# Energy Prices and Bills - impacts of meeting carbon budgets

## Annex

# Annex A1: impact of meeting carbon budgets on energy prices

This report has set out the impact of meeting carbon budgets on energy prices and bills in the residential and business sectors. This annex sets out the approach we used to estimate overall prices, including the climate policy components, and presents the price impacts in the context of our previous reports for comparison.

We set out our analysis in the following six sections:

- A1.1: Components of electricity and gas prices
- A1.2: Approach to calculating price components
- A1.3: Assumptions used in our analysis
- A1.4: Changes in price components over time
- A1.5: Comparison of low-carbon bill impacts in previous CCC reports

## A1.1 Components of electricity and gas prices

Retail electricity and gas prices in 2004 consisted of a set of basic components. Since then, in addition to changes in these components, a number of policy costs have been recovered, or are set to be recovered, through electricity bills. These policy costs include both non-climate policies and climate policies. In this section we describe the various components of electricity and gas prices in the residential, commercial and manufacturing sectors.

Table A1.1 describes the various components of energy prices, specifying whether each price component applies to electricity and/or gas, and to which sector (residential, commercial, manufacturing).

**Table A1.1.** Components of energy prices

| Price component | Fuel | | Sector | | |
|---|---|---|---|---|---|
| | Elec | Gas | Res | Com | Man |
| **Basic price components** | | | | | |
| **Wholesale price**. This is the cost of electricity and gas purchased on the wholesale market prior to its supply to the customer. | √ | √ | √ | √ | √ |
| **Supplier costs and margins**. These include the day-to-day expenses related to running an energy supply business, and include costs of customer service, staffing, IT, sales and marketing, billing, metering and bad debt; depreciation; and the supplier pre-tax margin (i.e. profit). | √ | √ | √ | √ | √ |
| **Transmission and distribution costs**. These are the costs of installing, refurbishing and upgrading the networks of gas pipes and electricity wires. These costs are regulated by Ofgem. | √ | √ | √ | √ | √ |
| **Balancing costs**. These costs primarily relate to the balancing of Britain's electricity system (i.e. procuring or constraining generation) which suppliers pay if they consume more or less electricity than they have contracted for. | √ | | √ | √ | √ |
| **Non-climate policy costs** | | | | | |
| **Warm Homes Discount**. A one-off discount on winter electricity bills for vulnerable customers. The scheme will run each winter to 2020-2021. Recovered through residential electricity and gas bills | √ | √ | √ | | |
| **Energy efficiency policies**. These include CERT, CESP, and the Energy Company Obligation (ECO). Under ECO, energy suppliers are obligated to fund energy efficiency improvements in households. While some ECO funding is aimed specifically at reducing carbon emissions (see below), we estimate that approximately half of ECO funding targeted fuel poverty in 2016. Recovered through residential electricity and gas bills. | √ | √ | √ | | |
| **Smart meters**. The Government has set a target to install smart meters in all homes and 2 million small businesses by the end of 2020. Recovered largely through residential electricity and gas bills, as well as from small businesses. We consider smart meters to be a non-climate policy, as carbon savings represents one of several elements of Government's stated rationale for smart meter roll-out, and only a part of the expected benefits. | √ | √ | √ | √[1] | |

**Table A1.1.** Components of energy prices

| Price component | Fuel | | Sector | | |
|---|---|---|---|---|---|
| | Elec | Gas | Res | Com | Man |
| **VAT**. Households pay a reduced rate of VAT of 5%. As businesses pay VAT but can fully reclaim it, we do not include this in our analysis for the industrial and commercial sectors. | √ | √ | √ | | |
| **Climate policy costs** | | | | | |
| **Carbon price**. Generators face a carbon price under the EU Emissions Trading System and the UK's Carbon Price Support. The carbon price increases wholesale electricity prices faced by all electricity consumers. | √ | | √ | √ | √[2] |
| **Direct support for low-carbon generation**. Price support is paid to new low-carbon generators through the Renewables Obligation (RO), Contracts for Difference (CfDs) and Feed-In-Tariffs (FITs) for small-scale generators. | √ | | √ | √ | √[2] |
| **Energy efficiency policies**. These include CERT, CESP, and the Energy Company Obligation (ECO). Under ECO, Energy suppliers are obligated to fund energy efficiency improvements in households. We estimate that around half of ECO funding targeted carbon emissions in 2016. Recovered through residential electricity and gas bills. | √ | √ | √ | | |
| **Energy taxes**. These include the CRC Energy Efficiency Scheme (CRC) and the Climate Change Levy (CCL).<br>The CCL is a tax on electricity, natural gas, solid fuels and liquid petroleum gas when used as fuels, aimed at encouraging energy efficiency. Many manufacturing sectors have a Climate Change Agreement (CCA) which entitles them to a discount on their CCL (90% for electricity and 65% for gas in 2016). In addition, metallurgical and mineralogical processes are exempt from CCL.<br>The CRC requires large energy users in the public and private sectors to buy allowances for every tonne of carbon they emit. The CRC will be closed following the 2018-19 compliance year, and replaced with an increase in the CCL, and the discounts associated with CCAs. | √ | √ | | √ | √[2] |

**Table A1.1.** Components of energy prices

| Price component | Fuel | | Sector | | |
|---|---|---|---|---|---|
| | Elec | Gas | Res | Com | Man |
| **Merit order effect**. This refers to the reduction in average wholesale prices arising from deployment of low-carbon generation (e.g. renewables, nuclear). The additional deployment moves lower marginal cost plant – including low-carbon plant itself - closer to the margin, with such plant setting the market price more often. | √ | | √ | √ | √ |
| **Additional costs associated with low-carbon generation**. These include the cost of intermittency imposed by renewables, additional transmission and distribution costs, and additional VAT imposed on the overall costs of climate policies. | | | | | |
| **Capacity Market**. The Capacity Market was introduced as part of Electricity Market Reform, partly to account for the impact of a significant amount of low-carbon intermittent generation on security of supply. The Capacity Market aims to ensure security of electricity supply by providing a payment for reliable sources of capacity, and support the development of more active demand management in the electricity market. The costs of the UK capacity market will be levied on electricity bills from 2018/19. | √ | | √ | √ | √ |
| **Gas grid uplift**. Climate policy is expected to reduce gas consumption. However, this is not expected to result in a commensurate reduction in the costs of maintaining and upgrading the gas transmission and distribution networks. We therefore estimate the increase in the unit cost of gas as network costs are spread over a lower level of throughput. | | √ | √ | √ | √ |

**Source:** CCC analysis.
**Notes:** [1]. A very small proportion of smart meter costs are recovered from small businesses. As the share of costs incurred by small businesses is very small, we do not include this in our analysis. [2]. Some manufacturing sectors are eligible for compensation and/or exemptions.

## A1.2 Approach to calculating price components

Table A1.2 sets out our approach to calculating the price components described above.

**Table A1.2.** Approach to calculating the price components

| Category | Approach |
|---|---|
| **Basic price components** | |
| Wholesale price | *Residential*<br>2004-2016: Estimated based on historical Ofgem bill breakdowns applied to historical retail prices (as set out in BEIS data on average annual residential electricity bills). 2016 values are adjusted to align to BEIS' QEP Consumer prices index.<br>2016: electricity and gas prices: 2015 p/kWh, adjusted to 2016 based on BEIS Domestic energy price indices.<br>2017-2030:<br>• *Electricity*. Estimated to be equal to the long-run marginal cost (LRMC) of gas generation, minus capacity market costs. The LRMC of gas is the central expectation for the wholesale price in a liberalised electricity market, where gas is the cheapest generation technology.<br>• *Gas*. Calculated as the projected natural gas price, accounting for storage costs, uplifted by the difference between natural gas prices and wholesale prices in 2016.<br>*Commercial and manufacturing*<br>2004-2014: breakdown into individual price components was not possible due to lack of data<br>2015-16: estimated based on 2015 total electricity or gas price, with remaining price components (supplier costs and margin, transmission, distribution, balancing) subtracted.<br>2017-2030: Estimated based on residential wholesale prices, adjusted (on a p/kWh basis) for the lower level of wholesale prices faced by commercial and manufacturing consumers in 2015.<br>Sources:<br>• BEIS Quarterly Energy Prices Table 2.2.1: Average annual domestic electricity bills by home and non-home supplier (Sep 2016)<br>• BEIS Quarterly Energy Prices Table 2.3.1: Average annual domestic gas bills by home and non-home supplier (Sep 2016)<br>• BEIS Quarterly Energy Prices Table 3.4.1: Prices of fuels purchased by non-domestic consumers in the United Kingdom (excluding the Climate Change Levy) (Sep 2016)<br>• BEIS Quarterly Energy Prices Table 3.1.4: Prices of fuels purchased by manufacturing industry in Great Britain (Sep 2016) |

| Table A1.2. Approach to calculating the price components | |
|---|---|
| **Category** | **Approach** |
| | • Ofgem (2004): Domestic Competitive Market Review 2004; Ofgem (2008, 2009, 2012, 2013): Household energy bills explained; Ofgem Supply Market Indicator<br>• BEIS (2016) electricity generation cost report<br>• BEIS (2016): Domestic energy price indices Table 2.1.3 Consumer prices index |
| Supplier costs and margin | *Residential*<br>2004-2015: Estimated based on historical Ofgem bill breakdowns applied to historical retail prices (see wholesale price section, above), minus costs of smart meter programme (see below); as we consider these to be non-climate policy costs.<br>2016-2030: Estimated on p/kWh basis based on five-year (2011-15) average.<br>*Commercial and manufacturing*<br>2004-2009: breakdown into individual price components was not possible due to lack of data<br>2009-2015: drawn from Energy companies' Consolidated Segmental Statements (annual statements published by large vertically integrated energy companies segmenting the financial results of their supply and generation activities).<br>2016-2030: Estimated on p/kWh basis based on five-year (2011-15) average.<br>Sources:<br>• Ofgem (2004): Domestic Competitive Market Review 2004; Ofgem (2008, 2009, 2012, 2013): Household energy bills explained; Ofgem Supply Market Indicator<br>• Ofgem's Energy companies' Consolidated Segmental Statements |
| Transmission and distribution | *Residential*<br>2004-2015: Estimated based on historical Ofgem bill breakdowns applied to historical retail prices (see wholesale price section, above) prices.<br>2016-2021: Assumed to increase from 2015 levels in line with allowed revenues to transmission and distribution owners<br>2022-2030: Assumed to remain at 2021 levels<br>*Commercial and manufacturing*<br>2004-2014: breakdown into individual price components was not possible due to lack of data<br>2015: Non-residential transmission and distribution costs are estimated as the remaining costs not paid by the residential sector, by subtracting estimated spend by residential consumers (price as above, multiplied by consumption in |

| Table A1.2. Approach to calculating the price components | |
|---|---|
| **Category** | **Approach** |
| | the residential sector) from total transmission and distribution spend under transmission and distribution owners' allowed revenues.<br>2016-2021: Assumed to increase from 2015 levels in line with allowed revenues to transmission and distribution owners.<br>2022-2030: Assumed to remain at 2021 levels.<br>Sources:<br>• Ofgem (2004): Domestic Competitive Market Review 2004; Ofgem (2008, 2009, 2012, 2013): Household energy bills explained; Ofgem Supply Market Indicator<br>• National Grid: Forecast TnUoS tariffs from 2017/18 to 2020/21[1]<br>• National Grid: RIIO-T1: Final Proposals for National Grid Electricity Transmission and National Grid Gas<br>• Ofgem: RIIO-ED1: Final determinations for the slowtrack electricity distribution companies |
| Balancing | *Residential, commercial and manufacturing*<br>2004-2015: Estimated based on historical Ofgem bill breakdowns applied to historical retail prices (see wholesale price section, above).<br>2016-2030: Assumed to remain at 2014 levels; does not include additional balancing costs arising from climate policy; these costs are considered separately.<br>Sources:<br>• Ofgem (2004): Domestic Competitive Market Review 2004; Ofgem (2008, 2009, 2012, 2013): Household energy bills explained; Ofgem Supply Market Indicator |
| **Non-climate policies (residential)** | |
| Warm Home Discount | 2011-2030: Estimate of impact on bill taken from DECC Prices and Bills publication, and divided by consumption to get price impact. Held constant in real terms beyond 2013.<br>Source:<br>• DECC (2013): Estimated impacts of energy and climate change policies on energy prices and bills |

[1] In February 2017 National Grid issued a new annual forecast of TnUoS tariffs covering the period to 2021-22. The new forecast for 2021-22 of £3.5bn is slightly lower than the previous forecast for 2020-21 of £3.8bn, which we assume in this analysis to be constant over the period to 2030.

| Table A1.2. Approach to calculating the price components | |
|---|---|
| **Category** | **Approach** |
| Energy efficiency policies (fuel poverty) | 2004-2015: Estimated based on historical Ofgem bill breakdowns applied to average retail prices.<br>2016-2017: Costs based on forecast ECO spend.<br>2018-2030: Costs based on ECO Transition Consultation.<br>We split energy efficiency costs between low-carbon spending and fuel poverty spending, based on the share of households in priority groups. For pre-ECO schemes this is based on Rosenow et al (2013), for ECO itself it is based on the 2014 ECO impact assessment.<br>Beyond 2017 we assume fuel poverty focused energy efficiency costs remain fixed at £620m per annum in line with the ECO Transition Consultation (we make separate estimates for low-carbon energy efficiency costs).<br>Sources:<br>• Ofgem (2004): Domestic Competitive Market Review 2004 (& subsequent Ofgem publications)<br>• DECC (2014): ECO – Final Impact Assessment<br>• BEIS (2016): ECO Transition Consultation<br>• Rosenow, J. et al (2013) Fuel poverty and energy efficiency obligations – A critical assessment of the supplier obligation in the UK |
| Smart Meters | 2013-2030: Based on BEIS' total estimated costs of smart meter roll-out, offset by resource cost savings. Savings comprise avoided costs of microgeneration metering, avoided site visits, and reduced inquiries and customer overheads. We do not include savings from reduced electricity generation or network upgrades (we account for these separately), or carbon or air quality related benefits as these do not reduce consumer bills.<br>Source:<br>• BEIS (2016): Smart meter roll-out cost-benefit analysis |
| VAT | Calculated as 5% of basic price components and non-climate policy costs for residential |
| **Climate policies** | |
| Carbon price | The carbon price increases consumer bills through its impact on the wholesale price, raising the wholesale price in each settlement period by the value of the carbon price paid by the marginal (price setting) generator. We consider the share of this value accruing to CfD generators to constitute support for low-carbon, rather than a carbon price impact. This is because CfDs guarantee a fixed price for generation, such that revenues to CfD generators are invariant to the level of the carbon price. |

| Table A1.2. Approach to calculating the price components | |
|---|---|
| **Category** | **Approach** |
| | We use BEIS' forecast of market carbon prices, rather than the Government's target-consistent carbon values.<br>We estimate this impact as the value of ETS allowances for gas generators, applied to non-CfD generation in our Fifth Carbon Budget Central Scenario.<br>*Manufacturing*<br>• Large manufacturing and Large manufacturing (low-carbon support compensation): firms assumed to pay full carbon price costs<br>• Extra-large manufacturing (low-carbon support and carbon price compensation): assumed to be compensated for 64% of the carbon cost in 2016 (80% compensation against an energy efficiency benchmark of 80%) and 60% in 2030 (80% compensation against a 75% benchmark).<br>Sources:<br>• BEIS (2015): Updated short-term values used for modelling purposes<br>• Committee on Climate Change (2015): Power sector scenarios for the fifth carbon budget<br>• BEIS (2015) Compensation for the indirect costs of EU Emission Trading System and the Carbon Price Support mechanism from 2015: Update guidance for applicants. |
| Support for low-carbon | Feed-in-Tariffs: Taken from BEIS's July 2016 forecast to 2020, and held constant to 2030.<br>Renewables Obligation: Taken from BEIS's July 2016 forecast to 2020, and held constant to 2027. Spend beyond 2027 is assumed to decrease as early-stage RO projects reach the end of the contract life.<br>Contracts-for-Difference:<br>• Spend under CfDs is calculated as the difference between an assumed strike price and our wholesale price forecast (see wholesale price, above). We consider the share of the carbon price component of wholesale prices accruing to CfD generators to constitute support for low-carbon, rather than a carbon price impact. This is because CfDs guarantee a fixed price for generation, such that revenues to CfD generators are invariant to the level of the carbon price (see carbon price, above).<br>• To 2020, projections align to BEIS's July 2016 forecast<br>• Beyond 2020, we forecast spend for existing and contracted projects, as well as additional funding required to support a portfolio of low-carbon technologies to reach a grid emissions intensity of 100g$CO_2$/kWh in 2030 in line with the CCC's 5th Carbon Budget advice. Specifically, we estimate the cost of the CCC's 'High Renewables' scenario.<br>In addition to our Levy Control Framework estimates, we include the carbon price uplift that we estimate low-carbon generators receive in the wholesale |

| **Table A1.2.** Approach to calculating the price components | |
|---|---|
| **Category** | **Approach** |
| | electricity market (see Carbon price, above).<br>The technology mix underpinning this analysis is set out in Table A1.3.<br>*Manufacturing:*<br>• Large manufacturing (no compensation): firms assumed to pay full support costs<br>• Large manufacturing (low-carbon support compensation) and Extra-large manufacturing (low-carbon support and carbon price compensation): assumed to be compensated for 85% of the RO/FiTs in 2016, and exempted from 85% of the RO/FiTs/CfD in 2030.<br>Sources:<br>• NAO (2016): Controlling the consumer-funded costs of energy policies: The Levy Control Framework<br>• BEIS (November 2016): Consumer Funded Policies Report<br>• CCC (2015): 5th Carbon Budget<br>• BEIS (2016): Estimate of Eligible Renewables Obligation (RO) and Feed-in-Tariff (FIT) Exempt Electricity Volume<br>• BEIS (2016) Compensation for the indirect costs of the renewables obligation and small scale feed-in-tariffs - guidance |
| Energy efficiency policies (low-carbon) | 2004-2015: Estimated based on historical Ofgem bill breakdowns applied to average retail prices.<br>2016-2017: Costs based on forecast ECO spend.<br>As described above for fuel poverty measures, we split the costs of the energy efficiency costs between low-carbon spending and fuel poverty spending across previous energy efficiency schemes.<br>Beyond 2017 we include the cost of those energy efficiency measures in our Fifth Carbon Budget Central Scenario that require subsidy, i.e. incur a net cost to households.<br>Sources:<br>• Ofgem: Domestic Competitive Market Review 2004 (& subsequent Ofgem publications)<br>• BEIS: ECO – Final Impact Assessment<br>• BEIS: ECO Transition Consultation |
| Energy taxes | *CCL*<br>Given Budget 2016 announcement to increase the CCL (and the discount) after the closure of the CRC, with an intention to equalise the electricity and gas rates of CCL, we assume the CCA discount for both to be 93% in 2030. |

| **Table A1.2.** Approach to calculating the price components | |
|---|---|
| **Category** | **Approach** |
| | Overall:<br>• Small commercial and Medium commercial: assumed to pay the full rate of CCL,<br>• Large manufacturing and Large manufacturing (low-carbon support compensation): assumed to face the discounted rates set out above,<br>• Extra-large manufacturing (low-carbon support and carbon price compensation): assumed to be exempt from CCL due to exemption for metallurgical/mineralogical processes.<br>*CRC*<br>We estimated unit prices of the CRC for gas and electricity respectively, based on the Government's forecast CRC sale price adjusted for the carbon intensities of natural gas combustion, and our forecast carbon intensity for the power sector to 2030. For our illustrative electricity price examples only the 'Medium commercial' would qualify to be in the CRC and pay the associated cost. |
| Cost of intermittency | Estimated based on our assessment of the system integration costs of intermittent generation of £10/MWh.<br>2004-2015: £10/MWh applied to BEIS data on historical levels of intermittent generation<br>2016-2021: £10/MWh applied to levels of intermittent generation consistent with our fifth carbon budget Central scenario.<br>Sources:<br>• BEIS (2016): Digest of United Kingdom Energy Statistics Table 5.1, Electricity: commodity balances<br>• Committee on Climate Change (2015): Power sector scenarios for the fifth carbon budget |
| Additional transmission and distribution costs | Estimated based on analysis by Element Energy and Imperial College assessing the costs of additional transmission and distribution investment required to meet the fourth carbon budget.<br>Source:<br>• Imperial College and Element Energy (2014): Infrastructure in a low-carbon energy system to 2030: Transmission and distribution |
| Merit order effect | We have drawn on modelling from Aurora Energy Research to estimate the impact of the merit order effect on retail prices in our scenarios:<br>• Aurora model a scenario that reduces emissions to under 100 $gCO_2$/kWh in 2030 in their GB Power Market Forecast.<br>• They model the impact of varying nuclear and wind output, finding that a |

| Table A1.2. Approach to calculating the price components | |
|---|---|
| **Category** | **Approach** |
| | 30 TWh increase in wind output would lead to an average electricity price that is 0.7 p/kWh lower in 2030, and that a 5 TWh increase in nuclear power would decrease power prices by 0.8 p/kWh in 2030<br>Scaling that up for the 280 TWh of low-carbon generation in our scenarios (and taking into account nuclear retirements) implies a reduction in wholesale prices, such that prices are 3 p/kWh lower by 2030.<br>The reduction in wholesale prices for CfD generation does not result in lower retail prices, as this reduction must be offset with higher price support. We therefore estimate the reduction in retail prices due to the reduction in wholesale prices on non-CfD generation only. In turn, some of this reduction in retail prices is offset by capacity market payments (see below).<br>Source:<br>• Aurora Energy Research: GB Power Market Forecast (October 2016) |
| Capacity Market | 2018-2021: Outturn costs for the three delivery years for which auctions have taken place: 2018/19, 2019/20 and 2020/21<br>2022-2030: Capacity Market costs rise to levels required to compensate gas and existing nuclear generators for the merit order effect (see below).<br>We separate the costs borne by the residential sector and non-residential sector based on the proportion of residential peak demand as part of average cold spell peak demand, from National Grid's 'Gone Green' scenario.<br>Sources:<br>• National Grid: Future Energy Scenarios (2016)<br>• Ofgem (2016): Monitoring trends in supplier's expected costs<br>• EMR Delivery Body: T-4 Auction Published Results<br>• BEIS: Capacity Market Parameters |
| Additional VAT | Calculated as 5% of climate policy costs for residential |

Table A1.2 sets out our approach to calculating the contribution to electricity prices of the cost of support for low-carbon generation. We note that price support for low-carbon generation is not a good measure of the level of subsidy, given for example that no alternative generation capacity could be built at the wholesale price against which price support is calculated.

## A1.3 Assumptions used in our analysis

This section sets out the detailed assumptions underpinning our estimates of the price components presented in Table A1.2 above. Table A1.3 sets out details of the CCC 'High Renewables' Scenario for 2030 which underpins our estimates of low-carbon support under the Levy Control Framework. Table A1.4 sets out Levy Control Framework costs and cost sensitivities.

Figures A1.1 and A1.2 show the detailed price trajectories for gas and carbon prices, respectively.

**Table A1.3.** CCC 'High Renewables' Scenario for 2030

| **Technology** | **2015** | | **2030** | |
|---|---|---|---|---|
| | **Capacity (GW)** | **Generation (TWh)** | **Capacity (GW)** | **Generation (TWh)** |
| Nuclear | 9 | 64 | 6 | 47 |
| Onshore wind | 9 | 23 | 22 | 52 |
| Offshore wind | 5 | 17 | 25 | 91 |
| Carbon capture & Storage | 0 | 0 | 4 | 27 |
| Solar | 9 | 8 | 40 | 34 |
| Tidal | 0 | 0 | 1 | 2 |
| Biomass | 4 | 25 | 3 | 24 |
| Hydro | 2 | 6 | 2 | 5 |

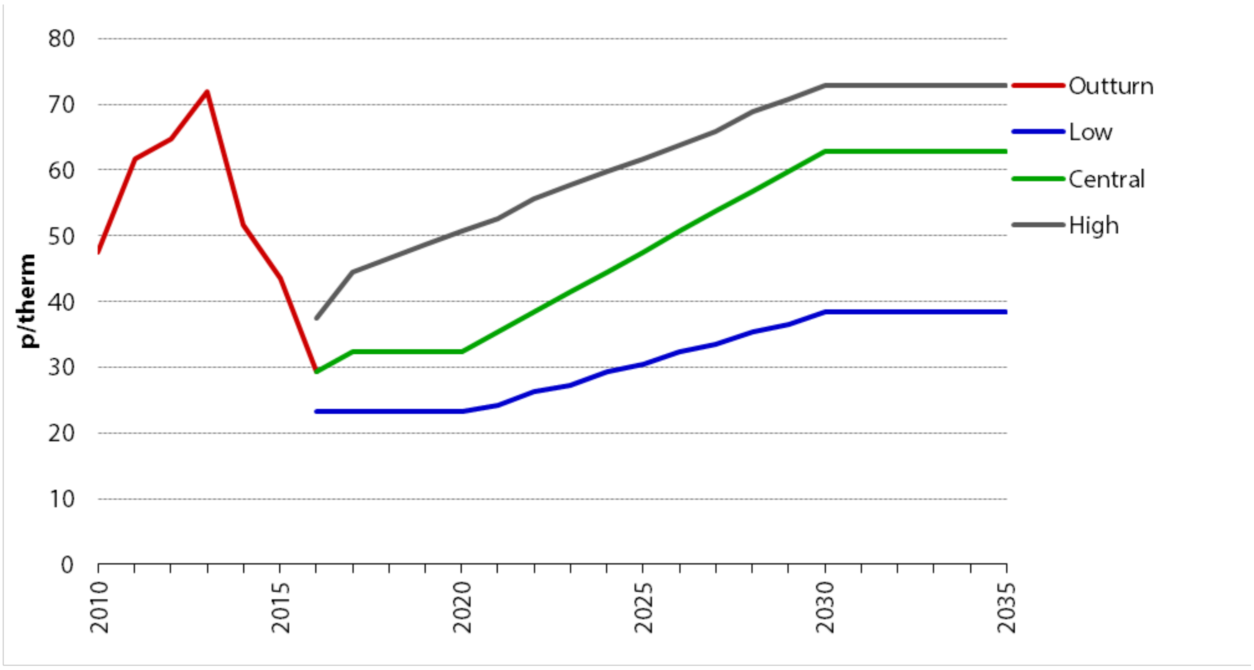
**Source:** CCC (2015): Power sector scenarios for the fifth carbon budget.
**Note:** We developed a number of scenarios for our fifth carbon budget advice, reflecting different levels of deployment of low-carbon generation technologies and different levels of demand. We assume around 8 GW of existing nuclear capacity will retire by 2030, with Sizewell B (1.2 GW) remaining.

| **Table A1.4.** Levy Control Framework costs and cost sensitivities | | | | |
|---|---|---|---|---|
| **£m per year (£2011/12)** | **2020** | **2025** | **2030** | **Source** |
| FiTs/RO | 6245 | 6245 | 5383 | BEIS LCF Forecast (October 2016) |
| FIDER | 1626 | 1603 | 1236 | CCC projections, aligned to BEIS LCF Forecast (October 2016) |
| Auction Round 1 | 338 | 292 | 198 | CCC projections, aligned to BEIS LCF Forecast (October 2016) |
| 2020 CfDs, of which:<br>(Offshore wind)<br>(CCS)<br>(Nuclear)<br>(Other low-carbon e.g. onshore/solar/marine) | | 2477<br>(1047)<br>(677)<br>(462)<br>(292) | 2057<br>(1069)<br>(754)<br>(482)<br>(-247) | CCC 'High Renewables' Scenario |
| **Total expenditure (£2011/12)** | **8275** | **10634** | **8890** | |
| **Total expenditure (£2016)** | 8748 | 11241 | 9398 | |
| Additional low-carbon support [1] | 206 | 1411 | 4017 | |
| **Total low-carbon support (£2016)** | **8954** | **12652** | **13415** | |

| **Table A1.4.** Levy Control Framework costs and cost sensitivities | | | | |
|---|---|---|---|---|
| **£m per year (£2011/12)** | **2020** | **2025** | **2030** | **Source** |
| **Sensitivities (£2016)** | | | | |
| Low gas price [2] | 133 | 985 | 2462 | Reflects BEIS' low fossil fuel price projections (see Figure A1.1 below) |
| High gas price | -248 | -814 | -1030 | Reflects BEIS' high fossil fuel price projections (see Figure A1.1 below) |
| No Carbon Price | 188 | 1284 | 3655 | Represents the upper bound of levy expenditure in the event of a collapse in carbon prices |

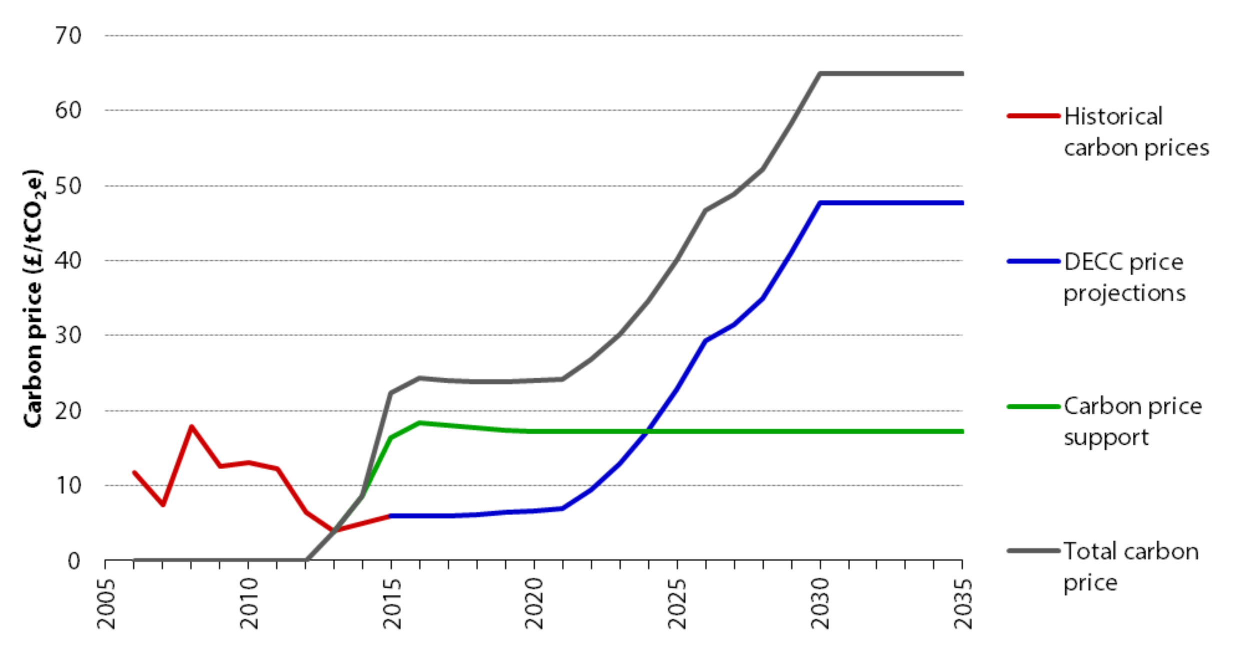
**Source:** listed in table; CCC analysis.
**Notes:** [1] As set out in Table A1.2, we account for the impact of the carbon price on wholesale prices differently between CfD generation and non-Cfd generation. For non-CfD generation we consider this a "carbon price impact", while for CfD generation we consider this support for low-carbon ("additional low-carbon support"), as, in the absence of a carbon price, the equivalent value would need to be paid as the CfD top-up in paying the contracted strike price. [2] Gas price sensitivities take account of the impact of gas prices on CCS costs.

**Figure A1.1** Gas prices and price projections (2010-2035)




**Source:** BEIS (2016): Fossil Fuel Price Assumptions.
**Note:** £2016, real terms.

**Figure A1.2** Carbon prices and price projections (2005-2035)

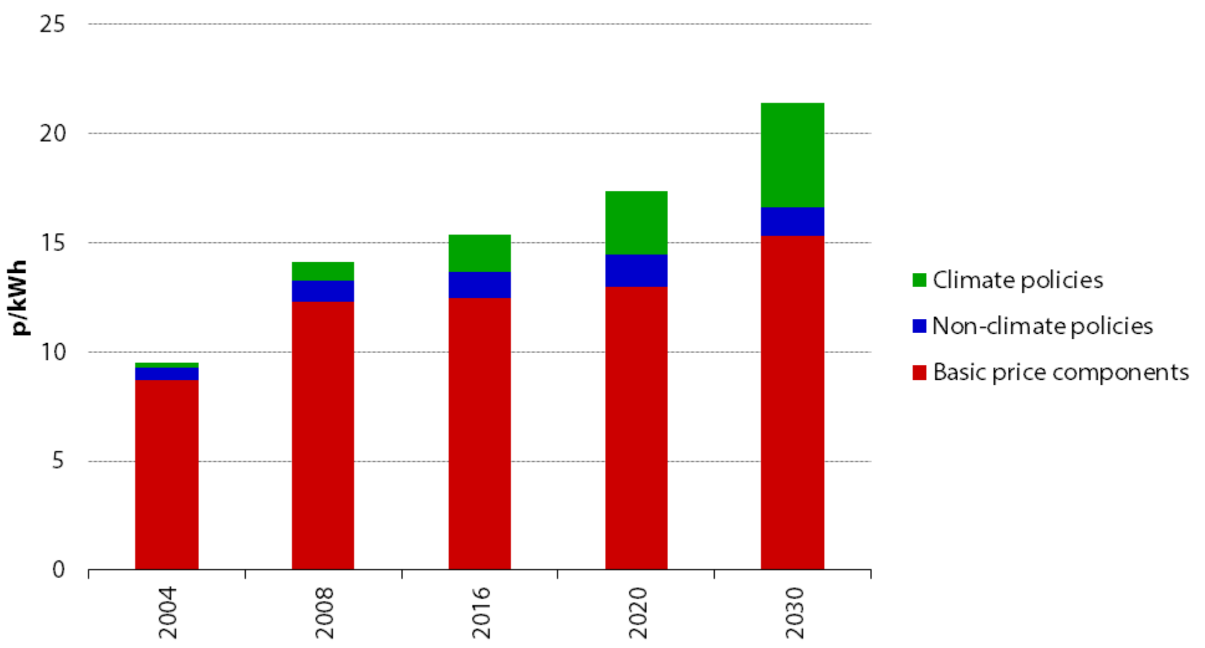



**Source:** DECC (2015): Updated short-term values used for modelling purposes.
**Note:** £2016, real terms.

## A1.4 Changes in price components over time

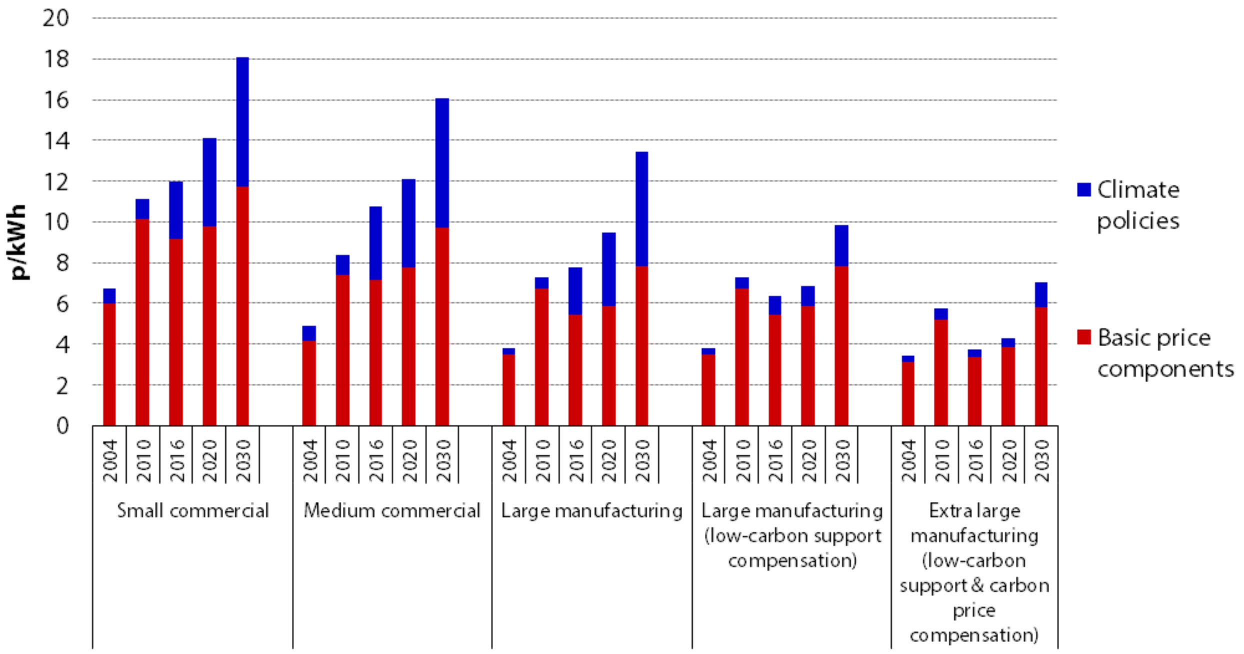
Figures A1.3 and A1.4 set out changes in each electricity price component between 2004 and 2016, and the expected changes to 2030, in the residential and business sectors, respectively. Figures A1.5 and A1.6 set out changes in each gas price component on the same basis. These figures and the detailed data underpinning them (disaggregating broad cost categories into their constituent parts) are available on our website.

**Figure A1.3.** Changes in electricity price components (2004-2030) in the residential sector



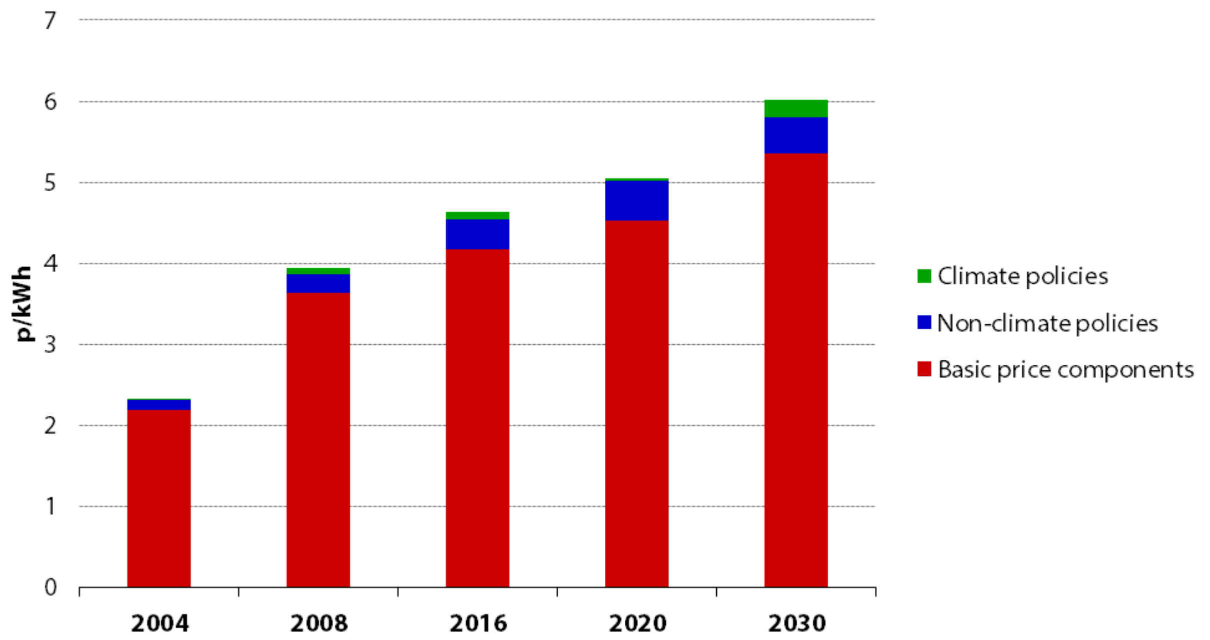

Source: CCC analysis
Note: £2016, real terms

**Figure A1.4.** Changes in electricity price components (2004-2030) in the business sector



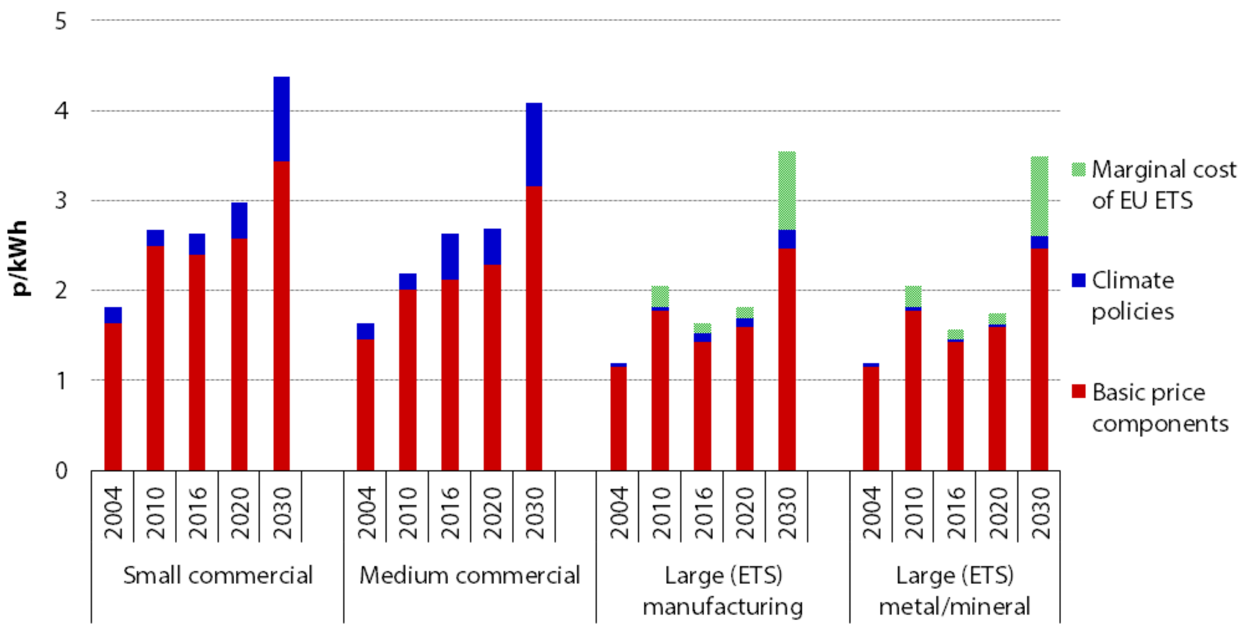

**Source:** CCC analysis
**Note:** £2016, real terms

**Figure A1.5.** Changes in gas price components (2004-2030) in the residential sector




**Source:** CCC analysis.
**Note:** £2016, real terms.

**Figure A1.6.** Changes in gas price components (2004-2030) in the business sector




**Source:** CCC analysis.
**Note:** £2016, real terms.

## A1.4 Comparison of low-carbon bill impacts in previous CCC reports

This is our fourth Energy Prices and Bills report, and the third to consider commercial and industrial sectors as well as households. In addition, we published estimates of the impact of meeting carbon budgets on energy bills with our advice on the Fifth Carbon Budget in 2015. This section compares the findings of these reports, and clarifies the differences in assumptions and methodology underlying the different findings.

In this report we have estimated that low-carbon policy would be expected to add £190-225 (a central estimate of £200) to energy bills in 2030. These figures are not directly comparable to previous estimates, which did not take account of the reduction in energy bills due to energy efficiency. In the absence of energy efficiency, we estimate that low-carbon policy would be expected to add £230-275 (a central estimate of £235) to energy bills in 2030.

This adjusted figure is significantly higher than we estimated in 2014 (£115-235, with a central estimate of £175). This difference is due to:

- An increase in our estimates of support for low-carbon generation. This primarily reflects an increase in the amount of low-carbon generation receiving payments under the Renewables Obligation relative to DECC's estimates in 2013.
- A reduction in the level of business sector demand assumed in 2030, such that a much greater share of the costs of low-carbon support are borne by the residential sector.
- A more complete accounting for the system integration costs of renewable generation. While our 2014 estimate accounted for additional balancing costs, our current estimate also accounts for the increase in transmission and distribution costs (see *Additional costs associated with low-carbon generation*, Table 1.1).
- A correction to our estimates of gas network costs, reflecting higher unit costs due to a reduction in gas throughput (see *Gas grid uplift*, Table 1.1).

Our £230-275 range is also significantly higher than we estimated in 2015 (£95-145), with a central estimate of £125). In addition to the above factors, this difference is also due to

- we did not include VAT on low-carbon policy in 2015; and
- we used a third-party (Point Carbon) carbon price projection in 2015, with significantly lower market carbon prices than BEIS' market price projections used in this analysis.

Our 2011 and 2012 publications did not present estimates for energy bills in 2030.

## Annex A2: Additional data (households)

This annex sets out supplementary data relating to Chapter 1: Household energy bills.

Tables A2.1 and A2.2 set out the historical and projected costs of low-carbon policy on electricity and gas bills between 2004 and 2030.

**Table A2.1.** Historical and projected costs of low-carbon policy on electricity bills, 2004-2030

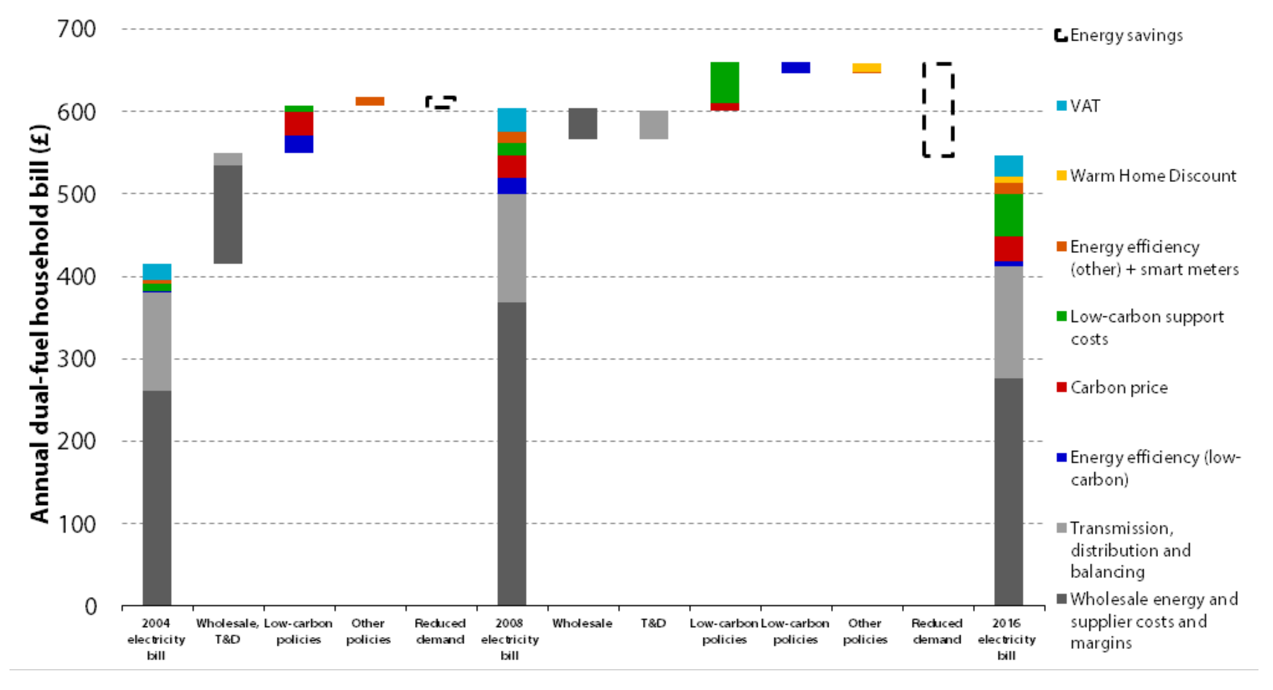
| Price component | 2004 | 2008 | 2016 | 2020 | 2030 |
|---|---|---|---|---|---|
| Warm Homes Discount | 0 | 0 | 7 | 7 | 6 |
| Energy efficiency (fuel poverty) | 4 | 13 | 6 | 9 | 6 |
| Smart Meters | 0 | 0 | 6 | 10 | 1 |
| VAT | 19 | 26 | 22 | 22 | 21 |
| *Total non-climate policy* | *23* | *39* | *41* | *48* | *34* |
| Carbon Price | 0 | 27 | 30 | 26 | 33 |
| Support for Low Carbon | 8 | 15 | 65 | 106 | 121 |
| Energy efficiency (low carbon) | 2 | 20 | 6 | 0 | 4 |
| System integration costs | 0 | 1 | 7 | 10 | 20 |
| Merit Order Effect Capacity Market | 0 | 0 | -20 | -22 | -16 |
| VAT (climate policy) | 1 | 3 | 4 | 6 | 8 |
| *Total climate policy* | *11* | *66* | *92* | *127* | *170* |
| **Total electricity** | **34** | **105** | **134** | **174** | **205** |

**Source:** CCC analysis.

| **Table A2.2.** Historical and projected costs of low-carbon policy on gas bills, 2004-2030 | | | | | |
|---|---|---|---|---|---|
| **Price component** | **2004** | **2008** | **2016** | **2020** | **2030** |
| Warm Homes Discount | 0 | 0 | 6 | 5 | 5 |
| Energy efficiency (fuel poverty) | 2 | 14 | 7 | 13 | 13 |
| Smart Meters | 0 | 0 | 9 | 15 | 3 |
| VAT (other) | 23 | 33 | 29 | 31 | 34 |
| *Total non-climate policy* | *26* | *48* | *50* | *64* | *54* |
| Energy efficiency (low-carbon) | 2 | 11 | 6 | 0 | 9 |
| Impact of lower gas throughput | 0 | 0 | 5 | 3 | 17 |
| VAT (climate policy) | 0 | 1 | 1 | 0 | 1 |
| *Total climate policy* | *2* | *11* | *11* | *4* | *27* |
| **Total gas** | **28** | **59** | **62** | **68** | **82** |
| **Source:** CCC analysis. | | | | | |

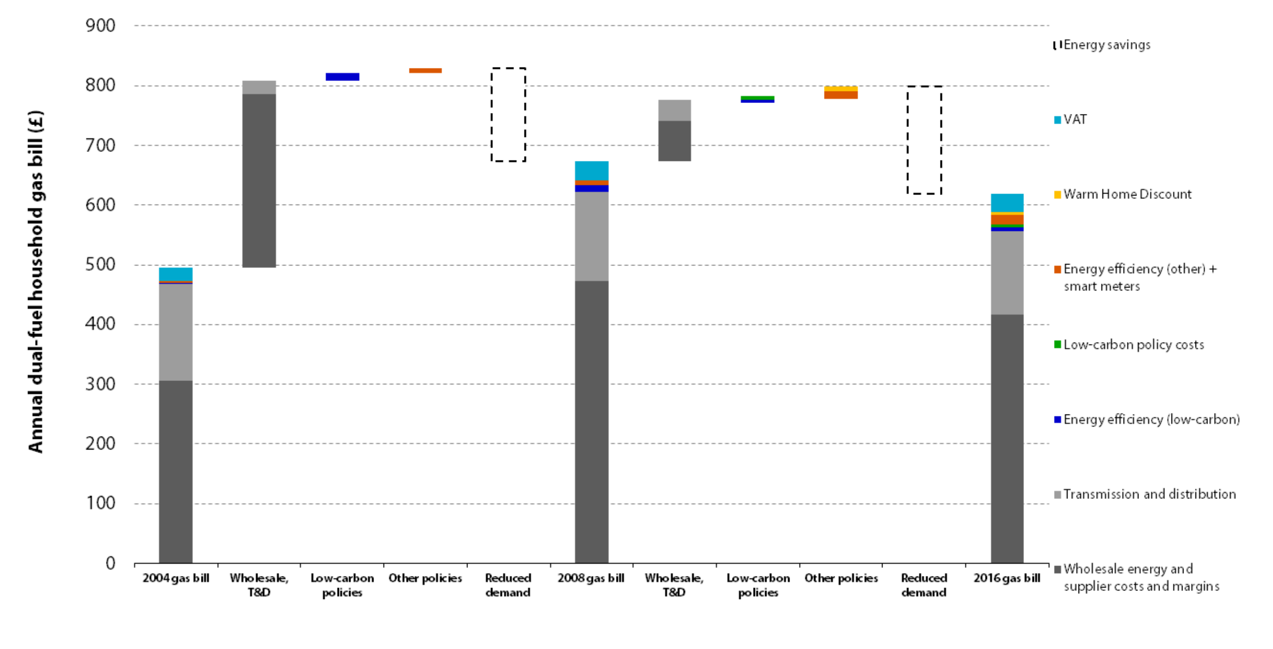
Figure 1.6 in Chapter 1 showed the changes in household electricity bills between 2004 and 2016. Figures A2.1 and A2.2 break these down into separate electricity and gas bill components.

**Figure A2.1.** Changes in dual-fuel household electricity bills (2004-2008-2016)




**Source:** CCC analysis.

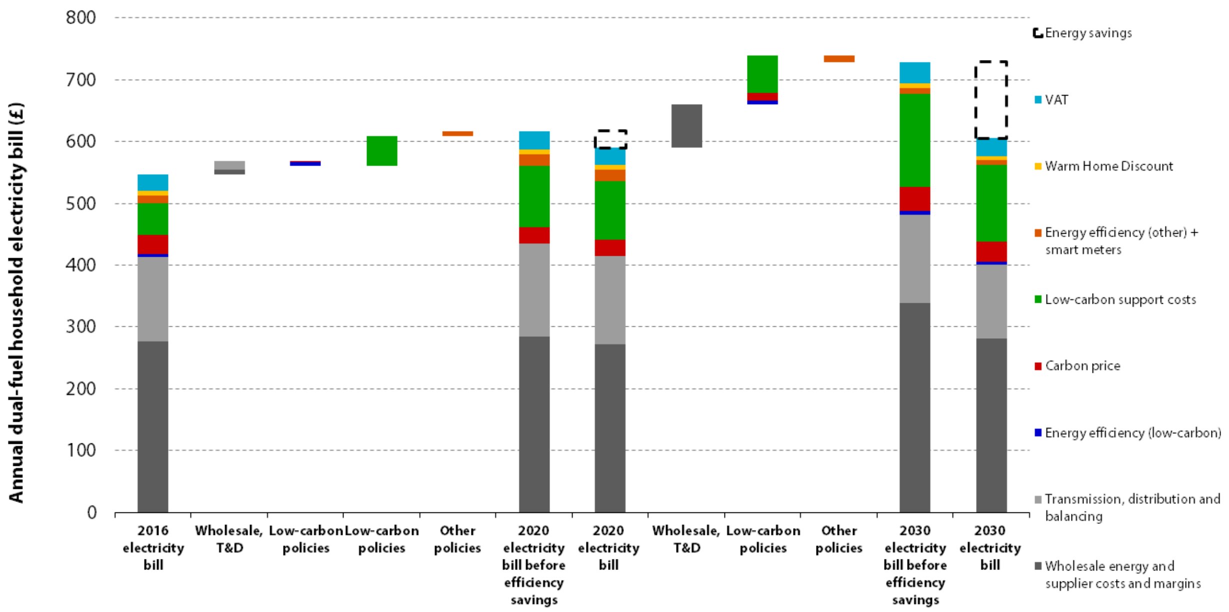
**Figure A2.2.** Changes in dual-fuel household gas bills (2004-2008-2016)




**Source:** CCC analysis.

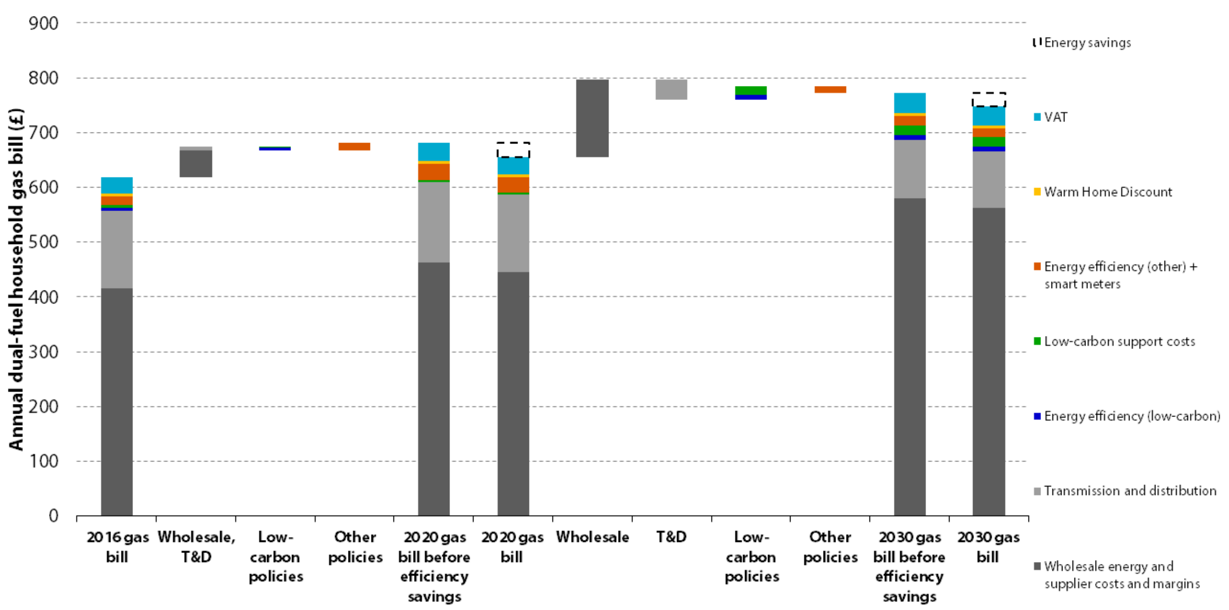
Figure 1.14 in Chapter 1 showed our projections for changes in household electricity bills between 2016 and 2030. Figures A2.3 and A2.4 break these down into separate electricity and gas bill components.

**Figure A2.3.** Changes in dual-fuel household electricity bills (2016-2020-2030)




**Source:** CCC analysis.

**Figure A2.4.** Changes in dual-fuel household gas bills (2016-2020-2030)




**Source:** CCC analysis.