

## The UK government's Net Zero Strategy (NZS)

Peter Somerville, Emeritus Professor of Social Policy, University of Lincoln

18.11.21

When the government published their [Ten Point Plan](#) a year ago they recognised that it did not go far enough to fulfil their international commitment to reducing carbon emissions. One year on, their [Net Zero Strategy](#) does go a little further, but still falls far short of what is required. The problems inherent in the original plan persist, namely:

- A failure to recognise that the world is now experiencing a climate emergency, and therefore that more drastic action is required in the short term (before 2025) to reduce carbon emissions (see p18, Fig 1, or p77, Fig 13 - minimal reductions up to 2025)
- A continuing (and increasing) reliance on problematic technologies that do not currently exist at scale, particularly in carbon capture, use and storage (CCUS) - e.g. [direct air carbon capture](#)
- A failure to explain clearly how expected future carbon savings have been calculated, particularly in industry, buildings and transport
- A neglect of issues relating to agriculture, food, land use and energy storage
- An emphasis on constructing new nuclear power plants, with a new (from 2022) Future Nuclear Enabling Fund of £120 million, but with no net increase in nuclear power capacity likely until after 2030 ([Minus 45 - UK FIRES](#), p7); in the meantime construction work is adding significantly to carbon emissions (see, for example: [Record-breaking concrete pour lays Hinkley Point base slab](#))
- An emphasis on GDP growth, despite the strong correlation between such growth and increasing carbon emissions
- A lack of clarity about how specific policies could achieve intended emission reductions, e.g. on hydrogen
- A failure to curb the expansion of aviation to 2030 and beyond (an expansion that is encouraged rather than hindered by the latest spending review's decision to cut air passenger duty)
- A failure to take account of other government programmes that increase rather than reduce emissions, e.g. increased spending on roads (£27 billion) and defence (£24 billion) up to 2024.

The government has already committed to invest £25.5 billion for a Green Industrial Revolution (£12 billion under the Ten Point Plan, £9.7 billion for 18 deals at the Global Investment Summit in October 2021, and £5.8 billion on other sustainable projects since the Ten Point Plan). Together with £40 billion for the new UK Infrastructure Bank (p206), and leveraging £90 billion of private investment, this funding is expected to support 440,000 jobs in 2030 (pp16,17,49).

NZS describes three future scenarios but arguably only scenario 1 (high electrification) is really worth considering. Scenario 2 is based on a hydrogen-dominated pathway, even though the

NZS is already committed to electricity as the main source of so-called ‘low-carbon’ domestic heating (it seems to be assumed that electricity generation will be fully decarbonised by 2035). And scenario 3 (high innovation) is based largely on wishful thinking about green aviation and [direct air capture](#). Even scenario 1 has serious limitations - for example, as with the other scenarios, it takes no direct account of uncertainty about future technology costs and availability (p316) - so much for the precautionary principle, one might argue.

Policy area	Claimed emissions savings to 2030 (MtCO2e)	Claimed emissions savings to 2035 (MtCO2e)	Public investment (£million)	Estimated jobs supported ('000s)	Comment
Negative emissions technologies	20-30	30+	20,000 (to 2037)	Not stated	NETs do not exist at scale in UK
Hydrogen manufacture	82-139 (for 2023-2032)		10-22,000 (to 2030)	10	Uncertain future
Energy generation		58 (100% decarbonised electricity)	380	60	Not possible if electricity demand expands
Industry	33.5-41	49-59	14,000	54	Policy is undeveloped
Heat and buildings	19-28.5	36-48	17,000 (to 2037)	240 (by 2035)	Insufficiently ambitious
Transport	42-56	65-76	Unclear (total investment of 220,000 to 2037)	74	The most egregious policy failure
Nature for Climate	Not stated	Not stated	750	Not stated	Policy is undeveloped
Waste	Not stated	Not stated	295	Not stated	Policy is undeveloped
<b>Total</b>	<b>196.5-294.5</b>	<b>377-410</b>	<b>62,425-84,625 (excl transport)</b>	<b>418</b>	<b>High level of savings for low level of investment and jobs</b>

**Fig 1: Policy areas and emissions savings expected under the NZS**

The discussion of negative emissions technologies (NETs) in the Strategy is difficult to follow. On p82 it talks about carbon capture of 20-30MtCO<sub>2</sub> a year being required to meet the increase in electricity demand (primarily for electric vehicles and heat pumps) by the early 2030s (see also p126), and at least 50MtCO<sub>2</sub> by the mid-2030s. Some of this is for industry (9MtCO<sub>2</sub> a year by 2035 is mentioned on p88 and p120) and some for direct air capture, but the details are unclear. Some must be for blue hydrogen manufacture but this is not specifically mentioned. In the Technical Annex, pp325-6, Table 10 provides a figure of 7MtCO<sub>2</sub> a year by 2035 of industrial CCUS and 23MtCO<sub>2</sub> a year by 2035 of bioenergy carbon capture and storage (BECCS) and Direct Air Carbon Capture and Storage (DACCS) (stated also on p188), and the latter figure is the same as that on p89, so it looks like the total envisaged removal may well be 30MtCO<sub>2</sub> a year by 2035, at least under the preferred high electrification scenario. As the Strategy says on p82, this is certainly more than double what was stated in the Ten Point Plan - it is in fact three times as much, and rising to 75-81 MtCO<sub>2</sub> a year by 2050 (p188) (75MtCO<sub>2</sub> under the high electrification scenario, 81MtCO<sub>2</sub> under the high innovation scenario - p318, Table 4). Overall, therefore, this is a much bigger carbon unicorn than a year ago (for an interesting commentary on why this might have occurred, see Nafaz Ahmed, 2021, [here](#)), but that does not mean it has become any less unreal - three times a fantasy is just a bigger fantasy (for useful summaries of the benefits and problems of using biofuels, see [The Biofuel Controversy](#) and [Economics of Biofuels](#); for a useful discussion of the problems with BECCS in particular, see [Can BECCS help us get to net zero?](#) To which the answer is: At best only slightly - and that is assuming that the biofuel is sustainably sourced, which is usually not the case). A total amount of £20 billion investment is said to be required for greenhouse gas removals up to 2037 (p192), which sounds like a lot of money to risk on technologies that will not be viable at scale in the UK before 2030 ([Minus 45 - UK FIRES](#), pp6, 10).

On *hydrogen*, the Strategy repeats the Ten Point Plan to build 5GW of 'low-carbon' capacity by 2030, achieving emissions savings of 41MtCO<sub>2</sub>e from 2023-32 (p109), and adds an aim to provide 10-17GW by 2035 (depending on whether the pathway follows scenario 1 or scenario 2) (p110). Assuming that 'low carbon' means relatively small quantities of carbon being emitted in the production process, by my calculation this could mean emissions savings of the order of 82-139MtCO<sub>2</sub>e. The actual savings, however, depend on the rate at which the additional capacity is developed, and this is not discussed in the Strategy (indeed the relationship between capacity development and emissions reduction generally is not discussed anywhere in the Strategy, which suggests that statistics about future emissions reductions are not intended to be taken too seriously). The construction of hydrogen capacity is supported initially by a Net Zero Hydrogen Fund of £240 million (p121), with an expected additional total investment of £10-22 billion up to 2030 (for scenarios 1 and 2, respectively) (p110). This seems to constitute an additional commitment compared to the Ten Point Plan (e.g. supporting 10,000 jobs rather than 8,000 jobs), but it is not clear how much of this additional investment is expected to be public (£500 million was pledged in the Ten Point Plan). Under Industrial Decarbonisation and Hydrogen Revenue Support, the Strategy offers £100 million for green hydrogen projects (p127) (that is, hydrogen produced by the electrolysis of water), but it also seems to assume (incorrectly) that the production of blue hydrogen (extracted from natural gas) is low carbon - see, for example,

Howarth and Jacobson (2021), [How green is blue hydrogen](#) and [Carbon from UK's blue hydrogen bid still to equal 1m petrol cars](#). Even though the cost of green hydrogen is falling ([Green Hydrogen's Rapidly Falling Costs Undermine the Gas Industry's Argument for Blue Hydrogen](#)), the government looks forward to an expansion of blue hydrogen in the interim. This is a serious error, not least because the carbon dioxide that is a byproduct of blue hydrogen's production needs to be captured and stored, which requires extra energy and costs (for possible explanations of this error see [Hydrogen hype](#) and [Blue Hydrogen is an Environmental Dead-End](#)). It is fortunate, then, that the Strategy defers a final decision on hydrogen until 2026, by which time green hydrogen may be more firmly established.

*Power.* The Strategy commits to £380 million for offshore wind by 2035 (p94), which is more than twice what was pledged in the Ten Point Plan (£160 million), with a Contract for Difference budget of £200 million already allocated for this purpose. However, the Ten Point Plan's offshore wind targets of 40GW (quadrupling current capacity) and 60,000 jobs by 2030 remain. Onshore wind is now being permitted but there is no provision for public investment or target setting either in onshore wind or solar - the relevant industry bodies estimate that by 2030 onshore wind capacity could reach 30GW (currently 14GW), and solar power capacity at least 28GW (currently 14GW), or as much as 40GW if linked to new build and deep retrofit programmes ([Lighting the way - Solar Energy UK](#)). In terms of electricity generated in 2030 this amounts to 128TWh from offshore wind (quadrupling the current output) plus about 68TWh from onshore wind (more than doubling the current output) and 26TWh from solar power (doubling current output) (see [Wind powered electricity in the UK](#) and [Minus 45 - UK FIRES](#), p7 and [Lighting the way - Solar Energy UK](#), p12). Total electricity generated from wind and sun in 2030, therefore, on the basis of current government pledges and likely market provision, will be around 222TWh, compared with the current generation of 77TWh (64 from wind, 13 from solar). This is a major increase, but the demand for electricity is set to rise substantially due to the electrification of transport and heating systems, the need for renewable energy storage, the manufacture of green hydrogen, and industrial decarbonisation generally - UK FIRES (2021, p8) estimates that 960TWh will be required by 2030, so there remains a huge shortfall.

The Strategy envisages a fully decarbonised electricity network by 2035 (p98), but this seems to be possible only on the basis of massive and overwhelmingly private investment (at least £280 billion - p99) and the abatement of emissions from fossil-fuel power stations (i.e. CCUS) (no closures of gas power stations are planned in the current decade). Carbon emissions from the power sector are expected to be reduced from 58MtCO<sub>2</sub>e in 2019 (p95) by 80-85% by 2030 (p96), that is, to 9-12MtCO<sub>2</sub>e. This is a reduction of over 46MtCO<sub>2</sub>e, more than twice the 21MtCO<sub>2</sub>e reduction due to offshore wind alone from 2023-2032 pledged by the Ten Point Plan. Presumably, much of this will be achieved by deployment of onshore wind and solar, but this is not stated in the Strategy. So it is not clear here how much the Strategy is relying on CCUS and other NETs, which will not be available at scale in the UK until after 2030 ([Minus 45 - UK FIRES](#), p6). The private investment could be forthcoming, as the national grid is driving electricity decarbonisation (see [Great Britain on track for periods of zero carbon electricity in 2025](#)), but this is not discussed in the Strategy, and the issue of energy storage (to allow for the intermittency of wind and solar energy) is also not addressed (though there is a reference on

p98 to the possibility of using hydrogen for this purpose). Given the uncertainties associated with CCUS, as with NETs more generally, it would make more sense to aim for higher capacity for renewable electricity generation, relying not only on offshore wind but also onshore wind and solar energy, and to give more serious attention to how this energy is to be stored so that it is available in sufficient amounts when the sun doesn't shine and the wind doesn't blow. However, it seems unlikely, to say the least, that this will be sufficient to meet the expected future demand for electricity, so fossil fuel use will continue unless demand is substantially reduced. Meanwhile the government continues to provide support for oil and gas (see, for example, [Johnson's backing for the Cambo oilfield is unscientific and potentially disastrous](#)) and has not ruled out the opening of new coal mines (see [Cumbria coal mine: What is the controversy about?](#)), not to mention the scandalous case of Drax (see, for example, some of the links in [Stop Drax's Greenwashing at COP26](#)). This all serves to reinforce the conclusion that the Strategy's expected emissions reductions in this area of policy are just not credible.

*Industry.* The Strategy's discussion of industrial emissions is complicated by its (arguably misplaced) reliance on CCUS. It envisages emissions reductions from CCUS alone of 6MtCO<sub>2</sub> a year up to 2030, and 9MtCO<sub>2</sub> a year by 2035 (p120), funded largely by a £315 million Industrial Energy Transformation Fund (p121), which will be extended to £500 million to 2028 in order to fund industrial retrofits (p131) to achieve net zero industrial clusters. In addition, Resource Efficiency and Energy Efficiency measures are expected to achieve 11MtCO<sub>2</sub>e savings by 2035 and a further 9MtCO<sub>2</sub>e by 2050 (p130), and the Industrial Decarbonisation Strategy published in March 2021 has allocated an additional £171 million for nine projects in five clusters (p121) (UK FIRES, 2021, p10, states that this strategy is unlikely to produce emissions savings). Perhaps more importantly, the new UK Emissions Trading Scheme cap will be aligned with the net zero trajectory by 2023, which is expected to result in a reduction in industrial emissions from a total of 78MtCO<sub>2</sub>e in 2019 by 43-53% (33.5-41MtCO<sub>2</sub>e) by 2030, and 63-76% (49-59MtCO<sub>2</sub>e) by 2035 (p121). Such large possible reductions were not mentioned in the Ten Point Plan but, as with hydrogen and CCS, detail is missing on how this level of reductions could be achieved. Mention is made of 'fuel switching' (£55 million for a switching competition - p126, and £40 million for a Red Diesel Replacement competition - p129), energy efficiency, CCUS, carbon pricing, and demand-side measures such as product labelling, regulatory standards, and changes to procurement approaches. Total additional investment of £14 billion is expected, supporting 54,000 jobs in 2030 (p124), so it would be good to know more about how this money might be spent. Possibly most important of all is the role of electrification, which is expected to reduce emissions by 5-12MtCO<sub>2</sub> a year by 2050 (5 if hydrogen is available, 12 if not) (p128). Once again, calculating total emissions is impossible as the Strategy does not provide year-on-year estimates from which totals can be calculated. Again, the failure to provide such estimates or totals tends to suggest that decarbonisation is still not being taken seriously enough (UK FIRES states baldly that, for the manufacturing sector, these measures 'will not directly bring about any meaningful physical changes by 2030' - [Minus 45 - UK FIRES](#), p12). Overall the Strategy on industry looks undeveloped and not sufficiently coherent. In view of the climate emergency, much bolder and clearer regulation is required (regulatory standards are not envisaged to come into force until the late 2020s - p131), e.g. to phase out fossil fuel use and to follow the three 'R's of reduce, reuse and recycle.

*Heat and buildings (in England)*. This section of the Strategy has been to some extent overtaken by the separate Heat and Buildings Strategy (HBS), published at the same time. However, the policy is largely unchanged since the Ten Point Plan, with a target for as many buildings as possible to reach at least Energy Performance Certificate (EPC) level C by 2035, and as many fuel poor homes as reasonably practicable to reach level C by the end of 2030; and the installation of up to 600,000 heat pumps a year by 2028. The Strategy envisages that after 2028 heat pump installations will increase to reach 1.9 million a year (1.7 million according to HBS, p16!) by 2035 under the electrification scenario, resulting in a total of about 13 million electrical heat installations (11 million homes with heat pumps and 2 million using heat networks) (p141) (for the hydrogen scenario, 4 of these 11 million will be using 'low-carbon' hydrogen instead - again it is not made clear how much of this will be green hydrogen by 2035). The Strategy assumes that a typical heating appliance has a lifetime of fifteen years, so proposes that no new fossil fuel installations should be allowed after 2035, in order to reach the 2050 zero emission target (p340).

The Strategy envisages that a total investment of £200 billion will be required up to 2037 to achieve this transformation but does not elaborate on the balance between public and private investment. There are two clues to what this balance might involve, however, offered by the [Heat and buildings strategy](#) (HBS): one is that the total cost of the government heat and building programmes from 2021 to 2025 is said to be over £5 billion (HBS, p35), and this spending of around £1 billion a year is then expected to increase up to 2035; and the other clue is that the HBS sees the Energy Company Obligation (ECO) increasing from £640 million in 2022 to £1 billion in 2026 and by a further £1 billion a year up to 2030 (p140). So the total public investment to 2037 is likely to be over £17 billion and the private investment for ECO alone will be at least £9 billion. This leaves open the question of where the remaining £174 billion will come from. The total public subsidy for heat pump installation costs could amount to £55 billion (grants of £5,000 each for 11 million heat pumps), and the government contribution to retrofitting buildings to EPC level C is likely to be in a similar ballpark, but has not been stated here. Reference is made to supporting over 240,000 low-carbon jobs by 2035 (NZS, p135; HBS, p10) (much higher than the 50,000 jobs pledged in the Ten Point Plan), but neither strategy explains how this figure has been reached. The NZS (p139) says that emissions could fall by 25-37% by 2030 and 47-62% by 2035 compared with 2019, which works out at rather more than the 71MtCO<sub>2</sub> for the whole period of 2023-32 cited in the Ten Point Plan (current emissions from this sector are around 77MtCO<sub>2</sub>e/year!). However, the only policy for which emission reductions are pledged is the Public Sector Decarbonisation Scheme for public sector buildings - 50% by 2032 and 75% by 2037 (NZS, pp136, 147) (public sector buildings are responsible for only 2% of total UK emissions - [2019 UK Greenhouse Gas Emissions, Final Figures](#)). Nevertheless, UK FIRES (2021, p18) has calculated that a linear expansion of heat pump installation to meet the government's 2028 target would save 6.5MtCO<sub>2</sub>, though this probably assumes that the electricity supply is decarbonised.

Two other points are worth noting: First, the HBS assumes that a building in EPC band C or above does not need to be retrofitted to low carbon (pp87-91), however 'low carbon' is

interpreted. This assumption is false, but we do not know what retrofitting is required for the 10 million homes that it ignores. The HBS also seems to assume that a property in EPC band D can reach band C by insulating loft and cavity walls, and 'modest draught-proofing and smart controls' (p90). In fact, in many cases much more than this is required, such as insulation of floors and double or triple glazing, and other alterations to the property - which means that retrofitting will cost significantly more than HBS considers. Second, the Strategy aims to reduce the costs of electricity (and hydrogen) relative to natural gas so that low-carbon heating appliances (mainly heat pumps but also possibly green hydrogen fuels in the future) will be the preferred choice. To accelerate this change, HBS favours a market-based mechanism for low-carbon heat, which involves an obligation on fossil-fuel heating appliance manufacturers to achieve sale of a certain level of heat pumps proportional to their fossil-fuel boiler sales in a given period (BEIS, 2021: [Market-based mechanism for low carbon heat](#), p11). This mechanism is similar to the Energy Company Obligation for power supply, and is intended to be used to phase out the sale of fossil-fuel heating systems by 2035, though it is not being considered for introduction until 2024. By the same token, however, higher and increasing proportions of heat pump installation over shorter periods could achieve greater numbers of heat pump installations overall and by an earlier date (e.g. why not 1 million by 2025?), with new gas boilers being banned from 2028 (as proposed by UK FIRES, 2021, p18). This would help to ensure zero emissions from heating systems well before 2050.

The emphasis on retrofit is welcome but it should also be mentioned that a Future Homes Standard is pledged to come into force in 2025, resulting in 75-80% lower emissions (HBS, p134). It is difficult to understand, however, why this long-postponed measure (see, for example, Somerville, 2020: [The continuing failure of UK climate change mitigation policy](#)) should not come into force as soon as possible, e.g. by 2023, along with other reforms such as zero VAT for retrofit (see, for example, [Demand an upgrade](#)).

(Scotland - p150. With only 5% of the UK's homes, Scotland's Heat in Buildings Strategy looks similar, with £1.8 billion of public investment over five years, and cashback grants to homeowners in the Home Energy Scotland Loan Scheme of up to £6,000 for energy efficiency improvements and up to £7,500 for new renewable heating.)

*Transport.* From a total of 124MtCO<sub>2</sub>e emissions in the domestic transport sector in 2019, the Strategy talks of reductions of 34-45% (42-56MtCO<sub>2</sub>e) by 2030 and 65-76% (81-94MtCO<sub>2</sub>e) by 2035 (p154). This requires total additional investment by 2037 of £220 billion, supporting 22,000 jobs in 2024 and 74,000 in 2030 (p157) (compared with 40,000 for electric vehicles alone in the Ten Point Plan). It is not clear how these figures are arrived at or how much public investment is at stake. The strategic roads programme of £27 billion public investment is not mentioned, nor the £23 billion public money committed to HS2 by 2025.

*Transport: private motor vehicles.* The key policy here is the zero emission vehicle (ZEV) mandate, which from 2024 will set targets requiring a certain percentage of new car and van annual sales to be zero emission rising to 100% in 2030 (p160). This is expected to result in 53% of cars and 40% of vans being ZEVs by 2035 (p326), with emissions savings being

somewhat less than this if the total numbers of cars and vans increase. Cars are currently responsible for the bulk of transport emissions (68MtCO<sub>2</sub>e in 2019 - p153), so this could still mean substantial emissions savings by the early 2040s. However, the exact amount of savings is unclear and is likely to be far less than the Strategy envisages. First, it seems to be assumed that electric or hydrogen-fuelled vehicles are zero emissions but this is not the case (see, for example, [Electric vehicles: the future we made and the problem of unmaking it](#)). Second, the extent of emissions reduction depends on how quickly the electricity grid is decarbonised. Obviously, the quicker the better, so that the ZEV mandate can be front-loaded - that is, coming into force at an earlier date than envisaged in the Strategy (e.g. by the end of 2022) and involving higher percentage reductions in the early years or an earlier end date (say, 2026), resulting in zero tailpipe emissions well before 2040. This front-loading looks unlikely, however, since the charging infrastructure for electric vehicles (EVs) remains undeveloped, and the Strategy promises only an EV infrastructure strategy later in 2021 (p152) - a sense of urgency is still lacking. Third, it has been estimated that any emissions savings made by the transition to EVs will be largely negated by the government's £27 billion investment in roads ([The carbon impact of the national roads programme](#)). The Strategy is generally encouraging rather than discouraging car use, and offers very little to reduce the impact of cars on the environment, e.g. by ensuring that they are constructed from lighter weight materials and designed to have lower impact ([Electric cars are no panacea](#)). Given all these problems, it makes no sense for the Strategy to offer £620 million for EV grants, plus a further £350 million from the Automotive Transformation Fund to support vehicle electrification, particularly given that EVs are cheaper to run and incur no fuel duty (which continues to be frozen at 2011 levels - a huge boost to fossil fuel consumption).

For vehicles that continue to require liquid fuel, the Renewable Transport Fuel Obligation (RTFO) will increase the proportion of renewable fuel required in the mix from 9.6% in 2021 to 14.6% in 2032 and extend the obligation to the maritime sector (for renewable hydrogen). This means that the RTFO will result in additional emissions savings of 21MtCO<sub>2</sub>e (pp161-3), but once again this would depend on the nature of the renewable fuel, which is not specified (e.g. blue hydrogen could be included). Overall, it is clear that the whole area of the Strategy's policy on cars is incapable of delivering the emissions savings that it expects.

*Transport: trains, buses, cycling and walking.* Policy here is largely unchanged from the Ten Point Plan - that is, £3 billion for 4,000 zero emission buses in the National Bus Strategy (p153) (which should reduce bus emissions by about 0.4MtCO<sub>2</sub>), and £2 billion for cycling and walking (segregated cycle lanes and low-traffic neighbourhoods - p152), though this is now by 2030 instead of by 2025. Some of this has clearly been spent already, but the Strategy does not say how much. Most interesting, perhaps, is the £12 billion allocated for local transport systems up to 2024, based on Local Transport Plans (pp152, 163), a significant increase on the £4.2 billion pledged in the Ten Point Plan. Most disappointing is the lack of support for rail decarbonisation, with the rail network expected to be net zero only by 2050 (pp153, 156). The UK lags far behind other developed countries in this respect, and its rail network could well be fully electrified by 2030 or earlier; as in the Ten Point Plan it is unclear how much the government will invest in improving and renewing the rail network. Perhaps worst of all is the Strategy's failure to identify

measures that can be clearly seen to produce the modal shift from private to public transport that it says it wants to achieve.

*Transport: aviation.* The main emphasis here is on developing Sustainable Aviation Fuel (SAF), so as to provide 10% of total aviation fuel by 2030, with state support of £180 million (pp153, 162). This is of course pie in the sky, for two reasons. First, as aviation is being allowed to expand by more than 10% up to 2030, it means that carbon emissions will increase over this decade, when they are supposed to be reduced. Second, the use of SAF has been touted for decades with no real progress at all: whether in the form of biofuels or e-fuels, SAF will do nothing to reduce the warming effect of contrails, which is estimated to be three times as great as that of carbon dioxide emissions (Lee et al, 2021: [Aviation-climate-forcing](#)). The argument against the use of SAF holds even without mentioning the strictly limited availability of biomass for biofuel and the high costs involved in producing e-fuel. Another point worth noting is Table 4 on p318, which shows that international aviation and shipping has by far the highest level of emissions in 2050 under the electrification scenario (35MtCO<sub>2</sub>e), requiring the lion's share of greenhouse gas removals. This is even without taking into consideration the problem of contrails. All things considered, tackling climate change requires an end to airport expansion, fair taxation of aviation fuel (currently exempt) and other measures to ensure that aviation pays its fair share of what is needed to achieve a safer world.

(Scotland - p165. The Scottish government is committed to decarbonise rail by 2035, provide £500 million for bus infrastructure, £500 million for active travel projects over five years, and free bus travel for under-22 year olds. Comparable funding in England would mean £10 billion for buses and £10 billion for cycling and walking - a considerable improvement.)

*Natural resources etc.* There appear to be two kinds of activity here: first, to enhance carbon sinks such as peatland and woodland; and second, to make the farming and food industry more sustainable. The key fund for the former is the Nature for Climate Fund, which amounts to £750 million to be spent by 2025 on restoring peat and creating and managing woodland (p167). This fund is mainly for planting 30,000 hectares of trees a year (£500 million) (p168), which will be continued from 2025 onwards, and the rest is for restoring 35,000 hectares of peatland in England (p167). By 2050, the strategy expects that 280,000 hectares of peatland will be restored with the help of funding under the new Environmental Land Management Schemes being put in place after Brexit (p178). The peatland restoration plan could do with being more ambitious, particularly as peatland continues to be degraded, and the Strategy contains no estimates of the amount of carbon that is likely to be sequestered by these programmes. The England Peat Action Plan aims to end the horticultural use of peat in the amateur sector by 2024 and to consult on potential legislation, e.g. to ban peat sales altogether (p177) - but why waste time consulting when ending the extraction and sale of peat is clearly the right thing to do?

Second, on farming and food, it is good to see that things have moved on since the Ten Point Plan, when this topic was barely mentioned. From 2022 a Farming Investment Fund will offer financial incentives to improve animal health and welfare and reduce emissions from animals,

and provide grants for equipment, technology and infrastructure, to reduce slurry pollution and methane emissions, and protect and restore biodiversity (p176). However, the Strategy does not provide details of this fund. Three new environmental land management schemes will then come onstream in 2025, to incentivise farmers to adopt low carbon practices (e.g. soil and nutrient management), to support local nature recovery and deliver local environmental priorities, and to fund long-term land use projects such as peatland restoration and large-scale tree planting as mentioned above. Again, however, it is not made clear how much funding is likely to be available under these schemes. Overall the Strategy seems insufficiently ambitious, with farmers needing only to be 'engaged with low carbon practices' (p171). This seems to rule out regulation and prompts the question of what is to be done about farmers who do not engage. Local authorities, in contrast, are to receive £295 million to pay for free separate food waste collections for all households from 2025 (p168), in order to end biodegradable waste to landfill (p179). Other provisions on waste under the Environment Bill will require local authorities to separately collect certain materials for recycling: paper and card, glass, metal, plastic, food waste, and household garden waste (pp179, 180). In addition, a new deposit return scheme for drinks containers, and extended producer responsibility for packaging disposal, will place the net costs of disposal on producers (p179). And in 2022 a plastic packaging tax will be introduced at £200 per tonne, payable by manufacturers and importers of plastic packaging that contains less than 30% recycled plastic (p180). This is all worthwhile, of course, but the Strategy contains no assessment of what it might mean in terms of environmental amenity, consumer benefit or emissions reduction. The urgent need to transform farming away from industrialised energy-intensive systems and towards an agro-ecological approach, and the need to reduce our reliance on livestock and move towards more plant-based diets, are not mentioned. These are serious omissions. The result is a Strategy in which the agriculture, forestry and land use sector continues to emit 14-21MtCO<sub>2</sub>e in 2050 (Table 4 on p318) when it should be acting as a carbon sink.

(Scotland - p180. The Scottish government plans for 250,000 hectares of peatland to be restored by 2030, and 18,000 hectares of new woodland created each year up to 2024-25, with the latter being supported by a fund of £150 million. These plans are on a different scale from those in England, and the following quote is worth noting: 'We have rewetted around 100,000 hectares of peatland across the UK' (p169). This is a real achievement but I suspect that most of it has been in Scotland, since that is where two-thirds of UK peatland is found ([UK natural capital: peatlands](#), 2019).)

*International leadership and collaboration.* The Strategy repeats the May government's pledge in 2019 to double International Climate Finance from £5.8 billion in 2016-21 to £11.6 billion from 2021-25 (p284), e.g. to protect and restore nature, to access technical expertise to limit emissions and build back greener. The government is calling for: an immediate global end to new unabated coal power and international coal financing, a halt to natural forest loss by 2030 (now agreed by over 100 countries at [COP26: World leaders promise to end deforestation by 2030](#)), and the restoration of millions of hectares of degraded landscapes and forestlands; and for developed countries to mobilise \$100 billion a year in climate finance for developing countries up to 2025 (as agreed originally in 2009 but never actually achieved), and accelerate

the shift to ZEVs by 2035 for all new car sales (p288). Further, the Strategy mentions Boris Johnson's pledge at the Climate Ambition Summit in 2020 to end direct government support for new fossil fuel energy projects overseas (p289), although massive funding continues for existing projects, e.g. in Mozambique ([UK's \\$1bn support for Mozambique gas project](#)). The Strategy also promises a new 2030 Strategic Framework in 2022, with a common vision on climate and biodiversity, and clear priorities for UK international climate and nature action to 2030 (p297). Overall, then, some positive developments but not enough emphasis on the action required before 2025. Moreover, this positivity has to be viewed against the government's cut in the overseas aid budget from 0.7% to 0.5% of GDP and a history of climate finance being mainly in the form of loans rather than grants (see, for example, [Statement from OECD Secretary-General Mathias Cormann on climate finance in 2019](#)), thus helping creditors (largely in the global North) more than debtors (mainly in the global South).

*Overall investment and savings.* Table 11 on p328 provides estimates for the additional annual investment requirements under the NZS pathway. Total investment figures are not provided but I have calculated that these amount to £675-783 billion up to 2037. This can be compared with the estimate of additional resource savings from reduced use of oil and gas products of £180 billion (p49), over what seems to be much the same period. As elsewhere in the Strategy, the balance between private and public investment or savings is not stated. Nevertheless, it seems clear that the level of both private and public investment required is far greater than the savings that are expected to be made.

*Conclusion.* In spite of progress in a number of areas, for example on the decarbonisation of electricity and industry, and possibly on restoring peatland, planting trees and reducing waste, this Strategy is little changed from the Ten Point Plan of a year ago. Progress on heat and buildings has stalled, due in part to the failure of the Green Homes Grant, and strategy on other sectors, such as transport and agriculture, remains confused and irrational, and inadequate to achieve the government's goals. Overall, the Strategy lacks urgency, coherence or precision. Far from being the promised green industrial revolution, the Strategy seems focused on merely incremental change, such as from internal combustion engines to electric ones, from fossil-fuel boilers to low-carbon heating appliances, with continuing support for unsustainable aviation - no real modal shift from private to public transport or from unsustainable to sustainable farming.

This strategy fails to demonstrate that the UK can stay within its Sixth Carbon Budget, which is itself too loose to ensure that the UK makes its fair contribution to limiting global temperature increases to 1.5 degrees Celsius ([Calculating a fair carbon budget for the UK](#)). The strategy takes no account of the UK's historical responsibility for greenhouse gas emissions or for emissions embodied in imports or of the City of London's key role in funding fossil fuels. It has nothing to say about divesting from fossil-fuel companies or about banks and pension funds divesting from those companies. It offers no forms of regulation or mandatory legislation that would be sufficient to bring about the necessary divestment. It exudes complacency by failing to comply with Committee on Climate Change (CCC) recommendations (as of June 2021, the CCC's [2021 Progress Report to Parliament](#), p16 stated: 'credible policies for delivery currently cover only around 20% of the required reduction in emissions to meet the Sixth Carbon

Budget'), and by effectively postponing decisive mitigative action until after 2025. The only amendment it suggests to the Climate Change Act 2008 is one that would include negative emissions technologies in the carbon budget, which would have the effect of making the carbon budget even looser than it is already, thus reducing the need for immediate and effective action - yet another clear step backwards rather than forwards in the struggle to prevent catastrophic climate change. Above all it continues to promote alleged climate 'solutions' that exist, if at all, only in the longer term (e.g. nuclear power and carbon capture and storage), while failing to act decisively in the short term and indeed continuing to support and encourage the fossil fuel extraction and burning that is primarily responsible for causing the current global climate emergency.