APPROPRIATE TECHNOLOGIES FOR SAVING THE PLANET

CLIMATE CHANGE AND THE FLORIDA KEYS

FACT SHEET 9

FKNMS/NOAA SOCIOECONOMIC RESEARCH AND MONITORING PROGRAM

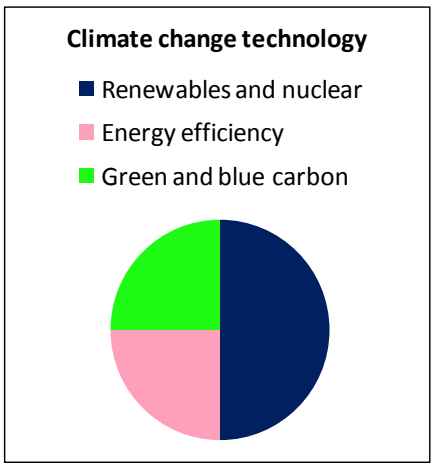
The views and recommendations are the author's and are not necessarily endorsed by NOAA.

THE NATURE OF TECHNOLOGY

This is the title of a book by Brian Arthur who is associated with the Santa Fe Institute in New Mexico and a leader in complexity economics (see Fact Sheet 8). Inspired by Joseph Schumpeter, Arthur developed a theory of technological change generated within the economic model, leading to *increasing* rates of return in a dynamically changing economic system, whereas the static neoclassical economic model shows decreasing returns.

Arthur's model explains technology as a continuous, organically evolving process which bears a strong resemblance to Darwin's theory of evolution (though the selection process has to be different). Innovation doesn't arise out of thin air but is *always* based on current technology, and once an innovation is adopted, it gives rise to further change involving a hierarchy of underlying technologies. The whole pattern is subject to continuing evolution and has to keep fitting in with this evolution in conditions of constant dynamic change.

APPROPRIATE TECHNOLOGIES



The background technology paper named in the further reading list identifies three main groups: energy technologies including renewable sources such as solar, wind, geothermal, hydro, and oceanic, plus nuclear energy; energy efficiency technologies with the main contribution coming from efficient building design and distribution of energy; and land and coastal management technologies to preserve and improve carbon sinks. "Green carbon" technologies are based on forestry and agricultural activities which have profound potential because they can be adopted in poor and rich nations at small and large scale. Biotechnology is advancing fast in support of these technologies and (like nuclear energy) is gaining acceptance. "Blue carbon" coastal management technologies serve to protect mangroves, seagrasses, and salt marshes which play a vital role through their photosynthetic activities in transferring CO_2 into long-term storage in the deep ocean.

The findings support the IPCC model that technology is a main driving force together with demographic change and economic development (see tree diagram in Fact Sheet 1).

However, there is no single-solution "silver bullet" allowing humanity to switch from fossil-fuel to renewable-energy technologies. Solutions along a broad front and involving the entire planet are required.

TECHNOLOGY DIFFUSION

It follows from Brian Arthur's model of technological development that the more sources there are, the more readily technological change will happen. Innovative and inventive activity were until quite late in the 20th century concentrated in the richest countries, but the evidence is strengthening that genuine innovation (as distinct from existing technologies copied from the rich countries) is spreading to other countries.

It fits Arthur's model that developing countries are moving into real innovative activities of their own: new technology may be initially imported but it will then be refined and adapted to particular applications within the countries themselves, and eventually lead to genuine innovations there. The result is an expansion of the genuinely inventive base of the planet, from the richest countries through upper- and even lower-middle-income countries.

INAPPROPRIATE OR IRRELEVANT TECHNOLOGIES

The Economist, in a new article, notes a big increase in the number of research papers on geoengineering over the past three years – large-scale proposals for fixing the problem after the greenhouse gases have been emitted, rather than trying to stop the emissions from happening. Large geoengineering "solutions" to the global warming problem are generally dismissed, mainly because they are environmentally risky. In addition, it will take years to develop these technologies at a time when climate change has become critically urgent. Finally, geoengineering cannot be part of a basic scenario because it represents possible solutions based on technologies that don't yet exist: the IPCC scenarios are supposed to run their course without action to change their impact.

One group of proposed geoengineering technologies is to seed the stratosphere with sulfur particles to deflect incoming sunlight back into space – but it is fraught with risks according to a Royal Society analysis of geoengineering options. Many proposals would also be prohibitively expensive such as placing trillions of reflective metal strips at the point in space where the earth's gravity pull matches that of the sun. In short, options that can be grouped as geoengineering in the sense of significant manipulation of nature are not part of the scenarios.

In contrast to geoengineering, nuclear energy is regarded as a technological option, although the degree to which it is adopted varies between the four scenarios. Nuclear energy exists, however, and it is being further developed. There is a growing consensus that it may be overcoming its problems of security, other risks, cost, and waste.

SUPPORTING APPROPRIATE TECHNOLOGICAL DEVELOPMENT IN ALL COUNTRIES

This is becoming increasingly important. It reflects Nicholas Stern's observation that climate change and the poverty in developing countries are inextricably linked. As well as directing the attention towards specific renewable energy technologies and particular scales of applying these technologies, beating the poverty trap also means encouraging other

technologies with which the climate-related technologies interact. The introduction of microcredit in the least developed countries (starting in Bangladesh) and the current rapid adoption of cheap cell phone and computer technology are important examples, but there will be others which are likely to vary considerably between countries.

HHG November 7, 2010

Further reading:

Climate Change and the Florida Keys, Chapters 2 and 7.

Background paper 4 (*Technology and Climate Change*).

Brian Arthur (2009), *The Nature of Technology: What it is and how it evolves* (Penguin, London, U.K. and The Free Press, Simon & Schuster, New York).

Peter Cosier (2008), *The Economics of Nature.* Economic and Social Outlook Conference, University of Melbourne, Victoria. 28 March. http://www.wentworthgroup.org/docs/The%20Economics%20of%20Nature%20-%202008%20Outlook%20Conference%20Final%20_41.pdf.

Chris Goodall (2008), *Ten Technologies to Save the Planet.* Profile Books, London, UK.

Christian Nellemann et al. (ed.) (2009). *Blue Carbon: A rapid response assessment.* United Nations Environment Program, GRID-Arendal. http://www.grida.no/publications/rr/blue-carbon/.

Stephen Pacala and Robert Socolow (2004), 'Stabilization wedges: Solving the climate problem for the next 50 years with current technologies'. *Science*, Vol. 305, 13 August.

John Shepherd et al. (2009), *Geoengineering the climate: science, governance and uncertainty.* The Royal Society, London. September.

Vandana Shiva (2005), 'Two myths that keep the world poor.' *Ode*. November. http://www.odemagazine.com/doc/28/two_myths_that_keep_the_world_poor/.

The Economist (2010), 'Geoengineering: Lift-off'. London, November 4.

Pictured: "A face of current technology", Venice, CA (HHG 2005)