

Global Warming Local Warning

Dr Caroline Lucas, Green Party MEP

*A study of the likely
impacts of climate
change upon
South East England*



The Greens | European Free Alliance
in the European Parliament

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Written and researched by Dr Caroline Lucas (Green Party Member of the European Parliament for South East England) and Dr Paul D. Williams (Atmospheric Physics Department, Oxford University).

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Front cover photo: 2000-01 flooding in Kent due to the River Nailbourne. Photography by Albert Snook and Thomas Baker, courtesy of the Climatic Research Unit, University of East Anglia. Used with permission.

Back cover photo: Wind turbines in North Cornwall. Taken by Cherry Puddicombe.



EUROPEAN PARLIAMENT

Over the coming years one of the biggest problems faced by my constituency will be the potentially devastating impacts that climate change will bring. Not only will there be difficulties in terms of rising sea levels, but also from the expected increase in freak and extreme weather conditions.

My concern as Green Party MEP for the South East of England is that recent predictions suggest that the South East may well be the worst affected region of the United Kingdom. It is therefore essential that this issue is not ignored, which is exactly what many politicians in the South East are at present doing.

The aim of this report is to emphasise just how serious a problem climate change is – not just to global weather patterns, but to the people and land of South East England. And in response to these dangers, this report proposes solutions which can be enacted at local, national and international levels.

Within the European Parliament I am working to combat aviation subsidies, since air transport is the fastest growing source of greenhouse gas emissions. I am also working to achieve far stronger plans for energy taxation and for a rigorous emissions trading system within the EU.

There is a lot more we can do to reduce the amount of carbon dioxide we emit, and this report aims to demonstrate how. But we have to act now. It's no good simply waiting for the consequences. Urgent action is essential if we are to significantly reduce the impacts that climate change will have on our way of life, on the environment and on the economy.

Dr Caroline Lucas, Green Party MEP

“There is a lot wrong with our world. But it is not as bad as many people think. It is worse. Global warming is slowly but relentlessly changing the face of the planet.”

Michael Meacher MP

Former Environment Minister

The Guardian, 14 February 2003

Global warming is the greatest environmental threat currently facing humankind. More than 30 per cent of Europeans put it as their top international concern – ahead of disease, war and poverty¹. There is already extensive evidence that human activities are profoundly changing the delicate thermodynamic balance without which life on Earth might never have flourished.

Even relatively conservative predictions indicate that the next one hundred years will bring a myriad of changes for the worse: massively increased flooding on some parts of the planet; major droughts on others; widespread crop failure; pole-ward spreading of tropical diseases; loss of human life and livelihood; and wildlife disruption on a scale rarely seen since the beginning of life itself. Weather conditions which we now think of as being exceptional may well become the norm. It is fair to say that there is not a single person whose life will not be adversely affected in some way by anthropogenic climate change this century.

Global warming does not recognise regional and national boundaries. The greenhouse gas emissions from one country will travel around the globe in days and immediately contribute to the slow warming of the entire planet.

Nevertheless, the effects of climate change are often felt most acutely at the local level: a river bursts its banks here and floods a village; a crop fails there and an isolated community faces starvation.

This report focuses specifically on the causes and likely effects of climate change in the South East of England, comprising Kent, East and West Sussex, Surrey, Hampshire, Oxfordshire, Buckinghamshire, Berkshire and the Isle of Wight. The South East is an important region for a detailed case study, as recent predictions suggest that it could be the worst affected part of the UK, and it therefore has a special interest in understanding and mitigating the problem.

In Section one, a brief overview is given of the science of climate change, and its present and expected generic effects across the globe. In Section two, we narrow the focus to look at the detailed predicted effects in the South East, highlighted by a number of case studies from around the region. In Section three, we analyse the sources of greenhouse gas emissions in the South East, by sub-region and by sector, and finally, in Section four, we examine the economic impacts of climate change in the region. We conclude with a summary and some policy recommendations.

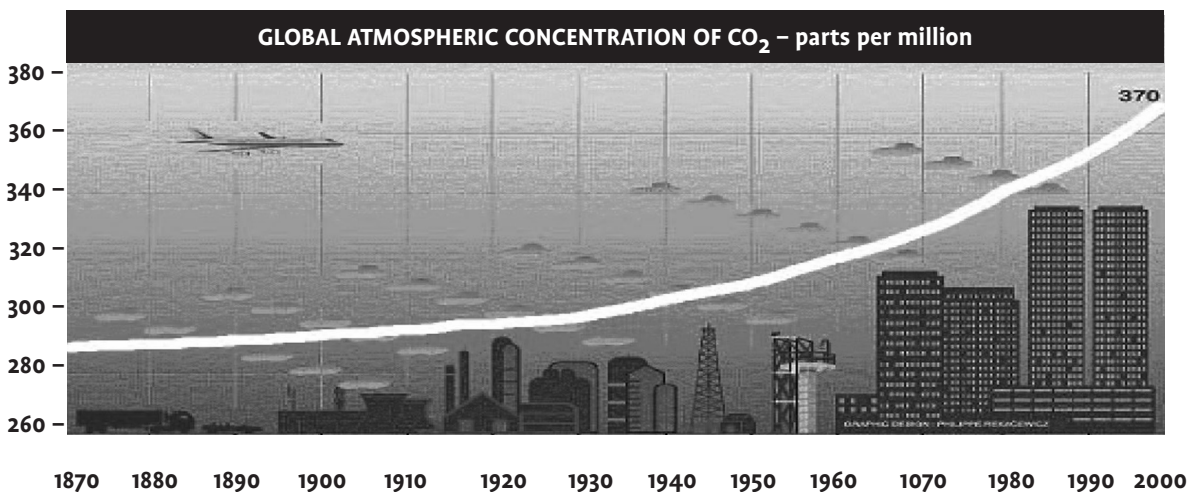
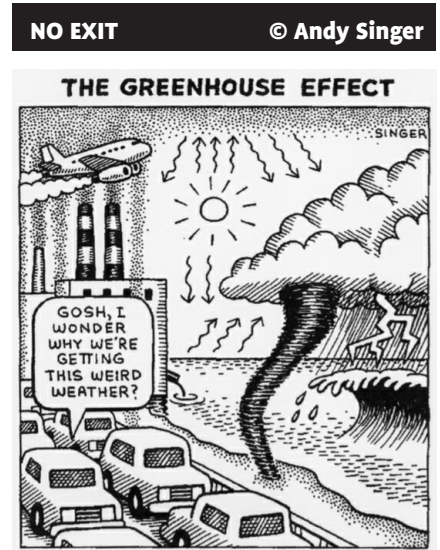
Climate Change

There is a considerable amount of confusion amongst the British public about global warming. In a recent survey, over two-thirds of respondents said they believed it was caused by the hole in the ozone layer, and one in ten said that it was caused by mobile phone use². These misconceptions are understandable given the lack of concern that successive governments have shown about the issue.

To set the story straight, global warming (or climate change) is caused by the *greenhouse effect*. Atmospheric greenhouse gases (principally carbon dioxide CO₂) allow energy from the sun to reach the surface of the Earth and warm it up, but they trap this energy as it tries to escape back to outer space. The result is that the Earth is warmer than it would be if the atmosphere were totally devoid of greenhouse gases.

A certain amount of the greenhouse effect is natural. In fact, the Earth's surface would be perpetually frozen without it, and life could not have evolved. The problem is that human activities have artificially increased the atmospheric concentration of CO₂ – the more we release, the more heat is trapped, and the warmer the planet becomes. This is referred to as the *anthropogenic enhancement of the natural greenhouse effect*.

Atmospheric CO₂ level shave increased by around 30% since the start of the industrial revolution (see figure below). The cause of this increase has been the burning of fossil fuels (coal, oil and gas, which all contain carbon) to generate energy. A car driven five miles releases a kilogram of CO₂ into the atmosphere³, and £1 spent on electricity releases ten kilograms⁴.



Philippe Rekawicz (UNEP / GRID-Arendal)

“There is new and stronger evidence that most of the warming observed over the last fifty years is attributable to human activities.”

IPCC Third Assessment Report 2001

Effects of climate change

At first sight, global warming can be made to sound rather attractive. Towards the end of this century in the UK, almost every single year is expected to be as hot as the current warmest year on record⁵. Global temperatures are predicted to rise by up to 5.8 degrees Celsius⁶, which conjures up images of Britain acquiring a Mediterranean-style climate. Unfortunately, the reality is not quite so pleasant.

The increased temperatures will lead to increased evaporation rates from the oceans, so we will experience heavier and more frequent rainfall inland, with accompanying increases in local flooding. This is already happening in the UK: Autumn 2000 was the wettest season since records began over two hundred years ago⁷, with consequent widespread flooding.

The elevated energy of the climate system will give rise to a higher incidence of extreme weather events, such as storms.

The rise in global temperature will be enough to begin to melt the polar ice caps and thereby raise sea levels, leading to coastal flooding and land loss. Tuvalu, a populated group of islands in the South Pacific, is already in danger of becoming permanently submerged⁸. Bangladesh is likely to be the next in line, causing tens of millions to flee their homes in a world where environmental disasters already create more refugees than armed conflict⁹.

The World Health Organisation has warned that global warming could lead to a major increase in insect-borne diseases in Britain including malaria and encephalitis, as non-native equatorial insects travel to higher latitudes.

There are various feedback mechanisms in the climate system, which could accelerate the warming. For example, massive amounts of carbon are believed to be stored in permafrost in the Arctic ice cap, which is at risk of melting and releasing its contents into the atmosphere. This mechanism, or any of the other feedback mechanisms, could lead to a *runaway greenhouse effect*, which would potentially threaten life on Earth. Even if the chance of this were small, would it be worth the risk?

The Kyoto Protocol was written with the intention of reducing greenhouse gas emissions, but its reductions targets have become so watered down that its potential to mitigate climate change risks being negligible and tokenistic, at best.

Effects in the South East

In this section, we consider the *local* effects of *global* climate change. On the one hand, the predictions for the South East represent, in microcosm, the augury for the entire country. On the other hand, the region is densely populated and relatively low-lying. This means that both the frequency and severity of the predicted impacts, together with the number of people affected by them, are larger for the South East than for any other region of the UK (apart, perhaps, from London). It seems that the region is destined to bear a disproportionately large share of the UK's climate change problem.

History of climate modelling

The *Intergovernmental Panel on Climate Change (IPCC)* was set up in 1988 by the *United Nations Environment Programme (UNEP)* and the *World Meteorological Organisation (WMO)*. It consists of hundreds of independent climate scientists, and aims to provide an authoritative assessment of the state of scientific knowledge of global warming.

The IPCC periodically publishes Assessment Reports, which paint a picture of how climate change will affect the globe as a whole, as summarised in Section one. Until recently, though, few studies had addressed the detailed impacts at the national and regional levels. The *UK Climate Impacts Programme (UKCIP)* was set up by the government in 1997 to redress this balance.

UKCIP recently commissioned the Hadley Centre of the UK Meteorological Office, and the Climatic Research Unit at the University of East Anglia, to produce a set of future national climate predictions. The study, known as UKCIP02, considered four different scenarios (low, medium-low, medium-high and high) corresponding to future greenhouse gas emissions. The results, in the form of UK maps of future rainfall, temperature, wind speed and other variables, are available on the internet¹⁰. Regional organisations such as the London Climate Change Partnership have begun to identify, from these maps, the likely impacts on their region. Much of the data, though, still remains to be fully analysed and interpreted.

Over the following two pages we look at some South East case studies, based on the UKCIP02 predictions for the 2080s under the high emissions scenario. There is no evidence yet that the world will take the appropriate steps to drastically reduce emissions, and so this worst-case scenario looks increasingly likely.

“Climate change presents serious challenges for the South East; many of the impacts on the UK will be most pronounced in our region.”

Mark Goldthorpe

Programme Manager, South East
Climate Change Partnership



The shape of things to come – a Kent road floods during autumn 2000.

Photo: Albert Snook and Thomas Baker

Summary of UKCIP02 findings

The main UKCIP02 predictions under the high emissions scenario are that, by the 2080s in the South East of England:

- winter rainfall will be 30-35% higher;
- summer rainfall will be 50-60% lower;
- autumn and summer soil moisture content will be 40-50% lower;
- winter snowfall will be over 90% lower;
- winter daily average wind-speeds will be 9-11% higher;
- summer cloud cover will be 15-18% lower.

The percentage changes are relative to the average climate in the South East between 1961 and 1990, which has become the standard period with which future climatologies are compared.

We now examine how these changes will affect various aspects of life in the South East.

Loss of coastal heritage

The increase in wind speeds is associated with an increase in the frequency and severity of storms, gales and hurricanes in the region. These extreme weather events threaten various natural features along the coastline.

Hurst Castle, in Hampshire, was built by Henry VIII in the sixteenth century. Its famous spit is in danger of being lost in a coastal storm, together with other coastal features such as East Head at the mouth of Chichester Harbour in West Sussex, Selsey Bill in East Sussex, and the Denge Peninsula in Kent¹¹.

Coastal land loss

Sea level rises, predicted to be as large as 79 centimetres by 2080¹², will lead to the coastline creeping inwards and swallowing up valuable land. It has been estimated that for each millimetre rise in sea level, the shoreline advances inwards by an average of 1.5 metres¹³. On this basis, Kent (with 190km of coastline) could lose 230km² of land. Similarly, the Isle of Wight and Hampshire could each lose 110km², and West and East Sussex could each lose 90km². Lives, livelihoods, homes and businesses would have to either relocate or perish.

Climate debt

Taken as a whole, the South East is one of the richest regions in the country. However, this fact disguises a great deal of variation in economic standards within the region.

The Gross Domestic Products of East Sussex, Kent, West Sussex and the Isle of Wight – all coastal counties and so particularly vulnerable to flooding – were all lower than the national average in 2001. Areas of significant deprivation exist within these counties, particularly close to the coast.

It is ironic that the less wealthy will pay the most for climate change-induced flooding, through damaged property costs (fully half of the lowest income households in the country do not have home contents insurance¹⁴) and elevated insurance premia (for those that do). The irony is heightened by the fact that it is lower income households which are responsible for the least greenhouse gas emissions, generally having fewer or no cars and smaller houses which require less heating.

This leads to the concept of a *climate debt*, owed as compensation to those who suffer the most from climate change, by those who are responsible for most of the emissions. Given that the UK insurance industry paid out in excess of £1bn in respect of more than 30,000 weather-related claims from the Autumn 2000 floods¹⁵, this climate debt is not insignificant. The same principle applies at the global scale: it has been estimated that the climate debt owed to developing countries due to the climate change problems forced upon them by developed countries' emissions, greatly outweighs conventional 'third world debt'.

Agriculture and gardening

Dramatically reduced summer soil moisture contents pose a real threat to plant life in the region. Whilst increased temperatures and CO₂ levels encourage faster plant growth, faster growth reduces nutritive value in crops, and pests, diseases and weeds are likely to make more of the favourable conditions than other plants¹⁶.

The countryside

The South East harbours a rich and distinctive countryside, but it is threatened by increased wind speeds and reduced rainfall. Surrey could lose its distinction as England's most heavily wooded county, as familiar trees such as the shallow-rooted Beech suffer¹⁷.

Human health

The reduced summer cloud cover in the South East will lead to heightened levels of exposure to direct sunlight. This is likely to give an increased incidence of skin cancer amongst the population, unless lifestyle changes (staying indoors more) are made. Shortages of water, essential for good health, are very likely given the dramatically reduced summer rainfall.

“Horse chestnut leaf miner has devastated trees in Spain, become established in Northern Italy and recently appeared in Wimbledon. An influx of exotic pests into British gardens is a likely consequence of climate change.”

Gardening in the Global Greenhouse

Royal Horticultural Society

Local Emissions

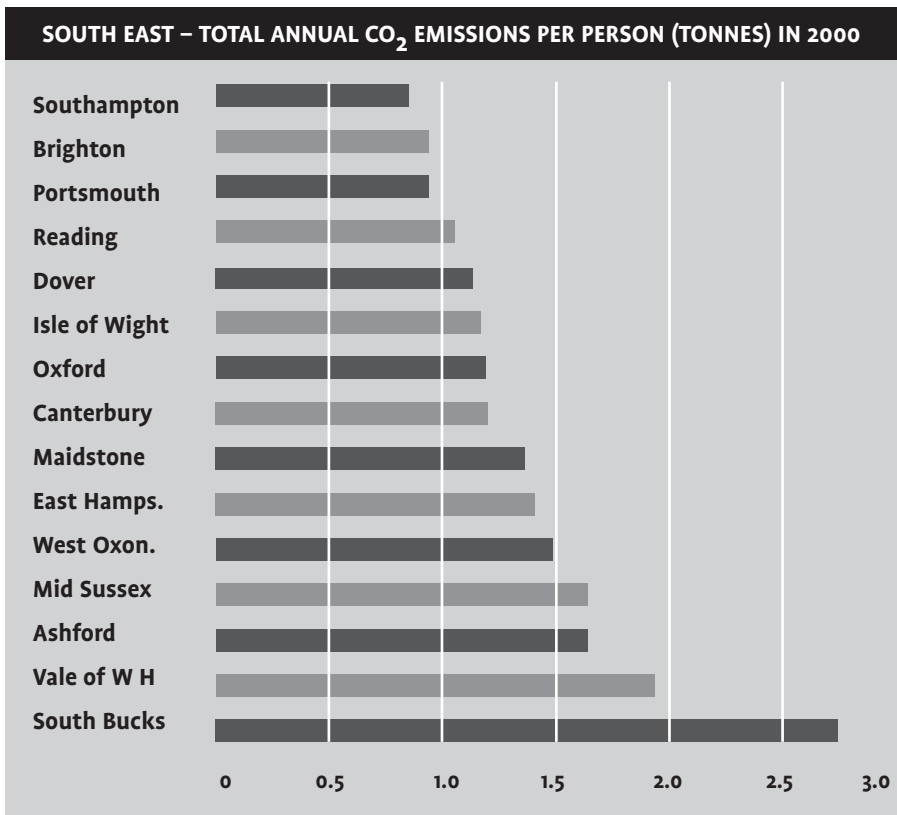
In order to power a standard domestic two kilowatt bar heater for one hour, using electricity generated by burning fossil fuels, around a kilogram of carbon dioxide (the same weight as a medium bag of sugar) is released into the atmosphere at the power station.

Having considered in the previous section the likely future *effects* of climate change in the South East, we now look at its present *causes* within the region.

Carbon dioxide is by far the most important greenhouse gas. Very detailed data are available on the internet¹⁸ giving sector-by-sector breakdowns of the CO₂ emissions from every square kilometre of the UK, which we look at in this section.

The figure below shows the average amount of carbon dioxide emitted per person, per year, for a selection of South Eastern sub-regions. So, for example, the average resident of Reading is responsible for just over a tonne (or a thousand kilograms) of *direct* emissions each year, largely due to the amount of fuel which is burnt to supply their personal energy and transport needs. This data does not include *indirect* personal emissions, for example from the manufacture and transport of purchased goods. With these included, the average UK CO₂ emissions rise to around ten tonnes per person, per year¹⁹. A breakdown is shown in the pie chart opposite.

Direct emissions in the South East region are significantly higher than the UK average, due to the North/South consumer spending imbalance, but the figure below reveals a great deal of variation even within the region. For example, the average South Bucks resident is responsible for over three times the emissions of the average Southampton resident. Factors to blame for this include differences in the quality of public transport, and in the proximity of employment and community facilities (e.g. schools, hospitals, shops) to homes.





Pie chart showing annual average personal CO₂ emissions per person (tonnes) for the UK in 2000.

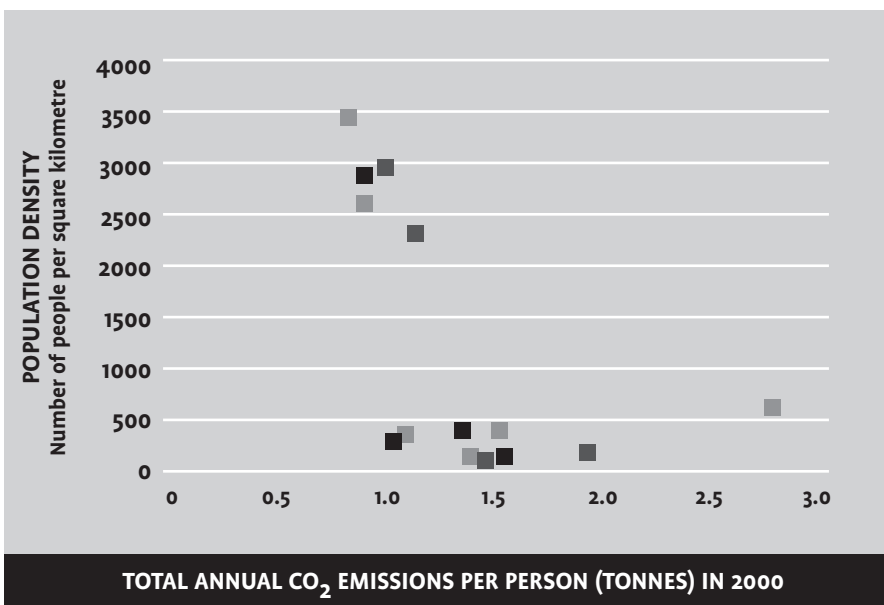
Source: Best Food Forward, personal communication

It is evident from the figure on page 10 that urban populations tend to be lower CO₂ emitters than rural populations. The figure below confirms this assertion. It is a scatter-plot, showing the relationship between population density and direct personal emissions for each of the 15 sub-regions. There is a clear trend: the greater the population per square kilometre (and hence the more urban the region), the lower the emissions.

The main reason for the rural/urban imbalance is road use. In communities which are relatively spread out, there is a greater need to use motorized transport to reach basic services. The problem is compounded by the fact that public transport is often dire in such areas, so any motorized transport is most likely to be by private car. This explains why emissions from road use are six times higher per person in South Bucks than in Reading, which has five times the population density.

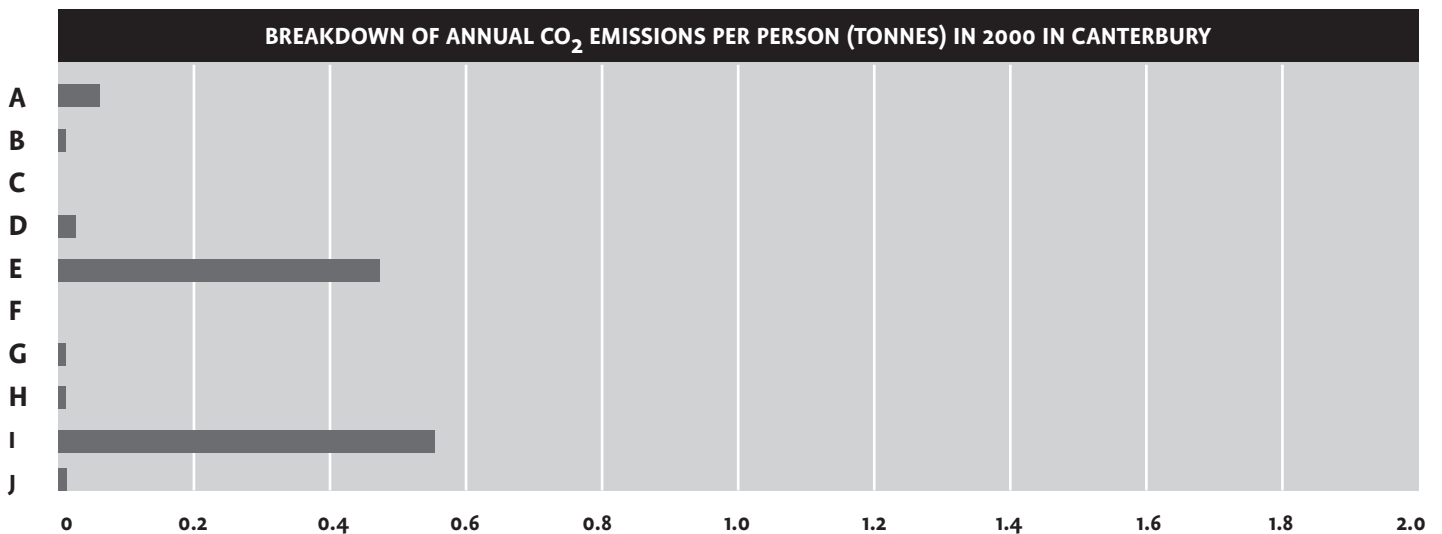
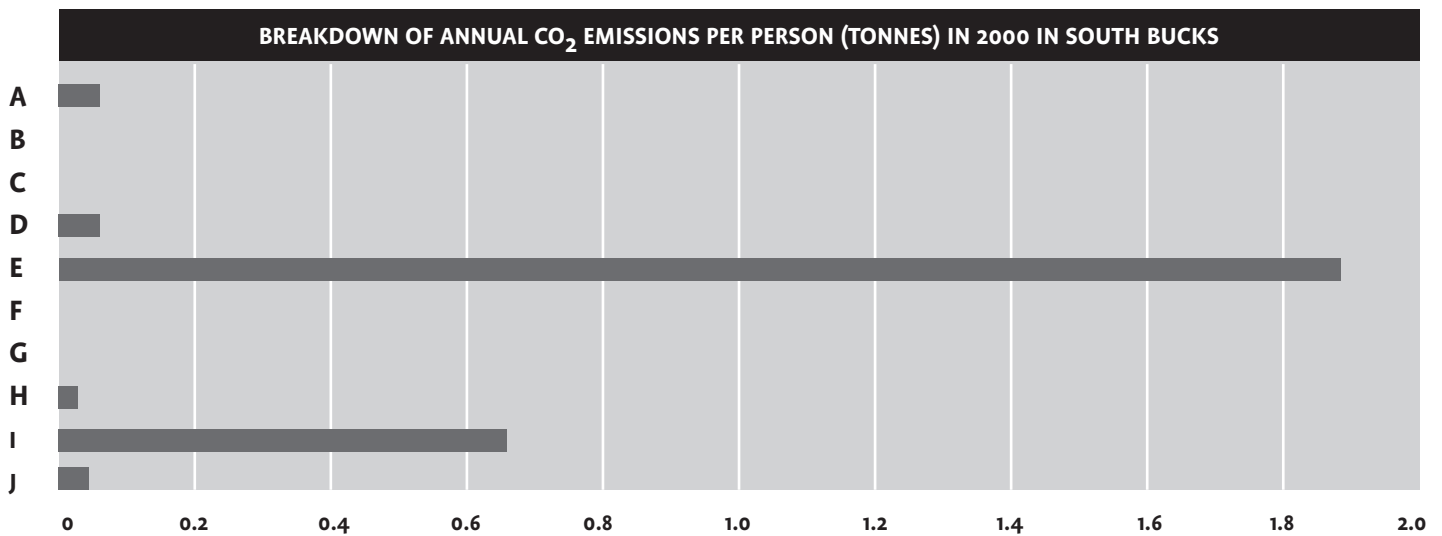
But there are vast variations in road use emissions even between similarly populated regions. The figures on the next page show emissions breakdowns for two regions with similar population densities but very different total emissions. Almost all of the difference is due to road use. There is a lot that local authorities could learn from one another about reducing the need to travel.

The distribution of a kilogram of apples from New Zealand to a UK consumer results in one kilogram of carbon dioxide emissions, an average of twenty times larger than if the apples were locally-sourced.²⁰



Key to figures

- A – Nature
- B – Agriculture
- C – Waste Treatment and Disposal
- D – Transport other than Road
- E – Road Transport
- F – Production and Distribution of Fossil Fuels
- G – Industrial Processes
- H – Industrial Combustion
- I – Commercial, Institutional and Residential Combustion
- J – Energy Production and Transformation



Economic Impacts

In this section the case for reducing carbon dioxide emissions will be made on economic grounds. The social and environmental benefits of a low-carbon economy are plain to see, and the arguments for them are well-rehearsed. On the other hand, the economic case for decarbonification has received relatively scant attention.

According to Munich Reinsurance, one of the world's largest insurance companies, the global cost of environmental disasters has doubled every decade from US\$50 billion in the 1960s to nearly US\$400 billion in the 1990s. Extreme weather events have been implicated in corporate performance disappointments this century²¹. Looking to the future, leading insurance firm CGNU warned delegates at the recent World Climate Change Conference that damage to property due to global warming could bankrupt the world by 2065.

So the economic cost of carbon emissions being sustained at high levels is potential global bankruptcy, but won't reducing emissions be just as costly? In fact, there is a lot of evidence to suggest that investment in green technologies will actually lead to financial savings rather than costs, and at the same time create many jobs.

For example, once a solar panel or wind turbine has been installed, the energy that it supplies is essentially free (apart from small maintenance costs). The only reason that installation costs aren't more affordable is that successive governments have heavily subsidized the nuclear and fossil fuel industries, at the expense of the renewables sector. The South East has a considerable amount of expertise in the area of environmental technology. There are at least 500 firms in the region specialising in it²², which would reap large benefits from any increase in green energy usage. For example, unit-for-unit, wind energy sustains six times as many jobs as nuclear energy²³.

It makes economic sense for energy users to switch to green electricity: Oxford University saved £185,000 pa by switching²⁴.

In a recent study, it was calculated that 165,000 new jobs could be created across the UK, given just a modest set of green transport policies²⁵. This would more than offset the 43,000 jobs predicted to be lost in the motor industry due to decreased car use.

If the industrialised world were to free itself from the ties of its love affair with fossil fuel energy, not only the environment, but also the economy, would have everything to gain and nothing to lose.

“A number of attempts have been made in recent times to estimate the cost of anthropogenic climate change worldwide. The results of these analyses are unmistakable: in the long term the cost of preventive strategies is much lower than the losses to be expected as a result of climate change.”

Topics 2000

Natural Catastrophes, The Current Position

Munich Re Group, 1999

Our most precious things – health, food supply, water resources, houses, businesses, gardens, forests, countryside, wildlife, heritage, coastal areas – are acutely vulnerable to the changes that global warming has already started to bring.

But it doesn't have to be this way. The worst effects of climate change can still be avoided, if we act quickly to reduce emissions in the ways suggested here.

Recommendations

- The pressure on the SouthEast to be the economic superpower for the whole of the country should be lifted. Recently-announced plans to build 200,000 new houses in the region, together with roads and facilities, will do nothing to increase the region's sustainability. Some of the heat of the economic growth of the South East should be redirected to the North, where tens of thousands of houses lie empty and poverty is rife.
- All energy users should be encouraged to switch to green (carbon-free) electricity from renewable sources, now available via the national grid.
- Local Authorities should reduce the need to travel, and impose lower road traffic speeds. Mile for mile, doing 50mph emits 25% less than doing 70mph²⁶.
- The Government recently considered taxing people who live in flood risk areas, to cover the costs of flood defence²⁷. Such a scheme is unfair and should be replaced with an 'eco-tax' on fossil fuels, so that it is the person responsible for the emissions who pays for the damage they cause.
- Local Authorities should encourage the consumption of locally-grown food, by supporting vegetable box delivery schemes run by local farmers, and increasing allotment provisions. Why do we import 'high air mile' food into the South East if it could easily be grown here?
- The South East is home to a number of large airports, and air travel is the most highly-emitting form of transport. Aviation fuel should be taxed at the same rate as other fuels. Instead, it is completely untaxed, representing a subsidy of £182.45 per year to the aviation industry from every child, woman and man in the UK²⁸.
- Local Authorities should implement strategies to reduce waste, and also to increase recycling and composting rates.
- Global warming should be taught to the region's school children, empowering them to make informed consumption and lifestyle decisions.

“Green energy must be put at the heart of sustainable development if the threats of climate change and the need to tackle poverty and ill health in the developing world are to be truly addressed”

Claus Toepfer

*Executive Director, United Nations
Environment Programme 2001*

- 1 **Oxford Today**, The University Magazine, Oxford University Development Office, 2002.
- 2 **The Environment in your Pocket**, Department for Environment, Food and Rural Affairs, 2001.
- 3 **Physics World**, Institute of Physics Publishing, February 2002.
- 4 Authors' own calculations, based on domestic electricity costing 5p/kWh with an emissions-to-energy ratio of 127gC/kWh.
- 5 **Living in the greenhouse**, Parliamentary Office of Science and Technology, December 1998.
- 6 **Third Assessment Report**, Intergovernmental Panel on Climate Change, 2001.
- 7 **Monthly Assessments**, The Meteorological Office, September, October and November, 2000.
- 8 **The Guardian**, 16 February 2002.
- 9 **Unnatural Disasters**, Christian Aid, 2000.
- 10 **www.ukcip.org.uk**
- 11 **Rising to the Challenge**, South East Climate Change Partnership, 1999.
- 12 **Climate Change Impacts**, South East Climate Change Partnership, November 2002.
- 13 Estimate by Prof. Donald F. Boesch, President of the University of Maryland Center for Environmental Science.
- 14 The Association of British Insurers' response to the **Flood and Coastal Defence Funding Review**, May 2002.
- 15 *ibid.*
- 16 **Don't count on plants to save the world from global warming**, New Scientist, 14 December 2002.
- 17 **Rising to the Challenge**, South East Climate Change Partnership, 1999.
- 18 National Atmospheric Emissions Inventory, at www.naei.org.uk
- 19 **Key world energy statistics**, International Energy Agency, 2002.
- 20 **The environmental impacts of distributing consumer goods: a case study on dessert apples**. PhD Thesis, J. A. Jones, University of Surrey, 1999.
- 21 **Carbon Finance and the Global Equity Markets**, report prepared by Innovest Strategic Value Advisors for the Carbon Disclosure Project, 2002.
- 22 **The Environmental Economy of the South East of England**, South East England Development Agency, 2002.
- 23 **Best of both worlds – Green policies for job-creation AND sustainability**, Green Party of England and Wales, 2001. www.greenparty.org
- 24 Oxford University Environment Committee, internal memorandum, 2002.
- 25 **Less traffic, more jobs**, Friends of the Earth UK, 1997.
- 26 **Tips on greener driving**, Department of the Environment, Transport and the Regions, 2000.
- 27 **Floodforum.net – an online discussion**, Parliamentary Office of Science and Technology, December 2002.
- 28 **Aviation's economic downside**, Green Party of England and Wales, 2002. www.greenparty.org

Dr Caroline Lucas, Green Party MEP

carolinelucas@greenmeps.org.uk

www.carolinelucasmep.org.uk

The Green Party of England and Wales

1a Waterlow Road , Archway London N19 5NJ

+44 20 7272 4474

office@greenparty.org.uk

www.greenparty.org.uk

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European office

European Parliament, Rue Wiertz ,

1047 Brussels, Belgium

+32 2 28 45153

UK office

Suite 58, The Hop Exchange,

24 Southwark Street , London SW1 1TY

+44 20 7407 6281



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