COST OF NOT ZERO IN 2023
Executive summary

Fossil fuels continue to drive climate change and economic damage.

The impacts of climate change continue to be felt around the world, with 2023 confirmed to be the warmest year on record, 1.48°C warmer than the 1850–1900 pre-industrial level. Severe weather has brought floods and droughts, affecting food production including some of the £58bn of food imported to the UK.

The latest energy crisis that started two years ago with Russia’s invasion of Ukraine, continues to linger. Although inflation is now falling, the damage has been largely ‘baked in’, with no prospect of the prices of energy and food falling back to pre-crisis levels in the foreseeable future.

Lower use of fossil fuels would have reduced the extent of climate change and the cost of fossil fuel crises. Britain was the first G7 country to commit to reach net zero emissions and now 91% of global GDP is covered by net zero targets.

But progress has been hindered by policy decisions as far back as 2012 and as recently as 2023. Because successful policies for home insulation and solar were scrapped, and because more ambitious policies for new homes, heat pumps, electric cars and renewables have been delayed, the UK is paying the cost of not zero.

Most households could have received one or more of these net zero upgrades, saving hundreds of pounds a year on energy costs. Some households, if they had all of the applicable technologies, could have saved around £1,850 on energy bills in 2022, and almost £1,900 in 2023, for a total of £3,750 over two years dominated by the gas crisis.¹

Households are facing more than £600 extra in food bills over two years due to the impact of climate change and oil and gas prices on the farming and food sector.

This amounts to a potential £4,350 of costs for some household over two years caused by climate change and the limited roll-out of net zero technologies.

¹ The figure for 2022 has been revised up slightly from our previous report using finalised datasets for that year.
Costs in 2023 from climate change and slow progress to net zero could be adding up to £2,100 to some household’s bills.

Date: 31/12/23

Missed insulation upgrades to average home £235
Still using gas boiler instead of heat pump £245
No solar PV panels on home £615
Still driving a petrol car instead of an EV £700
Use mains electricity with only 40% renewables £105
Fossil fuels & climate impact on food prices £200

Total: £2,100
It’s not just households that pay extra. Government support for energy bills during the energy crisis cost up to £300 more per household in 2023, and £150 more in 2022 compared to if net zero technologies had been more prevalent in the UK.

 Businesses, charities and the public sector are also paying higher bills due to the slow pace of the transition to net zero. But that’s beyond the scope of this report.

Deployment of net zero technologies would have required upfront investment. This investment would have stimulated growth in industries such as building, car manufacture and renewables. And the investment would have already begun to pay off in the form of lower bills, much more so due the gas crisis that caused prices to spike and has left them high for years to come.

Looking at the millions of items of net zero technology that could have been installed in the past decade, the extra costs for households and government were an estimated £56bn over the two years of 2022 and 2023. And with the extra food bill, the total cost of not zero for households and government comes to £73bn over two years.

The cumulative costs mount up even higher when looking back over a decade of slow progress. From the early 2010s to the end of 2023, energy costs for households (including government support in the gas crisis) have been £70bn higher due to the missing net zero technologies. And with extra food costs sitting at £17bn for just two years, and potentially more if earlier years were to be examined, the total cost of not zero since the early 2010s rises to at least £87bn and counting.
Because of the energy price freeze in the first half of 2023, the UK government could also be saving up to £300 per household with earlier investment in energy efficiency heat pumps, and renewables including solar on homes.

Insulation savings are larger for worse performing homes e.g. upgrading a home from EPC band F to C would have taken £500 off household heating bills in 2023, and also added to government savings.
Insulation

Britain has the least efficient homes in western Europe. The UK was on an upward trajectory with upgrading home insulation until 2013 when government support schemes were cut. Since then, insulation rates have been 90% lower than their 2012 peak, and have actually fallen even further during the gas crisis.

The rationale for cutting insulation support was to reduce levies, saving a few percent of total household energy bills. But this was at the cost of far higher savings from energy efficiency.

A home’s energy efficiency is shown on its Energy Performance Certificate (EPC). Currently the average band for UK homes is D.

The government did, until recently, have an ambition for most homes to reach EPC band C by 2035. Progress is being made with social housing. The next step was due to be a deadline for upgrading 2.8 million poor quality private rental homes, but this was postponed indefinitely in the Prime Minister’s net zero U-turn. And there are no sufficient policies in place to help upgrade owner-occupied homes.

Moving from band D to C reduces heating demand by over 20%, jumping from E to C saves over 30%, and the leap from F to C saves almost 40%. And the savings from lower energy use are far higher during the ongoing gas crisis. Band D homes could have saved £320 on their energy in 2023 after an upgrade, band E would have saved £560, and a band F home £680 in 2023.

Three-quarters (74%) of the savings would have been taken off household bills and the rest would be a cut to the government’s spending on the price freeze.

Adding the missed savings from 2022, the costs that insulation could have avoided in the gas crisis to-date are £540 for a band D home and £1,160 for a band F home. A little over three-quarters would have gone to the household, and the rest would have reduced the costs of the government’s support package.

If government policies to support insulation had continued at rates seen in 2012, a million extra homes every year could have each received two insulation upgrades, the key step to reaching EPC band C. That would be 10 million homes since 2013.

If these upgrades had included all of the estimated 4.4 million homes on the least energy efficient ratings of E to G, and the remainder had been EPC band D homes, all reaching band C, the savings for the UK could have been £4.3bn in 2023, on top of £2.8bn in 2022, for a total of £7.1bn in the gas crisis to-date.

Had the insulation push been maintained, the cumulative savings since 2013 to the end of 2023 could have been £12bn.
Heat pumps

Heating accounts for around 14% of the UK’s greenhouse gas emissions, and heat pumps will be the likely route to decarbonising people’s homes. As they run on electricity rather than gas, they have far lower emissions and will be zero emissions once the power grid becomes net zero.

The UK government’s target is to install 600,000 heat pumps a year by 2026. The Boiler Upgrade Scheme was launched in 2022, with grants towards air source and ground source heat pumps. The scheme was expected to fund just 90,000 installations until it ends in March 2025. But, in October 2023, the government increased the grant to £7,500, but did not increase the overall funding so there will be fewer installations.

Replacing a gas boiler with a heat pump eradicates all gas costs, including the standing charge of around £100 a year. The standing charge is the fixed daily amount households pay for energy, no matter how much they use. Heat pumps run on electricity, which costs more per unit, but they are typically at least three times more efficient. This means the total cost of heating can be lower.

Heat pumps can be installed in most types of homes. For a home that had already been upgraded with insulation to EPC band C, a heat pump could have cut its heating costs by a further £145 in 2022 and £245 in 2023.

The government set a target in 2021 to ramp up heat pump installation rates from around 60,000 per year to 600,000 per year by 2026. Had that target been set in 2016, when the government had also been expected to push for heat pumps in new-build homes (see below), installations rates could have reached 600,000 in 2021, and there would have been 2.1 million additional heat pumps in operation in existing homes in 2022, saving over £300million that year. Had installation rates carried on rising to exceed 700,000 in 2022, there would have been around 2.8million additional heat pumps in operation in existing homes in 2023, saving almost £700million that year.

Of the money saved by heat pumps over the two years of the gas crisis to-date, almost all would have been taken directly off household bills as opposed to the government's price freeze.

Had net zero heating policies been introduced earlier, the cumulative savings from a more rapid uptake of heat pumps could have exceeded £1bn by the end of 2023.
Solar PV

Rooftop solar panels capture the sun's energy and convert it into power to use on household appliances or direct back into the national grid. They are currently installed on 1.25 million UK homes.

A large proportion of these homes had their panels installed under feed in tariffs (FiTs), a system designed to support renewables by guaranteeing an above market price for producers. FiTs were hugely popular, but tariffs were reduced in 2013 and closed to new joiners in 2019. Solar panels have fallen in cost so the economics have changed, so support could have been phased down rather than being abruptly curtailed.

Solar panels are generally rated at 3kW power. Over the course of a year, this would create enough energy to power a home. But not all of that energy can be used in that home, it is usually about half.

A home getting half of its power from its own solar panels would have avoided buying £480 worth of electricity from the grid in 2022, and £640 in 2023. Exporting the other 50% of the solar generation to the grid would raise a payment at a lower unit rate of £120 in 2022, and £160 in 2023. Of the £600 total saving in 2022, £510 would have gone to the household, and of the £800 saved in 2023, the household would have seen an almost £615 bill reduction. The government would have saved the rest: £90 in 2022, and almost £190 in 2023.

One million UK homes have solar panels installed. Their total savings will have been almost £600 million in 2022 and £800 million in 2023.

Installation rates from 2011 to 2021 averaged 7,300 a month, according to government figures. Within this period, rates were higher in the earlier years, but fell to an average of around 3,000 per month for the six years of 2016 to 2021, with only a small drop during the pandemic. After the start of the gas crisis, installation rates tripled to an average of around 10,000 per month during 2022 and 2023. But the highest installation rates were found in November 2011, with 55,000 homes putting solar panels up. This was seven and a half times the average monthly rate for 2011 to 2021.

Had the monthly maximum rate had been achieved maintained after 2011, almost 600,000 extra homes would have received solar panels each year. Around 6million more homes would have had with solar panels in 2022, about a quarter of all households, saving the UK a further £3.5bn that year.

Had the installation rate continued, then over 6million homes would have had solar panels in 2023, and the UK would have saved a total of £5.1bn. Had net zero policies been stronger for longer, the cumulative savings from household solar panels could have reached almost £17bn by the end of 2023. And whilst these savings might have been affected by the impact of the larger amounts of solar generation on electricity markets, they would still have been significant.
New-build homes are expected to meet standards of energy efficiency or greenhouse gas emissions. ‘Fabric energy efficiency’ describes how well new buildings retain warmth and the power required to heat them. But these standards have not kept pace with leading practice for energy performance. Instead, new homes have continued to be built to poor standards, albeit with some slight differences between England, Wales, Scotland and Northern Ireland. And there are only limited inspections to determine whether even those lower standards are being met.

The Zero Carbon Homes (ZCH) standard was expected to be adopted in 2016 but was scrapped. A representative of a major housebuilder told a Commons Select Committee they campaigned against it. The Future Homes Standard has suffered years of slow consultation: it was meant to start in 2023, but has now been put back to 2025.

A long-awaited consultation was issued in December 2023, which finally confirmed the government’s position that all new homes in England should be ‘net zero ready’ by 2025. This includes the requirement that all new homes should use heat pumps and should therefore not have gas boilers nor ‘hydrogen-ready’ boilers. This move despite a major housebuilder lobbying against it during consultation.

However, from 2016 to 2025, newbuilds will have been allowed to have gas boilers. One improvement has occurred. An uplift in fabric energy efficiency standards introduced in 2022 roughly equates to the basic level of performance that would’ve been required by the ZCH standard in 2016, but six years late. But new homes still use 150% more heat than the ZCH advanced performance, which will eventually be required, nine years late, when the FHS targets come into force in 2025.

Comparing a new home built to current practice and with the higher energy performance, if they both used a gas boiler then the higher standard would have cut heating costs by £300 in 2022 (£250 for the household and £50 for government) and by £425 in 2023 (over £315 for the household and £110 for government). If the home with higher energy efficiency standards had also included a heat pump, then it would have cut heating costs by £430 in 2022 (£370 a home and £60 for the government), and by £600 in 2023 (almost £480 for the household and £120 for the government).

An average of around 200,000 new homes were built each year from 2016 onwards, that’s a total of 1.2 million by the start of 2022 and 1.4 million by the start of 2023. If, as planned, the ZCH basic standard had been adopted in 2016, then 600,000 new homes would have had that improved energy efficiency, and then the ZCH advanced standard been introduced in 2019 for all further new homes, and if all of the homes included heat pumps:

- In 2022, £450 million would have been saved (£390 million for households and £60 million for the government).
- In 2023, £750 million would have been saved (£600 million for households and £150 million for the government).

Had new home net zero policies been introduced earlier, as originally planned, the cumulative savings could have been £1.7bn by the end of 2023.

These savings require upfront investment of an extra few percent of the building costs. The price of a new-build home is not simply the sum of its parts, but rather it is also affected by land prices and the local market for existing homes, and major housebuilders make around £60,000 profit (20%) per new home.
To promote renewables deployment, the government introduced Contracts for Difference (CfDs), which guarantee a fixed price per unit of low-carbon power generation. Projects compete against each other in auctions to secure a fixed electricity price for their generation. These contracts have been the main route to market for renewable generators since 2016.

CfDs provide stable income for renewable power and hence lower financing costs that result in lower costs for customers. It was hoped these contracts would lower bills in the future, but have already done so during the gas crisis, paying back £660 million over 12 months. Renewables also bring down the high wholesale prices for energy by reducing the number of times when the most expensive gas power plants that set the price for many of the other generators in the market.

The government has targets of 50 gigawatts (GW) of offshore wind by 2030 and 70GW of solar power generated by 2035. It was said around the 2022 Energy Security Strategy that the government considered a target of 45GW of onshore wind by 2035.

But a series of government decisions put up hurdles for renewable infrastructure. The ban on onshore wind in England and the exclusion of onshore wind and solar from two rounds of CfD auctions have led to stalling deployment.

But had the government moved faster with CfDs, there would be greater power generation from renewables, and this would have further eased the high energy bills of homes across the country. CfD renewables could have saved Britain £6.6 billion in 2022 on top of the savings noted above. That's an extra £75 per home (£65 for the household and £10 for the Government). In 2023, there would have been even more renewable capacity, but lower wholesale prices would have meant that they were earning less and hence paying back less via CfDs: £3.6bn overall, and £40 per home (£30 for the household and £10 for the government).

This faster transition to renewables could have enabled power generators to reach milestones sooner for improved performance and lower costs, potentially saving an extra £17bn or £190 per home in 2022, (£160 for the household and £30 for the government). In 2023, the extra savings could have been £13bn overall, and £140 per home (£105 for the household and £35 for the government).

And had these renewables already been in place, the UK would have locked in their benefits ahead of the supply chain inflation that is raising the costs of projects worldwide. That said, new renewables will still be competitive with other forms of generation, and crucially will cut the UK's reliance on gas imports and exposure to volatile gas prices on international markets. And whilst the government's failure to secure new offshore wind capacity in 2023 auction was a potential setback, there is an opportunity to regain the initiative with the next auction completing in 2024.

**Had net zero policies been applied more consistently for renewables, cumulative savings for the UK could have reached £20bn by the end of 2023.** And whilst these savings might have been affected by the larger amounts of renewable generation on electricity markets, they would still have been considerable.
Cars

Norway is leading the world in the transition to battery electric vehicles (BEVs), with these models making up 3% of new car sales as early as 2012 and reaching almost 80% as of September 2022.

In the UK, whilst BEV sales are towards the front of the pack of major economies, it lags a long way behind the likes of Norway. The ZEV Mandate coming into force in 2024 will help to boost sales, bringing benefits to more drivers including through the second-hand market to make the savings accessible to more households.

The total costs of ownership of a BEV over the course of its lifetime are already lower than an equivalent petrol car, due largely to lower energy costs for BEVs.

BEV energy costs are currently at least three times cheaper than fuel costs for their petrol equivalents, despite electricity prices being elevated due to the gas crisis. This energy price differential has been as high as 7–9 times in the mid-2010s before the gas crisis, and is forecast to reach 5–6 times by 2030 as electricity prices fall and petrol prices mostly likely continue on their historical upward trend.

Looking at mid-sized cars that broadly present the UK car fleet, the average saving from a BEV compared to a petrol car was around £850 in 2022, and £700 in 2023.

There were almost 400,000 BEVs on the road at the start of 2022, saving over £300 million on energy costs that year. By the start of 2023, there were 620,000 BEVs, saving over £400 million over twelve months.

But the 620,000 BEVs at the start of 2023 made up just 1.8% of the UK’s total car fleet of 35 million, a share that is just one-tenth that seen in Norway. Had the UK incentivised BEV uptake in a similar way to Norway, there would have been a further 5 million BEVs on the roads at the start of 2022, rising to 6 million by the end of that year, saving over £4 billion extra in 2023. By the end of 2023, there were around 950,000 BEVs on UK roads, set to save money in 2024. And these numbers will continue to grow, in part due to the ZEV Mandate.

Had net zero policies been accelerated earlier, the cumulative extra savings from BEVs could have reached £19bn by the end of 2023. Whist this might have been affected if taxation was adjusted to account for the fall in petrol consumption and hence fuel duty for the Treasury, the savings would still have been considerable.

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2 The BEV cost saving for 2022 has been updated since the 2022 version of this report to reflect new data: annual mileage rebounded further than expected after the pandemic; and revised information about charging behaviour is available, albeit that the vast majority of charging is done at home on cheaper off-peak rates.

3 BEV savings in this report are different to those cited in some other ECIU analysis. This report’s scenario envisages earlier adoption of BEVs, in which case there would currently be more BEVs across the market segments, such that the average BEV would now be similar to the average petrol car in today’s fleet. Other ECIU analysis (e.g. ‘petrol premium’) considers the current UK car fleet, in which BEVs are more common in the larger car market segments, which have higher energy demand and hence larger energy cost savings.

4 There might have been a contribution from government under the price freeze, for home charging only. The amount can’t be stated precisely due to uncertainty about whether/how suppliers modified their home EV tariffs, but an estimate suggests that it might have boosted a household’s savings by a few percent.
Global food supplies have been hit by droughts, floods, the war on Ukraine and extreme temperatures in 2022 and 2023.

In mid-2022, food inflation was recorded at 12.7% and is second only to fuel bills in the rising cost of living faced by UK households. Analysis for ECIU found that climate change and use of fossil fuels in food production and supply chains accounted for 88% of that food price inflation.

This added £400 to the average annual food shopping bill in 2022. Overall, this translated into £11.4 billion being added to household food costs by climate change and fossil fuels in 2022. This could have been reduced with a shift away from oil and gas in food production and supply chains.

In 2023, extreme weather continued to be an important driver with global temperatures in 2023 exceeding previous records. This rise in global temperatures – with resultant droughts, flooding, lower yields – directly affects global agricultural production. Fossil fuels played a smaller part, having fallen albeit remaining elevated compared to before the crisis.

Further analysis for ECIU examined these impacts on food bills for 2023, and found that the overall impact was almost £200 for the annual average household food bill, or £5.5bn for all UK households in 2023.

Over these two years, British households are likely to have paid an extra £600 for food on average due to climate change impacts and historically high oil, gas and fertiliser prices.

In total since the end of 2021, around £17 billion has been added to the nation’s household food bill by these two factors alone, and the Bank of England Governor has warned of ongoing climate risks for food price inflation.
Methodology

This analysis presents some of the key costs of climate change and slow progress towards net zero, but it is not an exhaustive list. The actual costs to households are higher, for example due to costs in supply chains that companies pass through to customers.

Note that, since the report on the Cost of Not Zero in 2022, some refinements have been made to parts of the methodology, and some input assumptions for the end of 2022 have been replaced with confirmed data for that period. Some results have shifted slightly, but not so as to materially affect the conclusions for 2022 (indeed, the maximum savings in 2022 for a household that had all of the applicable net zero technologies have risen slightly in this new report, serving to reinforce the conclusions of the previous report).

Savings from each technology in any given year were calculated as the product of:
- savings per item based on energy prices in that year;
- number of items deployed before that year.

Savings per item of net zero technology were calculated using the following data:
- Annual household electricity demand and gas demand (and by proxy, heat demand) by EPC band, as per NEED tables 27 and 28 (BEIS, 2021)
- Insulation benefits for existing homes were calculated using the differences between median gas demand for different EPC bands.
- Weighting of household gas demand: Q1 42.2%, Q2 16.4%, Q3 7.6%, Q4 33.7%.
- Weighting of electricity demand: Q1 28.5%, Q2 22.1%, Q3 21.2%, Q4 28.2%.
- Unit prices for gas and electricity are taken from Ofgem’s price cap models. For Q4 2022 and Q1&2 2023, these are split between the household and the government as per the Energy Price Guarantee.
- A heat pump can be installed in most homes but was modelled in a band C existing home to illustrate the scenario of also upgrading insulation to that level. Efficiencies were: 85% for gas boiler; and COP of 3.5 for heat pump.
- For new-build homes, the ZCH specified heat demand, whereas the 2022 Uplift and the FHS instead specify carbon targets. Modelling by industry experts allows comparison on the basis of specific energy demand: 40-45kWh/m² per year for ZCH basic level and 2022 Uplift; 25kWh/m² per year for ZCH advanced level and FHS. Standards in force from 2014 to 2021 required 55-60kWh/m² per year, but actual performance is estimated at 64kWh/m² per year. The leading practice of Passivhaus requires 15kWh/m² per year.
- CfD savings were calculated on a national basis (see below), and then split amongst eligible UK demand (as per Ofgem’s price cap model) to get a value in £/MWh and then multiplied by TDCV demand to get the value per home. This is an update on the method used in the 2022 report, to more closely follow the method in Ofgem’s price cap model, hence a slightly different result for 2022.
- Household solar PV panels are taken to have a power rating of 3kW and load factor of 11%, giving annual output that happens to match typical household demand. However, it is assumed that the household can use only half, and hence reduce its imports by half, and that half is exported. Export unit rates are based on current competitive offerings, typically 25% of the import tariff.
For car costs, average car mileage was used, based on Government data: this includes updating the 2022 value from 5,300 miles per year used in the 2022 report to 6,600 miles in this new report, hence different savings for 2022 in the two reports. Mileage is assumed to be evenly distributed between quarters, so the unit price for the year is a simple average of the quarterly prices. This unit price is then modified to reflect different charging prices, and total costs are determined based on typical charging behaviour: 75% home night, 5% home day and 20% public (an update since the previous report, but with little impact on the results). Energy demand per mile was taken to be 8.8 miles/litre for petrol cars and 0.24 kWh/mile for BEVs, chosen as representative of a fleet with the size distribution of today’s UK car fleet, so as to model the situation in which faster BEV uptake had already led to widespread adoption across car sizes (as opposed to other ECIU analysis that tends to consider BEV uptake under current circumstances and hence with greater weighting towards larger sizes with higher cost savings).

Food price rises were taken from previous analysis for ECIU: Climate, fossil fuels and UK food prices (ECIU, 2023).

The numbers of items (not) deployed each year were calculated as follows:

- Insulation deployment was modelled using 2012 installation rates, such that 1 million homes would have been upgraded to EPC band C each year from 2013 onwards, as per previous ECIU analysis: Insulation and gas prices (ECIU, 2022). This was extended to reach a total of 10 million homes before 2023.
- Heat pump deployment was modelled based on the government’s current five-year trajectory (target set in 2021 to increase installation rates from 60,000 per year in 2021 to 600,000 per year by 2026), but implemented five years earlier, from 2016 (the date when heat pumps were expected to become common in new-builds, until the ZCH was scrapped).
- New-build benefits were modelled on the basis of an average of 200,000 homes built per year. Standards were based on the current situation of the 2022 Uplift followed three years later by the FHS in 2025, but instead with the ZCH being introduced in 2016 as planned (with its basic insulation level and a requirement for heat pumps), and then improved in 2019 (to its advanced insulation with heat pumps).
- CfDs were modelled on the basis of stated government targets (50GW offshore wind by 2030, 70GW solar by 2035) and a mooted target (45GW onshore wind by 2035), but as if these targets had been set earlier and steady progress made such that capacities rose linearly from initial levels (achieved via RO and FiTs) in 2016 towards the targets. Changes in load factors and strike prices were assumed to take place in the same years as seen in the historical deployment. The model was then re-run with changes in load factors and strike prices occurring at the capacity milestones at which they occurred in reality but hence in earlier years in this scenario.
- Solar deployment used the maximum monthly installation rate from that period (55,300 in November 2011) for every month of the 11 years from 2011 to 2021. That fact that the highest rate occurred in November 2011 suggests that a) winter is not an impediment and so installation rates can be high year-round, and b) the industry was geared up by 2011 and so rates could have been high since then.
- Electric car uptake was modelled using market share of new car sales in Norway, starting at 1% in 2010 and reaching almost 80% in 2022.