

# ONE MILLION CLIMATE JOBS

Tackling the Environmental  
and Economic Crises





A rally supports the workers who occupied the Vestas wind turbine plant on the Isle of Wight in 2009 to save their jobs

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Tackling the Environmental and Economic Crises



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This report was written by a group of trade unionists, environmental activists and experts working under the umbrella of the Campaign against Climate Change Trade Union Group. The trade union movement has many different emphases, priorities and policies. While all the unions involved support the general argument, not all of them agree with every demand. All of us, however, are united in the demand for a million jobs to save the planet.

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The *Online Technical Companion* to this report includes the references, further reading, background papers, and the calculations behind all our estimates of costs, job numbers, and cuts in emissions. You can download the technical companion at [www.climate-change-jobs.org](http://www.climate-change-jobs.org).

# Introduction

This booklet is about hope in the face of crisis. The economy is not working. Mass unemployment has lasted for years, and will last for many more. And at some point gradual climate change is going to turn into swift catastrophe.

Dangerous climate change is a consequence of the work of the hands and brains of many men and women. It will take the hands and brains of many men and women to undo the damage. So many climate activists, and several trade unions, have decided to fight to make the government create one million climate jobs. This report sets out our case.

To halt climate change we need drastic cuts in the amount of carbon dioxide and other greenhouse gases we put into the air. That means leaving most of the existing reserves of high carbon fuels—coal, oil and gas—in the ground. There are thousands of things we need to do to make that a reality. But three of them will make most of the difference.

We need workers to build enough wind power, solar power, wave power and tidal power to meet all our energy needs. We need workers to insulate and retrofit all our existing homes and buildings in order to conserve energy. And we need workers to run a massive public transport system powered by renewable electricity.

We have people who need jobs, and jobs that must be done. So we want the government to hire a million people to do new climate jobs now in an integrated National Climate Service.

Our estimate is that those workers could cut our CO<sub>2</sub> emissions by 86% in twenty years. We can also create another half a million jobs in the supply line. And we can guarantee a new job to anyone who loses their job because of these changes. This booklet explains how we can do all of this, and why we must.

‘Climate jobs’ are not the same as ‘green jobs’. Some green jobs help the climate, but ‘green jobs’ can mean anything—park rangers, bird wardens, pollution control, or refuse workers. All these jobs are necessary, but they do not stop climate change.

Climate jobs are jobs that lead directly to cuts in emissions of greenhouse gases, and so slow down climate change. For instance, workers who build wind farms replace power stations that burn coal or oil. Workers who insulate buildings reduce the oil and gas we burn. Bus drivers reduce the amount of oil we burn in cars.

We want a million new jobs. We don’t want to add up existing jobs and new jobs and say that now we have a million climate jobs. We don’t mean jobs that will be ‘created’ by some mysterious market process by 2030. We want the

government to hire 90,000 new workers each month to do new climate jobs. In a year we will have a million new jobs.

Government climate jobs are a new idea. Up to now government policy under all parties has been to use tax breaks and subsidies to encourage private industry to invest in renewable energy. That is much too slow. We want something much more like the way the government used to run the National Health Service. In effect, the government would set up a National Climate Service and employ staff to do the work that needs to be done.

Government policy has also been to give people grants and loans to insulate and refit their houses. Instead, we want to send teams of construction workers to renovate all homes, street by street. And we want the government to construct wind farms, build railways, and put buses on the streets.

Direct government employment will mean secure, flexible, permanent jobs. Workers with new climate jobs won't necessarily do the same job for life—they will be retrained as new kinds of work are needed. And the jobs can be safe and decently paid.

But some people will lose their jobs. They must be protected. Anyone who loses a job in an old high carbon sector like mining, oil, power stations or car sales must be guaranteed a permanent job in the National Climate Service at the same rate of pay. In the following chapters we explain how this could be done in different industries.

Moreover, a million new jobs can help to get the economy moving again. There will not just be the jobs in the Climate Service—there will be more workers in the supply line. And all those workers will be buying more goods, which will create more jobs. In all, a million climate jobs will take at least one and a half million people out of unemployment.

NO MORE BULLSHIT!  
TIME FOR ACTION  
EARTH FIRST!



DEVE





# Unemployment and Costs

This chapter explains what's gone wrong with the economy, how a million climate jobs can help fix it, and why we can afford the jobs.

The UK government regularly does sample surveys asking people questions about employment. These surveys revealed that in March 2014:

- 2.2 million people said they were out of work, they want a job, they have looked for work in the last four weeks, and can start work within two weeks.
- Another 2.3 million people were out of work and say they want a job, but have either given up looking or cannot start immediately. Many of these are women looking after children or people in their 50s and 60s.
- Another 1.4 million people said they are working part-time because they could not get a full-time job.<sup>1</sup>

That's 5,900,000 people. The good news is that unemployment was going down in the spring of 2014. It had fallen by 309,000 in a year. The bad news is that self-employment rose by 375,000, and many of those had been claimants who were bullied into calling themselves self-employed.

The long term outlook is not good. Most predictions by economists say that unemployment may fall some, but we are probably in for something close to a generation of mass unemployment from 2008 to 2020. And that is assuming we avoid another big recession like the one in 2008.<sup>2</sup>

## What went Wrong

We need to start with the banking crisis of 2008, and why it blew up. Radical economists have two main explanations.<sup>3</sup> One is inequality. Before 2008 Britain, and the world, had been growing more unequal for at least 30 years. The rich, and companies, took a larger and larger share of the total income. Working people had a smaller and smaller share. But for the economy to keep growing, working people had to be able to buy things. So the corporations and the banks loaned the rest of us more and more money so we could keep buying.

The other explanation is problems with profits and investment. For the last forty years profits from business and industry in the developed world have been relatively low. As a result, banks and companies have invested much less than they used to in new factories, offices, machines, lorries and so on. Instead, the banks, hedge funds and companies invested their money in sectors that

don't make things or provide services. They played the markets, speculated, and loaned money.

Whatever the explanation—inequality or profits – debts of all kinds increased massively in Europe and the US in the years leading up to 2008, including mortgage debt, credit card debt, and student loan debt.

There were massive bubbles in housing prices in many countries, and enormous markets in derivatives that few people understood. Banks, hedge funds and corporations were loaning and borrowing ever increasing sums. This was a confidence trick that worked as long as all the banks and hedge funds assumed that all the other banks and hedge funds could cover their debts. In September 2008 in New York someone lost confidence, everyone panicked, and they all stopped lending to each other. Suddenly, many banks and companies could not pay their debts.

Within hours this panic spread to banks in Europe and much of the world. Lehman Brothers, the fourth largest investment bank in the US, went bust. It seemed likely that many of the biggest banks in the world would fail. The governments and central banks of the US, Europe, the UK and other countries stepped in. They took over some banks, insurance companies and mortgage companies. The governments and central banks loaned other banks enormous amounts, and spent yet more buying up bad debts.

On October 3, 2008, the US Congress allocated about £440 billion to help the banks. On October 8 the UK government found £500 billion to help British banks. And that was only the beginning.

This saved most of the banks. But many people in many countries lost their jobs or homes. Six years later the banks are still paying off their debts and are nervous about lending more money. Corporations, too, are nervous about investing. Ordinary people, too, are trying to pay off their debts and save in case things get bad again.

The result is that banks are not lending enough, companies are not buying enough, and people are not spending enough—which is why we still have mass unemployment.

Governments in the UK, the US and Europe are convinced that the solution to our economic troubles is 'austerity'. They try to save money by cutting jobs, services, wages and benefits. Austerity has not worked. Greece and Ireland are spectacular examples; but these policies have also failed in Britain and across Europe.

The reason is simple. Businesses are not investing much. Banks are not lending much. And ordinary people have less to spend because of austerity. For the economy to grow, someone has to start lending and buying. Austerity means no one can do that.

### **So We Need to do Something Different <sup>4</sup>**

We need someone to start spending and buying. Climate jobs can help. They will provide jobs to a million people in a National Climate Service. Then there are the people in the supply line, working for the companies that make all the things and provide the services the National Climate Service needs to buy. We estimate that will be 500,000 jobs.

That's a total of 1.5 million workers. They will have money to spend on beer, kids' shoes, parsnips, pizza, downloads and everything else. There will be about 225,000 further new jobs producing and delivering all those things.

That makes a total of 1,725,000 new jobs. It won't be quite that rosy, though. Remember, we want to ensure that any worker who loses an old high carbon job will be guaranteed a Climate Service job if they want one. So we estimate the net effect will be about 1,500,000 new jobs.

How big a difference that will make depends on how deep the underlying problems are. Maybe a million and half new jobs will start the whole economy moving again, because finally people are spending and investing. Or maybe the banks and corporations will still be reluctant to invest. But even then, we will still be able to take a million and half people out of poverty. We will give them, their families and their communities, hope and dignity for a generation—and help save the future of the planet.

### **How Much Will it Cost? <sup>5</sup>**

At first sight the costs for a year look large. But these figures for 'cost' are deceptive because the government will get two thirds of the money back. The initial costs are:

- £30 billion a year in wages for one million jobs over one year
- £5 billion in employers' national insurance and pension contributions
- £31 billion in costs like materials, fuel, supplies, rent and interest
- Total cost: £66 billion

But the National Climate Service will build wind turbines, for which people will pay electricity bills. The NCS will build railways and run buses, for which people will buy tickets. The government will have to subsidise some of the cost of electricity and public transport, and retrofit and insulate homes for free. But even with these expenses, we still estimate that the National Climate Service will get back about £25.5 billion.

And the government will also save money on taxes and benefits. When a worker loses her job, she stops paying tax and starts collecting benefits. And

when an unemployed worker gets a job, she starts paying tax and stops collecting most benefits.

So every unemployed worker costs the government money. And every employed worker means the government is getting more money.

Individual cases vary. But on average, every time the government employs someone at £30,000 per year, they save £14,400 on that person's taxes and benefits. That's £14.4 billion saved with one million jobs.

Also, remember that one million new jobs will create about another 500,000 new jobs in the supply line and as a result of what the new workers spend. The government also saves another £7.2 billion on taxes and benefits from those new workers.

So the government recovers:

- £21.6 billion on taxes and benefits and
- £25.5 billion on tickets and electricity bills
- For a total of £47 billion
- But the government spent £66 billion
- So the real net cost to the government is £19 billion

### **How to Pay for It <sup>6</sup>**

£19 billion a year is just under £6 a week for every person in the country. The government can raise that money. Below are seven different ways they could do it. All of them involve taxing rich people in one way or another. None of them mean increased bills for electricity and heating. This is because we want to get the economy moving again.

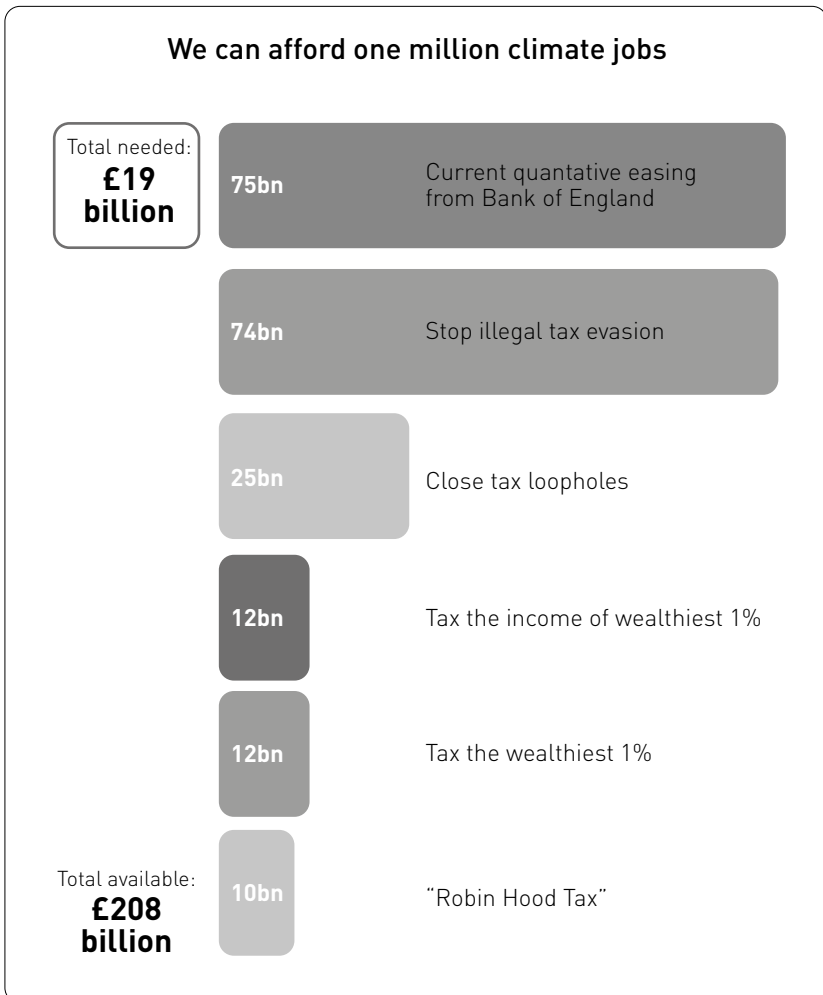
If we take the money from ordinary people, they will spend less on other things. If we tax rich people that will put money they would otherwise save into the economy. One taxpayer in 150 declares an income of more than £150,000. They currently pay an average of 37% in taxes on that income—only 27% when tax breaks are taken into account. If they paid 50% of their income in taxes we could raise £12 billion a year.

When Britain and other countries went to war in 1914 and 1939, they thought nothing of raising taxes on the rich to far higher rates than this. We can think of it not as a punishment, but as an honour, and an opportunity for the privileged and affluent to help the planet.

Or we could have a 'Robin Hood' tax on all financial transactions. Every time someone sells stocks or bonds or trades currencies or derivatives, they would pay

a tax of £1 for every £2,000 they spend. That would raise at least £10 billion to £20 billion a year.

We could raise at least £25 billion a year by closing tax loopholes to curb legal tax avoidance. Then there is illegal tax evasion. Instead of cutting the number of tax inspectors, we could simply hire more and get them to chase the people who are breaking the law to avoid taxes. That could raise £74 billion a year. Add loopholes and law breaking together, and the rich save £99 billion a year. A fifth of that would give us £20 billion a year.



Another possibility comes from the work of the economist Thomas Piketty. The top 1% of people in the UK currently own about £2,400,000,000,000 in shares, property, bonds, pensions and the like. If the wealthiest one percent, and no one else, paid an annual tax of one pound for every two hundred pounds they own, that would raise £12 billion a year. This tax would be difficult to collect, but it is worth imagining. A very simple way to start on this would be to reform Council tax, which is currently grossly regressive, by rebanding and taxing expensive properties more. This would also have immediate beneficial effects on the housing market.

Finally, the National Climate Service could borrow the money from the Bank of England. In the five years from 2008 to 2013, the Bank of England loaned £375 billion to the banks in what was called 'quantitative easing'. This would work in a similar way. For quantitative easing they loaned £75 billion a year. For climate jobs the Bank would only have to loan £19 billion a year. In acquiring the funds this way, we would in effect be borrowing from future generations. They will be grateful to us for doing so.

In any case, governments have long subsidised conventional energy and transport. The provision of free roads and bridges for cars is a subsidy. The aviation industry has been supported by untaxed fuel, orders for military versions of most new planes, and subsidies for airports. The oil, gas and coal industries are backed by governments, as are pipelines. There are literally hundreds more examples.<sup>7</sup>

### **Earth is Too Big to Fail**

Finally, governments do things that 'cost too much' when they decide to do so. The wars in Iraq and Afghanistan are an example. Rescuing the banks in 2008 is another. In some ways, the model for what we want to do is what happened in World War Two. Then all the great powers of the world took control of their economies and directed industry to make as many weapons as possible, as fast as possible, to kill as many people as possible and win the war. In the US the car factories closed in January 1942. By the end of March the car factories reopened, making tanks, weapons and a total of 66,000 bomber aircraft.<sup>8</sup>

That rearmament boom did not bankrupt the governments. Instead, it created jobs and lifted the whole world out of the Great Depression. We need to do the same thing now, but in order to save lives. If Mother Earth was a bank, we would already have a million climate jobs.

# The Dangers of Climate Change

Even if we could not afford climate jobs, this work and these jobs would still have to be done. This chapter explains why.<sup>1</sup>

The global climate is warming because humanity has been burning a great deal of coal, oil and natural gas over the last 200 years. Coal, oil and gas contain a lot of carbon. When they burn, the carbon joins with oxygen in the air to make carbon dioxide (CO<sub>2</sub>). The more CO<sub>2</sub> in the air, the more it stops the heat escaping into space, and the warmer the world grows.

Every year, some of the CO<sub>2</sub> we pump into the atmosphere is absorbed by the oceans and by vegetation on shore. But about half of it remains in the air for about a hundred years.

As part of a long term natural process, the temperature goes up and down with the amount of CO<sub>2</sub> over tens of thousands of years. What is new is that we are forcing the pace.

Over the last several hundred thousand years the temperature of the earth has gone back and forth between two roughly steady states: ice ages and warm periods like the mid twentieth century. During the ice ages there were about 180 parts per million (ppm) of CO<sub>2</sub> in the air. During the warm periods the level of CO<sub>2</sub> rose to 280 parts per million. That's a rise of 100 ppm.

Then came the industrial revolution, when we started putting CO<sub>2</sub> in the air. There are now just over 400 parts per million of CO<sub>2</sub> in the air. That's a rise of 120 ppm in 200 years—more than the difference between the ice ages and a warm climate. One half of that change has happened in the last 33 years.

Methane and nitrous oxide are also warming the world—we discuss them in the chapter on agriculture and waste. But CO<sub>2</sub> is responsible for more than 80% of UK emissions. So in this report we concentrate on CO<sub>2</sub>.

## Feedbacks

There is another worry. As we increase CO<sub>2</sub> levels we are beginning to run into feedback effects. An example will explain how these feedbacks work. Rising CO<sub>2</sub> levels are now warming the Arctic much faster than the temperate regions of the Earth. This begins to melt the permanent snow and ice. Snow and ice are white and reflect heat back into the atmosphere. When they melt, they reveal dark sea, dark tundra and dark trees. These dark surfaces absorb heat, and the Arctic warms up more, so the snow and ice melt more quickly. That reveals more dark tundra, trees and sea, which cause more melting, and so on.

Scientists have discovered several other feedbacks. For example, methane is a very powerful warming gas. As the Siberian tundra melts, frozen methane is released from the peat. That warms the air so the tundra melts more. This is already happening.

In the same way, as the ice in the Arctic Ocean melts, methane frozen in blocks under the sea also melts. It bubbles up to the surface, and the methane released into the atmosphere warms the air and the sea more. This feedback is already happening too.

Moreover, as people cut back rainforests, large stores of carbon are released from the trees, and even more from the soil. The danger is that this will warm the region and cause drought, which will kill more of the rainforest, and so on.

These are only some of the feedbacks. The more we warm the earth, the more we increase the speed of feedbacks, and the more they reinforce each other. So the more emissions we put into the air, the more warming influence each tonne of CO<sub>2</sub> has. Moreover, at some point we may well face runaway climate change, as the feedbacks feed each other.

If emissions continue rising at the present rate, we are on course for rises in the global average temperature of at least 4 degrees. That is an average. The rises will be lowest at the equator, and higher the further north you go. They will be higher in big cities, in summer, and higher than average on some days. So northern cities on hot days may see increases of 6 degrees or more above previous highs.

The Earth has warmed before. But humans have not seen warming on this scale. And when the ice ages came, small human populations were able to walk away from the ice. This time the climate will change very quickly, and 7 billion people will be stuck in a fixed and very complex economic and social system.

With less than a degree rise in temperature, we have already begun to see serious effects. There are prolonged droughts across the Sahel—just south of the Sahara—and across many countries in Central Asia, Australia, Northern Mexico and the South western United States. Flooding has displaced millions in Nigeria and Pakistan. Bangladesh, Burma, and the Philippines have endured unprecedented cyclones. Rising sea levels are a serious problem in the Mekong delta in Vietnam. Serious heat waves have killed many in Europe, Russia and India, and forest fires have spread across Spain, Australia and the western US.

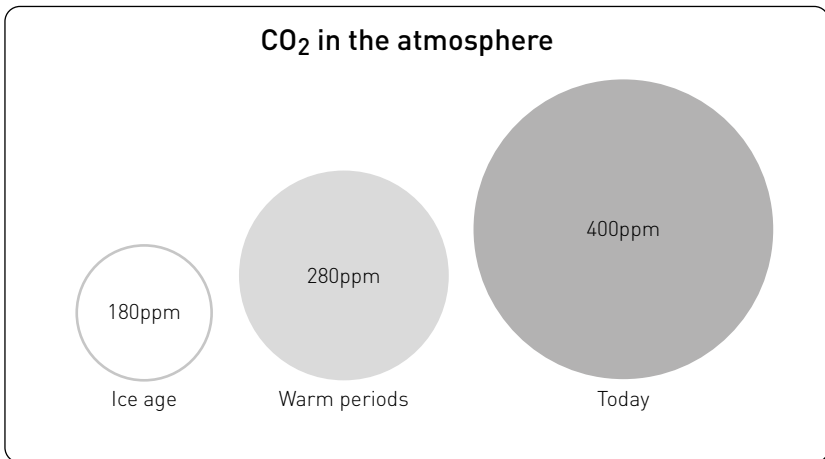
With much larger temperature rises, we can expect instability and many extreme weather events: bigger hurricanes and cyclones, hurricanes farther north, big winter storms, prolonged heat waves, “hurricane surge” waves like



tsunamis of 10 to 20 metres, droughts, torrential rains out of season, and great floods.

Famine, storms, drought and rising waters will produce hundreds of millions of refugees. This is likely to lead to conflicts, hatred, and mounting xenophobia and racism. The quickly changing climate will also change the balance of power between and within countries. That will mean war in many places at the same time.

There can be no accurate estimates of human fatalities from all these causes, but they will be in the hundreds of millions. Rough estimates suggest that half or more of the species on Earth will also perish. But it is in the nature of a runaway event that while the consequences will be horrific, the precise scale remains unknown.



This means we have to move quickly to cut emissions. The Intergovernmental Panel on Climate Change brings together the world's scientists to produce consensus documents, under the aegis of the United Nations. Two degrees centigrade is the generally accepted point at which we will begin to face dangerous change. The IPCC scientists estimate that to have a 50-50 chance of avoiding that danger, we must limit the total carbon dioxide emissions we can create in the future to about 1,000 billion tonnes of CO<sub>2</sub>. At present rates we will reach that limit in about 30 years. And if we go to that limit, afterwards we will have to emit no more CO<sub>2</sub> at all—a clear impossibility.<sup>2</sup>

That 50-50 point is, of course, only an estimate. It is not a trigger point. It is not that, once we pass the barrier, we are embarked on desperate runaway

change. Rather, what the world's scientists are saying is that once we pass that point, the odds are roughly even that the earth's climate will be changed in ways that will make it very difficult for human beings to cope. It looks likely at the moment that the world will reach that point. We need to cut emissions swiftly, globally, now, to make sure we do not go into even worse territory.

To do our share, we need to cut emissions in the UK by at least 80% within twenty years. To do that, we have to leave the large majority of the known reserves of coal, oil and gas in the ground. We have to reduce the amount of energy we use, and almost all that energy has to come from "renewable" sources that do not emit CO<sub>2</sub>. The rest of this report shows how we can do our share of that in the UK.

Visual Information Photographer/USDA



**Firefighters tackle a wildlands fire in Beaver Creek, Idaho**

# Overview of Climate Jobs

We now describe climate jobs in detail. The next few chapters concentrate on the big four: electricity, transport, heating, and industry. We explain how we have arrived at these numbers of jobs and try to provide a reasonably detailed plan. But with production on this scale the technology will change and improve massively. Our plan is designed to show that climate jobs could work with the technology we already have. The calculations and sources behind these numbers in this chapter are provided in our *Online Technical Companion*.

Let's start with what we need to cut. Most of our global warming emissions are in the form of carbon dioxide. This comes from burning coal, oil and gas. In 2013 total UK emissions were 525 megatonnes (Mt). These came from:

Transport	178 Mt
Electricity production	145 Mt
Heating residential buildings	77 Mt
Business combustion	65 Mt
Producing oil, coal and gas	33 Mt
Heating public and business buildings	20 Mt
Industrial processes	10 Mt
<b>TOTAL</b>	<b>528 Mt</b>

For an 80% cut, we want to get down from 528 Mt to 106 Mt.

On top of this, we also have the equivalent of another 100 Mt of emissions from three other greenhouse gases: methane, nitrous oxide, and fluorocarbons. Chapter 9 on agriculture and waste explains how we can cut these. The next four chapters will concentrate on cutting CO<sub>2</sub> from electricity, transport, heating and industry.

Our approach is emissions-led. That means that in all cases we look for the jobs which will cut the most emissions. And we concentrate our attention on the sectors with the highest emissions. One million jobs is a round number. From our calculations, it looks like a million will be almost enough jobs. But we could cut emissions more, or faster, with even more jobs.

Our plan starts by saving energy in three ways. First, new regulations and standards can cut the amount of electricity we use for appliances, lights and

machines. Second, we insulate and renovate all homes and public buildings to cut emissions there by about 40%. Third, we cut the amount of energy used in transportation, and we help industry change the production processes so as to use less energy.

At the same time as we are saving energy, we cover the country with wind, wave, tidal, and solar power so we can make twice as much electricity as now—and all of it renewable. When that work is done we will have enough extra renewable electricity to cover almost all the remaining energy needs of buildings, transport and industry.

In short, we cut the need for energy by about half. And we supply almost all our energy needs from renewable power.

# Renewable Energy

Currently the UK produces about 360 Terawatt hours (Twh) of electricity each year. We plan to double that to 720 Twh. More than half of that will come from wind power. This is because of our weather in the UK—we don't have much sun, but are blessed with wind.

To explain how this works, let's start with onshore wind farms. Almost everyone has now seen a wind turbine with three narrow blades that turn in the wind. The blades are attached to a cylinder that sits on top of a high tower. A turbine inside the cylinder transforms the energy of the turning blades into electricity. Cables carry that electricity to the ground and away to feed into the national grid.

Wind turbines need a steady supply of strong wind. So they are built in rural areas, often on ridges, in the hills, or along the shore. The turbines are usually built in groups, or 'wind farms'.

In the first few years, most of the jobs in wind farms will involve making the towers, the central cylinders (nacelles), and the blades in separate factories. They will then be transported and assembled together on site. These are mostly skilled factory jobs. But after 20 years, as the number of wind farms grows, about half of the jobs will be in maintenance.

The big bonanza for the UK, though, is offshore wind. There are three great sources of renewable energy in Europe. One is North Sea wind. On average the wind at sea blows more strongly and more regularly than on land. Britain is a small island, but there is a great deal of shallow water on the Continental Shelf offshore, with plenty of space for wind farms. So more than half of our electricity will come from offshore wind.

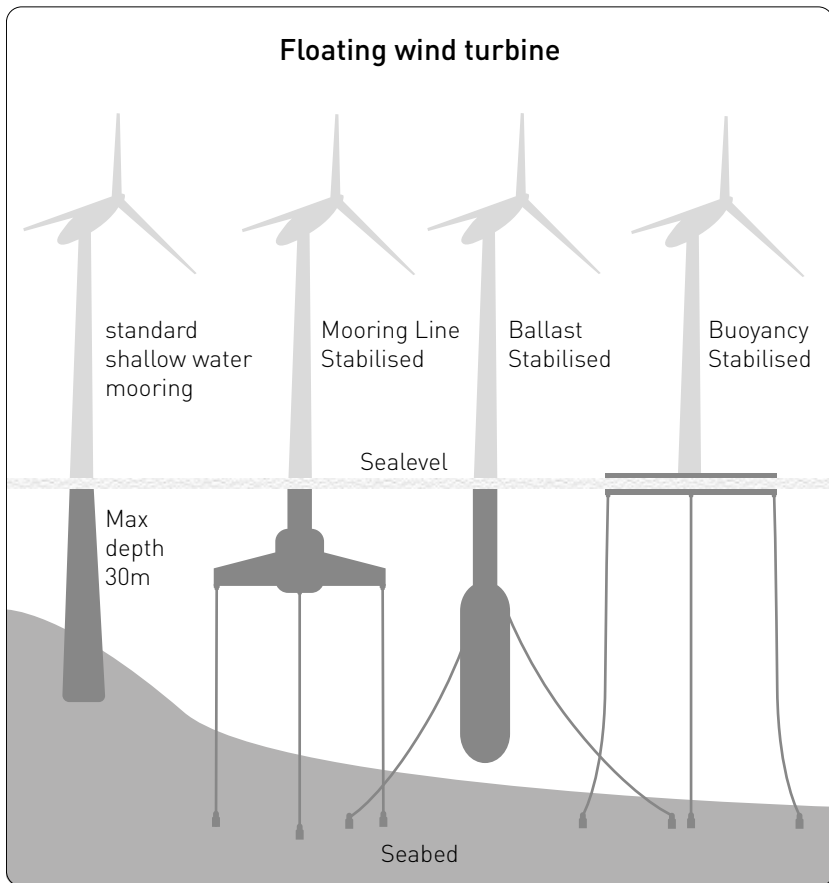
About half of the jobs in offshore wind will be the same as onshore wind—at first mainly in factory jobs. The other half, though, will be in assembling the turbines, taking them out to sea, and putting them in place.

There are also more maintenance jobs offshore. Turbines break down more often at sea. Installation and maintenance will both require many skilled engineers and electricians. Offshore wind also requires seafarers, and shipbuilders to make the specialist vessels needed. The days when seafarers and ships were central to the UK economy can return.

At the moment offshore wind turbines are built on top of cement and steel towers that rise from the sea floor. There is plenty of shallow water off the UK where this will work well. But a new technology called 'floating wind' now

makes it possible to go out to depths of 1,000 metres—a turbine rises from a broader platform that is anchored to the ocean floor by cables. Floating wind turbines were working in Portugal, Japan and the US by the summer of 2014. There are plans for floating wind farms in several countries by 2017, including eight floating turbines in Scotland.

We estimate that it will take 20,000 workers each year to produce 80 Twh of onshore wind by the end of 20 years. For offshore wind, it will take 216,000 workers each year to produce 480 Twh by the end of 20 years.



Several different kinds of floating wind turbines are being developed in different countries. All are anchored to the sea bed with cables

### **Combining Technologies and a National Grid**

Wind can produce about three quarters of our electricity in 20 years. But we will have to combine this with other kinds of renewable electricity. The reason is that renewable energy varies across times and places. Sometimes the wind is blowing hard, and sometimes it's still. The sun shines to make solar power in the day, but not at night.

The demand for electricity varies throughout the day, and is highest during early evenings in winter. Moreover, it is difficult to store electricity. This is less of a problem with gas or coal—you simply turn the power station supply up or down at different times of day, and burn less fuel when you need less electricity. But wind turbines turn through the night. If that electricity is not used at night, it is wasted.

There are several ways to solve the problem. One is a national grid that links up wind across the country, from Cornwall and Wales to the North Sea. When the wind is not blowing in one place, it is likely to be blowing 800 miles away. But we also need a grid that mixes sun, wind, wave and tidal power. And we need grid cables that cross countries, so wind from Siberia and Scotland can be mixed with sun from Turkey and Spain.

The existing national grid is aging and in serious need of replacement, and we will be doubling the total amount of electricity used. So we will need a new grid, with twice the capacity of the present one. And we need more ways to store electricity: by pumping water, in car batteries, and with air pressure. We estimate that a new grid and new storage will take 56,000 workers 20 years to build.

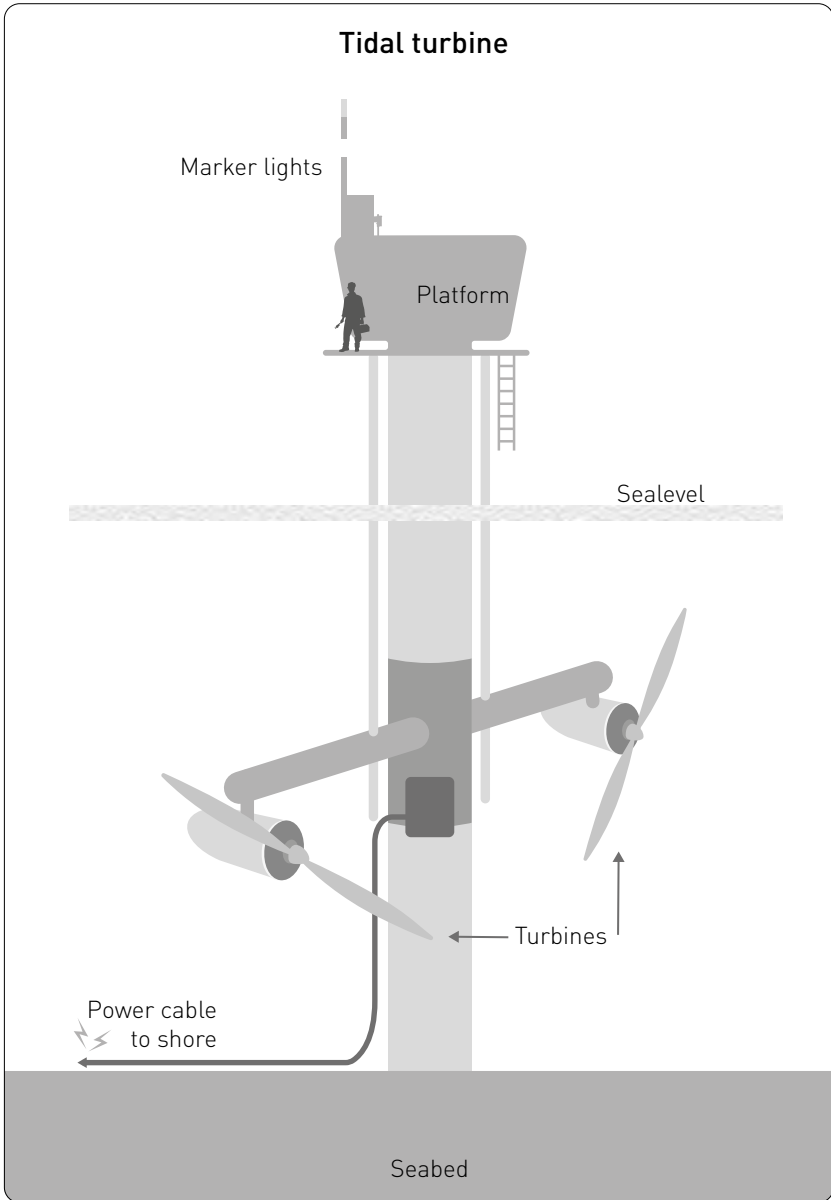
### **Wave and Tidal Power**

Another way to solve the problem of fluctuating wind is wave and tidal power. There are always waves around Britain, although the strength varies. Tides move in and out at different times as you go round the coast, and are of reliable strength.

Wave energy can be tapped using floating buoys, or via hinged flap systems, or by turbines. All these devices usually face the incoming waves, and use dynamos to turn the energy of the waves into electricity. Tidal stream power turbines do the same with incoming and outgoing tides. Tidal range power relies on barrages and lagoons in areas with particularly high tides.

These marine power technologies are developing quickly, but are still expensive. The UK currently has more than half of the functioning wave and tidal power in the world.

We estimate that 54,000 workers can produce 80 Terawatt hours of wave and tidal electricity within 20 years. Most of these jobs will be in research and development, in manufacture, and in maintenance at sea.



This figure shows one of the several different kinds of tidal turbines now being developed



### **Solar Power**

There are two ways to make electricity from the rays of the sun. The most useful kind in the UK is solar cells. These cells come in thin boxes, and are mostly attached to south facing roofs. They turn sunlight into electricity, even on cloudy days. Solar cells often produce more electricity than the building uses, and the excess goes back down the electric wires that feed into the house, and into the national grid for use elsewhere.

Solar cells work best in very sunny countries. In Britain they are more expensive than offshore wind. But the variability of the sun can balance the variability of the wind. And prices are coming down quickly now as technology develops further.

Most of the jobs here would be factory jobs in manufacturing, plus some construction and electrician jobs in installation and maintenance. We estimate 54,000 jobs a year in solar energy will produce 80 Terawatt hours by 20 years from now.

Solar cells really come into their own, though, in new homes and buildings. Then the solar cells are not just panels on top of the roof, they are the roof. This is cheaper, and it's quick and easy.

The second way of making electricity from the sun is using concentrated solar power (CSP). Mirrors concentrate the rays of the sun onto mercury or liquid salt. This in turn is used as a heat source to generate power by turning a turbine. CSP already works impressively in many countries, including Spain. It does not work as well in less sunny Britain. The obvious solution is to send some of the wind electricity from Britain to Southern Europe and North Africa, and bring solar electricity from those countries in return.

### **Evening out Demand and Supply**

We can also balance wind by spreading demand. We will be making twice as much electricity as we do now. That electricity can be used at night in transport and buildings. In transport we can charge the batteries on electric vehicles late at night. But if all the cars, vans and taxis are electric, we can use an awful lot of batteries for storage.

People can be encouraged to use electricity at night in homes and buildings as well. This starts with 'smart meters' in every building that can be programmed to control electricity use at different times. With new, big, well insulated boilers water can be heated mostly at night and used mostly during the day. Buildings can also be heated to a certain background temperature at night, and topped up during the day.

Very cheap or free electricity late at night will encourage people to spread the load. We can also use 'headroom' – have more electricity available than we need, rather than always running at the edge.

With all that, in some years there could be ten to fifteen days of exceptional weather when there would not be enough electricity to meet all demand. On these days we could use 'load shedding'. Some businesses would agree to shut down on part or all of those days, in exchange for cheaper electricity on other days.

### **Reducing Demand**

With all these new jobs, we will be able to double the amount of electricity produced each year. But we will need enormous amounts of electricity to run our vehicles and heat our homes and buildings. To free up supply for these uses, we also need to reduce the amount of electricity we use.

Currently about a third of electricity is used for lights, appliances, cooking and heating in homes. About a third is used for the same things in public buildings and businesses. And about a third is used for lighting, machines and processes in industry.

The main way to reduce these uses is through regulation, not jobs. We already have lights and appliances that use much less electricity. We just need regulations saying that in three years' time everything sold has to meet the standards of the best available now. Within five years after that, electricity has to be cut by half again.

This has been tried before with many technologies, and it works. However, we have to be careful not to regulate on the basis of 'energy efficiency'. That means a manufacturer can make a fridge that is twice as efficient, but also twice as big, so it uses the same amount of electricity. Instead, we need rules for the maximum amount of electricity each machine or appliance can use.

Reducing electricity use in factories is more complex, and we return to this in the section on industry. But with these sorts of controls, it should be possible to cut current electricity use by half.

### **Other Technologies**

There are also other possible ways of generating renewable energy. For instance, biofuels can be used in power stations. But almost all biofuels use land that could be better used for growing food or storing carbon in forests. So we do not recommend them here.

Another way to reduce emissions is Carbon Capture and Storage, also called 'clean coal'. In coal or gas fired power plants, a scrubber takes the CO<sub>2</sub> out of the air after the coal burns. That is the 'capture'. This CO<sub>2</sub> is then turned into a liquid under pressure and shipped to a cavern underground or undersea. That is the 'storage'.

The scrubbers work. They greatly increase the cost of a new power station. This would mean more jobs, but it also why power companies have not build full scale plants anywhere in the world that capture and store all their carbon.

The storage is more problematic. It takes a lot of energy to pump the CO<sub>2</sub> through a pipeline for any distance, and there is no way of being sure how much will eventually leak. It may also poison the aquifers underground.

Some of the contributors to this report strongly support clean coal, and others are less optimistic. But we agree that some of the one million jobs be used for building the first working coal plant in the world to capture and store all its carbon.

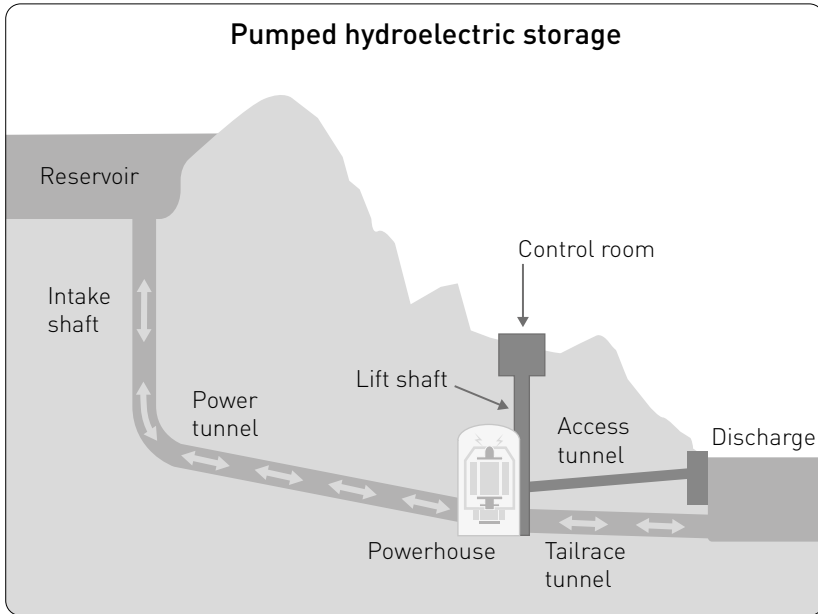
Another possibility is nuclear power. Most contributors to this report think that nuclear power is too expensive and dangerous, and so we have not included new nuclear power stations in our plans. However, we are also very aware that many people in the union movement support nuclear power, and we want to continue discussions with them about this.

Both nuclear workers and coal miners already face an uncertain future. One of our bedrock principles is that the new National Climate Service will guarantee a job in renewable energy for every nuclear worker if their plant closes down. The promise of a climate job, if needed, can offer them all secure futures, with decent pay, working close to home.

**Summary**

Onshore wind	80 Twh	20,000 jobs
Offshore wind	480 Twh	216,000 jobs
Wave and tidal	80 Twh	54,000 jobs
Solar power	80 Twh	54,000 jobs
Grid and storage	0	56,000 jobs
<b>TOTAL</b>	<b>720 TWh</b>	<b>400,000 jobs</b>

In 20 years we will produce twice as much electricity as we do now. But we will need only half as much for machines and lights. That will leave us a lot of spare renewable electricity to use in transport, in heating buildings, and in industry. And we can cut emissions in electricity production from 145 Mt of CO<sub>2</sub> a year to almost zero. Because nothing ever works out perfectly, we will say this is a 95% cut in emissions.



**One way of storing renewable electricity is to use it to pump water uphill into a reservoir. Then, when power is needed, the water flows downhill again and turns a turbine to make electricity**

#### FAQs

The *Online Technical Companion* answers many frequently asked questions about climate jobs, including:

- What about health and safety?
- What will happen to electricity bills?
- What about the fossil fuels used to make the renewable energy?
- What role is there for cooperatives and small business?
- What about the 'Jevons Paradox' or 'Rebound Effect'?
- What happens to the climate jobs after twenty years?

# Building Jobs

This chapter is about jobs in refitting houses, public buildings and businesses to reduce their energy use. We will need about 185,000 workers for twenty years. Most of them will be construction workers, of all kinds.

These workers will insulate and draught proof homes and buildings so they use less energy. As with any developing technology there are lots of new approaches and bright ideas for saving energy in homes. We will concentrate on those with a long, proven record—insulation, draught proofing, shading and so on. Where appropriate the workers will also install local renewable energy sources in buildings, and on the roofs. And they will install electric heating powered by renewable energy from the grid.<sup>1</sup>

## Homes

Here is how it will work in detail.<sup>2</sup> We will start with homes. The last chapter dealt with the electricity used in homes for powering lights and appliances. As we showed there, we can cut the electricity use by half, and eventually supply the remaining half with renewable electricity.

Three quarters of emissions from houses and flats, though, are caused by heating air and water. To reduce this we need to insulate and draught-proof the buildings, and replace inefficient boilers. This can cut the amount of energy used to heat the home and water by about 40% and delivers the double-whammy of reducing energy costs and helping mitigate the scourge of fuel poverty.

The first step will be to send in trained energy assessors to determine what work can be done in each home. Most older houses in Britain are built to be leaky because they were heated by open fires. If the windows are sealed to avoid heat loss, one common problem is that the house becomes damp because the reduction in ventilation encourages condensation. So each house needs careful assessment and planning before refurbishment.

The most direct way to save energy in a house is to use insulation to reduce the heat lost. This can usually be easily added to a loft space, which is particularly vulnerable. About one in four houses already have some loft insulation, but in many cases much less than is needed.

Another major source of heat loss is through the walls. Many houses built since 1945 have double walls with a cavity between so it is easy to pump in foam insulation. In older buildings with no cavity, the insulation has to be

applied inside or outside. Applying it inside is easier, though it reduces the size of the rooms a bit, and can also increase the risk of overheating in summer. Applying insulation to the outside as a render works better, but is more expensive and may be unpopular with conservationists in some areas.

A lot of heat is lost through windows. In the UK these are often single glazed, and many older buildings have draughty window frames. The solution here is double, multiple or 'secondary' glazing, draught proofing windows and doors, and plugging any other areas of heat loss.

It makes a lot of sense to do all these jobs together. A team of building workers can put up scaffolding all down one street. Then they go in as a team, work quickly, and do all the necessary jobs in one go. This cuts labour time and reduces the inconvenience so long as it is done sensitively and with expertise. This 'group' approach has been used to great effect in some places where public funding has been available with estimated cost savings of about 30% over house-by-house approaches. The work can be phased so that the worst stock is done first, and the greatest number of people are helped first.<sup>3</sup>

We will also need administrative and ancillary staff to make such projects work. Sometimes mass insulation programs don't deliver the hoped for benefits because the planners don't take account of seemingly minor things such as where to store loft contents to allow the builders to install proper loft insulation. So we need people to assess these problems beforehand, and help clear the loft and do other tasks.

### **Renewable Energy on Site**

As well as insulating, we can install solar hot water or ground source heat pumps on site. Solar hot water is also called solar thermal heating. The water goes through thin pipes, painted black, on the roof. The sun warms the water. But for this to work you need a suitable roof, and it may not cover all your water heating needs.

Photovoltaic (PV) arrays on the roof and ground source heat pumps, which gather energy from the ground, can also be integrated into buildings. But PV requires a suitable size of roof facing roughly south and ground pumps require suitable gardens.

Installing these renewable energy technologies can be done at the same time as the insulation and refitting work. This again is more efficient, and causes less trouble for the residents than doing things one by one.

Our estimate is that an average of 100,000 workers a year can transform almost all existing homes. We would do both council housing and privately

owned homes. Each house or flat will need a different combination of insulation, glazing, draught proofing, boiler replacement, solar hot water and other suitable technologies. Households will save a lot of money on bills over the years, but we propose that the work be done for free. A piecemeal approach relying on private funding is discriminatory and has been shown to be ineffective.<sup>4</sup>

### **Electricity for Heating**

Once all this work is done, we will have cut emissions from heating homes and water from about 75 million to 45 million tonnes of emissions a year. Then we can cut almost all of these 45 million tonnes by replacing gas and oil heating with renewable electricity. But we can't do it immediately, because burning gas, coal or oil on site is a relatively efficient way to heat houses. That is why it is more expensive to heat with electricity now. If you burn gas, coal and oil in a distant power station, and then turn it into electricity, you lose energy. You lose more energy sending the electricity over long distances, and then more turning it back into heat.

But once almost all of the electricity on the grid comes from renewable sources, that problem goes away. So we do the job in stages. During the first ten years we reduce energy use in the home and build renewable energy to make electricity. During the second ten years we switch from gas, coal and oil in the home to renewable electricity.

If we do all these things, we can cut emissions from existing homes by almost 100%. But there are always snags, so we estimate cuts of about 95% in reality.

### **Public Buildings and Businesses**

We turn now to non-domestic buildings—all the buildings that are not homes or factories. These include office buildings, hospitals, shops, restaurants, warehouses, schools and many more.

Many of us have worked in commercial offices built in the 1970s with single glazing in ill-fitting metal windows. Overheating is often a major problem because commercial buildings are put up with the minimum use of materials and the fashion is for buildings with lots of glass (letting in the sunlight—the original 'greenhouse effect'). As a result many buildings are air conditioned –some of them year-round—in an attempt to make up for the inability of the building to soak up the enormous amount of energy put out by the IT equipment and the occupants. Electricity for air conditioning generates vast amounts of CO<sub>2</sub>. In addition, one third of energy used in commercial buildings is used for lighting.

The increasing energy efficiency of IT and lighting equipment, the switch to renewable energy sources and the shorter life-span of many commercial buildings will eventually reduce the problem. Meanwhile, these buildings need similar treatment to homes.

Public buildings differ a great deal from one another in the ways they use energy. A school, an office building full of computers, a restaurant and a supermarket are very different. The basic climate jobs to be done are the same—insulation, fixing windows and doors, replacing boilers, regulating lighting and appliances, and adding thermal solar and heat pumps. We estimate that an average of 50,000 workers a year can cut energy use and emissions in non-domestic buildings by about 40%.

Then, as with homes, once there is enough renewable electricity, almost all the remaining heating, cooling and lighting in non-domestic buildings can be switched over. Even then the less energy the building uses the better to reduce the cost of power generation. Our estimate is that it will take 50,000 workers for each of the last five years of the programme to convert non-domestic buildings. Again, this should cut total emissions by 95%.

Public buildings like train stations, supermarkets, warehouses and airports also have very large roof spaces, which are ideal for large scale deployment of solar PV cells. The majority of the cost of solar cells is in the installation, and the savings in doing very large arrays are considerable.<sup>5</sup>

Bill Harrison/Creative Commons Licence



Newly built eco-houses in Aberdeen



## New Buildings

There is one more way of cutting emissions: new buildings. The average house is replaced after 100 years. The average public building stays up for 40 years. So after 20 years, only 20% of houses and flats will be replaced. But 50% of public and business buildings can be replaced.

It is much easier to save energy and cut emissions in new buildings. Here the answer to emissions is a matter of regulations, rather than new jobs. The government already has detailed building regulations. There are many examples, particularly in Germany, of developments of 'passive houses' that use very little energy. And these new building regulations need to take effect immediately.

Moreover, with new buildings it is cheap and easy to install solar panels. This is because the panels are not just tacked onto the roof, they are part of the roof. We will also need to change the design of office buildings. At the moment they are often in effect glass greenhouses. All the windows then have to be covered to keep the light off the computers, which means extensive internal lighting, and then air conditioning. Moreover, tall buildings use large amounts of electricity moving people and goods in lifts. All this could change.

The new buildings will be a bit more expensive than now—maybe about 20% more. That will create more building jobs in the construction industry, although these will not be part of the National Climate Service.<sup>6</sup>

Finally, there will be jobs for energy inspectors. At the moment the enforcement of building regulations on energy use is left to private inspectors paid by the builder, and abuse is widespread. The solution is about 10,000 well-trained public inspectors with stringent powers.

## Summary

The averages over the whole 20 years will be:

- 100,000 workers in renovating homes
- 50,000 workers in renovating other buildings
- 25,000 workers converting buildings to renewable electricity
- 10,000 building inspectors

**TOTAL: 185,000 jobs**

So an average of 185,000 building workers over 20 years should be able to cut CO<sub>2</sub> emissions from buildings by 95%.



TUC

A rally at Kings Cross station in 2014 by Action for Rail



Spsmitler/wikicommons

Underground trains have half the emissions of cars per passenger

# Transport Jobs

This chapter is about jobs in transport. To see how to change, we'll start with emissions now. UK transport produces almost a third of our total CO<sub>2</sub> emissions. In million tonnes of CO<sub>2</sub>, they break down as:

Passengers in cars, taxis and vans	70 Mt
Aviation	53 Mt
Heavy goods vehicles	23 Mt
Shipping	12 Mt
Vans for delivery	10 Mt
Buses and trains	6 Mt
Other	4 Mt
<b>TOTAL</b>	<b>178 Mt<sup>1</sup></b>

The big three are cars, planes and lorries. We'll start with cars. In 2013 the share of passenger kilometres was:

Cars, vans and taxis	82%
Trains	9%
Buses	5%
Walking	2%
Motorcycles	1%
Bicycles	1% <sup>2</sup>

But cars burn a lot of oil, so we need to replace them with public transport and electric cars. In the UK, CO<sub>2</sub> emissions per passenger in a car are:

- twice the emissions of underground and light rail
- almost two and a half times the emissions on trains
- four times the emissions on intercity coaches.<sup>3</sup>

On the other hand, emissions for cars are only a bit more than buses. The reason is simple. The average British local bus, on an average day, fills 10 seats. Many European countries, including Italy, Germany, Denmark, Norway, Austria, and Spain, do double that or better.<sup>4</sup> And it is possible to do even better than those

countries. We suggest doubling the size of the bus network, and aiming to increase the number of passengers on each bus from 10 passengers to 25.

To make such a service work, several strategies have to go together. We need more buses that come often and on time. We will need more reserved bus lanes, including fast-track bus lanes on motorways. Some streets would have to be bus only at certain times of day. It also makes sense to build long-distance bus stations at transport hubs on the edge of urban areas. With these changes buses would be much faster than cars are now, with much less congestion.<sup>5</sup>

All these measures would make cars less attractive, and buses more attractive. On some journeys, like rush hours in London, it would be hard to increase the numbers in each bus, but these are a small minority of total journeys.

The reduction in congestion would itself improve the regularity of buses. Increased passenger use will also make it possible to run smaller buses and shorter trains at slow times, and operate flexible “dial-a-ride” services for door-to-door journeys. Several studies show that where public transport systems are fast and reliable, people prefer public transit to driving private cars.<sup>6</sup>

A key step, though, is to make buses and trains cheaper. Many transport union activists feel there are dangers in introducing free public transport immediately. They fear, understandably, that without money coming in from tickets, the government will not invest properly in public transport. Some environmentalists argue that free public transport would lure people away from walking, thereby increasing emissions.

As a partial step, we can make travel free for all children, seniors, people with disabilities, and people on benefits. We can use current government subsidies to keep fares low. We can also simplify charges, with only one or two fares for any destination, and bring prices into line with the lower average prices in Europe. This will make for many more users, and fewer cars, and faster travel, and more frequent trains and buses. The reduction in traffic noise and pollution would also make walking more pleasant.

## **Trains**

We can switch to buses quickly, because the roads are already there. Every time you fill a bus you clear space on the roads. In the long run, though, trains use less energy per person than buses, and much less than cars. However, the train network is already nearly ‘full’. That does not mean all the seats are full. It means we can’t run many more trains without building more track. Again, seat occupancy in some other European countries is much higher than in the UK.<sup>7</sup> So we suggest doubling the size of the rail network. This may look like a big task. But, mile for mile, building railways is cheaper (in some cases much cheaper) than building

motorways.<sup>8</sup> And a big contribution could come from restoring some of the 6000 miles of track closed by Lord Beeching in the 1960s and the many additional miles axed during earlier rail cut-backs.<sup>9</sup>

With rail most of the jobs in the first few years will be in construction, not in driving and running the system. And a new rail system can be entirely electric from the beginning.

A big gain here is in carrying freight. HGV lorries produce 23 Mt of CO<sub>2</sub> a year.<sup>10</sup> It is difficult to electrify a lorry—they travel too far and consume too much energy changing speed. Rail freight already uses about one sixth of the diesel of a lorry carrying the same freight. So we suggest moving half of road freight onto rail.

We would need to expand the existing depots, and build a network of new ones. But the freight could be broken down and distributed in electric vans, recharged at the depot at night. It would also be possible to cut the remaining emissions from HGVs substantially. Design changes, ecodriving, and closer control of loads would help. Reducing the speed limit for lorries to 50 mph would save a great deal of fuel. A lower speed limit would also increase the number of jobs for lorry drivers, because in total they would have to be on the road longer.<sup>11</sup>

But what about the drivers' jobs when freight switches to rail? If we move half of freight to rail over twenty years, that would mean one driver in forty losing their job each year. But more than one lorry driver in forty already retire each year. Moreover, lower speed limits will mean more drivers. Smaller lorries can be run on electricity, and smaller lorries mean more drivers per tonne. And in the meantime, there will be an enormous number of jobs driving buses and training bus drivers. For all these reasons, lorry drivers won't need to worry much. But having the guarantee of a job with the National Climate Service in the background will reassure people mightily.

The existing rail network is already well fitted to moving freight—it just needs full electrification. A new passenger network could run double decker trains, as in France, because we could have higher bridges and longer platforms.

With trains, as with buses, more frequent services and cheap tickets would combine to attract even more passengers, and provide a denser and more reliable service. The new network could carry at least two and half times the number of passengers served by the old network.

### **Nationalisation**

It is difficult to see how any of this could work with a mixture of private rail franchises and bus companies and a new National Climate Service. We would have to renationalise rail and buses. Indeed, there is already strong public support for bringing back British Rail.

### **Shared Taxis**

We also need shared taxis. At the moment 214,000 people in the UK are chauffeurs or drive taxis and cabs.<sup>12</sup> We don't want to put them out of work. But for most cab trips they are only carrying one or two people, plus the driver. Many countries in the world have shared taxis and minibuses. They say on the front where they are going, they let you off when you ask, and you flag them down when you need them. At the start of the journey, the taxis line up, and each one goes off as it fills up, which usually takes three or four minutes. The system works well.<sup>13</sup>

The key is full taxis, so they use less energy. Once they become popular on certain routes, the drivers can perhaps upgrade to minibuses. And all the taxis can be electrified. They will be able to make a particularly useful contribution in rural areas and with transport for people with disabilities and the elderly, taking them right to their door. At the moment about half of vehicle miles in the UK are on rural roads.<sup>14</sup>

### **Cycling and Walking**

We also need to think of cycling and walking as part of a public transport strategy—they are good for your health, and the only CO<sub>2</sub> they produce is in the air you breathe out.<sup>15</sup>

The key thing here is building a network of wide, safe, segregated cycle lanes that are not simply blue or green paint on a road. This can be done quickly where they run alongside roads. With a more developed policy for cycle use it should also be possible to build well-lit lanes that follow independent routes, for example on the verge of railway embankments where there is space and no potential hazards. We figure that with this kind of investment, cycles could probably replace a tenth of car passenger miles.

We suggest 10,000 jobs for ten years be in converting roads so they have safe, dedicated cycle lanes. And there would be at least twice that number of jobs in cycle shops and another 20,000 jobs created in making and repairing the bikes.<sup>16</sup> Electric bicycles, now widely used in China and in Europe, also have very low emissions.<sup>17</sup>

### **Electrification**

Buses, trains, shared taxis, walking and cycling together can reduce total passenger emissions by nearly half. But then we can reduce emissions to almost nothing by running cars, buses, trains and taxis on renewable electricity. Electric cars already use about a third less energy than similar petrol or diesel driven cars. So the first step is to require all new cars to be electric.

There are problems with electric cars. Their range before recharging tends to be 100 to 200 miles, and recharging takes 4 to 6 hours. That means that most long distance travel will have to be by train or coach, with electric cars rented at the other end if necessary.

There is also the problem of congestion, and the large number of people killed and maimed by cars. Moreover, as long as we have millions of cars in rich countries, then people in China and India will want them too.

However, there is a big advantage to recharging batteries at night. A system of service stations where you haul out batteries and replace them, much as you would fill up a tank now, could make a big difference.

Moreover, a network of batteries charging at night could store electricity. Millions of batteries could use electricity from wind farms at night that would otherwise go to waste. And most people leave their cars parked or in a garage for most of the day. Those batteries could be a store of extra electricity at critical moments of demand.<sup>18</sup>

Electric buses, trains and taxis should also make similar savings of energy. And public transport already fits more easily with electricity. The whole rail system can be electrified. On motorways we can build reserved lanes for buses with overhead electric lines. These can be connected to cities by bus stations at each interchange. With a mixture of local buses stopping at each exit, and express buses running long distances, intercity bus travel could be far quicker than now, and run every few minutes.

Vans, buses and shared taxis fit electricity well. They don't have to go fast. They can use hybrid technology on all-electric motors to turn constant braking into saved energy. And they can change batteries regularly at depots.

### **The Future**

It should go without saying, but it doesn't, that all of the new comprehensive transport system will have to be accessible to people with disabilities. That could transform people's lives.

Any one of these strategies won't make public transport popular on its own. Taken together, and over time, they can make a decisive difference.

Finally, we can try banning cars from inner cities, or from whole cities, altogether. This would allow fast, efficient transport, and mean that most streets could be returned to trees, children, neighbours, grass, parks and gardens. This won't work by passing a law. But it could work if people in one city voted to try it. We think the results would be such that everyone else would want to do it too.

## Aviation

Planes account for more than a quarter of UK emissions from transport. Almost all of this comes from international flights.<sup>19</sup> Plane emissions are deposited in the upper levels of the atmosphere, where they have a greater warming effect than emissions on the ground. There is debate about how much difference this makes. In our calculations, we have assumed that aviation emissions will have about 50% more impact than emissions on the ground.

Airplane emissions are also hard to cut. Planes are already beautifully aerodynamic, they are already public transport, and there is no way to electrify them. There are ways of coping. Over twenty years we can replace most European and domestic flights with rail travel—with obvious exceptions like Orkney. And there is a strong argument for building a decent high speed rail system first and then discouraging or banning flights. A speedy reliable train service across Europe could take passengers 1,000 miles in seven hours to holiday in Spain.

This could reduce air emissions by at least a third. But this still leaves the longer flights. Design can have an effect here. Regulations can require that planes fly full, as charter flights do now. Businesses travellers can be discouraged, and teleconferencing encouraged.

Slower air speeds would also have a dramatic effect in cutting fuel use, and therefore emissions. Slower speeds would also increase the number of jobs, because planes would spend longer in the air.

All these methods could cut emissions by half again. That would be a total cut of two thirds in emissions from aviation. Over time, this would mean jobs losses in aviation. Let's say that over 20 years short-haul flights are replaced by rail travel. Over that time the aviation industry shrinks by about a third, but more jobs are created by flying at slower speeds. So in total about a quarter of jobs would be lost.

There are now about 100,000 workers in aviation in the UK. That would mean 25,000 jobs are lost in 20 years. That's 1,250 jobs lost a year. Roughly twice that many aviation workers now retire every year. And other people leave the industry for other reasons. But the process won't be smooth. Some routes, some airlines and some suppliers will close abruptly. Partly this can be covered by a government run register that requires former workers in the industry to be hired first for new jobs. Such registers have been used to protect the jobs of dock workers in many countries. But workers will also need the background guarantee of a climate job.

## Shipping

Ships are already the low emission way of moving freight. Air freight has 46 times the emissions per tonne, and even rail freight has six times the emissions of



shipping.<sup>20</sup> Ferries with half the crowding of sleeper carriages on railways would cut emissions drastically, and be as cheap as planes.

However, changes in design can make a difference to shipping emissions. And reductions in speed can make an enormous difference to fuel use. Most emissions currently come from container ships, which travel much faster than tankers. But cut the speed of a container ship in half, and fuel use and emissions are cut by three quarters. Cut the speed by three quarters, which is perfectly possible, and the emissions are one sixteenth of what they were. Moreover, if you cut the speed in half, you double the number of seafaring jobs.<sup>21</sup>

### Summary

With all these measures, and large amounts of renewable electricity, there will still be emissions from HGVs, planes and shipping. The changes in annual emissions will be:

	CO <sub>2</sub> Before	CO <sub>2</sub> After
Car, taxi & van passengers	70 Mt	0
Aviation	53 Mt	18
HGVs	23 Mt	6
Shipping	12 Mt	6
Delivery vans	10 Mt	0
Buses and trains	6 Mt	0
Other	4 Mt	0
<b>TOTAL</b>	<b>178 Mt</b>	<b>30 Mt<sup>22</sup></b>

That is a cut in emissions of 83%. The new jobs in the National Climate Service will be:

- 180,000 new jobs on buses
- 120,000 new jobs building and running railways
- 10,000 new jobs building cycle lanes

**TOTAL: 310,000 new transport jobs**

## **Main climate jobs in renewable power:**

The majority of jobs will be in factories and plants that make wind, wave and tidal turbines and solar PV cells and thermal heating

- Transport and assembly of turbines on site
- Maintenance of wind farms and marine turbines
- Transport and assembly of offshore wind, wave and tidal turbines
- Seafarers
- Shipbuilders
- Manufacture of long distance cables and pylons
- Building a new grid and storage
- Factories and mills supplying parts and materials
- Research and development in wave and tidal turbines
- Research and development in clean coal
- Manufacture of a new generation of low energy lights, appliances and machines
- Electricians, engineers and technicians
- Driving electric trucks
- Servicing and repair of all vehicles
- Electricians, engineers and technicians

### **Main Jobs in Buildings**

- Most jobs will be in building trades of all kinds
- Manufacture of building materials, insulation, new boilers, solar thermal and heat pumps
- Manufacture of low energy appliances
- Suppliers of materials and parts for all those manufactures
- Architects, engineers, and research and development
- Housing inspectors
- Building assessors

### **Plus**

- Research in low carbon industrial processes
- Advice teams for industry
- Research in low carbon agriculture
- Advice teams for farming
- Recycling and reuse jobs
- Burning off methane from landfill

**AND Training and education in all the skills necessary to do the above work**

### **Main Jobs in Transport**

- Bus drivers
- Shared taxi drivers
- Driving, stations, signals and track work in rail
- Building and electrifying rail line
- Manufacture of track, engines, rolling stock and electric buses
- Building cycle lanes
- Supply of parts and materials

# Jobs in Industry

So far we have been discussing cutting emissions from electricity, buildings and transport. These are the areas where it is easiest to agree on how to make cuts in emissions. But another 108 megatonnes of CO<sub>2</sub> emissions come from industry. Cuts in emissions here require complicated political choices. And industry is more immersed in the global economy, in ways we will explain.

Some cuts in emissions are straightforward. Thirty three megatonnes come from oil and gas rigs, refineries, and coal mining. Once the economy runs on renewable energy, almost all these emissions will disappear.

The rest of industry produces 65 megatonnes of CO<sub>2</sub> from burning oil, gas and coal to heat materials during the industrial process. The important industries here are Chemicals, Food and Beverages, and Mineral Products (like cement, lime, asphalt and aggregates). Smaller amounts of emissions come from Paper and Printing, Iron and Steel, and Vehicle Assembly.<sup>1</sup>

In these industries, some of the emissions from combustion can be reduced with improvements in design. This is not simple—each factory and each process is different. What is needed is a team of skilled engineers, designers, technicians and craftspeople that can come into a factory or plant, work out the changes needed, and advise the company on how to do them. This would require 25,000 professional and skilled engineers for twenty years.<sup>2</sup>

These teams can also redesign the layout of the machines, the pumps and the electricity lines to reduce the amount of renewable electricity needed.<sup>3</sup>

In addition, about 10 Mt of CO<sub>2</sub> come not from burning but from the industrial process itself. Almost half of these come from making cement. This is because cement is made by taking the carbon out of limestone, which releases CO<sub>2</sub>. Here some cuts can be made by using different materials for the cement, and by changes in design. Again, the factory teams can help.<sup>4</sup>

Yet there is still the question of who pays. That is pretty straightforward if the changes mean the company saves money quickly, as happens with most insulation. But what about changing industrial policies that require large investments, and would leave the company weaker in the face of competitors overseas?

After all, most industries export a lot of their product. Electricity, housing and transport are all mostly tied to one country. Government regulation can simply change what happens in one country, but industry makes things that go round the world. Of course regulations by any one government can make a difference. But the big changes are those that will come from concerted government actions, worldwide.

Changes in design, regulations and processes could probably cut total emissions from industry by about half. Renewable electricity could then replace three quarters of the remaining burning of fossil fuel. If we do all that, we can reduce industrial CO<sub>2</sub> emissions from 108 megatonnes to 31 megatonnes—a cut of 71%.



Hans Hillewaert/wikicommons

A wind farm in the North Sea in shallow water off the coast of Belgium

# **Jobs in Training and Education**

Some of the one million new workers will already have the skills needed. But many will not. Some of them will need block training for six months or a year, some will need day release, and some will need both. In the first three years the demand will be greatest as a million people start work. But we will still need trainers and support staff in subsequent years. People will leave the Climate Service, and new workers will come in. The skills needed will also change. At the start, for instance, we will need a lot of construction workers to convert houses. After ten years, we will need more people maintaining wind turbines and solar power.

Some of this training and retraining will be on the job—as with bus drivers and wind turbine blade technicians now. But we estimate that we will need 25,000 trainers and support staff for the first three years. After that, 10,000 trainers could be enough. Some of the trainers could become leading crafts people or supervisors.

However, many of the trainers would go on to research work, often after more education. We will need research in low carbon architecture, engineering, renewable energy, new processes for industry, in waste disposal, agriculture, and many more areas. These are new fields, and there is much to be learned. So we would expect at least another 15,000 researchers and support staff, often attached to universities.

## **Changing Education**

The economic transformation proposed in this booklet will require a major shake-up of the education sector. There is a huge 'skills gap' between where we are now and the requirements of a low carbon economy. Successive governments have adopted a market driven approach, which has failed to deliver the training and skills required. And employers are not investing in training at anywhere near the scale required.

The only way that the supply and demand of skills can be effectively matched up is through a curriculum shift in schools that prepares people for climate jobs. The government has signed up to international policy commitments designed to promote quality education and sustainable development.<sup>1</sup> But these documents are exhortations. No one is required to do anything.

The devolved governments of Scotland and Wales have done better, but not enough. In England policy is going into reverse. A number of measures have weakened the education sector, including the abolition of the Sustainable Development Commission; the removal of sustainability from the Ofsted

Common Inspection Framework; and the removal of sustainability from the funding letter to the Higher Education Funding Council. Moreover, sharp reductions in funding are starting to have devastating consequences, especially for further and adult community education.

We need to change the education of people across many fields. Of course we will need large numbers of building workers and energy workers. But financial consultants, asset managers, and accountants, for example, all require an understanding of how their decisions impact on the climate and environment.

There has been a significant decline in part-time adult students. How can we hope to forge a new type of economy when the existing labour force is not updating their skills? This will be exacerbated if student loans are introduced into the FE sector.

Apprenticeships need to be aligned to the growth areas in the economy that will deliver the transition. But in the last few years the system has suffered reputational damage with so-called apprenticeships lasting for a matter of weeks with little skills development.

Tuition fees are an obstacle to the education and training changes we need. Students need to be in an academic relationship with their teachers not a commercial one. The National Union of Students and the Higher Education Academy have consistently shown in surveys that 60% of students agree with the statement: 'Sustainable development is something which I would like to learn more about'. Economics students at Manchester and other universities have rejected the syllabus of their economics course, and called for content more relevant to today's realities.

Moreover, the proliferation of casualised staff and the use of short-term, part-time and zero-hours contracts in education demoralise the workforce. They also diminish the student experience by limiting contact time between staff and students.

We need to close the gap between the UK's investment in research and innovation and that of its major international competitors. A long-term plan to increase public investment in research will help to sustain the UK position as a premier global research power. Financial support for postgraduate study is needed to develop higher level skills in the workforce.

A strategy to boost the role of the sector in driving regional growth will set targets for matching training provision to local employment opportunities. The current Learning Enterprise Partnerships are too divorced from the education sector. Equally education providers are not promoting the kind of engagement around employability needed. Community initiatives are one way of trying to match jobs to local needs but they need to be driven by a national policy that provides the

funding and infrastructure to deliver at scale. If we needed an example how not to do it we only need to look at the failure of the Green Deal. Some FE colleges invested considerable time and money into expanding their facilities and courses to meet a demand that never materialised. The Government's flawed policies left them exposed because a strategy built on individual consumer demand failed.

In short, we need 10,000 permanent jobs in training and 15,000 permanent jobs in research. But we also need to reorient the whole education system so it delivers the skills, and understanding, we will need.



anyjaz65/wikicommons

A training and research facility in New Mexico, US. We will need 10,000 permanent jobs in training and 15,000 permanent jobs in research.



Nancy Lindisfarne



# Agriculture and Waste

Carbon dioxide (CO<sub>2</sub>) emissions from the UK are 530 Mt each year. But there are the equivalent of another 100 megatonnes (Mt) in other greenhouse gases: methane, nitrous oxide and “F-gases”. Most of the methane and nitrous oxide comes from agriculture and waste.<sup>1</sup>

## Agriculture<sup>2</sup>

32 Mt come from nitrous oxide emissions when nitrogen in fertilisers mixes with air. Most farming today prioritises fertilisers over almost all other concerns. Intensive monoculture increasingly relies on large amounts of nitrogen fertiliser to produce high yields with less labour and more pesticides. One solution is to reduce the amounts of fertiliser by changing farming methods.

Almost all the 20 Mt of methane in farming comes from the digestive systems of cattle and sheep. Because they chew the cud, they take a long time digesting their food, and so create a lot of methane. Pigs, chicken and other birds produce very little methane. But the use of land to grow crops to feed chickens and pigs requires more fertilisers and more land – and therefore more emissions.

There is now a great deal of debate about diet and climate emissions. We are keen to engage with that debate. It will involve reducing meat consumption, while keeping a healthy diet rich in proteins, fruits and vegetables. We are not in favour of bans or forcing people, so are not saying people have to give up meat. Yet the discussions around emissions and diet must address the need to end hunger and lives shortened by poor diet.

## Waste<sup>3</sup>

22 Mt of methane emissions come from organic material in waste – mostly food. The organic material decays in the landfill without oxygen and produces methane. This methane then seeps out of the landfill into the air. Many landfills are already fitted with pipes to collect the methane and burn it. This needs to be extended to all landfills.

To save energy and reduce emissions in the long term we also have to reduce the amount of waste of all kinds. This means less packaging and throwing less away in production and at home. Nevertheless, there will be some waste. But the vast majority of materials can be recycled or reused. That will mean many jobs in reuse and recycling. Some of these we have included in our estimate of one million climate jobs. But many more jobs could be created beyond those

we have identified here. And reuse and recycling has many other environmental benefits beyond energy saving. Recycling jobs, like many agricultural jobs, will also be local.

Cutting food waste is also important. One estimate is that about a third of food production ends up as waste. This extra food creates emissions in landfills or incinerators. The UK Waste and Resources Action Programme research suggests that 60% of this waste can be avoided.

### **F-gases, Leaks and Trees<sup>4</sup>**

In some sectors, emissions can be cut to almost nothing. 10 Mt come from “F-gases”, fluorinated gases that are used mainly in industrial refrigeration and in air conditioning. There are alternatives, so we can simply ban F-gases. And 9 Mt come from methane leaks in coal, gas and oil production. As we move away from fossil fuels, these will fall almost to zero.

Finally, trees take carbon dioxide out of the air, and forests fix carbon in the soil. So while farming leads to emissions of carbon, jobs in planting forests will take carbon out of the air. Some people argue that with careful land use and replanting agriculture can eventually take more carbon out of the atmosphere than it puts in.

### **Summary<sup>5</sup>**

We suggest at least 45,000 jobs in waste, recycling, reuse, farming, and forestry. We estimate that can help reduce emissions 100 Mt to 33 Mt in 20 years – a cut of 67%.

Some of the arguments in this chapter are contentious. All are complex. They deserve more in depth treatment than we have space for here. So we have included much more material in the *Online Technical Companion*.

# Total Jobs and Emissions Cuts

The total number of jobs will be:<sup>1</sup>

Electricity	400,000
Transport	310,000
Buildings	185,000
Industry	25,000
Education	35,000
Agriculture, Waste and Forestry	45,000
<b>TOTAL</b>	<b>1,000,000 jobs</b>

The total amount of cuts in CO<sub>2</sub> emissions will be:

	CO <sub>2</sub> before	CO <sub>2</sub> after	Cut
Electricity	145 Mt	7 Mt	95%
Transport	178 Mt	30 Mt	83%
Buildings	97 Mt	5 Mt	95%
Industry	108 Mt	31 Mt	71%
<b>TOTAL</b>	<b>528 Mt</b>	<b>73 Mt</b>	<b>86%</b>

There are another 100 Mt of CO<sub>2</sub> equivalent from other greenhouse gases. We estimate we can cut these to the equivalent of 32 Mt. That gives us total cuts, measured in CO<sub>2</sub> equivalents, of:

CO <sub>2</sub>	528 Mt	73 Mt
Other gases	100 Mt	33 Mt
<b>TOTAL</b>	<b>628 Mt</b>	<b>106 Mt</b>

That's a total cut of 83% in all greenhouse gas emissions over 20 years.

Charles Hutchins/flickr.com



The Climate Camp at the 2013 protests against the G20 summit in London



Camp Frack, Lancashire, 2014

# What You Can Do

If you are persuaded by the ideas in this booklet, what can you do? The first thing is get the booklet into the hands of as many people as possible. You can download it from the website. You can order copies and sell it. You can get your organisation to order several copies. You can push it out on Facebook and Twitter.

This booklet was produced by the Trade Union Group of the Campaign against Climate Change. You can get involved in our group, or in the parent Campaign, which brings together large numbers of people in national and global climate demonstrations. You can help the group with a donation, or a standing order. Or you can just get active with us.

In this chapter we also mention many other things you can do. Please don't be bowled over and think all this is far too much. It is just that each person is different, and we want you to select one or two of the many things we suggest and do them. Gil Scott-Heron says it well:

*'Nobody can do everything,  
But everybody can do something.'*

## Joining Environmental Groups

A million new climate jobs will not be an easy thing to win. We will have to convince people and organisations right across society. So one important thing you can do is to join an organisation and work with them in their cause—and mention climate jobs.

There are a wide variety of environmental groups you can get involved in, from the obvious ones like Greenpeace and Friends of the Earth to many smaller campaigns and local groups. As we go to press, there are at least 130 local anti-fracking groups around the country. And, for example, Fuel Poverty Action brings together environmental activists, pensioners groups, and low income people who sit in the cold.

You might also consider getting together with two or three other people to form your own campaign group. It isn't as difficult as it sounds. Detailed guidance on forming local groups and networks can be found on the Campaign against Climate Change website with lots of practical advice.

## Campaigning against Austerity

You can also join any of the campaigns against austerity. On the national level there is the Peoples Assembly, Keep Our NHS Public, Unite the Resistance, and

the National Shop Stewards Network. There are anti-cuts groups in many towns, and groups keep forming to stop local cuts in the NHS, libraries, youth services, and all the rest of the welfare state.

These campaigns are all connected to climate and jobs in two ways. First, we cannot have the sort of government spending we need on climate jobs as long as the politics of austerity dominates. Second, the fight against austerity has to be based on putting forward an alternative. Simply saying 'No' is not enough, and any serious alternative has to include decisive action on climate change.

### **Informing Yourself**

Climate change issues are complicated. How do you learn about it? How do you understand the science? How do you counter the arguments of climate deniers?

There are various websites you can go to—we include a list in the *Online Companion*. Trade unions are developing their own environmental courses. And the Campaign against Climate Change Trade Union Group can send you an education resource pack.

You can also set up a small discussion group in your workplace, or community. This can be informal—one or two people who want to get other people discussing climate. You can watch videos together, or discuss articles. You can ask the local Friends of the Earth group, your union, or our campaign to send you a speaker.

The point of a discussion group is not to mobilise people for action. It is to help each other understand. So you don't need a lot of people. And don't be intimidated by all the complications. Science is too important to be left to the scientists.

### **Green Issues at Work**

If you are in a union, you can take up green issues in the workplace in a very practical sense. You can start by looking at simple things like recycling, water use and energy efficiency.

Unions are developing the idea of an energy audit of the workplace, on the model of health and safety audits. PCS, the civil service union, has a checklist for audits, and there is useful material in the TUC's *Greening the Workplace* report. But in order to make that happen you have to engage the employer, and argue that they should give employees time off to do the new audits. This is part of electing union 'green reps', like health and safety reps.

It helps to remember that we have the law on our side. The Climate Act, whatever its weaknesses, means that the government has created a legal framework to reduce CO<sub>2</sub> emissions to meet various targets.

### **How Does All This Activism Link Up?**

At this point you may be feeling that we are proposing an enormous variety of worthy things you could be doing, but how does all this relate to climate jobs? Is it just an activist's shopping list?

No. Climate jobs are not an easy ask. Energy flows through every part of our economy and society. Great corporate and financial interests are involved. Paying for a million jobs would in effect mean an end to austerity politics – not just because of the expense, but also because of the principles involved. There is a great deal at stake here, on all sides.

This means it will take a large and determined public movement to achieve what we want. That movement will have to unite many kinds of people and organisations, and will have to be prepared to take many kinds of action. What we are asking you to do is to build the networks which that movement will rely upon.

As part of this, if you are not a member of a trade union, please do join one. Unions were created at the dawn of the industrial revolution to deal with inequalities of power, between bosses and workers. Working people combined because they knew their only strength was to act together. Like many human institutions unions can be good, and bad, or a mixture. But they should not be judged by the worst examples. There are still 6.5 million union members in the UK. Those people are part of the biggest voluntary organisation in the country, and the most resilient and durable.

In times of prosperity, unions can ensure that workers get at least some share of the profits. In times of austerity, unions are often the first and last refuge for working men and women. And even if you work in a non-union area, you can get advice on how to deal with the problems and know your rights..

But effective trade unions are always more than an insurance policy. Unions have historically been agents of social change. They fought not just for health and safety at work, but for public health. The National Union of Mineworkers fought for cottage hospitals, and all the unions fought for the NHS and the welfare state. Unions have campaigned and marched against the Iraq and Afghan wars.

Now we face climate change. Unions increasingly recognise climate as a trade union issue. The wide union support for this booklet is one of many examples. But far more needs doing. Being in a union also gives you the opportunity to raise issues like the environment in your workplace meetings, branch meetings and other forums.

If you are not sure which union to join, the TUC website has a useful list at [www.worksmart.org.uk/unionfinder/](http://www.worksmart.org.uk/unionfinder/). If you cannot find an appropriate union,

or work in isolation, the UNITE union has community branches in every town which welcome members who want to begin to make the world union.

### **Time to Act**

You can also be active around some of the themes in this booklet. You can familiarise yourself with the arguments about Tax Justice. You can support PCS union members—tax and customs inspectors—taking action to protect their jobs. Or you can get involved in UK Uncut's direct actions to shame the big tax dodging companies on the high street.

You can support the rail union campaigns to take the railways back into public ownership, and protests against the closures of local bus lines and the privatisation of other services. There is huge scope for decisive action in saving energy. You can lobby your local council about this. And you can make contact with town hall unions and construction unions. There are all the anti-fracking camps and protests. There are many direct action and grassroots groups you can join.

As we go to press, the Campaign against Climate Change is organising, with many other groups, a national demonstration on 7 March 2015, just before the parliamentary election. There will also be global action of some sort at the time of the UN Climate Talks in Paris in December of that year. And there will be more protests after that.

The future is not assured, but the potential for putting a million people to work to save the planet is undeniable. We hope the ideas and proposals set out in this booklet will contribute to the growing discussion and debate about an alternative to political inaction—one which recognises that social and climate justice are a common struggle in which we can all play a part.



# Scotland

This report went to press just before the Scottish referendum. The situations in Scotland and the rest of the UK are already very different. Scotland is blessed with 25% of the total wind energy resources in the EU, and 10% of the wave power resources. Scotland has proportionally much larger reserves of shallow water for offshore wind farms. And almost all development of tidal and wave power in the UK has been concentrated in Orkney.

Moreover, the Scottish government has been much more supportive of renewable energy than the UK government. As a result, Scotland now supplies 39% of its electricity from renewable energy. The most recent government target hopes to supply 100% by 2020.<sup>1</sup>

So if the vote for independence is yes, and we see an independent Scotland, there will be two campaigns for climate jobs: one in England, Wales and Northern Ireland, and one in Scotland. The campaign in Scotland will be starting from a higher level.

But we will still need up to a million jobs in the rest of the UK. A split would not make much difference to housing and transport. And there are large shallow areas in the Irish Sea, Dogger Bank, the North Sea off Northern Ireland, off Cornwall, and off the Channel Islands, which could be used to place wind turbines. But we will also need floating wind turbine platforms that can work in somewhat deeper water.

In Scotland an independent government could take advantage of the rich wind and marine resources to produce enough renewable electricity to export to the rest of Europe in large quantities—and to revive Scottish industry, seafaring and shipbuilding.

In the event of a No victory, we will still have the opportunity to campaign for climate jobs across Britain. But in Scotland we will also be able to build on the political atmosphere generated during the independence referendum to demand that the Scottish government builds on its existing commitments to renewables, by creating further climate jobs and pressing Westminster to do the same.

## **Floods – the sharp end of climate change**

Dave Green, Fire Brigades Union national officer

Flooding is the greatest threat from climate change to the UK and floods will hurt millions of workers across the globe. Firefighters have increasingly tackled major flooding in recent years, doing everything from shoring up flood defences and flood recover to emergency evacuation and rescue. Politicians have praised this magnificent response, and communities are understandably appreciative. But the legal framework and resourcing of this work leaves a great deal to be desired—and requires central political answers.

Perversely, the law in England and Wales does not legally mandate the fire and rescue service to respond to major floods. Scotland has had the duty since 2005; Northern Ireland introduced it in 2012. The FBU wants the law changed to make flood response one of the core functions of the fire and rescue service.

The government's austerity measures have hit flood preparations. A new adaptation report by the Committee on Climate Change says current underinvestment in flood prevention increases the potential for avoidable flood damage, with three-quarters of existing flood defences not being sufficiently maintained. It found that statutory local flood risk management strategies are only just being produced in many areas and "there is little evidence that local oversight and scrutiny committees are holding public bodies and their partners to account for the actions being taken".<sup>1</sup>

There are fewer firefighters available and on duty than in previous years. In England, whole time, retained and control firefighters were reduced by more than 5,000 between 2008 and 2014—a cut of over 10%. There were also fewer firefighter jobs in both Scotland and Wales (with Northern Ireland increasing slightly). Therefore, for the UK as a whole, there are at least 6,000 fewer firefighters than in 2005.<sup>2</sup>

A declining number of firefighters are being asked to do more in flood rescue now, and will be required to do far more in future. Climate adaptation is an immediate industrial issue for the fire and rescue service: firefighters already respond to floods and storms, to wildfires and drought. The UK Climate Change Risk Assessment (CCRA) projects an increase in flood risk going forward.<sup>3</sup> Climate change may result in more flooding, due to higher river flows and rising sea levels. Changes in rainfall patterns may also increase the risk of surface water flooding.

Defra estimated that around 900,000 people are exposed to significant likelihood of flooding at present. This is expected to increase to between 1.3 million

and 3.6 million people by the 2050s. In the UK today, around 6 million homes and workplaces (one in six of all properties) are exposed to some degree of flood risk. Over half a million exposed to significant likelihood of river and tidal flooding in England and Wales alone. The increase in deaths and injuries each year could be prevented if the right policies are implemented to reduce emissions, adapt flood defences, make infrastructure resilient and plan for emergencies.

### **Recent flooding**

Heavy rain and storms between December 2013 and February 2014 caused enormous upheaval across the UK, with over 7,800 homes and nearly 3,000 commercial properties flooded.<sup>4</sup> England and Wales endured the wettest winter since records began. A tidal surge and coastal flooding in early December was followed by widespread flooding on Christmas Eve. Further heavy rain at the beginning of 2014 led to extensive flooding, particularly in the south of England.

At the height of the flooding in February 2014, some 28 individual fire and rescue services were supplying personnel and assets, particularly to Somerset and the Thames Valley, and all 51 high volume pumps were deployed.<sup>5</sup> Firefighters helped build flood defences, evacuate people in need, distributed leaflets door-to-door and advised people in distress from control rooms. Firefighters visited every home in the Somerset levels by boat to identify anyone who was vulnerable. As well as pumping out high streets and homes, rescuing victims from their houses and vehicles, firefighters also checked premises as the waters receded and helped with the clear-up.

The fire and rescue service attended a large number of flood incidents, according to figures obtained by the FBU. Across the UK over the entire three months nearly seven thousand incidents were recorded. The vast majority attended were in England. Firefighters rescued almost two thousand people across the UK during those three months. Most of those were in Surrey, Kent and Devon & Somerset. These figures almost certainly underestimate the response—many fire and rescue services count a whole high street underwater and a basement flood in one house as one flood.<sup>6</sup>

The year 2012 was a record year for rain and for flooding: 2012 was the second wettest on record in the UK, according to the Met Office. It was the wettest year on record for England and the third wettest for Wales. Flooding from a range of sources (rivers, surface water and groundwater) affected both urban and rural areas. Around 8,000 properties were flooded, with some of the worst affected areas in the north east and the south west of England.<sup>7</sup>

Firefighters turned out to nearly twice as many flood incidents in 2012 as in 2011. Northern Ireland firefighters went to three times more flood incidents in 2012 than they did in 2011, and in Wales the response more than doubled.<sup>8</sup>

There have also been a number of significant flood events since the turn of the century—flooding in Cornwall in 2010 and 2004, Cumbria in 2005 and 2009, and Northumberland in 2008. The autumn of 2000 was then the wettest since records began and saw widespread flooding—with scientists subsequently linking these floods to climate change.<sup>9</sup> The year 2007 saw the wettest summer since records began, with extreme levels of rainfall compressed into relatively short periods of time caused 55,000 properties to be flooded. The Pitt Review found that around 7,000 people were rescued from the flood waters by the emergency services.<sup>10</sup>

### **Lessons\_**

After the 2007 floods, the FBU assessed the resilience of the fire and rescue service to tackle floods. The union published *Lessons of the 2007 floods*, and later *Climate Change: Key issues for the Fire and Rescue Service*, based on the latest science at the time. Firefighters faced problems tackling floods:

- There is insufficient funding for the fire and rescue service in order to tackle ongoing and increasing flooding incidents
- There are insufficient operational firefighters and control room staff during many flood incidents
- Flooding is not properly incorporated into all individual fire and rescue service planning (IRMPs)
- Not all firefighters have been trained to work safely in flood water
- Not all firefighters have the right personal protective equipment to work safely in flood water.
- While there has been some investment in boats and high volume pumps, fire and rescue services do not have sufficient equipment to tackle floods
- Some firefighters' have been made very ill after work in flood water.
- Firefighters' welfare during incidents, which may involve many days a long way from their home or normal fire station, has not been adequately managed.
- Fire and rescue service guidance on flooding has not been developed and agreed with the FBU.

But flooding needs to become an issue for every trade unionist. The TUC has published a useful adaptation report, *Changing Work in a Changing Climate*, and union officials in TUSDAC have repeatedly raised the issue of flooding with

## Case Study One

ministers. Every workplace needs an extreme weather plan, negotiated with union reps, so workers know what to do in the event of problems like flooding. Indoor workplaces need adapting to higher temperatures from climate change—this is a health and safety matter as well as a climate one. Workers should not pay the price if they can't get to work, or production suffers during extreme weather.

The FBU is committed to making climate change policy a central political demand. We do not have all the answers but we know we are part of the solution.



Adam Di Chiara

Over 100 sheep, and several red deer drowned in this glen alone, as the remnants of hurricane Bertha passed across the UK in August 2014

## **Fracking and Jobs in Salford and the Fylde**

Fracking is a new technique for drilling for natural gas invented in the United States. The full name is ‘hydraulic fracturing’, and it allows access to large reserves of gas trapped in many small pockets in shale rock. The drillers go down a long way to reach the shale—usually a mile or more. Then the drill turns sideways—a key innovation—for distances of a mile, two miles or more.

There are many small nozzles in the drilling pipe. A mixture of water and powerful chemicals is forced through the nozzles at great pressure. This mixture fractures the shale and releases the trapped gas.

There have been movements against fracking in many parts of the world. One reason is that it’s poisonous. The chemicals used are toxic, and they enter the water table. Drilling brings tonnes of polluted water to the surface, which is then disposed of in unsafe ways. Methane (natural gas) also escapes into the water table and bubbles up into people’s taps.<sup>1</sup>

The other reason is that the gas companies already have enormous reserves of gas and oil. To avoid catastrophic climate change, we have to leave about 80% of those known reserves in the ground. Fracked gas is extra—on top of these known reserves. The same is true of tar sands oil from Canada, or coal mine methane and other new forms of ‘extreme energy’. Fracking, and all these other cases, are a clear declaration by the gas and oil companies that they plan to use the known reserves plus the new forms of oil and gas—that they plan to go beyond five times the danger level.<sup>2</sup>

Two of the three earliest test drillings in the UK were in Salford, near Manchester, and on the Fylde Coast around Blackpool. In both places there was great local opposition. Local unions were deeply involved in the protests.

The gas companies, and the government, kept saying that unions and local people should support the drilling because it would bring jobs. This case study looks at how many jobs fracking would bring. Then we contrast that to the number, and range of climate jobs we could have.

### **Fracking Jobs and Climate Jobs**

There is much disagreement over the number of jobs in fracking. The *Online Companion* to this booklet has a detailed discussion of the reason for our estimates.<sup>3</sup> To summarise, we can make an estimate of the number of fracking jobs by looking at America. In 2012 in America there were about 625,000 workers in fracking, support activities, truck driving, preparing sites, manufacturing

equipment, and building pipelines. Most of these were not at the site of the drilling, but in various support and supply work. Those 625,000 workers drilled about 22,000 fracking wells that year.

The UK is a much smaller country than the US. Let's assume our fracking industry is about 5% of the American one. That would mean roughly 1,000 new wells a year, and 25,000 fracking jobs nationally. If we follow the American pattern, the peak drilling will only last a few years. After that, there will not be many jobs in keeping the gas flowing. So fracking would provide an average of roughly 12,500 jobs a year over 20 years. We are campaigning for 80 times as many jobs—one million a year.

Let's also assume that the Fylde and Salford are blessed with gas, and between them will have five times as many wells as the national average per person. The Fylde will have more of these wells, because it covers more territory. That would mean 30 new wells a year in the Fylde, and 840 jobs a year in the early years. Over 20 years there would be an average of 420 jobs a year. Salford would have 15 new wells and an average of 210 jobs each year over 20 years.

Now let's look at the sort of climate jobs we could expect in our two case studies. <sup>4</sup> The Fylde coast includes three councils (Blackpool, Fylde and Wyre) and 325,000 people. About 10,500 are unemployed. Blackpool is the only city, and tourism is the leading industry. Fleetwood, on the coast, was once an important deep sea fishing port and is now economically depressed.

Salford is an old industrial city near Manchester, with 240,000 people and 14,000 unemployed.

Of the million climate jobs, about 4,500 would be on the Fylde and another 4,500 in Salford. This seems reasonably fair—the Fylde has a third more people, but Salford has a third more out of work.

Here are the average number of jobs each year over a twenty year period:

	Climate Jobs	Fracking jobs
Fylde	4,500	420
Salford	4,500	210

### Climate Jobs on the Fylde <sup>5</sup>

What would the climate jobs be like in both places? In Salford only one dwelling in eleven is a council house, and one in thirty on the Fylde. But in any case we have to convert all the housing, public buildings and businesses.

Work would go more quickly in Salford because the buildings are denser, and there are more terraces and blocks of flats. And there are more dwelling units on

the Fylde. So there would be about 1,000 building jobs each year on the Fylde, and 750 in Salford.

In renewable energy, the Fylde is well placed for work in offshore wind. At the moment one of the major areas for development of wind power is the Celtic Array in the Irish Sea. It starts 40 miles from the coast of Cumbria, so the Fylde is convenient, and coastal.

The Crown Estate (which leases out offshore wind sites) says there should be at least 4.2 GW of wind from the Celtic Array. That would mean 10,800 jobs over seven years to build and install the wind farms. It makes sense to do these wind farms very early in the program, because the Celtic Array is an area of shallow water close to shore. These 10,800 jobs would be mainly in manufacturing wind and turbine towers, blades and nacelles, and assembling the parts at sea and installing them.

After those first seven years, there would be 2,800 permanent jobs maintaining the Celtic Array. In addition, the next obvious step for wind turbine manufacturing sites in the region would be more wind farms in the Irish Sea, and supplying floating wind turbines for use in deeper waters.

In short, there would be far more work in building and maintaining wind farms in the Irish Sea that we have planned for jobs in the Fylde. The old fishing port of Fleetwood would be the obvious place for installation and maintenance workers to have their depots and supplies. They would go back and forth to the wind farms on boats bases in the port.

For public transport, the Fylde is really two regions. Blackpool is flat, urban and smaller than Salford, and would lend itself to buses, trams and a lot of bicycles. The rest of the coast is much more rural, and would have more electric cars, shared taxis and minibuses.

There would also be training in the Fylde, much of it done with local FE colleges. Immediately, the key people needed would be electricians. It takes three years to train an electrician, and we would need large numbers to convert buildings at first, and then in the long term for maintaining renewable energy and electrical transport. This would require about 100 trainers.

### **Climate Jobs in Salford<sup>6</sup>**

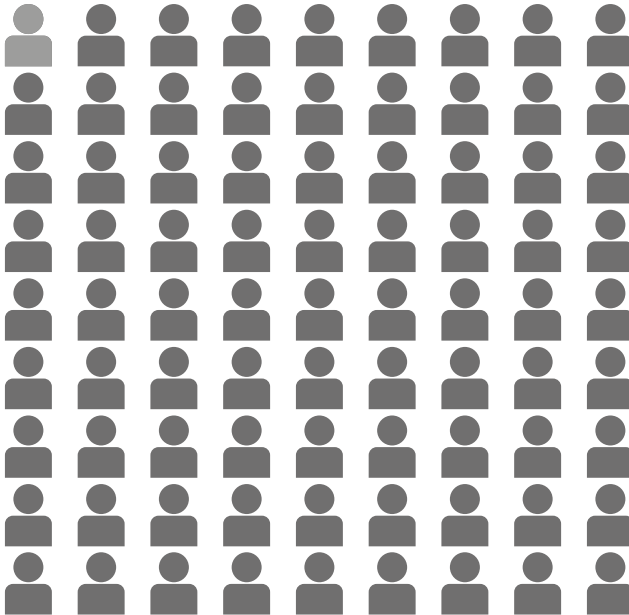
Salford is not on the coast, and so not ideal for making wind turbine blades or platforms. But it is a long established industrial area, with many unused industrial sites. Many different kinds of manufacturing would be possible—for example, factories producing solar cell arrays, rooftop thermal water heating pipes, and components for the nacelles of wind turbines. This would provide 2,000 jobs for factory workers.



Salford would be well placed for long-term jobs in transport. This is partly because it is a dense urban area where almost all journeys could be by public transport. The transport system in Salford is already part of Greater Manchester Transport. Public transport here would mean a substantial increase in buses and cycling, but also a very large increase in the new, and successful Metrolink tram system. Salford is also central enough to be a hub for rail freight distribution onto vans and small trucks. In all, there would be about 1,250 transport jobs.

### Fracking jobs vs Climate jobs

Nationally: 80 times as many Climate jobs



Salford and the Fylde: 14 times as many Climate jobs



Salford would also be a good place for 500 training and research jobs, because the University of Salford already does in research in Buildings, Architecture, Science and Engineering. One research team could work closely with the workers insulating and converting buildings. Another could work with the new local factories producing solar cells and nacelle components, and with the teams installing the solar arrays. Another team could go from to factories and other workplaces offering detailed advice on how to change the workplace so energy is used more efficiently.

### Summary

A million climate jobs would provide:

	Fylde	Salford
Renewable energy	2,400 jobs	2,000 jobs
Transport	1,000	1,250
Converting buildings	1,000	750
Advising Industry	0	200
Training and Research	100	300
<b>TOTAL</b>	<b>4,500 jobs</b>	<b>4,500 jobs</b>

Those jobs will last twenty years and more. Compare that with an average of 420 jobs fracking jobs on the Fylde and 210 in Salford. And remember that fracking jobs poison land and people. Climate jobs save lives.<sup>7</sup>

This is a report by the  
Campaign against Climate Change  
Trade Union group in conjunction with the  
Bakers, Food and Allied Workers Union (BFAWU)  
Communication Workers Union (CWU)  
Fire Brigades Union (FBU)  
National Union of Students (NUS)  
Public and Commercial Services Union (PCS)  
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# ONE MILLION CLIMATE JOBS

Tackling the Environmental and Economic Crises

To halt climate change we need drastic cuts in the amount of carbon dioxide and other greenhouse gases we put into the air. That means leaving most of the existing reserves of high carbon fuels in the ground.

We need workers to insulate and retrofit homes and buildings to conserve energy. We need workers to build enough renewable power to meet all our energy needs. And we need workers to maintain the new systems the future of humanity depends on.

This booklet calculates and explains how we can allow for a just energy transition for workers, society and the planet.

This is the third edition of the 'One Million Climate Jobs' report, written with the support of trade unions and environmental groups. It has been completely revised, expanded and updated.



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