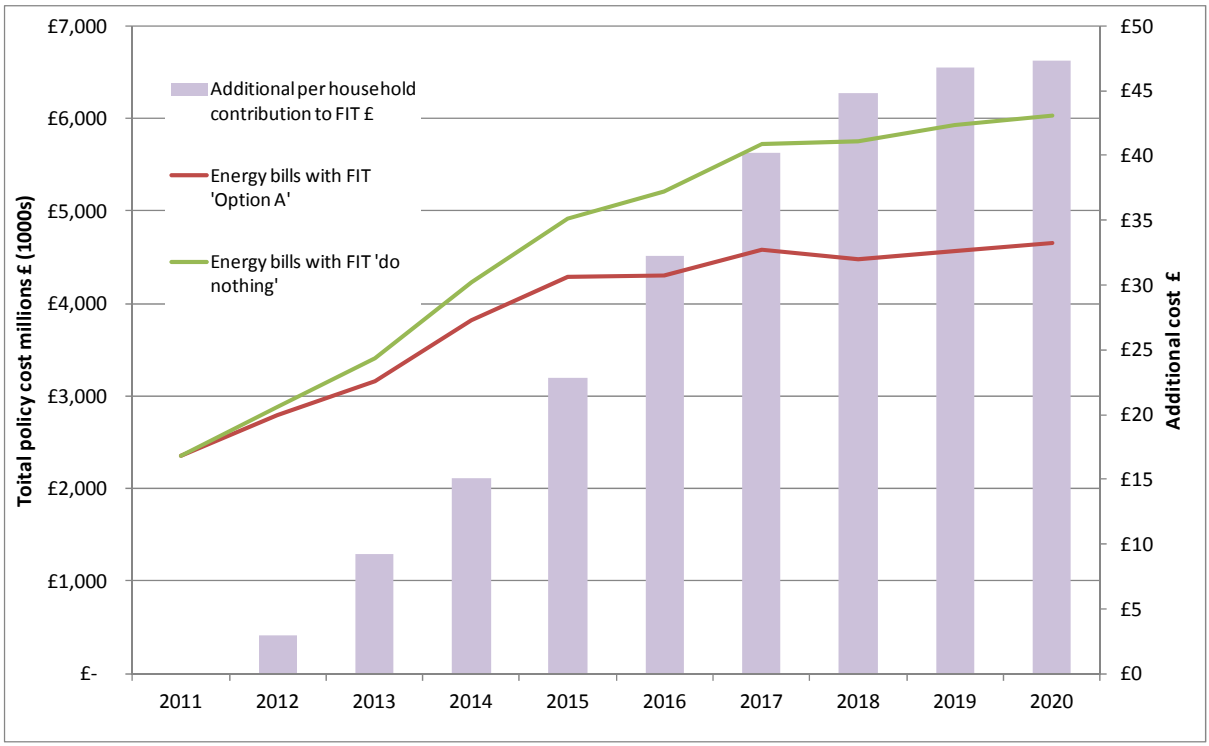


Table 7. Total mean energy bill by year under the two scenarios

Year	Total Bill £		Difference in cost	Total Bill £ (with energy payment)		Difference in cost (with payment)
	'Do nothing'	'Option A'		'Do nothing'	'Option A'	
2011	£1,237.73	£1,239.10	£1.37	£1,220.77	£1,222.14	£1.37
2012	£1,315.39	£1,315.60	£0.20	£1,291.87	£1,292.19	£0.33
2013	£1,385.34	£1,381.82	-£3.53	£1,352.40	£1,356.73	£4.33
2014	£1,397.08	£1,390.23	-£6.84	£1,354.43	£1,361.13	£6.69
2015	£1,435.69	£1,428.63	-£7.06	£1,382.97	£1,395.09	£12.12
2016	£1,425.01	£1,418.95	-£6.06	£1,358.24	£1,383.22	£24.98
2017	£1,392.62	£1,386.49	-£6.12	£1,309.30	£1,349.02	£39.72
2018	£1,324.62	£1,316.80	-£7.82	£1,228.82	£1,276.29	£47.46
2019	£1,320.01	£1,312.12	-£7.89	£1,215.72	£1,267.79	£52.07
2020	£1,326.30	£1,315.39	-£10.91	£1,215.57	£1,266.25	£50.68

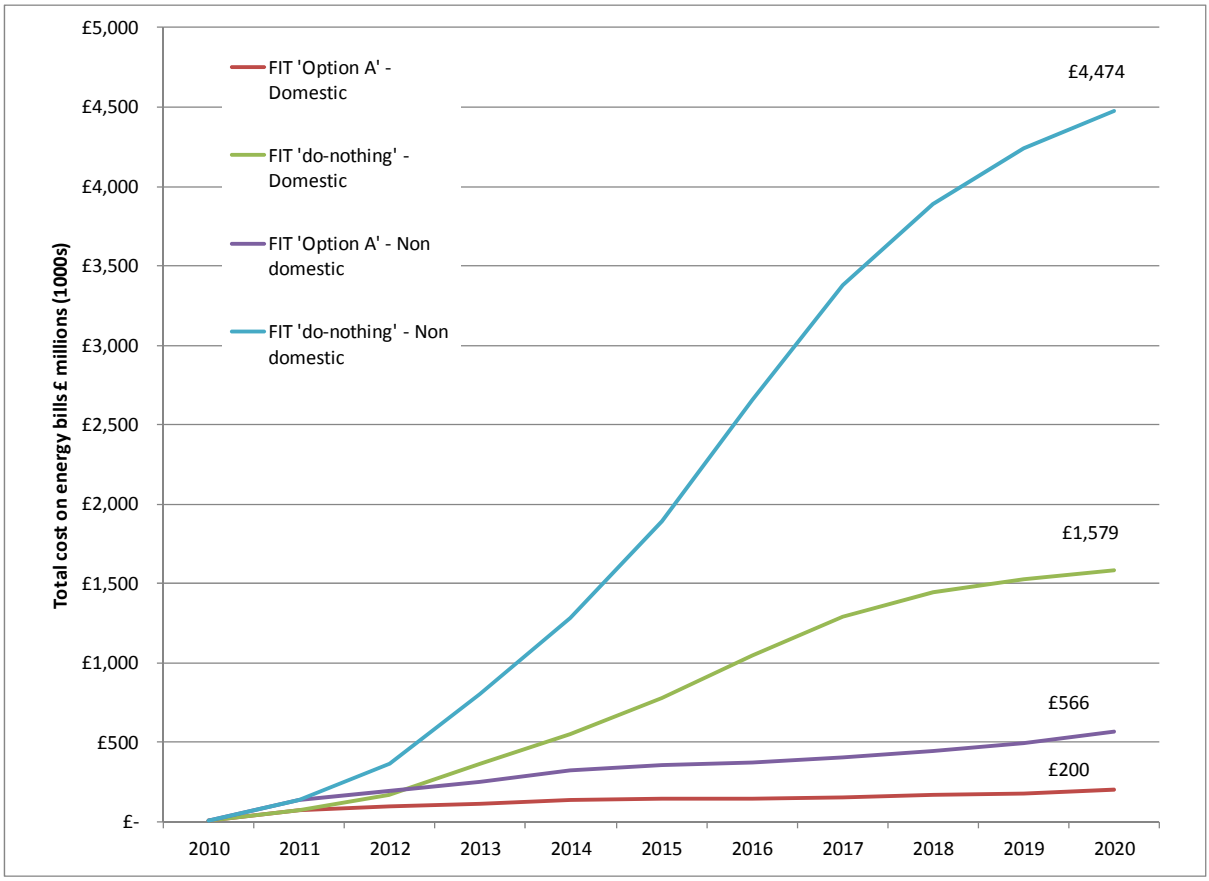
Figure 18. Total cost of FITs to domestic and non-domestic customers under the two scenarios shows the total policy cost contribution to FIT for the domestic and non-domestic sectors under both scenarios. The 'do nothing' scenario results in the non-domestic sector contributing an additional £3.9 billion to the policy. DECC's recent analysis of distributional impacts of climate change policies provides an indication of the electricity consumption associated with SMEs and large, energy-intensive users.[42] The DECC report suggests that SMEs use an average of 10,999 MWhs per customer. Under the 'do nothing' scenario, this equates to a cost to businesses of an additional £186,000 per year. This results in policies representing 30

[42] DECC, Estimated Impact of Energy and Climate Change Policies on Energy Prices and Bills, 2011

per cent of their total energy bill in 2020, an increase from the 22 per cent shown in DECC's analysis (so £508,000 as a proportion of £2.3 million).

The DECC report also provides a range of consumption profiles for large, energy-intensive users with a minimum and maximum of 40,000 and 160,000 MWhs per year. The additional cost of the 'do nothing' scenario under these consumption levels would therefore range from £678,000 to £2.7 million. This increases the proportion of their bill attributed to policies from a minimum of 10 per cent to 16 per cent, with a maximum of 25 per cent to 37 per cent. Non-domestic sector electricity consumers would not benefit from the deployment of domestic PV systems and, as such, would be subsidising their deployment. The costs of FIT at the non-adjusted rate would therefore not only jeopardise the HM Treasury Levy Control Framework (see Table 6. DECC Levy budgets by year) but would also place an undue burden on non-domestic customers.

Figure 18. Total cost of FITs to domestic and non-domestic customers under the two scenarios



Implications of the reduced FIT rate

The cut to the UK rate of the FIT was necessary given the HM Treasury Levy Control Framework, which is partially designed to protect consumers from any undue burden of environmental and social levies. In addition, the rate needed to be lowered quicker than expected due to the significantly high ROI experienced by early adopters and the potential future additional costs of the policy to both domestic and non-domestic consumers.

The cut to the rate of the FIT in October 2011 and subsequent legal challenge from Friends of the Earth has led many to question the original design for annual degression rates. In the Government's original consultation on the FIT in 2009, the document proposed 'degression rates in line with expected

technology cost reductions for different technologies at different scales. This gives the technology supply chain industries an indication of the cost reductions that will need to be achieved so that the tariffs can still deliver a sufficient return to encourage investment from potential generators.'

The consultation recognised other models for tariff degression, such as that deployed by Germany, whereby degression rates fluctuate depending on capacity installed in any particular year.[43] Germany has recently cut its own FIT rate significantly, which reflects the success of the scheme in supporting small-scale PV, the rising cost to energy consumers and the industry's competitiveness. The aim of Germany's programme is to remove subsidies once the industry is competitive, which the FIT has made possible, as noted by Minister Philipp Rösler (Federal Ministry of Economics and Technology - BMWi) and Minister Norbert Röttgen (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety - BMU) in a recent press conference.[44]

When the Minister Greg Barker launched the consultation on FIT rates for solar PV, he said he wanted to avoid the industry falling victim to "boom and bust". The UK and German solar industry have both benefited from significant reductions in capital costs as a result of low-cost manufacturers in China. However, unlike Germany, the supply chain and installer base in the UK is less established and, as such, the impact of the reduced tariff rate on installations is unclear. Notwithstanding that, the latest DECC impact assessment prediction of 3 million panels by 2020 is a significant advance on the policy's original projected number of 360,000.

[43] Question 51 of the consultation, providing respondents with the opportunity to comment on the tariff design and submit supplementary evidence

[44] www.bmu.de/pressemitteilungen/aktuelle_pressemitteilungen/pm/48390.php

Annex II: Additional tables

Table 8. Average gas and electricity bill (standard electricity customers) by year (DECC UK averages in real terms - deflated to 2005)

	Electricity (standard customers)			Gas		
Year	Standard credit	Direct debit	Pre-payment meter	Standard credit	Direct debit	Pre-payment meter
1991	£348	£343	£371	£367	£323	£385
1992	£366	£361	£390	£366	£322	£384
1993	£365	£360	£389	£352	£310	£370
1994	£377	£372	£402	£373	£328	£392
1995	£382	£377	£407	£386	£340	£406
1996	£366	£358	£390	£386	£340	£406
1997	£342	£332	£362	£382	£337	£402
1998	£314	£302	£334	£369	£325	£388
1999	£303	£290	£323	£349	£308	£365
2000	£292	£278	£311	£335	£300	£353
2001	£278	£266	£297	£326	£296	£343
2002	£268	£256	£286	£334	£303	£353
2003	£262	£249	£278	£335	£305	£351
2004	£262	£249	£280	£339	£315	£358
2005	£285	£269	£304	£386	£353	£401
2006	£328	£304	£348	£461	£412	£483
2007	£356	£328	£371	£506	£458	£540
2008	£398	£366	£415	£572	£532	£595
2009	£404	£369	£413	£639	£589	£667
2010	£381	£349	£391	£598	£560	£599
2011	£403	£372	£413	£639	£599	£635

Table 9. Assumed domestic FIT installations

Year	'Do nothing'	'Option A'
2010	30,811	30,811
2011	137,197	137,197
2012	576,228	120,733
2013	581,991	199,210
2014	727,488	311,764
2015	1,091,233	155,882
2016	1,418,603	116,911
2017	1,134,882	233,823
2018	794,417	327,352
2019	635,534	458,293
2020	508,427	916,587

Table 10. Average policy costs experienced by householders (energy bill impacts are based on average dual fuel consumption), 1990 to 2000

Policy	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Nuclear element of NFFO and nuclear decommissioning	£51.86	£51.39	£56.97	£57.10	£50.05	£47.26	£42.75	£42.48	£42.21	£41.87	£41.51
Warm Front (£m)											
Coal aid								£0.69	£0.61	£0.49	£1.63
RHPP											
EESOP, EEC, CERT, ECO and GD					£1.00	£1.00	£1.00	£1.00	£1.00	£1.00	£1.00
CESP											
WHD											
Renewables NFFO and the RO			£0.56	£1.12	£2.92	£4.09	£4.02	£4.00	£3.97	£3.94	£3.90
EU ETS and CPF											
FIT ('Option A')											
EMR											
Smart Meters											
Total costs on energy bills	£51.86	£51.39	£56.97	£57.10	£51.05	£48.26	£43.75	£43.48	£43.21	£42.87	£42.51
Total energy bill (homes heated by gas)	£656	£712	£730	£715	£748	£766	£748	£719	£678	£646	£623
Proportion of energy bill that relates to policy costs	7.9%	7.2%	7.8%	8.0%	6.8%	6.3%	5.8%	6.0%	6.4%	6.6%	6.8%

* Taxation-funded policies highlighted in grey.

Table 11. Average policy costs experienced by householders (energy bill impacts are based on average dual fuel consumption), 2001 to 2010

Policy	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Nuclear element of NFFO and nuclear decommissioning	£75.70	£14.24	£53.46	£2.35	£93.06	£88.42	£96.07	£12.01	£21.80	£85.70
Warm Front (£m)	£1.84	£2.14	£2.27	£2.31	£2.32	£3.06	£4.72	£5.28	£4.93	£4.56
Coal aid	£1.18	£0.49	£0.40	£0.58	£0.64	£0.30	£0.36	£0.52	£0.49	£0.44
RHPP										
EESOP, EEC, CERT, ECO and GD	£1.00	£4.00	£4.00	£4.00	£10.00	£10.00	£10.00	£10.00	£19.52	£19.78
CESP										£7.02
WHD										
Renewables NFFO and the RO	£3.87	£4.01	£6.05	£7.02	£8.37	£10.23	£12.22	£14.77	£15.52	£19.23
EU ETS & CPF					£39.08	£33.33	£2.10	£44.62	£25.48	£21.94
Small-scale renewables FIT ('Option A')										£0.09
FIT-CfD										
Smart Meters										
Total costs on energy bills	£1.00	£8.01	£10.05	£11.02	£57.45	£53.56	£24.32	£69.39	£60.51	£68.07
Total energy bill (homes heated by gas)	£602	£600	£593	£601	£666	£779	£853	£959	£1,027	£959
Proportion of energy bill that relates to policy costs	0.2%	1.3%	1.7%	1.8%	8.6%	6.9%	2.9%	7.2%	5.9%	7.1%

* Taxation funded policies highlighted in grey.

Table 12. Average policy costs experienced by householders (energy bill impacts are based on average dual fuel consumption), 2011 to 2020

Policy	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Nuclear element of NFFO and nuclear decommissioning	£15.56	£15.40	£15.24	£15.09	£14.93	£14.78	£14.62	£14.47	£14.32	£14.19
Warm Front (£m)	£1.44	£1.30								
Coal aid										
RHPP	£0.65	£0.64								
EESOP, EEC, CERT, ECO and GD	£19.20	£25.60	£28.51	£31.20	£31.82	£32.60	£31.66	£28.51	£30.02	£28.58
CESP	£6.43									
WHD	£5.04	£5.48	£5.92	£5.92	£5.92	£5.92	£5.93	£5.93	£5.93	£5.93
Renewables NFFO and the RO	£16.56	£23.43	£28.56	£31.30	£34.48	£30.48	£36.37	£36.00	£35.54	£36.98
EU ETS and CPF	£17.41	£17.47	£17.38	£19.98	£22.66	£22.41	£23.85	£25.79	£26.92	£27.33
Small-scale renewables FIT ('Option A')	£2.19	£3.00	£3.65	£4.44	£4.62	£4.66	£4.88	£5.15	£5.47	£6.15
FIT-CfD				£5.83	£9.28	£12.28	£14.43	£16.25	£19.80	£22.97
Smart Meters		£1.07	£1.94	£7.78	£12.37	£12.82	£12.72	£9.05	£3.70	£1.69
Total costs on energy bills	£66.84	£76.04	£85.96	£106.44	£121.15	£121.18	£129.85	£126.67	£127.37	£129.63
Total energy bill (homes heated by gas)	£1,166	£1,236	£1,302	£1,315	£1,348	£1,335	£1,290	£1,210	£1,201	£1,196
Proportion of energy bill that relates to policy costs	5.7%	6.2%	6.6%	8.1%	9.0%	9.1%	10.1%	10.5%	10.6%	10.8%

* Taxation funded policies highlighted in grey.