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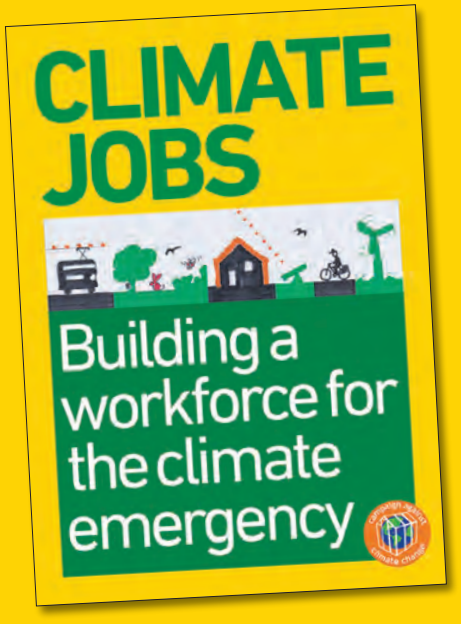

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Chapter 4:

Creating a green, affordable and accessible network for all: climate jobs in transport

This chapter is an extract from the forthcoming pamphlet Climate Jobs: Building a workforce for the Climate Emergency.

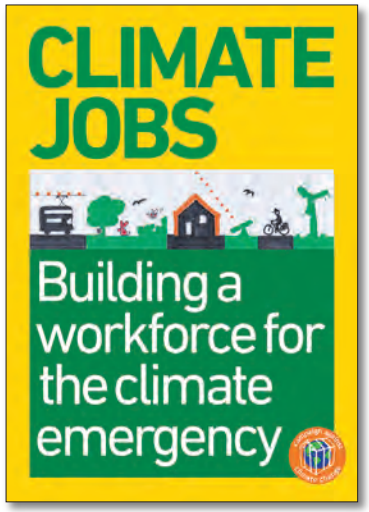
In this chapter, released in advance of the full pamphlet, we focus on the transport system, currently a major contributor to greenhouse gas emissions. We look at the significant changes we need to make in what type of transport we use and how it is powered. Crucially this means developing an affordable, **>>>**

>>> accessible and fully integrated public transport system. A transport system based around people's needs, rather than further road building programmes and airport expansion, will make the huge and urgent cuts in emissions possible and create thousands of new jobs.

In the forthcoming report we provide a detailed and in-depth update of the Million Climate Jobs report (2014), demonstrating that there are many more than a million good, well paid, skilled jobs that could be created if we get serious and urgently tackle the climate emergency, as the science demands.

But to do this requires us to break from the failed reliance on the market and instead to invest in a huge expansion of public sector jobs across all sectors from transport, energy and food to homes, education and more, which are essential to tackling the climate crisis.

At the heart of this, we argue, needs to be a National Climate Service which can organise, plan, train workers and deliver the jobs so urgently needed. The changes needed are ones which will improve our lives, ensuring among other things we have warm homes, a fully integrated public transport system and most importantly a safe climate and ecology now and in the future.



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Each chapter is accompanied by a Technical Companion which provides references, modelling and more detailed explanation expanding on some of the issues covered in the pamphlet.

Creating a green, affordable and accessible network for all: climate jobs in transport

Introduction

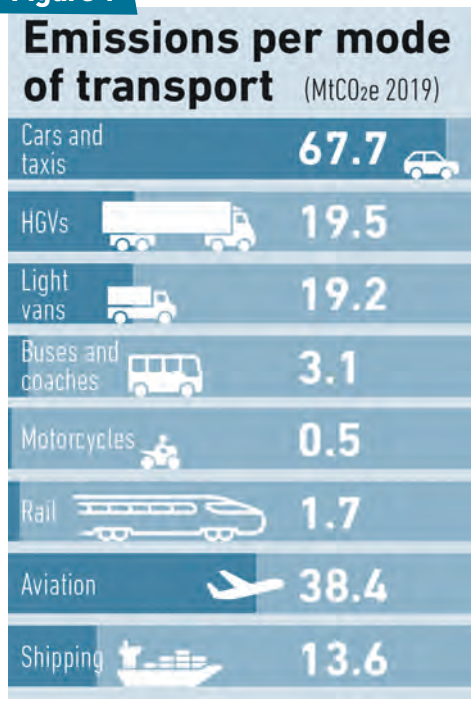
This chapter is about the transformation needed in our transport system if we are to tackle the climate emergency. The changes that we propose aim to massively reduce carbon emissions, improving quality of life and generating the jobs required to make that happen. To achieve this requires a radical transformation in the number and type of different modes of transport, and in the social and political mechanisms to render such actions practical, namely, (i) a shift to public ownership and (ii) a National Climate Service to organise and coordinate such a programme. [1]

In 2016, the transport sector overtook energy production as the largest source of carbon emissions in the UK. While the energy sector reduced its emissions by 63% between 1990 and 2018, transport reduced by only 4.6%. [2] In 2019, the latest year for which complete statistics are available, transport was responsible for 27% of total UK emissions.

Transport emissions are primarily attributed to increased road traffic, which 'has largely offset improvements in vehicle fuel efficiency'. Transport CO_2e emissions by sector are shown in Figure 1 on page 2. [3]

However, it should be noted that *international* aviation and shipping are recorded but currently not counted as part of UK emissions figures since there is

Figure 1



no internationally agreed way of allocating them to individual nation states. Together, these add 44.5Mt CO_2e, more than a third, to the total.

In this chapter we look at each sector of the transport system and how emissions can be massively reduced, and good, well-paid public sector jobs created. This work has never been more urgently needed as we face an escalating climate emergency, a huge jobs crisis and the impact of the COVID-19 health pandemic on our lives.

Characteristics of the future transport system

This chapter is based on around the proposition that for too long we have had to organise ourselves around the transport system, rather than transport being a means for members of our society to achieve particular ends. That is, the use of space, be it urban or rural, city or village, is often defined by the transport links that service that place (or not, in many cases). And the methods of providing those links often come at enormous expense to the climate, and to societies and ecologies around the world.

The transport system therefore needs to change to tackle these problems. We argue for a huge increase in public transport to meet people's needs, organised in a way that is far less damaging to the planet than our current methods of transportation and that creates the jobs that we identify here. There are two methods for achieving such sweeping changes in the role of transport in our society: one is the transfer of journeys from more to less polluting modes of transport, and the other is reducing the amount of travelling done.

In terms of transitioning from more to less polluting forms of transport, the basic outlines of the solution are:

- Providing more rail and bus services to facilitate mass movement within and between urban centres and to provide access to transportation for those in rural areas
- Ending the predominance of private motor vehicle use for the majority of journeys
- Transferring as much freight carriage as possible from road to rail, canal and sea
- Significantly reducing air travel and prohibiting airport expansions
- Replacing domestic flights with rail or bus, and international flights with rail, where this is a feasible alternative

> **"We need an integrated transport system that can be afforded by everyone and is owned and operated in the interests of all."**

- Providing the infrastructure to enable greater access to cycling and walking.
- Providing tram services where city centres can accommodate them
- Augmenting other forms of transport with electric vehicles where needed

The aim of these changes is not only to dramatically reduce CO_2 and greenhouse gas emissions. It is also to do so within the context of an integrated transport system structured around an ethos of public service and equality, regardless of age, gender, race, disability or income, that can be afforded by everyone and is owned and operated in the interests of all.

A crucial issue is the energy requirements of a largely electrified transport sector and how to meet them given the competing demands on a finite generating capacity. This needs to be done while also avoiding further damage and exploitation of people and resources in the Global South. Such issues are considered in depth in the chapter on energy. But they have relevance here as, in the system we envisage, transport would be one of the key consumers of that energy.

The creation of an integrated transport system would generate hundreds and thousands of new jobs overall. Where jobs are negatively affected in specific sectors, the principles of Just Transition are essential to guarantee alternative employment and the wellbeing of communities. A National Climate Service and public ownership to protect workers' jobs in transport would ensure that communities that have been heavily dependent on a single employment sector are not left stranded.

What most needs to change

A transformation of the transport system as described above would be a huge challenge in itself. But it becomes even more challenging when we consider that making these propositions realistic requires recognising that the two most polluting forms of transport – cars and aeroplanes – have been built up and normalised over decades as the most desirable ways to travel.

Cars

Private car ownership is so deeply entrenched in our society that it is difficult to believe we could function without it. Around 76% of households in the UK have a car and many have more than one.[4] In recent history, accommodating the private motor vehicle has been the key characteristic of our landscapes, with traffic congestion and struggles over parking spaces in cities, and large, noisy, high polluting motorways cutting swathes through our countryside.

At the same time, privatisation and deregulation has destroyed public transport systems in rural areas and within many towns and cities.

Simply replacing existing combustion engines with electric cars is not the answer.

Changes in employment patterns, gentrification and rising house prices has resulted in people living further from work. The road building policies of consecutive governments has produced and reinforced this problem. But such is the expense and inadequacy of privatised public transport that many people use the car even where the train or bus makes exactly the same journey.

And yet, private car ownership is highly inefficient; most cars spend the overwhelming majority of time idle and unused. Cities are awash with parked cars taking up space, while much of the road systems outside of the congested main thoroughfares are little used, although still used enough to render them dangerous for pedestrians and cyclists. Simply replacing existing combustion engines with electric cars is not the answer as many of these issues would simply be perpetuated. In addition, there would be serious problems with the overuse of scarce resources and the impact their extraction would have on the Global South if electric vehicles were to be produced on such a scale.

Planes

In terms of aviation, the highly commercialised nature of the industry makes flying – despite the advent of low-cost airlines – a relatively elite form of travel. It is estimated that 70% of flights in the UK are taken by just 15% of the population, while around half of citizens do not fly at all.[5] Globally, just 1% of the world's population created half of aviation's carbon emissions during 2018.[6] During the COVID-19 pandemic, the one unaffected area was use of private jets by wealthy individuals escaping lockdowns and avoiding busy passenger planes: in August 2020, private flights were down only 5% on the previous year, compared to 65% for commercial airlines.[7]

The competitive model of aviation among airlines and airports is a barrier to the coordinated public transport network required to encourage travel by other, lower carbon means. That domestic and short haul flights to the same destination are often far cheaper than the train is symptomatic of how the market skews logic and drives passenger choice, with comfortable long-distance train travel tending to be available only to the better-off via first class tickets.

While there is a place for electric cars, as well as developing the use of non-fossil fuel aeroplanes in the future, this needs to be set in the context of a more diverse transport strategy that massively increases public transport and reduces the need to travel.

> "Rail is the key mode of transport around which an integrated and green transport system that provides many jobs would hinge."

What does an integrated green transport system really look like?

The following proposals for an integrated transport system note the ideal form for each mode of transport, how they differ from what we have today, the workforce needed to support this transport system, and the anticipated reduction in emissions against the 2019 baseline shown in the table above.

Rail

Rail is the key mode of transport around which an integrated and green transport system that provides many jobs would hinge. Rail travel has the capability of replacing significant numbers of the two most polluting modes, cars and aeroplanes, of connecting easily with local bus networks and cycleways, and of carrying freight currently transported by Heavy Goods Vehicles (HGVs). Public ownership of trains and rail networks is essential to achieving these objectives.

Applications of rail travel that need to be at the forefront of a green public transport system are:

- Cross country travel between large urban centres
- Linkages for small towns and villages and remote rural areas
- Mass transport across large cities
- Cross channel, trans-European travel
- Night/sleeper trains
- Freight carriage

The main priority for reducing private car use is a switch to buses and trains. Trains use less energy per person than buses, and much less than cars. There are two ways in which we can develop a railway system that can fundamentally transform travel practices:

1. *Expand the size of the rail network*: Mile for mile, building railways is cheaper, in some cases much cheaper, than building motorways. Expansion of the system could begin by restoring some of the 6000 miles of track closed by Lord Beeching in the 1960s and the many more miles axed during earlier rail cutbacks.

2. *Increase seat occupancy per train*: The existing train network has little scope for running more trains, but the trains are often not full. Seat occupancy in some other European countries is much higher than in the UK. [8] Bringing car users onto trains would significantly increase occupancy levels, while at the same time providing enough services to avoid the opposite issue – overcrowding – that currently occurs on some trains at certain times.

The existing and expanded network needs to be entirely electric and should rank higher than electric vehicles in priority for deploying the potentially

scarce resources used for generating renewable electricity.

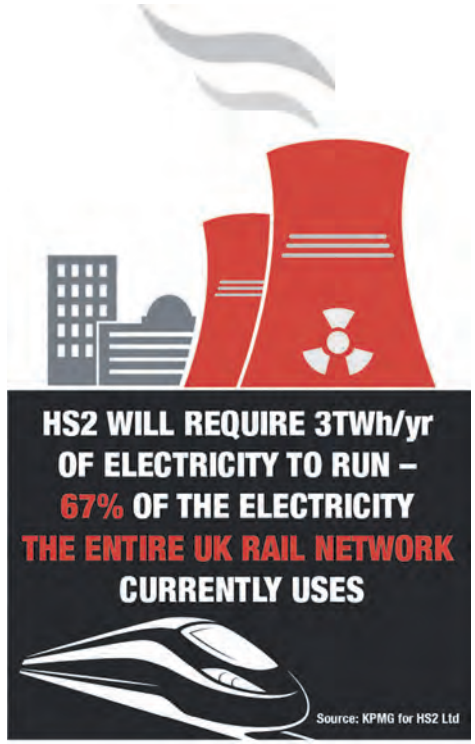
A big gain can be achieved by transferring freight from lorry to rail (and to canal and sea – see below). Rail freight uses about nine times less energy and is around four times more fuel efficient than a lorry carrying the same freight. [9] We propose moving as much road freight as possible onto rail. This requires expanding existing depots and building new ones, with freight broken down and distributed in electric vans that could be recharged at the depot overnight.

The existing train network has little scope for running more trains, but the trains are often not full.

While the scope for a wider network of sleeper trains is less than in Europe, increasing capacity and destinations on existing longer distance routes, in conjunction with affordable, and preferably free, accessible and fast daytime services, offers an alternative to domestic flights. Night trains and better integrated European links, together with additional leave and sustainable holidays for workers, could reduce the number of international and European flights.

A new passenger network designed to wean people off using cars and aeroplanes should have a number of features to improve the network that currently exists:

- More frequent services to attract more passengers and provide a more reliable service
- Affordable or free integrated ticketing, eliminating first class seating, along with ergonomic review of accessibility, luggage and cycle capacity
- Double decker trains, as in France, along with higher bridges and longer platforms, accommodating a larger number of passengers
- Serious attention to ventilation systems and hygiene facilities to prevent virus spread amongst passengers and crew, which could translate into community outbreaks at destinations along routes
- A system of night and sleeper trains, as operated in various parts of continental Europe, replacing domestic and some international flights
- High speed trains to make longer journeys feasible but integrating new projects into the requirements of a genuine public transport system for all



rather than, as with HS2, vanity projects of vast expense to the taxpayer affordable only by an elite minority

A shift from road to rail would be the largest single component for reducing carbon emissions from transport (to avoid double counting, this shift is counted in this chapter as a reduction in motor vehicle emissions of around 108Mt CO_2e per year [see below], the largest part of which would result from a transfer to rail and bus).

In the first few years, most of the jobs would be in construction of the expanded network, as well as in electrification of the existing network. These construction activities would incur significant embodied emissions of around 30Mt CO_2e in building the system. [10] Subsequently, however, the network would generate employment in driving,

running and planning the service, while reducing emissions from rail to almost zero compared to the current 1.8Mt CO_2e per year.

The work would require jobs during the five-year construction period to upgrade and expand the infrastructure – lay track, build or enhance stations and signalling systems, electrify the network, etc. – with a permanent workforce for maintenance in the years thereafter and eventual replacement. We can expect this task to utilise workers transitioned from the motor vehicle industry following our proposed reduction in car use.

For operations, we assume that the combination of expanding the network and running more frequent services would require roughly double the operations staff, introduced over the course of the five-year construction period as the size of the network increases.

Based on a rail workforce of 240,000 recorded in 2019, [11] including both infrastructure and operations staff, we estimate around 160,000 additional jobs at the outset to build the expanded network, rising to 225,000 at the end of the construction period as additional operations staff are introduced. Subsequently, we estimate this equates to nearly 100,000 extra jobs, in addition to the 2019 workforce, comprising the operations staff running the services and those required to maintain the network once construction is completed and then to replace it as necessary.

Buses

An expanded bus service would be a key component of an integrated and green public transport system. Buses can go to places that trains can't and can efficiently carry large numbers of people.

> **"A significant increase in the bus network and in the number of passengers on each bus is an essential element of reducing the number of cars on the road."**

A significant increase in the size of the bus network and in the number of passengers on each bus is an essential element of reducing the number of cars on the road.

The privatisation and deregulation of UK bus services has led to fare increases, discontinuation of routes, fragmentation and a 'race to the bottom' on staff pay and working conditions. Outside London, bus journeys have halved in number. [12] Returning the bus service to public ownership is essential. Municipal public bus services would allow better service provision, more comprehensive services, simpler fares and coordinated timetables.

Expansion of city bus networks can be implemented alongside measures to reduce car use in city centres, including reserved bus lanes and bus-only streets to reduce journey times. The aim is for a virtuous circle: a more frequent, regular and flexible service would help reduce congestion from cars, in turn encouraging more people onto buses. Another important change is to make buses more affordable. Bringing more people onto cheaper, more reliable services would help to keep income levels up. But travel

Fuller buses are much more energy efficient.

should be free for all children, pensioners, people with disabilities, and those on benefits, and National Climate Service investment is vital.

Fuller buses are also much more energy efficient. The average British local bus, on an average day, fills 10 seats. Many European countries, including Italy, Germany, Denmark, Norway, Austria and Spain, manage double that or more. [13] Several studies show that where public transport systems are fast and reliable, people prefer public transport over driving private cars. [14]

Buses are not just for cities. Rural bus services, which have been in the front line of cuts under austerity, are vital. Frequent and relevant services need to be restored and developed with much more strategic coordination. We envisage a framework based on inter-urban links and long-distance bus stations at transport hubs on the edge of urban areas. Demand responsive transport (DRT) services operating in a number of British regions to meet specialised needs, [15] such as London's Dial-A-Ride for people who experience accessibility or other barriers to travelling by public transport, can also be linked into these.

These buses could not, of course, run on diesel. Many would run on renewably powered electric batteries, though there are concerns about sourcing the minerals these batteries require. In fact, the most promising technology for electric buses, within city and town centres at least, may be trolley buses with a direct supply of electricity from overhead wires. These disappeared in the UK but not in continental Europe, where in many cities those that did disappear are being revived. [16]

Improved and increased bus services require conversion to electric vehicles in order to reduce emissions from 3Mt CO_2e per annum to almost zero. Embodied emissions for replacing existing vehicles and manufacturing a similar number of additional buses [17] would be around 3Mt CO_2e. [18] Transfer of car journeys to buses would provide a significant component of the 108Mt CO_2e per year reduction in emissions resulting from reduced car use.

As with rail, a large increase in staff would be required during the construction period to manufacture new electric buses and convert the existing fleet, with a permanent workforce for maintenance and replacement in the years thereafter. Many would be drawn from those no longer servicing private car use. For operations, we assume that the combination of expanding the network and running more frequent services would require roughly double the operations staff, introduced over the course of the five-year construction period as the size of the network increases.

Based on a bus service workforce of 116,000 recorded in 2019, [19] including both infrastructure and operations staff, we estimate around 23,000 additional jobs at the outset in order to build an expanded bus fleet and electrify the existing buses, rising to 117,000 by the end of the construction period as additional operations staff are introduced. Subsequently, we estimate 100,000 jobs in addition to the 2019 workforce, comprising operations staff to run the services and those required to maintain the network once construction is completed and replace it when necessary.

Trams

Trams sit between trains and buses on the transport 'spectrum'. They come under the broad heading 'light rail'. For the most part, trams are electricity-powered and produce little in the way of carbon emissions.

Globally, there are around 800 tram systems in current operation, around half of these being city networks. Trams account for around 3% of all public transport journeys in the UK, where tram systems operate in Manchester, Sheffield, the West Midlands, South London, Nottingham and Edinburgh. Where trams are in use in the UK, passengers give them a 93% satisfaction rating. [20] As with our bus and train proposals, tram fares should be free-to-cheap to encourage general usage. The Aubagne tramway in Southern France is the world's only tariff free tram service but is nevertheless highly successful. [21]

However, introducing trams should not be the default position. Careful thought should be given to the extent to which they can contribute to an integrated transport system and this would differ from place to place. The cost of implementing a tram system could be high if extensive redevelopment of city streets is needed, both for laying rails and adaptation depending on width, bridges and other obstacles. In a city centre already pedestrianised, or with redevelopment plans, the cost might be more marginal. Cities that had tram services in the early twentieth century may already have wide enough, and obstacle free, streets which could accommodate a revived service.

'Where trams are in use in the UK, passengers give them a 93% satisfaction rating."

One tram is estimated to replace around 40 cars on the road, a significant saving of space and a comparable capacity to buses. They also provide convenient, surface level links to rail stations and high streets. Their main disadvantage currently is the hazard that the rails present to cyclists for example. This is a problem that, in a city centre characterised by much reduced car use, would be designed away through the provision of dedicated cycle routes and walkways.

Our assumption is that cities of around 100,000 and more citizens might make use of a tram service in addition to local buses and rail. While that number is arbitrary, there are two countervailing factors: first, towns and cities smaller than 100,000 might wish to introduce a tram service and, secondly, some larger cities may be ill-suited to the adaptations required. With this level of uncertainty, we would caution that the figures presented here could vary by plus or minus 25%.

Based on the number of cities of over 100,000 the urban adaptations required to accommodate a tram service and build the infrastructure would be comparable to the expansion of the rail network with a similar level of embodied emissions to construct, that is 30Mt CO_2e.

The key is building a network of cycle lanes and walkways.

The work would require jobs during the five-year construction period to provide the infrastructure – lay track, build stations and signalling systems, adapt buildings and roadways, etc. – with a permanent workforce for maintenance and replacement in the years thereafter. We can expect this task to call significantly upon workers transitioned from the motor vehicle industry by our proposed reduction in car use.

For operations, we estimate that the size of population served by trams in these urban centres would total around 20 million people, and that the requirement could be for 20,000 trams nation-wide, each with two designated drivers, introduced over the course of the five-year construction period.

Given the uncertainty around the extent to which the option for a tram system could be picked up, it is appropriate to consider a range in our job estimates. [22] To build the services we estimate somewhere between 120,000 and 250,000 jobs by the end of the construction period as the operations staff are introduced. Subsequently, we estimate a workforce ranging from 40,000 to 80,000 jobs, comprising the operations staff to run the services and those required to maintain and replace the network once construction is complete.

Cycling and Walking

Cycling and walking are a key part of any public transport strategy, especially in towns and cities. Their health and social benefits are such that it has been estimated that every £1 spent on encouraging walking and cycling saves £13 in public health expenditure. [23] The key thing here is building a network of wide, safe, physically segregated cycle lanes and walkways, both alongside roads and on independent routes.

> **"Cycling should be seen as part of ordinary people's everyday mobility, as it is in cities such as Copenhagen and Amsterdam."**

Private car ownership has become a normal and institutionalised element of everyday life. It is culturally embedded and has distorted the physical landscape, with the 'cyclist' perceived as a figure of secondary importance with a specialist interest. These perceptions need to be reversed and cycling seen as part of ordinary people's everyday mobility, as it is in cities such as Copenhagen and Amsterdam. This is not achieved by moral arguments but by providing safe cycle routes and encouraging more people to cycle, leading to a cultural tipping point.

Electric bikes also have an important role to play, [24] particularly outside densely populated urban areas, expanding the range of journeys possible and increasing the number of people who would consider cycling. As well as national measures to promote e-bikes, localised promotion could run alongside the construction of safe cycle lanes linking cities, towns and villages and ultimately a national cycle network.

Similar requirements for safe, separated spaces apply to walking. Consistent with a reduction in car ownership and the use of roads in city centres for buses and occasional electric vehicles, more space can be set aside and adapted for pedestrians. Where such pedestrianised zones exist in city centres, they are highly popular and far more sociable and

amenable to activity than a high street rammed with congested traffic. Consequently, the impact on emissions from a switch to cycling and walking is counted here as a component of the 108Mt CO_2e reduction in car use noted below.

We propose a doubling of the current 64,000 workforce that support cycling and walking [25] for the first five years. This is needed to create the urban and rural infrastructure to enable safe accessibility for bicycles and pedestrians, adjusting road layouts and so on, in coordination with changes to enable bus and tram services.

Subsequently, we estimate around 6,000 jobs to maintain bikes and infrastructure, and another 6,000 for manufacturing and selling the increased number of bikes. Our estimate is therefore 64,000 additional jobs for the first five years and 12,000 jobs thereafter.

Electric vehicles

The volume of cars and lorries on the road at present is not sustainable. Road traffic increased by 29% between 1990 and 2018 and is forecast to increase again by

> **"We need a transition away from mass private car ownership and a conversion of the cars that we have to EVs."**

up to 59% by 2050.[26] Cars and the infrastructure to support them have already seen the destruction of large sections of our cities, towns and villages as well as the concreting of vast swathes of the countryside. And yet in 2020, the UK government committed £27 billion to build even more roads.[27]

Are Electric Vehicles (E.V.s) the answer to reducing greenhouse gas emissions? They are cleaner, although not as much as you might think, quieter and easier to maintain – even insurance is cheaper at the time of writing. But E.V.s are not a 'Get out of jail free' card. Converting the UK's surface vehicle traffic to all electric is not feasible on a one-to-one replacement basis. There are two key reasons:

i. The demand for electricity would be high and in competition with demand from other sectors including other modes of transport, and

ii. The demand for resources for electric batteries would far outstrip the amount accessible and involves considerable exploitation in the Global South.

The lithium required for a large-scale transition to EVs would bring inordinate pressure and exploitation to communities in Argentina, Bolivia and Chile. Alternative mineral sources exist, such as calcium, magnesium, mercury or zinc, but would involve similar exploitation and are both less efficient technically and more expensive.[28]

In practice, we need two key developments: a transition away from mass private car ownership to socially or communally owned vehicles for use by all, AND the conversion of the cars that we need to EVs. Within the context of a diverse transport strategy, the number of EVs needed could be accommodated in a way that a one-for-one replacement of current petrol cars could not.

Our suggestion is that in addition to a huge expansion of the public transport system as outlined above, the following developments would help make a transition away from private car ownership feasible:

- Community sharing of electric cars both formally and informally, for example through car clubs
- Linking smart phones to fleets of public electric cars so that a vehicle can be accessed for use
- Shared taxis – as is common in many other countries
- '15-minute neighbourhoods' in which residents are within walking distance of all essential services

Even with all the above, some exemptions will be necessary, for example for the elderly, disabled people, doctors and others who deliver front line services. EVs can be utilised where needs demand it, adding another option to transport possibilities, alleviating the current congestion of roadways, and remaining within resource constraints while other forms of public transport are massively expanded.

The manufacture of the required number of EVs would incur around 19Mt CO_2e in embodied emissions.[29] However, our proposed massive transfer from cars to public transport – and the electrification of those cars and lorries that would be in use – would reduce emissions by around 108Mt CO_2e each year based on 2019 figures.

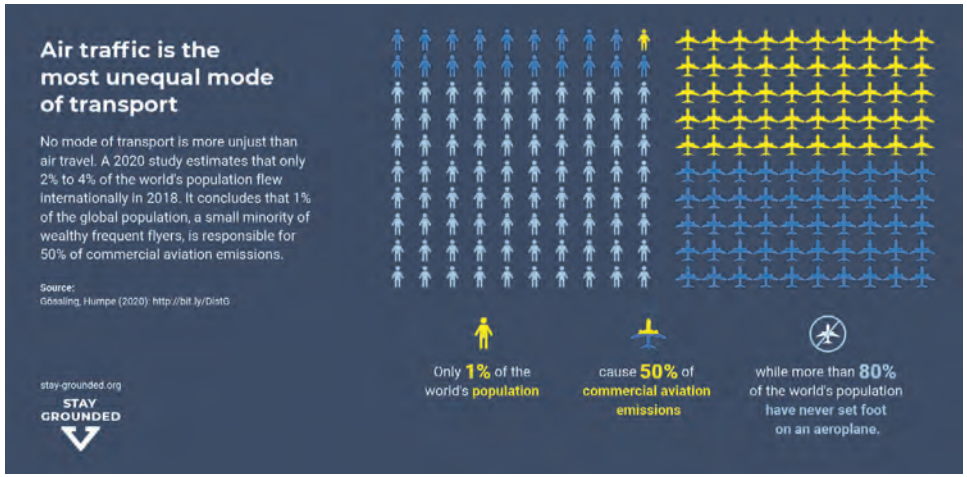
EVs are easier to manufacture than petrol cars, requiring fewer parts and less maintenance, which has implications for the workforce: around one third of labour time is required per electric car when compared with a petrol car.[30] In addition, our public transport system calls for a huge reduction in the number of cars, of around 75% compared to today's car numbers, and that they be designated for specialist needs, accompanied by huge extensions to rail, bus and other modes providing the primary sources of mobility.

As such, private car production will be a minus on the transport jobs balance sheet. With the current 180,000 jobs in manufacture and a further 18,000 in maintenance, the impact of a two-thirds reduction in switching to EVs and a 75% reduction in the number of vehicles required would produce a net job reduction of 165,000 in the first five years. However, this would be compensated by a transfer of many of these jobs to manufacturing of trains, buses and trams, and in supporting bicycle and pedestrian access, as counted in the respective sections above.

Aviation

Aviation is one of the most significant contributors to climate change. In the UK in 2019, total emissions from aviation (shown in the table at the beginning of this chapter) amounted to 38Mt CO_2e, more than 20% of all transport emissions. Aviation is the industrial sector seeing the fastest growth in emissions. While the UK's total emissions decreased by 39% since 1990 and domestic transport by 3%, emissions from international aviation to and from the UK *increased* by 138% over the same period.[31]

Equally importantly, the industry aspires to continue and accelerate this growth in the coming decades.[32] Flight numbers tend to double every 15 years[33] and if unchecked, that trend will be matched or



The threat posed by continued and increasing air travel could not be clearer.

exceeded between now and 2050. And while the proposed displacement of domestic flights by expansion of long-distance, high speed, electrified rail travel will help, domestic aviation only accounts for 1.5Mt of CO_2e compared to 36.3Mt CO_2e from international flights.

Further, it is not only the *amount* of CO2 emissions that is so threatening in the case of flying, it is also the *effect*. Greenhouse gases emitted in the thinner air of high altitudes is disproportionately damaging, having roughly double the polluting effect of the same amount of carbon emitted on the ground. [34] Since it is long haul, international flights that fly the highest and spend longest in the upper atmosphere, the threat posed by continued and increasing air travel could not be clearer.

There are two ways of reducing aviation's impact on the environment:

A. Reducing the number of flights through a combination of tax schemes and economic and societal changes

B. Technological solutions that reduce the carbon footprint of each flight

While technical innovations are to be welcomed, such developments on any meaningful scale are predicted to be decades away, contrary to the aviation industry's powerful 'greenwash' that presents these innovations as justification for continuing with business as usual. The battery power required for electric planes would limit the range of flights that could

> "Only by reducing the amount of flying can urgent climate goals be achieved."

use this technology, while alternative fuels are either unproven or – as with biofuels – have such significant detrimental effects in terms of land use and exploitation, especially in the Global South, that they are effectively unusable. [35]

Given these issues, like-for-like replacement of current aeroplanes with non-fossil fuel equivalents will not impact the 2030 climate time horizon. Only by reducing the number of flights can urgent climate goals be achieved. In the short to medium term, therefore, there is a need to transition workers in the domestic and European travel industry to other areas of the transport system.

Regular flyers in the Global North do not take into account the uneven nature of access to flying – globally only about 5%-10% of the population will ever set foot on a plane. [36] Fuel tax exemption and ludicrously low fares on budget airlines have encouraged frequent flying, second-home hopping, and even airline commuting, which is clearly not sustainable.

However, the number of business flights has reduced in recent years, [37] a trend that is likely to accelerate given that the pandemic has seen us take to online platforms, bringing people in remote locations together effectively and at low cost. Many companies are taking the opportunity to reduce costs by altering their travel policies as regards meetings and, in some cases, re-thinking the very concept of retaining dedicated offices. If such developments were combined with a renewed emphasis on the localisation of trade, food growth and manufacture, the economic benefits of aviation expansion would become considerably more tenuous.

There are important social justice issues around access to reduced and more realistically priced aviation, for example for separated families and those with relatives living far away, often impacting migrant communities more directly. While a steeply progressive tax regime applied to frequent flyers might help to blunt the amount of excessive flying, [38] the wealthy will always find a way around increased prices or scarcity. A limit on the number of flights a person can take, in combination with an expanded public transport system including European rail travel, and longer holidays, would be more effective in producing the reduction required as well as more accurately reflecting the social justice aspects.

Given the urgency of the need to reduce the amount of flying and to implement the proposed expansion in public transport, many current aviation workers need to be transitioned to rail and other transport modes. An end to domestic flights and a reduction in flights to and from Europe of, say, 50% in the short to medium term would reduce UK emissions by around 20Mt CO_2e per year, and as a proportion of the current workforce in the sector, [39] would involve the loss of around 110,000 jobs. A Just Transition under the auspices of a National Climate Service is therefore essential to reallocate workers to other sectors of the transport system.

Shipping

We cover shipping because of its significance for global emissions but of all the modes of transport modes, shipping is one of the most difficult to map onto a national climate jobs plan. About 90% of global trade is carried by sea, and around three-quarters of merchant ships are registered under 'flags of convenience', mostly in tax havens, a system that can also undermine workers' rights. [40]

There are three ways in which the industry's emissions can shrink towards zero carbon. The first is for the shipping industry itself to shrink. Fossil fuels make up 40% of maritime trade [41] and a reconfiguration towards a more circular economy would also tend to reduce global transport.

The second way is to reduce the energy needed. This could be done immediately by cutting ship speed. Cut speed by 20% and even accounting for the necessary extra ship capacity, emissions are reduced by 24%. [42] Cut speed by 30% and emissions drop reduced by 33%. Retrofitting technologies currently exist to give a wind power boost to ships, reducing fuel use by 8% or even 20%. [43] There is much greater potential if ships are designed for this from the ground up, but this is only at an early stage.

Our estimate is that, while the steps described would reduce carbon emissions from shipping by around 5Mt CO_2e per year, there is minimal impact in terms of job loss or gain.

The workforce needed to provide a green, cheap and accessible public transport system

The proposals for a massive overhaul of transport described in this chapter can be a great positive in the urgently needed massive decarbonisation of the transport sector and in developing services to meet the needs of the whole population and create many jobs. Building the transport system of the future will involve significant embodied emissions, of around 66Mt CO_2e, to manufacture new vehicles and provide the necessary infrastructure; once operational, however, such a large-scale shift to electrified transport would result in an emissions reduction of around 140Mt CO_2e every year against the 2019 baseline.

Building the public, green and integrated transport system described above would provide around 400,000 jobs, introduced over a five-year construction and transition period. The permanent workforce required to run that public transport system would include workers transferred from the car and aviation industries and would add at least another 200,000 jobs to those already employed in the transport sector. In this way, we can create a green and affordable transport system that doesn't wreck the planet, that is accessible to all, generates many jobs in our communities, and that is a vital part of the solution for our climate emergency.