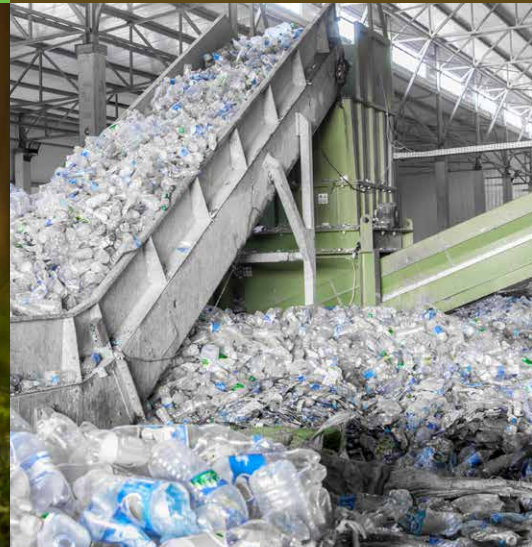


# MINUS 45



Delivering the UK government's pledge to COP26: Cutting UK emissions by 45% from 2018 to 2030



UK FIRES is a 5-year research programme funded by £5m of UKRI support and the subscriptions of an active and growing industrial consortium. With academics from six universities spanning from materials engineering through data science to economics, corporate strategy and policy and an industry consortium spanning from mining through construction and manufacturing to final goods.

UK FIRES stands for placing Resource Efficiency at the heart of the UK's Future Industrial Strategy. When we proposed UK FIRES, it was to focus on Resource Efficiency as the key means to reduce industrial emissions. However, in 2019, both houses of Parliament unanimously approved a change to the UK's climate change act to target zero emissions in 2050. This has been reinforced by recent Government targets for 2030 and 2035.

So, although we haven't changed our name to UK FIZES, our focus is now on placing Zero Emissions at the heart of the UK's Future Industrial Strategy.

UK FIRES takes a pragmatic approach: we focus only on technologies that are available to us today and exclude those that have yet to be proven at meaningful scale, since they simply may not be ready in time. In 2050 we aim to meet the energy demand of UK society by non-emitting electricity generation.

In December 2019, UK FIRES released the "Absolute Zero" report, a ground-breaking description of the operation of the UK with zero emissions by 2050, without relying on as-as-yet un-scaled energy sector or negative emissions technologies. This pragmatic but striking view of the journey to zero emissions has attracted widespread interest including a full debate in the House of Lords in February 2020.



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## Summary

Ahead of COP26, the UK Government has submitted its Nationally Determined Contribution to global climate mitigation which requires a 45% reduction in UK emissions from 2018 to 2030. Even if all planned new generation is delivered on time, the government's pledge can only be met with significant restraint across all sectors.

The government's commitment on emissions reduction in the UK is an important act of international leadership. It is aligned with the climate science that tells us how to ensure a secure future. Now we have to deliver on it.

The government's "Net Zero Strategy" released on 19th October 2021 describes big ambitions but small commitments. The total spending in the strategy is around 0.05% of GDP, and the delivery commitments add up to only a small fraction of the government's pledge to COP26. The strategy places all its hope in technologies that don't yet operate at all in the UK, fails to account for the new electricity demand created by its plans for greenhouse gas removal technologies and synthetic jet fuel, and includes no commitments on key areas such as rail electrification, reducing demand for aviation or reducing ruminant herds.

Over the next eight years, if the government meets its commitments, our offshore wind generation will quadruple. This will increase the UK's electricity supply by up to a third. But there is no time for any other newly-planned energy generation, negative-emissions or substantial hydrogen technologies to be constructed. Most of the emissions reductions must therefore come from changes to how we live and work.

In order to meet the Government's commitment, we must cut our annual car mileage by a fifth by shifting to public transport, halve all food wastage, and eat a third less beef, lamb, milk and cheese. We need to replace gas boilers with electric heat pumps in a million homes per year, while reducing the energy bills in seven million homes with better insulation.

At work, we need to cut our annual truck mileage by nearly half, halve our use of materials for construction, halve our production of cement, and replace half the UK's blast furnaces with electric furnaces that recycle our own steel scrap.

This won't happen by chance and it isn't about new technologies. It's about delivery. It requires the government to back its international pledge with funding and legislation that will ban all new gas boilers by 2028, electrify 2,500 miles of rail, change the way we manage our soil, and support a massive growth in building retrofit programmes. We need to update the law on stamp duty so we have an incentive to upgrade our homes when they're between owners. We need to ban any further support for the fossil industries of the past.

Most of the new policy we need is domestic. But the government has also, rightly, committed us to cutting our emissions by 68% from 2018 to 2035, including international aviation and shipping. We have to take action now to meet that commitment. As a result, in addition to international support for developing countries, the two key priorities for UK negotiators at COP26 are to tax the fossil fuels used by all ships and planes, and to change world trading rules, to allow new non-emitting industries in the UK to compete fairly.

This report is the first physically grounded description of what the government's leading international COP26 pledge really means. No one reading this report will like every aspect of it. But if we reduce emissions less in one sector, we have to reduce them more elsewhere. The plan has to add up, has to start delivering now, and can't wait for new technology.

We can prosper and grow as we deliver on the government's high-profile pledge. In a separate report we've listed 140 opportunities for new business growth compatible with zero emissions in the UK. But we can only create real zero-emissions growth with the right policy programme, focused on implementation. There's no time to wait for innovation later; we need to deliver now.

	Current government plan and physical consequences by 2030	Physical change required by 2030 for -45%	Policy required by 2030 for -45%	Change required beyond 2030
<b>Electricity Generation</b>	120TWh of new non-emitting electricity generation, if offshore wind capacity quadruples. Nuclear generation falls slightly as Hinkley Point C opens while all other nuclear power stations close. Contract for up to 2TWh of green hydrogen to be awarded in 2023.	<b>Reduce total energy demand by 30%</b> by 2030; Continue to <b>develop pilot trials</b> of CCS and hydrogen (no significant effect on UK emissions before 2030); <b>Halt offshore oil and gas</b> exploration and <b>remove any subsidies to fossil fuel</b> sectors.	Most of 45% cut in emissions by 2030 to come from <b>energy efficiency</b> ; Ensure that promised <b>x4 of offshore wind</b> is delivered; <b>Expand solar and onshore wind generation</b> rapidly, along with storage and demand-side response.	Continued expansion of non-emitting generation capacity, closure of the North Sea oil and gas fields and existing gas power plants.
<b>Industry and manufacturing</b>	Two CCS Clusters to move into next stage of negotiation for £1bn CCS fund, but no planned date for operation. £300m fund for fuel switching. No other specific commitments.	<b>45% cut</b> in blast furnace produced <b>steel, cement</b> and other <b>bulk chemical productions</b> ; Building material efficiency improved by <b>30-40%</b> ; <b>No new gas boilers</b> in low heat manufacturing <b>from 2028</b> ; <b>reduced weight</b> for new vehicles	<b>Zero carbon public procurement contracts</b> for low carbon materials; <b>Update building regulation</b> to include upper limits on material usage; <b>introduce VAT on demolition and new buildings</b> while removing it from retrofit and refurbishment.	All activities with process emissions stop, grow manufacturing base to replace imported goods.
<b>Transport</b>	Passenger / light goods vehicles: phasing out new fossil fuel vehicles by 2030; Freight: no meaningful policy before 2030; Public transport: no 2030 rail electrification targets, increase electric buses to 15% of fleet; Aviation: no targets.	<b>20% reduction</b> in vehicle-km for cars and vans, <b>45% reduction</b> in vehicle-km for heavy goods vehicles; <b>Reopen 350 miles of railway track</b> ; <b>50%</b> of outstanding rail network to be <b>electrified by 2030</b> .	<b>Decrease rail fares</b> and <b>increase fuel duty</b> ; <b>Vehicle excise duty</b> levied based on vehicle weight; <b>Electric road network for HGVs</b> ; <b>Tax incentives</b> to increase HGVs utilisation and reduce empty leg trips; <b>international taxation</b> on aviation and shipping.	Creation of an electric road system for freight on highways; increased use of the rail network for people and freight, aviation ceases.
<b>Space and water heating</b>	Heat pumps: target of 600 thousand installed per year by 2028, of which 90 thousand supported by £5k grants; ambition to have no new gas boilers by 2035, but no commitment. Small funding for partial retrofit of fuel-poor and social housing.	<b>7m heat pumps</b> installed by 2028; <b>Retrofit all homes</b> without <b>loft insulation</b> and <b>wall cavity insulation</b> ; Retrofits on 30% solid wall properties by 2030; <b>All non-domestic properties have EPC rating A by 2030</b> .	<b>Gas boilers banned</b> from <b>2028</b> ; Greater subsidies for <b>heat pump installation</b> and retrofits for low-income households; <b>Incentivise</b> deep energy retrofits; Minimum energy efficient standards for all rented buildings increased to an <b>EPC A rating</b> .	Heating in all homes is decarbonised by 2040 and all homes retrofitted to PassivHaus standard.
<b>Agriculture and land use</b>	No specific commitments	<b>Halve all food waste</b> ; <b>30% reduction</b> in beef, dairy and lamb consumption; <b>30% reduction</b> in agricultural waste; <b>Halve direct emissions</b> from soil; Manage <b>land-use</b> for net zero emissions.	<b>Information, labelling and procurement contracts</b> to promote low-emissions diets; <b>Taxes</b> on beef, lamb and dairy products; <b>Investment</b> in 'alternative proteins'.	All beef lamb and dairy consumption ends, replaced by new diets.
<b>Waste management</b>	Landfill tax continues to reduce methane releases.	<b>Ban on all biodegradable waste</b> going to landfill from <b>2030</b> .	The ban must be enacted as <b>legislation</b> with policies to support the transition such as whole crop purchase contracts, increases in landfill tax and household behaviour change policies.	Movement towards a complete material and waste recovery where all waste is minimized and directed towards recycling and reuse.

# Eight years to Minus 45

## The government's Nationally Determined Contribution submitted under the Paris Agreement for COP26 is a commitment to a 45% reduction in UK emissions from 2018 to 2030.

At COP26, the UK Government will pledge to reduce UK emissions by 68% relative to 1990 emission levels. This important target is in line with recommendations from the IPCC which has determined that we need to halve planetary emissions this decade to keep warming below 1.5°C.<sup>1</sup> Given progress in reducing UK emissions by 42% at the time the commitment was announced, the government's target for 2030 translates to a reduction in UK annual emissions by 45% from 2018.

## This report, Minus 45, describes a realisation of that pledge, based on physical changes and the policy interventions required to bring them about.

According to the Climate Change Committee, the UK is currently not on track to meet its 2030 emission target.<sup>2</sup> This report uses a bottom-up approach to describe how we can deliver it in the next 8 years.

Our sectoral analysis starts from the principal policies currently in place to drive emissions reductions this decade. We account for expected changes in the economy by 2030 (for example the growth in the electric vehicle fleet as we approach the ban on non-electric/hybrid vehicles).

The gap between the anticipated effect of current policies and the Government's -45% commitment is then estimated. Sufficient further physical changes that can be implemented in the next 8 years are specified. Finally, policy solutions that could bring about the required change are described.

To allow for an equitable split of the burden, a uniform 45% cut is applied to each sector. Some sectors may be harder to decarbonise or face additional political barriers. Alternative plans that propose a different approach to sector responsibility must therefore set out which sector(s) will take a greater than 45% cut to their emissions to alleviate pressure elsewhere.

## There is insufficient time for the planning, development and construction of new large-scale infrastructure to contribute to the 2030 target.

To date, climate plans have largely focused on new technologies, such as Carbon Capture and Storage

(CCS). However, given the requirements for public finance, planning, local consent, environmental and legal compliance, safety requirements, contracting, land acquisition, site preparation, construction and commissioning, there isn't time to construct any new large new energy infrastructure by 2030. Instead, in order to deliver the government's COP26 pledge, a whole-society approach must be mobilised. This includes restraint in our consumption of beef, lamb and dairy foods, reductions in vehicle use, changes in material production, and reduced use of heating energy. We can only alleviate the burden of these changes and continue to live full and flourishing lives with policies that support substantial reductions in energy demand.

Emissions reduction by 2030 depends primarily on using today's technologies differently:

- Electrification: powering a process that was previously powered by fossil fuels by electricity, i.e. using electric arc furnaces to produce steel instead of blast furnaces;
- Substitution: achieving the same outcome through a different method, e.g. replacing beef and lamb consumption with plant-based alternatives or having remote business meetings to avoid fossil-flying;
- Efficiency and demand reduction: carrying out the same activity using less energy, for example reducing demand for heating by insulating homes.

The physical approaches set out in this report have already been tried and tested and can be implemented rapidly and at scale with sufficient resources and policy support.

## The government has committed to further emissions reductions by 2035, specifically including a 78% cut in the emissions of international aviation and shipping

While there is insufficient time to deploy new infrastructure or technologies at scale to meet our targets for this decade, they may play a role in meeting future targets, including those for 2035 and the legal commitment to zero emissions by 2050.

In addition, many of the physical changes required to meet these future targets, such as electric road networks,<sup>3</sup> new rail lines or afforestation programmes, must be agreed and begun before 2030 to ensure they contribute to mitigation before 2050.

This proaction is particularly important for international aviation and shipping, which are not included in the 2030 target. It is inconceivable that the emissions of all ships and planes departing the UK can be reduced by 78% between 2030 and 2035. Significant action is required this decade to reduce the emissions of all fossil fuel transport.

## Alongside international support for developing countries, the key priorities for COP26 are to rewrite trade rules and agree high and rising taxes on fossil fuels used for international aviation and shipping.

As the first COP after new NDCs have been submitted, the COP26 meeting in Glasgow provides an opportunity to initiate changes in areas where international cooperation is essential to deliver mitigation. In addition to the crucial work of agreeing international aid to support decarbonised growth in developing countries, existing international agreements must be revised to be compatible with climate commitments.

Trade rules under the WTO prohibit policies which support the local production of goods, although this is an inevitable requirement as international fossil-shipping is rapidly phased out. Investment agreements and charters, such as the Energy Charter have hindered the transition to clean energy by providing rights for fossil fuel companies above and beyond those of the environment. To decarbonise globally at the pace required, COP26 must begin the work of removing these barriers to climate action and instigate new agreements that place decarbonisation at the heart of international relations.

Emission reductions for international aviation and shipping are vital in order to achieve global net zero by mid-century. This requires overturning article 24 of the Chicago Convention on International Aviation, to impose a high and rising tax on the use of fossil fuel in international flying with equivalent measures for international shipping to ensure its use is phased out completely by 2050.

## A brief history of CCS deployment rates

Carbon capture and storage has long been discussed as one of the key tools with which to fight the climate crisis. Extracting carbon from the atmosphere, or capturing it before it is released, would allow some continued use of fossil fuels.

Despite its promise, CCS has consistently failed to materialise at scale. In the UK there is one pilot scheme currently underway near the North Sea which may allow us to store CO<sub>2</sub> in disused gas fields, however with a timeline running into the mid to late 2020's this pilot scheme will not scale to significance by 2030. CCS also perpetuates the myth that climate mitigation can be delivered purely by technologies and without societal participation.



Image: Illustration of White Rose Plant / Drax. Credit: DECC / CC

## 2. Sectoral Analysis

### Constraints

The government's commitment to cut UK emissions by 45% from 2018 levels in the next eight years precludes many mitigation options because they cannot be delivered in time. By 2030:

- There will be no substantive negative-emissions technology operating in the UK. While pilot cases are currently under construction, there is insufficient time for any such technology to be available at scale;
- Hydrogen cannot be a key source of power as there is no time to produce 'blue' hydrogen (based on carbon capture and storage) and 'green' hydrogen made by electrolysis is so inefficient. The 'round-trip' efficiency of 'green' hydrogen is generally less than 30% and the UK will have no surplus emissions-free electricity by 2030;
- The government's planned expansion of non-emitting electricity generation (see Figure 1) will not deliver a 45% reduction in emissions, even if all of it is used to power electric replacements for combustion engines and gas boilers. Most of the 45% cut must be delivered by reducing energy demand.

The analysis of this report assumes that no further offshoring of emissions is acceptable. Beyond the 2030

commitment to Minus 45, the government has made emission reduction commitments for 2035 with complete elimination by 2050. International aviation and shipping emissions are specifically included in the 2035 target so have been included in this analysis as significant action is required this decade to reach the 2035 target.

### Our approach

Each section of this report analyses a critical sector of the economy. The analysis begins with an assessment of the physical changes likely to arise this decade from current government policies. This includes all policies mentioned in the Net Zero Strategy to which the government has committed funding and a start date. However, we have excluded the many "ambitions" of the Strategy where the government is yet to make a commitment. Out of this analysis, we derive an estimate of the expected emission savings from current policy by 2030.

No sector has sufficient policies at present, so additional physical changes that would produce a 45% cut in the emissions of each sector are described. Each section concludes with a discussion of the policy required to bring about these physical changes.

### Opportunities for growth in Energy Sector

The dramatic change that will occur as the economy shifts to full electrification will bring with it a number of business growth opportunities. Innovative energy-saving and energy-efficiency technologies will be highly valued in the market both as cost-saving devices, but also as ways to mitigate wider uncertainty stemming from a largely intermittent energy source.

Technologies that allow for the management of the intermittency, such as demand side management, or new ways to reduce peak loading also offer areas for growth and innovation

For more discussion on this, see the forthcoming UK FIRES report *UK FIRES report Energy Sector Growth in Absolute Zero*.



### 2.1 Electricity Generation

Approximately half the UK's electricity today is generated without emissions. Current government commitments for electricity generation in the next decade are shown in Figure 1. The figure assumes the closure of all remaining coal-fired generation and continued generation from gas at today's levels.

#### What physical changes will arise from current government commitments?

During the decade from 2010-2020, UK non-emitting generation expanded by around 100TWh. Figure 1 anticipates a similar rate of growth in non-emitting generation in the current decade.

The major contribution to this growth is from the government's commitment to quadruple offshore wind power within a decade. It is currently too early to assess the outcome of this commitment; however, the government has committed £200 million to offshore wind in the latest CfD auction<sup>6</sup> and is expected to release an *Offshore Transmission Network Review* by the end of 2021.

**Onshore wind:** there are no current government targets for deployment of onshore wind generation. However, the renewable sector industry body has suggested that onshore wind capacity could reach 30GW by the end of the decade. If this is delivered, under current load factors it would add 70 TWh to the supply by 2030.

**Solar power:** the UK does not have a dedicated solar power capacity target. With current policies, 28GW of solar capacity is anticipated by 2030. However, the industry believes this could increase to 40GW if supported by more ambitious policy,<sup>7</sup> for example if linked to new-build and deep retrofit programmes.

The new 3.6GW **nuclear power** station at Hinkley point C, originally scheduled to open in 2023 and now forecast for 2026, will add to non-emitting generation. However, even if this new installation is completed during the decade, the UK's total nuclear power generation will reduce, due to closure by 2024 of 5GW of expired capacity at the Dungeness B, Hinkley Point B, Hunterston B, Hartlepool and Heysham 1 sites. Given the very long time required to move from initiation of nuclear power projects to commissioning, it is certain that no other new nuclear generation will be operating in the UK before 2030.

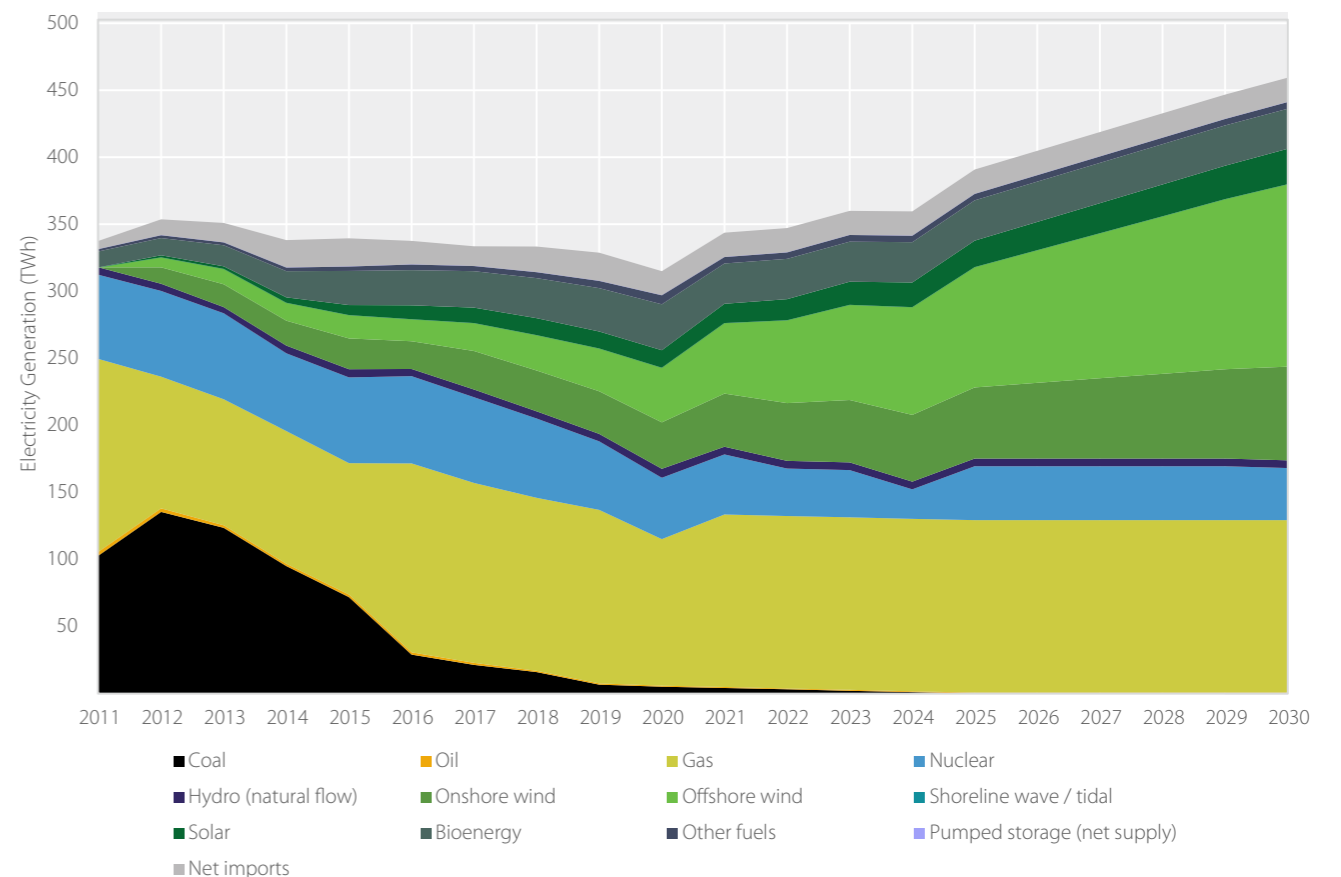


Figure 1: Planned expansion of the electricity sector (TWh)

Electricity generation from **gas** is anticipated to continue at today's levels in Figure 1. There are no planned closures of existing plants this decade. 17 new gas generation plants are under consideration<sup>8</sup> but have not been approved and will be contested on the grounds that they undermine climate targets. The Net Zero Strategy anticipates a reduction in power emissions of 71-76% by 2030 leading to zero emissions by 2035. This requires closure of existing gas-powered electricity generation. However, in the absence of a detailed plan, these intended closures have not been implemented in the forecast electricity supply in Figure 1.

Increased use of wind and solar power creates a problem with intermittency. Eventually, this must be addressed by either demand-shifting or storage. There is currently about 1.3GW of battery storage capacity in the UK, supported by 2.8GW of pumped storage. Battery storage capacity is expected to grow by 3GW in the next 2 years with a further 6GW later in the decade.<sup>9,10</sup> This could be increased further with additional policy support.

Figure 1 anticipates that with current policies, UK electricity generation will increase from 315TWh in 2020 to 460TWh by 2030. The increase is primarily from the growth of onshore and offshore wind generation, so allowing for estimated losses due to intermittency, 120TWh of additional generation will be available to deliver the Minus 45 target.

### What emissions savings are expected from these commitments?

Electrifying all current UK energy needs would require around 960TWh of electricity, around 760TWh more than today's total non-emitting supply. The additional 120TWh of non-emitting electricity anticipated by 2030 will therefore be enough to reduce UK emissions by around 16% when it is used to electrify current fossil fuel applications, such as petrol cars or gas boilers. This figure would be reduced substantially if any electricity were used to produce 'green' hydrogen or other synthetic fuels, due to their poor round-trip efficiency.

### What additional physical changes are we recommending?

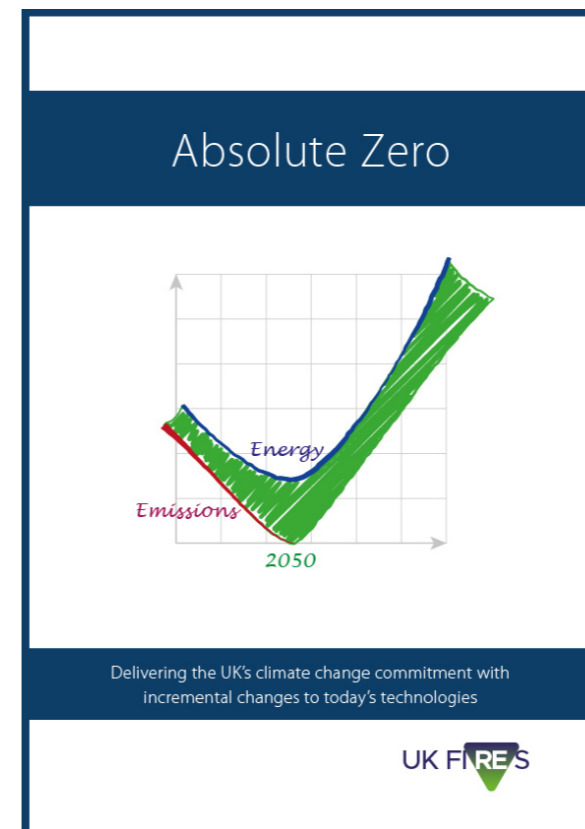
As a result of the above analysis, most emissions reductions within the Minus 45 target must come from a 30% reduction in our total energy demand. This is feasible, without a negative impact on people's lives, but unless the government acts to implement the suggestions in the remaining sections of this report, or equivalent, it will require a 30% energy austerity. Any increase in non-emitting generation beyond the projection of Figure 1 would reduce this requirement for energy demand reduction.

### What policies could lead to increased emissions-free electricity supply by 2030?

Government policies for onshore wind, solar and storage will be reflected in future Contract-for-Difference (CfD) auctions. In the most recent CfD (2021), onshore wind and solar contracts have delivery dates of 2023-2025. There are therefore only two more meaningful rounds of CfD actions that can contribute to the 2030 target, and at most one more for offshore wind which takes longer to install. The capacity cap for solar and onshore wind generation should be doubled in each successive auction round in order to meet the extended 2030 capacity targets described above.

Roof-top solar generation and domestic storage technology could be better integrated into housing policy. For example, subsidies could be offered to install solar panels at the same time as retrofitting work.

Finally, the challenge of meeting the UK's 2030 commitment to the United Nations will only increase if the government continues to subsidise existing fossil fuel sectors. Almost 30% of emissions in the Energy Supply sector come from non-electricity generation sources, in particular refineries and the manufacturing of solid fuels. In June 2021, it was announced that the government would grant permission for a new oil and gas project in the North Sea. This should be cancelled.

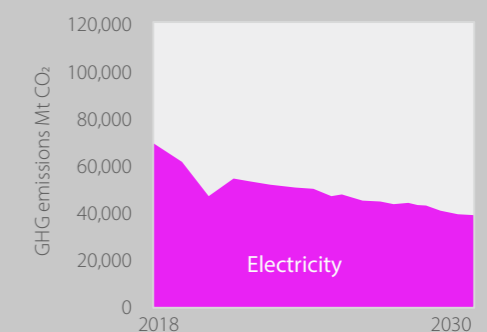


### Actions driving emission reduction:

- Reduce total energy demand by 30% by 2030;
- Continue to develop pilot trials of Carbon Capture and Storage (CCS) and hydrogen but recognise that they will have no significant effect on UK emissions before 2030;
- Halt offshore oil and gas exploration and identify and remove any subsidies to fossil fuel sectors.

### Key policy requirements

- Most of the 45% cut in emissions by 2030 must come from energy efficiency;
- Ensure that the promised quadrupling of offshore wind is delivered in reality;
- Expand solar and onshore wind generation as rapidly as possible, along with storage and demand-side response.



## 2.2 Industry and manufacturing

Most industrial emissions arise in the production of the bulk materials. These are then used in construction and manufacturing.

### Material production

Material production refers to the production of bulk materials, in particular to steel, cement, plastics and chemicals. Production of these materials dominates industrial emissions, albeit their impact is partially hidden by our net imports of goods.

### What physical changes will arise from current government commitment?

The government's current approach to industrial decarbonisation has four main themes<sup>11</sup>:

- Capital funding. However, less than 4% of the capital funding set aside for decarbonisation had been allocated by December 2020 (£35m out of £831m);
- Decarbonisation incentives in particular the EU Emissions Trading Scheme (or its UK replacement). However, to date this has given free allowances to energy intensive industries to protect domestic industry from international competition, so has had limited if any effect in reducing emissions;
- Energy and resource efficiency policies including the Climate Change Levy and the Industrial Heat Recovery Scheme. New powers under the Environment Bill also provide opportunities to mandate product standards and extend producer responsibilities, however these are yet to be translated into policy;
- Strategy development which was announced in March 2021 with the release of the Industrial Decarbonisation Strategy. However, the strategy included no new policy or physical changes so is unlikely to produce emission savings.

Current government roadmaps within the sector (particularly for iron, steel and cement) rely on Carbon Capture and Storage (CCS) and hydrogen for future decarbonisation. However, there will be very little, if any fully operational CCS or emissions-free hydrogen production in the UK by 2030, and it is highly uncertain how much will be operating in 2050. The use of fly ash or ground blast furnace slag to 'bulk out' high-emissions Portland cement has already been maximised and is not compatible with zero emissions in the long term as these substitutes are themselves by-products of other emitting processes.

As a result, current government policy is unlikely to lead to physical changes that reduce emissions in the material production sector this decade.

### What emissions savings are expected from these commitments?

BEIS' *Energy and Emissions Projections* anticipate industrial process emissions decreasing by 14%. Without specific policy support, these reductions are most likely to come from the closure of existing UK industrial processes, in favour of further expansion in imports. This is unlikely to deliver any real reduction in global emissions.

### What additional physical changes are required?

#### Steel Production

45% of blast furnace steel production must either be closed or replaced by Electric Arc Furnaces powered by non-emitting electricity. By volume, the UK could meet its requirements for new steel by recycling its own scrap metal, if total demand is reduced by 30% by more efficient construction and manufacturing and if best practice scrap sorting is applied to maintain alloy purity.<sup>12</sup> However, most UK scrap steel is currently exported, due to lack of domestic demand. Developing domestic facilities and incentives to recycle steel to high quality is therefore critical to reducing steel sector emissions by 2030.

#### Cement Production

There is currently no viable zero-emission process to make cement so production must fall by 45% by 2030. This reduction can largely be accommodated with minimal disruption to construction through more efficient building design (see next section). However, without significant changes to building design, and policies to enforce them, the total amount of construction will have to fall in line with reduced cement availability.



### Chemicals & Plastics

Emissions from the chemicals and plastic sector are dominated by a small number of key chemicals, ethylene, ammonia, nitric acid, adipic acid and caprolactam.<sup>13</sup>

Of these five, only ammonia could in future be produced with zero emissions (through using green hydrogen.) Production of emitting ammonia should therefore be phased out across the next decade.

All other chemical production processes release CO<sub>2</sub> or N<sub>2</sub>O as a by-product, and therefore production must be scaled down by 45% over this decade.

Many of the end uses of these chemicals can be adjusted to compensate for this reduced supply. For example, reducing plastic use and extending the lifetime of goods will reduce ethylene demand whereas changes in the agricultural sector (discussed in section 3.5) such as more sustainable farming practices will reduce demand for nitric acid.

### What policies will bring these changes about?

The government has a public procurement policy to support the continued production of steel in the UK.<sup>14</sup> This could be developed into Zero Carbon Public Procurement obliging use of low emissions products or designs in public projects. This would incentivise corporate investment by underwriting future demand. In parallel, while since 2016, the government has retroactively funded periods of unprofitability at both Port Talbot and Scunthorpe steel works, it could support proactive strategic investment in the change to electric arc furnace steel making, just as it funded the last major upgrade to Port Talbot in 1970.

Further policies that would reduce demand for the bulk materials are discussed in the sections on construction and manufacturing below.

### Construction

The construction industry is the dominant user of bulk materials. Most construction projects use more material than necessary through a combination of over-specification, over-building and under-use, so significant material efficiencies are possible.

### What physical changes will arise from current government commitments?

Several policies govern how buildings should be constructed to minimise their operational emissions for heating and cooling (such as Part L of the Building Regulations and Energy Performance Certificates).

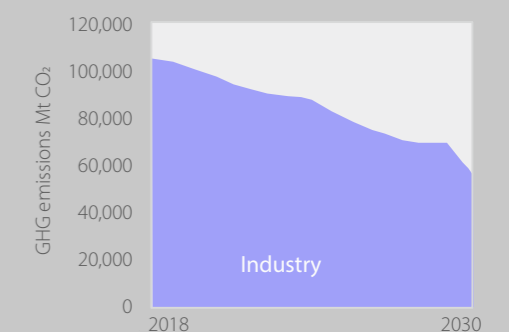
However, there are currently no regulations governing the embodied emissions associated with the construction process. Current policies are therefore unlikely to deliver any physical changes in the way the construction industry operates this decade.

### Actions driving emission reduction

- 45% cut in blast furnace produced steel, replaced with recycled steel from EAF or a cut in steel use;
- 45% cut in cement production;
- All ammonia production to be made with green hydrogen by 2030;
- 45% cut in other bulk chemical productions including ethylene, nitric acid, adipic acid and caprolactam;
- Building design efficiency improved to reduce material consumption;
- No new gas boilers in low heat manufacturing processes from 2028;
- Extended lifetime of materially intensive goods and reduced average weight for new vehicles;

### Key policy requirements;

- Zero carbon public procurement contracts for low carbon materials;
- Update building regulation to include upper limits on material usage;
- Introduce VAT on new buildings while removing it from retrofit and refurbishment.



## What emissions savings are expected from these commitments?

As embodied emissions in construction are not currently regulated, current policies will not drive any reduction in emissions from the construction sector by 2030.

## What additional physical changes are required?

Analysis of the design of buildings has shown that significant emission savings could be made through material efficiency. Material is currently wasted by using 'too much' during construction, or making poor technology choices (for example a concrete building frame is used when a steel or timber frame would suffice). Analysis in our forthcoming report on the construction sector suggests that up to 30-40% of emissions from the sector could be reduced without any reduction in the number or quality of buildings constructed.

Emissions savings from changing the building frame and reducing the materials used has not occurred to date primarily due to established convention. There has been no incentive to reduce material consumption and emissions in the sector.

Further changes to how we design buildings could provide additional carbon savings while also having indirect emission savings in the wider economy. Densification, including the construction of flats, multi-family units and mixed-use developments, requires less materials per unit of service and can reduce heating requirements. Flats and mixed-use units designed with amenities closer to home would also reduce car dependency and allow for greater use of public transport providing further emission savings.

In addition to improving the efficiency of construction projects, reducing the total number of new construction projects will reduce the physical requirement for emitting materials. This could be achieved through repurposing and refurbishing existing buildings and infrastructure rather than demolishing and building new. For example, several ongoing (and planned) large infrastructure projects that facilitate carbon intensive activities, such as roads, the Silvertown Tunnel and new runways, should be cancelled.

## What policies will bring these changes about?

The following policy actions are required:

- Update planning law and regulation to ensure that low carbon construction is the norm, including optimising the building frame and reducing material

consumption, in line with the findings of the UK FIRES construction report;

- An upper limit on material use in construction should be added to building codes alongside the existing minimum requirements to create an acceptable range which would reduce total material use while retaining building safety;
- VAT should be applied to the construction of new buildings and developments and removed from retrofits and refurbishments;
- The government should also do more to encourage high density affordable housing, including increased provisions for local councils to build more council housing;
- All government infrastructure projects should be brought in line with net zero targets. This includes avoiding building new roads or runways while investing in the rail network and electrifying road systems (see section on freight transport).

## Manufacturing

Manufacturing spans all other uses of the bulk materials and includes the processing of food and drink.<sup>15</sup>

## What physical changes will arise from current government commitments?

Current government plans are defined by the industrial decarbonisation strategy which makes no specific reference to decarbonising the less energy intensive industries of downstream manufacturing. Several existing broad policies including the ETS and Climate Change Levy, the Non-Domestic Renewable Heat Incentive, and the Industrial Energy Transformation Fund apply to manufacturing. However, as written at present, they will not directly bring about any meaningful physical changes to the manufacturing sector by 2030.

## What are the expected emissions savings from these commitments?

BEIS' *Energy and Emissions Projections* anticipate a 21% reduction in emissions from the business sector this decade. However the definition of "business sector" includes material production and commercial activity in addition to manufacturing. Given the lack of meaningful physical changes discussed above, current government policies are unlikely to lead to emission savings in manufacturing.

## What additional physical changes are required?

The primary physical change required this decade is the electrification of 'low temperature' processes.<sup>16</sup> Typically, these are processes where gas burners are used to heat materials to temperatures under 400°C, where efficient electric alternative processes are already available. One third of manufacturing emissions from low temperature processes could be abated through electrification by 2030.

Further emission reduction could be delivered through changes to business models leading to longer lasting, less material-intensive goods, with greater utilisation. By shifting revenue from replacing physical goods, to maintaining, upgrading and adapting existing goods, less total production (and hence emissions) would be required.

A good example of this physical changes would be to combine a reduction in the average weight of new cars with much longer warranties and new apps to support ride-sharing.

## What policies will bring these about?

A reduction in low temperature process emissions could be achieved through a ban on gas boilers where electric alternatives are viable. This could be tied to the ban on household boilers (discussed in section 2.5) with subsidies offered before 2030 to drive early adoption.

The weight reduction in vehicles could be achieved through a government mandate, similar to the CO<sub>2</sub> performance standards that already apply.

The incoming 'Right to Repair' bill should be focused on material-intensive goods, including cars, large industrial equipment, and large domestic appliances.

## Opportunities for growth in Material Production, Construction and Manufacturing

Proactive legislation in the UK that ensures delivery of our emissions reduction commitments for 2030 and 2035 creates the opportunity for rich first-mover advantages to innovative UK businesses. Whether in all-electric bulk material production, new approaches to electric material upcycling, or the software and services of materially-efficient design, maintenance use and life-extension, UK businesses will prosper from firm policy applied to deliver on the emissions targets.

Forthcoming UK FIRES reports *Construction in Absolute Zero* and *Materials and Manufacturing in Absolute Zero* describe specific business opportunities in these sectors, while our recent publication *Emissions Not Entrepreneurs* extends the survey of business growth opportunity across all sectors.





## 2.3 Transport

The transport sector accounts for over a quarter of all UK emissions (excluding international aviation and shipping).

In July 2021 the Government released its *Transport Decarbonisation Plan* which describes the intention to decarbonise the transport sector by 2050. However, the plan does not define sufficient actions to meet the 2030 target. The report promotes hydrogen as a key energy source for decarbonisation without recognising the energy constraints of hydrogen use. It describes an ambition to increase walking and cycling but does not recognise the need to reduce vehicle mileage substantially. It also omits any discussion of policies to support shifts in preferences from private car use towards public transport.

Most importantly, current policy assumes that aviation can continue by using new fuels. However, constraints on the global supply of biomass rule out bio-kerosene, and without an excess supply of non-emitting electricity, there is no possibility that synthetic fuels can be produced at high scale. As a result, aviation must decline towards virtually zero by 2050, with a significant reduction required by 2030. This requires policy to reduce airport capacity and support mode-shift for example through better integration with the European Rail Network. However, the government has no policy in place to move in this direction, and meanwhile many UK airports are proposing expansion.



## Passenger Transport and Light Goods Vehicles

### What physical changes will arise from current government commitments?

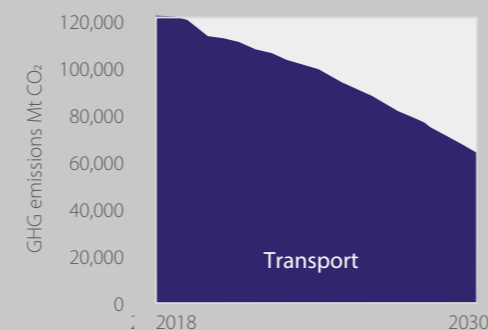
The government has committed to phasing out the sale of all new petrol and diesel cars from 2030, and from 2035 all new cars and vans sold will be required to have zero tailpipe emissions.

### Actions driving emission reduction

- 20% reduction in vehicle-km for cars and vans combined with reduction in vehicle weight;
- 45% reduction in vehicle-km for heavy goods vehicles;
- Reopen 350 miles of railway track to increase access to the rail network;
- 50% of outstanding rail network to be electrified by 2030.

### Key policy requirements

- Decrease in rail fares and increase in fuel duty to achieve at least price parity between cars, trains and planes;
- Vehicle excise duty to be levied based on vehicle weight;
- Long term commitment to an electric road network for HGVs;
- Tax incentives to increase HGVs utilisation and reduce empty leg trips;
- Clear signals on rapid reductions in aviation.



The ban, and the resultant increase in battery electric vehicle sales this decade is one of the most meaningful actions by the government designed to reduce emissions one of the few policies passed since the Climate Change Act was redirected to net zero in 2019.

As a result of the policy, it is anticipated that around 40% of all cars/LGVs on the roads of the UK will be either battery-electric or plug-in-hybrid vehicles by 2030.<sup>17</sup>

### What emissions savings are expected from these commitments?

If non-emitting electricity is used to power the increased number of electric vehicles, and if the phase out of petrol and diesel vehicles increases linearly between now and 2030, existing policy could reduce car and LGV emissions by 35% (relative to 2018) by 2030.

Under these strong assumptions, with no change in the annual mileage of vehicles, annual car and LGV emissions could fall from 88MtCO<sub>2</sub>/yr in 2018 to 53MtCO<sub>2</sub>/yr by 2030.

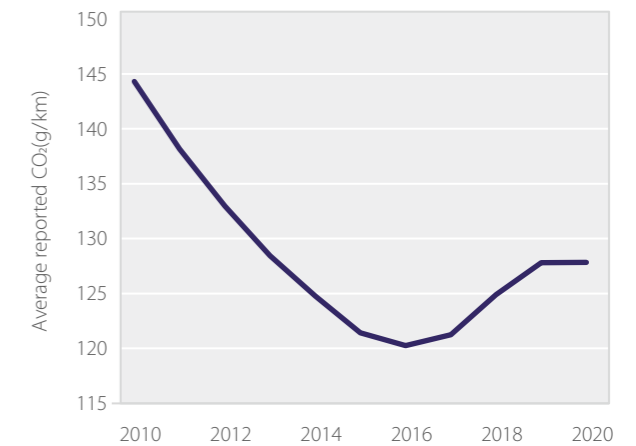
### What additional physical changes are required?

Two further physical changes are required to bring the car/LGV sector in line with the UK government's commitment to the United Nations. Firstly, the total traffic on UK roads, measured in vehicle-km, must be reduced by 20% by 2030. Secondly, despite recent trends favouring larger SUV type vehicles, the average weight of new vehicles sold should be reduced from 1,400kg to 1,000kg by 2030. This reduces material production requirements, while also reducing the demand for non-emitting electricity, as the energy required to propel cars grows roughly in proportion to their weight.

In parallel, government must begin to act before 2030 to curb demand for aviation, in order to guarantee its commitment to reducing aviation emissions by 2035 by 68% from 1990 levels.

### What policies will bring these changes about?

Train travel costs up to six times more than travelling by car at present. To reduce the number of vehicle-km driven this decade, the government should ensure price parity between train and car journeys. When the government regains control of ticketing and pricing in 2023, under the Great British Railway, train ticket prices should be significantly lowered to encourage greater use with revenue supported by increases to road taxes and fuel duty.



**Figure 2: Average reported emissions of new vehicles 2010-2020 (gCO<sub>2</sub>/km<sup>18</sup>)**

In anticipation of a national shortage of non-emitting electricity, as both road travel and space heating are electrified, the government must pass regulation limiting each manufacturer's new car fleets to an average weight of 1,000kg. This could be supported by taxing vehicles by weight and expanding the current practice of differentiating tax rates to cover all years of ownership. By pairing a tax by weight with a partial rebate for electric vehicles, the government could provide a dual incentive to support the introduction of smaller, more efficient vehicles while accelerating the adoption of electric vehicles.

## Freight Transport

Freight transport refers to road freight transported by Heavy Goods Vehicles and Rail Freight. Road freight is currently dominant but the government's commitment to 2030 emissions reduction requires a significant shift to rail.

### What physical changes will arise from current government commitments?

There is currently no government policy actively targeting a substantial decarbonisation of the freight industry this decade. The Mode Shift Revenue Support scheme provides small incentives to shift from HGV to rail, and some innovation support has been provided to stimulate Heavy Goods Vehicle (HGV) decarbonisation. However, policies at this scale are unlikely to drive substantial change before 2030.

The plan anticipates a ban on the sale of new non-zero emission HGVs (under 26ft) in 2035 and those over 26ft in 2040, however this will have no effect before 2030 and is still under consultation.

Independent of the government's consultations, the sector is researching net zero freight, including battery electric HGVs, hydrogen and biofuels. However, battery electric HGVs require very large batteries with significant material

concerns, while hydrogen is inefficient (so would drive up demand for non-emitting electricity) and expanded use of biofuels is incompatible with the essential requirements of global conservation and eco-diversity.

The government has committed to introducing policies that will incentivise Rail Freight Operating Companies to use more electric and low-carbon traction this decade. It has also recognised the need to ‘infill’ track to connect to key ports and terminals to incentivise expanded electric train use in future. However, no targets have been set regarding how or when this is to be achieved. In their transport plan the government committed to introducing a rail freight growth target but did not provide a date or target.

### What emissions savings are expected from these commitments?

Some emission reductions can be expected this decade, through continuation of existing policies such as the Renewable Transport Fuel Obligation and the Mode Shift Support Revenue. If new programmes such as the new rail freight target are introduced, they may have an impact. However, given that no meaningful target has been set or new regulation passed since the net zero target was introduced no meaningful emission reduction is expected this decade to support the government’s pledge at COP26.

### What additional physical changes are required?

Immediate actions are required to reduce freight emissions by 45% by 2030. As there is insufficient time for a meaningful shift to zero emission vehicles, this emissions reduction can only be delivered by a 45% reduction in total vehicle-km.

This reduction can be achieved by three changes:

- mode shift from road freight to rail to make better use of available rail capacity. Currently 10% of UK freight is transported by rail. A target should be set to increase this to 20% by 2030;
- more efficient utilisation of available vehicle capacity. UK freight capacity utilisation is approximately 60%, increasing this to 80% (as seen in Germany)<sup>19</sup> could see up to a 25% reduction in vehicle-km;
- reducing the number of empty load trips. HGVs in the UK are currently empty for 25-30% of their trips.<sup>20</sup> If half of these empty legs were used to cover existing freight trips, a further 10-15% of HGV vehicle-km could be saved.

Longer term, a new electric road system (ERS) should be pursued, with electricity transmitted directly to HGVs on major roads through a pantograph (similar to that used for electric trains and trams). Freight would then be powered through overhead cables for most of their journey, with smaller batteries installed for the final mile(s).

### What policies will bring these changes about?

Existing plans to ‘infill’ sections of the rail network to allow more freight transport must be prioritised to allow freight on to the rail network, as well as an expansion of the carbon levy to include road freight transport.

Tax incentives will also be required to increase load capacity and reduce empty leg journeys. A tax and subsidy scheme should be introduced, taxing empty leg journeys but offering subsidies to hauliers achieving average 80% utilisation rates.

### Public Transport

Public transport must expand to allow for greater decarbonisation in private passenger journeys.

### What physical changes will arise from current government commitments?

The government has set out a plan to bring UK passenger rail under greater government control, through the creation of Great British Rail (although with continued franchising).

The transport plan claims that this will allow the industry to “modernise fares ticketing and retail”, however neither this or the commitment to improve integration between different modes of transport is sufficiently specific to anticipate any physical changes this decade.

The government’s ‘bus back better’ plans to introduce 4,000 electric buses (12.5% of the current fleet) which would electrify 15% of the current UK bus fleet. The plan includes other commitments to improve frequency, reliability and reduce the cost of buses to increase passenger use, but details have not been released.

### What emissions savings are expected from these commitments?

Without meaningful commitments to electrify the rail network this decade, current policy will not lead to any emission reduction from the rail sector this decade.

The delivery of 4,000 electric buses, if all powered by new non-emitting electricity, would reduce CO<sub>2</sub> emissions from buses by 12.5% (saving approximately 0.4MtCO<sub>2</sub>).

### What additional physical changes are required?

The government should commit to electrifying 50% of the UK’s non-electric rail track by 2030 to support zero-emissions passenger and freight rail transport.

To expand rail connectivity, the government should reopen lines based on the recommendation of the Campaign for Better Transport. Specifically, the government should seek to reopen all Priority 1 – Phase 1 routes by 2025 and all Priority 1 – Phase 2 routes by 2030. The reopening of ~350 miles of track, combined with appropriate price incentives, could see 20 million passenger journeys switch from car to rail by 2030.<sup>21</sup>

### What policies will bring these about?

Both objectives could be achieved through direct government action, via National Rail and Great British Railway.

### International Aviation and Shipping

International Aviation and Shipping are included in the government’s 2035 emission reduction target. Given the lack of zero carbon alternatives for these activities, plans to reduce our dependence on these activities need to begin today. Therefore a 45% cut in emissions should also be targeted for the sector this decade.

The government’s transport plan assumes that we will be able to meet the demand for aviation through new sustainable fuels. However, there are currently no viable alternatives to the use of fossil fuels; with insufficient global bio-capacity for the mass production of bio-kerosene and insufficient surplus non-emitting energy for synthetic fuels.

To reduce aviation emissions, we need to grow our international rail travel capacity and directly reduce the number of flights taking-off from the UK. The above policies to favour rail travel may contribute to this goal. However, more targeted policies must include raising passenger duty tax, planning the closure of airports and leading international negotiations to tax aviation fossil-fuels.

Reducing international shipping emissions similarly requires reducing our dependency on imported goods. This can be achieved through extending the lifespan of goods and becoming more self-reliant, for example by recycling steel domestically rather than exporting UK scrap while important new steel (as discussed above).

Unless domestic capabilities are greatly expanded this decade, the requirement to reduce shipping emissions must be translated into a direct reduction on shipping and hence imports, leading to significant and rapid harm to the economy.

## Opportunities for growth in Transport

Policy action in the transport sector will unlock a number of opportunities for business growth and innovation. The investment required to electrifying the rail network and install an Electric Road System has the potential to create thousands of jobs while demand for primary materials to build these systems can also stimulate low carbon materials production.

The government can also stimulate growth in new and existing sectors such as rail freight, while expanding UK manufacturing to reduce demand for goods imported by emitting planes and ships.

For more discussion on this, see the forthcoming *UK FIRES Transport in Absolute Zero* report.



## 2.4 Space and water heating

Heating the spaces and water in both homes and commercial buildings drives most energy-use in buildings.

### What physical changes will arise from current government commitments?

The Government's 10-point plan includes a target to install 600,000 heat pumps annually by 2028, a 20 fold increase on the 31,000 heat pumps installed in 2019.<sup>22</sup> In October 2021, the government's 'Net Zero Strategy stated an ambition that no new gas boilers will be sold beyond 2035.

However, the government has scrapped the Green Homes Grant programme which was intended to stimulate home retrofits. The Net Zero Strategy announced two small schemes for modest retrofit (to EPC Band C) of fuel poor and social housing. Over the last six years, the number of building retrofits stemming from government policy (including the Green Deal Framework and the Energy Company Obligations) have fallen from a peak of 80,000 installations per month in 2014 to 10,000 per month in 2019.<sup>23</sup> At the current rate, less than a million retrofits will be carried out between now and 2030. This would be less than 7% of the 14 million retrofits required to ensure that all properties have a baseline level of insulation.

The government is also consulting on a tighter minimum energy efficiency standard for non-domestic properties that would require such properties to have a minimum Energy Performance Certificate (EPC) B rating by 2030.

### What emissions savings are expected from these commitments?

Residential heating produced almost 68MtCO<sub>2e</sub> in 2019, 15% of all domestic UK emissions. A linear expansion of heat pump installation to meet the government's 2028 target would see an emission saving of approximately 6.5 MtCO<sub>2</sub>.

Continuing retrofits at the current rate without any new government interventions or incentives would save less than 1MtCO<sub>2</sub>. The final form of the proposal for non-domestic buildings and any exemptions has not been made public and therefore its effect on emissions cannot be estimated.

### What additional physical changes are required?

Heat pumps are essential to decarbonise heating as they run off electricity and are very efficient. However, the government's current commitment is insufficient and should be increased to over 1 million heat pumps installed annually by 2028. From 2028 onwards no new gas boilers should be installed in the UK. The combination of these two actions would save approximately 11Mt CO<sub>2</sub> by 2030. This figure is still far below the government's commitment to Minus 45 so further measures are required.

30% of UK homes are currently in need of cavity wall insulation while another 35% of homes need loft insulation. As a minimum, these properties must be retrofitted by 2030. In addition, only 10% of solid walls have insulation. Owing to the greater challenge of retrofitting solid walls, a third of outstanding properties should be retrofitted this decade. Our analysis suggests that 12MtCO<sub>2e</sub> could be saved annually by carrying out these three forms of retrofit.

The zero-carbon homes commitment that was cancelled by Prime Minister Cameron in 2015, should be reinstated requiring that all new homes have net zero emissions from 2025 would save around 8MtCO<sub>2</sub> by 2030.

Finally, the minimum EPC standard for non-domestic buildings should be raised to A as soon as possible and no later than 2030.

### What policies will bring these changes about?

A ban on all new gas boilers from 2028 would set the direction of travel and drive rapid adoption of heat pumps. The 2028 date would allow sufficient time for business growth and production to be scaled in advance of the ban. This policy requires supportive subsidies for low-income households and investment in training to scale up the required workforce.

The decline in retrofits over the last decade and the cancellation of the Green Homes Grant shows that simply offering money for retrofits is not sufficient to promote adoption. This is supported by research dating back to 2013 conducted by the UK Green Building Council. This same research set out several other policy proposals that would have a greater impact and should be considered today. These include a variable Stamp Duty Land Tax,

variable Council Tax, and an Energy Efficiency Feed-in-tariff scheme,<sup>24</sup> all of which should be trialled immediately, given the speed and number of retrofits required.

The EPC target for new domestic and commercial buildings can be implemented through an amendment to existing Minimum Energy Efficiency Standards with a new requirement to prove net zero use emissions during the planning and commissioning process.

### Actions driving emission reduction

- 1 million heat pumps installed per year by 2028;
- Retrofit the 35% of homes without loft insulation and 30% of homes without wall cavity insulation by 2030;
- Begin to carry out retrofits on solid wall properties, targeting 30% of solid wall homes by 2030;
- All non-domestic properties have EPC rating A by 2030.

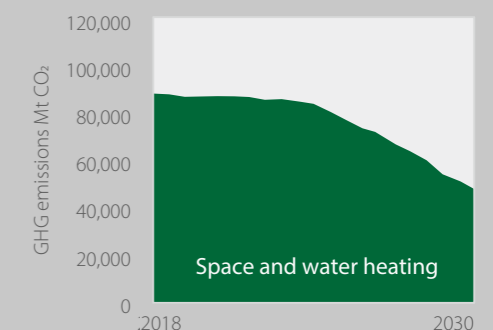
### Key policy requirements

- Gas boilers banned from 2028;
- Additional subsidies for heat pump installation and retrofits for low-income households;
- Introduce variable Stamp Duty Land Tax, variable Council Tax, and an Energy Efficiency Feed-in-tariff to incentivise deep energy retrofits;
- The current minimum energy efficient standards for non-domestic and domestic rented buildings should be increased to an EPC A rating.

## Opportunities for growth in Space, Water and Heating

The technology for reducing energy demand from buildings (i.e. air-tightness, insulation and heat management) is widely available, but there are few specialist installers, and we lack advisors to help house-holders develop and finance a retrofit plan.

The market for building retrofits (including installing heat pumps) is going to grow rapidly, creating not just business growth opportunities but new demand for a suitably skilled workforce. New government investment in training and education to meet this demand for skills, will facilitate business growth and accelerate deployment.



## 2.5 Agriculture and land use

This sector includes emissions from the agricultural sector and from land-uses including forestry, wetland and settlements.

### What physical changes will arise from current government commitments?

Government support of the agricultural sector is currently in a transition moving away from 'Direct Payments' to different forms of support.<sup>25</sup> While the need to reduce emissions in the sector is recognised as part of the transition, and the Net Zero Strategy includes unquantifiable suggestions (e.g. "75% of farmers in England will be engaged in low carbon practices by 2030") no specific emissions reductions can be anticipated.

### What emissions savings are expected from these commitments?

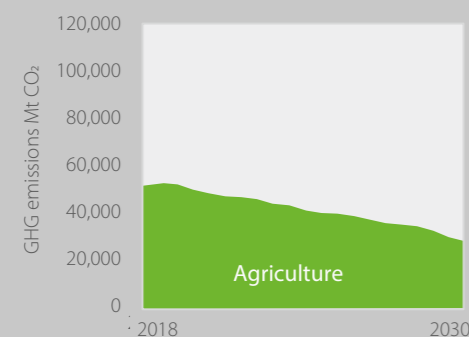
BEIS's *Energy and Emissions Projections* projects no change in agricultural emissions and a slight decrease in the net negative emissions in the land use sector.

### Actions driving emission reduction

- Halve all food waste;
- 30% reduction in beef, dairy and lamb consumption;
- 30% reduction in agricultural waste;
- Halve direct emissions from soil;
- Manage land-use for net zero emissions.

### Key policy requirements

- Information, labelling and procurement contracts to promote low-emissions diets;
- Taxes on beef, lamb and dairy products;
- Investment in 'alternative proteins'.



### What additional physical changes are required?

The largest source of agricultural emissions is from rearing ruminant livestock. In the absence of proven technological options, the government's commitment to reducing these emissions can only be delivered by reduced consumption of beef, lamb and dairy products.

A portfolio of changes that would deliver the government's commitment to the United Nations might be:

- Halve all food waste in the UK by 2030, saving 5Mt CO<sub>2e</sub> per year;
- Beef, lamb, and dairy consumption reduced by 30% by 2030;
- Emissions from agricultural waste cut by 30% through better waste management;
- 50% reduction in direct soil emissions from better allocation, and reduced use of industrial fertilisers;
- Managing total land-use to have net zero emissions by converting cropland to carbon sinks and restoring wetlands, targeting 50% of peatland in good condition by 2030.
- What policies will bring these changes about?

Government information campaigns, labelling and procurement contracts could be modified to support reduced consumption of beef, lamb and dairy products. However, given the speed and scale of the Government's commitment, additional incentives such as a tax will be required, accompanied by increased funding and access to appropriate alternatives such as plant-based diets.

The National Food Plan's recommendation to invest in 'alternative proteins' should be implemented alongside increased innovation funding to farms and communities.

Reducing consumption of ruminants has the co-benefit of releasing land currently used for growing fodder. This could be "re-wilded", to increase UK carbon sinks and reduce emissions associated with fertiliser use, although this would require government compensation to farmers. Other policy to support emissions-reducing practices in arable agriculture could include ensuring better (reduced) application of fertilisers, expanded use of cover crops and regenerative agriculture.

Although afforestation is politically attractive, no new forests planted before 2030 will contribute to meeting the government's 2030 commitment, due to the speed of tree growth.

## 2.6 Waste Management

Capturing and reducing methane emissions from UK landfill has been a success for UK climate policy since 2000. Between 2000 and 2019 UK waste emissions fell by almost 70% (see Figure 3).

### What physical changes will arise from current government commitments?

No new commitments have been proposed by the government to reduce emissions further from the waste sector, and therefore any future emission reduction will occur from the continuation of existing policies including the landfill tax, permit requirements under the EU landfill directive and financial incentives to capture and use methane as a renewable energy source.

### What emissions savings are expected from these commitments?

BEIS's *Energy and Emission Projections* show emissions from the waste sector falling 22% this decade.

### What additional physical changes are required?

No bio-degradable waste should be land-filled from 2030.

### What policies will bring this change about?

The landfill tax rate should be raised through this decade to until a legal ban on landfilling biodegradable waste is passed.

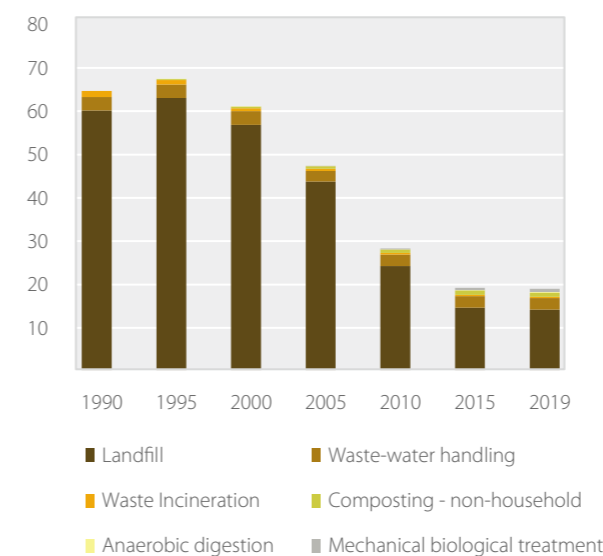
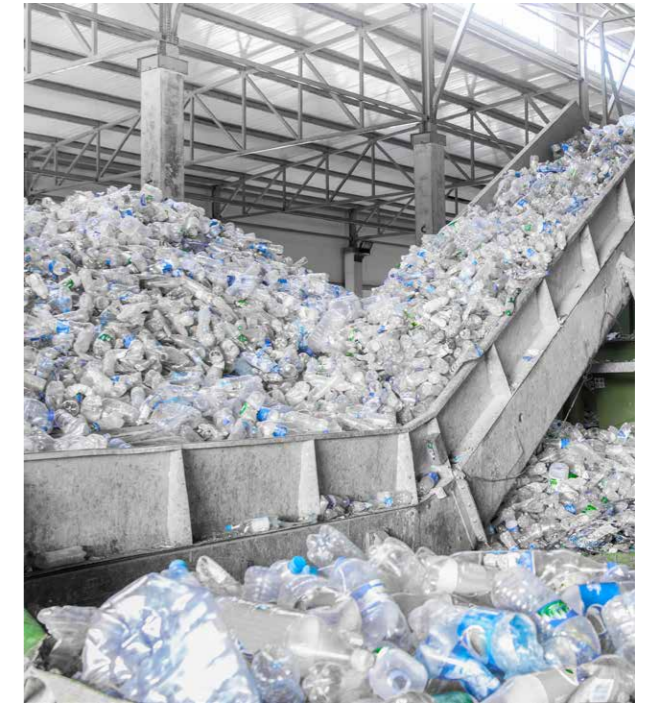


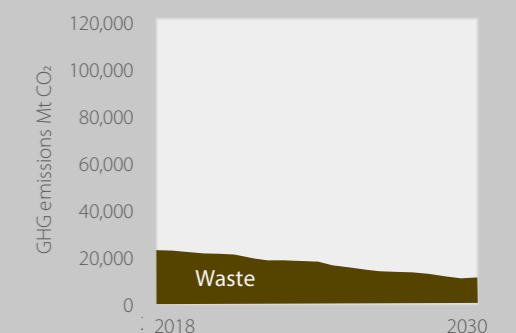
Figure 3: Waste sector emissions 1990 - 2019

### Actions driving emission reduction

- Ban on all biodegradable waste going to landfill from 2030 onwards.

### Key policy requirements

- The ban must be enacted as legislation with policies to support the transition such as whole crop purchase contracts, increases in landfill tax and household behaviour change policies.



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