

# WHAT WE NEED TO DO NOW

FOR A ZERO CARBON SOCIETY

**The Wainwright Prize 2020**

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Chris Goodall

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PROFILE BOOKS

**The Wainwright Prize 2020**

*'The world is waking up.  
And change is coming,  
whether you like it or not'*

Greta Thunberg at the United Nations

23 September 2019

**The Wainwright Prize 2020**

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## NOTES & SOURCES

For sources of data throughout this book, most of them online, see the ‘What we need to do now’ section on my **Carbon Commentary** website ([www.carboncommentary.com](http://www.carboncommentary.com)). The website includes further analysis and updates on topics featured in the book, and you can also subscribe to a free regular newsletter.

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## INTRODUCTION

# A NEW DEAL FOR CLIMATE

We need to create a zero carbon  
world by 2050 – or earlier

It feels like a turning point. In the past year, tens of national governments have stated that they will cease emitting greenhouse gases by 2050. The UK did so in May 2019, declaring a ‘climate emergency’. Scotland made a commitment to cut emissions to zero by 2045, planning to get three quarters of the way there by 2030. Among our European neighbours, France and Spain have also legislated for zero greenhouse gases by 2050. Norway, the most ambitious, is aiming for 2030, although it will still extract oil for sale overseas, making its commitment very much less impressive.

Many cities, regions and states have set even more challenging targets. Similarly, a rapidly rising number of major

companies have pledged to getting to ‘net zero’, often by 2030 or even earlier. (‘Net zero’ means that any remaining greenhouse gases are at least counterbalanced by extraction of CO<sub>2</sub> from the atmosphere by trees and/or technology.)

Even twelve months ago, these statements of intent seemed very unlikely to be made. But intense public concern about the environment – combined with a growing sense that advanced economies really do have the capacity to make the transition away from fossil fuels – has increased the willingness of companies, cities and countries to make promises on climate change.

In almost all cases, that is exactly what these statements are – promises. They have rarely been accompanied by even the most general plans for how the move away from greenhouse gases will be achieved. The UK government can make a case for being better than most, as in May 2019 its principal advisers, the Committee on Climate Change, issued a report on how it saw the path to zero emissions. But it is an inadequate blueprint, all too heavy on statements of desirability rather than actual plans.

## **WHY THE UK NEEDS TO ACHIEVE ZERO EMISSIONS**

Each tonne of carbon dioxide emitted to the atmosphere adds to the climate problem. The CO<sub>2</sub> will typically remain in the air for hundreds of years, unless it is removed from the atmosphere. Fossil fuel use today will therefore still be causing problems in the lifetimes of our great grandchildren. It is the stock of greenhouse gases in

the atmosphere that determines how hot it will get, not how much is emitted in any single year.

Climate researchers often talk of a global ‘carbon budget’, which is the total amount of CO<sub>2</sub> and other greenhouse gases the world can emit and still remain below global heating of 1.5 or 2 degrees Celsius\*. (So far, the we have seen an average temperature increase of about 1 degree over pre-industrial levels). There’s considerable debate over these figures but in January 2018 the Intergovernmental Panel on Climate Change (IPCC) said the world should emit not more than 420 gigatonnes of carbon dioxide to have a 67 per cent chance of avoiding a rise of 1.5 degrees. Today that figure is down to less than 350 gigatonnes and global emissions are running at around 40 gigatonnes each year. This means we probably need to achieve zero global emissions by 2030–35 to keep total heating below 1.5 degrees, and 2040–50 for a 2 degree target.

Scientists also tell us that, if we do increase temperatures by more than 2 degrees, we face a much increased risk of unleashing further heating. ‘Feedbacks’ such as melting ice reducing the reflectivity of the world’s surface, thus retaining more heat, become more likely as global heating progresses.

Reducing emissions to zero within thirty years should be the world’s most important objective. Even a 2 degree temperature rise will have very substantial effects around the world, including intense rainfall and flooding, rising sea levels and periods of searing drought.

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\* All temperatures in this book are given in degrees Celsius (C).

## HOW THE UK PLAYS ITS PART

The purpose of this book is to give an outline of the strategy the UK needs to adopt to address the climate threat – *what we need to do now*. It is a plan that will be similar to that of most other European countries, though each has different challenges and advantages. The UK, for example, has old and poor housing stock, but viable solar power and massive potential for onshore and offshore wind. We also have less than the European average forest cover, and can do much good by a radical reorganisation of our farmland.

We should pursue this strategy, or better alternatives, both because our country should play its part in addressing the global climate threat and because an effective zero carbon strategy will provide multiple benefits to our fellow citizens, both economic and social. Some would argue that the UK has a particular responsibility for leading the way in reducing emissions. We began the Industrial Revolution and our historic wealth is based on fossil fuels. But this is no time for historical debate. We need to act now, in concert with Europe and the world. We can and should become leaders in zero emissions systems and technology.

The UK has made decent progress in recent decades, cutting domestic emissions by 43 per cent since 1990, although a rising volume of imports with high carbon footprints are not included in this figure, nor international aviation and shipping. If all these factors are included, the figures may be closer to 10 per cent (as Greta Thunberg told the UK's MPs in 2019). And it has to be said that most of these reductions have been achieved in relatively easy areas, for example, from the decommissioning of

coal-fired power stations. In recent years, progress has slowed, just when it needs to be ramped up to lightning speed. Most independent sources see the UK missing its existing official targets from 2023 onwards.

Meeting the short-term aims, and then cutting our emissions to zero within a few further decades, is a hugely challenging task, requiring action across every part of our economy and society. The incremental, cautious and incomplete programmes the UK government and its advisers are proposing are unlikely to be sufficiently radical. We need a New Deal for Climate. And, as I hope to show in this book, this should be a New Deal with real benefits for those who need it most – giving new purpose to the old industrial towns, renovating our housing stock with effective insulation, getting polluting traffic off the roads to create clean air environments. The big gain is to address climate change. But, in parallel, a Green New Deal offers huge possibilities for improving our quality of life and in creating a fairer society.

### **A GREEN NEW DEAL**

The chapters of this book cover matters as diverse as energy supply, wood cultivation and the fabrics used for our clothes, as well as taxation and research. We need to take action across all of these areas. Addressing climate change isn't just a matter of increasing the percentage of our electricity that comes from renewable sources. It requires coordinated planning across the full range of human economic activities, ranging from what we eat

and how we heat our homes through to how we reduce our reliance on cement. Failure to take significant action in any one of these areas means that we will probably fail to reach net zero emissions by our target date.

Of course, all these steps will need the informed support of people across society. In each chapter, I look for ways to ensure that the less prosperous members of society are net beneficiaries of the changes proposed. The original ‘New Deal’ in President Roosevelt’s 1930s America had a similar objective. Without an overwhelming commitment to greater social justice, a democratic society is unlikely to obtain consent for the painful, expensive and complex changes necessary to move us from a society entirely reliant on fossil fuels to one entirely free of them in just thirty years. For example, without a plan to find alternative livelihoods for hill-sheep farmers, how do we get support for radical plans for reforestation of most of the UK’s uplands? How will we obtain consensus about giving over the land around cities to solar power unless we deliver lower electricity bills for those in energy poverty? And how do we reduce (as we must) the sales of clothing when over a third of a million people work in the fashion business?

Some argue that a transition to zero emissions is impossible in a world controlled by short-term modern capitalism, noting that few shareholder-owned companies have done much to speed up the energy transition (although there are notable exceptions, often from Nordic Europe). Most fossil fuel businesses have doggedly opposed rapid change at the same time as shamelessly and relentlessly advertising minor initiatives

to reduce responsibility for climate breakdown. However, my contention in this book is that a global carbon tax at a high enough level could rapidly rotate fossil fuel companies into allies in combating climate change. We desperately need their skills in allocating capital and managing the giant projects necessary to help society implement the massive economic transformations that are needed over the next decades.

I'm encouraged in such optimism by a large number of private conversations I have had over the last few years with employees of fossil fuel companies. I believe that these people are as eager as the rest of us to see progress on climate change. Typically, they know far more about the threat of climate change than the rest of us. They often feel shame at what their employers are doing, and many executives very much want carbon taxation because it will help them escape the financial imperative of continuing to extract and burn oil and gas. A properly designed carbon tax can acquire their active support.

### **THE NEW DEAL EXAMPLE**

Franklin Roosevelt became US President in 1933 and led the country until his death in 1945. Elected at a moment of intense economic depression, he pursued a group of policies that he called the New Deal. Their purposes were varied. Some were intended to provide employment and others to improve business profitability, to create better housing and transport infrastructure and increased availability of electricity.

Although the New Deal did use government spending to kick-start the American economy, one of Roosevelt's aims was to encourage private capital to begin making investments again. Paralysed by the economic crisis of the Great Depression, banks had sharply cut their lending. His administration put in place measures that helped mortgages and loans grow rapidly. The simple view that the New Deal involved little more than pouring government money into the construction of public infrastructure is incomplete. Roosevelt also used incentives to restart the investment activities of private and municipally owned companies across the country. Similarly, governments today can encourage capital to flow at unprecedented levels into the zero carbon economy.

The speed of Roosevelt's New Deal is inspiring. One of its most effective initiatives was the REA (Rural Electrification Administration), set up to encourage local cooperatives to build electricity supply across the farming regions of the US. The REA increased the percentage of rural homes with electricity from 10 to 40 per cent in just five years between 1935 and 1940. With full support from electorates, countries can make truly striking progress.

A group of insightful UK activists and politicians first proposed a Green New Deal in 2008 and I have used many of their ideas in this book. Much more recently, members of the US Congress, and notably Alexandria Ocasio-Cortez, have proposed an outline plan for the US. The ideas are sketchy, but the group proposes to move the US to 100 per cent renewable electricity and switch to zero emission vehicles, among many other measures. As with



Roosevelt's New Deal, the cutting of carbon emissions is intended to go hand in hand with a redistribution of income towards the less privileged and a systematic devolution of economic power away from the big cities.

Is it possible for a UK government to sharply reduce greenhouse gases within a few decades while helping rather than penalising the least privileged? My conclusion is that it may be easier than we might think, and that, despite political divisions, we can reach consensus over good policy. In March 2019 I watched from the edge of a square in central Nice\* as the demonstrators quietly dispersed after one of the weekend gatherings of the Gilets Jaunes. Several hundred people were milling about in the spring sun, wearing the yellow jackets that symbolised affiliation to the populist movement seeking to improve life in the less prosperous areas of their country. A second demonstration then began to form in the square, this time from various ecological groups. The Gilets Jaunes are typically regarded as to the right of centre politically while Greens are generally of the left. But, to my surprise, the yellows and greens mixed comfortably, holding polite conversations about objectives and tactics. I overheard discussions about community transport, organic agriculture and the need for local energy generation. It struck me that these two groups were natural allies, each aiming to create a society that restores economic power to the hands of people outside the capital. We need a similar alliance in

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\* London to Nice is an easy and enjoyable ten-hour train ride, changing in Paris. Bought well in advance, the cost is little more than the air fare.

the UK to push for an equitable carbon transition. There is no inconsistency in aiming for lower emissions at the same time as improving living standards for the less well-off.

## **WHAT WE NEED TO DO NOW**

In summary, the proposals in this book cover ten key areas for action – starting now, with our current level of emissions, which stand at roughly 450 million tonnes of ‘domestic’ CO<sub>2</sub> emissions (but as much as 875 million tonnes, when you include all consumer activities).\*

» **1** Increase renewable electricity generation twenty-fold. This will ensure that the UK has enough electricity both to meet today’s needs and to provide for new uses of electric power, such as battery cars. In periods of surplus generation, I propose that we turn spare electricity into hydrogen. We can then use this hydrogen to make power when wind and sun aren’t available, to heat homes and to create synthetic fuels that are chemically identical to fossil gas and oil but which have negligible carbon emissions. I also propose that control of the local energy system is handed to municipally owned utilities, who are encouraged to build local generation facilities (much as Roosevelt did). Towns and cities will be allowed to manage the energy networks within their areas, using advanced digital controls that match supply and demand within microseconds.

» **2** Massively improve the insulation of UK houses. Our focus should be on the homes of the less privileged in order to improve living standards and health, using

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\* See the ‘Note on numbers’ at the end of this chapter.

‘deep refurbishment’ techniques, with most components built offsite and then transported to the buildings. Our government should make cheap capital available for all types of insulation improvement and mandate that all new building, including factories and offices, be carbon neutral or better (a key failure of legislation to date).

» **3** Electrify the transport system, starting with cars and then moving on to heavy vehicles. Because of the very high carbon footprint of making cars in the first place, prioritise public transport, car-sharing, walking and cycling in order to reduce vehicle ownership. Switch shipping to electricity and to hydrogen made from renewables. We have to assume aviation continues to use liquid hydrocarbons, but we can make its emissions nearly zero carbon by creating fuels synthetically from hydrogen and captured CO<sub>2</sub>.

» **4** Move the food system away from meat, due to the impact on emissions of cows and other animals. Shift to forms of agriculture that do not require animal cultivation or artificial fertilisers. Move towards indoor cultivation of plants, to meat substitutes and some organic agriculture.

» **5** Make the fashion business more sustainable. Clothes manufacture is one of the most damaging sources of greenhouse gases and we need to urgently reduce its effects. It is hard to avoid emissions from either cotton or synthetic fabrics, so the best solution is to buy fewer and longer-lasting clothes. Ideally, we should buy items made from cellulose and keep all our clothes for many years.

» **6** Change technologies for production of steel, cement and fertilisers. The key change needed is to use renewable hydrogen as the heat source in manufacturing, or as an ingredient for making ammonia-based fertilisers.

» **7** Increase the area of woodland, raising its percentage of cover in the UK to typical European levels. This will ensure that forests increase the carbon dioxide they capture through photosynthesis, offsetting those greenhouse gas emissions we find it hard to avoid.

» **8** Collect carbon dioxide directly from the air and either sequester it safely or use it to make synthetic, very low carbon chemicals, using the hydrogen generated with surplus electricity. This, again, will help counterbalance remaining greenhouse gas emissions.

» **9** Introduce a meaningful carbon tax, remitting its proceeds to the less well-off, with the principal objective of incentivising the big fossil fuel companies to switch from oil and gas to zero carbon energy. Capitalism can and should be the servant of the energy transition.

» **10** Research and plan geoengineering techniques. The world will need to have safe, equitable means to artificially hold down global temperatures. Although ‘geoengineering’ has its risks, we probably have no alternative if we want to keep global temperatures from rising more than 1.5 or 2 degrees celsius. Even the fastest action now looks insufficient to avert dangerous amounts of climate breakdown without measures to block a portion of the sun’s energy.

### **IS THERE POLITICAL SUPPORT?**

Awareness of climate change has reached new levels, globally and in the UK. One British opinion poll in July 2019 indicated that 85 per cent of people are concerned about climate change, up sharply from previous surveys. Over half are ‘very concerned’. Almost three quarters

said that we are already feeling the effects of higher temperatures, and just over half support bringing forward the target of net zero from 2050. A French poll the same month suggested that almost two thirds of the population agreed that the fight against climate change should be the government's top priority, while in Germany, the environment and energy are ranked as the top political problem, with 62 per cent saying that they are very concerned. Across Europe as a whole, the issue is now seen as the most important issue after immigration.

These are only opinion polls. When it comes to backing the difficult political decisions that will need to be made to revitalise the move away from fossil fuels, support may evaporate. But all today's evidence is that emergency action on climate is more possible than ever before. And electoral support will be enhanced if climate action also allows us to push decisions out to local communities and enhances living standards.

The plan outlined in this book shows how a New Deal for Climate might be constructed. It does not provide every detail of how the strategy would work out, but it does indicate a number of routes that we could travel to achieve our aims. It is not an easy or painless strategy. The plan involves huge capital investments and significant changes to the way we live our lives. But, after a period of transition, living standards will be better and the damage being caused to our environment hugely diminished. We might also have far more satisfying working lives.

It would, of course, be good to believe we could make this change to a low carbon society without disruption and expense. But the policy of gradually edging towards lower emissions is not going to work fast enough. My sense is that a majority of British people now share this view and that it may be possible to act with sufficient vigour to avert the worst effects of climate change. And investment in zero carbon has significant rewards. If we invest trillions in offshore wind farms and other infrastructure, standard economic theory tells us living standards may temporarily drop. But the US New Deal suggests that may not necessarily be the case. The Defense Plant Corporation channelled about 25 per cent of US national income towards manufacturing investment in 1940, but the average income in the US rose very steeply during the succeeding five years.

The UK has a dismal record in industrial investment (total investment in machinery and buildings was less than 10 per cent of GDP in machinery and buildings in 2016), and this is one reason why our productivity is so low compared to our European neighbours. A sustained push towards development of a post-carbon economy by investing in the transition away from carbon-based fuels will eventually improve incomes, skill levels and economic output.

Much of this investment will need to be managed locally, possibly by the municipal utilities that I believe should control much of the supply and distribution of electricity and other forms of energy. Democratic and local control of the key enterprises driving the transition to net zero will help ensure continued support.

## A NOTE ON NUMBERS

UK government estimates of the country's overall 'domestic' greenhouse gas emissions are about 450 million tonnes a year, of which about 360 million tonnes is carbon dioxide and the rest made up of methane, nitrous oxide and gases containing fluorine.

However, these numbers are significantly underestimated in several areas. They exclude international transport (air travel and ships), as well as emissions from changed land use (notably widespread disturbance of British peatlands). These activities add about 75 million tonnes, taking the UK total to approximately 525 million tonnes. That represents about 8 tonnes of CO<sub>2</sub> per year for each of us (roughly the European average).

However, the 'real' figures are still more worrying. Imported goods and services are unrecorded in the UK national accounts (although the government does publish some estimates provided by academic researchers). Much of our food, clothing, steel and fertilisers are therefore not accounted for, because we are almost wholly dependent on imports. These add about 350 million tonnes – or over 5 tonnes a person per year – to the domestic numbers, making 13 tonnes in total per person. There's some reduction from deducting the emissions generated by UK exports, but this only takes the aggregate number down to about 12 tonnes per person. This is a high figure when compared to our neighbours.

In the following chapters I have tried to provide a sense of the importance of each area of the economy by giving an approximate figure for its share of overall emissions. In some cases, such as energy use, I measure emissions against the UK domestic total. In other instances – food for example – I compare the figure against the UK's overall responsibility for greenhouse gas, including imports. This is

because much of the UK's food comes from abroad and so is not included in our national emissions.

In the chapters on energy I use two types of number. The first refers to the capacity of a renewable source of electricity. This is usually expressed in terms of gigawatts, or Gw. A very large offshore wind farm might have a capacity of 1.0 Gw, which is its maximum output when the wind is blowing hard. (To give a sense of scale, the typical UK need for electricity over the course of the entire year is about 35 Gw.)

The second measure is for the annual generation or use of electricity (or other fuels), which is expressed in terawatt hours, or TWh. A terawatt hour is equivalent to the power of 1 Gw over a thousand hours. A 1.0 Gw wind farm working at full capacity for the 8,760 hours of the year would generate a total of 8.76 TWh. In normal circumstances, an offshore wind farm will actually typically generate 45–50 per cent of its maximum output over the course of a year as the wind varies in strength, implying an annual production for our 1.0 Gw wind farm of around 4.2 TWh (about 1.5 per cent of UK annual need). A solar farm will produce a lower average output, possibly achieving 10–12 per cent of its maximum capacity during a full year.

We need these two different types of numbers, because the cost of a source of renewable energy is determined largely by the amount of capacity (in gigawatts) installed, while its value arises from its output of electricity – the number of terawatt hours produced.