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COULD KYOTO KILL?

THE MORTALITY COSTS OF CLIMATE POLICIES

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EXECUTIVE SUMMARY

Whether or not the United States should ratify an international treaty to limit greenhouse gases is the most prominent question in today's environmental policy debate. Yet this discussion has all but ignored the most crucial policy issue – whether policies to limit greenhouse gas emissions might do more good than harm. Few have asked whether the Kyoto Protocol and other measures to reduce greenhouse gas emissions could be contrary to the interest of public health.

Advocates of a climate policy commonly invoke the precautionary principle – the idea that "it is better to be safe than sorry." This principle is commonly invoked by environmentalists confronted by uncertain environmental threats. The shortcoming of this argument is that action will itself create risks that may be far more certain and significant than the high uncertain risk prevented. There are substantial public health and safety risks of government regulations. The most serious concern about a global warming policy is that actions to restrain CO_2 emissions could cause thousands of deaths per year.

It is now well established, if not widely recognized, that environmental policies commonly cause increases in mortality. The climate policies currently under consideration, which are largely designed to decrease energy use, would create new risks and almost certainly cause greater harm to human health than benefit. Whether energy conservation is mandated, or induced by higher energy prices or government subsidy programs, it seems likely that any prospective energy savings would have to come from three sources – reductions in automobile energy use, reductions in home energy use, and reductions in industrial energy use. Additional reductions in greenhouse gas emissions could also be achieved through fuel switching.

- Increases in automobile fuel efficiency will reduce vehicle size and weights. An increase in average fuel economy from 27.5 to 40 miles per gallon, such as that contemplated by global warming policy, would cause approximately 1,650 additional highway fatalities and 8,000 more serious injuries per year.

- The most effective route to heating and cooling efficiency is to reduce the ventilation rate of buildings, but this increases the concentrations of indoor air pollutants. A fifty percent reduction in ventilation will roughly double indoor pollution concentrations and hurt public health.

- Alternative fuel sources are rarely, if ever, risk free. Alternative automotive fuels, such as ethanol, can increase emissions of certain air pollutants, and alternative energy sources, such as solar, create risks by increasing the production of hazardous waste.

While these costs are significant, the greatest health costs of requiring greenhouse gas emission reductions undoubtedly would result from the economic costs of such a policy. The economic costs of a global warming policy will translate directly into increased morbidity and mortality among U.S. citizens. Study after study demonstrates that richer is safer, that increasing income causes less death and illness. Money spent on increased energy costs is unavailable for the purchase of smoke detectors, fire extinguishers, bicycle helmets, and other products that protect health. Greater wealth also increases access to health care and education. As one recent study noted, "any public policy that leads to declining disposable income, such as environmental regulations, is likely to have significant adverse health effects" from injury and disease. The Kyoto Protocol, by itself, is expected to cost $7 to $1,830 billion, according to recent estimates. Using a conservative estimate that regulatory costs of $10 million induce one premature mortality shows that climate policies will result in an estimated 700 to 183,000 additional deaths each year.

Equally important, the distribution of the costs from mandated emission reductions is sure to be regressive. The poor tend to consume relatively more energy and energy-intensive products per capita, and will be the hardest hit by price increases. Placing the greatest burdens on the poor also exacerbates the public health costs of global warming policy. The studies on the health effects of income loss consistently find that the association is stronger for poor individuals, so a policy that takes money from the poor will have even greater adverse health consequences than the numbers estimated above.

Finally it is important to recognize the strong correlation between societal wealth and energy efficiency. As per capita income increases, so does energy efficiency. Increases in wealth also correlate with reductions in pollution. Economic growth is a sound environmental policy in its own right, and government actions that hurt such growth can undermine energy efficiency and control of environmental pollutants.

Adopting the Kyoto Protocol could be a public health catastrophe. Energy conservation measures could easily result in many tens of thousands of additional deaths. An even greater toll could result from the enormous economic costs of global warming policy and its effect on national income. From the perspective of the economy, public health, and even the environment, such a policy could be a lose-lose proposition.

Global warming may well entail substantial risks. But so do global warming policies. Before advocates of the Kyoto Protocol can claim that mandatory emission reductions represent the "safest" course, they must account for the substantial risks to public health that their suggested policies will cause.

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INTRODUCTION

Few environmental issues have seen more discussion than global warming. Whether or not the United States, and other nations, should ratify an international treaty to limit greenhouse gases is the most prominent question in today's environmental policy debate. Much ink has been spent debating whether the globe is actually warming and discussing the economic costs of efforts to combat any such warming.[1] Yet this discussion has all but ignored the most crucial policy issue – whether policies to limit greenhouse gas emissions might do more good than harm. Few have asked whether the Kyoto Protocol and other measures to reduce greenhouse gas emissions could be contrary to the interest of public health.

Few have asked whether the Kyoto Protocol could be contrary to the interest of public health.

Advocates of a climate policy commonly invoke public welfare concerns, claiming that global warming will cause hurricanes, disease epidemics, and so on. While there is little direct evidence of these effects, advocates rely upon the precautionary principle – the idea that "it is better to be safe than sorry." This principle is commonly invoked by environmentalists confronted by uncertain environmental threats. They argue that the uncertainty itself is cause for action, that the risk of adverse effects demands action to avert the risk. Such actions are often characterized as an "insurance policy" against unforeseen environmental harms. The shortcoming of this argument is that action will itself create risks that may be far more certain and significant than the high uncertain risk prevented. There are substantial public health and safety risks of government regulations. The most serious concern about a global warming policy lies in the direct and indirect public health costs of taking action to restrain CO_2 emissions.

There are substantial public health and safety risks of government regulations.

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[1] For highly contrasting perspectives on the science of global warming, see Patrick J. Michaels, Sound and Fury: The Science and Politics of Global Warming (Washington, DC: Cato Institute, 1992) and Stephen H. Schneider, Laboratory Earth: The Planetary Gamble We Can't Afford to Lose (New York: Basic Books, 1997). For similarly contrasting perspectives on the economics of climate change, see The Costs of Kyoto: Climate Change Policy and Its Implications, Jonathan Adler, ed. (Washington, DC: Competitive Enterprise Institute, 1997) and Roger Reppetto & Duncan Austin, The Costs of Climate Protection: A Guide for the Perplexed (Washington, DC: World Resources Institute, 1997).

It is now well established, if not widely recognized, that environmental policies commonly cause increases in mortality.[2] When an activity is proscribed, an alternative activity takes its place, and that alternative may be less safe. For example, imposing strict environmental standards on new cars or new production facilities causes prolonged use of dirtier old cars or facilities. Banning one "hazardous" material may induce people to use another that poses an even greater health risk.[3] The climate policies currently under consideration, which are largely designed to decrease energy use, would create new risks and almost certainly cause more health harm than they would benefit health. Indeed, as this paper demonstrates, one might expect tens of thousands of additional deaths to result from the types of measures contemplated to restrain global warming.

Policies designed to reduce greenhouse gases could well increase mortality and morbidity rates.

DIRECT HEALTH COSTS OF CLIMATE POLICIES

While using less energy is often regarded as an unqualified good, experience demonstrates that energy conservation can cost many lives. Energy efficiency – using less energy to produce the same output – is not always economically efficient, in that it does not always produce the economically optimal outcome. Energy conservation may be beneficial but unless reflectively undertaken, it can harm public health. Policies designed to reduce greenhouse gases by mandating or otherwise inducing reductions in energy use could well increase mortality and morbidity rates. In other words, as a result of mandated emission reductions, more people could die.

Those who argue for increased energy efficiency are often vague about where those efficiencies are to be found. Many economists argue for use of a carbon tax to control global warming, which has the benefit of letting the market find the greatest opportunities to increase efficiency. A tax, however, does not ensure that resulting conservation measures will be safe. Precipitously taken measures in response to such a jolt as a new tax are especially likely to be unsafe. Whether energy conservation is mandated, or induced by higher energy prices or government subsidy programs, it seems likely that any prospective energy savings would have to come from three sources – reductions in automobile energy use, reductions in home energy use, and reductions in industrial energy use.[4] Additional reductions in greenhouse gas emissions could also be achieved through fuel switching. Each of these, and their respective health risks, are discussed in turn.

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[2] See, e.g., John D. Graham & Jonathan Baert Wiener, *Risk Verus Risk: Tradeoffs in Protecting Health and the Environment* (Cambridge Mass: Howard Unversity Press, 1995); W. Kip Viscusi, *Fatal Tradeoffs: Public and Private Responsibilities for Risk* (New York: Oxford Unversity Press, 1992); Frank B. Cross, "Paradoxical Perils of the Precautionary Principle," 53 Washington & Lee Law Review 851 (1996).

[3] In 1992, a federal appeals court threw out Environmental Protection Agency asbestos regulations promulgated under the Toxic Substances Control Act (TSCA) for precisely this reason. Corrosion Proof Fittings v. EPA, 947 F.2d 1201 (5th Cir. 1991).

[4] One outline of energy savings in response to global warming is found in Edward S. Rubin, et al., "Realistic Mitigation Options for Global Warming," 257 Science 148 (July 10, 1992).

Automobile Energy Efficiency

The easiest way for automakers to increase auto efficiency is to reduce vehicle weights.

Increases in automobile fuel efficiency are central to efforts to control global warming. Environmental activists, from Vice President Al Gore to the Sierra Club, stress the importance of fuel efficiency standards in climate policy.[5] The Sierra Club, for its part, declared that increasing federal fuel economy standards is "[t]he biggest step to curbing global warming."[6]

Increases in vehicle fuel economy could be mandated by Congress or administrative rulemaking. They could result from significant increases in gasoline prices caused by other government policies designed to reduce energy consumption. Each automaker's fleet of new cars must average 37.5 miles per gallon (mpg) under current federal Corporate Average Fuel Economy (CAFE) standards.

The easiest way for automakers to increase auto efficiency is to reduce vehicle weights. When Congress required improvements in fuel economy in the 1970s, vehicle weights dropped from about 3,700 pounds to around 2,700 pounds. Unfortunately, making vehicles lighter makes them less safe and increases the toll from auto accidents. In 1991, the National Highway Traffic Safety Administration (NHTSA) estimated that the weight reduction from past fuel economy measures caused increases of approximately 2,000 fatalities and 20,000 serious injuries annually.[7] A peer-reviewed 1989 study by researchers from Harvard University and the Brookings Institution estimated that current CAFE standards cause a 14 to 27 percent increase in highway fatalities due to vehicle downsizing.[8] This amounts to between 2,700 and 4,700 highway fatalities in 1996.[9]

Further reductions in vehicle weights would require significant additional weight reductions and produce further health hazards.[10] The fatal crash rate increases by 1.1 percent for each one hundred pound reduction in vehicle weight, according to NHTSA.[11] Another recent analysis of the matter found that an average vehicle weight reduction of only one hundred pounds would cause an increase in incapacitating injuries to drivers ranging from a 1.5 percent increase for crashes involving fixed objects to a 5.9 percent increase for crashes.[12] An increase in average fuel economy from 27.5 to 40 mpg, such

Making vehicles lighter makes them less safe and increases the toll from auto accidents.

[5] See, e.g., Al Gore, Earth In the Balance (New York: Houghton-Mifflin, 1992), p. 325; Paul Rauber, "The Great Green Hope," Sierra, July 17, 1997.
[6] Julie C. DeFalco, "CAFE's Smashing Sucess," *CEI Update*, July 1997, p. 6.
[7] National Highway Traffic Safety Administration (NHTSA), A Collection of Recent Analyses of Vehicle Weight and Safety (May 1991).
[8] R.W. Crandall and J.D. Graham, "The Effect of Fuel Economy Standards on Automobile Safety," 32 Journal of Law & Economics 97 (1989).
[9] Julie C. DeFalco, "CAFE's 'Smashing' Success," CEI UpDate, July 1997, pp. 6-7.
[10] Graham & Weiner, supra n. 2, at 95.
[11] NHTSA, "Vehicle Size and Safety," 62 Federal Register 34491 (June 26, 1997).
[12] Charles Kahane, The Effect of Decreases in Vehicle Weight on Injury Crash Rates (NHTSA Washington, DC January 1997).

as that contemplated by global warming policy, would cause approximately 1,650 additional annual fatalities and 8,000 more serious injuries per year.[13]

Defenders of increased CAFE standards point to improvements in vehicle design and increases in material strength that improve vehicle safety. These improvements are real, and small cars today are substantially safer than the small cars of yesteryear. Some are even safer than larger cars were a decade ago. Technology and design advances have improved the safety of small and large cars alike, without eliminating the fundamental fact that, all other things equal, larger, heavier cars are safer than smaller, lighter cars.

Home Energy Efficiency

Considerable experience in home energy efficiency programs demonstrates their hazardous nature.

A substantial amount of energy is used for home heating and cooling. Therefore, reducing greenhouse gas emissions through energy efficiency measures will require reductions in home energy consumption.[14] Considerable experience in home energy efficiency programs demonstrates their hazardous nature. The most effective route to heating and cooling efficiency is to reduce the ventilation rate of buildings, so that heating and cooling do not escape to the external air. But such ventilation reductions cause the internal buildup of indoor air pollutants to levels significantly higher than those found in the outside air. The increased indoor air pollution is directly proportional to the amount of energy savings. A fifty percent reduction in ventilation will roughly double indoor pollution concentrations.[15] Because Americans spend more than 90 percent of their time indoors, the risk from indoor pollution exceeds that from outdoor pollution.[16]

Most of the attention regarding the hazards of concentration of indoor air pollution regards radon. Radioactive radon gas naturally is emitted from the ground beneath houses and, without ventilation air changes, concentrates in those houses. Energy-efficient homes may have indoor radon concentrations five times that of other buildings.[17] The hazards of radon exposures are somewhat uncertain, as estimates range from 7,000 to 30,000 premature deaths attributable to such exposures.[18] Some question the reality of the radon

[13] John Graham, "The Safety Risks of Proposed Fuel Economy Legislation," 3 Risk: Issues in Health and Safety 95 (1992).
[14] See Rubin et al., supra note 3. This analysis finds that nearly 50 percent of the energy savings that is available at low net cost are from residential and commercial energy use; Intergovernmental Panel on Climate Change (IPCC), Climate Change 1995: Economic and Social Dimensions of Climate Change at p. 238 (suggesting that most energy conservation must come from residential heating and cooling).
[15] Frank B. Cross, Legal Responses to Indoor Air Pollution (New York: Quotum Books, 1990), p. 9.
[16] See Andrew M. Pope, "Indoor Allergens – Assessing and Controlling Adverse Health Effects," 269 Journal of the American Medical Association 2721 (June 2, 1993).
[17] Milton Meckler, Indoor Air Quality Design Guidebook (Liburn, GA: Fairmont Press, 1985), p. 17.
[18] Kenneth Warner, David Mendez, & Paul N. Courant, "Toward a More Realistic Appraisal of the Cancer Risk from Radon," 86 *American Journal of Public Health* 1222 (1996).

risk,[19] but not the Environmental Protection Agency (EPA). According to the EPA, indoor radon clearly represents one of the greatest public health threats confronting the American public, and policies designed to increase home energy efficiency will only aggravate the risks. In the 1980s, the EPA estimated that past Department of Energy weatherization programs may have resulted in 10,000 to 20,000 additional lung cancer deaths.[20] Because much of the future energy saving from any global warming policy must come from home energy efficiency, substantial increased mortality would be expected.

Home energy efficiency measures will also increase public health risks from other indoor air pollutants, including formaldehyde, carcinogenic volatile organic compounds, carbon monoxide, particulates, and nitrogen oxides, among others.[21] Even with the current housing stock, indoor exposure levels are far in excess of those regulated outdoors.[22] Many energy efficiency measures will further concentrate current indoor exposures to these compounds. Ironically, the environmentalists so concerned with outdoor pollution exposures will incidentally increase indoor exposures to the same pollutants, should climate policy be adopted.

Many energy efficiency measures will further concentrate current indoor exposures to these compounds.

Another recommendation for home energy efficiency is painting roofs white to improve reflectivity and planting shade trees around half of all American homes.[23] This seemingly innocuous policy would actually have significant public health costs. Take a conservative estimate of 32 man-hours per repainted roof and 22 million homes (roughly half the housing stock) yields over 700 million man-hours for the job or annual full-time employment of about 350,000 roof painters. Roofing is one of the 25 most hazardous occupations, with over 24 annual deaths per 100,000 workers.[24] By these calculations, the painting policy would cause over 80 deaths. This estimate is only the tip of the iceberg, of course, ignoring occupational injuries and other hazards arising from the paint production process.

Planting shade trees is also a hazardous policy. High levels of outdoor shade can cause substantial (up to five-fold) increases in indoor concentrations of mold spores.[25] Reduced ventilation adds to the increase of indoor mold exposures even more; a halving of ventilation would double concentra-

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[19] *See, e.g.*, Leonard A. Cole, *Elements of Risk: The Politics of Radon* (Washington, DC: AAAS Press, 1993).

[20] Isaac Turiel, *Indoor Air Quality and Human Health* (Stanford, CA: Stanford Unversity Press, 1985), p. 40.

[21] Cross, supra note 14, at 52.

[22] A major study of actual human exposures found that exposures to pollutants in indoor air was consistently and significantly higher than in outdoor air. EPA, The Total Exposure Assessment Methodology (TEAM) Study (June 1987). L. Wallace, The Total EAM, Summary & Analysis: Vol I. Environmental Monitoring and Quality Assurance, Office of Research and Development, EPA, Washington, DC.

[23] See Rubin et al., supra note 3.

[24] J. Paul Leigh, *Causes of Death in the Workplace* (Westport, Conn.: Quorum Book, 1995).

[25] Peter P. Kozak & Janet Gallup, "Endogenous Mold Exposure: Environmental Risk to Atopic and Nonatopic Patients," in *Indoor Air and Human Health*, R.B. Gammage & S.V. Kaye eds. (Chelsea, Mich: Lewis Publishers, 1985).

tions, so that the combination of shade trees and tightened ventilation could cause a ten-fold increase in indoor exposures. Such mold spores are a significant cause of human disease. Mold allergens are a leading cause of asthma, which causes over 4500 deaths and 450,000 hospitalizations annually.[26] A ten-fold increase in mold exposures would presumably increase these numbers materially.

Lessened home ventilation would even further compound the indoor exposure levels.

Lessened home ventilation would even further compound the indoor exposure levels. Due to the many adverse health effects attributable to home energy efficiency, it appears that tens of thousands of deaths could be caused or contributed to by mandated emission reduction policies. Moreover, as discussed below, economic losses associated with climate policy would compound the asthma problem, as poverty is the leading risk factor for asthma.[27]

Industrial Energy Efficiency

In contrast to automobile and home energy efficiency measures, there is little evidence that federal efforts to encourage industrial energy efficiency have cost lives. Further improvements in industrial energy efficiency may likewise be a safe policy. Yet federal intervention is unnecessary to obtain these efficiencies, and such a policy may even be counterproductive. Not surprisingly, a considerable amount of private enterprise seeks to profit from enhanced energy efficiency. State and federal electric deregulation would do more to promote further increases in industrial energy efficiency than a federal global warming policy.[28] Moreover, existing environmental regulations often delay energy efficiency improvements. Input-based pollution control standards actually penalize energy efficiencies.[29] Similarly, the Environmental Protection Agency's listing of mercury as a hazardous waste has slowed and complicated the shift to high efficiency fluorescent lighting because the trace amounts of mercury in fluorescent bulbs subjects their disposal to federal regulation under the Resource Conservation and Recovery Act (RCRA).[30] Reducing government subsidies to energy industries would also promote increased energy efficiency, without requiring the imposition of energy taxes, regulatory controls on energy use, or subsidies for increased energy efficiency.

Existing environmental regulations often delay energy efficiency improvements.

[26] Pope, supra note 13.
[27] Susan E. Dudley & Wendy L. Gramm, "EPA's Ozone Standard May Harm Public Health and Welfare," 17 *Risk Analysis* 403, 405 (1997) (quoting conference articles of the American Thoracic Society).
[28] Trigen Corporation, *The Policy Link Between Electric Deregulation, Climate Change Policy and Output-Based Emission Standards* (1997).
[29] *Id.*
[30] See, e.g., Jonathan Adler, "Wasted Lights," *Regulation*, 1996, No. 2, pp. 15-18.

While increased energy costs logically will encourage greater energy efficiency over time, the short-term impact of higher costs may have been overstated. An Argonne National Laboratory study of six major industries for the Department of Energy found that in the short run, increases in industrial energy efficiency are not stimulated by increases in fuel costs but tend to come from "continuous and incremental improvements over time in existing plant and equipment."[31] As a practical matter, much of the increase in energy efficiency results from overall improvements in productivity, which tend to result from capital investment, which could perversely be discouraged by a global warming policy.[32] By reducing industry's ability "to fund research, development, and implementation of new technologies," climate policy "may impede crucial technological advancement."[33] Hence, global warming policies could interfere with efforts to increase the efficiency of industrial processes. Industrial energy efficiency efforts may be relatively safe, but a global warming policy will not enhance such efforts.

A shift to wood-burning stoves would significantly increase air pollution.

Fuel Switching

Some advocates of global warming policy advocate fuel switching, from fossil fuels to some other source. The health costs of such fuel switching will depend largely upon the alternative chosen.[34] It is worth noting that supposedly "clean" alternatives, such as solar power, would themselves pose health risks due to the wastes that they generate.[35] Switching sources of electric power generation is a very long-term process that will not produce many costs or benefits in the short run. For industrial uses of energy, prevailing production processes do not permit much fuel switching.[36]

A global warming policy may produce some short-term fuel switching away from electricity altogether. A tax passed on through electricity prices would cause some homeowners to switch to other untaxed sources of home heating, such as wood-burning stoves. Electricity costs could increase by around 50 percent, which surely would lead consumers to shift to untaxed sources such as wood.[37] A shift to wood-burning stoves would significantly increase air pollution. The highest level of airborne particulate pollution recorded in the U.S. came in Klamath Falls, Oregon, where heating with wood

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[31] Ronald J. Sutherland, *The Impact of Potential Climate Change Commitments on Energy Intensive Industries: A Delphi Analysis* (Argonne National Laboratory, February 5, 1997), p. 20.
[32] *Id.* at 18-20.
[33] Frederick H. Rueter, *Framing a Coherent Climate Change Policy* (St. Louis: Center for the Study of American Business, October 1997).
[34] A switch to natural gas would probably offer health benefits, but contemplated global warming policies would cause a substantial increase in natural gas prices, discouraging its consumption. Sutherland, supra note 30 at 5.
[35] See Bernard L. Cohen, "The Hazards of Nuclear Power," in *The State Of Humanity*, Julian Simon ed. (London: Blackwell, 1995), p. 583, Table 51.1.
[36] Sutherland, supra note 30, at 17.
[37] The 50 percent estimate is from Sutherland, supra note 30.

is more common.[38] The energy price increases of the 1970s caused a dramatic shift to wood as a fuel and an attendant increase in air pollution, both indoors and out.[39] One study found the presence of a wood stove in a home increased the probability of a child having a severe respiratory symptom from 3 percent to 84 percent.[40] Large scale switching to wood stoves obviously implies considerable increases in disease.

Switching automotive fuels to ethanol is another possible effect of global warming policies.[41] Alcohol-based automotive fuels have been touted as solutions to global warming. Such a switch is not environmentally beneficial, however. Alternative fuels such as ethanol can aggravate ozone problems.[42] An official of the California Air Resource Board has announced that use of alcohol-based fuels in cars "hurts air quality."[43] Fuel switching, like other potential global warming policies, could actually hurt public health.

Economic losses mean poorer health and more mortality – poverty is perhaps the greatest threat to public health.

INDIRECT COSTS OF CLIMATE POLICIES

The greatest health costs of requiring greenhouse gas emission reductions undoubtedly would result from the policy's aggregate economic costs and the consequent decrease in societal wealth. Economic losses mean poorer health and more mortality – poverty is perhaps the greatest threat to public health. Climate policy threatens considerable economic losses. Direct price increases would be considerable, as the price of electricity would increase by 50 percent, the price of coal would more than double, and the price of natural gas and fuel oil would increase by 70 to 80 percent.[44] These increased costs would take a considerable toll on economic growth.

The effects of a global warming policy, such as a carbon tax, on economic growth have been studied extensively. Dozens of studies have sought to measure the effect of such a policy on national income, using different assumptions and varying models. Nearly all foresee substantial economic costs from efforts to reduce greenhouse gas emissions over the next few decades. The estimates of some of the leading studies on the effects on the U.S. economy are set forth in Table 1, which reports lost GDP according to the percentage decrease in CO_2 in a given future year.[45]

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[38] Gregg Easterbrook, *A Moment on the Earth* (New York: Viking: 1995), p. 581.
[39] Jonathan M. Samet, Marian C. Marbury, & John D. Spengler, "Health Effects and Sources of Indoor Air Pollution" 136 *American Review of Respiratory Disease* 1486 (1987).
[40] *Id.* at 1503.
[41] See Rubin et al., supra note 3.
[42] Michael Fumento, *Science Under Siege* (New York: William Morrow,1993), pp. 320-321.
[43] See Matthew L. Wald, "'Gasohol' May Cut Monoxide but Raise Smog, Study Asserts," *The New York Times*, May 9, 1990, p. D2.
[44] Sutherland, supra note 30, pp. 4-5.
[45] The estimates of the studies are taken from IPCC, supra note 13, p.304 and Gary Yohe, *Climate Change Policies, Living Standards, and Real Wage Growth* (September 11, 1996), at Table 3.1; John Douglas, "Global Climate Research: Informing the Decision Process," *EPRI Journal* (November-December 1995).

Table 1

Economic Costs of Global Warming Policy

Study	% Decrease	Year	GDP Loss
Barnes (1992)	45%	2020	2%
DRI (1992)	37%	2020	1.8%
AES Corp. (1990)	20%	2030	1.4%
Jorgenson & Wilcoxen (1991)	32%	2020	1.6%
Manne & Richels (1990)	45%	2020	2.2%
Burniaux (1991)	20%	2050	0.9%
Oliveira-Martins (1992)	45%	2020	1.1%
Rutherford (1992)	45%	2020	1.3%
Goulder (1993)	20%	2030	1.2%
EPRI (1995)	20%	2010	2.3%
Edmonds & Burns (1991)	20%	2095	1.1%

Studies of the economic effects on the developed nations of Western Europe have reached very similar results.[46] It seems fair to assume that the economic costs of such a policy over the next 25 to 30 years will be a loss of at least 1 percent of GNP. The most recent study, by an independent government research arm of the Australian government found comparable losses and pegged the ultimate per capita loss at over $1,500.[47] One consequence of the economic losses is reduced employment – a federal study estimated that a climate policy could cost 900,000 jobs by the year 2005.[48]

Some advocates of reducing greenhouse gas emissions might point favorably to the many jobs created by, say, house painting, as evidence of economic benefits from the policy. While global warming policies would create new markets and new jobs, these are not a net increase in new jobs. The money spent on roof painting is not magically created, it must be drawn from other goods or services that will suffer a corresponding decrease in employment. The estimated economic losses are, after all, net losses in GDP. To argue that requiring house painting or other labor-intensive modifications will create net jobs is what economists refer to as the "broken-window fallacy," as one could just as easily argue that hoodlums create net jobs by vandalizing storefronts. Moreover, the jobs created by the global warming policy would be short-term and some research suggests that transitory employment does not offer health benefits and may actually increase the mortality risk.[49]

[46] See IPCC, supra note 13, p. 314.
[47] Australian Bureau of Agricultural and Research Economics, *The Economic Impact of International Climate Change Policy* (ABARE, 1997).
[48] Interagency Analytical Team, Economic Effects of Global Climate Change Policies, draft report of U.S. Department of Energy and U.S. Environmental Protection Agency (June 1997).
[49] John D. Graham, et al., "Poorer is Riskier," 12 *Risk Analysis* 333 (1992).

The World Resources Institute (WRI) has sought to demonstrate how, with certain assumptions, mandated greenhouse gas reductions could help the economy.[50] But some of the WRI assumptions are patently unrealistic – such as assuming the efficient return of carbon tax revenues through lump sum rebates – and others are contrary to current policy proposals – such as coordinated international implementation. The WRI ran 162 different simulations, varying the assumptions, and over 125 of their estimates showed a negative effect on GDP.[51] Most of these negative effects exceeded a 1 percent loss of GDP, so that even the economic advocates of global warming policy acknowledge the very real possibility of a substantial economic loss.

The economic costs of a global warming policy will translate directly into increased morbidity and mortality among U.S. citizens.

The economic costs of a global warming policy will translate directly into increased morbidity and mortality among U.S. citizens. Study after study demonstrates that richer is safer, that increasing income causes less death and illness.[52] Money spent on increased energy costs is unavailable for the purchase of smoke detectors, fire extinguishers, bicycle helmets, and other products that protect health. Greater wealth also increases access to health care and education.

Using the sort of extrapolation commonly applied to environmental pollutants, researchers have found the amount of lost wealth statistically associated with a premature death. For example, if an additional $70,000 per person reduces the annual risk of death by 1 in 100, an increase of $7 million

Table 2

Association of Income and Health

Study	**Association**
Graham, et al. (1992)	$4.0 million
Chapman & Hariharan (1993)	$12.2 million
Keeney (1990)	$12.3 million
Chirikos & Nestel (1991)	$3.3 million
NIH (1992)	$12.4 million
Wolfson (1992)	$6.0 million
Duleep (1991)	$3.9 million
Anderson & Burkhauser (1985)	$1.9-$4.3 million
JEC (1984)	$1.8-$2.7 million

[50] Roger Reppetto & Duncan Austin, *The Costs of Climate Protection: A Guide for the Perplexed* (Washington, DC: World Resources Institute, 1997).
[51] *Id.* at 12.
[52] Many of these studies are summarized in Frank Cross, "When Environmental Regulations Kill: The Role of Health/Health Analysis," 22 *Ecology Law Quarterly* 729 (1995). See also W. Kip Viscusi, "Regulating the Regulators," 63 *University of Chicago Law Review* 1423 (1996); Cass R. Sunstein, "Health-Health Tradeoffs," 63 *University of Chicago Law Review* 1533 (1996).

would correlate to an additional life saved. These studies are summarized in Table 2, which presents the amounts of lost income likely to result in a probabilistic premature death.[53]

Implementing the Kyoto Protocol could cause anywhere from 700 to 183,000 additional mortalities per year.

While the studies do not agree on the precise magnitude of the association, the data clearly demonstrates a strong association between relative wealth and human death rates. Indeed, the comparative results of this research are far more consistent than that on environmental health effects. Not surprisingly, the association with income also extends to other health measures. The most recent research in this field controlled for literally dozens of potentially confounding variables and still found a strong association between income and both physical and mental health.[54] The author concluded that "any public policy that leads to declining disposable income, such as environmental regulations, is likely to have significant adverse health effects" from injury and disease.[55]

Even ignoring the increased burden of disease, a global warming policy would cause a substantial increase in the death rate. Take a conservative estimate of the association between income and risk of death of $10 million and a conservative estimate of a loss of only $1,000 per year in income as a result of global warming policy. The result would be an increased risk of death of 1 in 10,000 for the entire U.S. population. Assume a population of 250 million, and the risk assessment would project 25,000 premature deaths annually from the global warming policy. Regrettably, the costs of climate change policies could be greater than this.

The accompanying table shows recent estimates of the emission reductions called for under the Kyoto Protocol, and the increase in annual mortality assuming one premature death for every $10 million in costs. It indicates that implementing the Kyoto Protocol could cause anywhere from 700 to 183,000 additional mortalities per year.

Table 3

Annual Indirect Mortality Costs of Enacting the Kyoto Protocol

Study	% Decrease	Year	GDP Loss (million 1997$)	Annual Mortality
Council of Economic Advisors	31%	2008-2012	7,000 - 12,000	700 - 1,200
Charles River Associates	31%	2010	129,000	12,900
WEFA, Inc.	37%	2010	343,000	34,300
Standard & Poor's DRI	30%	2012	572,000 - 1,830,000	57,200 - 183,200

[53] The summary of studies is taken from Viscusi, Sunstein, and Cross, supra note 50.
[54] Susan L. Ettner, "New Evidence on the Relationship Between Income and Health," 15 *Journal of Health Economics*, 67 (1996).
[55] *Id.* at 82.

The distribution of the costs from mandated emission reductions is sure to be regressive. Contemplated policies will produce a substantial increase in energy costs which will reach consumers in the form of higher prices. The poor tend to consume relatively more energy and energy-intensive products per capita. One study found that a representative $100 per ton carbon tax would create an additional cost burden of more than 10 percent for the poorest ten percent of Americans and a burden of about 1.5 percent for the richest ten percent.[56] By other measures, regressivity would be less – around 3 percent for the poorest twenty percent versus 1.8 percent for the wealthiest quintile.[57] Even with the latter more sanguine distributional estimates, the degree of regressivity is significant. The poorest citizens do not have three percent of their income to spare.

Placing the greatest burdens on the poor also exacerbates the public health costs of global warming policy. The studies on the health effects of income loss consistently find that the association is stronger for poor individuals, so a policy that takes money from the poor will have even greater adverse health consequences than the numbers estimated above. Keeney found that a regressive distribution of costs could as much as double the adverse health consequences of lost income.[58] It is ironic that the same Administration that has elevated concerns about "environmental justice" to the fore is also promoting environmental policies that will have a tremendously regressive, and unjust, effect.

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Finally it is important to recognize the strong correlation between societal wealth and energy efficiency. As per capita income increases, so does energy efficiency. Increases in income in affluent countries also mean decreases in pollution.[59] The association is also true for per capita emissions of greenhouse gases. A study of the developed OECD nations found that from 1971 to 1988, every additional $1,000 in per capita income meant a 3.5 percent decrease in per capita carbon dioxide emissions.[60] Economic growth is a climate policy in its own right, and government actions that hurt such growth can undermine energy efficiency and control of carbon dioxide emissions.

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[56] James M. Poterba, "Tax Policy to Combat Global Warming: On Designing a Carbon Tax," in *Global Warming: Economic Policy Responses*, R. Dornbusch & J.M. Poterba eds. (Cambridge, Mass: MIT Press, 1991).
[57] K. Hamilton & G. Cameron, "Simulating the Distributional Effects of a Canadian Carbon Tax," 20 *Canadian Public Policy* 385 (1994).
[58] Ralph L. Keeney, "Mortality Risks Induced by Economic Expenditures," 10 *Risk Analysis* 147 (1990).
[59] See, e.g., Indur M. Goklany, "Richer is Cleaner," in *The True State Of The Planet*, Ronald Bailey ed. (New York: The Free Press, 1995), pp. 339-378.
[60] Frank B. Cross, "A Syncretic Perspective on Environmental Protection and Economic Growth," 2 *Kansas Journal of Law & Public Policy* 53, 61 (1992).

HEALTH EFFECTS OF GLOBAL WARMING

It is generally assumed that restraining increases in global temperature will have health benefits for citizens. This assumption may reflect an erroneous belief that we have a stable climate or can stabilize our climate. In fact, climatic change is a constant in world history, and such change may be good as well as bad. While it is not clear that global warming policy would have a significant effect on temperatures, an effective policy that prevents warming would probably cause worsened health. As it happens, even aside from the health costs of regulatory policies discussed above, warmer – by itself – can be safer.

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Until recently, many climate scientists worried about the environmental effects of global cooling. Such naturally occurring cooling, it was feared, might trigger a new ice age.[61] Were this the case, human-induced warming would have obvious benefits. The presence of natural cooling is uncertain, of course, but the possibility illustrates the potential perverse consequences of global warming policy.

Regardless of whether natural forces are cooling or warming the planet, there is reason to believe that heating would be good for public health. Global warming does not necessarily mean dangerous summer high temperatures – much of the heating that purportedly has occurred has come in the winters and at night.[62] Whenever the warming occurs, it will likely reduce deaths. One multiple regression on the effects of temperature on mortality in 89 counties concluded that a warmer climate of 2.5° Celsius would reduce deaths nationwide by about 41,000.[63] Other studies suggest different results,[64] but this recent research shows considerable health benefits from warming.

Global warming, if it occurs, could also benefit agriculture considerably. Increasing CO_2 levels enhance photosynthesis and boosts plant growth correspondingly.[65] Warming might also bring increased precipitation that

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[61] See Easterbrook, supra note 39, p. 268.

[62] C.K. Folland et al., "Observed Climate Variability and Change," in *Climate Change 1992: The Supplementary Report to the IPCC Scientific Assessment*, J.T. Houghton, B.A. Callander, & S.K. Varney eds. (1992).

[63] Thomas Gale Moore, *Health and Amenity Effects of Global Warming*, Hoover Institution Working Papers in Economics E-96-1 (January 1996). The study controlled for other variables likely to affect mortality rates. Moore also studied three years of data on temperature and mortality in Washington, D.C. and found results that would suggest a 2.5° increase in temperature would save 37,000 lives.

[64] IPCC, supra note 13, pp. 195-198, reviews studies on effects of global warming on human mortality.

[65] See Graham & Weiner, supra note 2, p. 215 (reviewing research showing an increase of up to fifty percent in plant growth from elevated carbon dioxide levels). They note that commercial greenhouse operators keep levels two to six times that of the ambient atmosphere. *Id.*

would stimulate plant growth.[66] One model found that a 2.5° increase in temperature would cause the value of U.S. agricultural production to increase by nearly $15 billion per year.[67] Studies on agricultural effects are uncertain and conflicting,[68] but the possible benefit of global warming is real.

Of course, the full consequences of global warming on human welfare are highly speculative. A net global warming could conceivably present human health risks of various sorts, regionally if not worldwide. Humans are not passive, however, and are capable of adapting to the effects of warming.[69] Adaptation ability therefore becomes significant in assessing the impact of any warming, and adaptation need not be terribly expensive.[70] Adaptation ability, though, is influenced by a variety of factors, particularly national wealth.[71] Richer, more productive, and more technologically advanced nations are better able to adapt to climate change. Ironically, then, a global warming policy, even if somewhat successful, could aggravate the consequences of warmingby reducing wealth. Thus, relatively less warming could produce greater harm due to reduced societal adaptability.

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INTERNATIONAL EFFECTS OF CLIMATE POLICY

Global warming policy, as currently envisioned, would focus on reducing CO_2 emissions from the developed world and might virtually ignore emissions from developing nations. Given the enormous magnitude of the contemplated carbon tax, the policy would cause a shift to the developing world for production facilities in several major industries. The 1997 study by Argonne National Laboratory found that virtually all production in the paper and allied products industry, the iron and steel industry, the petroleum refining industry, the aluminum industry, the chemical manufacturing industry, and the cement industry would shift to largely unregulated countries.[72] Such a production shift obviously would have a major adverse effect on the U.S. economy, with consequent health and environmental impacts.

In addition to the economic harms to the U.S., contemplated global warming policies would have little positive environmental effect. Overall CO_2 emissions would not decline but would simply shift overseas, a process called

[66] Robert C. Balling Jr., "Global Warming: Messy Models, Decent Data, and Pointless Policy," in *The True State of the Planet*, Ronald Bailey ed. (New York: The Free Press, 1995), pp. 100-101.
[67] Douglas, supra note 46.
[68] IPCC, supra note 13, pp. 189-191 reviews studies on effects of global warming on agricultural production.
[69] For a discussion of possible adaptation, see National Academy of Sciences, *Policy Implications of Greenhouse Warming* (Washington, DC: National Academy Press, 1991).
[70] See Douglas, supra note 46 (suggesting that full adaptation to a one meter rise in see levels would cost only a few billion dollars annually).
[71] See Indur M. Goklany, "Strategies to Enhance Adaptability: Technological Change, Sustainable Growth and Free Trade," 30 *Climatic Change*, 427 (1995).
[72] Sutherland, supra note 30.

leakage.[73] While leakage is unlikely to be one hundred percent, it may be substantial. Estimates range from 25 percent to 70 percent.[74] Overall emission of other substances would certainly increase, at least in the short run. Poorer developing nations have substantially less stringent environmental controls, much lower willingness to pay for environmental protection, and greater emissions per unit of industrial output than the U.S. and the developed world.[75] A production shift could therefore mean more exposure to particulates, nitrogen oxides, and other pollutants, at least until the increased development led to greater demand for environmental protection and the adoption of cleaner technologies.[76]

Global warming policy could be a public health catastrophe.

Of course, a major industrial production shift overseas would help the economies of developing nations and correspondingly improve their health status. But if the policy objective is to help the economies of poor countries, a global warming policy is hardly an honest or efficient means. Direct policies would be more straightforward and effective. Indeed, the economies of poorer nations might not benefit so much from a global warming policy after all. Developing countries depend for growth on exports to developed nations. As the economies of the developed world labor under a global warming policy, developing country exports of all sorts will decline.[77] So such a policy might provide little net reduction in CO_2 emissions, increase pollution in both developed and developing nations, severely damage the economies of developed nations, and provide little or no benefit to the economies of the developing world. A more perverse policy is hard to imagine.

CONCLUSION

Global warming policy could be a public health catastrophe. Energy conservation measures could easily result in many tens of thousands of additional deaths. An even greater toll could result from the enormous economic costs of global warming policy and its effect on national income. From the perspective of the economy, public health, and even the environment, such a policy could be a lose-lose proposition, leaving everyone worse off in each regard.

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[73] *Id.* at 2.

[74] IPCC, *Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analysis* (1995), pp. 342-343.

[75] See N. Shafik & S. Bandyopadhyay, *Economic Growth and Environmental Quality: Time Series and Cross-Country Evidence*, World Bank Policy Research Working Paper (June 1992).

[76] Cross, supra note 34, p. 53. The resulting economic slowdown in the United States could also reduce the willingness to pay for environmental protections in this country. *Id.*, pp. 56-57.

[77] The Australian Bureau of Agricultural and Resource Economics found that a global warming policy would hurt the growth of even some of those undeveloped countries that would be largely exempt from the restrictions on CO2 emissions. *The Economic Impact of International Climate Change Policy*, supra note 48, pp. 56-64.

The claimed health benefits of a climate policy include a reduction in severe weather, avoidance of coastal flooding, and reduced risk of insect-borne disease. These risks are all highly uncertain and well in the future. Yet the health costs of a climate policy are far more certain and immediate. As illustrated in Table 4, these include increased driving fatalities (perhaps two thousand additional deaths annually); health consequences of increased indoor air pollution (perhaps ten thousand annual additional deaths and hundreds of thousands of disease episodes); greater mortality from reduced income (as many as twenty-five thousand additional deaths annually). This toll does not include other health costs from occupational mortality and other potential pollution increases.

Table 4

Annual Mortality Costs of Global Warming Policy

Highway Fatalities from Automobile Fuel Economy Standards	~2,000
Indoor Air Pollution Caused by Residential Energy Efficiency Measures	~10,000
Increased Indoor and Outdoor Air Pollution from Fuel Switching	Unknown
Increased Mortality from Reductions in Wealth	~13,000-34,000
Reduced Societal Capacity to Adapt to Change	Unknown

Global warming policy could simultaneously reduce public health and perpetrate one of the greatest environmental injustices in history. The environmental justice movement argues that the health concerns of the poor and minority groups should be forefront in environmental protection. Yet imposing greenhouse gas emission reductions would regressively increase the costs of essential products and services needed by the poor, including transportation and electricity; cost jobs necessary for their economic advancement; produce increased morbidity and mortality associated with poverty; and increase the already severe health toll of asthma, among other consequences.

Global warming policy could simultaneously reduce public health and perpetrate one of the greatest environmental injustices in history.

Global warming may well entail substantial risks. But so do global warming policies. Before advocates of the Kyoto Protocol can claim that mandatory emission reductions represent the "safest" course, they must account for the substantial risks to public health that their suggested policies will cause. Rushing forward to ratify a treaty or enact other policies while ignoring the potential mortality costs is irresponsible and unjust.

ABOUT THE AUTHOR

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