Department of Energy & Climate Change

Department of Energy & Climate Change
3 Whitehall Place,
London SW1A 2AW

www.decc.gov.uk

Our ref. EIR 2014 24122

25 November 2014

Re: The use of fossil fuel

Thank you for your above-titled email dated 28th October 2014 to the Department of Energy and Climate Change (DECC), in which you requested the following information:

What empirical evidence do you have/do you rely on to support your view that human emissions of CO2 will cause catastrophic global warming?

What empirical evidence do you have/do you rely on to support your view that the growth of global population will cause a shortage of food or resources?

What technologies will be developed over the next 100 years that may alleviate/negate both issues?

We have considered your request in accordance with the Environmental Information Regulations 2004 (EIRs) as the information you have sought disclosure of does, in our view, fall within the definition of 'environmental information' as stated in the EIRs.

Information that addresses your questions is available in the public domain.

Evidence for 'human emissions of CO_2 will cause catastrophic global warming'

DECC relies upon the scientific evidence that has been published in peer-reviewed journals and other information sources within the public domain, for confirmation of the reality and potential dangers of global warming and resulting climate change.

This evidence is produced by a wide range of academic, research and other organisations in the UK and around the world. The actual data underpinning this evidence is held by various organisations, including for example the Met Office (http://www.metoffice.gov.uk/), The Climatic Research Unit (http://www.cru.uea.ac.uk/), NASA (http://www.giss.nasa.gov/) NOAA

(http://www.noaa.gov/) and various other institutes throughout the world. However, DECC does not hold such data.

Assessments and reports produced by the Intergovernmental Panel on Climate Change (IPCC; see www.ipcc.ch/index.htm) and analysis by the Committee on Climate Change (CCC; see www.theccc.org.uk/) provide key summaries of much of the scientific evidence for global warming and the risks of dangerous climate change, due to human-caused emissions of greenhouse gases including, primarily, carbon dioxide (CO_2).

The IPCC's Fifth Assessment (AR5) Report, which was published in four volumes over the past 14 months, is regarded as the world's most comprehensive and authoritative source of recent scientific, technical and socio-economic information on climate change. The first (Working Group 1) volume, entitled *The Physical Science Basis of Climate Change*[1], presents a summary of the observational evidence for recent changes to the Earth's climate and concludes that '*Warming of the climate system is unequivocal and since the 1950s, many of the observed changes are unprecedented over decades to millennia'.* The WGI report also shows that climate models can only explain the warming over recent decades by taking into account the effects of human emissions of greenhouse gases.

As described in the IPCC's WGI report, climate models project that, in the absence of significant reductions in greenhouse gas emissions, the mean global temperature could rise by as much as 5°C over this century. The response of the climate system to continued increases in greenhouse gas emissions would almost certainly be unprecedented in geological history and will very likely have serious consequences for human society during this century. As noted in the report, the fact that climate models correctly reproduce the 20th century temperature history and have been able to capture the key features of past climate change gives scientists confidence in the reliability of climate model projections of future climate change.

Impact of global population growth on food resources

We have addressed your second question within the context of climate change. Global population increased by about 3.2 billion between 1970 and 2009[2] but had no significant impact on global resources – world food production grew faster than population and per capita consumption increased[3]. According to the United Nations, the world's population is predicted to rise to about 9½ billion people by 2050, which would be a slower rate of growth than for the previous 40

[1] See http://www.ipcc.ch/report/ar5/wg1/.
[2] See http://esa.un.org/wpp/.
[3] N Alexandratos & J Bruinsma, 2012, world agriculture towards 2030/2050: the 2012 revision, ESA working paper no. 12-03, Rome FAO. http://www.fao.org/fileadmin/templates/esa/Global_persepctives/world_ag_2030_50_2012_rev.pdf.

years[2]. This population increase, along with changes in diet, will mean that agricultural production will need to increase by 60% on the basis of current food consumption trends just to feed the growing population (see Chapter 7 of the IPCC's AR5 Working Group II Report, on *Impacts, Adaptation & Vulnerability*). However, as also shown in Chapter 7 of the IPCC WGII Report, Figure 7.4, global agricultural production is expected to progressively decrease as the rise in global average temperature associated with greenhouse gas forcing is increasingly felt, adding stress to an already challenging situation.

Section 7.2 of Chapter 7 describes some of the currently observed impacts on crops due to rising global temperatures, in particular from extreme weather events, which are expected to increase in severity and frequency in future decades as the world continues to warm.

Mitigation Technologies

The range of low carbon technologies presently available or envisaged that are expected to help address the two issues raised in your request, are outlined in Chapters 7 to 9 of the third (Working Group III) volume of the IPCC AR5 Report, on *Mitigation of Climate Change* and the references therein. These technologies include:

- Renewable energy sources (e.g. wind power, solar power, wave power and heat pumps). The IPCC have published a special report on these technologies which can be downloaded from http://www.ipcc.ch/report/srren/
- Fossil fuel based electricity generation combined with carbon capture and storage (CCS). This involves removing CO_2 from power station exhaust gases and burying it in secure underground reservoirs. CCS combined with fossil fuel burning avoids additional CO_2 being released into the atmosphere from those sources, which have been locked out of the carbon cycle for millions of years. However, CCS can also be combined with biomass (e.g. wood chips) burning power plants, a combination that effectively reduces the atmospheric CO_2 concentration because biomass is derived from biological material that was already part of the present-day carbon cycle. A demonstration biomass project, known as the White Rose Project, is planned at Drax in the UK. For further details see, http://www.whiteroseccs.co.uk/about-white-rose.
  The IPCC have published a special report on CCS technology which can be downloaded from http://www.ipcc.ch/report/srccs/.
- Nuclear energy. See https://www.gov.uk/government/policies/increasing-the-use-of-low-carbon-technologies/supporting-pages/new-nuclear-power-stations.

- Low carbon transport, e.g. vehicles powered by electricity, fuel cells. See https://www.gov.uk/government/publications/low-carbon-transport for more information.
- More efficient use of energy. See http://www.theccc.org.uk/tackling-climate-change/reducing-carbon-emissions/what-can-be-done/using-energy-more-efficiently/ for further information.

Low carbon technologies, if implemented successfully, will help to limit future rises in global temperature and will thus also contribute to alleviating the adverse impacts of climate change on societies and ecosystems in the near future. There are other potential low carbon energy technologies, most notably nuclear fusion, which have not yet been effectively demonstrated – and indeed it is possible that there are others which are as yet unknown. Government policy is therefore to ensure a suitable policy framework to stimulate the deployment of viable low carbon technologies, and also supporting innovation to bring forward new technologies.

A slower rate of change in warming will increase the likelihood that suitable adaptation measures can be applied to help offset the effects of climate change on agriculture. As shown in Figure 7.4 in Chapter 7, IPCC WGII AR5 Report, effective adaptation can reverse the projected decline in cereal crop production in temperate countries and reduce the rate of decline in tropical countries. Adaptation measures are region-specific but it should be noted that agriculture, food security and nutrition are highly sensitive to changes in rainfall associated with climate change. A range of agronomic measures, such as altering cultivation and sowing times, developing crop cultivars with greater resilience to drought and heat extremes and more efficient irrigation systems, could help reduce the impacts of climate change on food resources. More detailed information is given in section 7.5 of the WGII report. Also reference 2 cited above considers likely future diets in developed and developing countries up to 2050.

Geo-engineering has also been proposed as a potential mitigation option for addressing climate change. This could involve large scale deliberate human intervention in the global environment to counteract the effects of climate change, either by direct removal of greenhouse gases from the atmosphere or by reflecting some of the sun's energy that reaches the Earth's surface back into space. However, based on the evidence currently available, it is premature to consider geo-engineering as a viable option for supplementing mitigation efforts and further research is needed to understand better the potential risks and benefits of such technology. The Government's view on geo-engineering can be found at:
https://www.gov.uk/government/publications/geo-engineering-research-the-government-s-view

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An overview of geo-engineering has been published by the Royal Society and a copy of their report can be downloaded from:
https://royalsociety.org/policy/publications/2009/geoengineering-climate/

Appeals Procedure

If you are dissatisfied with the handling of your request, you have the right to ask for an internal review. Internal review requests should be submitted within 40 working days of the date of receipt of the response to your original letter and should be sent to the Information Rights Unit at:

Information Rights Unit
Department for Business, Innovation & Skills
1 Victoria Street
London
SW1H 0ET
E-mail: foi.requests@bis.gsi.gov.uk

Please remember to quote the reference number above in any future communications.

If you are not content with the outcome of the internal review, you have the right to apply directly to the Information Commissioner for a decision. The Information Commissioner can be contacted at:

Information Commissioner's Office, Wycliffe House, Water Lane, Wilmslow, Cheshire, SK9 5AF

Yours sincerely

Science Team
Department of Energy and Climate Change