



Getting to Net Zero: Executive Summary

A report for Shell Energy



Shell
ENERGY

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Contents

About us	2
About this project	2
1. Executive Summary	3
1.1 Four steps to zero carbon homes	3
1.2 How can people take those steps	4
1.3 Progress is slow so far	5
1.4 Rapid change is possible	6
1.5 Recommendations	7
1.5 Enjoying the journey to Net Zero	9
1.6 Next steps	9

About us

Energy Systems Catapult was set up to accelerate the transformation of the UK's energy system and ensure UK businesses and consumers capture the opportunities of clean growth. We are an independent, not-for-profit centre of excellence that bridges the gap between industry, government, academia and research.

We take a whole systems view of the energy sector, helping us to identify and address innovation priorities and market barriers, in order to decarbonise the energy system at the lowest cost.

We have more than 200 staff based in Birmingham and Derby with a variety of technical, commercial and policy backgrounds. We work with innovators from companies of all sizes to develop, test and scale their ideas. We also collaborate with industry, academia and government to overcome the systemic barriers of the current energy market to help unleash the potential of new products, services and value chains required to achieve the UK's clean growth ambitions as set out in the Industrial Strategy.

About this project

The UK was the first large economy to pass laws ending its contribution to global warming by 2050. Shell Energy asked Energy Systems Catapult what this means for how we all use energy at home. This is what we found.

Executive Summary

Four steps to zero carbon homes

We can live rich, rewarding lives in a zero-carbon world, but we must find ways to travel and use energy at home without emitting any greenhouse gases. Today this emits about six tonnes of CO₂e per year and accounts for two thirds of our carbon footprint.

To cut that to zero, we need to:

1. Switch to a zero-carbon energy supply
2. Install a low carbon heating system; and
3. Drive zero emissions vehicles (if we have to drive); and
4. Be more flexible about when we use energy

It's relatively **easy to switch** to a zero carbon electricity supplier, but the rest is harder.

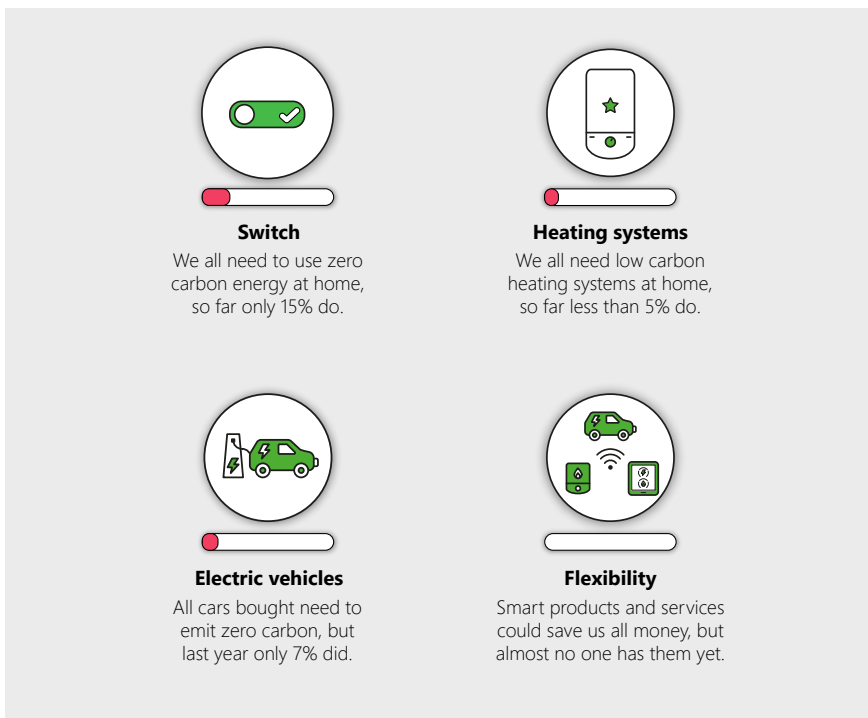


Figure 1: Infographic showing what people need to do to cut their carbon emissions at home.

How can people take those steps?

Today almost everyone **heats** their home with fossil fuels. Nearly 30m households need to replace their heating system with low carbon alternatives, rising to about 1.6m per year, or ten a minute. Currently we install around ten an hour (or 26,000 a year), so there is a long way to go.

We will urgently need to accelerate the pace of installations to meet the target of three million home-owners switching to low carbon heating by 2030.

People who try to do this face a maze of options – electric heat pumps, hydrogen boilers, heat networks and more. Many will also need to prepare their home (e.g. with insulation) before switching to low carbon heating systems. There is no silver bullet and the ‘best’ choice varies from place to place. It is hard to pick an option and get it installed so it works well in practice. People need clarity so they can do the right thing.

We must also change how we **travel**: reducing unnecessary trips; walking or cycling more for short trips; using public transport for longer trips (where it’s available); and ultimately using electric vehicles where it is not. Long distance travel is tougher. We can still fly but need to halt recent rises in the amount we do. It would help if we substituted short-haul flights with train, coach or car trips.

Sales of battery electric vehicles are rising fast: we bought 110,000 last year. **That number could triple in three years and grow twenty times by 2030** (unless we start traveling in different ways). Most people will want to charge their cars at home. This could be tricky for the third of households who park their cars on the street. People will need charging options that get them from A to B.

Finally, we might need to be more **flexible** about when we use electricity. To understand why, we need to look at what happens as we switch to low carbon energy supplies.

Today when we flick a switch, jump in a shower, turn on our heating, or refuel our cars we generally get the energy we need straight away. Practically all of it (90%) comes from fossil fuels (gas, oil, petrol or diesel). These are easy to store, so we can use them when we need to.

In future we will use lots more renewable electricity to heat our homes and charge our cars. Solar and wind power will be cheap and plentiful when the sun shines or the wind blows. That means our energy supply will vary more with the weather.

This problem is we will want our homes warm when it’s cold, our water hot when we take a shower and our cars charged when we go somewhere, but we can’t make the sun shine or the wind blow when we need more electricity. Smarter homes could help us buy electricity when it is cheap and store it to use when we need it.

To give a sense of scale, the amount of electricity we use at home could vary eight times as much as it does today. Making our energy system smarter can really help tackle this challenge. Government estimates that smart flexibility and storage in our homes, on our electricity grid and connections to electricity grids in other countries could save the nation £12bn per year. So we need smarter homes that can vary their need for electricity to match the supplies available and use technologies like solar and household batteries to take pressure off the grid.

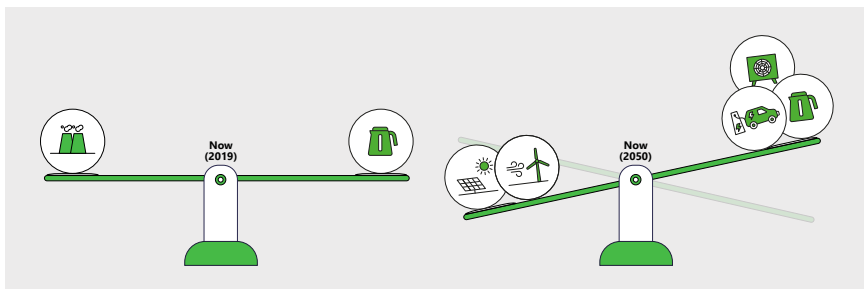


Figure 2: It gets harder to balance energy supply (left of each seesaw) and demand (right of each seesaw) as we use more renewables to power more electric heating and electric cars.

Making these changes will prove more challenging for some than others. Getting it right will be particularly critical for **vulnerable people** who cannot afford their energy or who need to use energy to maintain their health. There are also difficult decisions to take, for instance around how to share costs and how to make sure **local Net Zero** plans add up to meet the national target.

Progress is slow so far

Most people say *something must be done* about climate change and that *they will do their bit*. COVID has also shown that people can make huge changes when needed.

Unfortunately, lots of people are confused and do not know what they can do to help. About 15% are on 'green' or '100% renewable' electricity tariffs, but half the nation does not even know that emissions from their home heating also drive climate change. Also, many say they have heard of low carbon heating systems and would consider installing them, but practically no one does (i.e. <5%) when they replace their boilers.

At first glance, the outlook looks similar for electric vehicles: many people say they are open to buying one, but uptake remains low ($\approx 7\%$). However, prospects look far better than for heating as sales of electric vehicles are growing rapidly. Understanding why could drive more action on heat.

Far more people (77%) understand the link between transport and climate change so it would help to explain the link with heating. However, raising public awareness is just the simplest first step of a long and complex journey. We need much more major change to drive uptake of low carbon heat.

Rapid change is possible

Previous energy transitions **changed consumers' behaviour by offering people clear benefits**: cars were cleaner and faster than horses; gas central heating was simpler and safer than coal fires. People who prefer electric vehicles to their existing cars also think they are better in important ways. Could the smart home make low carbon heating as good as, or better than what we have?

Digitalisation has transformed many other parts of our lives: how we learn, shop, relax, travel and so much more. These sectors have invested in using digitalisation to understand what people want and driven change across complex supply chains to deliver improvements in their experiences. Could a similar transformation deliver the change we need in heating?

It is certainly possible to **design and deliver high quality heating solutions**. Smart thermostats can use weather forecasts and smart meters to improve consumers' control of their comfort and costs. Innovators have shown they can use this technology to offer consumers new propositions that drive uptake of low carbon heating systems, unlock flexibility, improve energy efficiency and help people afford their heating. However, these innovations will need to work alongside future energy policy if they are to transform heating at the scale needed.

Sectors that deliver radical change start out by asking what they can do to improve people's lives, rather than expecting people to change their lives to help that sector succeed.



Figure 3 - It will be easier to convince people to cut their carbon emissions if acting delivers clear benefits.

Government has significant ambitions. 'Greener buildings' was the 7th of its 10-point plan for a green industrial revolution. The Energy White Paper set out twenty-three commitments on buildings and consumer protection. The Heat and Buildings Strategy will set out more detail soon.

Recommendations

We think there are four things Government should do to help people go to zero carbon at home.

1. Introduce a technology-neutral target focused on outcome, not delivery

Banning the sale of petrol and diesel cars by 2030 gives the transport sector a clear motive to design zero emissions vehicles that consumers want to buy. Contrast this with the twenty or so regulations, subsidies and standards that exist for heating. This leaves consumers to decide how to combine different components – insulation, heating systems, controls etc. – to decarbonise their home heating. Just imagine introducing taxes and subsidies for car components like batteries and motors, then expecting consumers to design their own electric vehicle: it would never work. Given the scale and pace of change needed, it must be worth trying a new approach. Technology-neutral heating targets would **give industry a reason to create appealing, effective, low carbon heating solutions that consumers want to buy** (i.e. that combine components holistically).

Consumers will also need help paying for low carbon solutions. Government could help by moving policy costs to more carbon intensive energy sources so that bills reward people for making low carbon choices, encouraging green finance products and subsidising *solutions*, not components.

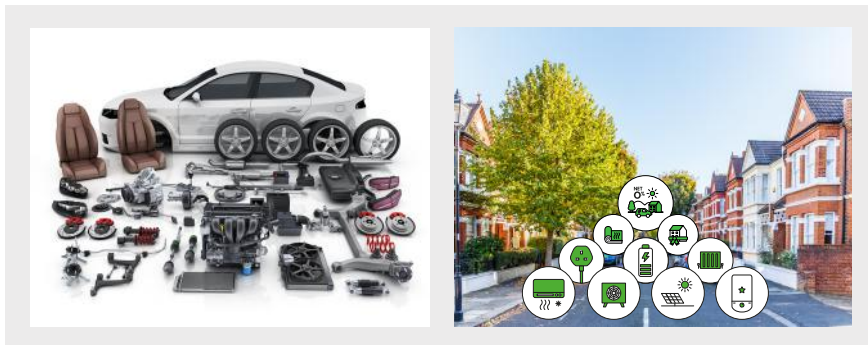


Figure 4 - Great solutions combine lots of components to help people get around (left) and get comfortable at home (right).

Carmakers manage complex supply chains and combine lots of components to deliver what people want, great cars. Supermarkets and telecoms do much the same to deliver tasty, nutritious food and mobile phones. By contrast, when it comes to heating, home-owners must solve this highly complex problem if they want to decarbonise their home heating. Very few do. **People will need low carbon heating solutions** that bring together lots of components to make sure they can easily get comfortable in their own homes.

2. Help people realise that their home heating drives climate change

A lack of understanding exacerbates the challenges of decarbonising heat. **People need to know why they must act.** Imagine if they had annual **carbon MOTs** for their home, including their plan to get to Net Zero. Their energy supplier could use their smart meter data to report their annual carbon emissions. Asking people to make sure their home met a **minimum carbon standard** would help them realise they need to decarbonise their homes and create demand for solutions. They could shop around for an energy retrofit quote to get them to Net Zero any way they liked, just as they do for other home improvements like loft extensions, kitchens or bathrooms.

3. Use public funding to make sure we learn how to do this well

Both the public and private sectors need to act with vigour and creativity to decarbonise heating. They will work together to **rapidly test and learn to get it right.** Early setbacks would harm consumers' confidence in low carbon technologies and cost us time we do not have.

It would help to prime the market through **place-based low carbon energy programmes.** These should create Living Labs where innovators can find better ways of making progress without harming consumers, develop standards to share lessons, embed good practice and accelerate interoperability. Public funding should include vulnerable consumers, not just early adopters, so the sector can find effective ways to solve challenges like fuel poverty and prevent digital exclusion.

4. Ensure local areas publish their plan for getting to Net Zero

People will need to power their heating systems by connecting to a low carbon energy network. The choices available will vary from area to area. Places could upgrade their electricity grid, build heat networks, or convert their gas grid to use hydrogen. **Each area will need a clear plan** so the people who live there know what to prepare for (i.e. electric heat pumps, heat networks, hydrogen boilers or something else). Plans will be more popular if the people who live in areas are involved with developing them. They will also inform the investments needed to build Net Zero networks.

Enjoying the journey to Net Zero

Climate change represents an existential threat to our existence, but it also presents a unique opportunity to improve our lives. If we act now, we can ensure we all enjoy the Net Zero future.

We know what the target is, we need to make sure we hit it. There are many routes possible. Government could set us on a pathway by (1) introducing a technology-neutral target; (2) helping people realise that their home heating causes climate change; (3) using public funding to learn how to do it well; and (4) making sure local areas have a good Net Zero plan.

Next steps

Faced with such a daunting challenge it can be hard to know how to start. It would help to:

- Involve citizens in plans to decarbonise their area so they support action;
- Find out which homes are ready for low carbon heating and tell their owners;
- Learn how to deliver the quality that gives these people the confidence to act; and
- Discover how flexible people are about when they charge their cars and heat their homes, so we build enough energy supplies and networks to power the lives people want to lead.

Energy Systems Catapult supports innovators in unleashing opportunities from the transition to a clean, intelligent energy system.

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