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Policy Brief

Paying for net zero: can we find a way that is more equitable and less costly to the economy than placing the burden on electricity bills?

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Summary

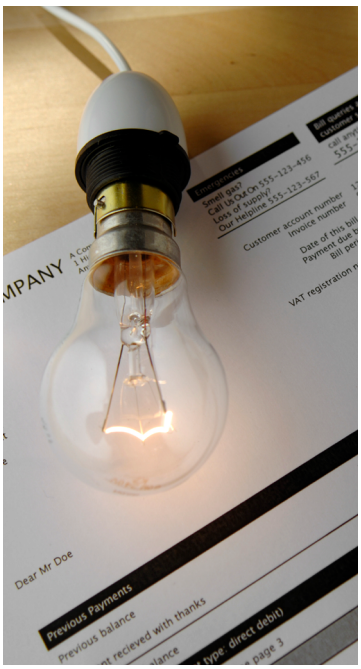
A central concern in debates on delivering net zero is how the costs are distributed. A key issue is the burden on UK households and businesses where costs are borne through electricity bills, which raises two specific concerns: (a) the regressive impact on lower-income households, and (b) higher business costs that further intensify cost-of-living pressures.

Here we use economy-wide scenario simulation modelling to consider the impacts of recovering green costs from UK households in different ways. At this stage, we deliberately abstract from how funded actions might support economic expansion, focusing instead on how introducing additional green costs affects distributional and economy-wide outcomes depending on who bears the cost. We test three 'who pays' options for the introduction of an illustrative additional green cost: (a) electricity bills, (b) consumption taxes (e.g., VAT), and (c) income tax.

Our central finding is that recovering green costs through electricity bills produces the least favourable and most regressive economy-wide outcomes. Crucially, our results show that adding further green costs to bills will trigger a sustained increase in the user price of electricity. This will not only damage system wide decarbonisation activity and energy security by disincentivising the uptake of decarbonisation solutions in private transportation, residential heating, and industry, but exacerbate energy cost driven price pressures across the economy.

Recovering green costs through taxation (on income or consumption) limits further electricity price pressure and other negative effects across the economy and income groups. However, the precise impacts depend on workers' ability or willingness to maintain real incomes amid wider economic change.

A consumption tax approach is likely to be less regressive and less damaging to the economy than levies on energy bills.



In terms of activity and distributional impacts across the economy, the **three key underlying findings** are as follows:

1. Placing the burden on electricity bills is both regressive and economically dampening. It hits lower-income households hardest, reducing real spending power as businesses pass on substantially higher electricity costs, while also curbing wider economic activity and employment across sectors.

Hits lower-income households hardest

Businesses pass on high energy costs

2. Broadening the burden across household consumption is less regressive and protects business competitiveness. Spreading costs through measures such as higher VAT is less damaging to lower-income households than targeting essentials like energy and limits business impacts by reducing consumer demand rather than increasing production costs.

Less damaging to lower-income households

Limits business impacts

3. Shifting the burden to income tax is more progressive, but its impact on UK businesses depends on wage bargaining responses. If workers seek to maintain real take-home wage rates, part of the tax burden shifts to employers and ultimately to consumers through higher prices, further intensifying real wage pressures.

Impact depends on wage bargaining responses

Burden shifts to employers & consumers

The remainder of this brief explains these findings in more detail, drawing on an illustrative analysis of a £10 billion green cost burden introduced gradually over five years to 2030, while noting that the key findings are not sensitive to the assumed scale of this burden. We also note that future analyses can take account of how the actions funded will affect the wider economic picture, with the cost-focussed analysis providing a crucial baseline for such investigations.

About the authors

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Our approach

CEP routinely uses economy-wide computable general equilibrium (CGE) scenario simulation modelling to investigate the distributional and macroeconomic impacts of funding different low carbon solutions and net zero pathways. We typically incorporate consideration of the implications of who pays and when[i] into investigations of how actions are funded - such as industrial carbon capture and storage[ii], residential retrofitting[iii], heat pump deployment[iv], and/or electricity network upgrades[v] - may impact across the wider economy. This includes explaining and quantifying a range of impacts at macroeconomic, market, sectoral and household levels, with attention to the interaction of both activity and price effects, including those driven by the costs incurred and who directly and/or indirectly bears them.

In the current work, we focus in on this latter issue. Here we use our CGE model of the UK economy, UKENVI[vi], to consider the economy-wide and distributional impacts of introducing an illustrative £10 billion additional green cost burden (introduced over 5 years from 2026 to 2030) under different scenarios regarding how the direct burden is distributed.[vii] We focus on alternative assumptions regarding labour market responses, where wage bargaining behaviour has marked quantitative and qualitative impacts on the wider economic outcomes observed. On the other hand, the qualitative findings have been found robust to the assumed scale of the additional green cost burden.

However, in contrast to the examples of previous research listed above, at this stage we deliberately abstract from any consideration of how actions funded may support economic expansion to investigate ***how the introduction of additional green costs is likely to have different distributional and economy-wide outcomes depending on how the direct cost burden is allocated***. Here, we consider three options for how the direct cost burden may fall, involving increasing (a) 'green costs' in electricity bills; (b) consumption taxes (e.g., VAT); (c) income tax.

Key findings

Our results confirm that recovering green costs through electricity bills (Option A) produces the least favourable and most regressive economy-wide outcomes. Transferring the burden to consumption tax (Option B) or income tax (Option C) limits negative effects across the economy and income groups. However, the precise impacts depend on workers' ability or willingness to maintain real incomes amid wider economic change.

There are three key underlying findings which we now set out in turn.

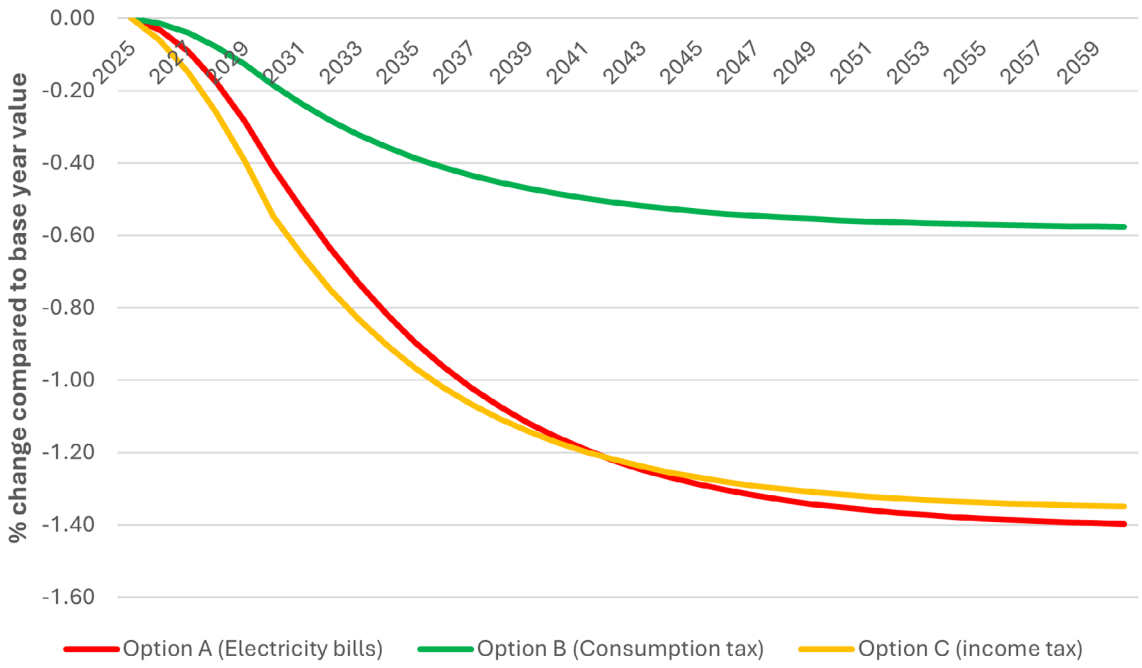
Key Finding 1: Placing the burden on electricity bills is both regressive and economically dampening.

This approach hits lower-income households hardest, reducing real spending power as businesses pass on substantially higher electricity costs, while also curbing wider economic activity and employment across sectors.

Figure 1 illustrates the impacts on the UK GDP trajectory of introducing the illustrative £10 billion additional green cost burden under the three different 'who pays' cases under our central case scenario assumptions. This involves assuming that wage bargaining in the UK labour market means that workers have the power to act to maintain the real value of their take home wage rate. Note that in the absence of any consideration of how the actions funded may support some degree of expansionary activity across the economy, introducing additional costs will always have a dampening effect. However, the drivers are different in each of the three 'who pays' cases.

If we focus first on the case of recovering green costs through electricity bills (coloured red in **Figure 1**), here the drivers of declining activity are two-fold. First, green cost levies on electricity bills make this a more expensive production input for businesses and consumption item for households. However, these two outcomes are linked. When businesses face higher electricity bills, just like any increase in production costs, they will increase the price of what they produce if they can. Thus, higher energy costs for businesses are likely to be passed on, to some extent, downstream to other producers and, ultimately, to end consumers, via impacts on the cost-of-living, as reflected in the consumer price index (CPI - see **Figure 2**).

Figure 1: GDP impacts of allocating an illustrative £10billion green cost burden in different ways
(labour market bargaining maintains real value of take home wages)

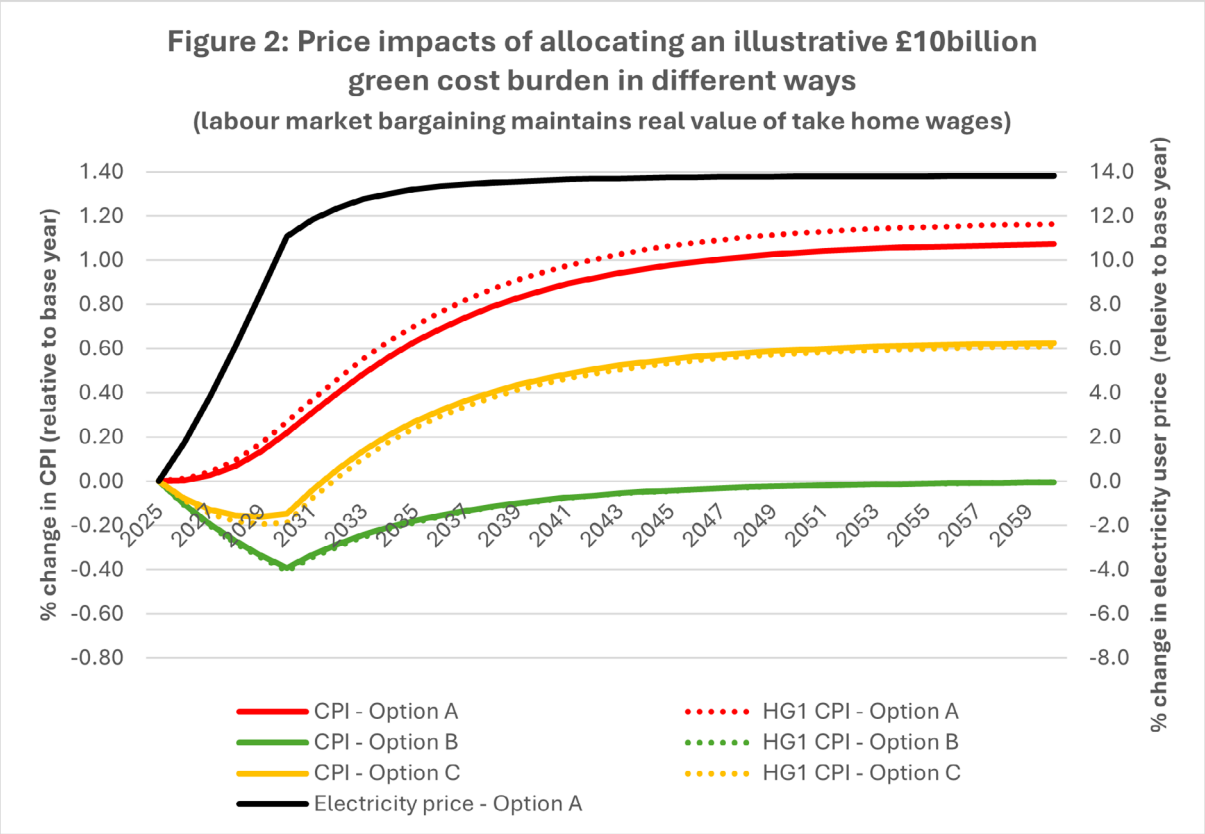


In our scenario simulations, the impact of higher energy costs to businesses negatively affects the demand both within the UK and in international markets. Moreover, UK consumers might opt to use less expensive, imported, alternatives so that there is a negative trade effect. In international markets, higher prices lead potential buyers to seek for businesses in other countries that can provide the same goods and services at a lower cost.

Together, the negative activity impacts of UK business becoming less competitive and UK households facing both higher electricity bills and a hike in the wider CPI (see **Figure 2**) contribute to the economy slowing down as shown in **Figure 1**. Moreover, this gives rise to, and interacts with, the second driver of the decline in overall activity. This is the associated contraction in employment, the main source of income to most UK households, which acts to further reduce the spending power of households and overall level of household consumption.

Crucially, placing the green cost burden on electricity bills also has a regressive impact particularly in terms of how the cost of living of the different income quintiles is affected. This is reflected in how the CPI increase for the lowest household income quintile (Household Group 1, HG1) has a higher trajectory that that of the overall CPI in **Figure 2**. This is indicative of a recovery approach that disproportionately affects those less equipped to absorb any increases in the cost of living. **Figure 2** also shows that the overall CPI

impact is higher than under the other two cost recovery options, due to how the higher price of electricity feeds through complex supply chains to the price of all goods and services.



Beside the regressive nature of recovering green costs via the electricity bills, the surge in the electricity prices (also reported in **Figure 2** for this case, Option A) is challenging in terms of delivering on other UK Government priorities for both energy security and decarbonisation, both of which require a shift away from imported fossil fuels and greater reliance on electrified solution. For instance, the British Industrial Competitiveness Scheme (BICS) in the June 2025 industrial strategy statement calls for a reduction of the electricity cost for certain fundamental industries. Similarly, current government policy relies on electric heating, mainly heat pumps, to decarbonise residential properties, and electric vehicles to decarbonise private transport. In all these cases, the type of rise in the UK electricity price (up to 14% by the mid- to late-2030s) shown for Option A in **Figure 2** reflects how green cost recovery through electricity bills is likely to cause sustained harm to system-wide decarbonisation activity and energy security efforts.

Key Finding 2: Broadening the burden across household consumption is less regressive and protects business competitiveness.

Spreading costs through measures such as higher VAT is less damaging to lower-income households than targeting essentials like energy and limits business impacts by reducing consumer demand rather than increasing production costs.

Raising consumption taxes (Option B) to cover green costs is in some ways equivalent to introducing some restriction on households' disposable income, as the tax directly reduces the purchasing power of salaries and other sources of income. This negatively affects the level of activity across the economy, leading to reduced GDP as can be seen in **Figure 1**.

However, an increase in a consumption tax like VAT only directly affects final consumers, such as households. Crucially, as shown for Option B in **Figure 2**, our scenario simulations indicate that recovering green costs through consumption taxes does not drive an increase in the CPI. Moreover, there is a temporary reduction of the consumer price level as total household consumption demand declines due to the higher tax thereon. The implication is that the competitiveness of UK businesses is maintained (and, indeed, slightly improves for some time), allowing firms to maintain and/or even potentially expand their share in domestic and international markets. In short, one of the drivers of the negative GDP impacts triggered by Option A (electricity bill recovery), is no longer present under Option B. This is the key driver of the smaller scale negative GDP impacts under the latter in **Figure 1**.

There are also differences in terms of how Options A and B affect the distribution of impacts across different household income groups. Because the consumption tax is not affecting the cost of producing goods and services, the negative impact is proportionate to an individual household's consumption level. Thus, we find that the CPI impact is effectively the same for all households, reflected in the green dotted line for the lowest income quintile (HG1) tracking the overall CPI trajectory in **Figure 2**. This means that the consumption tax approach reduces the regressive impact of green cost recovery but does not make it progressive.

An important policy trade-off is therefore emerging. Covering green costs via consumption tax could be a good option if the objective is to minimise the impact on the wider economy. However, this requires accepting that this approach will not distribute the green costs in a progressive way among the different household income groups.

Key Finding 3: Shifting the burden to income tax is more progressive, but its impact on UK businesses depends on wage bargaining responses.

Here, the crucial issue is that if workers seek to maintain real take-home wage rates, part of the tax burden shifts to employers and ultimately to consumers through higher prices, further intensifying real wage pressures.

The more progressive element of this finding is supported by the design of income tax, where working households are taxed according to their ability to pay in contributing to the dominant source of government income. It is reflected in **Figure 2**, where the CPI trajectory for the lowest income quintile (HG1) lies slightly below that of the overall indicator. While not reported in the charts, we also find that the progressive nature of this approach in covering the green costs is further supported when examining the disposable real income impacts across the different household income groups. For the £10 billion example, our estimates suggest that households in the lowest income quintile will on average experience long-term losses in real disposable of around 0.7%, while those in the highest income quintile suffer an average loss of just under 1.9%.

However, in terms of the UK activity level impacts of recovering green costs through income taxes, the Option C GDP trajectory in **Figure 1** shows this could be as contractionary as Option A (electricity bill recovery), albeit with reduced CPI pressure (**Figure 2**). Basically, under all three options, the cost recovery process erodes the consumer spending power of UK households, which will trigger contractionary processes across the economy. In the case of Option C, this happens by the route of reducing the value of real-take home income. However, in our central case, we assume that workers have the bargaining power in the (very tight) UK labour market to restore the value of their real take home wage rate.

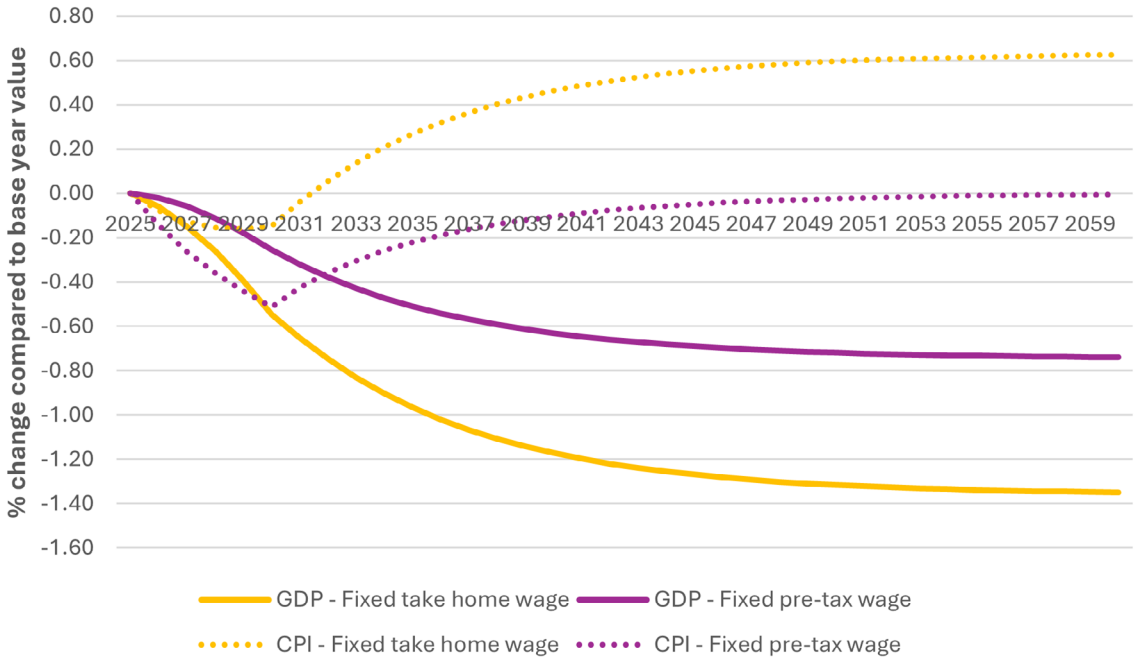
Thus, the real driver of contraction under Option C in **Figure 1** is the nominal wage (rather than energy) cost price pressure introduced to the economy due to wage bargaining pressure. This in turn drives a loss in UK competitiveness and overall activity levels, supporting a lower level of employment so that the real value of total household consumption falls because (a) fewer people are earning wage incomes, (b) the cost-of-living rises.

On the other hand, if we relax that central case assumption around worker wage bargaining power in the UK labour market, to the extreme that the pre-tax wage is fixed (i.e., nominal wage costs will not rise at all due to worker responses to the increase in income tax, thereby removing thereby removing that pervasive cost pressure), the outcomes are radically different. This is reflected in **Figure 3**, where the purple GDP and CPI trajectories for the income tax Option C compare with those drawn from **Figure 1** and **Figure 2**. Crucially, the GDP impact becomes markedly less negative, and the consumer price effect is positive, in that the CPI falls slightly or some time, before becoming ultimately neutral (with zero change relative to the base year in the dotted purple line in Figure 3).

In terms of the impact on real household incomes, the outcome becomes slightly more progressive with the reduced cost-price pressure, where the average long-term loss for households in the lowest income quintile falls from 0.7% above to 0.6%. This compares to a slightly higher average disposable income loss in the highest income quintile, where this rises from long terms 1.8% impact for the central case above, to slightly over 2%.

In practice, the outcome may be somewhere between what is reflected for the two Option C cases in **Figure 3**. The key point is that the more workers seek to retain the value of real take home wages when income tax rises, the more the risk of negative outcomes in terms of both pervasive and widespread cost-price pressures and activity levels.

Figure 3: Economic impacts of allocating an illustrative £10billion green cost burden to income tax (Option C) under different labour market assumptions

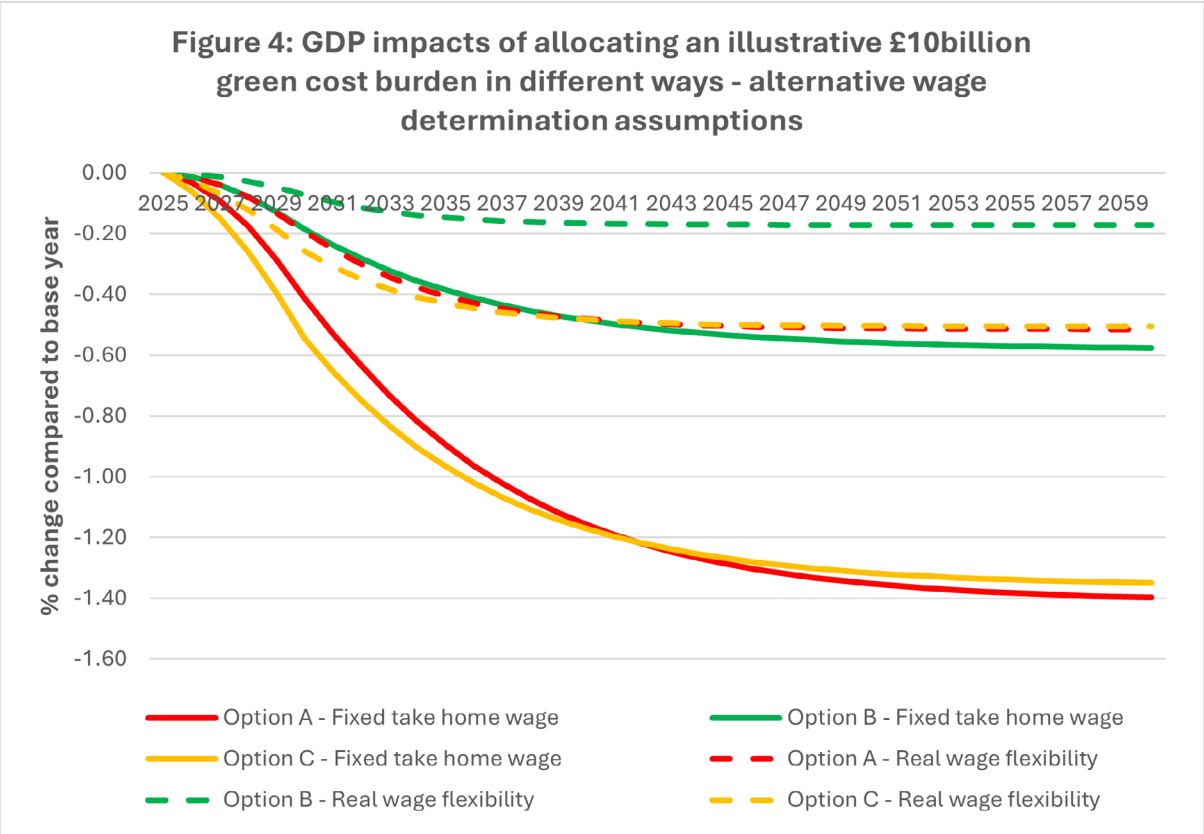


The role of labour market conditions in determining the potential outcomes

Generally, the response and assumed bargaining power of workers in relation to not only the value and purchasing power of real take home wages but also to prevailing labour market conditions will have some impact on the outcomes under any option for recovering green costs. In the scenario simulations run in undertaking the current research, we find that the latter – what happens to labour demand as the economy

contracts due to the imposition of additional green costs (again, abstracting throughout from any expansionary power of what these costs fund/enable) – is a central driver of outcomes.

Specifically, in the central case scenarios reported via **Figure 1** and **Figure 2**, we assume that workers seek to maintain the real value take-home wage rates, despite employment conditions, and taking account of CPI impacts. When we rerun our scenarios assuming downward wage flexibility in the wage bargaining process – i.e., workers lose bargaining power and must lower wage settlement expectations as unemployment rises – this reduces cost-price pressures and cushions the contraction of the economy in all cases.



This is reflected in **Figure 4**, where we replicate the central case GDP trajectories from **Figure 1** for all three options. Here we focus on the real-take home wage (rather than the pre-tax wage, as considered for the Option C income tax case in **Figure 3**) as the central focus on worker wage bargaining activity.

The key message reflected in **Figure 4** is that the more real wage rates are flexible downwards as contractionary pressures emerge, the net reduction in activity levels will be reduced.

Indeed, under the real wage bargaining closure that we commonly invoke in running the UKENVI scenario simulation model, the GDP outcomes under Options A and C (energy bill recovery and income tax respectively) remove markedly. Quantitatively, both cases become similar to what is observed in the central case for Option B (consumption tax), where damage is limited by a much more neutral impact on price levels across the economy. In terms of Option B, there is also an improvement in the GDP outcome, but a more limited one, given the very limited cost-price pressure, with the improvement with downward wage flexibility linked to the more limited reduction in total household spending when less jobs are lost.

Thus, **Figure 4** highlights another key consideration: the consumption tax (Option B) could be considered a less risky prospect in terms of the potential variability of outcomes to labour market responses, a factor

over which policymakers have limited control. It also consistently delivers the most favourable economy-wide outcomes. On the other hand, it does not deliver a progressive distribution of the burden, rather being somewhat neutral in distributional terms. Thus, as with many policy choices, there are trade-offs that must be considered and balanced by decision-makers.

Conclusions

Generally, results in all three cases are quantitatively (but generally not qualitatively) sensitive to what we assume about wage bargaining behaviour in the UK labour market, including whether wage demands reduce if activity levels contract and unemployment rises. Here we find that:

(i) Recovery of green costs through income tax generally delivers the most progressive outcomes, but the extent to which this is the case, and how activity levels are affected, is highly sensitive to what we assume about labour market conditions and wage bargaining behaviour.

(ii) The extent to which increasing the burden on electricity bills is regressive and negatively affects activity levels is also highly sensitive to what we assume about labour market conditions than the income tax case. Moreover, since green costs on electricity bills directly affect business users, the consumer price index (CPI) impact is generally larger than under either of the other two 'who pays' options considered here. This will impact real wage demands even where activity is contracting.

(iii) The main driver of outcomes in the consumption tax case is what happens to household spending, with no direct impact on business costs. Here, results are only mildly sensitive to what we assume about wage bargaining responses, and only in terms of limiting the extent of any wider economic contraction triggered by households bearing additional green costs.

Our findings highlight that there is no approach that can deliver the best outcomes both in terms of avoiding negative impacts on activity levels and delivering more progressive outcomes. Thus, there are trade-offs to be considered in deciding how green costs may be recovered, and the decision will ultimately be a political one.

However, there is value in continuing to consider scenarios in the type of economy-wide analysis conducted here, which could extend to consider how some of the trade-offs identified here may be mitigated and/or improved going forward.

End-notes and references to underlying research

i. A 2024 CEP policy briefing discusses what we refer to as the 'Horse and Chart' challenge of attempting to assess the macroeconomic impacts of net zero actions without considering who will pay, how and when. The briefing, which also cites relevant peer-reviewed CEP work, is available here: https://doi.org/10.17868/strath.00087969

ii. For example, see the peer reviewed publication on introducing CO_2 transport and storage via a nascent sector servicing regional industry clusters at https://doi.org/10.1016/j.ecolecon.2022.107547 where we consider various public funding approaches. We have also conducted work focussing on deployment of industrial carbon capture in the work published at https://doi.org/10.1016/j.ecolecon.2021.106978 where we consider the challenges of adopting a unilateral industry pays approach in the absence of green market development.

iii. Considering the implications of different funding options to support retrofitting residential properties is a central area where CEP research has considered the importance of addressing the question 'who pays' to improve the energy efficiency of households in assessing wider economy implications. A short briefing summarising the insights from our work and highlights the relevant peer-reviewed CEP publications, is available at: https://doi.org/10.17868/strath.00082777

iv. See our peer reviewed paper at https://doi.org/10.1016/j.esr.2024.101518, which identifies the potential economy-wide impacts of using more energy efficient heat pumps instead of gas heating systems taking account of the need to cover both associated electricity network upgrades and residential heat pump installation costs.

v. For example, in recent CEP work – available at https://strathprints.strath.ac.uk/91528/ - we consider the net expansionary potential of expanding the UK electricity network transmission network through the RIIO-T3 price control process, taking account of the need to recover investment costs via user bills.

vi. A detailed description of the UKENVI model is provided in an open access paper published in 2022 in the peer reviewed journal Ecological Economics at: https://doi.org/10.1016/j.ecolecon.2022.107547. The applied focus of that study is the implications of 'who pays' for CO_2 transport and storage services. However, the fundamental model specification detailed is more broadly applicable, with further refinements to capture different 'who pays' options set out in the works cited above.

vii. The UKENVI model is currently calibrated on a social accounting matrix for 2018. We assume no real changes across the economy prior to the introduction of the additional green cost burden and would generally adjust all real values to 2024 prices in reporting inputs to and outputs from the model. The key implication to note is that the £10 billion green cost burden introduced would inflate to £12.6 billion in 2024 prices. All reporting in the brief is in terms of percentage changes from base year values. Thus, the reader should bear the need to inflate if considering outcomes in value terms.