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The health benefits of tackling climate change

An Executive Summary for *The Lancet* Series



“If properly chosen, action to combat climate change can, of itself, lead to improvements in health. The news is not all bad.”

Introduction

The threat of climate change has generated a global flood of policy documents, suggested technical fixes, and lifestyle recommendations. One widely held view is that their implementation would, almost without exception, prove socially uncomfortable and economically painful. But as a series of new studies shows, in one domain at least—public health—such a view is ill founded. If properly chosen, action to combat climate change can, of itself, lead to improvements in health. The news is not all bad.

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Climate change will harm human health, and successful strategies to mitigate the extent of the change will restrict that harm. But new studies published in *The Lancet* show that appropriate mitigation strategies will themselves have additional and independent effects on health, most of them beneficial. The potential value of these co-benefits has not so far been given sufficient prominence in international negotiations.

The Lancet studies, supported by a global partnership of funders, were undertaken by an international team of researchers with the aim of informing discussions at the 2009 Copenhagen conference of parties to the UN Framework Convention on Climate Change. Authored by an international group of public health, environmental, and other scientists, each focuses on one sector in which greenhouse-gas emissions need to be reduced. These sectors are household energy use, urban land transport, electricity generation, and food and agriculture. A fifth study reviews the effect on health of short-lived greenhouse pollutants, which are produced in several sectors.

Each study examines the health implications of actions in both high-income and low-income countries designed to reduce the release of carbon dioxide (CO₂) and other greenhouse gases. In line with the recommendations of the Committee on Climate Change, each would yield reductions by 2030 that are broadly consistent with the aim of meeting a global 50% reduction target (compared with 1990) by 2050, and an 80% reduction in emissions for high-income countries.

Key messages

- Measures to restrict our output of greenhouse gases may also result in benefits to public health
- These co-benefits will offset at least some of the costs of climate change mitigation, and should be taken into account in international negotiations
- The co-benefits to health arising from action on climate change are not widely appreciated. A greater awareness might sweeten the otherwise bitter taste of some climate change policies

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Household energy emissions

In rich countries, energy use in buildings for heating, lighting, and other needs is responsible for a large part of energy demand. In the poorest parts of the world, energy for cooking and heating relies on the humblest of technologies: the solid-fuel household stove. Either way, household energy use is responsible for a significant amount of greenhouse gases. In the UK, residential buildings account for just over a quarter of the total emissions of CO₂, a figure that could be lowered by increasing energy efficiency. The simple stoves used by the poorest half of the world's households, especially in sub-Saharan Africa and low-income Asia, operate at low combustion efficiency and produce airborne particles, including black carbon in addition to a various greenhouse and other health-damaging pollutants.

The study considers the effects of two programmes of change. In the UK it analyses the effects of five interventions: more house insulation; better ventilation and heat recovery; a switch to electric heating; a reduction in household temperature of 1°C; and a combination of all the above. For India the study considers a 10-year programme to introduce 150 million low-emission cookstoves.

Benefits for health

Taken together, the UK programmes would yield a 36% reduction in CO₂ emissions compared with 1990 (baseline). Health benefits—mostly a product of improvements to indoor air quality—would be comparatively modest. They include reduction in burdens associated with exposure to fine particles, radon, and carbon monoxide poisoning.

The benefits to India of replacement cookstoves would be more substantial. Indoor air pollution from inefficient cookstoves increases the risk of acute respiratory tract infections in children younger than 5 years and chronic respiratory and heart disease in adults older than 30 years. Globally, almost 1 million children are currently dying every year of respiratory infections induced or exacerbated by the inefficient burning of solid fuels.

By 2020, the cumulative effect of the proposed Indian stove programme would be to lower the national burden of the three diseases mentioned above by about a sixth. This would be equivalent to elimination of nearly half the country's entire cancer burden.

“New stove technologies have the potential to bring emission of products of incomplete combustion from biomass stoves down nearly to those of clean fuels, such as liquefied petroleum gas.”

Paul Wilkinson et al. Public health benefits of strategies to reduce greenhouse-gas emissions: household energy.



Nigel Bruce

Key messages

- In the UK, improvements in household energy efficiency could have net benefits for health, mainly through improved indoor temperature and air quality
- In low-income countries, the products of incomplete combustion in traditional solid fuel stoves create various heart and respiratory problems
- National programmes offering low-emission stove technology for burning local biomass fuels in poor countries could, over time, avert millions of premature deaths, and constitute one of the strongest and most cost-effective climate–health linkages

Urban land transport

Transport accounts for almost a quarter of all fossil fuel greenhouse-gas emissions. Reduction of motor vehicle use through more walking and cycling will not only diminish transport emissions but should also reduce obesity, lower the rate of chronic diseases caused by physical inactivity, lessen the health-damaging effects of air pollution, and make the roads safer for pedestrians and cyclists. However, the scale of these changes has never been quantified.

To estimate how different transport patterns would affect health, the analysis considers four alternative 2030 futures for London (an example of a large city in a highly motorised country) and for Delhi (an example of one in a rapidly motorising country). The alternative London futures are: business-as-usual, envisaging a 5% rise in emissions from 1990 levels; lower-carbon-emission vehicles, relying on more fuel-efficient motor vehicles and leading to a two-fifths cut in emissions; increased active travel in which walking and cycling replace many car trips, so allowing a two-fifths cut in emissions; and a “towards sustainable transport future”, which combines active travel and low-emission vehicles and which cuts CO₂ emissions by three-fifths.

In view of its lower starting point, its rapid growth in car use, and projected increases in population, the Delhi transport futures aim to constrain rather than reduce emissions. In this case the business-as-usual projection for 2030 foresees a six-fold rise in emissions above 1990, the lower-carbon-emission vehicles scenario a five-fold rise, the increased active travel scenario a more than three-fold rise, and the “towards sustainable transport” scenario a three-fold rise.

Benefits for health

In both cities, cutting emissions through more walking and cycling and less motor vehicle use would bring the largest health benefits. In London, more active travel would bring substantial health gains. Heart disease and stroke could fall by 10–20%, with reductions in breast cancer (12–13%), dementia (8%), and depression (5%). Combining increased active travel with low-emission vehicles would bring greater benefits by further reducing air pollution.

In Delhi, more active travel is projected to bring a 10–25% cut in heart disease and stroke, and a 6–17% reduction in diabetes. Bigger benefits are expected in Delhi because

“Creation of safe urban environments for mass active travel will require prioritisation of the needs of pedestrians and cyclists over those of motorists.

James Woodcock et al. Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport.



of the increased burden of air pollution. Reduction in car travel and increase in active travel could also reduce the burden of road traffic injuries by up to a third.

The results show that technological measures such as hybrid cars will make only minor inroads into the burden of disease from transport. Major public health benefits will depend on the introduction of policies that combine reduced motor vehicle use, more walking and cycling, and low-carbon-emission motor vehicles.

Key messages

- Transport-related greenhouse-gas emissions are increasing, especially in countries of low and middle income
- Meeting targets to reduce greenhouse-gas emissions will require more walking and cycling and less motor vehicle use, which will bring substantial health benefits, including from reduced cardiovascular disease, depression, diabetes, and dementia
- Although reducing motor vehicle use would decrease the injury risk for existing pedestrians and cyclists, if many more people walked and cycled there may be an increase in the number of injuries, since more people would be exposed to the remaining risk

Low-carbon electricity generation

Electricity production is a major contributor to greenhouse-gas emissions, but economic and industrial conditions vary widely from country to country. This review analyses the mitigating effect of carbon trading policies in China, India, and the European Union (EU) and explores the health consequences of strategies to reduce greenhouse-gas emissions in all three regions. It concentrates on only one of the health effects of power generation: the emission of airborne particles causing damage to the respiratory and cardiovascular systems.

The study uses a method of anticipating energy demand by region and country according to various likely constraints, including carbon trading. It applies it to three possible future scenarios. The first is a business-as-usual projection envisaging no measures to reduce greenhouse gases beyond those already in place. In the second, a limited-trade scenario, high-income countries aim for an 80% reduction by 2050 relative to 2000, with the rest of the world making whatever further reductions are needed to achieve a 50% global reduction by 2050. In the third, a full-trade scenario, only the 50% target is imposed on the system, and cuts are made wherever it

“Health benefits are not usually taken into account when deciding between policies affecting electricity production, whether or not that policy considers climate change. Here, we make a case for doing so.”

Anil Markandya et al. Public health benefits of strategies to reduce greenhouse-gas emissions: low-carbon electricity generation.

is most cost effective to do so. In this case, low-income countries have more low-cost options, so they would make greater cuts.

With use of another standard method the analysis calculates exposure to outdoor particle pollution, and the consequent number of deaths due to cardiorespiratory disease and lung cancer in adults, and acute respiratory infections in children.

Benefits for health

Within the EU, even if the policy remains business as usual, improved technology and a decreasing use of coal will bring about a fall in particle emissions by 2030, and a reduction in deaths. However, the full-trade alternative would save an extra 100 life-years per million of the EU population in 1 year. The health gains of this scenario would be greater in China (a saving in 1 year of an extra 500 life-years per million people) and greater still for India (1500 life-years). The biggest gains would be in cardiopulmonary disease, followed by lung cancer. Health improvements due to a lessening of respiratory infection in children would be largely confined to India and China.

The more modest improvement to be expected in Europe arises from the relatively clean methods of burning fossil fuels already in use.

Key messages

- Changing methods of electricity generation to reduce CO₂ emissions would reduce particulate air pollution and deaths. The effect would be greatest in India and lowest in the EU
- The cost of these changes would be significantly offset by reduced costs of death from pollution, especially in China and India



Agriculture and food

Agriculture and food production account for 10–12% of greenhouse-gas emissions. Livestock farming is responsible for four-fifths of these emissions, which include methane (a greenhouse gas more potent than CO₂) emitted by ruminant animals. Land-use changes, including deforestation for livestock production, add substantial further emissions. Increasing affluence boosts meat consumption, and forecasts predict livestock production will increase dramatically in the future to meet consumer demand. Heart disease, diabetes, some cancers, and other disease associated with overnutrition, high fat diets, and reduced exercise are already increasing in some countries of low and middle income.

The study identifies several changes being implemented in farming practices to reduce emissions: greater efficiency in livestock farming; more carbon capture through changes in land use; better manure management; and less dependence on fossil fuels. These four changes are necessary but unlikely to be sufficient to meet the 2030 target for greenhouse-gas emissions, and the study assesses the consequences for health of a fifth approach: a 30% reduction in



Libby Welch, Wellcome Images

“Reduction of greenhouse-gas emissions in the food and agricultural sector could help to prevent climate change and reduce the burden of ischaemic heart disease.”

Sharon Friel et al. Public health benefits of strategies to reduce greenhouse-gas emissions: food and agriculture.

livestock production. The study assumes that this cut would lead to a similar fall in the consumption of meat and dairy produce. It illustrates the likely effect on health with use of data from the UK (a high-income country) and the city of São Paulo, Brazil (a country with an economy in transition, but high meat consumption).

Benefits for health

A 30% fall in the adult consumption of saturated fat from animal sources would reduce heart disease in the population by around 15% in the UK and by 16% in the city of São Paulo, Brazil. If the study had used additional health outcomes such as obesity and diet-related cancers, the health gains might have been even more substantial.

The trade in livestock is global, and the suggested policies might have their full effect only if applied worldwide. Because of current inequalities in the availability of food products, policies in the agricultural sector should ensure that the nutritional requirements of all populations are met.

Key messages

- The food and agriculture sector contributes 10–12% of total global greenhouse-gas emissions, with additional contributions from land use change
- Demand for animal source foods is increasing
- Achieving a substantial cut in greenhouse-gas emissions will depend on reducing the production of food from livestock and on technological improvements in farming
- A reduction in consumption of animal source foods could have great benefits for cardiovascular health

Short-lived greenhouse pollutants

Short-lived greenhouse pollutants, which derive mostly from fuel combustion in the power, transport, and household sectors, include materials with global warming and global cooling effects. Even though all these pollutants apart from methane last only a few weeks at most in the atmosphere, overall they account, directly or indirectly, for a substantial proportion of global warming, and for the bulk of the direct damage to human health from global energy use. The pollutants include sulphate, organic and black carbon particle aerosols, carbon monoxide, non-methane volatile organic compounds, and other gases that are responsible for ozone creation, such as methane and nitrogen oxides.

Benefits for health

Whether they are warming or cooling, all short-lived greenhouse pollutants—or, in the case of methane, its atmospheric byproduct, ozone—affect human health. Atmospheric ozone and sulphate, for example, are both associated with cardiopulmonary toxicity. Breathing air laden with particles from fuel combustion is associated with increased morbidity and mortality. WHO has estimated that in 2000 this caused well over 2 million premature deaths. But the relative toxicity of particles of different chemical composition is uncertain.

Patterns of emission of short-lived greenhouse pollutants, and exposure to them, vary greatly; and because they are short-lived, their health effects

“All short-lived greenhouse pollutants, whether warming or cooling, have effects on health when people are exposed to them or, in the case of methane, their atmospheric byproduct, ozone.”

Kirk R Smith et al. Public health benefits of strategies to reduce greenhouse-gas emissions: health implications of short-lived greenhouse pollutants.

depend on local and regional factors such as weather, geography, and population distribution. Some of the existing data for toxicology and epidemiology seem to be contradictory. These and other factors impede the formulation of optimum control strategies.

Key messages

- In the atmosphere, a combination of sulphate and black carbon seems to signal a significant risk factor for cardiovascular mortality. Evidence is growing that ozone too can cause death. Reduction of atmospheric concentrations of all three will benefit health
- There is little evidence that sulphate particles, which are climate cooling, are less harmful to health than are undifferentiated particles, and some evidence that they are more harmful. Measures needed to protect health could, in this case, be at odds with measures needed to tackle climate change
- Because of their short lifetimes in the atmosphere, a reduction in the emissions of black carbon and ozone precursors will offer almost immediate benefits



Policy implications and call to action

“We call on health professionals to reach beyond conventional professional boundaries to collaborate with policy makers and scientists concerned with the study, development, and implementation of policies and technologies to mitigate climate change.”

Andy Haines et al. Public health benefits of strategies to reduce greenhouse-gas emissions: overview and implications for policy makers.

These studies show that despite uncertainties about size and timescale, some policies intended to reduce the output of greenhouse gases can be expected to yield public health improvements. These improvements will offset some of the costs of mitigating climate change. These co-benefits are important not only because they may provide an additional rationale to pursue mitigation strategies, but also because progress has been slow to address international health priorities such as the UN Millennium Development Goals (MDGs) and reductions in health inequities. Careful selection of climate change mitigation measures will therefore benefit both the environment and public health.

Some policies, such as the promotion of some types of biofuel, may have adverse effects on health. Therefore the health effects of mitigation policies should be assessed.

The original UN Framework Convention seeks to protect the environment, economic development, and human health. The health gains associated with climate change mitigation policies have received little attention up to now and must feature more prominently in discussions at the Climate Change Conference of December, 2009. We call on health professionals to educate the public and policy makers about the health effects of climate change and the benefits of greenhouse-gas mitigation.

In view of the trillions of dollars likely to be spent on greenhouse-gas mitigation in the coming decades, the relatively small resources needed to guide investments along paths bringing the world closer to its health and climate goals would be money well spent.

Acknowledgments

For further information about this Series see <http://www.thelancet.com> and <http://www.wellcome.ac.uk/climatechange>

Geoff Watts wrote the Executive Summary for *The Lancet Series on Health and Climate Change*.

Task Force on Climate Change Mitigation and Public Health

London School of Hygiene and Tropical Medicine, London, UK Andy Haines (chairman), Ben G Armstrong, Zaid Chalabi, Alan D Dangour, Phil Edwards, Karen Lock, Ian Roberts, Cathryn Tonne, Paul Wilkinson, James Woodcock; American Cancer Society, Atlanta, GA, USA Michael J Thun; BC3 (Basque Centre for Climate Change), Bilbao, Spain Aline Chiabai (also at University of Bath) Anil Markandya; Brigham Young University, Provo, UT, USA C Arden Pope III; Edinburgh Napier University, Edinburgh, UK Vicki Stone; Food Climate Research Network, University of Surrey, Surrey, UK Tara Garnett; Health Canada, Ottawa, ON, Canada Richard T Burnett; Health Effects Institute, Boston, MA, USA Aaron Cohen; Indian Institute of Technology, Delhi, India Ishaan Mittal, Dinesh Mohan, Geetam Tiwari; Imperial College London, London, UK Richard Derwent; King's College London, Environmental Research Group, London, UK Sean Beavers; London International Development Centre, London, UK Jeff Waage; National Centre for Epidemiology and Population Health, The Australian National University, Canberra, ACT, Australia Ainslie Butler, Colin D Butler, Sharon Friel, Anthony J McMichael; New York University School of Medicine, New York, NY, USA George Thurston; San Diego State University, Graduate School of Public Health, San Diego, CA, USA Zohir Chowdhury; St George's, University of London, Division of Community Health Sciences, and MRC-HPA Centre for Environment and Health, London, UK H Ross Anderson, Richard W Atkinson, Milena Simic-Lawson; Takeda International, London, UK Olu Ashiru; University of Auckland, School of

Population Health, Auckland, New Zealand Graeme Lindsay, Alistair Woodward; University of California, Berkeley, School of Public Health, Berkeley, CA, USA Heather Adair, Zoe Chafe, Michael Jerrett, Seth B Shonkoff, Kirk R Smith; University College London, Bartlett School of Graduate Studies, London, UK Michael Davies, Ian Hamilton, Ian Ridley; University College London, Energy Institute, London, UK Mark Barrett, Tadj Oreszczyn; University of Grenoble and CNRS (Centre Nationale de Recherche Scientifique), Grenoble, France Patrick Criqui, Silvana Mima; University of Liverpool, Division of Public Health, Liverpool, UK Nigel Bruce; University of Oxford, School of Geography and the Environment, Centre for the Environment, Oxford, UK David Banister, Robin Hickman; University of Ottawa, Ottawa, ON, Canada Daniel Krewski; University of Warwick, Health Sciences Research Institute, Coventry, UK Oscar H Franco; World Health Organization, Geneva, Switzerland Simon Hales, Diarmid Campbell-Lendrum.

Financial support

The project that led to this Series was funded by the Wellcome Trust (coordinating funder); Department of Health, National Institute for Health Research; the Royal College of Physicians; the Academy of Medical Sciences; the Economic and Social Research Council; the US National Institute of Environmental Health Sciences; and WHO. The Royal College of Physicians was supported by an unrestricted educational grant from Pfizer. The funders had no role in the design, analysis, or interpretation of the study. The views expressed are those of the authors and do not necessarily reflect the position of the funding bodies.