Chapter 14

Climate change, poverty eradication, and sustainable development

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What is the principal challenge facing humanity in the twenty-first century? Is it the challenge of lifting billions out of poverty into a life of dignity? Or is it one of ensuring that we do not transgress the boundaries beyond which the risks of catastrophic environmental change are unacceptably large? In my view the word 'or' in the previous question is misleading. The two challenges are now so connected that coping with one requires that we cope also with the other. That is what sustainable development is all about – how poverty eradication and environmental protection can be mutually supportive.

The persistence of poverty[1] can be attributed to many factors, but, of these, resource poverty is the crucial one. A large proportion of the world's poor live in the rural areas of the developing world and face a growing scarcity of land and water. Many of them are in ecologically fragile regions such as arid and semi-arid zones, mountain areas, coastal areas exposed to violent weather, and so on. A critical dimension of resource poverty is the lack of access to safe and sustainable energy. In developing countries some 2.5 billion people are forced to rely on biomass – fuelwood, charcoal, and animal dung – to meet their energy needs for cooking. Indoor air pollution claims the lives of 1.5 million people each year, more than half of them below the age of five. 1.6 billion people – a quarter of humanity – live without electricity.

For all of these people in poverty, as well as for policymakers in the developing world, development that raises productivity, production and income is understandably the highest priority. Slowing down economic growth is not an option that they can consider. But I would argue that growth that is more mindful of the local environment is something that they can and should pursue, for it is the poor who are most exposed to environmental stress and resource poverty. Hence, when it comes to climate change, mitigating the risks and adapting to the changes that are unavoidable have to be components of any long-term strategy for poverty eradication.

The issue is not what we do first. Climate change is a threat that could worsen global inequality because it will affect low-latitude developing countries to a greater extent, and mostly in an adverse manner. Changes in water availability, the increase in vector-borne diseases such as malaria, and the greater risk of extreme climate events are some of the consequences that will affect the poor more than the wealthy. Therefore, the real challenge is to find solutions that address both problems simultaneously. This is the goal of sustainable development.

[1] The facts about poverty are well known: 2.6 billion people live on less than two US dollars per day, 800 million go to bed hungry every day, 26 000 children die every day because of poverty, a billion people entered the twenty-first century unable to read or write, 72 million children should be but are not in school, 1.1 billion people in developing countries have inadequate access to water, 2.6 billion lack basic sanitation, a billion urban dwellers live in slum conditions, and 1.4 million children die every year due to lack of access to safe water and sanitation (http://www.globalissues.org/article/26/poverty-facts-and-stats. Accessed 14 January 2009).

According to the Brundtland Commission, 'Sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations' (World Commission on Environment and Development, 1987, p. 46). The risks associated with climate change are clearly not consistent with this notion of sustainability. As the present author, who was involved in the writing of the Brundtland Commission's report, has stated elsewhere that 'Environmental resources like biodiversity or the delicately balanced chemistry of the atmosphere are resources which are critical to the maintenance of life on Earth. In such cases the objective of sustainability would require conservation in a stricter sense since compensation to preserve options may not be possible' (Desai, 2007, pp. 506–9).

A sustainable development strategy that addresses this risk must involve changes that mitigate the risk, and measures that help people to adapt to the climate change that is unavoidable even with mitigation efforts.

Mitigation

The key to mitigation lies in rethinking energy policy. The carbon dioxide emitted by fossil fuel use is not the only greenhouse gas, but it is by far the most important, and the one most amenable to policy influences. In 2005 humans emitted some 27 billion tonnes of carbon dioxide into the atmosphere as a result of fossil fuel use – this is a little over 4 tonnes per capita. This aggregate hides huge differences – the per-capita figures are 20 tonnes for the USA, 12 for Russia, 8 for Europe, around 3.5 for China, and 1 tonne for India (Energy Information Agency, 2006).

The scientific consensus is that to contain climate change risks to a manageable level, by 2050 carbon dioxide emissions will have to be 50–75% lower than the business-as-usual level. The challenge of energy policy is to bring the global per-capita emission of carbon dioxide down to about 1 to 1.5 tonnes within this time frame. Another way of stating the challenge is that we need to increase our carbon productivity tenfold from the current level of around USD 740 of GDP per tonne of carbon dioxide emitted – an effort comparable in scale to the increase in manufacturing labour productivity over a century during the Industrial Revolution (McKinsey Global Institute, 2008, pp. 10–11).

Climate change is a global externality and requires a depth of cooperation between countries that goes far beyond anything we have experienced so far. The challenge is to agree on a fair sharing of environmental space between those who have occupied it first and those who are now in need of room to grow. A control on emissions will be required and, as Amartya Sen states in his interview at the Potsdam Nobel Laureate Symposium, the key questions are, who should do how much,

and how should the costs be shared (Sen and Stern, 2007)? Should the long-term goal be to converge towards equal per-capita emissions at a level consistent with manageable climate change risk, say 1–1.5 tonnes by 2050? Or should those who have occupied the space with their past emissions do more to create space for the newcomers?

The risks of climate change depend on the cumulative emissions of greenhouse gases, and judgements about the fairness of alternative proposals on limits should take this into account. An illustrative calculation, presented in Table 1, shows that, even with limits greater than what are on offer at the moment, the developed world with less than one-sixth of the world population will occupy roughly one-half of the incremental space.

Energy consumption in the developing world is rising – as it should, given the present level of energy poverty. The big question for sustainability is whether the increase in energy demands that will necessarily accompany the move out of poverty can be met by low-carbon supply alternatives that are environmentally sustainable. In the developed world, adjustment must extend to already established energy consumption patterns. Thus, the real challenge is to manage demand. Is there a price that will be paid in terms of growth as we move to alternate energy paths? Or can the low-carbon alternatives provide an opportunity for new growth possibilities, particularly in regions deficient in fossil fuel resources, just as electricity did when it was first introduced?

Low-carbon growth may provide new business opportunities. But it also involves additional costs over and above the business-as-usual scenario. Some of the savings that arise from improved efficiency may have negative or zero costs (or collateral benefits, which amounts to the same thing). However, the required emissions reduction of 50–75% by 2050 will involve moving beyond low-carbon growth to measures that involve net additional costs. A recent McKinsey study has estimated that the abatement required to stay below 500 ppm of greenhouse gases will cost EUR 500–1100 billion in 2030, or about 0.6–1.4% of that year's projected global GDP (McKinsey Global Institute, 2008, pp. 15–16). However, 40+% of the abatement potential exists in the developing countries (excluding China), and will not be realized unless the transfers of finance and technology are substantially larger, more predictable, and more robust than at present. In addition, the developing world will need financial support for adaptation actions, which poses an even greater challenge because the rich countries do not see any direct return in terms of risk mitigation in this case. The application of the polluter-pays principle requires that the rich countries accept this obligation on the grounds that they are responsible for around 70% of accumulated carbon dioxide emissions from fossil fuel use since 1850.

Table 1. *Cumulative emissions of carbon dioxide from fossil fuel use (percentage share of world total).* (*Source:* Author's calculations based on data and BAU projections in Energy Information Administration, 2006).

	Developed countries	Developing countries	Developing Asia	Absolute amount ($GtCO_2$)
1980–2005	66.2%	33.8%	21.2%	568
2005–2030 BAU	53.8%	46.2%	33.3%	895
2005–2030 with cuts*	50.9%	49.1%	34.6%	841

*Cuts: In 2030 Europe 30% below 1990 level; North America and OECD Asia at 1990 level; business as usual (BAU) in Russia and developing countries.

Adaptation

Adaptation actions in the developing world have to address the links between poverty, ill health, population growth, and the deterioration of land, water and biotic resources at the local level. In the villages of the Asia, Africa and Latin America poverty eradication requires that the productivity of poor households is raised. This in turn requires a systematic effort to rehabilitate degraded land and water resources, and an integrated approach to land, water, and biotic management that respects climatic and other ecological constraints. The climatic changes which now are unavoidable will require that this will be even more necessary as a condition for poverty eradication.

In the rural areas of the developing world the impact of climate change will be felt directly through changes in precipitation, groundwater recharge, and river flows. Our knowledge about impacts in developing countries is still sketchy, and not all of the impacts will be negative. However a major change, even a favourable one, in something as basic as climate will require substantial societal, technological, and economic adaptation. The key instrument for such adaptation is water resource management. If we can get that right, many other things will also fall into place.

Balancing water use and availability in a watershed or river basin, setting priorities between competing demands, ensuring adequate drainage of used water, and maintaining water quality necessarily require that we get the land, forest, and settlement policies right. Rational land use, forest conservation in catchment areas, restoration of degraded lands, and land engineering for water retention and drainage are all aspects of water management. Public spending programmes for agriculture and rural development must be tailored to agro-climatic regions, and water resource planning must move away from civil engineering projects to become an element in integrated land and water management.

Climate change will change the physical geography of the planet, and this will lead to changes in its human geography too. One dimension of this is migration. The 60% of the world population that lives within 100 km of the coast will be affected by rising sea levels, worsening storm surges, saline intrusion, and so on. Many people will migrate, and much of this migration will be from one poverty-stricken area to another, as we already see among conflict refugees in Africa. But, as Amartya Sen points out, this will involve a slow process rather than sudden large-scale migration (Sen and Stern, 2007).

The population movements induced by climate change will come on top of a huge rural-urban shift. More and more of the population in the developing world will live in cities, which are already under pressure. Ensuring sustainable urbanization may be the most important challenge for coping with climate risks. The critical areas that need to be addressed are water, sanitation and energy use, particularly in transportation.

Economic and technological solutions

Energy, water and human settlements are the critical sectoral areas both for poverty eradication and for mitigation and adaptation actions to cope with climate change risks. The policies and programmes in these areas have to operate in a market economy where the most important challenge is to get prices right so that they reflect full social costs from the beginning to the end of the production and consumption process, including, particularly, the costs of waste disposal. Unfortunately the three sectors of greatest concern are precisely the ones where markets are distorted by subsidies and often operate inequitably.

The most important policy challenge for mitigation is carbon pricing (see Edenhofer *et al.* and Mirrlees, this volume). There is, at present, no cost attached to carbon emissions in most countries, the few exceptions being those where some form of carbon taxation is in force. The market in carbon credits that has emerged with the establishment of emission caps fulfils a similar purpose. In a market economy the most effective instrument for promoting mitigation is to ensure through taxes or cap-and-trade systems that the global social cost of carbon is reflected in the calculations of companies, which decide on investments and develop new techniques, and of individuals, who consume goods and energy.

In the long run, the scale of adjustment required is such that we have to look to radically new technologies. Our past experience shows that a single, objective-oriented approach to technology development often leads to new problems. For instance, when CFCs were first introduced for refrigeration, aerosols, and foam rubber manufacture, they were considered safe chemicals because they are stable, non-corrosive, do not involve any explosion hazard, and are not directly toxic to

human beings. It was only later that their impact on the ozone layer and the consequences of this were understood (see Molina, this volume). A more germane example is that of biofuels whose indiscriminate promotion has led to inappropriate land use and unintended increases in food prices (see Creutzig and Kammen, this volume). Hence, any mission-oriented approach to carbon-saving technologies must be accompanied by a system of technology assessment that takes ecological and economic dimensions into account and keeps the principle of equity in sight.

The elements of a potential climate agreement

What are the elements of a potential climate accord that could address these problems in a manner that is, in Nicholas Stern's words, 'effective, efficient and equitable'?

First, we must agree on a long-term goal corresponding to an acceptable risk level for global warming. It has to be realistic enough to be attainable, yet ambitious enough to avert the more catastrophic consequences of temperature change. This will involve both an assessment of likely risks and value judgments about the level and distribution of the costs and benefits of mitigation measures. One point worth noting is the growing concern among scientists about potential tipping points that could cause serious change to the organisation and appearance of the Earth system, and produce consequent challenges for human society. Runaway climate change, which would make human life on Earth difficult if not impossible, is not a part of any projection; but we cannot currently rule out scientifically that it could be triggered.

Second, the most elementary notions of fairness require that the burden for immediate action must fall on those who are most culpable in terms of past emissions. The calculations presented above on how future cumulative emissions would be distributed suggest that the immediate commitments by the developed countries would need to be greater than what is being talked about at present. If the developed countries, USA and Russia included, fail to demonstrate a responsible sense of purpose, it will be difficult to persuade poorer countries, who have only just started on the path of energy consumption growth, to take on any serious commitment.

Third, the developing countries will also have to contribute to mitigation measures in the long-term. But their exemption from immediate commitments does not mean business as usual. Their energy consumption and emissions may grow. But they can and should be assisted in using all economically viable means to promote energy efficiency, to use lower-carbon energy alternatives, and to implement appropriate forms of demand management. It is in the global interest to provide concessional finance and technology transfer, first through means like the Kyoto

Protocol's Clean Development Mechanism (CDM, see Liverman, this volume), and second through the direct provision of soft loans and grants for mitigation efforts, including for deforestation avoidance and reforestation. One could even integrate the two strands by providing the soft grants for mitigation in the form of the purchase of carbon credits from developing countries that add to global mitigation because, unlike the CDM purchases, they are not used to offset developed country mitigation obligations.

Fourth, a certain degree of climate change is inevitable based on any realistic assumption of what the long-term agreed mitigation goal will be. The burden of adjustment to this change will be very unevenly distributed. Much of it will fall on countries that have limited financial and technical capacity to take on the additional effort required. These adaptation costs must be paid for in strict proportion to the responsibility for the problem (for example, as defined by cumulative emissions), and distributed according to need so that small island countries, for instance, receive much more in per-capita terms, because of their greater need, than large continental countries.

Finally, new technologies that save on carbon dioxide or other greenhouse gas emissions, or which sequester the emissions in some way, will be needed as we move to a point at which we do not add to the stock of greenhouse gases in the atmosphere. This will require cooperative arrangements beyond normal commercial exchanges for the development, dissemination, and sharing of these technologies.

All of these elements are envisaged in the agreements reached in the UNFCCC at Bali. They are being negotiated at present and are to be finalized by the end of 2009. The difficulty now is not the lack of a mandate but the willingness to recognize that time is running out and we do not have the option of concluding a weak agreement now in the hope that the next agreement a decade from now will be better.

Time to change our thinking

We need to change how we think, and move beyond inherited concepts to develop a common language of discourse between economists, ecologists, engineers, and ethical philosophers. Like an ecologist, we must respect the integrity of natural systems; but, like an engineer, we must be willing to intervene in these systems to meet human needs. The solutions proposed have to work in a market economy, and this is where the economist's concerns about balancing costs and benefits and choosing optimally between alternatives comes in. Every solution that is proposed will involve some distribution of responsibility within and between generations, and within and between the political jurisdictions into which the human population

and our planetary ecosystem are divided. This is where ethics comes in with its judgments of what is just and fair.

Effective global action on climate change will require such a synthesis. To an extent this has been achieved already as scientists, engineers and technologists look for creative solutions to climate change. The consensus-building process in the Intergovernmental Panel on Climate Change (IPCC) and the structured dialogue that it has promoted have clearly contributed to this. The economics of climate change are also receiving attention, while the recent seminal exercise led by Nicholas Stern has contributed hugely to the debate (Stern, 2007). But the degree of agreement that prevails in this area is well short of a consensus. The really difficult area is the ethical concern about burden-sharing, which has largely been left to the cut and thrust of diplomatic negotiations, where we have not moved beyond a few general principles such as 'common but differentiated responsibility'.

What we need is what Amartya Sen has called 'public reasoning'– a process of raising awareness not just about the problem but also about how it affects people differently, who has the capacity to cope and who needs help, the solutions that are available and those that still need to be found, and so on (Sen and Stern, 2007). But more than that, we need a sense of urgency. Ten years from now it may be too late to prevent catastrophic climate change. That will be a disaster both for sustainability and for development. The time to act is now.

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