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How the UN IPCC (and others) Exaggerate the Impacts of Global Warming

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Executive Summary

It is frequently asserted that climate change could have devastating consequences for poor countries. Indeed, this assertion is used by the UN Intergovernmental Panel on Climate Change (IPCC) and other organizations as one of the primary justifications for imposing restrictions on human emissions of greenhouse gases.

But there is an internal contradiction in the IPCC's own claims. Indeed, the same highly influential report from the IPCC claims both that poor countries will fare terribly *and* that they will be much better off than they are today. So, which is it?

The apparent contradiction arises because of inconsistencies in the way the IPCC assesses impacts. The process begins with various scenarios of future emissions. These scenarios are themselves predicated on certain assumptions about the rate of economic growth and related technological change.

Under the IPCC's highest growth scenario, by 2100 GDP per capita in poor countries will be double the U.S.'s 2006 level, even taking into account any negative impact of climate change. (By 2200, it will be triple.) Yet that very same scenario is also the one that leads to the greatest rise in temperature—and is the one that has been used to justify all sorts of scare stories about the impact of climate change on the poor.

Under this highest growth scenario (known as A1FI), the poor will logically have adopted, adapted and innovated all manner of new technololgies, making them far better able to adapt to the future

climate. But these improvements in adaptive capacity are virtually ignored by most global warming impact assessments. Consequently, the IPCC's "impacts" assessments systematically overestimate the negative impact of global warming, while underestimating the positive impact.

Moreover, in these "impacts" assessments, global warming is not expected for the most part to create new problems; rather, it is expected to exacerbate some existing problems of poverty (in particular, hunger, disease, extreme events), while relieving others (such as habitat loss and water shortages in some places).

Reducing greenhouse gas emissions, which would reduce every warming impact regardless of whether it is good or bad, is but one approach to dealing with the consequences of warming. And it would likely be very costly. In fact, reducing emissions is unlikely to help poorer countries deal with most of the problems they face either today or in the future. With respect to mortality from hunger, malaria and extreme events, for example, global warming is estimated to contribute to only 13% of the problem in 2085.

Another approach to reducing the impact of global warming would be to reduce the climate-sensitive problems of poverty through "focused adaptation." This might involve, for example, major investments in early warning systems, the development of new crop varieties, and public health interventions. Focused adaptation would allow society to capture the benefits of global warming while allowing it to reduce climate-sensitive problems that global warming might worsen. For instance, emission reductions would at most reduce mortality from hunger, malaria and extreme events by only 13%, whereas focused adaptation could essentially eliminate these causes of mortality.

A third approach would be to fix the root cause of why developing countries are deemed to be most at-risk, namely, poverty. Sustained economic growth would, as is evident from the experience of developed countries, address virtually all problems of poverty, not just that portion exacerbated by global warming. It is far more certain that sustainable economic growth will provide greater benefits than emission reductions: while there is no doubt that poverty leads to disease and death, there is substantial doubt regarding the reality and magnitude of the negative impact of global warming. This is especially true as assessments often ignore improvements in adaptive capacity.

Of these three approaches, human well-being in poorer countries is likely to be advanced most effectively by sustained economic development and least by emission reductions. In addition, because of the inertia of the climate system, economic development is likely to bear fruit faster than any emission reductions.

For richer countries, too, net GDP per capita in the future is expected to be much higher than it is today despite any climate change. Thus, all countries should focus on generating sustained economic development. This approach would not only address all of the current problems that might get worse in the future but would also enable humanity to address more effectively any other future problems it encounters, whether climate-related or otherwise.

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Part 1

Introduction

The UN Intergovernmental Panel on Climate Change (IPCC) deems poor countries to be at greater risk from global warming (GW) than rich countries because they are less able to mobilize the resources required to use technologies needed to cope with the impact of GW. That is, their "adaptive capacity" is low.[1] The IPCC also claims that GW will exacerbate many problems—such as malaria and other vector-borne diseases, hunger, water shortages, vulnerability to extreme weather events and flooding—that the poor currently face and with which they have difficulty coping. Yet aren't these both basically the same thing and both caused by an underlying lack of economic development?[2]

Building on the notion that the current adaptive capacity of poor countries is low, the IPCC, among others, claims that global warming could also hinder their sustainable development.[3] Others argue that the impact of global warming could overwhelm weak or poor governments, leading to economic and political instability, which, in turn, could breed terrorism and conflict, and precipitate mass migration to richer countries.[4]

This paper seeks to assess whether these assertions are justified. It begins with a discussion that sheds light on the main factors that affect the trends in climate-sensitive indicators of human well-being. The discussion recognizes the role of fossil fuels in powering economic and technological development.

Next, it examines the notion—implicit in the view that poor countries will be swamped by the future impact of GW—that their adaptive capacity will remain low in the future. It specifically examines whether this view is justified in light of the economic assumptions built into the IPCC scenarios. These economic assumptions are among the primary drivers of the IPCC's climate change projections, which are then used to estimate the likely future impact (including specific damages) from GW. They are, thus, fundamental to estimates of the magnitude and direction of the future impact of GW.

The paper then considers the proposition that while higher rates of economic development would lead to greater climate-related impact from GW, it would also result in higher adaptive capacity.[5] This raises the question as to whether or not the economic development and associated technological change assumed by the IPCC scenarios will increase the damage from GW faster than the increases in adaptive capacity and, consequently, hinder sustainable development. Likewise, it raises the question as to whether insufficient economic and technological development would hinder the ability to cope with future GW. The answers to these questions are crucial in determining which policy is best suited to addressing GW resulting from human activity.

Finally, based on the foregoing analysis, the paper outlines policies to help advance human well-being in poor countries while enhancing their ability to cope with GW.

Part 2

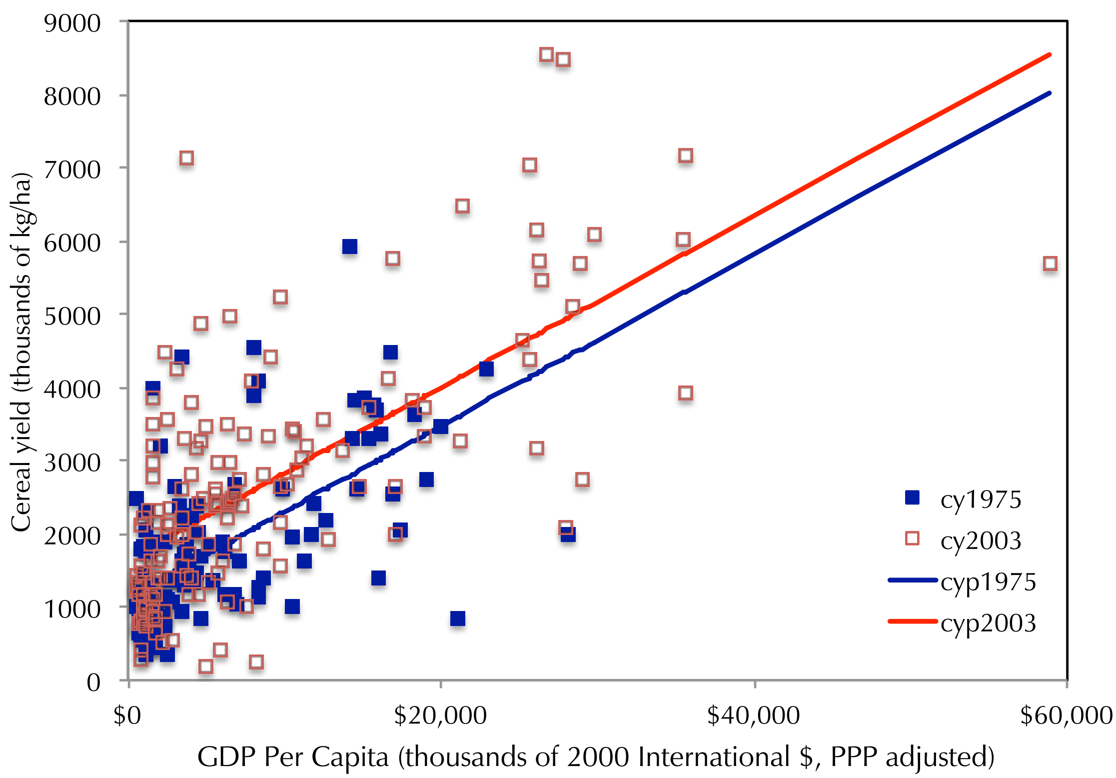
Determinants and Indicators of Adaptive Capacity

Societies that are wealthier, have access to more advanced technology, and have more skilled people will in general be better able to cope with a wide array of problems, from heatwaves to floods, than societies that are poorer, lack modern technologies, and have few skilled people. It therefore stands to reason that among the main determinants of adaptive capacity are economic development (which results in wealth), access to technology, and human capital (i.e. skills).

Closely related to these determinants are various indicators of well-being, notably education, health, availability of nutritious food, access to safe water and sanitation, and investment in research and development.[6] Comparative data by country show that these indicators of well-being generally advance with the level of economic activity, measured as GDP per capita. Moreover, starting at any specific level of economic activity, these indicators also improve with time, reflecting "secular" improvements in technology, i.e. improvements in technology that occur over time. This pattern is illustrated in Figure 1 for cereal yields, Figure 2 for available daily food supply per capita, Figure 3 for the prevalence of malnutrition, Figure 4 for infant mortality and Figure 5 for life expectancy.

Both life expectancy and infant mortality capture the aggregate effect on human well-being of many of the indicators noted previously, such as education, health status, availability of food, lack of malnutrition, access to safe water and sanitation, and research and development expenditures.[7] In essence, they capture the total effect of societies' abilities to cope with death and disease, regardless of their causes. As such, they are not only indicators of well-being but also of adaptive capacity.

Figure 1: Cereal Yields vs. GDP Per Capita Across Countries, 1975–2003

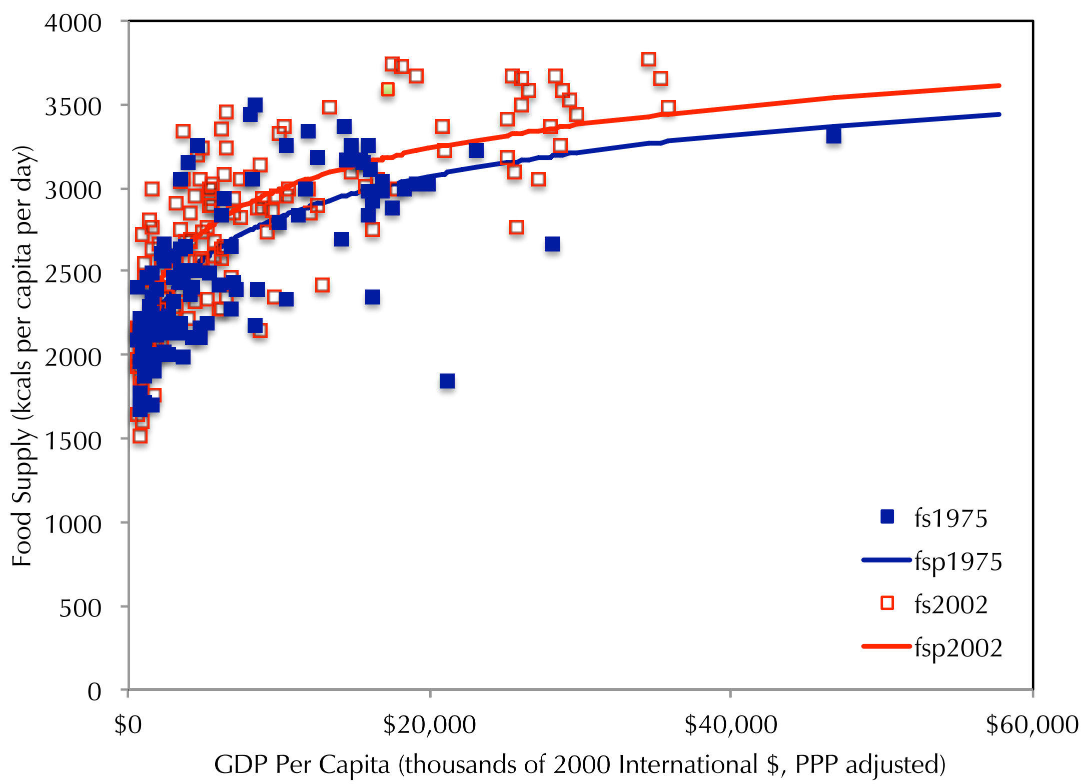


Source: Indur M. Goklany, *The Improving State of the World* (Washington, DC: Cato Institute, 2007).

Figure 1 shows that as cereal yields increase, so does income. For an average country, every $1,000 increase in GDP per capita, is associated with an increasein cereal yield of 117 kg per hectare in both 1975 and 2003. The upward displacement of the entire cereal yield curve from 1975 to 2003 indicates that, because of secular technological change, yield increased by 526 kg per hectare at any given level of income.[8]

Since increasing yields should result in higher food supplies, it is hardly surprising that Figure 2 shows the latter also increasing with both GDP per capita and time. However, as the lines of best fit for the two dates show (cyp1975 and cyp2003), the relationship between food supply and income is logarithmic, not linear like it is for yield, probably because wealthier countries can buy food (via trade) on the world market and even a small amount of additional income goes a long way to meeting food requirements. Figure 2 shows that as annual average GDP per capita increases from $100 to $1,000, average daily food supply increases by 816 kcal per capita per day. Further increasing annual average GDP per capita to $10,000 would raise food supply by the same amount because the relationship between food supply and income is logarithmic. Secular technological change raised food supply at any particular level of GDP per capita by 166 kcal per person per day from 1975 to 2002.[9]

Figure 2: Available Food Supplies Per Capita Per Day (FS) vs. GDP Per Capita Across Countries, 1975–2002

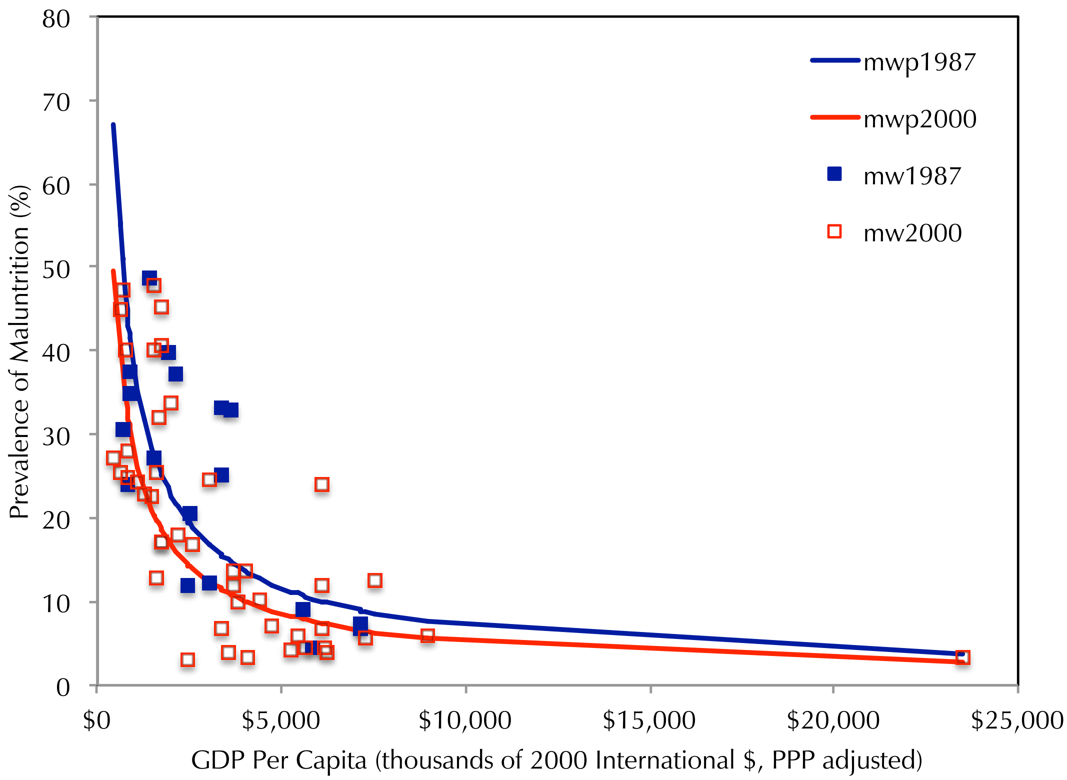


Source: Goklany, *The Improving State of the World*.

If food supply increases, one should expect malnutrition to diminish. Not surprisingly, therefore, Figure 3 indicates that malnutrition declines with both income and time (the latter as a result of secular technological change).

Note that malnutrition declines more rapidly with income than with food supply, especially at the lowest levels of income. This is because while food supplies are critical to reducing malnourishment, other income-sensitive factors, e.g., public health services and infrastructure to transport food and medicine, reinforce the resulting reductions in malnutrition. Moreover, lower malnutrition (i.e. better nutrition) also reduces susceptibility to disease, which means that the amount of food needed to maintain healthy weight is actually lowered, i.e., better health helps reduce malnutrition even if food supplies are static.

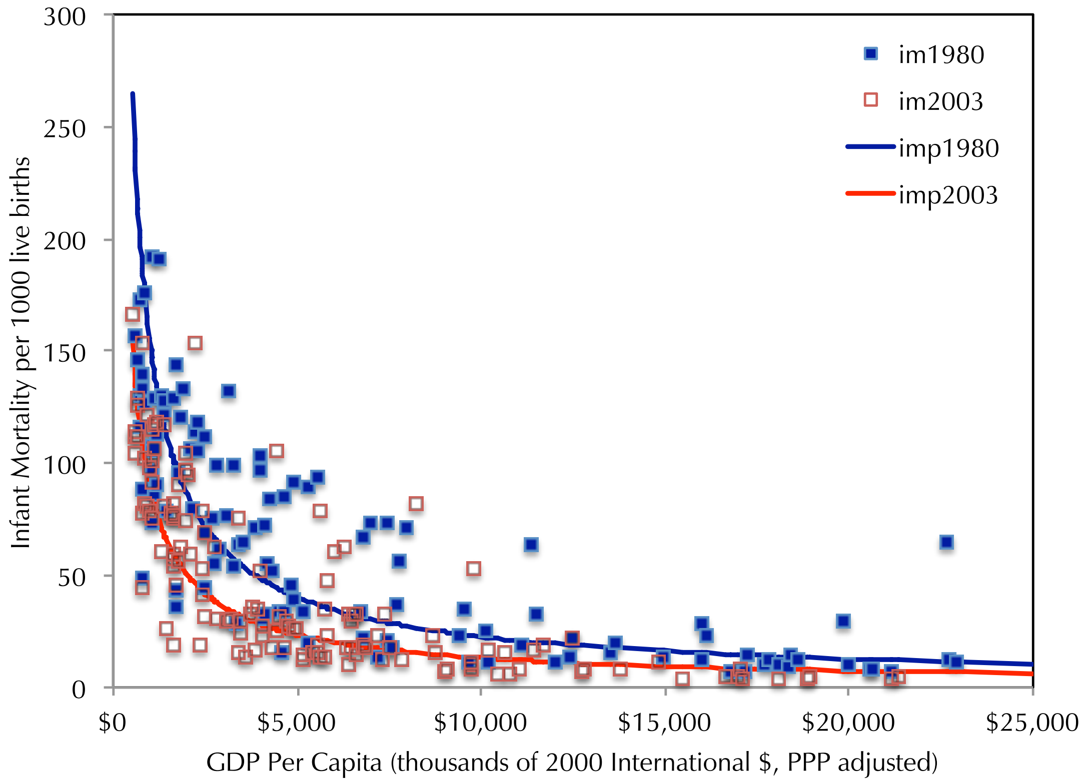
Figure 3: Prevalence of Malnutrition (as Percent of Population) vs. GDP Per Capita Across Countries, 1987–2000



Source: Goklany, *The Improving State of the World*.

Lower malnutrition should also translate into lower mortality rates. And, as shown in Figure 4, infant mortality, predictably, improves with income and time (the latter because of secular technological change). If mortality rates decline with income and time, life expectancies should then increase with income and time. And, as shown in Figure 5, that indeed is the case. These figures illustrate that both economic development and time (i.e. secular technological change), individually and collectively increase society's ability to adapt to and cope with whatever problems it faces. Many other indicators of well-being also improve with income and technological change, e.g., access to safe water and sanitation and educational levels.[10]

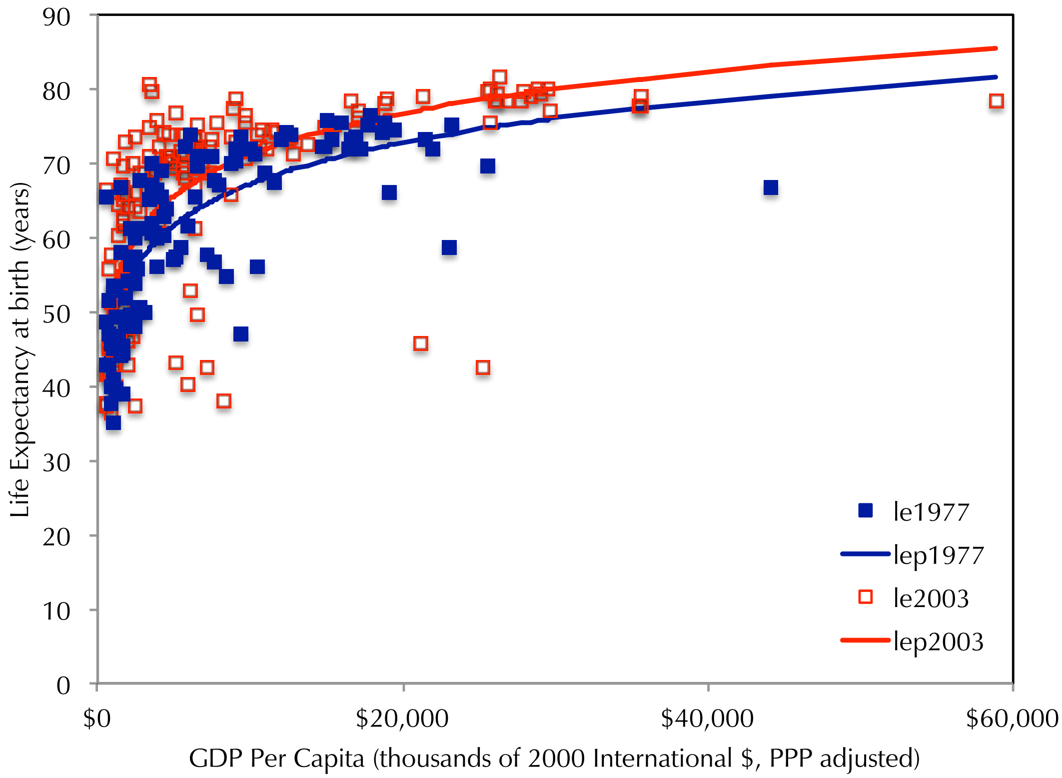
Figure 4: Infant Mortality vs. GDP Per Capita Across Countries, 1980–2003



Source: Goklany, *The Improving State of the World*.

These figures also indicate that the compound effect of economic development and technological change can result in quite dramatic improvements even over the relatively short period for which these figures were developed. Figure 5, for instance, covered 26 years. By contrast, climate change impacts analyses frequently look 50 to 100 years into the future. Over such long periods, the compounded effect could well be spectacular. Longer term analyses of climate-sensitive indicators of human well-being show that the combination of economic growth and technological change can, over decades, reduce negative impacts on human beings by an order of magnitude, that is, a factor of ten, or more. In some instances, this combination has virtually eliminated such negative impacts.

Figure 5: Life Expectancy vs. GDP Per Capita Across Countries, 1977–2003



Source: Goklany, *The Improving State of the World*.

For instance, during the 20th century, deaths from various climate-sensitive waterborne diseases were all but eliminated in the U.S. From 1900 to 1970, U.S. GDP per capita nearly quadrupled, while deaths from malaria were eliminated, and death rates for gastrointestinal disease fell by 99.8%.[11] From 1900 to 1997 GDP per capita rose seven-fold, while deaths rate from typhoid and paratyphoid were eliminated and from 1900 to 1998 the death rate for dysentery fell by 99.6%.[12] This suggests a need to be highly skeptical of global warming impacts analyses that extend two or more decades into the future if they do not properly account for the compounded effect on adaptive capacity from (a) economic growth built into emission scenarios and (b) secular technological change.

Part 3

Future Adaptive Capacity of Poor Countries

As noted, economic development and available technology are two key determinants of adaptive capacity.[13] But economic development is also a fundamental driver of greenhouse gas emissions, the magnitude of any resulting climate change, and its future impacts. The IPCC's emissions scenarios all assume substantial economic growth, especially in countries that are currently poor.[14] Most impact assessments undertaken since 2000 have relied on the IPCC scenarios.

This section examines the implications for future adaptive capacity of the economic growth estimates assumed in the IPCC scenarios. It then analyzes whether and how studies of the impacts of GW cited by the latest IPCC assessment report account for these changes in adaptive capacity in the future.

A. Economic Development

Figure 6 provides estimates of *net* GDP per capita—a key determinant of adaptive capacity—for 1990 (the base year used by the IPCC's emissions scenarios) and 2100 using four IPCC reference scenarios for areas that comprise today's "developing" and "industrialized" countries.[15] The scenarios are:

- A1 Fossil fuel Intensive (A1FI), a high-growth, high-emission scenario (*unadjusted* world GDP rises from \$53 trillion in 2020 to \$525 trillion in 2100, while the proportion of primary energy derived from coal in 2100 is 29%, the same as in 2020);
- A2, a low-growth, high-emission scenario (*unadjusted* world GDP rises from \$41 trillion in 2020 to \$243 trillion in 2100, while the proportion of primary energy derived from coal rises from 22% in 2020 to 53% by 2100);
- B2, a low-growth, low-emission scenario (*unadjusted* world GDP rises from \$51 trillion in 2020 to \$235 trillion in 2100, while the proportion of primary energy from coal falls from 17% in 2020 to 10% in 2050 but then rises again to 22% by 2100); and

- B1, a medium-growth, low-emission scenario (*unadjusted* world GDP rises from $53 trillion in 2020 to $328 trillion in 2100, while the proportion of primary energy from coal falls from 22% in 2020 to 8% in 2100).[16]

The *net* GDP per capita is calculated by subtracting the equivalent costs per capita of global warming from the *unadjusted* GDP per capita (that is the GDP per capita in the absence of any warming). (Figure 6 also provides estimates for 2200, as detailed below.)

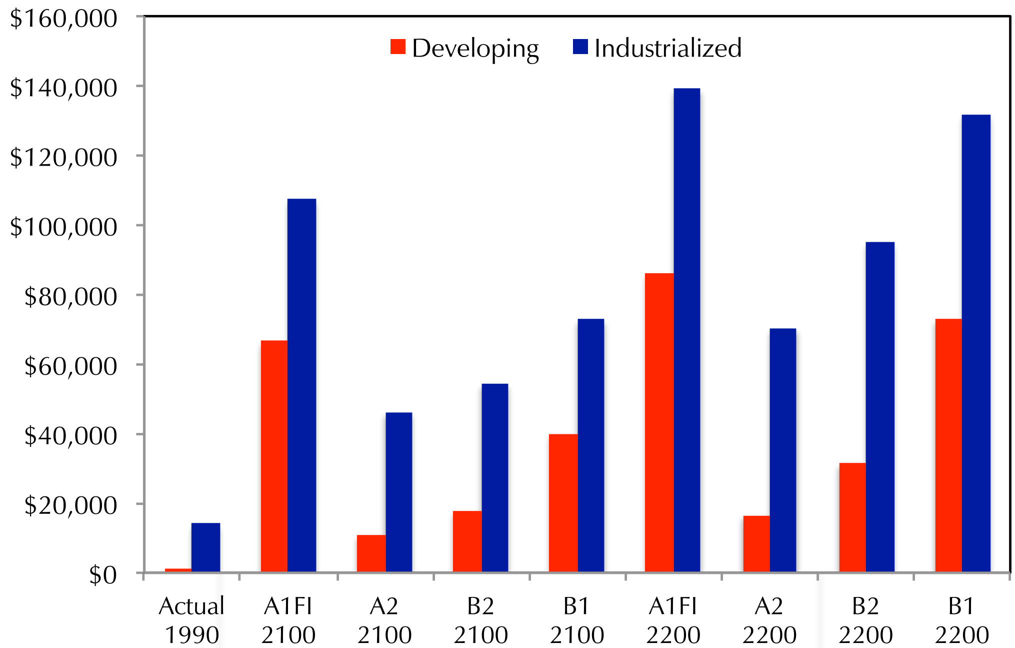
Note that Figure 6 is intentionally designed to provide a conservative (low) estimate of the future net GDP per capita because part of the purpose of this study is to assess whether, under the most conservative assumptions, the costs of global warming will drive net GDP per capita below today's levels, that is, whether future generations will be worse off than current generations because of GW. Accordingly, the study uses the Stern Review's estimates for the damages (in terms of equivalent losses in GDP) from GW.[17] These differ from other estimates in the following respects:

- First, unlike most other studies, Stern accounts for losses not only due to market impacts of global warming but also to non-market (i.e., environmental and public health) impacts, as well as the risk of catastrophe.[18]

- Second, in order to develop a very conservative estimate for the future net GDP per capita, this study uses the Stern Review's 95th percentile (upper bound) estimate of the losses in GDP due to global warming. Note that many economists believe even the Stern Review's central estimates overstate losses due to global warming: Richard Tol observes, "[The Stern Review's] impact estimates are pessimistic even when compared to other studies in the gray literature[19] and other estimates that use low discount rates."[20]

In Figure 6, the net GDP per capita for 1990 is the same as the actual GDP per capita (in 1990 U.S. dollars, using market exchange rates, per the IPCC's practice). This assumes that the GDP loss due to global warming is negligible in 1990, which is consistent with using that as the base year for estimating changes in globally averaged temperatures (as is the case for impacts studies that will be employed below).[21] The costs of global warming are taken from the Stern Review's 95th percentile estimates under the "high climate change" scenario, which is equivalent to the IPCC's warmest scenario (A1FI) that projects a global temperature increase of 4°C from 1990–2085. Per the Stern Review, these costs amount to 7.5% of global GDP in 2100 and 35.2% in 2200. These losses are adjusted downwards for the cooler scenarios.[22]

Figure 6: Net GDP Per Capita, 1990-2200



Estimates account for losses due to global warming for four major IPCC emission and climate scenarios. For 2100 and 2200, the scenarios are arranged from the warmest (A1FI) on the left to the coolest (B1) on the right. The average global temperature increase from 1990 to 2085 for the scenarios are as follows: 4°C for AIFI, 3.3°C for A2, 2.4°C for B2, and 2.1°C for B1. For context, in 2006, GDP per capita for industrialized countries was $19,300; the United States, $30,100; and developing countries, $1,500.

Source: Indur M. Goklany, "Discounting the Future," *Regulation*, Spring 2009, Vol. 32, pp. 36–40

Figure 6 shows that despite the various assumptions that have been designed to overstate losses from GW and understate the unadjusted GDP per capita in the absence of any warming:

- For populations living in countries currently classified as "developing," net GDP per capita (after accounting for global warming) will be 11–65 times higher in 2100 than it was in the base year. It will be even higher (18–95 times) in 2200.

- Net GDP per capita in today's developing countries will be higher in 2200 than it was in industrialized countries in the base year (1990) under all scenarios, despite any global warming. That is, regardless of any global warming, populations living in today's developing countries will be better off in the future than people currently inhabiting today's industrialized countries. This is also true for 2100 for all but the "poorest" (A2) scenario.

- Under the warmest scenario (A1FI), the scenario that prompts much of the apocalyptic warnings about global warming, net GDP per capita of inhabitants of developing countries

> in 2100 ($61,500) will be double that of the U.S. in 2006 ($30,100), and almost triple in 2200 ($86,200 versus $30,100). [All dollar estimates are in 1990 U.S. dollars.]

In other words, the countries that are today poorer will be extremely wealthy (by today's standards) and their adaptive capacity should be correspondingly higher. Indeed, their adaptive capacity should on average far exceed the U.S.'s today. So, although claims that poorer countries will be unable to cope with future climate change may have been true for the world of 1990 (the base year), they are simply inconsistent with the assumptions built into the IPCC scenarios and the Stern Review's own (exaggerated) analysis.

If the world of 2100 is as rich—and warm—as the more extreme scenarios suppose, the problems of poverty that warming would exacerbate (i.e. low agricultural productivity, hunger, malnutrition, malaria and other vector-borne diseases) ought to be reduced, if not eliminated, by 2100. Research shows that deaths from malaria and other vector-borne diseases is "cut down to insignificant numbers" when a society's annual per capita income reaches about $3,100.[23] Therefore, even under the poorest scenario (A2), developing countries should be free of malaria well before 2100, even assuming no technological change in the interim.

Similarly, if the average net GDP per capita in 2100 for developing countries is between $10,000 and $62,000, and technologies become more cost-effective as they have been doing over the past several centuries, then their farmers would be able to afford technologies that are unaffordable today (e.g., precision agriculture) as well as new technologies that should come on line by then (e.g., drought-resistant seeds).[24] But, since impact assessments generally fail to fully account for increases in economic development and technological change, they substantially overestimate future net damages from global warming.

It may be argued that the high levels of economic development depicted in Figure 6 are unlikely. But if that's the case, then economic growth used to drive the IPCC's scenarios are equally unlikely, which necessarily means that the estimates of emissions, temperature increases, and impacts and damages of GW projected by the IPCC are also overestimates.

B. Secular Technological Change

The second major reason why future adaptive capacity has been underestimated (and the impacts of global warming systematically overestimated) is that few impact studies consider secular technological change.[25] Most assume that no new technologies will come on line, although some do assume greater adoption of existing technologies with higher GDP per capita and, much less frequently, a modest generic improvement in productivity.[26] Such an assumption may have been appropriate during the Medieval Warm Period, when the pace of technological change was slow, but nowadays technological change is fast (as indicated in Figures 1 through 5) and, arguably, accelerating.[27] It is unlikely that we will see a halt to technological change unless so-called precautionary policies are instituted that count the costs of technology but ignore its benefits, as some governments have already done for genetically modified crops and various pesticides.[28]

Part 4

Current Impacts Models Fail to Account for Changes in Future Adaptive Capacity

It is possible to obtain an idea of whether, how and the extent to which impacts assessments used in the IPCC's latest assessment report account for changes in adaptive capacity over time through an examination of the suite of studies that comprise the so-called Fast Track Assessments (FTAs) of the global impacts of climate change. These British government-sponsored FTAs, which were state-of-the-art at the time of the writing of the IPCC's *Fourth Assessment Report* (AR4WG2), have an impeccable provenance from the point of view of proponents of greenhouse gas controls. Many of the FTA authors were major contributors to the IPCC's Third and Fourth Assessments.[29] For instance, the lead author of the FTA's hunger assessments,[30] Professor Martin Parry, was the co-chair of IPCC Working Group 2 during its latest (2007) assessment. Similarly, the authors of the FTA's water resources and coastal flooding studies were also lead authors of corresponding chapters in the same IPCC *Fourth Assessment Report*. A dissection of the FTA methodologies shows that:

- The water resources study[31] totally ignores adaptation, despite the fact that many adaptations to water-related problems, e.g., building dams, reservoirs and canals, are among mankind's oldest adaptations, and do not depend on the development of any new technologies.[32]

- The study of agricultural productivity and hunger allows for increases in crop yield with economic growth due to greater usage of fertilizer and irrigation in richer countries, and decreases in hunger due to economic growth, some secular (time-dependent) increase in agricultural productivity, as well as some farm-level adaptations to deal with climate change.[33] But these adaptations are based on 1990s technologies, rather than technologies that would be available at the time for which impacts are estimated (i.e., 2025, 2055 and 2085 in the FTA). Nor does the study account for any technologies developed to specifically cope with the negative impacts of global warming or take advantage of any positive outcomes.[34] But the potential for future technologies to cope with climate change is large, especially if one considers bioengineered crops and precision agriculture.[35]

- The Nicholls study on coastal flooding from sea level rise takes some pains to incorporate improvements in adaptive capacity due to increasing wealth. But it makes a number of questionable assumptions:

> First, it allows societies to implement measures to reduce the risk of coastal flooding in response to 1990 surge conditions, but not to subsequent sea level rise.[36] But this is illogical. One should expect that any measures that are implemented would consider the latest available data and information on the surge situation at the time the measures are initiated. That is, if the measure is initiated in, say, 2050, the measure's design would at least consider sea level and sea level trends as of 2050, rather than merely the 1990 level. By that time, we should know the rate of sea level rise with much greater confidence.
>
> Second, Nicholls also allows for a constant lag time between initiating protection and sea level rise. But one should expect that if sea level continues to rise, the lag time between upgrading protection standards and higher GDP per capita will be reduced over time, and may even turn negative. That is, the further we go into the future, if sea level rise accelerates (as indicated by models), then it is more likely that adaptations would be anticipatory rather than reactive, particularly, as societies become more affluent (as they should if one gives credence to either the IPCC scenarios or the Stern Review; see Figure 6).
>
> Third, Nicholls does not allow for any deceleration in the preferential migration of the population to coastal areas, as is likely if coastal storms and flooding become more frequent and costly.[37]

The analysis for malaria undertaken by van Lieshout, et al. includes adaptive capacity as it existed in 1990, but does not adjust it to account for any subsequent advances in economic and technological development.[38] There is simply no justification for such an assumption. If the IPCC's assumptions about future economic development are even half right, it is, as already noted, likely that malaria will have been eliminated by 2100.

Part 5

Overestimation of Impacts from Underestimation of Future Adaptive Capacity

So how much of a difference in impact would consideration of both economic development and technological change have made? If impacts were to be estimated for five or so years into the future, ignoring changes in adaptive capacity between now and then probably would not be fatal because neither economic development nor technological change would likely advance substantially during that period. However, the time horizon of climate change impact assessments is often on the order of 35–100 years or more. The Fast Track Assessments use a base year of 1990 to estimate impacts for 2025, 2055 and 2085.[39] The Stern Review's time horizon extends to 2100–2200 and beyond.[40] Over such periods one ought to expect substantial advances in adaptive capacity due to increases in economic development, technological change and human capital.

As already noted, retrospective assessments indicate that over the span of a few decades, changes in economic development and technologies can substantially reduce, if not eliminate, adverse environmental impacts and improve human well-being, as measured by a variety of objective indicators.[41] Thus, not fully accounting for changes in the level of economic development and secular technological change would understate future adaptive capacity, which then could overstate impacts by one or more orders of magnitude if the time horizon is several decades into the future.

The assumption that there would be little or no improved or new technologies that would become available between 1990 and 2100 (or 2200), as assumed in most climate change impact assessments, is clearly naïve. In fact, a comparison of today's world against the world of 1990 (the base year used in most impacts studies to date) shows that even during this brief 20-year span, this assumption is invalid for many, if not most, human enterprises. Since 1990, for example, the portion of the developing world's population living in absolute poverty declined from 42% to 25%,[42] and in sub-Saharan Africa Internet users increased from 0 to 50 million, while cellular phone users went from 0 per 100 to 33 per 100.[43]

It should be noted that some of the newer impacts assessments have begun to account for changes in adaptive capacity. For example, the CIESIN study of 2006, in an exercise exploring the vulnerability to climate change under various climate change scenarios, allowed adaptive capacity to increase between the present and 2050 and 2100.[44] However, the researchers arbitrarily limited any increase in adaptive capacity to “either the current global mean or to a value that is 25% higher than the current value—whichever is higher.”[45] Such a limitation would, for example, have missed most of the increase in U.S. adaptive capacity during the twentieth century that virtually eliminated death and disease from climate-sensitive water-borne vector diseases.

More recently, another study analyzed the sensitivity of deaths from malaria, diarrhea, schistosomiasis and dengue fever to warming, economic development and other determinants of adaptive capacity through the year 2100.[46] The results indicate, unsurprisingly, that economic development alone could reduce mortality substantially. For malaria, for instance, deaths would be eliminated before 2100 in a number of the more affluent sub-Saharan countries.[47] This is a much more realistic assessment of the impact of GW on malaria in a wealthier and more technologically advanced world than is the corresponding FTA study, despite the latter being considered state-of-the-art during the preparation of the latest IPCC report. It is also more consistent with long-term trends regarding the extent of malaria, which indicate that the *P. falciparum* malaria–the most deadly kind–declined from 58% of the world’s land surface around 1900 to 30% by 2007.[48]

Part 6

Global Warming and Development

Although the IPCC notes that sustainable development "can reduce vulnerability to climate change, and climate change could impede nations' abilities to achieve sustainable development pathways,"[49] many proponents of greenhouse gas controls dwell only on the latter (downside) aspect of economic development while generally ignoring the upside.[50] But does global warming hinder sustained development or does sustained development make it easier to cope with warming, and which effect, if either, is predominant?

It is possible to answer these questions using results from the previously discussed British government-sponsored "Fast Track Assessments" (FTAs) of the global impacts of global warming.[51] The FTAs provide estimates of the contribution of global warming to the total populations at risk of malaria, hunger and coastal flooding due to sea level rise for 2085. Notwithstanding the implausibility of any forecast of events in 2085, these estimates of populations at risk may be converted into mortality estimates by comparing historical mortality estimates from the World Health Organization (for 1990, the base year) against FTA estimates of populations at risk for that year.

The results indicate that under the IPCC's warmest (A1FI) scenario, global warming would contribute no more than 13% of the total mortality from malaria, hunger and coastal flooding in 2085.[52] The remaining 87% or more is due to non-global warming related factors.

Had improvements in adaptive capacity been appropriately accounted for, the mortality attributed to both global warming and non-global warming factors would have been much smaller, but probably by a similar amount, so the proportional contribution from each would likely not be changed much.

FTA results also indicate that by 2085, global warming would reduce the global population at risk of water shortages, although some areas would see increases.[53] This finding is contrary to the erroneous impression conveyed by the IPCC's AR4's *Working Group II Summary for Policy Makers*[54] because that summary emphasizes the number of people that may experience an increase in water shortage but neglects to provide corresponding estimates for the number that would see a reduction in water shortage.[55] However, the finding that the net population experiencing water shortage would be reduced is consistent with other studies of the global impact of global warming on water resources.[56] Remarkably, this result is obtained despite the fact that the author of the study does not allow for any adaptation and, consequently, nor does it account for advances in adaptive capacity that should logically occur under the IPCC scenarios.[57] Had adaptation been considered, the net population at risk of water shortage due to global warming would have decreased even more substantially than the author indicates.

Partly due to increases in net primary productivity because of CO_2 fertilization, the amount of habitat devoted to cropland would be halved by global warming under the A1FI scenario, at least through 2100.[58] Since diversion of habitat to cropland is perhaps the single largest threat to species and ecosystems,[59] this means that global warming could actually reduce pressures on biodiversity.[60]

Thus, at least through 2085–2100, GW may relieve some of the problems that some poor countries face currently (e.g., water shortage and habitat loss), while in other instances, the contribution of GW to the overall problem (e.g., cumulative mortality from malaria, hunger and coastal flooding) would be substantially smaller than that of non-GW related factors. Notably, economic development, one of the fundamental drivers of GW, would reduce mortality problems regardless of whether they are due to GW or non-GW related factors (see Figure 4). Hence, lack of economic development would be a greater problem than global warming, at least through 2085–2100. This reaffirms the story told by Figure 6, which shows that notwithstanding global warming and despite egregiously overestimating the negative consequences of global warming while underestimating its positive impacts, future net GDP per capita will be much higher than it is today under each scenario through at least 2200.

Note that Figure 6 also shows that through 2200, notwithstanding global warming, net GDP per capita will be highest under the warmest scenario, and lowest under the poorest scenario (A2). This suggests that if humanity has a choice of which development path to take, it ought to strive to effect the scenario that has the highest economic growth, whether or not that exacerbates global warming.[61] The additional economic development would more than offset the cost of any warming.

No less important, it is far cheaper for the world to advance economic development than mitigate climate change by a meaningful amount.[62] This is consistent with the aforementioned analysis of various climate-sensitive infectious diseases, whose authors observe that:

> *[D]eaths will first increase, because of population growth and climate change, but then fall, because of development … As climate can only be changed with a substantial delay, development is the preferred strategy to reduce infectious diseases even if they are exacerbated by climate change. Development can … increase the capacity to cope with projected increases in infectious diseases over the medium to long term.*[63]

Thus, it is most unlikely that under the IPCC's warmest scenario, global warming will overwhelm economic development in countries that are currently poor, regardless of the Stern Review's upper bound damage estimates. Second, economic development should be given priority over reducing greenhouse gas emissions. It would enable poorer countries to cope not only with any negative impacts of climate change, but more importantly, other larger problems that they will face.[64] This is most obvious from an examination of Figures 3 through 5, which indicate that malnutrition, infant mortality and life expectancy improve most rapidly with economic development at its lowest levels.

Part 7

Discussion and Conclusions

Despite claims that GW will reduce human well-being in poor countries, there is no evidence that this is actually happening. Empirical trends show that by any objective climate-sensitive measure, human well-being in such countries has improved remarkably over the last several decades. Specifically, agricultural productivity has increased;[65] the proportion of people suffering from chronic hunger has declined;[66] the rate of extreme poverty has been more than halved;[67] rates of death and disease from malaria, other vector-borne diseases and extreme weather events have declined.[68] Together, these improvements correspond with life expectancy in poor countries more than doubling since 1900.[69]

While economic growth and technological development, made possible by the use of fossil fuels, may have been responsible for some portion of GW experienced this past century, they have also been largely responsible for these improvements in human well-being in poor countries (and elsewhere).[70] The fact that these improvements have occurred in spite of GW indicates that economic and technological development has been, overall, a very significant benefit to people in poor countries.

The recent upturn in the rate of hunger is due not to GW but, in large part, to GW policies, specifically, policies to stimulate the production and use of biofuels in lieu of fossil fuels.[71] These policies diverted crops away from food to fuel production, which increased food prices and, therefore, hunger worldwide. That, in turn, also pushed a greater share of the population of poor countries into extreme poverty.[72] Although this biofuel production increased extreme poverty in the short term that effect has been swamped in the longer term by the reduction in poverty from economic development.[73] Nonetheless, any increase in extreme poverty necessarily increases the toll from diseases of poverty, which are among the major causes of death and disease in poor countries.[74]

It is often argued that unless greenhouse gases are reduced forthwith, the resulting GW could have severe, if not catastrophic, consequences for people in poor countries because they lack the economic and human resources to cope with GW's consequences. But there are two major problems with this argument. First, although poor countries' adaptive capacity is low today, it does not follow that their ability to cope will be low forever. In fact, under the IPCC's warmest scenario, which would increase globally averaged temperature by 4°C relative to 1990, net GDP per capita in poor countries (that is, after accounting for losses due to climate change per the Stern Review's exaggerated estimates) will be double the U.S.'s 2006 level in 2100, and triple that in 2200. Thus developing countries should in the future be able to cope with climate change substantially better than the U.S. does today. But these advances in adaptive capacity, which are virtually ignored by most assessments of the impacts and damages from global warming, are the inevitable consequence of the assumptions built into the IPCC's emissions scenarios.

Hence the notion that countries that are currently poor will be unable to cope with GW does not square with the basic assumptions that underpin the magnitude of emissions, global warming and its projected impacts under the IPCC scenarios.

Second, GW would for the most part not create new problems; rather, it would exacerbate some existing problems in some locations (i.e. hunger, disease and extreme weather events). But it would also likely reduce other problems (i.e. water shortages in some places).

One approach to dealing with the consequences of GW is to reduce greenhouse gas emissions. That would reduce all GW impacts, whether good or bad. And at best it would only reduce GW's contribution to the problem. But GW generally is not now and is unlikely in the future to be a major contributor to the most important problems facing people in poor countries.[75]

An alternate approach to reducing the GW impacts would be to reduce the climate-sensitive problems of poverty through "focused adaptation."[76] This might involve, for example, major investments in things such as early warning systems, the development of new crop varieties, and public health interventions. Focused adaptation would allow society to capture the benefits of GW while allowing it to reduce the totality of climate-sensitive problems that GW might worsen. Focused adaptation could in principle address 100% of the problems resulting from hunger, malaria and extreme weather events, whereas emission reductions would at most deal with only about 13%. Focused adaptation, moreover, would likely be much less expensive than emission reductions.

Yet another approach would be to address the root cause of why poor countries are deemed to be most at risk, namely, poverty. But the only way to reduce poverty is to have sustained economic growth. This would not only address the climate-sensitive problems of poverty but all problems of poverty, and not just that portion caused by GW. It would, moreover, reduce these problems faster and more cost-effectively. No less important, it is far more certain that sustained economic growth would provide real benefits than would emission reductions because although there is no doubt that poverty leads to death, disease and other problems, there is substantial doubt regarding the reality and magnitude of the negative impacts of GW, especially since they ignore, for the most part, improvements in adaptive capacity.

Of the three approaches outlined above, human well-being in poor countries is most likely to be advanced furthest by sustained economic development and to be advanced least by emission reductions.[77] In addition, because of the inertia of the climate system, economic development is likely to bear fruit faster than any emission reductions.

This conclusion is consistent with Figure 6, which shows that despite exaggerating the negative consequences of global warming, net GDP per capita is highest under the richest-but-warmest scenario and lowest under the poorest scenario. Thus poor countries should focus on becoming wealthier. The wealthier they are, the better able they will be to cope not only with the urgent problems they face today and will face in the future, but any additional problems brought about by GW, if and when they occur. For richer countries, too, economic growth and technological development are superior to emissions reduction as a means of addressing climate-related problems.

About the Author

Indur M. Goklany, Ph.D. is an author and a researcher who was associated with the Intergovernmental Panel on Climate Change off and on for 20 years as an author, expert reviewer and U.S. delegate to that organization. He is the author of *The Improving State of the World: Why We're Living Longer, Healthier, More Comfortable Lives on a Cleaner Planet* (Cato Institute, Washington, DC, 2007). Opinions and views expressed by Dr. Goklany are his alone, and not necessarily of any institution with which he is associated.

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