HEAT PUMP ASSOCIATION

ACCELERATING HEAT PUMP DEPLOYMENT: INTERIM DOMESTIC HEAT PUMP TARIFF

BACKGROUND AND SUPPORTING ANALYSIS

January 2024

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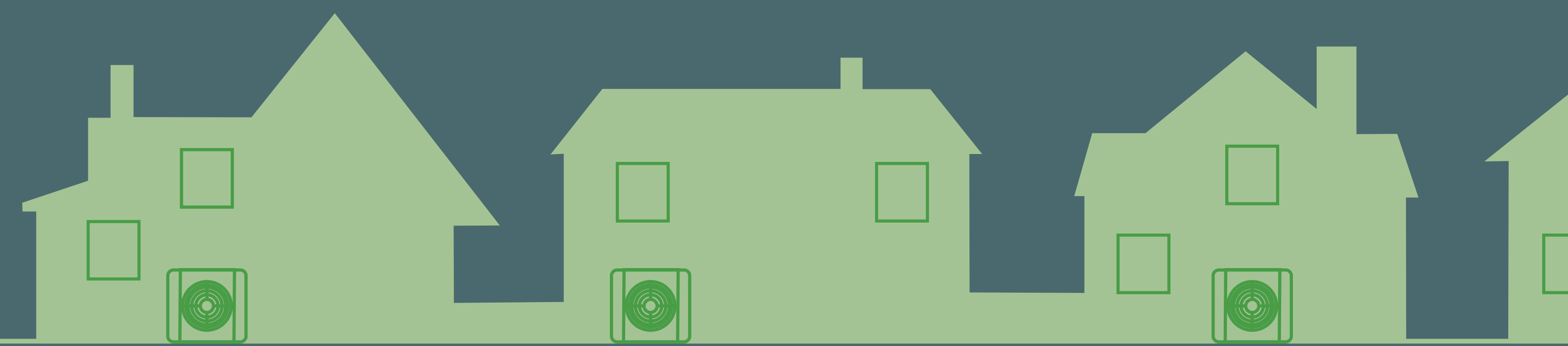


INTRODUCTION TO THE HEAT PUMP ASSOCIATION

The Heat Pump Association is a dedicated voice for the UK heat pump sector and works to drive widespread deployment of heat pump technology throughout the UK. Our membership comprises a broad range of stakeholders, including the UK's leading manufacturers of heat pumps, components and associated equipment, utility companies, installers, certification bodies, awarding organisations, training providers, and others with an interest in heat pumps.

The Association supports policymakers in the development of effective heat decarbonisation policy and other matters that affect the interests of end users, wider stakeholders, and the industry. In addition, the HPA coordinates technical and market research into areas of mutual interest identified by members, the aim of which is to improve market opportunities and help markets transform to low carbon heating solutions and technologies.

HEAT PUMP ASSOCIATION DELIVERABLES:

- **Advocacy and Policy:** Provide informed, well-constructed, evidence-based policy advice to support heat pump market growth within the UK. Lobbying and advocating for favourable government policies, incentives, and regulations that promote the adoption and deployment of heat pumps in the UK, including incentives for consumers and businesses to switch to heat pump technology.

- **Quality, Training and Standards:** Through establishing training standards and feeding into certification standards, the HPA works to improve the quality and safety of heat pump installations whilst promoting best practice amongst our members and the wider industry.

- **Sector growth:** Developing strategies and initiatives to expand the market for heat pumps including consumer awareness initiatives, industry collaborations and efforts to increase adoption rates.

- **Unity:** Provide a united industry voice, collaborating with key stakeholders to align policy proposals, calls for action and be representative of the heat pump supply chain.

- **Data and Analysis:** Develop thought provoking, workable policy proposals underpinned by detailed analysis, create unique market updates, and undertake analysis created to suit member needs.

INTRODUCTION

To meet the UK's legally binding target of reaching Net Zero by 2050, a transition away from using fossil fuels to heat our homes will be required within at least 80% of properties[1]. Heat pumps have been proven to be a highly efficient and low carbon way of heating properties. They are likely to play a huge role in decarbonising the heating sector. This has been reflected by the Government setting a target of installing 600,000 heat pumps a year by 2028, with ambition around heat pump deployment increasing annually following 2028[2]. This reflects a 10-fold increase in 6 years (compared to the market size in 2022[3]). A series of policy levers will be required to enable this market growth and deliver a range of economic, technical, and social enablers as outlined in our 'Unlocking Widescale Deployment of Heat Pumps in the UK' report, published in November 2023[4].

In the short term, the Heat Pump Association is proposing the development of an interim tariff discount for domestic heat pump consumers to insulate early adopters against increased energy bills. This would be an interim measure with discounts decreased and then removed as levies are removed from electricity bills, as proposed in the medium term. This **Domestic Heat Pump Tariff Discount** would reduce the price of electricity used for hot water and heating produced by a domestic hydronic heat pump, to an amount equivalent to exempting that proportion of electricity from levies. This report provides supporting analysis and evidence to the main policy proposal report[5], and it is suggested that the main report is read first.

UNCOMPETITIVE BRITISH ELECTRICITY PRICES

Despite heat pumps being three times more efficient than conventional fossil fuel boilers[6], replacing a typical gas boiler with an air source heat pump could **increase average annual heating costs by £119**[7]. This is because retail electricity prices are around four times higher than retail gas prices[8]. Nonetheless, well-installed, optimally sized heat pumps can deliver running cost savings, especially when utilising specialised type-of-use or time-of-use electricity tariffs. Additionally, some market offerings are quoting £500 for a heat pump installation when a £7,500 Boiler Upgrade Scheme grant is redeemed[9]. The much higher energy conversion rates that heat pumps achieve can yield significant running cost savings, which can offset higher capital costs, especially when using green financing instruments.

1 Inside Housing (2023) One-fifth of homes to be exempt from gas boiler ban after PM's net zero shake-up
2 DESNZ (2023) Energy Security Bill factsheet: Low-carbon heat scheme
3 EHPA (2023) Market data
4 Heat Pump Association (2023) Unlocking widescale heat pump deployment in the UK
5 HPA Publications and Consultation Responses (2023)
6 Energy Systems Catapult (2023) Electrification of Heat UK demonstration project
7 Assumptions as follows: a heat pump SPF of 2.8, gas boiler COP of 0.84, heat pump space heating uplift of 5%, heat pump owner does not pay gas standing charge.
8 Ofgem (2023) Energy Price Cap (default tariff): 1 January to 31 March 2024
9 Which (2023) A heat pump might be a lot cheaper than you think: here's how

Principally, however, the **heat pump market in Great Britain is hindered by the second highest ratio of electricity to gas prices in all of Europe, currently at around 4**. For comparison, the European Heat Pump Association recommend a ratio of electricity to gas prices of 2 should be targeted to grow domestic heat pump markets[10]. This is especially relevant in Great Britain because natural gas boilers are the primary central heating system used in 75% of properties[11]. The ratio of electricity to gas prices has been highlighted as a serious barrier to growth in the British heat pump market through both local evidence and evidence from neighbouring countries. For example, 63% of domestic survey respondents suggested that lower running costs would convince them to change their minds on the decision to install a heat pump[12]. However, the current price ratio limits this potential. Furthermore, as shown in Figure 1, generally, nations which maintain lower electricity to gas price ratios have been more successful in growing their domestic heat pump market. For example, in Sweden, where the average price ratio since 2018 is 1.45, there are 22,727 heat pump installations per 100,000 people, 40 times that of the UK[13]. However, it should also be noted that the penetration of gas heating is very low in Sweden and there are other factors contributing to the high growth of the heat pump market[14], although, the economic attractiveness of heat pumps compared to fossil fuel heating systems is evidently a large driver and the gas to electricity price ratio is a key part of this in many countries.

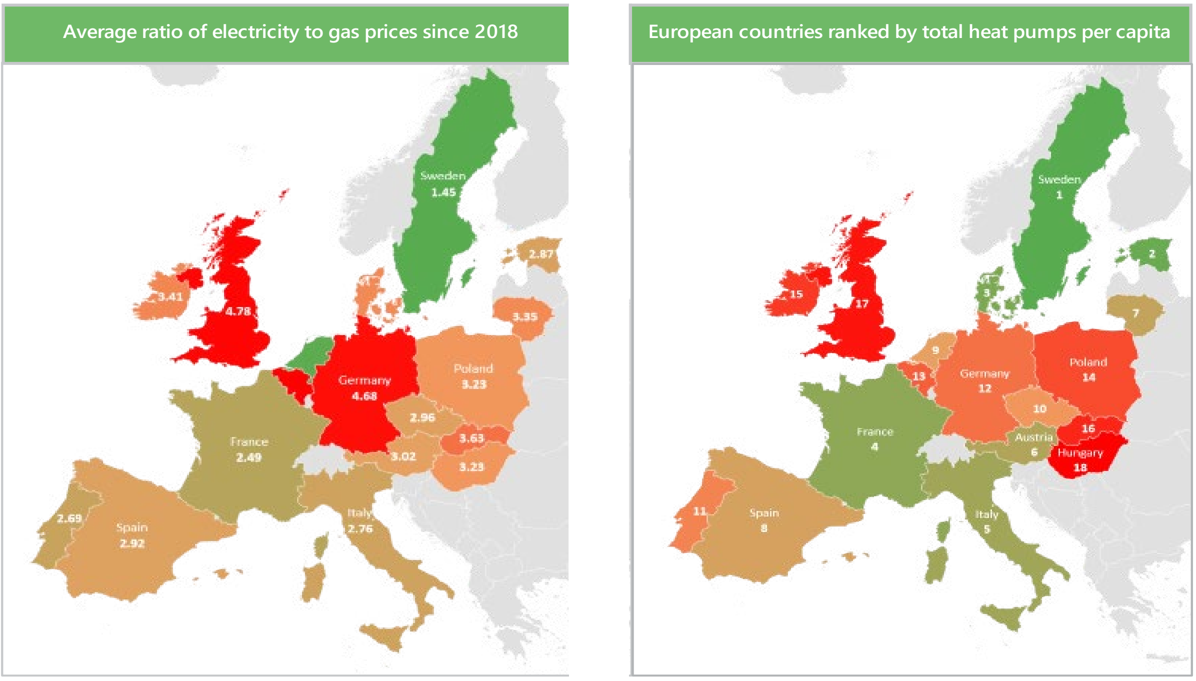


Figure 1 - Average ratio of domestic electricity to gas prices since 2018 (left)[15]. European countries ranked by total heat pump installations per capita (right)[13][16]

10 EHPA (2023) EU Heat Pump Accelerator

11 ONS (2023) Census 2021: how homes are heated in your area

12 Behavioural Insights Team (2022) How much are we willing to pay to make home heating greener?

13 The ECO Experts (2023) Which Countries Are Winning the European Heat Pump Race?

14 Energimarknads Inspektionen (2021) An overview of the Swedish natural gas market

15 Data for European (non-UK) prices inclusive of taxes and is for properties that consume between 2500 and 4999 kWh of electricity and between 11,000 and 110,000 kWh of natural gas per year. Non-UK data courtesy of: Eurostat (2023) Database. UK Price data courtesy of: Ofgem (2023) Energy Price Cap (default tariff): 1 October to 31 December 2023. Please note that incomplete time series data available for Bosnia and Herzegovina, Ukraine, and Albania, therefore, only time periods with available data used in average.

16 Please note that the left hand map assumes that the price ratio within Great Britain is similar for the whole of the UK.

Electricity prices are a clear driver of heat pump deployment, recent data from across Europe confirms this. Figure 2 shows the relationship between heat pump sales and the electricity to natural gas price ratio in 2022. The trendline suggests that nations with a higher price ratio in 2022 had a poorer heat pump sales record, and vice versa. For example, in France, the ratio of electricity to gas prices in 2022 was 2.2[15], far lower than in Great Britain[8]. **On average, for every increase to the price ratio of 1, the sales per 1,000 households decrease by 6.4. This is a significant impact considering that only 1.9 heat pumps were sold per 1,000 households in the United Kingdom in 2022.** However, it should be highlighted that other social, economic, and technical factors may also contribute to the stronger sales record in European countries compared to the UK.

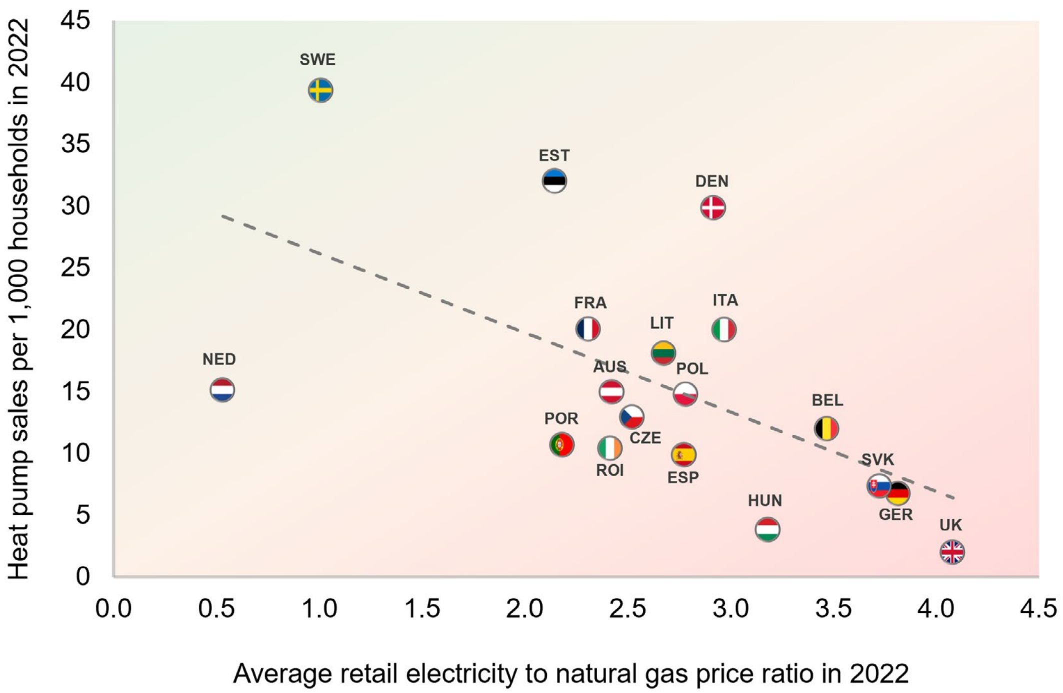


Figure 2 - Heat pump sales against ratio of electricity to natural gas prices across Europe[17] [18]

Some of the key causes of the high electricity to gas price ratio are described in detail within **Appendix 1 – Components of energy prices and what makes electricity prices so high**. Levies being disproportionately faced by electricity consumers are notably a key driver of this ratio, however, other structural causes lead to this ratio too.

17 Please note that the electricity to gas price ratio used in this chart is for 2022 whereas the average since 2018 is shown in figure 3. Please note that the data assumes that the price ratio within Great Britain is similar for the whole of the UK.

18 European Heat Pump Association (2023) Heat pumps: Europe's buildings avoid more emissions than ever

The components of electricity bills faced by the average dual fuel household, inclusive of VAT and standing charges, are displayed in figure 3 and 4. There are multiple potential areas to make electricity prices more competitive across these pricing components. However, the key causes for the current high electricity to gas price ratio are:

- The marginal pricing system in the wholesale market means that the wholesale price of electricity is commonly determined via the price of producing electricity through a gas-to-power facility, meaning that the low operating costs of renewable generators are not reflected in retail electricity prices. Ignoring carbon pricing, the price of producing electricity from natural gas is roughly 54% greater than the cost of the gas itself, causing electricity wholesale prices to be greater than gas wholesale prices under the current pricing system[19].

- Electricity generators are taxed at a rate greater than downstream gas refineries, further inflating the electricity wholesale price. According to DESNZ electricity generation cost estimates, 48% of the levelised cost of producing electricity from gas is from carbon costs[19] [20], with gas-to-power facilities setting the wholesale price 84% of the time[21]. Therefore, downstream carbon taxing has a knock-on effect on retail prices paid by domestic households, though this effect is likely to be far smaller than 48% due to it only effecting the wholesale element of retail prices and wholesale prices being increasingly set by interconnectors or low carbon generation. It is estimated that around 14% of retail electricity prices are due to carbon taxing of generators.

- Difficulties with grid balancing and the transmission of electricity, specifically over long distances, means that network and operating costs for electricity are 4.65 times higher than that of natural gas, per unit of energy delivered[22].

- Levies on consumer bills, used to fund various government schemes, are disproportionately placed onto electricity bills rather than natural gas bills. Inclusive of VAT, energy levies make up 16% of the average electricity bill and just 4% of the average gas bill[22]. This distorts the ratio of electricity to gas prices further and disincentivises the take up of electrical heating systems, despite this running contrary to the Government ambition of installing 600,000 heat pumps a year by 2028[23].

19 DESNZ (2023) Electricity generation costs 2023. Based on levelized cost estimates for an Open- cycle gas turbine (300MW 2000 hr) project commissioning in 2025.

20 Note that this estimate is based on a carbon price of £83.03 per tonne CO_2e in line with the carbon price used for civil penalties in 2023 under the UK ETS. See here for further details: DESNZ (2023) UK ETS: Carbon prices for use in civil penalties, 2023. Current relative impact of carbon taxing on electricity wholesale costs is likely to be lower due to higher wholesale gas prices and lower carbon prices under the UK ETS. Using most recent ETS carbon prices and wholesale gas prices, it is estimated that around 28% of the levelized cost of generation would be from carbon costs.

21 UCL (2022) Electricity prices dictated by gas producers who provide less than half of UK electricity.

22 Ofgem (2023) Energy Price Cap (default tariff): 1 January to 31 March 2024

23 DESNZ (2023) Energy Security Bill factsheet: Low-carbon heat scheme

Actions can be taken across the electricity supply chain and market structure to address the negative price signals that current energy prices deliver in the drive to reduce carbon emissions, as described in **Appendix 1**. Addressing these structural distortions will likely take longer to address than the implementation of the **Heat Pump Tariff Discount** proposed. However, it should be noted that **efforts to address the electricity to gas price ratio in the short term should not prevent or delay action to address the structural causes in the long term**.

The removal of levies from electricity bills will have a material impact on a consumer's economic case for installing a heat pump and is an area that Government can have tangible influence over in the medium term.

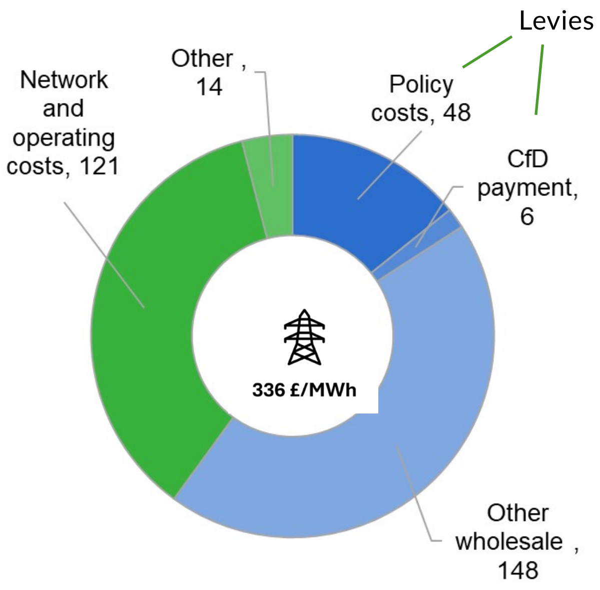


Figure 3 - Breakdown of average electricity bill normalised per unit of energy (October 2023 Price Cap)[22]

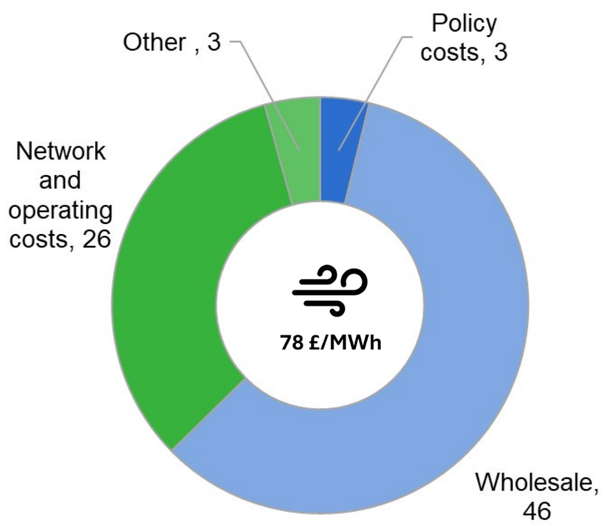


Figure 4 - Breakdown of average gas bills normalised per unit of energy (October 2023)[22]

THE IMPACT OF ENERGY LEVIES ON THE HEATING MARKET

Some existing policies for carbon reduction are currently funded, almost exclusively, by electricity consumers. These levies are detailed in **Appendix 3 - Energy levies considered within analysis.** The share of levy costs faced by the typical heat pump household are shown in Figure 3 . In turn, this distorts the domestic heating market because consumers using heat pumps bear a disproportionate burden of these costs, relative to consumers of fossil fuels – mostly gas. In the medium term, addressing the distortions caused by energy levies is expected to be achieved via the removal of levies from electricity bills.

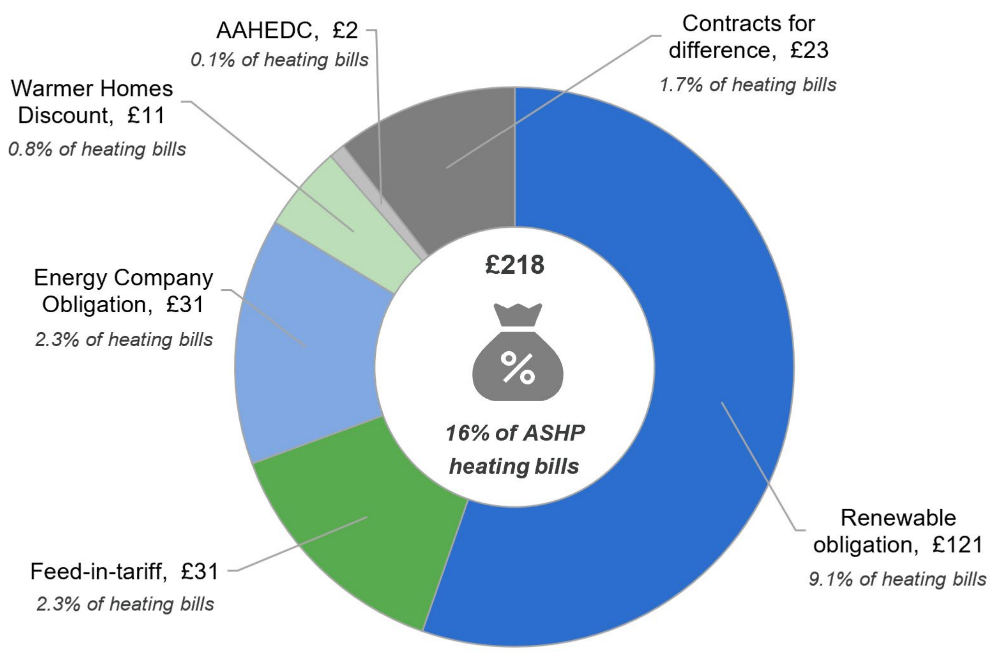


Figure 3 - Breakdown of levies on an air source heat pump consumer's heating bills and share of typical heat pump consumer's heating bills (October 2023. Inclusive of VAT and standing charges)[22]

Whilst the removal of levies from electricity bills is widely seen as a fundamental step towards achieving lifetime cost parity between a gas boiler and a heat pump, it is worth noting that the schemes funded by levies on electricity bills are beneficial to the UK economy and often the electricity system. For example, the Renewable Obligation, Feed-in Tariff, and Contracts for Difference schemes have all contributed towards the decarbonisation of the electricity grid, a process which has delivered a significant reduction in territorial emissions in the UK through a 71% reduction in the carbon intensity of grid electricity since 2010[24]. Therefore, although it is important to target the removal of levies from energy bills, it should be noted that alternative funding approaches will be required to maintain the positive effects of the relevant schemes.

24 DESNZ (2023) Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal

Meanwhile, until the levies are apportioned differently, they can make a typical heat pump more expensive to run than an equivalent gas boiler. On average, they add a total of £398 in levy costs to a typical heat pump consumer's annual electricity bill across heating (£218) and non-heating uses (£180), constituting 17% of all energy bills. By comparison, a typical household with a gas boiler pays £229 per year across heating (£49) and non-heating uses (£180), equivalent to 10% of all energy bills which is £169 less than a heat pump consumer.

The current structure of energy levies means consumers who make the positive decision to decarbonise their heating face higher levies on their energy bills. Early adopters of electrical heating systems, such as heat pumps, are forced to bear a disproportionately high share of the burden of energy levies, leading to an increased incentive to stick with fossil fuel heating, especially when considering the higher capital costs of a heat pump and the current cost of living crisis.

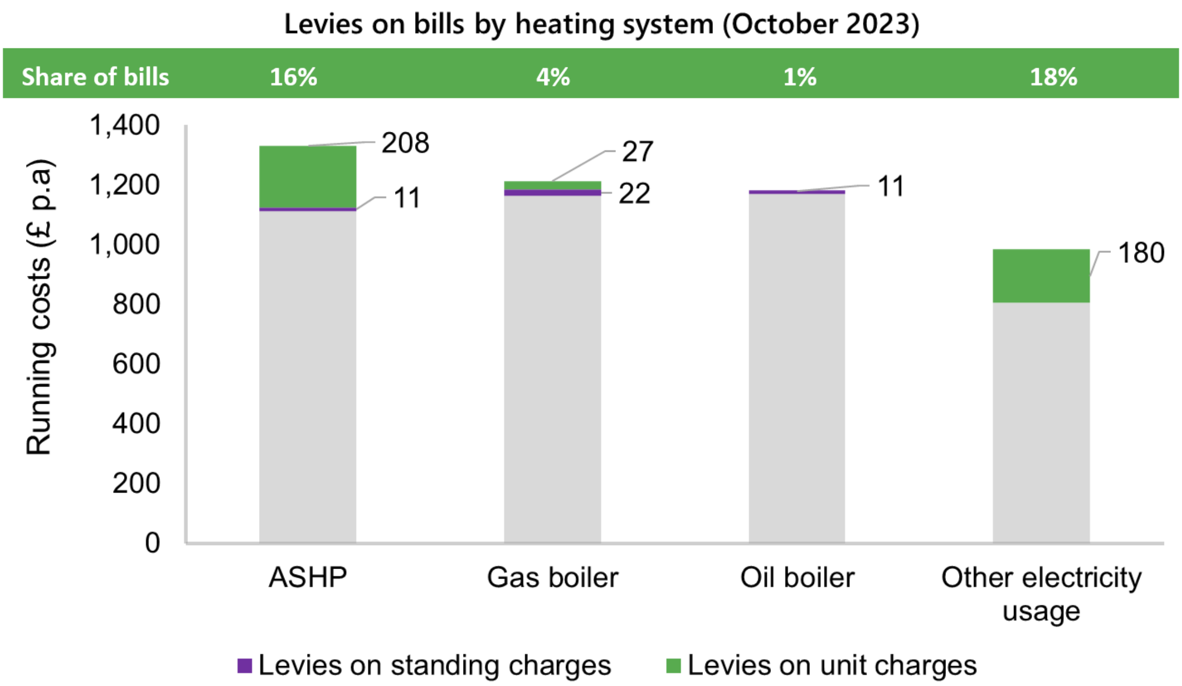


Figure 6 - Levies on bills by heating system (October 2023)[25]

25 Includes all levies detailed in Appendix 3. Assumes that heat pump consumer does not pay gas standing charge. Standing charges included under heating system and not included in "other electricity usage". Inclusive of VAT. For remaining assumptions please see footnote number 7.

HPA forecasts that total levy obligations on electricity bills will increase in the medium term by 19% between 2023 and 2030.[26] Between 2025 and 2050, it is expected that 82% of revenue raised through domestic energy levies will be via levies on electricity bills unless action is taken. Therefore, short, medium and long term policy fixes are required to enable heat pump market growth.

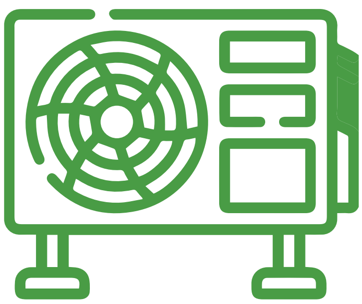
In the medium to long term, the removal of levies off electricity bills will enable more competitive heat pump running costs and remove the need for the interim **Heat Pump Tariff Discount** proposed in this report. However, there are many factors to consider concerning the removal of levies from electricity bills. Not least the potential distributional impacts on those at risk of fuel poverty, meaning that removal of levies from electricity bills is likely to take considerable time. The distributional impacts of rebalancing are outside the scope of the analysis conducted for this report. The Government will need to carefully consider options such as social tariffs and other measures to protect vulnerable households from pricing shocks.

26 Based on total revenue raised from levies on domestic energy bills in Great Britain.

ANALYSIS OF ALTERNATIVE FUNDING OPTIONS

The removal of levies from electricity bills is a fundamental step towards achieving lifetime cost parity between a heat pump and a fossil fuel boiler. To be effective in driving heat pump uptake whilst providing a sustainable and fair way to fund the policies whose costs are met by those levies, the long-term effects should be considered. Specifically, changes in funding requirements, the heating mix and potential distributional impacts on society should be reviewed. To understand the potential long-term impact that levy rebalancing could have on consumer bills, forecasts of the relevant funding requirements for policies paid for via energy levies have been undertaken, as shown in Figure 22 within **Appendix 2**. However, it must be noted that the forecasts shown in Figure 22 are under the assumption that no additional levies are added to electricity bills, the further addition of which we strongly discourage as new levies would further distort the heating market. Nonetheless, there are some indications that further levies may be placed on electricity bills in the foreseeable future. For example, it is currently being proposed that an additional levy would be placed on electricity prices to fund an exemption for Energy intensive Industries via the British industry Supercharger Network Charging Compensation Scheme[27].

Figure 7 displays the approaches to removing levies from electricity bills that have been considered and full descriptions of each scenario, including potential approaches towards exempting vulnerable customers, are included in **Appendix 2**. Exact funding approaches have been included as an illustrative demonstration of the impact rebalancing scenarios may have on bills. Therefore, the descriptions detailed within **Appendix 2** should be considered as illustrative examples of one of a series of options for alternative funding approaches to achieve the given electricity price. There is flexibility in how the removal of levies from electricity bills could be funded, and the options we have modelled for illustrative purposes are outlined in Figure 7.



27 Department for Business and Trade (2023) Government response: British Industry Supercharger Network Charging Compensation Scheme

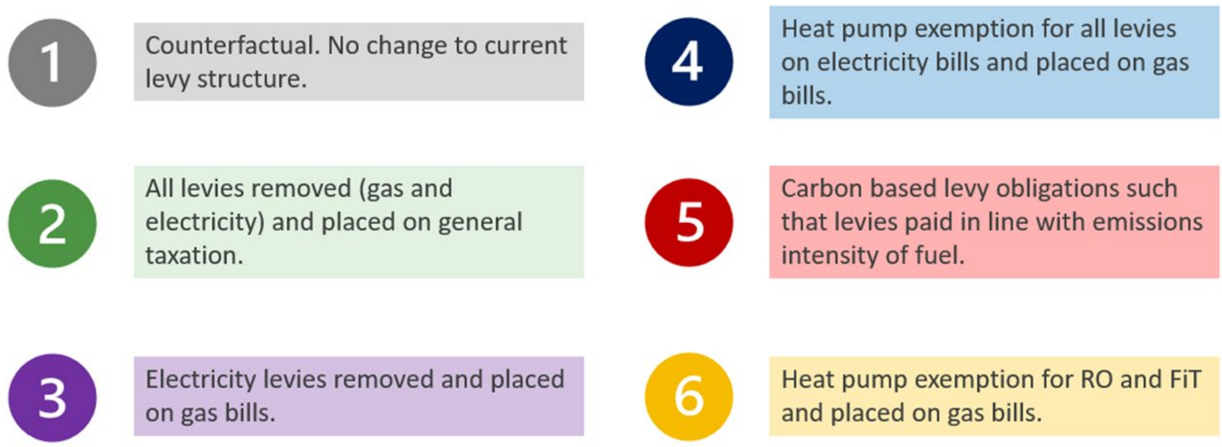


Figure 7 - Summary of levy rebalancing scenarios

The key metric to understanding the economic case is the ratio of electricity to gas prices. As noted above, this ratio in Great Britain is at 3.97 which is consistently one of the highest ratios in all of Europe. [28] [29] It is increasingly evident that a price ratio this high is inconsistent with the push to decarbonise heating through electrification. The European Heat Pump Association recommend that a price ratio of 2 should be aimed for to accelerate the electrification of heat[30].

Figure 8 shows the price ratio that could be achieved via the rebalancing scenarios described. The gas, oil, and electricity price forecasts can be found in **Appendix 5** (see Figure 32, Figure 33, and Figure 34). Under the current levy structure, the price ratio is expected to increase in the medium term from a share of 18% of the electricity unit charge to 27% by 2028. This is largely due to an increase in funding requirements from schemes currently funded through levies on electricity bills. Using current price forecasts, only via a carbon-based levy obligation scheme or a complete transfer of electricity levies to gas bills could a price ratio of two or lower be achieved by 2040. Therefore, without action, market distortions caused by levies being disproportionately paid by domestic electricity consumers will become more severe. An Interim **Heat Pump Tariff Discount** could reduce the price ratio to 3.3 by 2027, a considerable improvement on the ratio of 4.6 by the same year under the counterfactual.

28 Ofgem (2023) Energy Price Cap (default tariff): 1 October to 31 December 2023. Price ratio for direct debit consumer. Not inclusive of standing charges.

29 Nesta (2023) How the UK compares to the rest of Europe on heat pump uptake

30 EHPA (2023) EU Heat Pump Accelerator

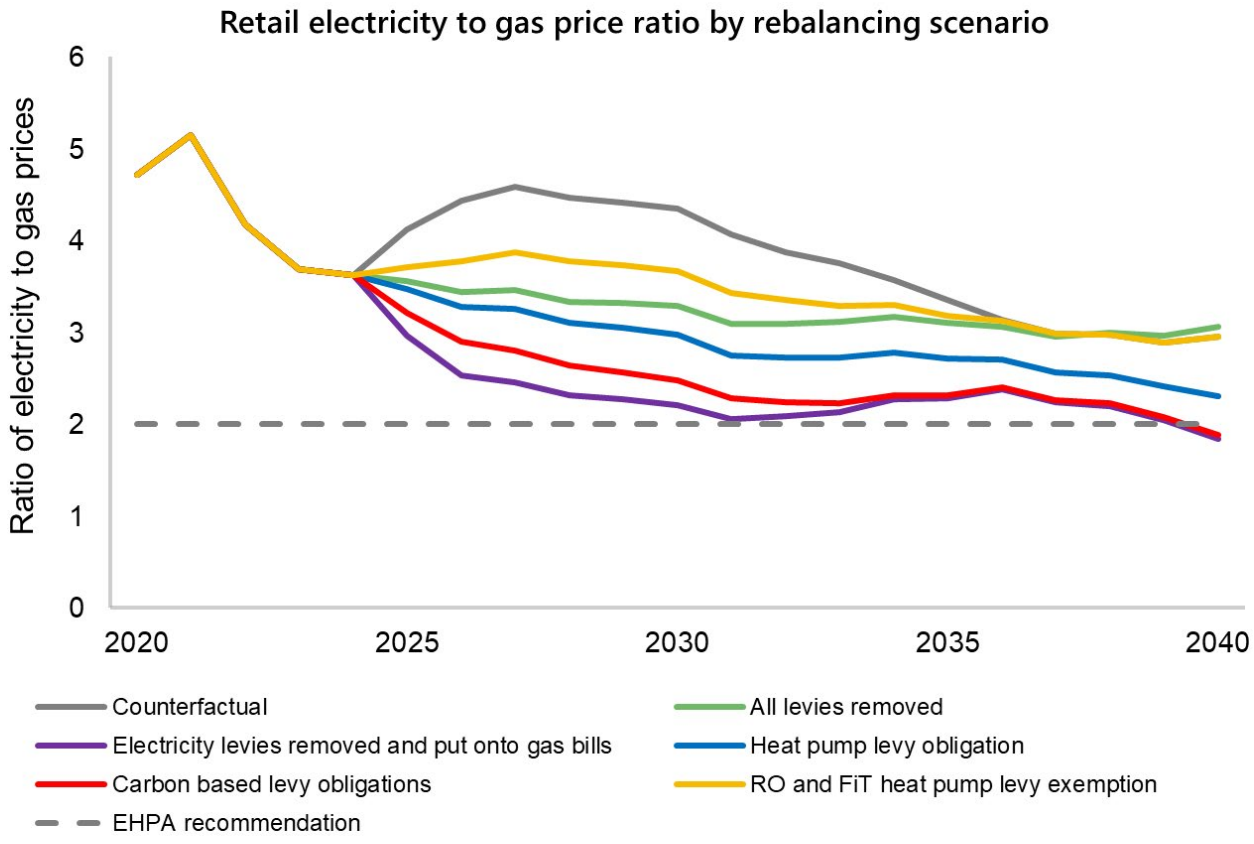


Figure 8 - Electricity to gas price ratio by rebalancing scenario (for electricity used via a heat pump)[31]

** Heat pump levy exemption mirrors proposed heat pump tariff discount in the years 2024-2027 assuming that costs are placed onto gas bills*

By decreasing the price ratio between electricity and natural gas, heat pumps become far more competitive. Figure 9 shows the running cost savings of heat pumps compared to gas boilers over a 15-year assumed lifetime. Under all scenarios, both air and ground-source heat pumps are expected to deliver significant running cost savings, compared to a gas boiler counterfactual. Exempting heat pumps from levies would enable savings of nearly £2,500 for an air source heat pump and over £4,000 for a ground source heat pump over 15 years to be realised.

31 Please note that this is for electricity via heat pump only.

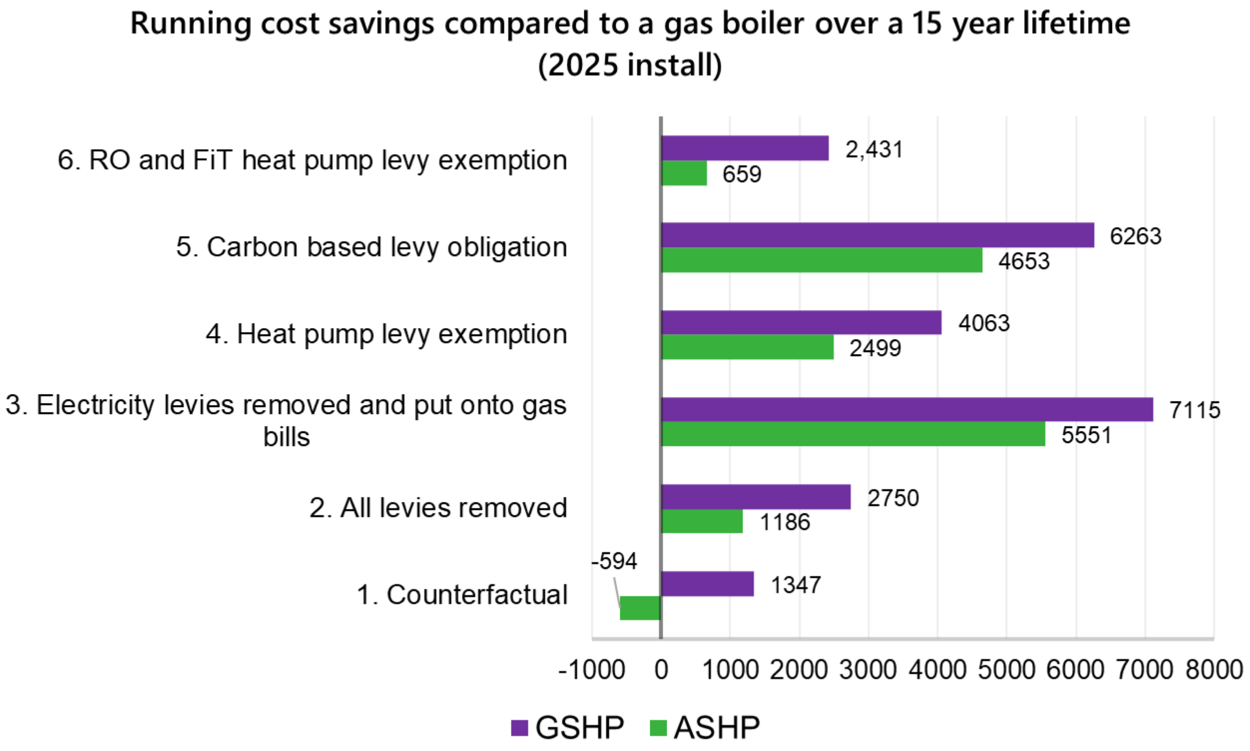


Figure 9 - Running cost savings compared to a gas boiler over a 15-year lifetime (2025 install)

The current levy structure (the counterfactual in Scenario 1) runs against the Government's ambition to decarbonise heating, as the price signals currently in the energy market disincentivise domestic use of electricity which has a lower carbon footprint than other energy sources. Therefore, **the removal of levies from electricity bills is a fundamental part of the process of achieving lifetime cost parity between a gas boiler and a heat pump, as is Government's ambition**[32].

32 DESNZ (2023) Energy Security Bill factsheet: Low-carbon heat scheme

Table 1 - Summary of maximum[33] obligation costs for each levy rebalancing scenario from 2025-2040

Obligated party	Unit	Scenario 2: All levies removed from electricity and gas bills[34]	Scenario 3: Electricity levies removed[35]	Scenario 4: Heat pump levy exemption[36]	Scenario 5: Carbon based levy obligations[37]	Scenario 6: RO and FiT heat pump levy obligation[38]
Gas bills (all bill payers)	Maximum increase to average annual gas boiler running cost between 2025 and 2040 (£ / year)	NA	231	55	194	12
Gas bills (exempting vulnerable households)	Maximum increase to average annual gas boiler running cost in non-vulnerable household between 2025 and 2040 (£ / year)	NA	323	76	270	17
Other electricity usage (all bill payers)	Maximum increase to average dual fuel households' annual electricity bill between 2025 and 2040 (£ / year)	NA	NA	23	NA	8
Other electricity usage (exempting vulnerable households)	Maximum increase to average non-vulnerable dual fuel households' annual electricity bill between 2025 and 2040 (£ / year)	NA	NA	33	NA	11
Funded by the Exchequer	Maximum costs to be borne by the exchequer in this scenario, expressed for illustrative purposes as a share of income taxation at current levels between 2025 and 2040 (%)	1.72%	1.45%	0.22%	NA	0.07%

33 Note that estimates are maximum values due to ambitious assumptions around heat pump deployment and forecasts for future levy obligations being upper thresholds. Heat pump deployment estimates are in line with National Grid ESO's Consumer Transformation scenario. Under the Consumer Transformation scenario, total heat pump installation assumptions, including hybrids, are as follows: 2024 = 133,300, 2025 = 215,000, 2026 = 312,000, 2027 = 461,000.

34 By definition, no levies on energy bills.

35 By definition, no levies on all electricity usage.

36 Electricity does not include heat pump electricity usage.

37 Obligations are carbon based so only high emissions fuels will face additional costs. Vulnerable household exemption is therefore illustrative.

38 Electricity does not include heat pump electricity usage.

By insulating vulnerable households from increased heating bills, fuel poverty levels should be largely unaffected, however, there may be instances whereby households that are not classed as vulnerable are pushed into fuel poverty as a result of the inflated impact on running costs caused by exempting vulnerable households. By ensuring a definition of vulnerability that covers those both in fuel poverty and at risk of fuel poverty, exempting vulnerable households should be an effective approach to the removal of levies without exacerbating fuel poverty levels.

AN INTERIM HEAT PUMP TARIFF DISCOUNT

In previous sections, we have identified how levies on electricity bills distort the heating market that works counter to the general direction of Government policy – namely towards the electrification of heat. We have also analysed the possible impact of several options for finding other sources of funding for the programmes these levies currently support. The Government's proposed Fairness and Affordability consultation expected before the end of the 2023/24 financial year which will outline options for changes to the levies to reduce the electricity price relative to gas, has yet to be published. Once the consultation is concluded, the process of removing levies from electricity bills is legislatively complex and will take considerable time.

Whilst we hope to see this consultation published without undue delay, we believe a temporary policy change should be implemented in the short term that has the same effect as the removal of levies from electricity bills for the electricity used by a heat pump to produce heating and hot water. This would avoid stalling progress in developing the heat pump market whilst the process of removing these levies takes place.

PROPOSAL

We propose an interim **Heat Pump Tariff Discount be implemented as soon as possible** and tapered over time as levies on electricity bills are progressively removed. We propose the **Heat Pump Tariff Discount** should have the following features:

1. Require Licensed Electricity Suppliers to reduce the price of electricity used by a heat pump for domestic heating or hot water by **5p/kWh in 2024/25 and 2025/2026 rising to 6p/kWh in real terms in 2026/27.** Heat pump electricity consumption could be determined via a deemed or metered approach, as described in the "Ensuring the tariff is only applied to the appropriate electricity consumption" section[39].

2. Provide the **same tariff discount for air source to water and ground/water source heat pumps** to avoid internal distortions within the heat pump market.

3. Apply to all **hydronic heat pumps**, including when heat pumps are used in a hybrid heating system, in line with National Grid ESO's Consumer Transformation scenario[40]**.**

4. Be implemented as a **temporary measure, starting in the financial year 2024/25**, and tapered progressively as different levies are removed from electricity bills until the complete removal of all electricity bill levies has been achieved.

5. Have the scope to **extend the scheme beyond the above 3 years** if removing levies from electricity bills takes longer.

6. **Allow the tariff discount levels for new consumers to be reviewed quarterly** upon publications of the Price Cap, with a **consumer's tariff discount locked in and indexed** at point of application for the tariff.

7. **Be available for all domestic heat pump consumers**[41] with an MCS certificate, Building Regulations Compliance Certificate or appropriate building control sign-off being used as the means to provide proof of a heat pump installation.

8. **Strike the right balance between speed of implementation, versus accuracy and limiting scope for gaming or fraud**.

39 HPA (2023) HPA Publications and Consultation Responses (2023)

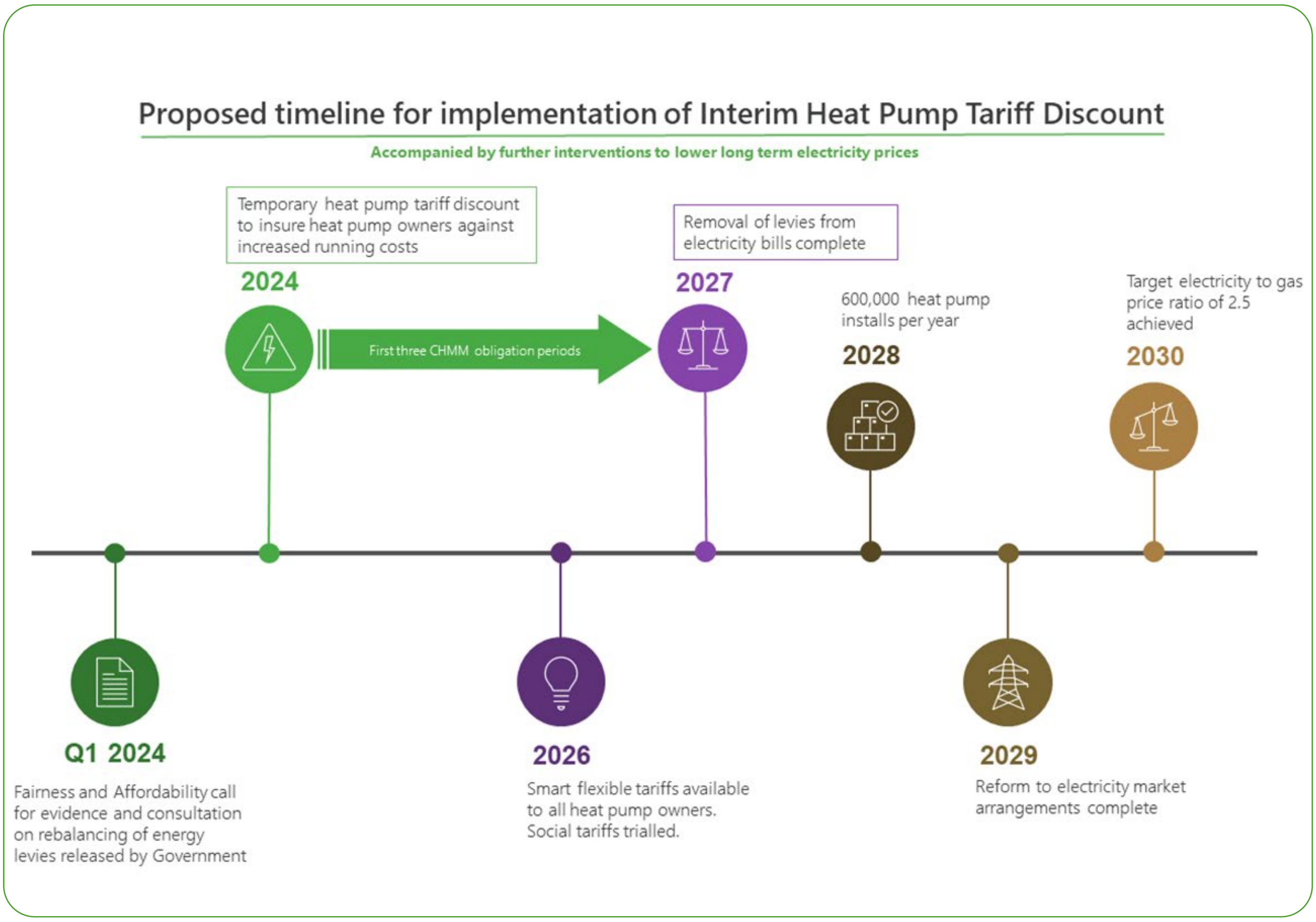
40 National Grid ESO (2023) Future Energy Scenarios. Inclusive of air-to-water heat pumps, ground-to-water heat pumps and hybrid heat pump systems where an air-to-water heat pump or ground-to-water heat pump is included. Air-to-air heat pumps and domestic hot water heat pumps are not included.

41 Inclusive of heat pumps in new build properties, the rental market and consumers in properties with existing heat pump installation.

TIMING

An indicative timeline of how our recommended actions may be implemented is given below. We consider an electricity to gas price ratio of 2.5 to be achievable by 2030, given the right policy levers are utilised, as was demonstrated in Figure 8. The Interim **Heat Pump Tariff Discount** should be in place until all levies are removed from electricity bills. On the timeline below, it is projected that this will be completed by 2027, a relatively conservative estimate. Therefore, with the tariff introduced in 2024, it is assumed that the tariff has a lifetime of three years, which would mean these costs would represent an upper threshold.

This three-year lifetime has been used in our analysis. However, we encourage urgency in completing the removal of levies from consumer electricity bills, as this will deliver long term investor confidence in the heat pump market and support a wider move to electrification. Additionally, some of the approaches that involve the rebalancing of levies are likely to take less time than others. For example, a movement of energy levies to exchequer funding could be achieved more quickly because this would entail less legislative complexity.



We propose the **Heat Pump Tariff Discount** be implemented in 2024 following an appropriate period of consultation with key stakeholders, such as licensed energy suppliers, and sufficient notice by which to implement the scheme robustly and sustainably. This discount would therefore emulate the end-point of lifting the costs of environmental and social obligations for the electricity used by heat pump consumers for heating and hot water. The tariff should be tapered down progressively as each levy is removed from electricity bills. This would mirror the impact of removing all levies from the portion of electricity used by the heat pump, therefore reducing the running costs. As a result, the investment case for a heat pump would dramatically improve and the market will grow.

The impact of the Heat Pump Tariff Discount is equivalent to the modelling in **Rebalancing scenario 4 – Heat pump exemption for all levies on electricity bills** within **Appendix 2**. The introduction of the tariff would abruptly end an important distortion in the heating market because heat pump consumers will no longer bear a greater obligation to fund energy and climate related policy relative to consumers using fossil fuels.

Our analysis suggests that the tariff subsidy required per unit of electricity consumed via a heat pump would be equivalent to £51 (40-56) / MWh in the financial years 2024/2025 and 2025/2026 rising to £55 (51-58) / MWh in 2026/2027[42]. We have therefore proposed that the Heat Pump Tariff Discount takes the form of a reduction in retail electricity price of 5p/kWh in 2024/25 and 2025/26, rising in real terms to 6p/kWh in 2026/27. Under central price forecast assumptions, this would decrease the cost of electricity faced by heat pump consumers by 12% in 2024 and by 24% in 2026[43]. This is equivalent to the estimated total direct levies per unit of electricity consumed in those periods, as described in the previous section.

ENSURING THE TARIFF IS ONLY APPLIED TO THE APPROPRIATE ELECTRICITY CONSUMPTION

A method for recording or estimating heat pump electricity consumption would have to be determined. This could be achieved through a metered approach, or a deemed energy usage approach which either uses property specific data or national averages.

Metered approach.
Under a metered approach, the actual electricity usage could be captured provided the consumer has a smart meter. The current specification for smart meters allows a single smart meter to record separately the electricity used by (for example) a heat pump, and for this consumption to be registered to a separate Meter Point Administration Number (MPAN), although registering an additional MPAN may carry additional cost and hassle factor for the consumer[44]. This captures the raw data needed and provides an existing and established mechanism into the settlements system that could allow the consumer to pay a one tariff rate on electricity used for heating and hot water use via a heat pump and a separate tariff rate on electricity for other uses.

42 Note that range is due to uncertainty around the future electricity wholesale price which will determine the total cost of Contracts for Difference payments.

43 Note that this is a conservative estimate as price forecasts are high following the impact of the Energy Crisis.

44 Open Energy Monitor (2023) [Heat Pump Monitoring]

Deemed energy usage approach – Property specific data.

Deeming an amount of energy using property specific data is a precedent already established under the (now closed) Domestic Renewable Heat Incentive (RHI) scheme. The RHI used a deemed amount of energy used to calculate subsidy amounts[45]. Although for the RHI the deemed quantity was units of heat, a figure for heat pump electricity consumption could be estimated based on the Energy Performance Certificate (EPC) for the property and assumed heat pump efficiency[46]. The consumer could receive a subsidy discount according to how much electricity was deemed to be used for heat.

Deemed energy usage approach – National averages.

It has been noted under other similar schemes that access to property level data, such as EPCs, can be a limiting factor and occasionally prove a barrier to some consumers accessing funding for retrofit measures such as heat pumps. Therefore, an alternative approach could be to use the average electricity consumption of heat pumps in Great Britain as a proxy for consumption within a consumer's property, with the consumer receiving a unit discount on electricity consumption accordingly.

The pros and cons of each of these approaches are summarised in Table 2. To be eligible, installations would have to be certified under a suitable scheme, for example, heat pump consumers could have to provide a Building Regulations Compliance Certificate, an appropriate building control sign off or an MCS Certificate.

45 Ofgem (2021) Domestic Renewable heat Incentive (Domestic RHI)

46 DLUHC (2023) EPC Open Data

Table 2 - Pros and cons of different methods of administrating heat pump levy exemption

APPROACH	PROS	CONS
Metered Approach	• Most accurate method of determining heat pump electricity consumption. • Would enable more accurate tracking of the true costs that need other funding sources and inform decisions to be taken on the longer-term removal of levies from electricity bills. • Support the adoption of smart meters.	• Potentially incentivises an increase in energy consumption to maximise the exemption. This could have the adverse effect of increasing emissions. • Potential for fraud if consumers wire other loads to a heat pump circuit. • Potential implementation barriers due to the requirement for energy companies to update processes and support the deployment of smart meters. • Potential hassle associated with consumer having to register a separate MPAN and could carry costs of around £500 per home.
Deemed Energy Usage Approach – Property Level Data	• Simpler implementation process than the metered approach as would not require consumers to have a smart meter. • Would limit administration and familiarisation costs from obligated parties. • Maintains a degree of accuracy around the real electricity consumption of a consumer's heat pump.	• Requires property to have an EPC record, or alternative data which can be used to estimate heat consumption. • Outdated or inaccurate property data could lead to incorrect discount payments. • Property data would not consider the personal heating behaviour of household.
Deemed Energy Usage Approach – National Averages	• Simplest approach, limiting administration and familiarisation costs. • Does not require properties to have an EPC record or smart meter. • Removes incentive to increase consumption because of discounted electricity price.	• Would lead to over-subsidy of properties with lower energy consumption and under-subsidy of properties with higher energy consumption than the national average. May therefore under-incentivise the latter causing less heat pump deployment for higher demand properties. • Inaccuracy in property level consumption estimates would decrease justification for a discount on the grounds of energy prices currently distorting the heating market.

COST REDISTRIBUTION

We estimate the maximum total discounted cost of levies on domestic electricity used by heat pumps in Great Britain from 2024/2025 – 2026/27 to be £533m. This uses assumptions consistent with National Grid ESO's Consumer Transformation Scenario – that with the most rapid growth in heat pump installations[47], and can therefore be assumed to be an upper estimate of these costs. For example, the total installations under the Consumer Transformation are 133,000 in 2024/2025 and 215,000 in 2025/2026[48]. This would be around a 4-fold increase on the current market within 2 years, and therefore likely represents the upper limit of ambition (and therefore cost to be redistributed).

We have calibrated our interim **Heat Pump Tariff Discount** proposal to have the same financial effect as exempting heat pump consumers from the levies for the electricity that their heat pump would consume, for the three years we have modelled. In turn, those costs fund the range of policies described earlier in this chapter, and these costs would have to be met by an alternative source of funding if our proposed **Heat Pump Tariff Discount** is introduced.

Table 3 displays illustrative values in Great Britain for a range of alternative funding for these costs, should a **Heat Pump Tariff Discount** be introduced in the timescales we propose. Values given are the result of our modelling of several options, included to inform the forthcoming policy debate and are not indications of any preference or hierarchy of preference by the HPA. We recognise there may also be other options we have not considered. Values are given under the assumption that levies will be removed fully from electricity bills three years after the start of the **Heat Pump Tariff Discount** being implemented and, therefore, represent costs over three years. The average impact per year is also provided. For the scenarios where the cost is placed onto non-exempt electricity usage or gas bills, a version which avoids placing additional levies onto the energy bills of low income and/or vulnerable households is also displayed. For this estimate, we used the definition of vulnerable household used for the Government's cost of living support in 2022, equating to 8 million households[49].

47 National Grid ESO (2023) Future Energy Scenarios. See data table ED3.

48 Includes air source heat pump, ground source heat pump, and all hybrid systems which include a heat pump component.

49 HM Treasury (2022) Millions of most vulnerable households will receive £1,200 of help with cost of living

Table 3 - Summary of funding options for interim ***Heat Pump Tariff Discount*** *(2024-2027) (Domestic consumers in Great Britain only))*[50]

Funding source	**Maximum total average impact per consumer over 3 years.** £575 million of undiscounted revenue over three years (£533m discounted), or around £192 million per year (£177m discounted).	**Maximum annual impact per average consumer.**
Non-exempt electricity usage (all bill payers)	£7.46 (range of £6.42-8.07) over three years.	£2.49 (range of £2.14-2.69)
Non-exempt electricity usage (exclusive of vulnerable households)	£10.41 (range of £8.97-11.26) over three years.	£3.47 (range of £2.99-£3.75)
Gas bills (all billpayers)	£7.78 (range of £6.70-8.42) over three years.	£2.59 (range of £2.23-2.81)
Gas bills (exclusive of vulnerable households)	£10.86 (range of £9.35-11.75) over three years.	£3.62 (range of £3.12-3.92)
Funded by the Exchequer	A maximum undiscounted sum of £575 million (equivalent to £533m discounted) required from the Exchequer over three years.	A maximum annual average of £192 million required from the Exchequer across the 3 years modelled. (As an illustration this is equivalent to 0.073% (0.063-0.079%) of annual income taxation revenue).

WIDER RECOMMENDATIONS

This **Heat Pump Tariff Discount** does not and should **not**:

- Negate the urgent need for the Government's consultation intended to address the current imbalance between levies on gas and electricity bills.
- Prevent or slow down medium to long term progress on electricity market reform, following the Government's consultation in 2022[51].

50 Assuming an average dual fuel household with gas consumption of 12,000 kWh and electricity consumption of 3,100 kWh

51 DESNZ (2023) Consultation on Review of Electricity Market Arrangements.

Given that levies placed on electricity bills work counter to the Government's policy on heat electrification, and distort the heating market, levies on electricity bills should be excluded from becoming a source of funding for any future policies.

SUPPORTING EVIDENCE WITHIN THE APPENDIX

Please see the appendixes for supporting evidence and analysis:

- **Appendix 1** summarises the key components of electricity prices and why the electricity to gas price ratio is one of the highest in Europe.
- **Appendix 2** provides detailed descriptions of each of the 6 levy rebalancing scenarios analysed.
- **Appendix 3** provides details on the levies considered within this analysis and the current schemes funded by them.
- **Appendix 4** provides key assumptions used in the analysis as well as details on the methodology.
- **Appendix 5** provides additional graphs and figures relevant to this analysis.

APPENDIX 1 – COMPONENTS OF ENERGY PRICES AND WHAT MAKES ELECTRICITY PRICES SO HIGH

The vast majority of domestic households in Great Britain will have the price of their gas and electricity determined via the Price Cap set by Ofgem[52], the regulator for gas and electricity markets in Britain, with 29 million households on default or variable rates via the Price Cap[53]. Of those households almost all will consume electricity and the vast majority will consume gas for cooking and heating. Therefore, to understand the pricing decisions facing consumers with respect to their choice of heating system, it is best to look at the Price Cap.

Figure 10 and Figure 11 show the breakdown of the average dual fuel household bill for electricity and gas respectively, with all prices inclusive of a 5% VAT rate[54]. When considering standing charges, the average household pays £336 per MWh of electricity used and £77.9 per MWh of gas consumed, 4.3 times lower. Perhaps somewhat surprisingly, wholesale costs, the price suppliers pay to electricity generators, make up less than half (44%) of electricity bills when excluding Contracts for Difference (CfD) payments[55] and 58% of gas bills. The remainder of electricity bills are made up of levies (policy costs and CfD payments), network and operating costs and other costs, including adjustments made based on payment methods and allowable earnings before interest and tax margin for suppliers. Strikingly, the average electricity consumer pays £121 per MWh of electricity consumed towards network and operating costs, 55% more than the entire cost of a MWh of gas. Each individual component of fuel prices is explored in detail in this section as we look to explain differences in pricing and create solutions for lowering electricity prices.

52 Note that although Ofgem are responsible for setting the Price Cap, the Price Cap is Government policy.

53 Ofgem (2023) Energy prices to fall again this winter

54 Ofgem (2023) Energy Price Cap (default tariff): 1 October to 31 December 2023. Total average bill breakdown for dual fuel household using "other" payment method. All prices include VAT rate and are normalised according to Ofgem assumptions of 12,000kWh gas consumption and 3,100 kWh electricity consumption. Inclusive of standing charges.

55 Excluded as defined as an energy levy because CfD payments are an adjustment to the wholesale price rather than direct fuel costs.

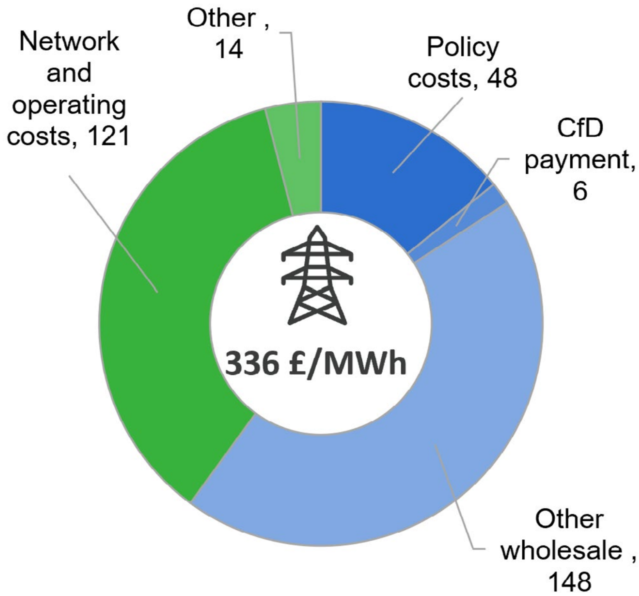


Figure 10 - Breakdown of average electricity bill normalised per unit of energy (October 2023 Price Cap)[54]

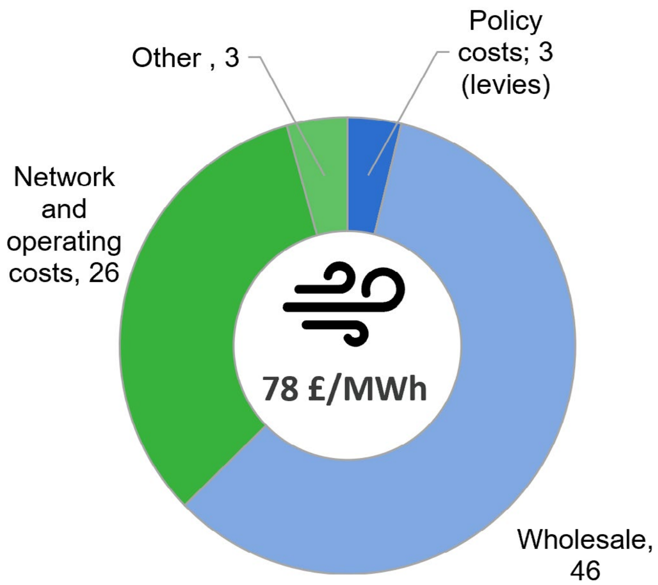


Figure 11 - Breakdown of average gas bills normalised per unit of energy (October 2023 Price Cap)[54]

WHOLESALE COSTS

The wholesale electricity market is where energy suppliers pay generators for electricity, which in turn, they can sell onto consumers via the retail market. There is a wholesale market that spans across Great Britain and there are separate arrangements in Northern Ireland.

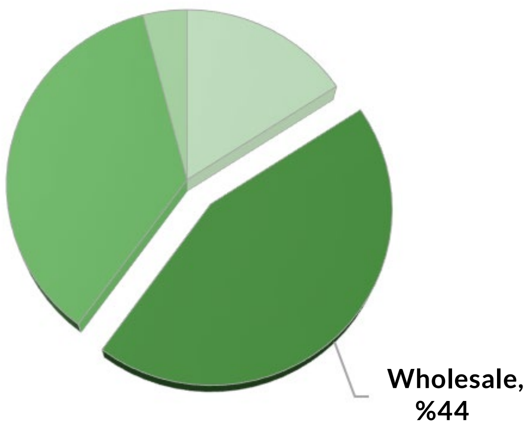


Figure 12 - Wholesale costs as a share of electricity bills

Wholesale prices are determined via trades between generators and suppliers, alternatively, generators can sell their electricity via a purchase power agreement (PPA), the CfD scheme or directly into the distribution network (for smaller generators)[56]. There are also additional components to the wholesale price in consumer bills external to the direct fuel component:

- **Contracts for difference (CfD) payments** go towards funding new renewable and low carbon power generation. As this is a form of environmental levy that instead of being classified as a policy cost is classified as wholesale adjustment, CfD payments are discussed instead in the energy levies section.
- **The Capacity Market** allowance fund payments are designed to ensure reliable electricity peaking generation capacity is available at all times and encourage investment into new capacity.

56 UK Parliament POST (2023) Electricity Market Reform

Ever since the privatisation of the electricity system in the late 1980s[57], the wholesale price of electricity has been set by the marginal price, the price offered to a generator producing the highest cost unit of energy required to meet demand. Most commonly the generator of the most expensive unit of electricity is a combined cycle gas turbine (CCGT) and hence, the wholesale price of electricity is inherently tied to the price of natural gas. This is shown in Figure 13 with electricity wholesale prices almost perfectly correlating with gas wholesale prices. However, in the period February 2021 – June 2023, the ratio of electricity wholesale prices has generally fallen, going from 3.2 to 2.8, far lower than the ratio in the retail market. This fall could be explained by the energy crisis, which was principally caused by an increase in gas rather than electricity prices. Some estimates suggest that gas to power facilities set the wholesale electricity price 84% of the time[58]. Furthermore, these are commonly the times when domestic heat demand is high, meaning Great Britain has one of the markets in Europe where gas is the most determinant of electricity prices[59].

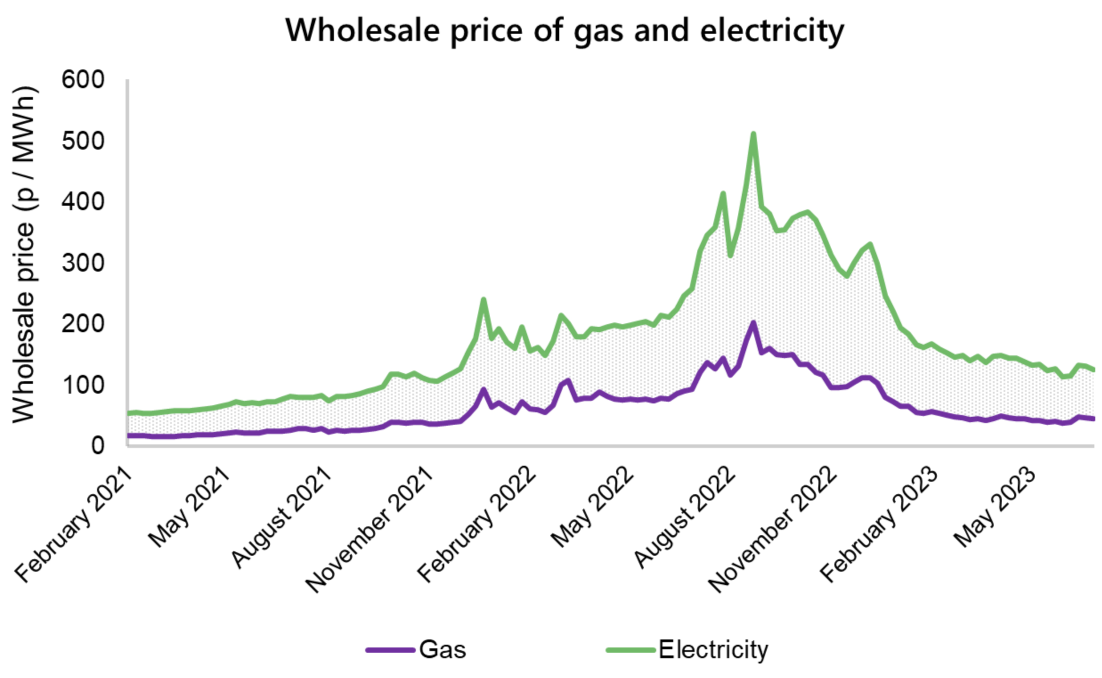


Figure 13 - Wholesale price of gas and electricity

57 Liu, Wang, Cardinal (2022) Evolution and reform of UK electricity market

58 UCL (2022) Electricity prices dictated by gas producers who provide less than half of UK electricity

59 UCL (2018) Wholesale cost reflectivity of GB and European Electricity Prices

This system of marginal pricing has generally been successful in ensuring a reliable supply of electricity for businesses and homes in Great Britain, by incentivising investment into peaking capacity. This pricing system was suitable when the British electricity system was dominated by coal and more recently natural gas. However, as we transition to an increased penetration of renewable and low carbon sources, it is evident that the system requires rethinking. In fact, between 2009 and 2022, the share of the generation mix in Great Britain coming from solar, and wind has gone from 1% to 31%, as shown in Figure 14. In that same period, the share of coal has fallen from 30% to 1% and the share of gas has fallen from 45% to 39%[61]. Renewable sources such as electricity and wind have very low marginal costs due to having zero or minimal fuel costs. Thus, prices are no longer reflective of the overall marginal cost of generation on the grid. In 2022, it was reported that the cost of offshore wind power funded via CfD contracts was nine times cheaper than the cost of electricity produced via gas, although, this was largely due to historically high gas prices which have since fallen considerably[60].

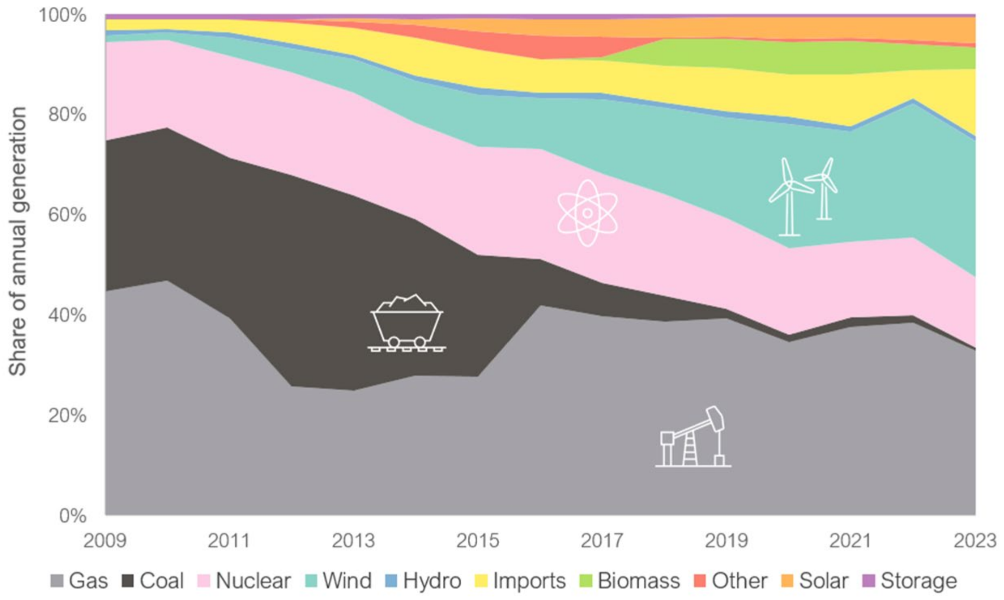


Figure 14 – Electricity generation mix in Great Britain by year[61]

Measures have been taken to reform the electricity market, as in its current format it is neither conducive to bringing on renewable generation capacity nor encouraging the electrification of current fossil fuel applications, such as replacing gas boilers with heat pumps. This is because, after thermal efficiency losses from generation and transmission losses, electricity produced from gas will always be considerably more expensive than the gas itself. The Contracts for Difference scheme has been developed to bring on additional renewable capacity by offering long term contracts with set strike prices. Additionally, the Capacity Market has been introduced to ensure reliable generating capacity. Although, this too has encouraged additional gas fired capacity, with 68% of contracts in the most recent auction for gas-fuelled plants[62].

The Government's main method for addressing high electricity wholesale prices in comparison to gas and encouraging both mass adoption of electrical heating systems and decarbonisation of the electricity grid, is the Review of Electricity Market Arrangements (REMA)[63]. REMA detailed a series of options and reforms

60 Carbon Brief (2022) Analysis: Record-low price for UK offshore wind is nine times cheaper than gas

61 National Grid ESO (2023) Carbon Intensity. Data as of August 2023 and therefore data for 2023 is incomplete.

62 DESNZ (2023) Capacity Market Rules

63 DESNZ (2022) Review of electricity market arrangements

that could be taken to assist in the transition to a decarbonised, cost effective and secure electricity system. Of these options, many are concerned with reform to the wholesale market, especially with improved price signalling to encourage electrification as well as grid balancing and flexibility. With any reform, consumer protection must be at the forefront of plans as exposing consumers to excessively high or uncertain energy pricing would run counteractive to the electrification agenda overall. Many wholesale market reforms are considered under REMA, however, the ones most relevant to encouraging the mass adoption of heat pumps are:

- **Splitting the wholesale market** would be a reform to the wholesale market with the intent of decoupling gas and electricity prices by separating revenues made by low carbon generators from prices set by marginal gas-fired plant[64]. Revenues received by new renewable plants are inextricably linked to wholesale prices as CfD payments are made on the difference between an agreed strike price and the wholesale price[65]. Splitting the market would mean creating a market for "as-available" generation, such as wind and solar, and a market for "on-demand" flexible generation, such as gas CCGTs[66]. Theoretically, by leaving on-demand generation to be funded via marginal pricing, and used via a merit order, and the as-available to be priced according to the levelized cost of production, overall wholesale prices could decrease, and the right market signals sent to both electricity offtakers and potential generators. However, in practice, there are drawbacks to splitting the market. Not least, the potential for investor hiatus[67] and difficulty with defining which markets technologies like biomass-to-power and nuclear would have access to, as they can both operate at a baseload and flexibly[66].

- **Locational pricing** would involve splitting the Great Britian wide wholesale market into multiple regional markets, with zonal markets separated based on areas of network constraints, and nodal pricing splitting the market on a more granular basis, potentially based on the boundary between transmission and distribution systems[68]. The benefits of this would be strengthening local price signals to encourage new offtakers in areas of constraint and new generators in areas of under supply. Improving the flexibility and efficiency of the electricity system via nodal markets could deliver benefits as high as £31 billion between 2025-2040[69], although, more recent and conservative estimates are around £14 billion[70]. The main drawbacks to this proposal are regulatory complexity and the potential for punishing certain consumers based purely on their geographical location[71].

Wholesale costs are a complicated and nuanced part of retail electricity prices, and any effects of wholesale market reform are likely to take many years to consider and implement – certainly longer timescales than needed for the increased uptake of heat pumps needed to reach the Government's ambitions. As the penetration of low carbon and low operating cost electricity generation comes online, it is hoped that prices will no longer be set by gas and wholesale costs can fall. However, it remains to be seen whether this will come to fruition, and it is evident that a rethinking of the systems we use to price energy is needed to allow for this to become reality.

64 National Grid, Baringa (2023) Assessment of Investment Policy and Market Design Packages
65 LCCC (2023) Contracts for difference
66 The Oxford Institute for Energy Studies (2017) The Decarbonised Electricity System of the Future: The 'Two Market' Approach
67 Imperial College London (2018) Electricity markets, incentives and zero subsidy renewables
68 CMS (2022) Nodal Pricing to Achieve Net Zero: National Grid ESO publishes its conclusions on Phase 3 of the Net Zero Market Reform
69 FTI Consulting, Ofgem (2022) Updated modelling results
70 Ofgem (2023) Assessment of Locational Wholesale Pricing for GB
71 University of Strathclyde (2023) Exploring Market Change in the GB Electricity System: the Potential Impact of Locational Marginal Pricing

NETWORK AND OPERATING COSTS

Operating costs are the costs of retailing energy faced by the supplier. They exclude the costs of purchasing energy, the cost of meeting environmental and social obligations (ESO), and network charges[72]. Operating costs make up 13% of the average household's electricity bills.

Network costs are the costs associated with investing in new network infrastructure and maintaining current infrastructure. For example, revenue collected from network costs is used to build new electricity cables. Network costs also go towards balancing charges. The supply and demand of electricity is balanced on a second-by-second basis which often requires the dispatch of flexible demand and supply services[73]. Network costs represent 23% of the average household's electricity bills. The need for flexible balancing services and the technical difficulties with transmitting electricity, especially over long distances, are to a large part the reason that network costs are nearly seven times higher per unit of electricity consumed than per unit of gas consumed.

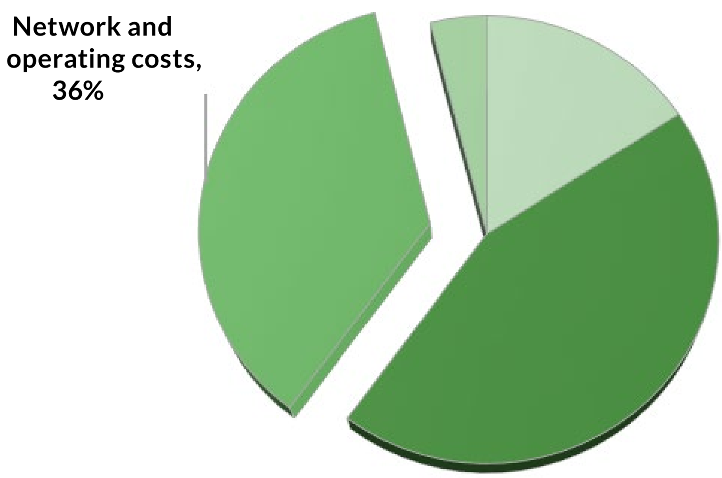


Figure 15 - Network and operating costs as a share of electricity bills

72 Ofgem (2018) Default Tariff Cap: Decision Appendix 6 – Operating costs

73 Ofgem (2023) Your energy bill explained

ENERGY LEVIES

Large suppliers are often obligated to pay towards government policy and public schemes. These schemes cover a range of areas but most commonly involve a sub-sector of energy such as improving energy efficiency in vulnerable households or funding take-up of renewable technologies[73]. To recover these costs, levies are placed on consumer bills, either on standing charges or per unit of energy consumed, to an allowable level determined by the Price Cap set by Ofgem, as is Government policy. These costs are often referred to as environmental and social obligations (ESO). Direct levies, accounting for both policy costs and CfD payments, account for 16% of the average dual fuel consumer's annual energy bills.

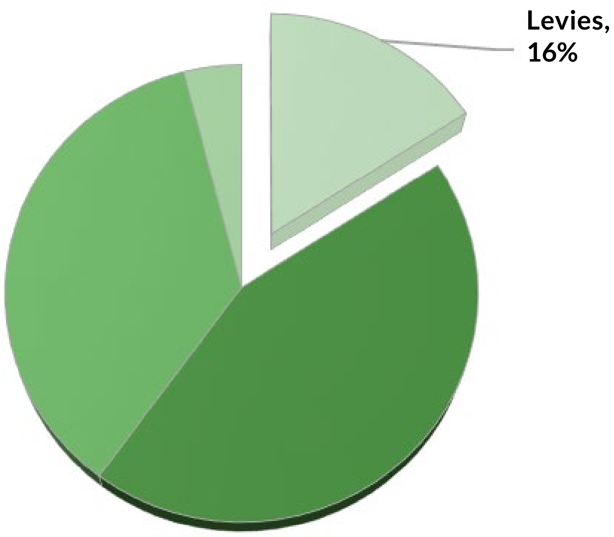


Figure 16 - Energy levies as a share of electricity bills

Additionally, to direct levies placed on energy bills, there are also indirect fiscal and policy interventions that affect the cost of domestic energy usage. For example, electricity generators are subject to the UK Emissions Trading System (ETS). The UK ETS limits the total greenhouse gas emissions that can be emitted by sectors covered by the scheme. Participants either receive free allowances and/or can buy emission allowances from other participants that they can use to reach the mandated cap on emissions[74]. As electricity generators are subject to the UK ETS, there is a net transfer of funds from electricity generators to the UK ETS authority via the purchasing of emissions allowances, equivalent to a carbon tax, with the UK ETS generating £4.56 billion in total revenue in 2022[75]. In 2013, the UK Government introduced an additional policy, the Carbon Price Support, which placed additional obligations on emissions intensive electricity generators to require the phasing out of coal power plants[76].

74 DESNZ (2023) Participating in the UK ETS

75 Statista (2023) Government revenue from the emissions trading scheme (ETS) in the United Kingdom (UK) from 2009 to 2022. Please note that not all of this revenue was from electricity generators.

76 University College London (2019) Annex: Impact of Carbon Price Support on British energy bills

The evidence on what share of electricity bills is caused by carbon pricing varies and due to the complex nature of energy markets and the wide range of generating technologies it is hard to determine the exact impact. However, as shown in Figure 17, DESNZ electricity generation cost estimates suggest that by 2025, 48% of the levelized cost of producing electricity via a gas open cycle gas turbine (OCGT) will be from carbon costs[77 80]. This of course varies by technology, with renewable and low carbon generating technologies, such as offshore wind and dedicated biomass, not facing any carbon costs. However, when considering that 84% of the time, gas to power facilities set the wholesale electricity price[59], it is easy to see how carbon taxing may indirectly raise wholesale electricity prices and therefore retail electricity prices. Although gas refineries are subject to the UK ETS, they are classified as an industry participant and not electricity generator, therefore, they receive free allowances meaning that the obligation under the ETS is less stringent[78]. Additionally, most emissions associated with domestic gas usage are through the combustion of gas in the property rather than the refining of the gas (scope 3)[79], and therefore, the indirect carbon tax on domestic gas usage is far lower than that for electricity usage.

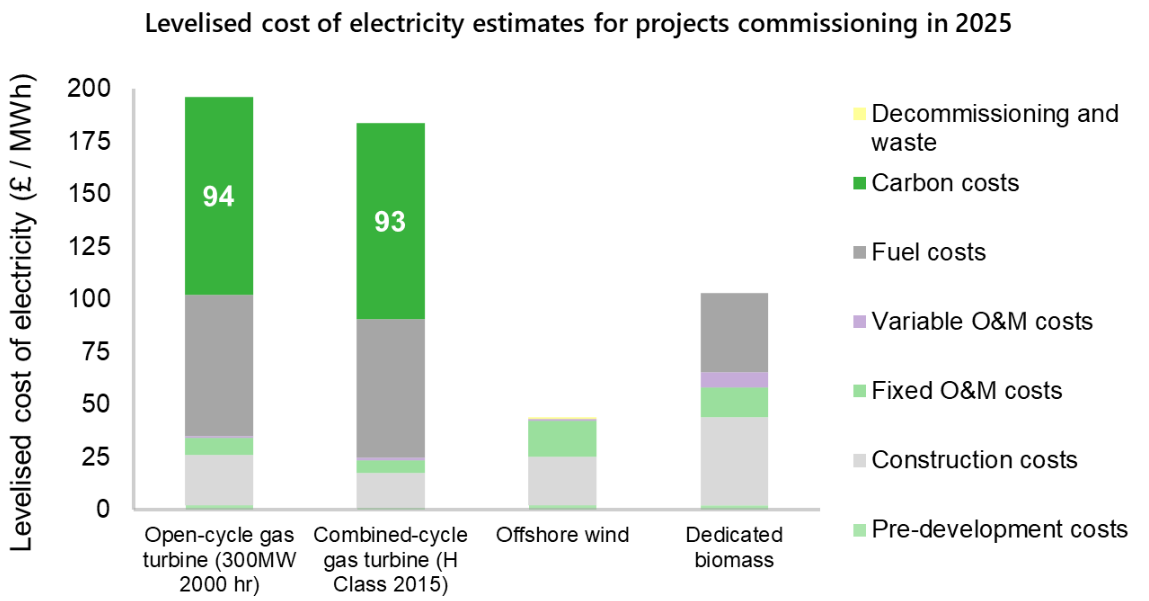


Figure 17 - Levelised cost of electricity estimates for projects commissioning in 2025 (2021 prices)[80]

Although the evidence suggests that carbon taxing has a disproportionately high indirect effect on electricity bills rather than gas bills, it is also clear that carbon taxing is in place to encourage decarbonisation in the power sector, and therefore, our analysis looks at the direct levies faced by electricity consumers. However, carbon taxing on domestic energy is important context for the recommendations in this report. A summary of the direct levies placed on electricity and gas bills via the Price Cap is detailed in **Appendix 4**.

77 Note that this estimate is based on a carbon price of £83.03 per tonne CO_2e in line with the carbon price used for civil penalties in 2023 under the UK ETS. See here for further details: DESNZ (2023) UK ETS: Carbon prices for use in civil penalties, 2023. Current relative impact of carbon taxing on electricity wholesale costs is likely to be lower due to higher wholesale gas prices and lower carbon prices under the UK ETS.

78 DESNZ (2022) Developing the UK Emissions Trading Scheme (UK ETS)

79 DESNZ (2023) Government conversion factors for company reporting of greenhouse gas emissions

80 DESNZ (2023) Electricity generation costs 2023

The schemes and policies funded by these levies are worthy causes and often set up with the ambition of pushing forward the net zero agenda. However, energy levies, both direct and indirect, are disproportionately placed on electricity bills rather than gas bills or other funding mechanisms. As of October 2023, 16% of the average dual fuel consumer's electricity bills are from direct levies whereas only 4% of gas bills are from direct levies. As shown in Figure 18, traditionally, this share is even higher with the median share of electricity bills from levies since April 2017 at 21%. Placing levies on electricity bills to this extent significantly disincentivises consumers to adopt electrical heating systems, such as heat pumps, and runs counteractive to the overall decarbonisation agenda.

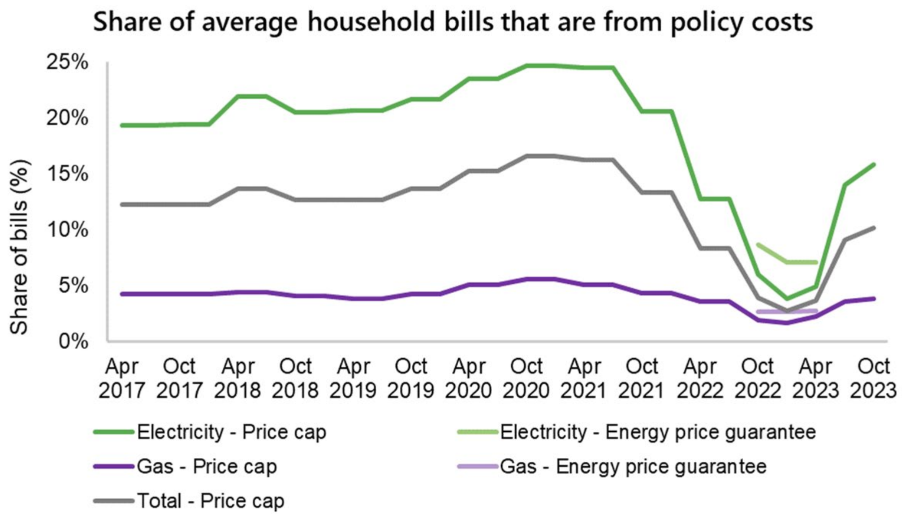


Figure 18 - Share of average household bills that are from policy costs[81]

81 Assuming a household with annual gas consumption of 12,000 kWh and electricity consumption of 3,100 kWh in line with Ofgem assumptions.

For a consumer to adopt a heat pump as opposed to a gas boiler, under the current arrangement, they would also be committing to paying higher levies on their energy bills. As shown by Figure 19, the average heat pump consumer currently pays £398 per year in energy levies, with £218 via electricity used for heat (and standing charges) and £180 via electricity for other uses such as lighting. This is significantly higher than the obligations faced by gas boilers with this distorting the economic decision-making process consumers face, especially when considering the potential for higher heat pump running costs compared to gas boilers as a result of these high levy obligations. Figure 20 shows the individual levies making up the total levy obligation on the average heat pump consumer's annual heating bills, including standing charges. Over half of the levies go towards the Renewable Obligation and a further 14% goes towards Feed-in tariffs. Details of potential methods of rebalancing energy levies are shown in Appendix 2.

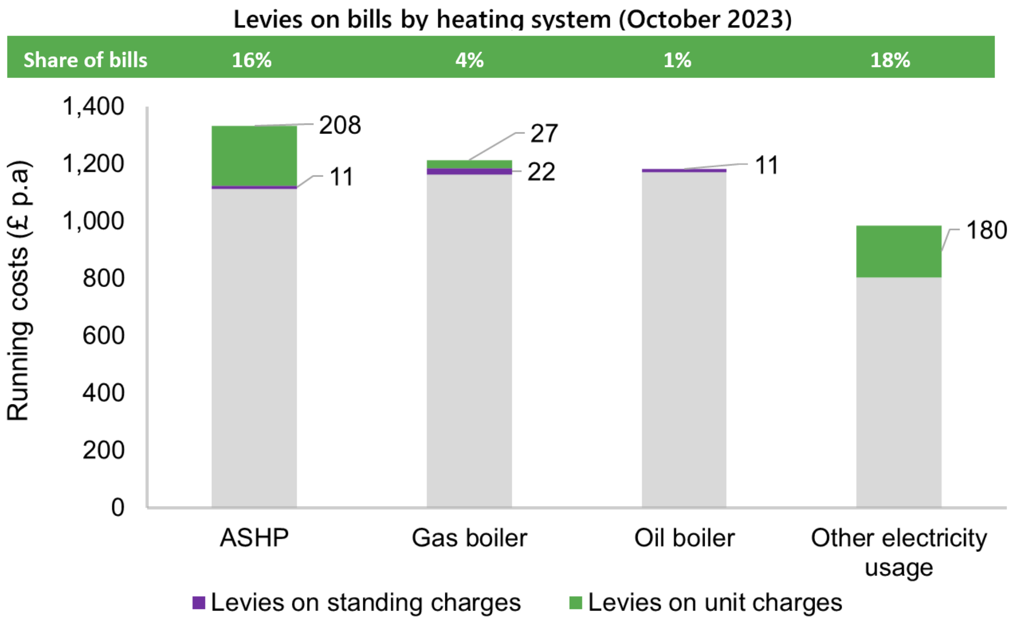


Figure 19 - Levies on bills by heating system (October 2023)[82]

82 Includes all levies detailed in Appendix 1. Assumes that heat pump consumer does not pay gas standing charge. Standing charges included under heating system and not included in "other electricity usage". Inclusive of VAT. For remaining assumptions please see footnote number 7

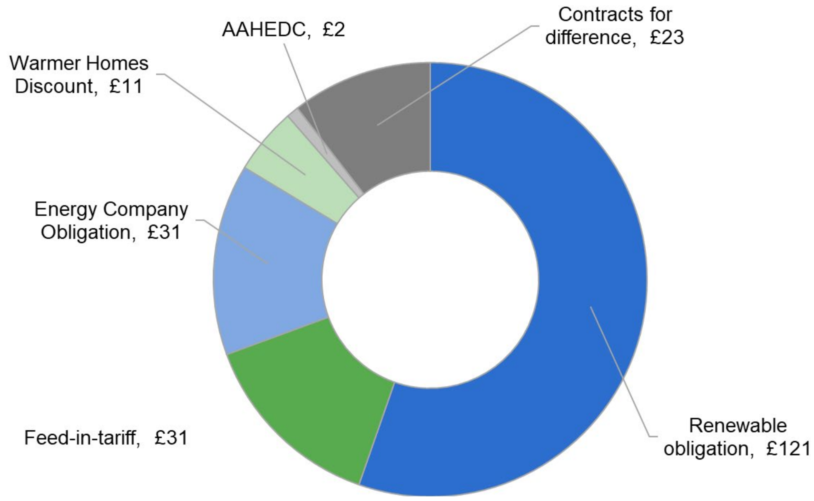


Figure 20 - Breakdown of levies on an air source heat pump consumer's heating bills (October 2023. Inclusive of VAT and standing charges)

APPENDIX 2 - LEVY REBALANCING SCENARIOS

For heat pumps to deliver significant running cost savings and enable the offsetting of higher capital costs, work is required to address imbalances distorting the running costs of heat pumps compared to counterfactual heating systems. To address the imbalance, in terms of levy obligations being disproportionately placed onto electricity bills, 6 rebalancing scenarios have been developed, as shown Figure 21.

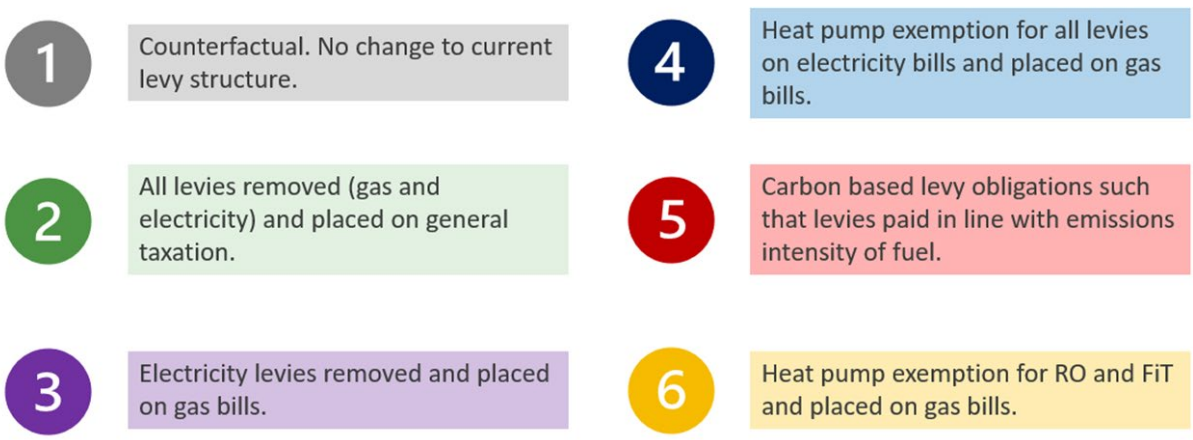


Figure 21 - Summary of levy rebalancing scenarios

REBALANCING SCENARIO 1 – COUNTERFACTUAL. NO CHANGE TO CURRENT LEVY STRUCTURE.

Energy levies currently on bills are all at different points of their lifetime and to understand the long-term impact levies may have on the take up of heat pumps, we have produced a forecast of the funding required for the relevant schemes. This analysis used third party forecasts, such as those produced by the Low Carbon Contracts Company (LCCC)[83], DESNZ[84], and the Office for Budget Responsibility (OBR)[85], as well as reasoned assumptions around the phase out of schemes with set durations and historic funding trends, for example, records for the Renewable Obligation scheme[86]. For further details on the methodology, please see **Appendix 4**. This analysis focuses on the levies faced by domestic consumers only, however, the analysis also accounts for any exemptions some consumers may have, for example, the exemption given to some industrial electricity consumers via the Energy Intensive Industries (EIIS) scheme[87].

As the subsidy paid to renewable generators under the CfD scheme depends on the wholesale cost of electricity, forecasts were made across a low, central, and high price sensitivity. The forecasted total funding by individual energy levy is shown in Figure 22. Assuming the current levy structure remains, and no additional levies are placed on energy bills, according to these forecasts, energy levies will grow until 2031, largely due to increases in the funding requirements for the CfD scheme. As the Feed-in Tariff and Renewable Obligation schemes are both closed to new applicants, the total funding requirements are expected to decrease steadily until being completely removed from domestic consumer bills around the year 2037. Strike prices under the CfD scheme are expected to decrease at a faster rate than wholesale electricity prices and therefore, despite the CfD scheme expected to continue funding projects until the late 2030s, the total funding requirement is expected to gradually decrease with time after 2031. The Warmer Homes Discount and Energy Company Obligation schemes both tackle fuel poverty, which is expected to also be a priority for future governments, it has been assumed that total funding requirements remain the same.

Between 2025 and 2050, these forecasts suggest that, under the counterfactual scenario, a total of **£84 billion (£76-89 bn)**[88] in revenue will be raised from levies on domestic energy bills, an **average of £3.37 billion per year**. Of this funding, **£69 billion (£61-74 billion)** is expected to be funded via levies on electricity bills **and £15 billion via levies** on gas bills. Therefore, these estimates suggest that 82% of revenue raised through domestic energy levies will be via levies on electricity bills. Therefore, in scenarios where these levies are moved from bills to taxation, this is the upper limit for increases to general taxation. However, it should be noted that levies themselves are an imputed tax so overall fiscal revenue would be unaffected.

83 LCCC (2021) Forecast Dashboard

84 DESNZ (2022) Energy and emissions projections: 2021 to 2040

85 OBR (2023) Economic and fiscal outlook – March 2023

86 Ofgem (2023) Renewables Obligation (RO) Annual Report: Scheme Year 20 (2021-22)

87 HMG (2023) Energy Intensive Industries (EIIS)

88 Please note that range is due to sensitivities in the wholesale price of electricity which will influence the size of CfD payments.

Non-domestic energy consumers often pay levies on energy consumption also, although, many receive exemptions. For example, under the Energy Intensive Industries Exemption Scheme, 43% of industrial energy consumption[89] is exempt from 85% of policy costs[90]. Many of the levies described in **Appendix 3**, such as the Energy Company Obligation, only benefit domestic households and so are only funded via levies on domestic energy consumption. This analysis focuses entirely on domestic energy levies; however, it must be noted that only 35.1% of UK electricity consumption is from domestic consumers[91] and 57% of gas consumption is from domestic consumers[92].

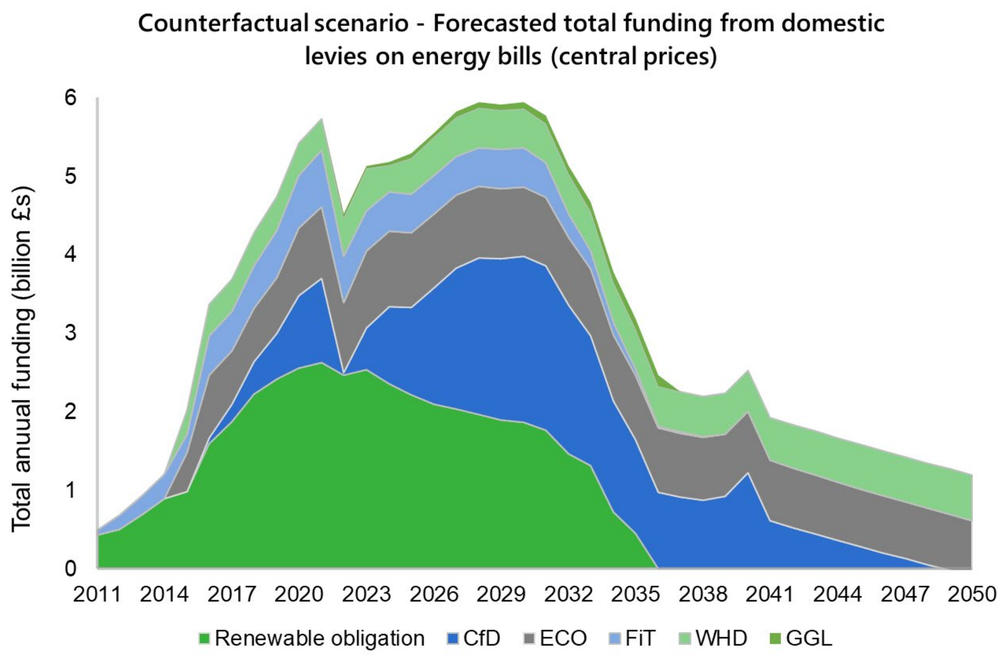


Figure 22 - Forecasted total funding from domestic levies on energy bills (central prices) (2022 prices)

Using the total funding requirements from the forecasts shown in Figure 22 as well as data on the total energy consumption and heating mix from National Grid ESO's Consumer Transformation scenario[93], the forecasted levies per unit of energy consumed can be estimated, as shown in Figure 23. Due to the changes in total funding requirements, the levy per unit of electricity consumed in domestic properties is expected to increase to £59/MWh in 2028 before decreasing to £11/MWh in 2038. Due to the expected phase out of gas grid connected homes and gas fuelled boilers, the total consumer base that gas levies are mutualised across is expected to decrease with time. Therefore, as the two main levies placed on gas bills are expected to continue for the foreseeable future, the costs per gas consumer are expected to increase, especially after 2035 when the proposed fossil fuel boiler phase out is expected to decrease the total domestic consumers of natural gas.

89 CREDS (2020) Industrial decarbonisation policies for a UK net zero target.

90 DESNZ (2023) Energy Intensive Industries.

91 DESNZ (2023) Energy Trends: UK electricity

92 DESNZ (2023) Energy Trends: UK gas

93 National Grid ESO (2023) Future Energy Scenarios

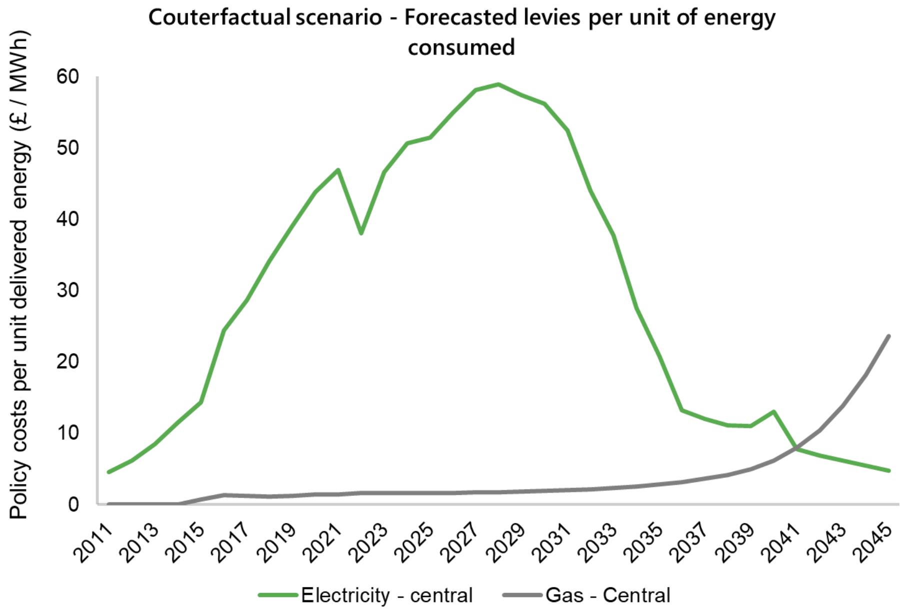


Figure 23 - Forecasted levies per unit of energy consumed

With these forecasted levies calculated, DESNZ price forecasts[94] were adjusted according to changes in levy obligations expected over time. Using these adjusted prices as well as forecasted efficiency changes[95], the annualised lifetime running cost[96] of heat pump technologies against fossil fuel heating systems was estimated for units installed in 2025 and 2030, as shown in Figure 24. A rebalancing of levies on energy bills is expected to require significant legislative change and design so could take more than a year to complete. Therefore, 2025 has been selected as the reference year for this analysis.

Under the counterfactual scenario, an air source heat pump installed in 2025 could face higher average annual heating bills throughout its lifetime than a gas boiler by £18, as shown in Figure 24. Due to the higher average efficiencies of a ground source heat pump compared to an air source heat pump, a ground source unit can deliver significant running cost savings compared to both a gas and oil boiler in 2025. Due to the tailing off of environmental levies narrowing the ratio of electricity to gas prices and improved efficiencies of heat pumps, by 2030, it is expected that both ground source and air source heat pumps will have lower annualised lifetime running costs than fossil fuel boilers. However, for a consumer deciding on their heating system in the near term, this possibility of running cost savings in the future may not drive them towards installing a heat pump over a fossil fuel boiler, especially when considering that many consumers may intend to leave their home before savings could be realised. Therefore, action to remedy near term running costs are vital despite the current potential for savings in the long term.

94 DESNZ (2023) Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal. See "Data tables 1 to 19".

95 Heat pump assumed efficiency increases according to: CCC (2021) Development of trajectories for residential heat decarbonisation to inform the Sixth Carbon Budget (Element Energy). Fossil fuel boiler efficiency improvements according to: DESNZ (2023) Clean Heat Market Mechanism Impact Assessment.

96 Annualised lifetime running cost defined as the average annual running cost over the lifetime of a heating system.

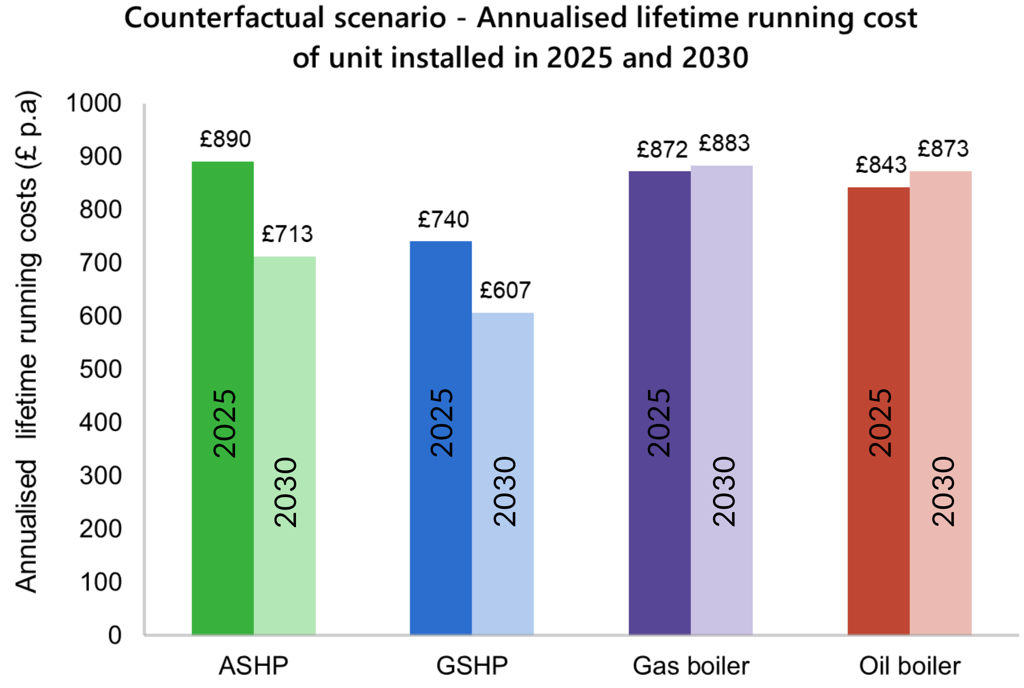


Figure 24 - Annualised lifetime running cost of unit installed in 2025 and 2030[96]

REBALANCING SCENARIO 2 – ALL LEVIES REMOVED AND FUNDED CENTRALLY BY THE EXCHEQUER.

Under this scenario, levies placed on both gas and electricity bills would be removed with the schemes funded by the exchequer. Generally, funding raised by Government is regarded as more progressive than levies on fuel bills. This is because the consumption of basic goods, such as energy for heating, makes up a larger share of the spending for a lower income household than a higher income household. This is especially the case when considering that lower income households tend to have lower fabric efficiency in their homes and potentially a lower efficiency and/or older heating system, raising their demand for heating fuels. For example, over half of low-income households are estimated to be living in energy-leaking homes[97]. As shown in Figure 25, lower income households are more likely to be fuel poor, meaning that the household lives in a property with poor fabric efficiency levels leading to higher energy costs and that paying those costs would push the household below the poverty line[98] – with a single person with no children defined as being in poverty if their weekly income after housing costs is less than £174[99]. Many funding options could be considered for revenue raising from tax and government borrowing if these costs are moved from energy costs to the exchequer, but consideration and analysis of those options is outside the scope of this report and its accompanying analysis.[100]

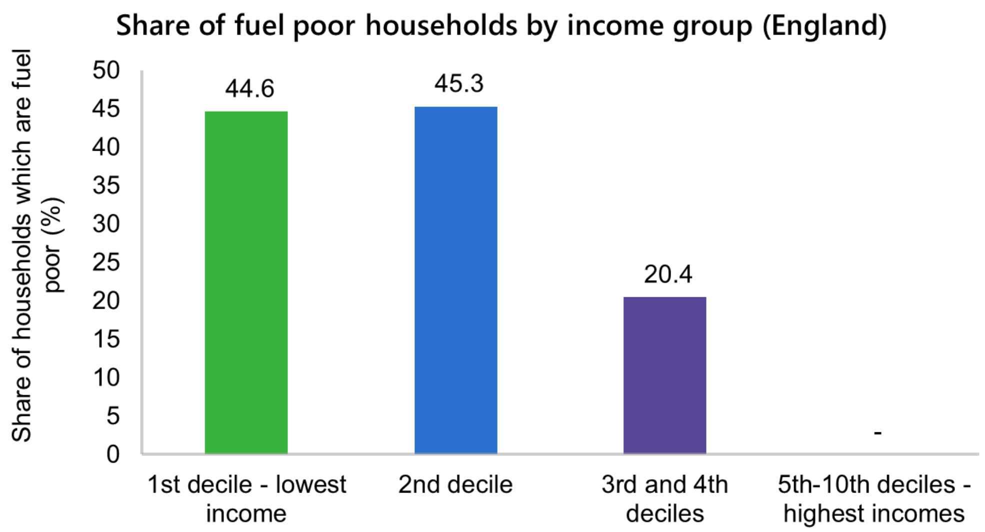


Figure 25 - Share of fuel poor households by income group (England)[101]

97 DESNZ (2023) Annual Fuel Poverty Statistics in England, 2023 (2022 data)

98 National Energy Action (2023) What is fuel poverty?

99 Leeds Observatory (2023) Leeds Poverty Fact Book. Note that poverty line varies based on age, relationship status and household breakdown.

100 Luxury good is a good for which demand increases more than proportionally as income rises

101 DESNZ (2023) Fuel poverty statistics

Removing levies on both electricity and gas bills would make heat pumps more competitive compared to gas boilers, as the overwhelming proportion of those energy levies presently fall on electricity bills. This effect is shown in Figure 26. Assuming that levies were moved from bills to general taxation in 2025, the annualised lifetime running cost of an air source heat pump would be £173 lower than under the counterfactual. Additionally, whereas under the counterfactual the running cost of an air source heat pump would be £18 higher than a gas boiler, under this rebalancing scenario, an air source heat pump would deliver £86 in running cost savings per year on average over the course of the systems lifetime. Similarly, with levies removed an air source heat pump would deliver an average of £97 in annual running cost savings compared to an oil boiler over the course of its lifetime.

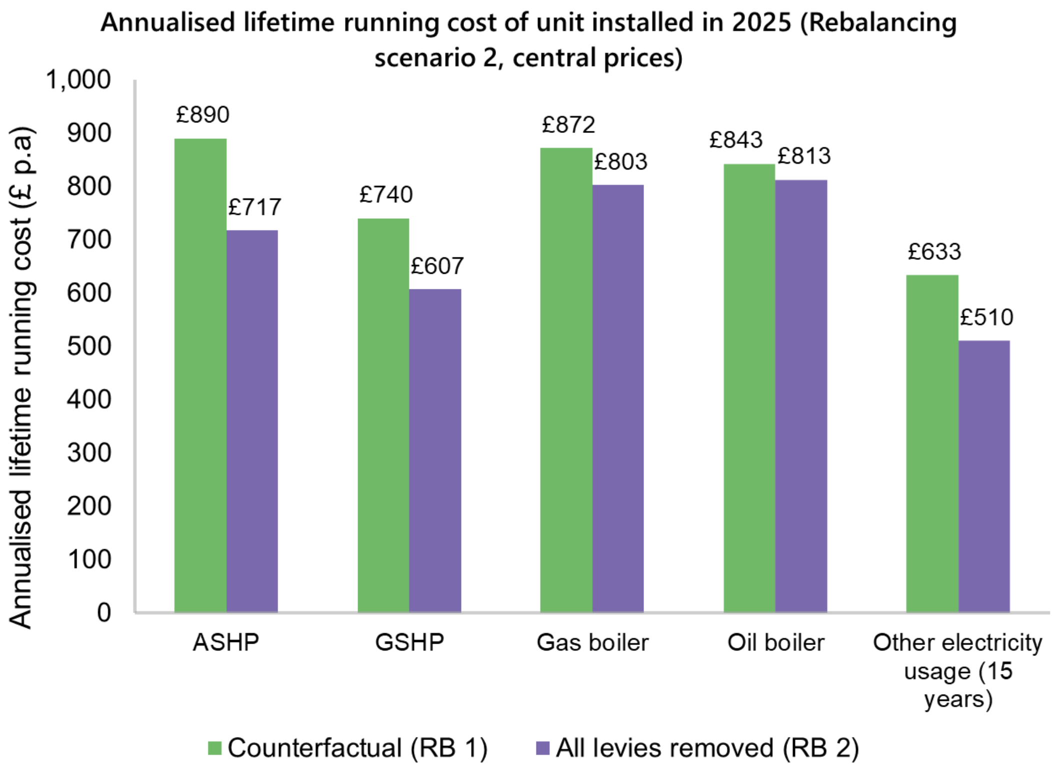


Figure 26 - Annualised lifetime running cost of unit installed in 2025 (Rebalancing scenario 2, central prices)

The major drawback of this proposal is that it requires the movement of a large amount of revenue raising from energy bills to general taxation. Although this may be a more progressive way of funding public schemes and would not raise the overall financial burden on domestic households, raising taxation from other sources can also induce social resistance. Between 2025 and 2050, this would require the exchequer to raise a total of **£84 billion (£76-89 bn)** in additional funding to offset the lost revenue from levies on domestic energy bills in Great Britain. This is equivalent to an **average of £3.37 billion per year**, which would constitute roughly one 300th of total UK public sector current receipts in 2022/23[102].

102 UK Parliament (2023) Tax statistics: an overview

Energy used for domestic heating makes up a larger share of the consumption of a lower income household than a higher income household and therefore, moving levies onto general taxation should be the most progressive form of rebalancing and achieves the policy target of the lowest carbon heat being the lowest cost heat. However, the rationale for placing levies onto energy bills is that the schemes that are funded are often in place to benefit consumers of energy, whether that being through tackling fuel poverty or accelerating the net zero transition. Therefore, moving all levies from bills to taxation is likely to be an unpopular move, especially when considering the high tax burden in the UK economy compared to historical levels[103].

103 OBR (2023) The UK's tax burden in historical and international context

REBALANCING SCENARIO 3 - ALL ELECTRICITY LEVIES REMOVED AND PLACED ONTO GAS BILLS.

Whereas rebalancing scenario 2 was a progressive way of rebalancing levies, scenario 3 is potentially a more regressive approach and the distributional impacts are more extreme. As the majority of the obligation of energy levies are currently on electricity consumers, moving all energy levies onto gas bills would significantly increase the levies on gas consumption whilst lowering the levies paid by gas boiler consumers on other electricity usage, such as lighting and other electrical appliances. Assuming the rebalancing took place in 2025, the levies per unit of gas consumed in domestic properties would increase from £2/MWh in 2024 to £16/MWh in 2025. Between 2025 and 2040, this rebalancing approach would place a total of £71 billion in additional levies on gas consumers, equating to £4.47 billion per year on average. Alternatively, this could be funded via a small increase to general taxation, equivalent to around 2% of income tax on average per year.

In terms of total energy content, roughly three times more natural gas than electricity is consumed currently[104]. Therefore, moving levies from electricity to gas would result in lower levies per unit of energy consumed. However, as gas consumption decreases and electricity consumption increases, due to the phase out of fossil fuel heating systems and improved energy efficiency, the total number of properties that gas consumption costs are mutualised across would decrease. Therefore, the share of levy obligations per gas consumer would increase with time. Assuming a high share of domestic electrification in line with the National Grid's Consumer Transformation scenario[105], under this rebalancing scenario, levies per unit of gas consumed would increase from £16/MWh in 2025 to £31/MWh in 2040, despite overall levy revenue raising requirements decreasing in that time.

Figure 27 shows the impact this rebalancing scenario would have compared to the counterfactual scenario. The average annual running cost over the lifetime of a gas boiler installed in 2025 would increase by £222, whereas electricity consumption for non-heating uses would decrease by £123. Together, this would result in a net increase of £99 to average dual-fuel households annual energy bills over the period 2025-2040. This is a significant increase, however, it should be noted that even with the addition of these levies onto gas bills, prices are expected to be much lower than the high prices seen as a result of the energy crisis, as shown in Figure 32.

104 DESNZ (2023) Digest of UK Energy Statistics (DUKES) 2023

105 National Grid ESO (2023) Future Energy Scenarios – Consumer Transformation Scenario

However, many of the households most vulnerable to fuel poverty will use gas boilers, and often older inefficient gas boilers, resulting in increased risk of fuel poverty as a result of the levy rebalancing. 87% of fuel poor households are estimated to use natural gas as their main fuel[106]. Although these households would realise lower electricity bills for non-heating uses, overall, their bills would be higher. This is the largest drawback of this form of rebalancing. The impact of increased energy bills could be limited by sustained efforts to target vulnerable households with energy efficiency measures, as is done under schemes such as the Energy Company Obligation, which has seen the installation of over 160,000 energy efficiency measures in the latest phase, ECO4[107].

Alternatively, an exemption could be built into the rebalancing, such that vulnerable households[108] are protected from an increase in their gas bills. Therefore, the average vulnerable dual-fuel household would receive the £99 discount on their average annual electricity bill without an increase to their gas bills. However, by limiting the consumer base to which the levies are charged, the cost per obligated consumer would increase. By exempting vulnerable households from additional levies on their gas bills, the average non-vulnerable dual fuel consumer's gas bills would increase by £310 rather than £222 over the course of a gas boiler's lifetime. This would mean that the net increase to the average non-vulnerable dual fuel consumer's energy bills would be on average £211 per year between 2025 and 2040.

Many fuel poor households already rely on electrical heating systems, mostly less efficient direct electric heating systems rather than heat pumps. 24% of households using electrical heating are estimated to be fuel poor, compared to 12% for gas heating[106]. Due to the high electricity consumption of properties using direct electric heating systems, this rebalancing scenario stands to benefit them the greatest. The average annual running cost of a direct electric heating system over its lifetime would decrease by £470, with these households also realising £123 in savings from other electricity usage. Therefore, the exact distributional impacts on fuel poverty are hard to determine as although many households use gas heating, a higher share of electrical heating system consumers are fuel poor.

106 DESNZ (2023) Fuel poverty detailed tables 2023 (2022 data). Table 12. Sample of 21,097 households.

107 DESNZ (2023) Household Energy Efficiency Statistics, headline release September 2023. Latest available data as of October 2023.

108 Used the definition of vulnerable household used for the Government's cost of living support in 2022, equating to 8 million households. Information available here.

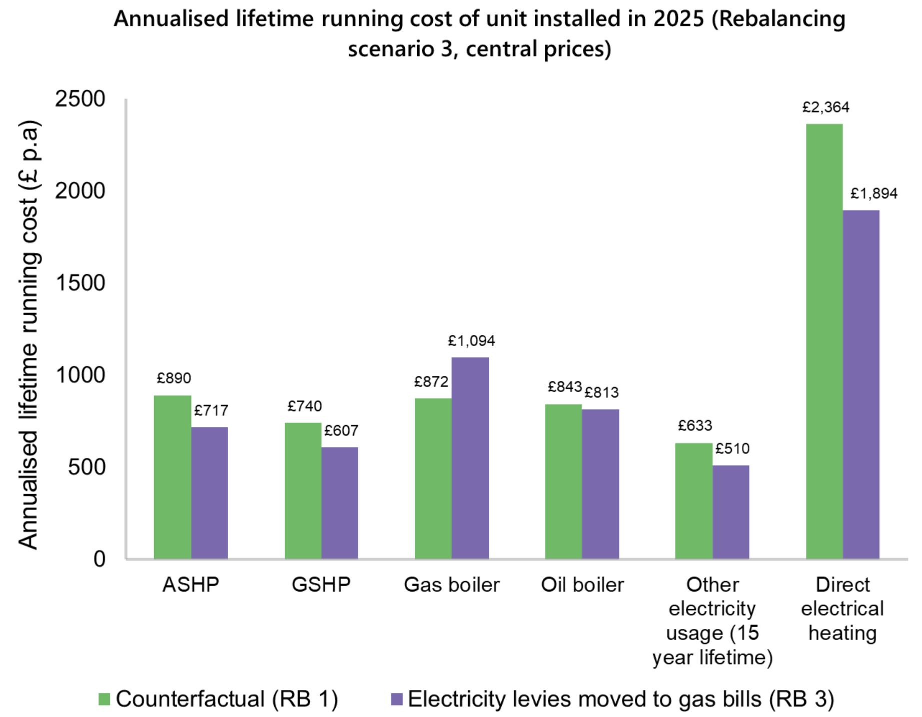


Figure 27 - Annualised lifetime running cost of unit installed in 2025 (Rebalancing scenario 3, central prices)

Rebalancing energy levies in this manner would result in the highest price distortions. By raising the price of gas to facilitate a decrease in the price of electricity, the price signals incentivising the decarbonisation of heat through electrification would be strengthened. Additionally, this would be in line with the "polluter pays principle"[109]. However, as many of the policies currently funded by electricity levies directly benefit the electricity system, such as the CfD scheme funding renewable generation, moving these levies onto gas bills would raise concerns about the fairness of the funding approach. Additionally, raising gas bills is a more regressive form of revenue raising compared to raising income- or wealth-based taxation and could lead to concerns around fuel poverty.

109 DEFRA (2023) Environmental principles policy statement

REBALANCING SCENARIO 4 – HEAT PUMP EXEMPTION FOR ALL LEVIES ON ELECTRICITY BILLS AND MOVED TO GAS BILLS.

Generally, the purpose of rebalancing energy levies would be to improve the price signals in the retail energy market to encourage decarbonisation through the electrification of heat. Therefore, a targeted approach, whereby electricity used for heat via a heat pump is exempt from levies, would achieve this whilst causing limited distortions to the market and a reduced risk of increased fuel poverty. Levies on electricity usage not used for heating with a heat pump would still be levied. A similar system was implemented in Denmark in 2021, where electricity used for space heating via a heat pump was made subject to the minimum allowable tax rate of 0.01p/kWh[110].

The modelling completed has been under the assumption that the funding gap created by exempting heat pumps from levies is filled with a levy adjustment on gas bills. Of course, alternatively, the funding gap could be filled via general taxation, with the exemption funded via a direct subsidy discount to heat pump consumers. However, common across both assumptions is that although, due to low current heat pump deployment, the total exemption would be relatively low to begin with, as more heat pumps are deployed, the funding changes would be more severe. For example, if the exemption were to be implemented in 2023, just £4.20 would have to be added to the average gas bill to fund it. However, assuming high heat pump deployment and phase out of gas boilers[105], by 2030 the exemption would add £47 to the annual gas boiler heating bill. However, if vulnerable households were to be made exempt, the average gas boiler heating bill would increase by £66 in 2030 for the average non-vulnerable household. Between 2025 and 2040, the exemption would create an additional funding requirement of £9 billion, equating to £550 million per year on average. Alternatively, this could be funded via a marginal increase in general taxation, equivalent to an average of 0.19% of income taxation over the period 2025-2040.

Overall, the average annual running cost over the lifetime of an air source heat pump installed in 2025 would decrease by £144, whereas that of a gas boiler would increase by £49, as shown in Figure 28. With the exemption, an air source heat pump would deliver an average of £175 in annual savings compared to a gas boiler and a ground source heat pump would deliver £286 in annual savings. If vulnerable households were to be exempt from additional levies on their gas bills, the average annual running cost over the lifetime of a gas boiler installed in 2025 would increase by £68 for non-vulnerable households.

110 Jan Rosenow, Richard Lowes (2021) Redesigning UK electricity taxes to boost Heat Pump sales

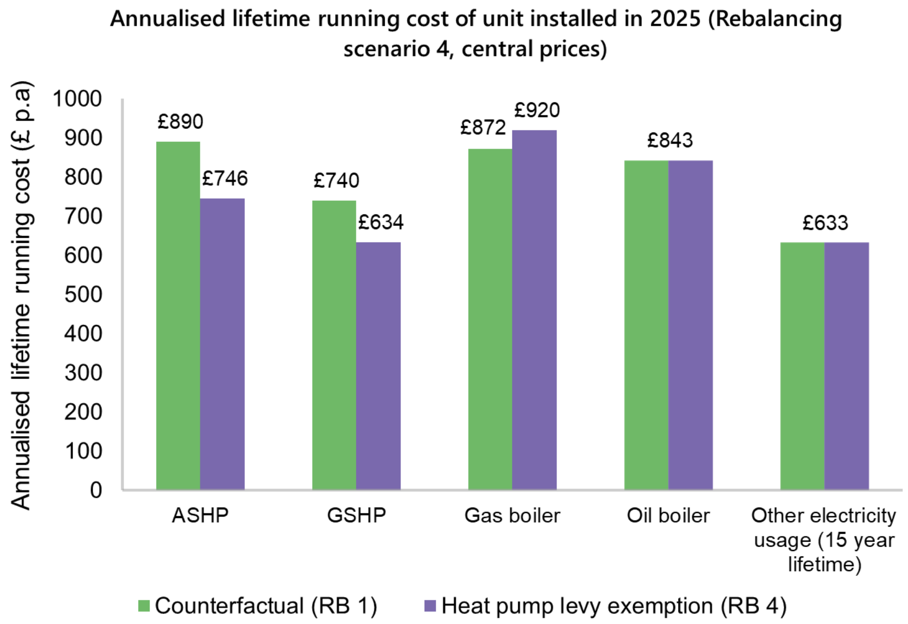


Figure 28 - Annualised lifetime running cost of unit installed in 2025 (Rebalancing scenario 4, central prices)

Implementing such an exemption would be potentially complicated. The exemption could be based on metered heat pump electricity usage or deemed electricity usage, utilising property data and the technical specifications of the heat pump. The pros and cons of these two approaches are described in table 2 within the "Ensuring the tariff is only applied to the appropriate electricity consumption" section.

A targeted approach that focused purely on levies on electricity used for heat via a heat pump would achieve the policy ambition of lowering heat pump running costs, whilst minimising the potential negative externalities of additional levy obligations on gas boiler consumers or additional revenue garnered through general taxation. This approach to removing levy costs from heat pump consumer bills would help to ensure that the lowest carbon heat is the lowest cost heat.

REBALANCING SCENARIO 5 – CARBON BASED LEVY OBLIGATIONS.

The polluter pays principle, part of DEFRA's environmental principles[109], says that, where possible, the costs of pollution[111] should be borne by those causing it, rather than those suffering from the consequences of environmental damage, or wider society. By placing a charge on emissions intensive activities and using the revenue to fund efforts to reduce emissions, policymakers can disincentivise the release of additional emissions whilst funding climate mitigation policies. This principle is commonly used across policy. For example, the UK ETS scheme[74] encourages industrial sites, aviation operators and electricity generators to cut emissions by setting an allowable level of emissions that can be emitted and mandating that participants pay a financial penalty if they do not meet this level. This funding can then be invested into tackling climate change, although some estimates suggest that just 20% of UK ETS revenue is invested into tackling climate change with European countries often better at using revenue from carbon taxing to fund climate mitigation action[112].

When many of these levies were placed onto electricity bills, electricity was far more carbon intensive than it is now, with the phase out of coal powered generation and increased deployment of renewable generation drastically reducing the emissions intensity of the electricity grid since then. Therefore, as historically electricity usage has been more carbon intensive than natural gas, following the polluter pays principle, it has made logical sense to tax electricity usage more heavily and use the revenue to fund climate mitigation policy. For example, when the Feed-in-tariff scheme was launched in 2010, the emissions intensity of electricity was 147% higher than that of natural gas, as shown in Figure 29. Since then, however, the emissions intensity of electricity has fallen by 71% (largely due to policies such as the Feed-in tariff scheme) and is expected to fall further[113]. Similarly, downstream carbon-related taxation of electricity was implemented when electricity was far more carbon intensive, arguably speeding up the decarbonisation of the electricity grid. For example, electricity generators have been taxed on their carbon since 2005 when the first phase of the EU ETS was implemented[114].

111 Pollution is synonymous with environmental damage in this context.

112 New Economics Foundation (2022) UK Govt spending a billion pounds less on cutting domestic emissions than it raises through carbon taxes.

113 DESNZ (2023) Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal. Grid average, consumption-based emissions intensities used.

114 European Commission (2021) Development of EU ETS (2005-2020). Note that the UK used to be part of the EU ETS scheme.

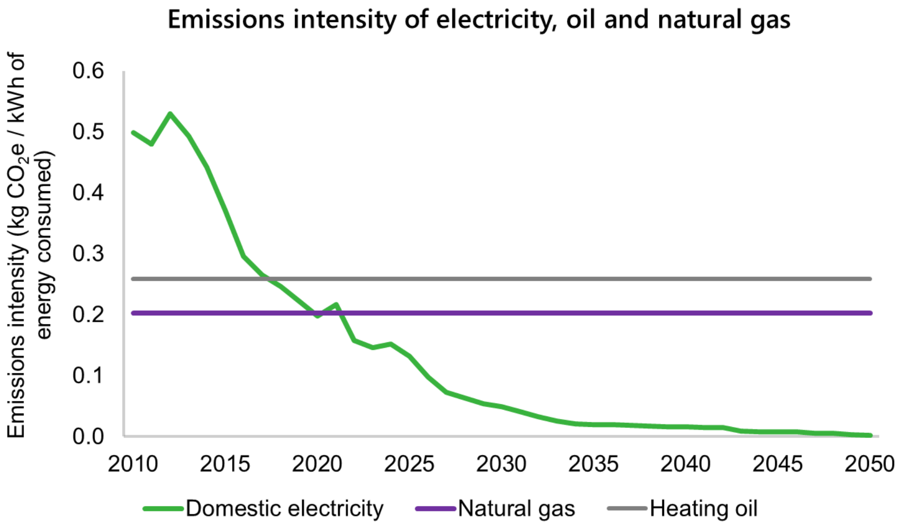


Figure 29 - Emissions intensity of electricity and natural gas[113] [115]

Whilst placing the burden of paying for climate change mitigation on electricity may have made sense historically, as the grid decarbonises, this approach is no longer in line with the polluter pays principle, especially when the electricity is used via a highly efficient heat pump. Therefore, approaches to taxing fuel usage in domestic properties according to emissions are now being discussed. For example, in the EU, an expansion to the current ETS scheme is in development which would account for residential emissions by covering the emissions upstream, and regulating fuel suppliers rather than end-consumers[116].

Rebalancing scenario 5 would be largely similar to what is being proposed in the EU[116], although, this analysis only involves a rebalancing of levies directly on consumer bills, rather than those downstream such as the UK ETS. The levies faced by consumers under this rebalancing scenario would be directly proportional to the emissions as a result of fuel consumption[117]. Only emissions from electricity, oil, and mains natural gas are included in this analysis, accounting for roughly 98% of all properties[118]. As the electricity grid decarbonises, the levy obligation placed on electricity consumption reduces and in turn, the levy obligation placed on the consumption of gas and oil increases. This is compounded by the phase out of fossil fuel heating systems because as more consumers transition to using electrical heating systems, the levy obligation on each consumer of gas and oil increases.

Between 2025 and 2040, £47 billion less in levies would be on electricity bills compared to the counterfactual scenario, owing to the low carbon intensity of electricity in comparison to the high levy costs currently faced by electricity consumers. In the same time period, an additional £43 billion in levies would be faced by gas consumers and an additional £4 billion by consumers of oil.

115 DESNZ (2023) Greenhouse gas reporting: conversion factors 2023. Net CV value used for Natural gas and heating oil. See "burning oil" for heating oil. Scope 1 emissions only.

116 International Carbon Action Partnership (2023) EU Emissions Trading System for buildings and road transport ("EU ETS 2")

117 Scope 1 and 2 emissions. Does not include scope 3 emissions.

118 ONS (2023) Census 2021: how homes are heated in your area. Tank or bottled gas, district heating, solid fuel, and wood only central heating only present in 2.3% of homes in England and Wales.

The impact of this rebalancing scenario on average consumer bills is presented in Figure 30. The largest impact is on oil boilers as consumers go from paying no direct levies on their heating bills to £18/MWh in 2025 due to the high emissions intensity of heating oil. The average annual heating bill for an oil boiler increases by £286, although, this would be partially compensated by a £108 reduction in bills from other electricity usage, resulting in a net energy bill increase of £178. Gas consumers would see their average annual heating bill increase by £184 throughout the boiler's lifetime, a net increase to total annual energy bills of £76. If vulnerable households were to be made exempt from any additional levies on their bills, the average annual running cost of an oil boiler in a non-vulnerable household would increase by £399 (£291 net increase to energy bills when considering reduced electricity costs) and the average running cost of a gas boiler would increase by £257 (£149). Due to the low emissions produced by heat pumps, with this decreasing over time, the total levies faced by heat pump consumers reduce drastically, with a £154 reduction in the annualised running cost of an air source heat pump compared to the counterfactual.

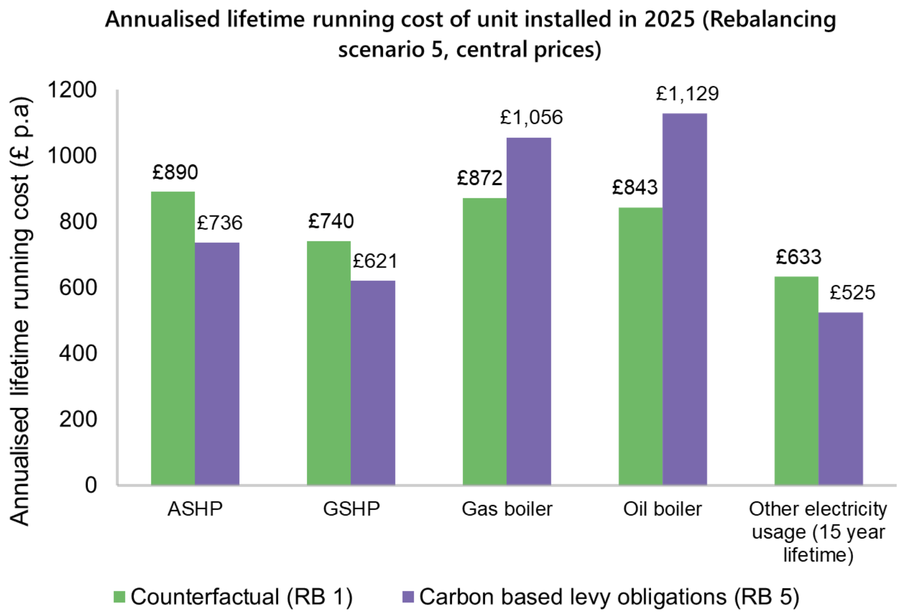


Figure 30 - Annualised lifetime running cost of unit installed in 2025 (Rebalancing scenario 5, central prices)

Shifting levies based on heating emissions would be consistent with the polluter pays principle with the current levy structure being inconsistent with the principle due to higher levies being placed on the least carbon intensive energy, electricity. However, implementation and administration could be difficult, although, lessons could be learnt from a similar proposal in the EU[116]. Additionally, spreading levy obligations to off-grid consumers by taxing the consumption of oil could have negative distributional effects and make enforcement of the system difficult.

REBALANCING SCENARIO 6 – HEAT PUMP EXEMPTION FOR LEVIES TOWARDS THE RENEWABLE OBLIGATION AND FEED-IN TARIFF AND LEVIES PLACED ONTO GAS BILLS.

In this scenario, it is assumed that heat pumps receive an exemption for the Renewable Obligation (RO) and Feed-in Tariff (FiT) levies only, with the funding gap being filled via additional levies on gas bills or general taxation. The RO and FiT levies have been selected as they have been closed[119] to new applicants, meaning that total funding requirements are expected to decrease with time (see Figure 22), and the funding mechanism means that removing these from heat pump bills could be simpler. As these schemes are closed, total funding requirements are expected to reduce over time. Therefore, the increased levy exemption over time caused by the growing deployment of heat pumps will be partially offset by reductions in funding requirements for the schemes that heat pump consumers are made exempt from.

Between 2025 and 2040, this rebalancing approach would result in a total of £2.81 billion being made exempt from heat pump running costs. This could be funded via additional levies on gas bills, non-heat pump electricity usage, or via general taxation. However, the modelled scenario, as presented below, assumes the exemption is funded via gas bills. Figure 31 summarises the effect of this rebalancing scenario on the annualised lifetime running costs of heating systems installed in 2025. The impact is more minor than under the previous scenarios. The average annual running cost of an air source heat pump over its lifetime is decreased by £62, with that of gas boilers increasing by just £13. Oil boilers and electricity usage not for heating is unaffected. Despite the relatively modest swing in running costs, this rebalancing scenario is sufficient to enable air source heat pumps to deliver a slight running cost saving compared to gas boilers of £57. This saving is potentially too low to provide the incentive for consumers to adopt heat pumps on mass, however, insulating early adopters against potential increases to their energy bills is a strong first step.

119 Closed with some minor exceptions.

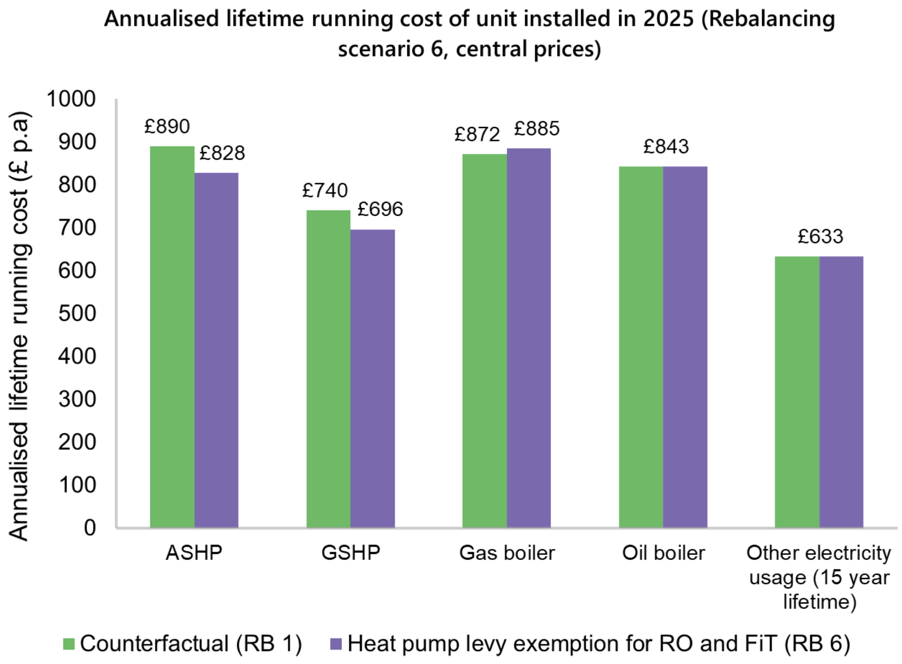


Figure 31 - Annualised lifetime running cost of unit installed in 2025 (Rebalancing scenario 6, central prices)

Rebalancing scenario 6 would be a lighter touch approach to delivering more affordable electricity prices than the other scenarios, limiting large distortions to the market. However, this rebalancing scenario would only go part of the way to tackling the underlying issue, which is that electricity consumers currently carry a disproportionate share of the burden of paying for climate mitigation policy. Therefore, there is a strong argument for a more comprehensive rebalancing of policy costs to send the correct price signals into the heating market and encourage the electrification of heat.

APPENDIX 3 - ENERGY LEVIES CONSIDERED WITHIN ANALYSIS

Table 4 - Summary of levies placed on energy bills (October 2023)

Scheme	Annual cost for average dual fuel household[120]	Scheme description
Renewable Obligation (RO)	£90	The RO placed an annual obligation on electricity suppliers to ensure that a share of the electricity supplied to consumers in the obligation period was from renewable sources. Suppliers could meet their obligation by earning Renewable Obligation Credits (ROCs), either through supplying renewable energy or trading credits with other suppliers, by making a payment into a buy-out-fund or a combination of the two. The RO came into effect in 2002 and closed to new generating capacity in 2017[121]. As contracts with renewable generators were set at a fixed rate for 20 years[122], despite the scheme closing to new generations, the costs are still being recuperated via consumer bills through a charge per unit of electricity used. Therefore, the annual cost of the RO on future bills is expected to tail off over time, but this will counter-balanced by increases expected in costs arising from Contracts for Differences (CFDs) – covered below.
Feed-in Tariff (FIT)	£23	Consumers who installed small scale (up to 5MW) renewable and low-carbon electricity generation technologies, most notably solar photovoltaic panels, could apply for accreditation and suppliers were obligated to make payments on electricity generated or exported by the installations. The scheme was introduced in 2010 and since 2019 has been closed to new applicants, with some exceptions. Contracts are set at periods between 10-25 years and so legacy installations are still being funded through a charge on consumer bills per unit of electricity consumed[123].

120 According to Ofgem fuel demand assumptions for dual fuel household. Inclusive of VAT.

121 Ofgem (2017) Renewables Obligation

122 House of Commons Library (2016) Energy: The Renewables Obligation

123 Ofgem (2021) Feed-in Tariffs

Energy Company Obligation (ECO)	£47	The ECO is an obligation placed on energy suppliers to install energy efficiency measures in select properties designed to tackle fuel poverty and help reduce carbon emissions. Medium and large energy suppliers must promote measures that improve the ability of low-income, fuel-poor and vulnerable households to heat their homes. This can include any measures that lower the energy usage of a household, including insulation and upgraded heating systems[124]. ECO also includes the Great British Insulation Scheme, designed to improve the least energy efficient homes in Great Britain, which focuses mostly on single installations[125]. Suppliers recuperate costs via a charge per unit of gas and electricity consumed by a household, with roughly half of the costs coming from gas and half from electricity.
Warm Homes Discount (WHD)	£22	The WHD is a one-off discount of £150 applied to the electricity bills of eligible vulnerable households during the winter. Some consumers may be eligible for an additional discount off their gas bills[126]. Suppliers recuperate costs by placing a charge on both the gas and electricity standing charges paid by consumers on an annual basis. The charge is equal per electricity and gas consumer.
Assistance for Areas with High Electricity Distribution Costs (AAHEDC)	£1	The scheme recovers costs for the North of Scotland, currently the only area specified to receive assistance, where due to the generation mix, distribution charges are especially high[127]. The costs are placed on consumer bills via a small charge per unit of electricity consumed. These costs are not considered in the latter analysis.
Green Gas Levy (GGL)	<£1	The Green Gas Levy is funded via a charge on gas standing charges and is used to make payments towards the Green Gas Support Scheme (GGSS) participants for the amount of eligible biomethane they inject into the gas grid[128].
Contracts-for-Difference (CfD) payments	£17	The Contracts for Difference (CfD) scheme is now the Government's main mechanism for supporting low-carbon electricity generation. Low carbon generators enter an auction whereby the most competitive bids receive funding per unit of electricity generated over a fixed contract duration[129]. Participants agree on a fixed strike price and are subsidised the difference between the strike price and wholesale electricity price. Since 2022, in times of high wholesale prices, the electricity price faced by consumers can be lowered due to the CfD scheme[130], with average consumer bills being £60 per year lower in April 2023 as a result of the CfD scheme[131]. Since the establishment of the scheme in 2014, the CfD scheme has facilitated the investment into 29.4 GW of renewable energy generation[132]. The costs of these subsidy payments are placed on consumer bills via an adjustment to the wholesale electricity price within the Price Cap.

124 Ofgem (2023) Energy Company Obligation

125 Ofgem (2023) Great British Insulation Scheme

126 HMG (2023) Warm Home Discount Scheme

127 National Grid ESO (2023) Assistance for Areas with High Electricity Distribution Costs

128 Ofgem (2023) Green Gas Support Scheme and Green Gas Levy

129 DESNZ (2023) Contracts for Difference

130 Ofgem (2022) Decision on the Contract for Difference (CfD) allowance methodology in the default tariff cap

131 According to Ofgem Price Cap model, available here. Inclusive VAT.

132 Low Carbon Contracts Company (2023) CONTRACTS FOR DIFFERENCE

APPENDIX 4 - KEY ASSUMPTIONS AND METHODOLOGY

KEY ASSUMPTIONS

Table 5 - Key assumptions and references used in analysis.

Assumption	Source
Discount rate = 7%	University Of Dundee
Retail energy prices (historic and forecasted) (gas, oil, electricity)	DESNZ Green Book (modified according to rebalancing analysis).
Current levy structure	Ofgem
Forecasted levy structure	Office For Budget Responsibility, Gemserv Forecasts
Forecasted energy demand and heating split in Great Britain	National Grid ESO (Predominantly Consumer Transformation Scenario)
Historic and current efficiencies (current: ASHP à 2.8 SPF, GSHP à 3.34 SPF)	EST1, EST2, RHPP, EOH
Forecasted efficiency changes	CCC
Wholesale electricity prices	DESNZ
Archetypal heat demand	NEED (DESNZ)
Heat pump capital cost reductions	DESNZ
Capital costs by unit size	CCC

METHODOLOGY

Levy rebalancing price forecasts methodology

To estimate the future energy levies on consumer bills, first the current levy structure was analysed. Data on the current levies placed onto domestic consumer bills was found in the relevant Ofgem workbooks[133] used for calculating fuel prices under the Price Cap. Complementary data on the current and historic consumption of natural gas and electricity by end use was taken from the Department of Energy Security and Net Zero's annual Energy Trends data[134]. This allowed for the estimation of current funding pots for relevant schemes funded via levies on domestic consumer bills. This was a useful cross reference for future levy forecasts.

For each individual scheme funded via levies on consumer bills, a different approach was taken to forecasting the total funding requirement over time. Where appropriate total funding requirements were scaled down according to projections in future energy usage[135], and the share of non-domestic consumption, which is exempt from levy costs, for example, through the Energy Intensive Industries Exemption[136]. The total funding requirements were then mutualised across the total eligible energy consumption or total eligible consumer base according to the current funding structure and data from the National Grid ESO's Consumer Transformation scenario[137] on future energy consumption. For example, the Energy Company Obligation is funded via a levy per unit of energy consumed and charges are split equally between gas and electricity consumers, so levies were apportioned accordingly. This was used to forecast levy charges per consumer and per unit of energy consumed. More detail on forecast methodologies for each relevant levy cost can be found in table 6.

133 Ofgem (2023) Energy Price Cap (default tariff): 1 October to 31 December 2023. See "Model – Default tariff cap level", "Annex 2 – Wholesale cost allowance methodology", and "Annex 4 – Policy cost allowance methodology".

134 DESNZ (2023) Energy Trends: UK electricity. DESNZ (2023) Energy Trends: UK gas

135 DESNZ (2023) Energy and emissions projections: 2021 to 2040

136 BEIS (2023) Energy Intensive Industries. CCC (2020) Industrial decarbonisation policies for a UK net zero target

137 National Grid ESO (2023) Future Energy Scenarios

Table 6 - Methodology for forecasting by scheme

SCHEME	FORECAST METHODOLOGY
Renewable obligation	The RO scheme is closed and so using the average contract length, the year in which funding requirements for certain capacities of generation could be estimated using historic data on the scheme[138].
Feed-in Tariff	The FiT scheme is closed to new applicants and so a phase out of funding requirements was assumed according to average contract lengths and historical data on Feed-in Tariff contracts[133].
Contracts for Difference	Forecasts for the average weighted strike price and total funded capacities were taken from the Low Carbon Contracts Company[139]. Using forecasted wholesale electricity prices[135], the subsidy per unit of generation could be estimated as well as total funding requirements.
Energy Company Obligation	It was assumed that current funding requirements for the core ECO scheme continued at the current rate, according to data on historic ECO scheme costs[140]. The scheme costs were also adjusted according to the Great British Insulation scheme[141], with estimated total funding requirements divided equally across the scheme's lifetime.
Warm Homes Discount	Current funding requirements were assumed to continue, accounting for inflation and historic data on funding requirements[133].
Green Gas Levy	The scheme was assumed to continue until the financial year 2036/2037 at the current rate.

138 Ofgem (2023) Renewables Obligation (RO) Annual Report: Scheme Year 20 (2021-22)
139 LCCC (2023) Forecast Average Strike Price and Market Price
140 DESNZ (2023) Household Energy Efficiency Statistics, headline release October 2023
141 Free Insulation Scheme (2023) Great British Insulation Scheme

Retail fuel price forecasts

Base price forecasts were taken from DESNZ's Green Book Assumptions[142]. These forecasts were developed according to long run trends in fuel prices. It was therefore assumed that these forecasts did not account for future changes in levy costs on bills. Therefore, the price forecasts were adjusted according to changes in levy costs per unit of energy from the 2023 baseline. For example, if levies on electricity bills decreased by 0.1£/kWh, then an adjustment of -0.1£/kWh was made to the retail price forecast. Standing charges were estimated according to the average historical ratio of unit charges to standing charges from the Ofgem Price Cap methodology[143]. Please note that all prices are real and all financial values are given in 2022 prices. Where required, Government price deflators were used to adjust prices to 2022 values.

Running costs, net present costs and implementation costs

Using the assumptions detailed in table 5, running costs were estimated by year through to 2050. Running costs were combined with an equivalent annualised installation costs to estimate net present costs for each heating system by the year of install. These were then repeated to account for upfront grant support via the Boiler Upgrade Scheme. To estimate the total cost of the proposed **Heat Pump Tariff Discount**, data on future energy consumption from heat pumps was taken from the National Grid ESO's Consumer Transformation scenario. By assuming that all electricity consumed via heat pump received the discount, total costs were estimated. To estimate the potential impact of placing these costs on gas or electricity consumers, costs were mutualised across gas/other electricity usage and multiplied by Ofgem average energy consumption assumptions for a dual fuel household.

142 DESNZ (2023) [Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal]

143 Ofgem (2023) [Energy price cap (default tariff): 1 January to 31 March 2024]

APPENDIX 5 - ADDITIONAL GRAPHS AND FIGURES

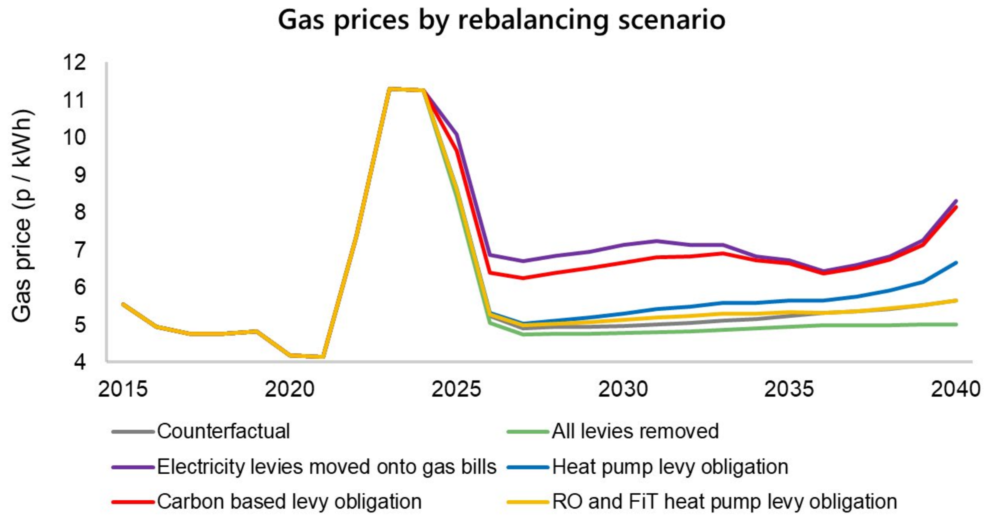


Figure 32 - Domestic retail gas prices by rebalancing scenario

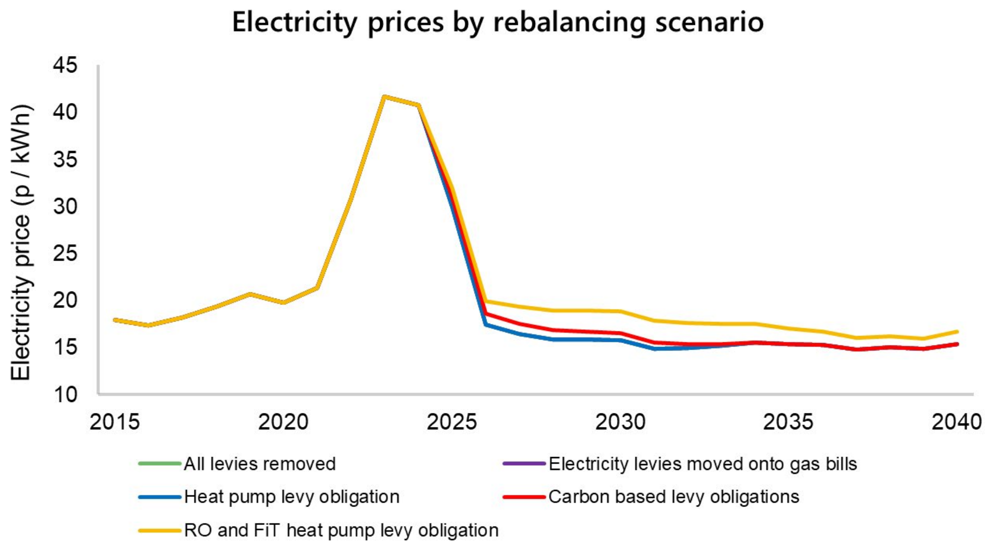


Figure 33 – Domestic retail electricity prices by rebalancing scenario[144]

144 Electricity price for heat pump usage only in scenarios 4 and 6.

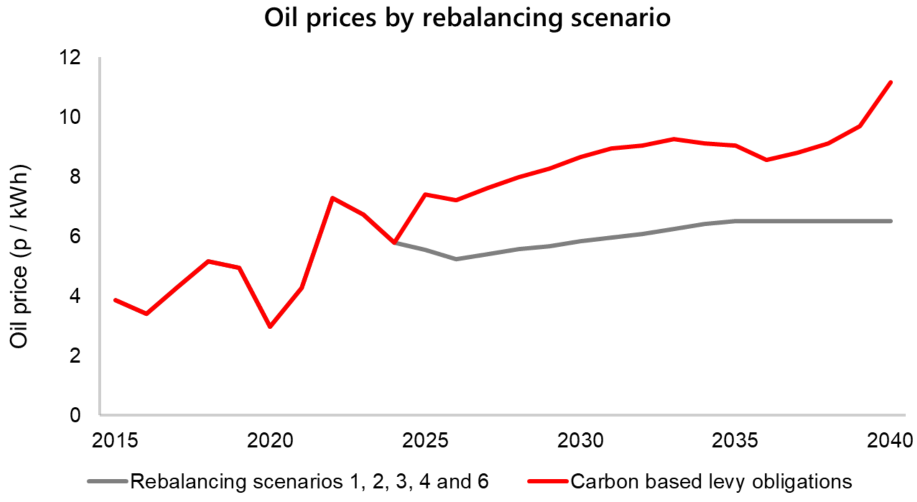


Figure 34 – Domestic retail oil prices by rebalancing scenario[145]

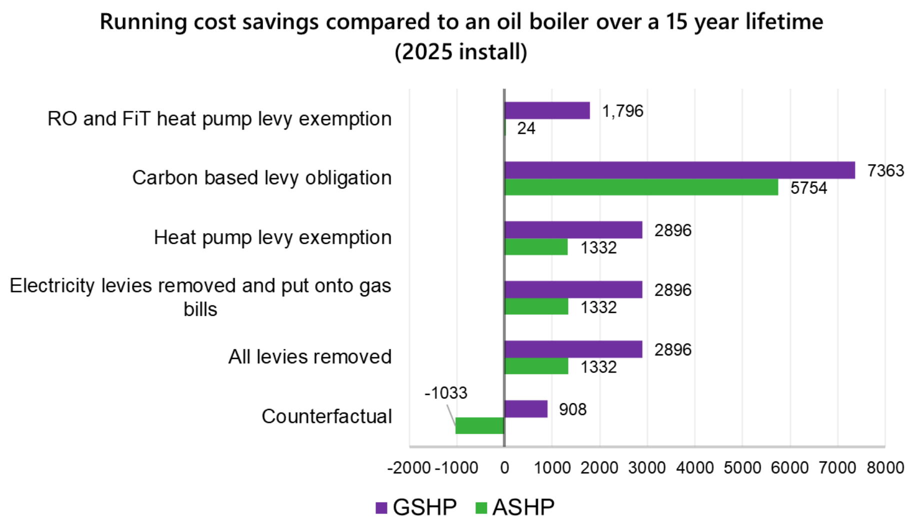


Figure 35 - Running cost savings compared to an oil boiler over a 15-year lifetime (2025 install)

145 Oil price is the same across all rebalancing scenarios apart from where levies are based off emissions.

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16. Please note that the left hand map assumes that the price ratio within Great Britain is similar for the whole of the UK.
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34. By definition, no levies on energy bills.

35. By definition, no levies on all electricity usage.

36. Electricity does not include heat pump electricity usage.

37. Obligations are carbon based so only high emissions fuels will face additional costs. Vulnerable household exemption is therefore illustrative.

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41. Inclusive of heat pumps in new build properties, the rental market and consumers in properties with existing heat pump installation.

42. Note that range is due to uncertainty around the future electricity wholesale price which will determine the total cost of Contracts for Difference payments.

43. Note that this is a conservative estimate as price forecasts are high following the impact of the Energy Crisis.

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144. Electricity price for heat pump usage only in scenarios 4 and 6.

145. Oil price is the same across all rebalancing scenarios apart from where levies are based off emissions.

Disclaimer

This paper was commissioned by the Heat Pump Association. The work was overseen by the Heat Pump Association with analytical, writing and design support from Gemserv Ltd. While Gemserv considers the data and analysis included in this report to be reasonable based on current information, Gemserv offers no warranty or assurance as to accuracy and completeness. Details of the principal sources used are set out within the document.

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