Clean Energy *Independence*

HOW A CLEAN GB ENERGY SYSTEM PROTECTS HOUSEHOLDS AND THE ECONOMY FROM PRICE SPIKES

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In January, household energy prices in Great Britain are going to increase by a quarter. This follows 5 years of high energy prices and shocks which have forced more households into energy debt than ever before, and when too many households are struggling to afford basic heating. The cause of these high prices are volatile fossil fuels. New E3G analysis shows that if we had a clean energy system, GB households would have saved £3,000, and allowed £130bn to be invested in Britain, not wasted on lining the pockets of fossil fuel corporations.

A clean energy system would have protected Britain's economy from the fossil fuel price spikes in the 5 years from 2022 to 2027, when the economy was rocked by successive fossil fuel-based energy price shocks. The system would have saved the average household **£600 a year, or £3,000 over the whole period**. Looking at the entire economy, GB households and businesses could have saved **£130bn**, which could have been re-invested in the British economy, boosting growth and helping keep down inflation.

Between 2022 and 2027, households have spent around **£3,160 a year on home energy and car fuel**, excluding fuel duty. Before accounting for household capital costs (mainly heat pumps) a clean energy system would cost households a third less a year at £2,200. Over the five years, about **£49bn** of the saving is money taxpayers spent holding bills down, mostly through the Energy Price Guarantee. A clean system would not have needed it.

Why we did this

Russia's full-scale invasion of Ukraine in February 2022 pushed home heating and transport prices in GB to the highest-level ever paid by bill payers in recent times. A price crisis followed because most of our energy systems still rely on fossil fuels.

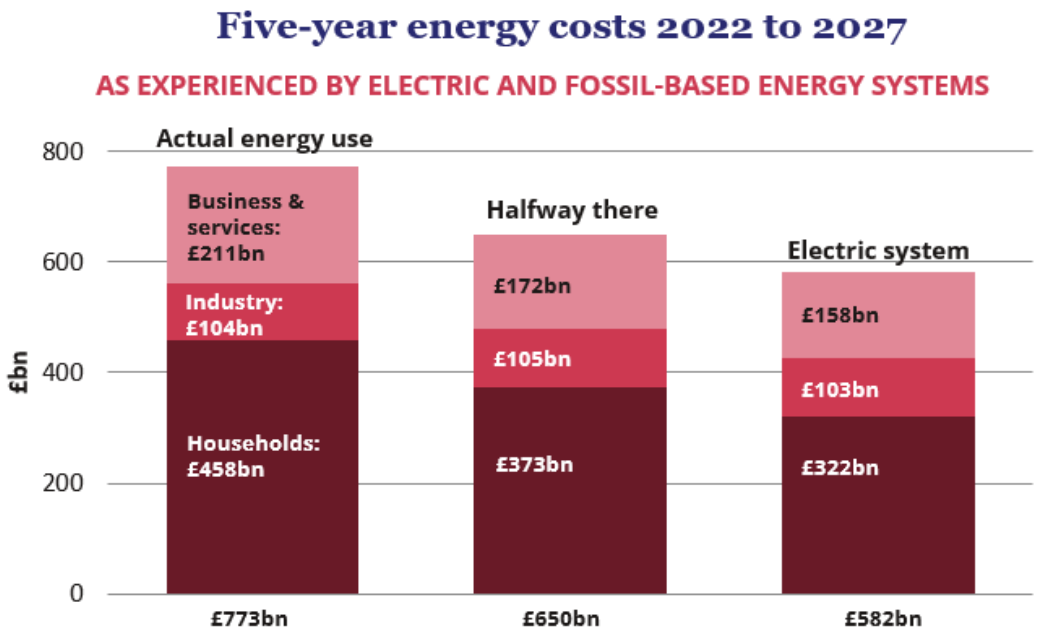
The price cap for the first quarter of 2027 will be over a quarter higher than the final quarter of 2026, marking a period of exceptionally high energy prices for GB billpayers. Almost five years on from Russia's full-scale invasion we asked how much a clean energy system would have paid had it experienced the same international price shocks.

In the theoretical energy system, electricity is mostly clean and fossil fuel use is mostly switched to electric. The system is based on clean heating, clean cars, and a clean power system in line with the generation mix in the National Energy System Operator's "Holistic Transition" clean power scenario for 2030. Everything else is held equal. People drive the same miles and businesses produce the same output.

What we found

The high cost of fossil fuels has been well documented since the start of Russia's invasion of Ukraine in 2022. Transitioning to a fully electric system that is insulated from price spikes is the best way to avoid the economic shocks and harm which follows. In this analysis we have sought to quantify the additional energy costs which British households and businesses have paid because of continued dependence on fossil fuels compared to a scenario where the main energy source is low-carbon and home-grown electricity. **Error! Reference source not found.** shows a substantial saving of nearly £200bn in energy costs under a clean energy economy compared to one which is predominantly dependent on fossil fuels.

One of the main takeaways from the research is that economy-wide savings which follow from a fully electrified and clean energy system would be experienced continuously, including during times in between the peaks in gas prices, and act as a shield against global price volatility. **Error! Reference source not found.** zooms in on energy costs to the GB economy in the two years between 2025 Q1 and 2027 Q1. Actual energy costs climb quickly in Q4 of 2026 and Q1 of 2027, caused by the war in Iran and subsequent bottleneck in fossil fuel supplies. Under a clean energy system which E3G modelled, energy prices are not dictated by fossil fuels and fossil fuels are not the main energy source for heating. As a result, the cost of energy remains stable.



Source: *E3G model of actual energy cost and the cost of energy in a future clean power system. For a summary of the workings see "**How we did it**". For full workings email the author **james.dyson@e3g.org**.*

Figure 1. The total cost of energy in the current fossil fuel system compared to electrified economies

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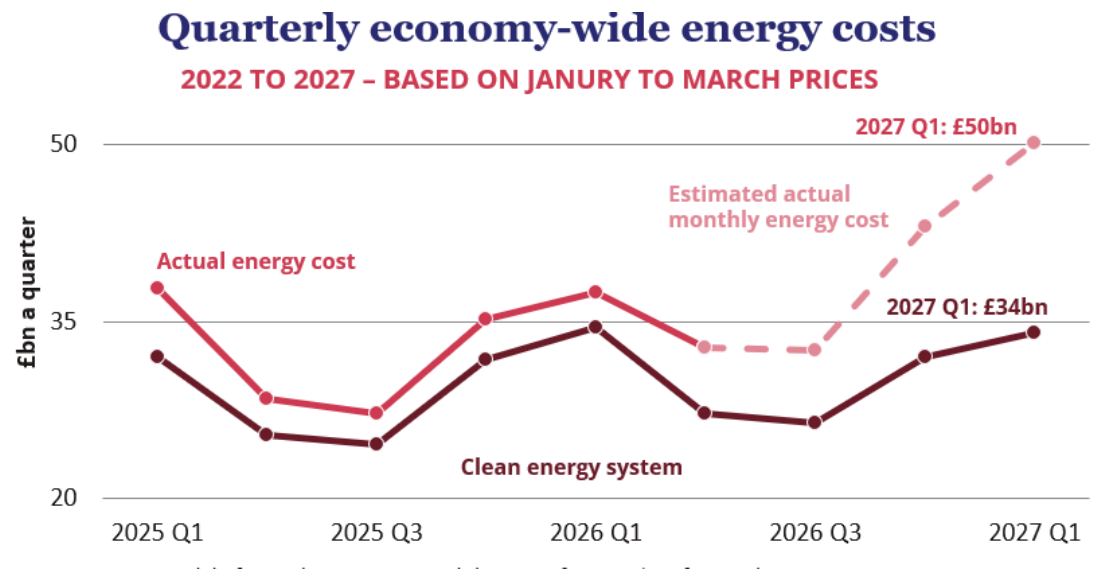

Source: *E3G model of actual energy cost and the cost of energy in a future clean power system. For a summary of the workings see "**How we did it**". For full workings email the author **james.dyson@e3g.org**.*

Figure 2. Quarterly economy wide energy costs.

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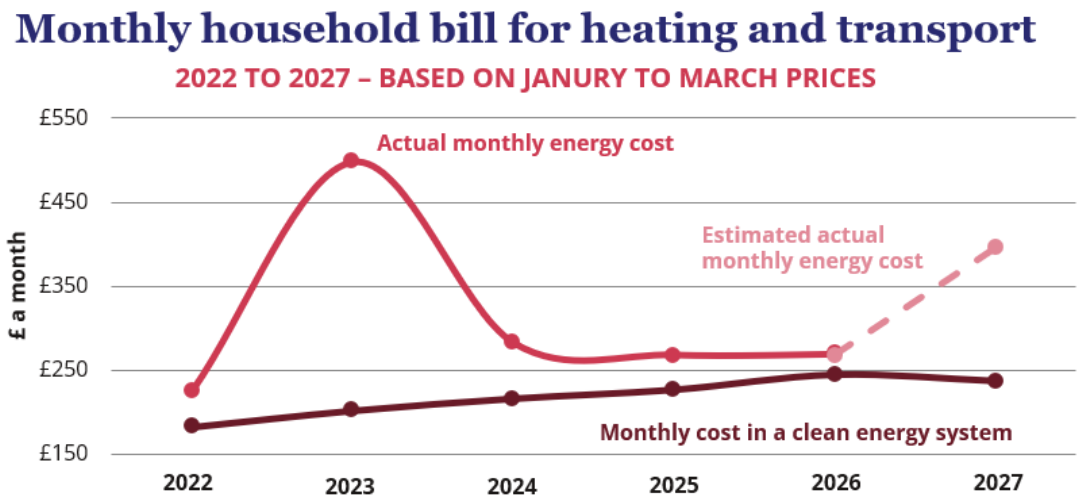

Figure 3. Monthly household bills for heating and transport are lower in a clean energy system

Over the whole period, household energy bills follow a similar pattern and would have been lower throughout and protected during price spikes. **Error! Reference source not found.** shows that in the clean system households have lower and more consistent costs. This analysis accounts for the additional upfront investment required to install a heat pump instead of a gas boiler.

Home heating is a major consumer of fossil fuels. At the peak of heating season, over 50% of UK natural gas consumed is to keep homes warm in winter. In our model, we show that heat pumps would have cheaper running costs both outside of and during gas crises. This has two crucial benefits: one, the cost of heating is more affordable, and two, it is predictable. One of the challenges that fuel-poor households experience is how unpredictable energy price shocks are. An electric system with predictable future prices would help households to plan for future costs more easily and live more comfortably as a result.

How we did it

We costed five years of Britain's energy use twice, quarter by quarter: once as it was (fossil fuel dependent) and once as a clean energy system.

- **What was used and paid**. Energy use by fuel and sector comes from DESNZ Energy Trends and car and van mileage from the Department for Transport. We priced it at what people paid, using the Ofgem price cap, the Energy Price Guarantee and DESNZ fuel and business prices. Government bill support is added at National Audit Office outturn because taxpayers paid it.

- **The same activity, run on electricity**. Buildings swap boilers for heat pumps. Car and van miles are driven electrically and industrial heat below 200 °C is electrified. Together this replaces 88% of the fossil fuel used in these sectors. As a result, electricity use nearly doubles.

- **Where the electricity comes from.** The generation mix is the National Energy System Operator's (NESO) Holistic Transition pathway for 2030, from its 2025 Future Energy Scenarios: about 64% wind, 11% solar, 8.5% nuclear and 6.6% unabated gas, with the rest from other low-carbon sources.

- **What clean power costs.** To estimate what a future clean energy system costs to build and run, we used **this Department for Energy Security study.** We used the Levelised Cost Estimates for Projects Commissioning in 2030, £/MWh, adjusted to 2024 prices.

- **Backup for calm, dark days.** We increase the overall gas back-up needed to help cover additional demand on days when there is low renewable generation. We also use NESO's assumption that flexible energy use means 55% of demand can be shifted outside of peak periods. Each backup plant is paid the fixed cost of a new gas plant run 5% of the time, as estimated by DESNZ.

- **The rest of the bill.** We added networks at today's cost per unit, so network spending scales with demand. This is aligned with the finding from this DESNZ and Ofgem study for the **Electricity Networks Strategic Framework**, which found network spending is most likely to stay the same per unit of electricity delivered as the network grows. We also added existing renewable subsidies, ECO and the Warm Home Discount (on household bills only), other levies, a 3% supplier margin and VAT.

- **The comparison.** The saving is actual spend minus spend in the clean system, averaged over the five financial years. Per-household figures divide the household saving by Britain's 27.8 million households.

- **The kit, including the cost of capital.** We costed the extra upfront cost of a heat pump over a gas boiler at £6,000 per home based on the Climate Change Committee's Seventh Carbon Budget which includes a reduction in future upfront costs. The Seventh Carbon Budget finds electric vehicles' upfront cost will fall below petrol or diesel cars. For this model, E3G take a conservative estimate that electric vehicles incur households no additional upfront costs in the model. Both heat pumps and electric vehicles are repaid over their working life, 15 years for heat pumps and 18.4 for cars. We compare kit with household savings only.

- **We also ran a "Half The Way There" case**, in which half of the same fossil fuel use switches to electricity and the rest stays as it was. It uses the same clean power system, with backup sized to its demand. On the DESNZ estimate it would have saved households about £388 a year after extra capital costs.

Key assumptions and what is left out

The headline compares what was actually spent on energy, and how much would have been spent under a clean energy system. The following assumptions also matter:

- Clean power is paid for at cost, with the additional grid capacity required. Costs per unit are fixed in real terms, so gas never sets the price of electricity. The system is treated as already built: we do not model how fast it could be built or the costs associated with a rapid buildout. All power generation capital costs are included, spread over their operational life.
- The 55% cut in backup power is NESO's estimate that flexible demand. NESO's Holistic Transition estimates that 55% of peak demand could be cut in a system with a high proportion of flexible demand (electric vehicles, heating and industrial processes). This means energy consumers shift demand, such as, electric vehicle charging, away from peak demand in return for a lower energy bill.
- Fuel duty is excluded. Drivers paid about £24bn a year in duty on car and van fuel. It is lost Treasury revenue rather than a cheaper energy system, so it is not in the saving.
- Some uses stay on fossil fuels. HGVs, buses, rail, aviation, shipping, high-temperature industry and steelmaking are left out of the comparison because this analysis has focused on transitioning the bulk of light energy usage over where technologies are mature and ready for implementation.
- The latest months are partly estimated. Energy use from July 2026 repeats the same quarter a year earlier until official figures are published. Prices after November 2026 are held at their latest level.

ABOUT E3G

E3G is an independent think tank working to deliver a safe climate for all.

We drive systemic action on climate by identifying barriers and constructing coalitions to advance the solutions needed. We create spaces for honest dialogue, and help guide governments, businesses and the public on how to deliver change at the pace the planet demands.

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