Prof. Anthony Leiman has been teaching economics at UCT since 1987. Environmental issues have been the focus of his research for the past fifteen years.

Economic Planning for Sustainability in the Face of Climate Change

This pendant world, in bigness as a star
Of smallest magnitude close by the moon
(Milton, Paradise Lost bkII, ll1050/1)

Climate change is a fact of life. What isn't clear, though, is how South African policy makers should react to it. For a country in Africa merely having a large, disempowered population of urban poor should not preclude policies to counter global warming. But political realities may make the opportunity costs of imposing such policies unacceptably high. There is, of course, a counter-argument. Some cite Michael Porter's hypothesis that imposing strict regulation now will translate into increased competitiveness when such regulations become widespread in the future. What, then, are the real challenges to sustainability in South Africa, and how high up the ladder should climate change rank?

When Jack Pezzey wrote his first survey of the literature on sustainability in 1992[1], the number of definitions he found already ran into the thousands. Although authors on the topic seemed to take their cue from Humpty Dumpty and use the word to mean just what they chose it to mean, all were, to some extent, trying to answer the same questions. That said, some definitions were so fluffy as to be meaningless. The Brundtland Commission's definition of sustainable development was a classic of this sort. "Development that meets the needs of the present without compromising the ability of future generations to meet their own" is the sort of definition that gives policy makers no help at all. At the other extreme some presented simple operational rules. But with simplicity came narrowness. The Hartwick Rule[2] was a case in point. Dating back to the mid-1980s, its bottom line was that, to achieve sustainability in a mineral based economy, one should simply reinvest mining rents in activities that would yield real returns, and then live on those returns. A simple example is the person who uses the revenue from selling his family silver to buy a consol and then lives (sustainably) on the interest. Unfortunately, though, this sort of rule cannot be extrapolated to deal with the non-marketed by-products of the modern economy.

Sorting through the conceptual morass, however, one does find a number of commonalities. Writings on sustainability typically follow one or more of three strands: environmental, economic and political. The economic and political dimensions will return a little later in this article. For now it is enough to focus on the ecological/environmental dimensions, which are, after all, the ones most often associated with sustainability. The public eye is filled with images of pandas, whales and rhinos, and, amongst the more sophisticated, with visions of threatened ecosystems. This is not surprising. These are the aspects best suited to fund raising, and, consequently, most frequently and dramatically presented in the public media. Global warming too has sold itself to the media. This is not to say that it is not real, but that it has become the high profile face of much earnest fundraising.

The literature does not ignore the high profile aspects of environmental sustainability, but its perspective is broader and more balanced than the popular view. Ecological economics in particular looks at the ways in which production and consumption deplete non-renewable stocks, treat the environment as a waste sink, and increase entropy – in other words they increase

the proportion of energy and materials which are no longer usable with current technologies. This problem was elegantly identified by Boulding in his short essay, 'The Economics of the Coming Spaceship Earth'[3], a thought exercise prompted in part by the first space missions. In it he argued that ours is a closed system, that the era of the expanding frontier and apparently limitless resources is gone, and that consequently any activities that affect the Earth's ecological balance may have dire consequences.

The article of faith on which most western economists fall back when all else is fails, and which they are most reluctant to abandon, is that, whatever its limitations, the market mechanism is still the best available means for allocating resources and meeting society's needs.

This leads us to the challenge of anthropogenic climate change and the global warming debate, a debate which has been gaining intensity for over twenty years. Interestingly, as the scientific element of the debate has lost heat, so the economic component has warmed. It seems sensible to start any discussion on climate change with a rhetorical question: if the science is so assured, why is the policy response in doubt? The answer to this question, as to so many in economics, is found in the price mechanism. The article of faith on which most western economists fall back when all else is fails, and which they are most reluctant to abandon, is that, whatever its limitations, the market mechanism is still the best available means for allocating resources and meeting society's needs. When faced by the Malthusian predictions of the Club of Rome[4] the consensus economic response was that these had emerged because the Club's model had ignored the market. As any resource becomes increasingly scarce so its price rises; the result should be increased incentives to explore, to improve the efficiency of production methods and to adapt, engendering substitute inputs and new technologies. The ingenuity of man and the power of the market will keep human welfare rising despite depleting resources. This view became the foundation of neoclassical weak sustainability.

But what of resources that are not traded and have no price – resources like the atmosphere around us and the global climate it determines? After seeing the financial carnage of the past three years, itself a result of market freedom, an economic sceptic might further ask, 'Didn't the free market also cause global warming, and can it cure climate change?' While the rise in atmospheric carbon is clearly a consequence of increasing populations and rising living standards, I believe that the answer to both questions is unambiguously, 'No'. The question we should be asking is a different one, 'Can the free market mitigate the effects of climate change sufficiently to leave it a non-issue?'

There appears to be historical basis for the belief that it can, in the form of the success of the Montreal Protocol on Substances That Deplete the Ozone Layer. After entering into force in 1989 it was ratified by nearly 196 parties and effectively halted the use of halogenated flourocarbons (refrigerants like *Freon*) which were depleting atmospheric ozone. Production of halogenated fluourocarbons (HFCs) was in the hands of a few large corporations. The patents (established in the early 1930s) had long run their course, and substitute products were available to the same large producers. The problem was clear, and while the corporations initially resisted, it was apparent that neither the market for refrigerants nor their profits would be seriously eroded. Opposition was therefore brief and the international agreement was rapidly signed by over 190 states. The incentives to cheat on the production

and use of HFCs are limited as substitute products exist, and the benefits of the agreement are already evident. HFCs were private goods, the producers were few in number, the transaction costs of addressing the problem were low, and public awareness was high. Market incentives could have been used to solve the problem, but there was no need.

The issue of global warming, though, presents totally different challenges. The heart of the problem is that humanity treats the atmosphere (like so many other environmental assets) as a free good, a product that has no market. Many speak airily of 'the tragedy of the commons' but our atmosphere is no common. As the failure of Kyoto shows, even nation states are unwilling to manage it communally. In legal terms it is a *res nullius*. Rather than a few multinational firms producing clearly defined problem products like HFCs, global warming comes from a wide array of greenhouse gases generated daily by millions of individuals spread over the entire globe. In the absence of cheap and atmosphere friendly substitutes for fossil fuels, the transactional costs of persuading or coercing all those who generate greenhouse gases to cut their emissions are unattainably high.

Climate change is a long term issue, while elections are short term realities. Ironically democracy seems part of the problem. For as long as electorates are unwilling to suffer in the present for the sake of the future, only very brave or very secure governments will be free to act.

At a state level the problem looks less tricky: a few large economies have been the sources of the problem, and if they act quickly they might soon deal with it. The incentives are, however, perverse. Climate change is a long term issue, while elections are short term realities. Ironically democracy seems part of the problem. For as long as electorates are unwilling to suffer in the present for the sake of the future, only very brave or very secure governments will be free to act.

This leads to a second question: are rising levels of greenhouse gases the hopeless global tragedy described by the green campaigners? Perhaps not. The emissions which are at the heart of long term climate change are often generated together with others that present more immediate threats and, while not quite as well advertised, these are often far more problematic.[5] Ironically, it is this rather perverse characteristic of fossil fuels that offers a way forward. As an example consider the cases of the USA and China, the two largest individual contributors to greenhouse gas emissions. The USA refused to ratify the Kyoto Protocol, and China, while it approved the protocol, undertook no obligations in terms of it. But both have put in place regulations to curb urban air pollution. These are regulations which coincidentally reduce the use of problem fuels and increase the efficiency with which such fuels are used. Coal is widely held as a greenhouse villain, but when poorly combusted it does more profound and immediate damage in terms of particulates and acid rain. It was these problems that saw Western Europe cut the use of coal as a fuel, not the threat of climate change. Moreover, they have raised the cost of constructing an environmentally acceptable coal-fired power station to a level at which more climate-friendly energy sources have become cost competitive.

The same issue is relevant in South Africa. Locally, air pollution in our cities imposes direct costs on residents that dwarf those which we impose on the global commons through our contribution to climate change, yet, perhaps because of familiarity, these are often glossed over. Consider first the external cost through climate change

of the atmospheric carbon released in South Africa; now look at the local effects of air pollution in lost worker productivity and statistical life years lost each year. To put this into perspective, a 2001 study of air quality interventions in the Gauteng Highveld found that simply insulating fuel burning houses, which would reduce their annual coal purchases by 40% from R750 to R450, would have profound net benefits. If only 20% of the 72,000 coal burning households were insulated the present value (at 8%) of the improvement in worker productivity over the following thirty years would be a R161m, with a R98m present value for the decline in statistical mortality (at 2001 prices!)[6]. By comparison Nedbank advertises the price of CO_2 reductions at a mere R120 per tonne[7], similar to the prices in Europe which have oscillated around that level over the past few years - European carbon allowance, introduced in 2005 at 15 euro per tonne, is now down to two thirds of that[8].

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The impact of South Africa's poorly combusted fossil fuels on the global climate may be relatively small, but as anyone who has driven past Soweto during the temperature inversion of winter morning can testify, their impacts on the air we breathe every day are profound. The essence of this line of argument: if policy makers are to change our energy sources, they can justify their actions as responses to immediate concerns for the country's own citizens[9]. There is thus no need to cite possible impacts on distant nations or distant generations.

Accepting anthropogenic climate change as a reality does not prevent one from being a climate sceptic. For this one merely has to interrogate the costs climate change will impose. Much is made of the impacts on ecosystems and on small island states. But ecosystems have been living with rapid fluctuations in the global climate for eons. Mini ice ages and rapid warming periods have been well documented. The history of Greenland under the Vikings was defined by them, and much of England's political trauma from the fourteenth to the seventeenth centuries seems to have been predicated on periodic climatic fluxes.

But slow steady warming based on rising levels of atmospheric carbon seems to pose different questions. If temperatures rise by two degrees every fifty years, and rainfall patterns slowly shift, will farmers be incapable of reasoned responses? 'Look at the Mayans' we are told, or 'consider the fate of the Pueblo Indians of New Mexico'. Even Easter Island is haled forth as case study. Historically, people often existed in geographically isolated units, with a narrow range of crops available, and no help from global markets to meet short term threats to food security. Today seed technology is evolving at apparently exponential rates. In an era of hybrid and genetically modified seeds, with wide selections of crops and international produce markets, are we as vulnerable as we were? It isn't fashionable to argue this, but one can make a strong argument that higher levels of CO_2 and longer summers in the temperate lands of the USA, Canada and Russia will actually *increase* global production of cereal crops. There will be costs to some, but there are likely to be considerable benefits to others. The classic rebuttal would be to say that climate change presupposes greater probabilities of extreme weather events – basically hail, locusts, drought, floods, wailing, gnashing of teeth and bands of marauding Riffs – but of this there is little empiric evidence. Bad weather events have been on the go

for years; look at what took Jacob's sons to Egypt! So what challenge does this pose for equity across nations, across income groups and across generations?

What are the policy steps that follow on the ecological side? Cutting carbon can certainly be one, but its welfare benefits pale against others – like curbing population growth, cutting the amount of primary natural resources used up in each unit of national income, and reducing pollution in general.

This leads us to the two remaining legs of the sustainability tripod, economics and politics. The root of most economic approaches lies in the Rawlsian concept of justice. Rawls suggested that the most just society will be the one that maximizes the welfare of its worst-off members at any point in time. The logic of sustainability takes this idea and extends it over time. In these terms the most just growth path will be the one that maximizes the welfare of its worst off generation. Of course identifying this 'worst off' generation presents a problem. In the absence of clarity, a number of alternatives have emerged. These include growth paths in which social welfare is non-declining, or since this is difficult to identify, where production is non-declining. Then there are rule-based approaches like Hartwick's 'reinvest all resource rents'. If one's concern is with the worst-off individual across generations (or if the growth path followed requires non-declining income per capita), then both income distribution and population growth become key aspects of policy. In the first world (and in China) declining birth rates have helped raise per capital incomes. This has not been costless; aging populations raise the spectre of potentially unsupportable dependency ratios. For South Africa, however, whose greatest present social problem is youth unemployment, this will not be a credible issue for many years to come. Keeping birth rates down is not only a sound approach to socio-economic sustainability, but also helps reduce humanity's impact on the environment. People, as much as motor cars, drive climate change.

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Both income and population are issues with political ramifications, and on reflection it seems obvious that political sustainability is the crucial component of the problem. The demographic profile of South Africa's population, the rate of urbanization and the level of urban unemployment, present clear and present sustainability challenges. Populist politics are anathema to sustainability, and there can be no greater support for populism than widespread city-based youth unemployment. Demagoguery is surely the greatest and most present challenge to the country's future welfare, and any climate change policy that provides a footing for the demagogues has to be a concern. In cities where the poor, living in uninsulated homes, are burning coal, wood and paraffin for cooking and space heating, cheap accessible electricity has much to recommend it. Does it matter that it comes from the combustion of coal? Of course not. Put bluntly the question is whether the coal should be burnt in controlled furnaces away from metropolitan areas, or in uncontrolled poorly designed stoves with low chimneys in dense urban settlements prone to temperature inversion. If cheap coal based power can encourage industrialization, create jobs, improve living standards and enhance public health, then one has to question the "sustainability" of policies that preclude it.

The 'green alternative' of renewable natural energy is a prospect devoutly to be wished; but unemployment, smog and urban poverty are omnipresent realities of South African life. The opportunity cost of genuine commitment to the green alternative may be politically untenable. The urban climate, whether physical or political, urgently needs cheap secure supplies of electricity. Coal fired thermal power stations are one source, Nuclear power is another. Between the two lies natural gas. Yet we see sustainability campaigners opposing coal on grounds of climate change, opposing the nuclear option as a matter of principle, and opposing the exploration for gas in the Karoo on the grounds that it may have negative impacts, albeit on South Africa's least settled landscape. Maybe the search for sustainability should begin with a realistic search for perspective!

NOTES

1 Pezzey, J.(1992) Sustainable development concepts: an economic analysis - Environment Paper; no. 2 World Bank

2 Hartwick, J.M. (1977) Intergenerational equity and the Investing of rents from Exhaustible Resources. American Economic Review 67.5: 972-974

3 Boulding, K. (1966) The Economics of the Coming Spaceship Earth. Resources for the Future Forum on Environmental Quality in a Growing Economy. Washington, D.C. http://dieoff.org/page160.htm

4 Meadows et al 1972

5 While these may ultimately be separate issues, the severity of particulates far exceeds that of global warming. Particulates are killing thousands annually in South Africa; greenhouse gases promise that they might affect the comfort of our grandchildren. See table, below, for details of some of the estimates of deaths caused by particulate matter annually in SA.

Table: Annual deaths caused by particulate matter in South Africa

Cause of death	Annual Nr. Of deaths	% related to domestic use	Area	Source
Ambient PM	4 6371	69%	Metropolitan areas	Norman et al. (2007b)
Indoor PM	2 4893	100%	SA	Norman et al.(2007a)
Paraffin poisoning	4 000	100%	SA	Lloyd (2006:1), Bizzo et al (2004:66)

6 Leiman, A. Standish, B. Van Zyl, H. & Boting A. (2003) Social and Economic Impacts of Phasing-out 'Dirty' Fuels in South Africa. Documents 4b and 5 in FRIDGE Dirty Fuels Project - Nedlac

7 Nedbank: Carbon finance and the future. Accessed at http://www.nedbank.co.za/website/uploads/files/NedbankCapitalCarbonBrochure.pdf

8 Bloomberg: (http://www.bloomberg.com/apps/quote?ticker=EUETSSY1:IND)

OTHER SOURCES:

Meadows, D. H. Meadows, D. L. Randers, J. & Behrens, W. W (1972).The Limits to Growth. Universe Books. New York

Pezzey, J.and Toman, M. A. (2002) The Economics of Sustainability: A Review of Journal Articles Discussion Paper 02-03. Resources for the Future.

9 Cf. Leiman, A. Standish, B. Van Zyl, H. & Boting A. (2007) Reducing the Healthcare Costs of Urban Air Pollution: the South African Experience. Journal of Environmental Management. 84.1:27-37