

Reasonable Responses to Climate Change

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by H. Sterling Burnett

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Many people are concerned that an increasing concentration of greenhouse gases in the atmosphere — due primarily to such human activities as burning fossil fuels for energy — is causing the Earth to warm, with potentially harmful results. In response, many developed countries agreed to the Kyoto Protocol on Climate Change, committing them to limit and eventually reduce their greenhouse gas emissions. The United States chose not to participate, in part because the agreement exempts such developing countries as China and India, although they have the world's fastest-growing economies and emissions.



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Executive Summary

However, the Obama administration supports a cap-and-trade system similar to the one implemented by the Kyoto agreement. The U.S. Senate will debate a cap-and-trade proposal in fall 2009 under the American Clean Energy and Security Act. The initial version of the bill would have auctioned all of the emissions allowances, but business lobbies and special interests influenced Congress to give away 85 percent of them.

Climate researcher Chip Knappenberger estimates the bill would only reduce global temperatures by about one-tenth of a degree by 2050. The U.S. Energy Information Administration estimates it would reduce U.S. gross domestic product (GDP) by 0.2 percent over the period from 2012 to 2030 — but other organizations estimate the cost to be much higher:

- Cap-and-trade would cost an average of \$314 billion a year in lost GDP, according to Heritage Foundation estimates, or \$9.4 trillion over the period from 2012 to 2035.
- It could cost taxpayers up to \$200 billion year, or \$1,761 per family annually, according to a U.S. Treasury Department report.
- It would increase the cost of residential electricity 31 percent to 50 percent by 2030, says the American Council for Capital Formation and the National Association of Manufacturers.
- Job losses would total 2.5 million by 2030, estimates the National Black Chamber of Commerce.

In contrast to the economic costs of limits on greenhouse gas emissions there are responses to climate change that would have substantial economic benefits.

Climate change is mainly projected to add to existing problems, rather than create new ones. Focused adaptation addresses these problems — including malaria, hunger and coastal flooding — directly now, rather than indirectly in the future via emissions reductions. For example,

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according to the World Health Organization, malaria's current yearly death toll of one million could be *halved* with annual expenditures of \$1.5 billion or less (in 2003 dollars). By contrast, limiting emissions to 1990 levels, as called for under the Kyoto Protocol, would reduce the total number of people at risk from malaria in 2085 by 0.2 percent, while costing about \$165 billion in 2010 alone.

No-regrets policies are actions that are desirable even if there is no threat of global warming. They would reduce greenhouse gas emissions, increase energy efficiency, reduce harms associated with global warming and/or increase the world's ability to deal with climate-change-associated problems. No-regrets policies include:

- Eliminating fuel subsidies.
- Reducing regulatory barriers to building new nuclear power plants.
- Encouraging breakthroughs in new technology by fostering competition.

Such policies would reduce world emissions, reduce America's dependence on foreign oil and reduce energy prices for consumers.

As a stopgap measure, geoengineering deliberately modifies the Earth's climate, yet does not address the underlying causes. One type of geoengineering, solar radiation management, seeks to increase the Earth's reflectivity in order to mimic the natural cooling effects of clouds and volcanic eruptions. While the cost of reducing greenhouse gases enough to stave off serious harm has been estimated at 2 percent to 5 percent of GDP, Johns Hopkins University professor Scott Barrett says that geoengineering solutions would cost only 0.2 percent to 0.02 percent as much as mandatory stringent emissions reductions, while preventing more damage.

These policies, taken together, could do a great deal to minimize the risks of global warming while at the same time promoting economic growth and global development.

About the Author

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Dr. Burnett has been published in *Ethics*, *Environmental Ethics*, *Environmental Values*, *The Review of Metaphysics*, *International Studies in Philosophy*, *The World and I*, *USA Today* and the *Washington Post*. Dr. Burnett received a Ph.D. in Applied Philosophy from Bowling Green State University in 2001.

Introduction

Many people are concerned that an increasing concentration of greenhouse gases in the atmosphere — due primarily to such human activities as burning fossil fuels for energy — is causing the Earth to warm, with potentially harmful results. In response, many developed countries agreed to the Kyoto Protocol on Climate Change, committing them to limit and eventually reduce their greenhouse gas emissions. [See the side bar “Is Kyoto the Answer?”] The United States did not ratify that treaty, but there is support for imposing restrictions on U.S. greenhouse gas emissions using a cap-and-trade system designed to lower the cost of emissions

reductions. [See the side bar “Is Cap-and-Trade the Answer?”]

However, according to most economists, combating climate change through emissions reductions would likely impose substantially higher costs to society than will global warming. The world would surely regret if billions of people are mired in poverty because resources are diverted to solve a nonexistent or trivial problem.¹ On the other hand, the world would also regret doing nothing if human-made global warming is a serious problem.²

In contrast to the economic costs of limits on greenhouse gas emissions — an approach called mitigation — there are responses

to climate change that would have substantial economic benefits. Three different but complementary policies are focused adaptation, no-regrets and geoengineering.

Reasonable Response: Focused Adaptation

Focused adaptation refers to policies that would reduce society’s vulnerability to, or help cope with, the consequences of global warming. Climate change is mainly projected to add to existing problems, rather than create new ones. Malaria, hunger and coastal flooding are among the hazards to human health and safety frequently cited as major reasons for controlling greenhouse gas emissions.¹³ Policies focused on

Is Kyoto the Answer?

The 1997 Kyoto Protocol is an agreement among a number of countries to reduce emissions of greenhouse gases — principally carbon dioxide (CO₂) — thought to be warming the Earth’s climate. Some 38 developed nations pledged to reduce CO₂ emissions by about 5 percent below 1990 levels. The United States chose not to participate, in part because the agreement exempts such developing countries as China and India, although they have the world’s fastest-growing economies and emissions.

In December 2009, countries will meet in Copenhagen, Denmark, to discuss a new climate agreement to succeed the Kyoto Protocol. India and China are still reluctant to commit to binding emissions targets. Absent emissions reductions in these countries, policies that restrict energy use in developed countries will do little or nothing to reduce greenhouse gas concentrations — but they will impose substantial economic harm.³

In 2010, the United Nations’ Intergovernmental Panel on Climate Change (IPCC) estimates, Kyoto will cost participating countries from 0.1 percent to more than 2 percent of their cumulative gross domestic product (GDP) over the period the agreement has been in effect.⁴ This study assumes that the cost of Kyoto in 2010 will be at the lower end of this range: equivalent to 0.5 percent of the cumulative GDP of the signatory countries, or about \$193 billion (in 2008 dollars).⁵

However, these reductions will not stop the rise in the level of atmospheric CO₂. Kyoto implicitly assumed that subsequent agreements would include developing countries and would require much larger emissions reductions. In fact, the IPCC suggests that it might require a 60 percent reduction in cumulative CO₂ emissions during this century to merely stabilize atmospheric CO₂ concentrations at 750 parts per million (ppm), which is twice today’s level.⁶ However, emissions cuts of that magnitude would only reduce the rate of warming rather than prevent it.

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adaptation address these problems directly now, rather than indirectly in the future via emissions reductions.

Malaria. Table I shows that the population at risk of malaria will grow from 4.4 billion today to 8.8 billion in 2085 due to increased population in developing countries where the disease is endemic.¹⁴ This is about 80 percent of the projected world population in 2085. Ac-

ording to results of recent studies sponsored by the U.K. Department of Environment, Food and Rural Affairs, climate change would add only marginally to the at-risk population, mainly due to an increase in the range of mosquitoes at higher altitudes.

Table II provides estimates of the reduction in total global population at risk under four mitigation scenarios: the Kyoto Protocol, stabiliza-

tion of atmospheric CO₂ at 750 ppm in 2250, stabilization at 550 ppm in 2150, and, as a baseline, no climate change. Under these scenarios the increase in the global mean temperature between 1990 and 2085 would be held to 3.0 degrees Celsius, 1.8 degrees Celsius, 1.4 degrees Celsius and 0 degrees Celsius, respectively.¹⁵ The results:

- Limiting emissions to 1990 levels, as called for under the Kyoto

Is Cap-and-Trade the Answer?

The Obama administration supports a cap-and-trade system under which the government would set a ceiling on total emissions and auction or give away allowances to industries required to reduce emissions. The allowances would permit these industries to emit CO₂. Companies that exceed their individual emissions caps could purchase unused allowances from other firms. However, the cost of purchasing the permits is, in effect, a tax on energy consumption, and is passed on to consumers through higher energy prices.

The goal of a cap-and-trade system is to gradually reduce the number of allowances until emissions are cut to the desired level. However, experience with tradeable allowances in Europe, as well as theoretical modeling, suggests that the price of achieving emissions reductions through a cap-and-trade system vastly exceeds the likely cost of those emissions to society. Thus, cap-and-trade would hinder economic development and investment in human capital, which are crucial to developing the capacity to adapt to climate change or to mitigate it.

A cap-and-trade bill to be debated in the U.S. Senate in fall 2009, the American Clean Energy and Security Act, would impose strict limits on greenhouse gas emissions, focusing on CO₂. The bill would require a 17 percent emissions reduction by 2020 and an 83 percent reduction by 2050. The initial version of the bill would have auctioned all of the emissions allowances, but business lobbies and special interests influenced Congress to give away 85 percent of them. The U.S. Energy Information Administration estimates the proposal would reduce U.S. GDP by 0.2 percent over the period from 2012 to 2030.⁷ Other studies indicate that the cost would be much higher:

- Cap-and-trade would cost an average of \$314 billion a year in lost GDP, according to Heritage Foundation estimates, or \$9.4 trillion over the period from 2012 to 2035.⁸
- It could cost taxpayers up to \$200 billion year, or \$1,761 per family annually, according to a report from the U.S. Treasury Department.⁹
- It would increase the cost of residential electricity 31 percent to 50 percent by 2030, according to the American Council for Capital Formation and the National Association of Manufacturers.¹⁰
- Job losses would total 2.5 million by 2030, estimates the National Black Chamber of Commerce.¹¹

However, the bill would only reduce global temperatures by about one-tenth of a degree by 2050, according to climate researcher Chip Knappenberger.¹²

Protocol, would reduce the total number of people at risk from malaria in 2085 by 0.2 percent, while costing about \$165 billion in 2010 alone.

- Stabilizing greenhouse gas concentrations at either 550 ppm or 750 ppm would be even less effective, reducing the population at risk of malaria by 0.4 percent and 1.3 percent, respectively, while costing trillions of dollars.¹⁶

- Curiously, stabilizing CO₂ at 750 ppm would reduce the total global population at risk of malaria in 2085 more than stabilization at 550 ppm — by 1.3 percent versus 0.4 percent — because some temperature and precipitation-pattern changes will favor mosquito propagation and malaria transmission, and some will retard them.

- Halting climate change as of 1990 would at best reduce the total problem of malaria in 2085 by 3.2 percent.

According to the World Health Organization (WHO), malaria's current yearly death toll of one million could be *halved*

TABLE I
Magnitude of Problem

Climate-Sensitive Risk Factor	Population at Risk in 1990 (in millions)	Population at Risk in 2085 if No Climate Change after 1990 (in millions)	Net Increase in Population at Risk in 2085 Due to "Unmitigated Emissions" (in millions)	Contribution of Unmitigated Climate Change to Population at Risk in 2085
Malaria	4,413	8,820	256 to 323	2.8 to 3.5%
Hunger	521	300	69 to 91	18.7 to 23.3%
Coastal Flooding	10	13	81	86.2%

Sources: N.W. Arnell et al., "The Consequences of CO₂ Stabilization for the Impacts of Climate Change," *Climatic Change*, Vol. 53, No. 4, June 2002.

with annual expenditures of \$1.5 billion or less (in 2003 dollars). The \$1.5 billion would be used for research targeted specifically at malaria treatment and prevention, as well as further development and better delivery of public health services.¹⁷

Reducing malaria would also enhance the adaptive capacities of developing countries, assuring fuller development of their human capital and potential for economic growth, thereby enhancing their resiliency and reducing their vulnerability to adversity.¹⁸

TABLE II
Percent Reduction in Total Population at Risk in 2085

Climate-Sensitive Risk Factor	Due to the Kyoto Protocol	Stabilization Path Toward 750 PPM	Stabilization Path Toward 550 PPM	No Climate Change
Malaria	0.2%	1.3%	0.4%	3.2%
Hunger	1.5%	16.6%	9.7%	21.1%
Coastal Flooding	18.1%	62.8%	80.1%	86.2%

Sources: N.W. Arnell et al., "The Consequences of CO₂ Stabilization for the Impacts of Climate Change," *Climatic Change*, Vol. 53, No. 4, June 2002; Reductions due to Kyoto Protocol are per Indur M. Goklany, "Relative Contributions of Global Warming to Various Climate Sensitive Risks, and Their Implications for Adaptation and Mitigation," *Energy & Environment*, Vol. 14, No. 6, November 1, 2003.

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Hunger. Table II also indicates that post-1990 warming will be responsible for 21 percent of the total global population at risk for hunger by 2085. This is the result of a small (1.9 percent) warming-related drop in future global food production between 1990 and 2085. In effect, unmitigated warming would reduce the annual growth in food productivity from 0.84 percent per year

to 0.82 percent per year.¹⁹ As with malaria, stabilizing CO₂ concentrations at 750 ppm would reduce the total global population at risk for hunger in 2085 by a greater amount than stabilization at 550 ppm. This is because the higher level of atmospheric CO₂ benefits crop growth.

In the 1990s the world spent about \$33 billion annually on

agricultural research and development (R&D), including \$12 billion in developing countries. Increasing R&D investment by \$5 billion per year should more than compensate for the 0.02 percent annual shortfall in productivity increases caused by unmitigated warming, especially if the additional investment is focused on solving current agricultural problems in developing countries

Biotech Now Reduces Regret Later

The 1995 introduction of genetically engineered, or biotech, crops in the United States and other countries provided farmers with a valuable tool to increase farm yields while protecting the environment. In 2001 alone, biotechnology-derived plants increased U.S. food output by approximately four billion pounds, saved \$1.2 billion in production costs and decreased pesticide use about 46 million pounds.²² These plants have improved air, soil and water quality as a consequence of reduced tillage, less chemical spraying and fuel savings. They have also enhanced biodiversity as a consequence of reduced insecticide use.²³

Scientists are developing corn, wheat and other crops that are drought and heat tolerant, have higher soil-nutrient uptake and can grow in salty and acidic soils. These crops could increase agricultural productivity dramatically.²⁴ Even delaying ripening of fruits and vegetables could substantially enhance food supplies — post-harvest and end-use losses are estimated to be as high as 47 percent worldwide.²⁵ All of these changes would further reduce energy use and consequent emissions in both food production and transport.

Countless scientific bodies have found that biotech varieties pose no new risks and require no different safety regulations than conventional crops, but regulators impose vastly higher burdens. The maze of scientifically indefensible rules governing the testing, development and sale of genetically engineered seeds, plants and foods has greatly hindered the use of biotechnology. The expense of complying with these regulations makes it uneconomical to use biotechnology for all but the largest commodity crops.²⁶

Many countries have effectively banned biotech crops altogether, including members of the European Union.²⁷ Consequently, many of the poorest nations in Africa and Asia have been reluctant to approve biotech crops for fear of jeopardizing important export markets. For example, Asian, North American and European scientists have used biotech methods to develop several insect-resistant, pathogen-resistant and herbicide-tolerant rice varieties. However, none of these are commercially available in Asia because European commodity shippers have threatened to boycott nations that adopt biotech rice.²⁸

Eliminating or reducing the barriers to biotech crops would substantially increase food production around the world. It would also allow developing countries to adopt these crops, contributing to the incomes of agricultural nations. Thus, the increased yield from the adoption of these crops would benefit farmers, consumers and the environment.

By 2085, more than 300 million people will be at risk for hunger due to unmitigated warming and other factors.²⁹ Biotech crops would reduce this risk, and equally important, they would do more in the interim to reduce the global at-risk population than emissions reductions. [See Table I.] Moreover, the additional R&D investment is relatively modest compared to the cost of the Kyoto Protocol.

that might be exacerbated by warming.²⁰ [See the sidebar “Biotech Now Reduces Regret Later.”] Thus, as shown in Table II:

- Meeting the Kyoto Protocol’s emissions reduction targets would reduce the population at risk of hunger by 1.5 percent in 2085.
- Stabilizing CO₂ emissions at 550 ppm would reduce the at-risk population about 9.7 percent in 2085.
- By contrast, investing an additional \$5 billion to solve agricultural problems that developing countries face today would reduce the population at risk of hunger by 50 percent.²¹

If warming causes poor agricultural and climate conditions to spread, agriculture might have to expand further into less productive areas. Thus, actions to improve current agricultural production under marginal conditions would alleviate hunger in the future whether or not the climate changes.

Coastal Flooding. The studies underlying Table II project that unmitigated warming will raise the global sea level by 0.41 meters (16 inches) by 2085, due to such things as melting ice sheets, storm surges and thermal expansion. This will put an additional 81 million people at risk of coastal flooding.³⁰ However, this risk can be reduced, if not eliminated, for relatively little investment:

- Meeting the Kyoto Protocol’s emissions reduction targets would lower the total population at risk of coastal flooding in 2085 by 18 percent.

- Stabilizing CO₂ emissions at 550 ppm would reduce the at-risk population about 80 percent in 2085.³¹
- By contrast, investing an additional \$1 billion annually in preventive measures would address the problem just as well, if not more effectively.³²

In the United States, much of the investment in areas vulnerable to repeated flood and storm damage is a result of the National Flood Insurance Program (NFIP). This 41-year-old program has arguably outgrown its original purpose — to provide

“Malaria, hunger and other problems will not be solved by reducing CO₂ emissions.”

temporary flood insurance to property owners who were unaware they were in flood-prone areas.³³ However, because of full-disclosure mortgage and insurance requirements, nearly all current owners are aware of an area’s flood problems when they purchase or develop properties. Thus, federally subsidized flood insurance implicitly encourages people to build homes where they otherwise would not and encourages lenders to finance mortgages they otherwise would not.

According to the 2000 U.S. Census, more than half of Americans live within 50 miles of a coast, and by 2025, 75 percent will.³⁴ Indeed,

the Heinz Center, an environmental research institute, determined that in the absence of insurance and flood control programs, development density in areas at high risk of flooding would be about 25 percent lower than in areas at low risk.³⁵ Thus, ending the NFIP would discourage development that creates problems today and be a valuable adaptation in a world with rising sea levels.

Reasonable Response: No-Regrets

No-regrets policies are actions that are desirable even if there is no threat of global warming. They would reduce greenhouse gas emissions, increase energy efficiency, reduce harms associated with global warming and/or increase the world’s ability to deal with climate-change-associated problems. A number of no-regrets policies are complementary to or would actually be the primary components of effective adaptation to future climate challenges.

Eliminate Fuel Subsidies. While many governments of developed nations argue for a worldwide reduction in fossil fuel use in order to combat climate change, those same governments also subsidize energy use and production. Thus, in 2001, the EU-15 (the “old Europe” nations in the European Union) spent \$16.77 billion (in 2009 dollars) subsidizing coal and \$11.23 billion subsidizing oil and gas.³⁶

For the United States, the U.S. Energy Information Administration calculates that federal energy subsidies amount to more than \$16 billion annually [see Table III]:³⁷

Table III
Energy Subsidies, Fiscal Years 2007 and 2008
(millions of 2007 dollars)

Beneficiary	Direct Expenditures	Tax Expenditures	Research & Development	Federal Electricity Support	Total
2007 Subsidies					
Coal	\$ -	\$ 290	\$ 574	\$ 69	\$ 932
Refined Coal	-	2,370	-	-	2,370
Natural Gas and Petroleum Liquids	-	2,090	39	20	2,149
Nuclear	-	199	922	146	1,267
Renewables	5	3,970	727	173	4,875
Electricity (Not fuel specific)	-	735	140	360	1,235
End Use	2,290	120	418	-	2,828
Conservation	256	670	-	-	926
Total	\$ 2,550	\$ 10,444	\$ 2,819	\$ 767	\$ 16,581

Source: "Federal Financial Interventions and Subsidies in Energy Markets 2007," Energy Information Administration, Executive Summary, Table ES1.

- In 2007, the federal government spent approximately \$5.5 billion on subsidies for the coal, oil and natural gas industries — principally tax breaks for investment.
- Subsidies included \$3 billion for coal and natural gas, and almost \$3 billion for research and development of clean-coal technology to reduce greenhouse gas emissions.
- The government spent an additional \$1.2 billion for electricity production and use (not fuel specific), and \$2.8 billion to increase

the energy efficiency of homes and businesses.

- It spent a further \$5 billion for renewable energy production and use, mostly in the form of tax breaks.
- Finally, \$1.2 billion went to the nuclear industry.

Such subsidies reduce energy prices below what the market would set, encouraging greater use and raising emissions levels.

British Petroleum estimates that countries that subsidize trans-

portation fuel-use accounted for 96 percent of the increase in oil demand in 2007.³⁸ Many of these countries are less-developed nations that subsidize both production and consumption of fuels. The International Energy Agency estimates that developing countries spend around \$220 billion annually on subsidies for energy production and consumption, of which \$170 billion subsidizes fossil fuels.³⁹ [See Figure I.] Thus, it estimates that removing domestic price subsidies in China, India, Indonesia, Iran, Russia, Kazakhstan, South Africa and Venezuela would reduce global energy use

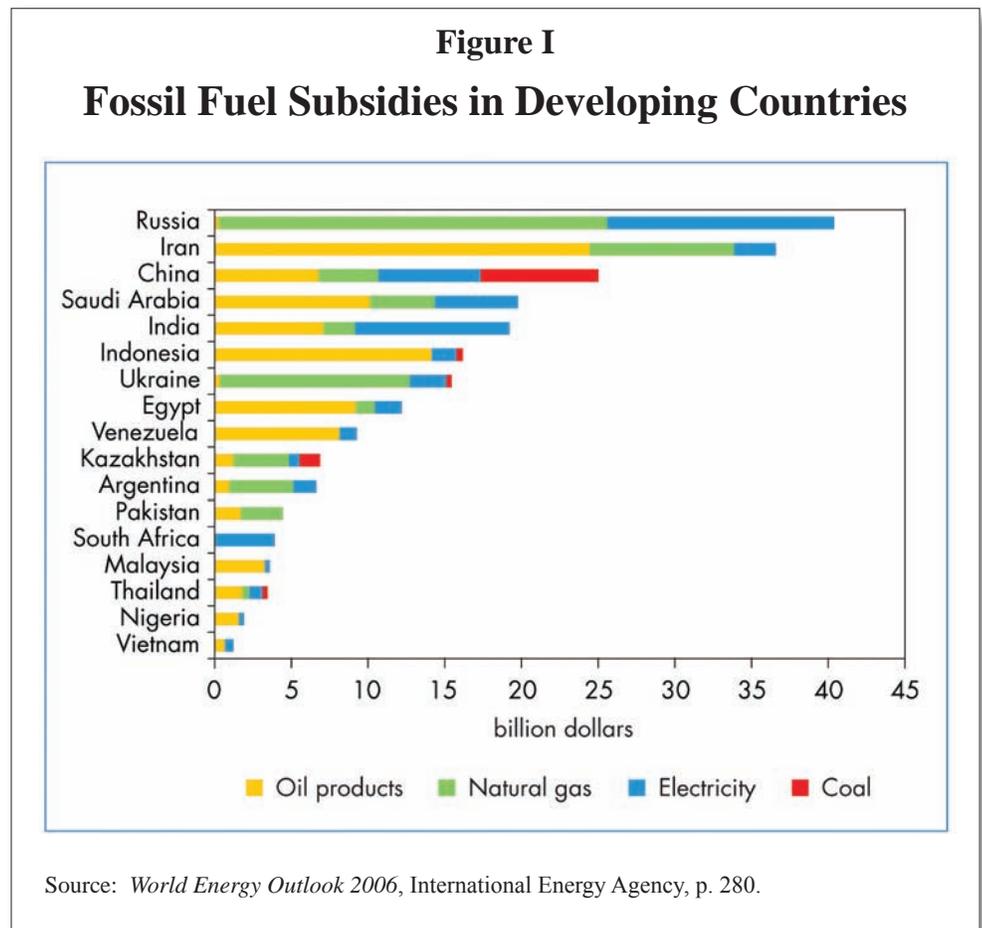
3.5 percent and reduce global CO₂ emissions 4.6 percent.⁴⁰

Including developed countries, subsidies for energy production and consumption worldwide amount to around \$300 billion per year, the majority of which are for fossil fuels.⁴¹

There are a number of neutral energy policies that could be implemented at the national or international level to reduce subsidized fuel production and use. Thus:

- International trade talks should include eliminating subsidies for fossil fuel production and consumption.
- National budgets should be reviewed with the goal of eliminating programs that encourage energy use.
- Subsidies and tax breaks, or tax penalties, for specific energy technologies should be eliminated to remove price distortions in energy markets.⁴²

A neutral energy tax policy, for example, would include replacing the federal tax-depreciation schedule for investment in new capital stock with immediate expensing.⁴³ New equipment almost always produces fewer emissions per unit of output than older equipment. Changing the depreciation schedule so that new investments could be written off immediately would make it profitable to replace old equipment at a quicker rate. This simple change could do more to increase energy efficiency throughout the economy than the current complicated expensing regime.



Kyoto and more recent proposals would have almost no effect on overall emissions since they do not include fast-growing developing countries, such as China (now the number one CO₂ emitter). The United Nations projects that these countries will produce the vast majority of future CO₂ emissions. An agreement to end energy subsidies that includes developing countries would cost less than Kyoto or similar agreements because preventing or reducing future emissions in developing countries is less expensive than forcing developed countries to radically alter their energy and transportation infrastructure. Although no such agreement has been proposed, it would make sense as part of the Obama administra-

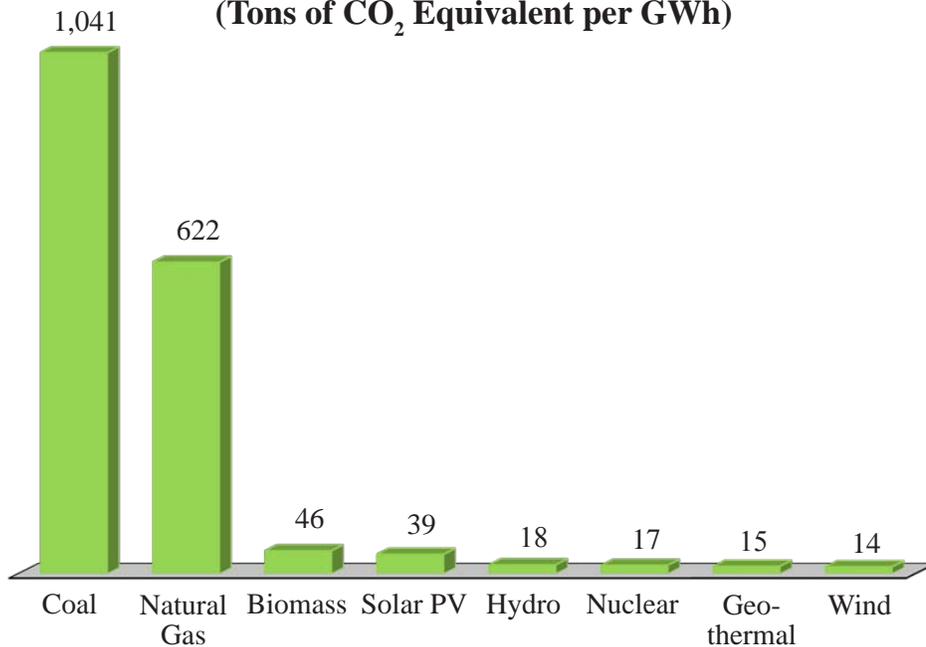
tion's new approach to international energy policy.

Reduce Regulatory Barriers to New Nuclear Power Plants.

Currently, nuclear power is the only technology capable of providing emissions-free energy on the scale required to significantly reduce carbon emissions. In the United States, almost 700 million metric tons of CO₂ emissions are avoided annually due to nuclear-generated electricity. Worldwide, nuclear generation reduces emissions by almost two billion metric tons below what they would be otherwise.

However, due to environmental antinuclear activism beginning in the 1970s, building a nuclear plant takes a very long time — up to

Figure II
Comparison of Life-Cycle Emissions
(Tons of CO₂ Equivalent per GWh)



Note: GWh denotes one billion watt-hours.

Source: "Life-Cycle Assessment of Electricity Generation Systems and Applications for Climate Change Policy Analysis," Paul J. Meier, University of Wisconsin-Madison, August 2002.

10 years from conception to construction, according to the Nuclear Energy Institute. This makes development and construction costs for nuclear power plants not economically competitive with forms of electricity that emit greenhouse gases, like coal and natural gas.

Removing import tariffs for vital construction materials such as steel and cement would help reduce construction costs. Currently, cement producers like Mexico find it more profitable to send shipments to China than to the United States because of a 40 percent U.S. import tariff. In 2004, the Portland Cement Association, a trade group representing American and Canadian companies, found that 29 states were experiencing shortages despite

virtually all U.S. cement plants working around the clock, seven days a week. Lifting or reducing the tariff would obviously benefit other areas of the economy, such as home building, making this a wide-reaching no-regrets policy.

Over the next 20 years, electricity demand in the United States is expected to increase more than 45 percent. Even the most comprehensive conservation and efficiency efforts would offset less than one-fourth of this increase. Not counting hydropower, the rated capacity of all renewable energy combined is less than 2 percent of total generating capacity. Power plants fueled by coal, natural gas or nuclear fuel are the only reliable sources for baseload power (required to keep electric

power flowing) and peaking power (required to meet daily spikes in demand). Natural gas and coal both emit CO₂ as a byproduct of combustion. [See Figure II.] Absent a significant breakthrough in the capture of carbon, nuclear fuel is clearly preferable for electric power.

Encourage Breakthroughs in New Technology. Responding to environmental concerns, the federal government currently promotes the use of alternative fuels and renewable sources of electricity — primarily wind and solar power. However, these technologies are intermittent and unreliable. Solar cells do not produce power at night and only deliver reduced amounts of electricity on cloudy, rainy or otherwise overcast days. Wind power is subject to wind speed, and turbines can malfunction or break. Even in the best locations, solar- and wind-powered generators only supply electricity 30 to 40 percent of the time.⁴⁴ Without storage technology, wind and solar power sources must be backed up by traditional power plants using fossil fuels, which operate on standby to fill any gaps left by wind or solar power.

Substantially reducing CO₂ emissions and meeting future energy demands will require a revolution in transportation and electric power technologies.⁴⁵ One way to encourage the development of these technologies is to introduce competition through an X Prize-type challenge. The X Prize Foundation promotes the growth of new technologies by offering cash prizes in competitions designed to bring about breakthroughs in areas like energy, education, life sciences and exploration.⁴⁶

Encouraging private innovation and investment through monetary prizes has led to significant advancements in technology. For example:

- In 1996, Dr. Peter Diamandis started the first X Prize competition — the Ansari X Prize — to spur the creation of a private vehicle capable of space flight, with the ultimate goal of obtaining new low-cost methods of reaching orbit.
- In 2004, aerospace engineer Burt Rutan, funded by Microsoft co-founder Paul Allen, beat out 26 other teams for the \$10 million Ansari X Prize award.
- Another X Prize Foundation competition aims to create a passenger vehicle that gets the equivalent of 100 miles per gallon of gasoline.
- Billionaire Richard Branson is offering a \$25 million prize to anyone who can devise a technology that can remove one billion tons of CO₂ or other greenhouse gases per year for 10 years.

The federal government should follow the X Prize model and support competitions to create technologies that meet the twin goals of improving energy use while reducing greenhouse gas emissions. These technologies could range from batteries that store wind and solar power to affordable vehicles powered by hydrogen fuel cells.

Awards could be funded out of revenues from new oil and natural gas production in areas that are currently off limits to exploration and production. By one recent estimate, oil and natural gas production in

these areas could potentially top 2.03 million barrels a day and 5.34 billion cubic feet per day, respectively, by 2030. The total revenue from expanded energy production could reach \$1.7 trillion.⁴⁷

Moreover, new energy production would increase America's domestic reserves of oil and reduce its dependence on foreign oil and gas supplies. It would also create tens of thousands of additional jobs and should reduce energy prices for consumers.

Reasonable Response: Geoengineering

Geoengineering is the deliberate modification of the Earth's climate. It is a stopgap measure that ameliorates the problem of global warming without addressing the underlying causes. Alan Carlin, a senior economist with the U.S. Environmental Protection Agency, says that geoengineering is "our best hope of coping with a changing world," because it can work, it can be implemented relatively quickly and, perhaps most importantly, because it is affordable.⁴⁸ The IPCC has already signaled it will be devoting more attention to geoengineering.⁴⁹

Solar radiation management (SRM) is a type of geoengineering that seeks to increase the Earth's reflectivity in order to mimic the natural cooling effects of clouds and volcanic eruptions. Volcanic eruptions, for example, release massive amounts of sulfur dioxide (SO₂), which eventually turns into highly reflective solid particles that bounce solar radiation back into space, cooling the climate. Thus, the eruption of Mount Tambora in

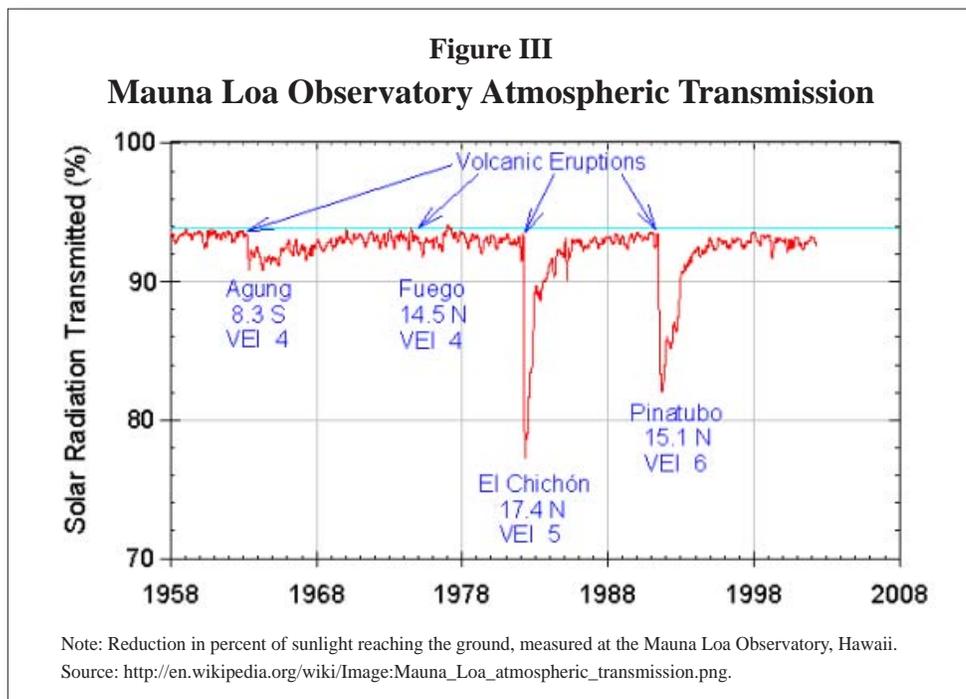
1815 caused 1816 to be labeled the "year without summer." And in 1991 the Philippines' Mount Pinatubo spewed such huge amounts of SO₂ into the atmosphere that the average global temperature dropped 0.5 degrees Celsius for almost two years — the same amount of climate warming experienced over the last 100 years. [See Figure III.]

“Geoengineering is a quicker, more affordable solution to climate change.”

One SRM proposal is to launch a fleet of 1,900 wind-powered ships that suck up ocean water and spray it from tall towers to create large clouds.⁵⁰ The clouds would increase the Earth's reflectivity, directing sunlight away from the surface. The unmanned ships would be directed by satellite to areas best suited for cloud formation, increasing the effectiveness of the system. Research estimates that this solution would cost approximately \$9 billion to test and launch, and it could be fully implemented within a relatively short 25 years.⁵¹ Researchers estimate that this technique could reverse the warming effects of doubling atmospheric CO₂ over preindustrial levels.⁵²

The cost of reducing greenhouse gases enough to stave off serious harm has been estimated at 2 percent to 5 percent of GDP. Stanford University climate scientist Ken Caldeira projects the

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cost of one geoengineering solution — putting reflective aerosols into the atmosphere — would be one-thousandth the cost of the low-range greenhouse gas reduction estimate, which is 2 percent.⁵³ Johns Hopkins University professor Scott Barrett has argued the cost of geoengineering solutions to be 200 to 2,000 times cheaper than mandatory stringent emissions reductions, while preventing more damage.⁵⁴ Yale University economist William Nordhaus agrees, stating the price of preventing the effects of global warming through geoengineering is virtually “costless.”⁵⁵

Until recently, geoengineering has been largely considered taboo. Many environmental activists fear using geoengineering to reduce climate change will provide policymakers with an excuse not to cut carbon emissions. For example, in *Earth in the Balance*, Al Gore describes policies like geoengineering as “...a kind of laziness, an arrogant

faith in our ability to react in time to save our skins.”⁵⁶ They also see it as a way of continuing the consumerist, consumptive lifestyle of developed countries while spreading warming to the developing world. In this view, geoengineering responses are just a further symptom of the larger disease of humanity’s vaulting ambition — “the control and domination of nature,” which they abhor.

However, should warming and its impacts be worse than expected or climate changes be more rapid than other proposals can cope with in a timely fashion, geoengineering provides a cost-effective buffer against short-term impacts, giving other, more expensive policies time to take effect. Therefore, geoengineering solutions must be seriously explored.

Conclusion

Many scientists and politicians have declared that global warming

is the most important environmental challenge facing the planet.⁵⁷ In a joint declaration, former British Prime Minister Tony Blair and former French President Jacques Chirac declared climate change the “world’s greatest environmental challenge.”⁵⁸ Contrary to these claims, the magnitude of the problems caused by unmitigated climate change is generally smaller than the problems due to nonclimate-change-related factors; and where it is not, as in the case of coastal flooding, adaptation is a more economical remedy.

For the next several decades, any mitigation scheme would expend scarce resources without commensurate improvements in global well-being. Thus, the focus should be on increasing adaptive capacity over all time horizons and implementing no-regrets policies that produce benefits beyond their impact on climate. No-regrets policies and increased adaptive capacity are likely to reduce risks from climate change faster, more economically and by a greater amount — making mitigation more cost-effective if and when it becomes necessary.

Equally important, various indicators of human well-being that aren’t sensitive to climate change would also be advanced much further, faster and more efficiently. These measures would, incidentally, also contribute to mitigation and increase mitigative capacity.

These policies, taken together, could substantially minimize the risks of global warming while simultaneously promoting economic growth and global development.

Endnotes

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The NCPA is a nonprofit, nonpartisan organization established in 1983. Its aim is to examine public policies in areas that have a significant impact on the lives of all Americans — retirement, health care, education, taxes, the economy, the environment — and to propose innovative, market-driven solutions. The NCPA seeks to unleash the power of ideas for positive change by identifying, encouraging and aggressively marketing the best scholarly research.

Health Care Policy.

The NCPA is probably best known for developing the concept of Health Savings Accounts (HSAs), previously known as Medical Savings Accounts (MSAs). NCPA President John C. Goodman is widely acknowledged (*Wall Street Journal*, *WebMD* and the *National Journal*) as the “Father of HSAs.” NCPA research, public education and briefings for members of Congress and the White House staff helped lead Congress to approve a pilot MSA program for small businesses and the self-employed in 1996 and to vote in 1997 to allow Medicare beneficiaries to have MSAs. In 2003, as part of Medicare reform, Congress and the President made HSAs available to all nonseniors, potentially revolutionizing the entire health care industry. HSAs now are potentially available to 250 million nonelderly Americans.

The NCPA outlined the concept of using federal tax credits to encourage private health insurance and helped formulate bipartisan proposals in both the Senate and the House. The NCPA and BlueCross BlueShield of Texas developed a plan to use money that federal, state and local governments now spend on indigent health care to help the poor purchase health insurance. The SPN Medicaid Exchange, an initiative of the NCPA for the State Policy Network, is identifying and sharing the best ideas for health care reform with researchers and policymakers in every state.

**NCPA President
John C. Goodman is called the
“Father of HSAs” by *The Wall
Street Journal*, *WebMD* and the
National Journal.**

Taxes & Economic Growth.

The NCPA helped shape the pro-growth approach to tax policy during the 1990s. A package of tax cuts designed by the NCPA and the U.S. Chamber of Commerce in 1991 became the core of the Contract with America in 1994. Three of the five proposals (capital gains tax cut, Roth IRA and eliminating the Social Security earnings penalty) became law. A fourth proposal — rolling back the tax on Social Security benefits — passed the House of Representatives in summer 2002. The NCPA’s proposal for an across-the-board tax cut became the centerpiece of President Bush’s tax cut proposals.

NCPA research demonstrates the benefits of shifting the tax burden on work and productive investment to consumption. An NCPA study by Boston University economist Laurence Kotlikoff analyzed three versions of a consumption tax: a flat tax, a value-added tax and a national sales tax. Based on this work, Dr. Goodman wrote a full-page editorial for *Forbes* (“A Kinder, Gentler Flat Tax”) advocating a version of the flat tax that is both progressive and fair.

A major NCPA study, “Wealth, Inheritance and the Estate Tax,” completely undermines the claim by proponents of the estate tax that it prevents the concentration of wealth in the hands of financial dynasties. Actually, the contribution of inheritances to the distribution of wealth in the United States is surprisingly small. Senate Majority Leader Bill Frist (R-TN) and Senator Jon Kyl (R-AZ) distributed a letter to their colleagues about the study. In his letter, Sen. Frist said, “I hope this report will offer you a fresh perspective on the merits of this issue. Now is the time for us to do something about the death tax.”

Retirement Reform.

With a grant from the NCPA, economists at Texas A&M University developed a model to evaluate the future of Social Security and Medicare, working under the direction of Thomas R. Saving, who for years was one of two private-sector trustees of Social Security and Medicare.

The NCPA study, “Ten Steps to Baby Boomer Retirement,” shows that as 77 million baby boomers begin to retire, the nation’s institutions are totally unprepared. Promises made under Social Security, Medicare and Medicaid are completely unfunded. Private sector institutions are not doing better — millions of workers are discovering that their defined benefit pensions are unfunded and that employers are retrenching on post-retirement health care promises.

Pension Reform.

Pension reforms signed into law include ideas to improve 401(k)s developed and proposed by the NCPA and the Brookings Institution. Among the NCPA/Brookings 401(k) reforms are automatic enrollment of employees into companies’ 401(k) plans, automatic contribution rate increases so that workers’ contributions grow with their wages, and better default investment options for workers who do not make an investment choice.

The NCPA's online Social Security calculator allows visitors to discover their expected taxes and benefits and how much they would have accumulated had their taxes been invested privately.

Environment & Energy.

The NCPA's E-Team is one of the largest collections of energy and environmental policy experts and scientists who believe that sound science, economic prosperity and protecting the environment are compatible. The team seeks to correct misinformation and promote sensible solutions to energy and environment problems. A pathbreaking 2001 NCPA study showed that the costs of the Kyoto agreement to reduce carbon emissions in developed countries would far exceed any benefits.

Educating the next generation.

The NCPA's Debate Central is the most comprehensive online site for free information for 400,000 U.S. high school debaters. In 2006, the site drew more than one million hits per month. Debate Central received the prestigious Templeton Freedom Prize for Student Outreach.

Promoting Ideas.

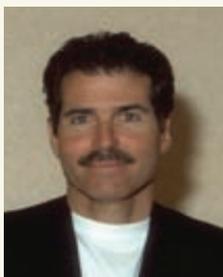
NCPA studies, ideas and experts are quoted frequently in news stories nationwide. Columns written by NCPA scholars appear regularly in national publications such as the *Wall Street Journal*, the *Washington Times*, *USA Today* and many other major-market daily newspapers, as well as on radio talk shows, on television public affairs programs, and in public policy newsletters. According to media figures from Burrelle's, more than 900,000 people daily read or hear about NCPA ideas and activities somewhere in the United States.

What Others Say About the NCPA



"The NCPA generates more analysis per dollar than any think tank in the country. It does an amazingly good job of going out and finding the right things and talking about them in intelligent ways."

Newt Gingrich,
former Speaker of the U.S. House
of Representatives



"We know what works. It's what the NCPA talks about: limited government, economic freedom; things like health savings accounts. These things work, allowing people choices. We've seen how this created America."

John Stossel,
co-anchor ABC-TV's *20/20*



"I don't know of any organization in America that produces better ideas with less money than the NCPA."

Phil Gramm,
former U.S. Senator



"Thank you . . . for advocating such radical causes as balanced budgets, limited government and tax reform, and to be able to try and bring power back to the people."

Tommy Thompson,
former Secretary of Health and
Human Services