

Introduction to Special Topic: Energy Pathways to a Low-Carbon Society

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Introduction to Special Topic: Energy Pathways to a Low-Carbon Society

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Energy and carbon are at the nexus of climate change, environment, health, and socio-economic development. The imperative to move towards cleaner and renewable energy to reduce greenhouse gas is gaining significant public and private sector support. Reducing carbon in the atmosphere has fast emerged as a major means to achieve this, since carbon content can be measured and hence the pathways can be well-defined. The December 2009 Copenhagen Accord recognized “the scientific view that the increase in global temperature should be below 2 degrees Celsius on the basis of equity and in the context of sustainable development.” To achieve this goal, the emerging scenario (e.g., the International Energy Agency (IEA) Report: World Energy Outlook 2009) is that the atmospheric concentration of CO₂ be stabilized at around 450 ppm. If global emissions peak in 2015, we estimate that annual reductions in CO₂ concentration of up to 5% would be necessary, equivalent to the Kyoto Protocol targets. Delaying reductions beyond the 2015 peak, however, would necessitate more drastic reduction rates that would be very difficult to achieve. To reach the necessary annual reduction in either case, investment in nonfossil energy must be significantly increased. © 2010 American Institute of Physics. [doi:10.1063/1.3459736]

The role of black carbon and sulfates in climate change and global warming is increasingly recognized. Recent United Nations Environment Programme (UNEP) publications indicate that black carbon is the second largest contributor to global warming after carbon dioxide¹ and could be two to four times more heat-forcing than estimated by the 2007 Intergovernmental Panel on Climate Change (IPCC) Report.² Black carbon particles and other aerosols that form atmospheric brown clouds impact human health and well being, as well as ecosystem functions.³⁻⁵

The impact of increases in atmospheric carbon catalyzed the 2008 G8 Toyako Summit of Leaders' endorsement of a move towards a low-carbon society and the establishment of the Low Carbon Society Research Network (LCS ResNet) with the Secretariat in Japan.⁶ Momentum was also given by the April 2009 Royal Society London Nobel Laureates Symposium on Climate

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Change: The St. James's Memorandum "Action for a Low Carbon and Equitable Future" called for "The fiercest urgency of now."⁷ The July 2009 UK Government Low Carbon Transition Plan⁸ to cut emissions by 34% compared to 1990 levels by 2020 envisages more than 1.2 million people in green jobs. It is just one example of the job creation potential in low-carbon transitions.

The role of society in a low-carbon transition is critical. The G8 concept of a low-carbon society recognizes this and provides an overarching, holistic framework to encompass the critical roles of technology and development to achieve a low-carbon economy. Going beyond carbon neutral is the ultimate transition goal. Increased and accelerated research and development are needed, along with enabling policies, to make available the technology that will produce carbon-free energy. The pathway to a low-carbon society paradigm includes (1) technology, (2) economic incentives, (3) financing mechanisms, (4) normative measures, (5) societal determinants, (6) innovative partnerships, (7) education, training, and capacity building, and (8) enabling policies. The articles in this Special Topic section^{9–21} provide a starting point to elaborate on these themes and accelerate the movement towards a low-carbon society. It is hoped that the Copenhagen Accord will catalyze further thinking and debates to improve knowledge and encourage application for the transition towards low carbon; a major means to a sustainable and clean energy future.

This special topic section endorses the fundamental premise that minimizing CO₂ emissions through low-carbon pathways, including improving energy efficiency, makes economic and environmental sense. The pathways discussed in the contributed papers will help maximize the availability of finite sources of fossil fuels; an important step toward meeting increasing global demand and the need for sustainable development.

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