

“How much are we willing to spend now to insure our grandchildren against environmental disaster? How much are developed countries willing to spend to ward off problems for emerging economies?”

The Cost of Keeping Our Cool

DAVID WYSS

The planet's environment is going through an epochal upheaval in weather patterns. What might this mean for global economic growth?

It is a very difficult question, considering that the relevant time scale occurs over decades, not years, and that most of the burden of both damage and remediation will fall on future generations. Economists usually analyze choices that individuals make based on those individuals' own preferences. We are not as good at comparing the welfare of the present generation with the well-being of those to come, or at weighing costs incurred by developed countries against damage done to the environment of poorer nations, or at predicting how much people are willing to sacrifice today to help their grandchildren. To quote the famed economist Joan Robinson, “What has posterity ever done for me?”

Clearly, the costs of controlling carbon emissions remain highly uncertain, primarily because of technological variables. Analysts are still guessing what costs would be associated with substituting various types of nonfossil-fuel energy sources for oil, and how much conservation can cut energy demand. Still, as the technologies become better defined, the range of cost estimates is narrowing, and now at least some reasonable projections are becoming available.

Perhaps the most comprehensive look at the economics of climate change comes from a study for the British government overseen by the economist Nicholas Stern. It cites a likely cost of about 1 percent of the world's gross domestic product (GDP) by 2050—that is, the international community would need to invest about 1 percent of global GDP

per year to pay for conversion to alternative energy sources. However, the range of possible costs that the report mentions is rather wide. In the best-case scenario, GDP would actually increase by 1 percent because savings in energy costs would more than offset the costs of switching away from fossil fuels. In the worst-case scenario, global output would be reduced by 5 percent because it would prove more expensive than is currently expected to sharply reduce or eliminate the use of fossil fuels.

Of course, the costs of doing nothing are potentially much higher, although equally uncertain. The Stern report's estimate of the most likely cost of inaction is 5 percent of world GDP, but the range is up to 20 percent. The more catastrophe-minded would put the worst case at 100 percent—wiping out civilization (or at least economic output) as we know it. And it is clear that even though economic costs from the damage inflicted by global warming will be steep for Europe, North America, and East Asia, the heaviest burden will be borne by countries that can least afford it—the poor nations in equatorial regions.

CONVERSION COSTS

While global warming's economic ramifications are uncertain, the scientific consensus on climate change itself is nearly unanimous: It is happening, and carbon emissions are at least a significant part of the greenhouse gas problem that is contributing to warming. The extent of the coming damage is less knowable, but the incoming evidence seems to be undercutting the most optimistic models. For example, melting of the Greenland ice cap and upper-atmosphere temperature readings are both in the upper range of estimates produced by computer models.

Fortunately, the most pessimistic scenarios also seem less than likely to become reality. The Stern report cites a near-certain 2°C rise in world temperatures by 2035, with a 50 percent chance of a

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5°C jump, assuming continued increases in emissions at recent growth rates. Other reports show a lesser warming, but it is hard to find any reasonable scientific study that does not predict a significant rise.

On the other hand, even without efforts to reduce global warming, it is unlikely that carbon emissions could continue to rise at current rates. For one thing, there simply is not that much oil left in the ground (although coal produces even more carbon per unit of energy released). Also, global population growth is slowing, and China is likely to pull back from its recent breakneck rates of economic expansion.

Still, the evidence amassed so far indicates that, without effective emission controls, the use of fossil fuels will almost certainly make life uncomfortably hot for our descendants.

The primary cause of increased emissions is economic growth, particularly in Asia. Chinese energy demand has been rising at a double-digit pace for a decade, and the country has become the world's second-largest energy consumer. Even so, the average Chinese citizen still uses barely one-tenth the energy that the average American uses, and to blame China for trying to catch up seems hypocritical.

The other major impetus behind higher carbon emissions is population growth, even though in some parts of Europe, North America, and East Asia, fertility rates are below the zero-population-growth level. This does not mean populations are declining (although they already are in some countries), but it does imply that if birth rates continue at this pace, populations will stabilize eventually. However, in Africa, the Middle East, most of Latin America, and parts of South Asia, birth rates remain high, and populations there will continue to grow until the concentration of people in their childbearing years comes down.

The biggest single source of greenhouse emissions is power generation, which constitutes 24 percent of the world total. Transportation and industry each account for 14 percent. Motor vehicles have been the primary target for emissions controls, but fixed-source emissions are easier to limit in many ways. Consider coal, which is becoming the dominant fuel, especially in China, for electricity production. It has extremely high

carbon emissions per unit of energy generated, but new technologies may be capable of controlling them. However, these technologies still have to be tested and put into place.

It should be noted that 35 percent of all emissions are not from energy sources, but derive, primarily, from agriculture and other land uses. For example, growing crops creates emissions because carbon dioxide is stored in the soil. Plowing releases the gas. Decaying vegetation and landfills containing organic materials contribute carbon dioxide as well.

Some promising technologies are coming along to move energy use away from fossil fuels. By far the most effective method is simple conservation. Many conservation measures actually yield decent savings for modest initial investments. “Green lighting”—the use of fluorescent light bulbs, for instance, and even more efficient “LEDs” (light emitting diodes)—offers the clearest example. The

“green building” movement shows that designing buildings with the objective of reducing energy needs can be cost-effective at current prices. But even these simple, obvious measures require

that builders and developers think about long-term energy costs. Most people, given the choice, will choose to buy a refrigerator that costs \$100 less than a more efficient model, even if doing so results in additional electricity costs of \$30 a year (based on my recent shopping trip for an emergency replacement).

The good news is that there is no shortage of energy in the world. Solar, geothermal, wind, and other energy resources are available, and greater use of such renewable resources is a necessary part of the long-term cure. As already mentioned, however, the costs of converting to these sources are unclear and likely to be quite high. Also, many nonpolluting alternatives, including nuclear and wind power, face environmental objections themselves. In the short run, the answer will involve cleaner-burning fossil fuels, including improved coal technologies, and biofuels.

GAUGING THE ECONOMIC IMPACT

Even though the ultimate solutions are as yet unknown, a consensus is emerging that climate change needs to be addressed, as the UN Framework Convention on Climate Change and the

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There May Be Winners As Well As Losers

Gideon Rachman

HERE IS AN inconvenient truth: Global warming is good news for parts of the world. This is truly awkward. A planetary emergency that affected everyone equally would be much easier to tackle. However, climate change that hurts some places but helps others opens the way for dangerous new conflicts.

A recent report by the UN-sponsored Intergovernmental Panel on Climate Change (IPCC) confirms that global warming puts large parts of the world at risk from the biblical woes of famine, flood, and disease. The places most at risk are those that are already poor: sub-Saharan Africa and parts of Asia.

But in northern Europe, agriculture will become more productive and the climate will improve. From a parochial British point of view, for instance, the latest IPCC report sounds like good news. It has taken off the table the single most threatening scenario—the paradoxical threat that global warming was going to make Britain considerably colder by shutting down the Gulf Stream, the ocean current that gives the United Kingdom a much warmer climate than its latitude implies. The latest thinking from scientists reporting for the IPCC is that this is very unlikely to happen during this century.

Global warming, meanwhile, offers a positive bonanza for Russia. The legendary Russian winter gets more tolerable. As the permafrost retreats in Siberia, new mineral resources are revealed—and huge new areas become available for settlement and cultivation.

Gideon Rachman writes a column for the *Financial Times*, from which this is adapted.

In an irony that will infuriate environmentalists, oil companies are also likely to benefit from global warming. The US Geological Survey estimates that 25 percent of the world's known oil and gas reserves are in the Arctic Circle. As the ice melts, they become easier to exploit.

As a recent paper in *Environment and Urbanization*, an academic journal, makes clear, three-quarters of the 634 million people deemed to be most at risk from rising sea levels connected to global warming live in Asia. Coastal cities in the developed world, such as New York and Los Angeles, may be at risk. But wealthy countries are best placed to adapt to the problem. Certainly the Dutch, who have long experience of keeping the sea at bay, are not panicking. They are simply planning to spend billions more on flood defenses.

A WARM NEW WORLD

Of course, even countries that may benefit directly from global warming could suffer indirectly—as other parts of the world descend into chaos. Dealing with refugees and desperate immigrants, for example, will only get harder as life becomes tougher in Africa and the Asian subcontinent. In fact, it is now dawning on the world's politicians that global warming could transform international relations—introducing a range of new issues and conflicts.

The most obvious problems are struggles over refugees and resources. Some argue that the conflict in Sudan's Darfur region is partially caused by global warming, as settled farmers and nomadic herders fight over failing land. This sort of conflict could proliferate in the future. A conference arranged earlier this year

Kyoto Protocol suggest. How expensive remediation will be is unclear, in large part because the technologies are still being developed. But the Stern report's cost estimate of 1 percent of world GDP annually by 2050 is certainly a manageable figure. For the United States, that amounts to less than the cost of the Iraq War and is similar to estimates for increased security to fight terrorism after September 11, 2001. Moreover, expenses for global warming remediation, like those for extra security,

represent to a large extent an insurance policy against much greater future costs.

GDP itself is actually a poor measure of the economic impact of global warming, since statistical estimates will differ depending on how costs are incurred. Expenditures by the government or as capital investment by businesses will generally add to GDP, while costs incurred by individuals and corporations as ongoing expenses, such as higher energy or other operating costs, will not. The bet-

by the US Army War College heard that: “Within a century, extreme drought will affect 30 percent of the world, up from 3 percent today.”

Water shortages are a particular threat. They have long been an underlying source of conflict in the Middle East. But as India and China run short of water, their neighbors are worried that struggles may arise over the diversion of rivers and the building of dams.

The idea that the Chinese are oblivious to the threat of global warming is untrue, as I discovered on a recent trip to Beijing. Officials were openly concerned that the Yangtze and Yellow rivers were at their lowest levels for years. Much of the problem has to do with irrigation and industrial use. But the Chinese believe that global warming is also contributing to water shortages because of its effect on rainfall and the glaciers that feed into Chinese rivers.

The government in Beijing faces a dilemma. Terrified of social unrest, it is reluctant to do anything that might slow economic growth—such as stopping the building of coal-fired power stations. Yet water shortages are already causing social unrest in the countryside and the water table is falling fast in Beijing. One Western analyst based in China speculates that the next political upheaval there could come “when people in Beijing turn on their taps in 2009 and find there is no water coming out.”

Global warming will not just provoke conflicts over scarcity. It may also cause struggles over the emergence of new resources—in particular, the oil and gas that lie underneath the Arctic. Outstanding territorial disputes between Canada and the United States, between Russia and Norway, and between Denmark and Russia have taken on a new urgency in recent years, as

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these countries develop a new interest in hitherto unpromising stretches of ice.

Struggles over territory and borders are, at least, familiar ground for politicians and diplomats. But the new diplomatic world will increasingly be dominated by debates over the environment and international regimes for combating climate change. The argument over global warming could quickly turn into the latest and bitterest struggle between the traditional industrialized countries and the developing world.

Any successor to the US administration of George W. Bush is likely to be much more concerned about global action on climate change. And just as a new administration settles down in Washington, it will discover that China has sur-

passed the United States as the world's leading source of carbon dioxide emissions.

Although rich northern countries are best placed to cope with global warming, domestic public opinion means they are also likely to

be the countries pushing hardest for new international regulations to tackle greenhouse gas emissions. In the United States and Europe, climate change is becoming a new issue to berate China about—merging with protectionist concerns regarding exports from Chinese companies that practice “environmental dumping.”

But the Chinese will not lack allies in any struggle over who bears the costs of global warming. The Russians—with an economy based on fossil fuels, and a society that benefits from a warmer climate—may well stand with them. So might India and much of the developing world. Global warming presents a formidable environmental and scientific challenge. The political consequences may prove just as vexing. ■

ter measure is cost of remediation as a percentage of GDP, not change in GDP caused by remediation.

Look at it this way. Replacing a power plant with a windmill farm will add to GDP, since building windmills is an investment. However, the country will still have the same energy output. On the other hand, if a power generator uses sequestration of carbon dioxide, the costs incurred would probably not count as additions to GDP, but rather as a rise in the expense of operating the power plant. The

costs might be the same in either of these examples, and the results in terms of reduced emissions might also be the same. But the accountants would treat them differently.

Neither is unemployment a good way to measure the economic effects of climate change remediation. This is really not a jobs issue. The global costs of reducing carbon emissions will be felt in slower growth in real incomes, not higher unemployment. Simply put, the remedia-

tion process will create as many jobs as lower productivity growth will eliminate. There is no reason for the costs of mitigating global warming to raise unemployment.

International competitiveness could be a problem if all countries do not adopt similarly tight energy policies. If the United States were to adopt strict carbon emission controls while other major emissions producers did not, US costs of production would rise relative to those of other countries, and the current trade imbalances could be exacerbated. Currency exchange rate moves could solve that imbalance, but as we have seen recently, this adjustment can be difficult, especially if other countries do not allow their exchange rates to adjust.

On the other hand, the trade imbalance will be solved eventually, and countries that try to stop the adjustment may find themselves losing money on foreign exchange movements later. Note, too, that Europe and Japan, which have adopted tighter carbon restrictions than the United States has, are currently running trade surpluses, while the United States has a large trade deficit.

The issue of competitiveness, moreover, has another side. If other countries adopt new green technologies and conservation measures and the United States does not, it runs the risk of falling behind on the technology curve. As energy efficiencies improve overseas, American producers may find themselves making goods that are not competitive in the rest of the world. American consumers may turn to more energy-efficient imports as energy costs rise or when the United States does eventually move toward greater emissions control.

RESULTS MAY VARY

The economic damage from global warming itself, considered separately from the costs of reducing emissions, will vary by region. Worst hit will be low-lying countries and those that are already hot. These include mostly nations with high birth rates and low incomes. Countries in cooler climates, which have less to fear, generate the bulk of pollution. But even countries such as the United States

and China will feel the pain of climate change eventually, especially in the worst-case scenarios.

The impact on markets is harder to assess. Clearly, global warming will cause major changes in markets of all kinds across the world. The first impacts, especially in developed countries, will come from increased storm damage and a rise in the cost of insurance. (Scientists have linked global warming with increased intensity of storm activity, including hurricanes, and higher sea levels will exacerbate flood damage.) The effect on insurance companies themselves is already an issue: Witness the large-scale cancellation of homeowners' policies along America's East Coast, which is now affecting property values and mortgage availability.

Further down the road, a company's "carbon footprint" may even become a consideration in the process for rating corporate bonds. Depending on how a company pursues remediation, emitting carbon may become more expensive, giving an advantage to firms that are more energy-efficient. Remediation will create an additional business risk that companies will have to manage.

PAY TODAY—OR PAY TOMORROW

The global climate is changing—this is a certainty. What remains uncertain is how severe the damage will be, how much of the change in climate reflects a natural cycle or is man-made, and how expensive it will be to fix. But the room for argument is narrowing. The damage will be severe, and it could be disastrous. Human use of fossil fuels is a significant part of the problem. Even if we are not the primary cause, humans have to address the problem. While much uncertainty surrounds the cost, the cost will clearly be significant—but not impossible to bear. And remediation almost certainly will prove less costly than not fixing the problem.

The fundamental issue remains intergenerational and international. How much are we willing to spend now to insure our grandchildren against environmental disaster? How much are developed countries willing to spend to ward off problems for emerging economies? Here is one certainty: The longer the world waits, the more expensive and less credible the solutions become. ■