

Remembering Drs. Frederick Seitz and Robert Jastrow, Founders and Chairmen Emeriti of the Marshall Institute

We regret to announce the recent passing of Dr. Frederick Seitz and Dr. Robert Jastrow, the founders, former chairmen and long the leading lights of the George C. Marshall Institute.

Dr. Frederick Seitz

Dr. Frederick Seitz, the distinguished physicist and government science advisor who led Rockefeller University and the National Academy of Sciences, passed away at his home in New York on March 2, 2008. In addition to his accomplishments in quantum theory and condensed-matter physics, he was a prominent voice in issues of climate change, defense and public health.

Frederick Seitz was born in San Francisco on Independence Day, 1911. He earned his bachelor's degree from Stanford University in 1932 and his doctorate in physics at Princeton University in 1934. He taught physics at the University of Rochester, the University of Pennsylvania, and Carnegie Institute of Technology before going to the University of Illinois at Urbana-Champaign in 1949, where he had a long association with the Physics Department and the Materials Research Laboratory. His 1940 textbook *The Modern Theory of Solids* was a major contribution to the understanding of solid-state physics. Professor Seitz became the Physics Department Head in 1957, remaining in that position until 1964. He served as Dean of the Graduate College and Vice-Chancellor

for Research at Illinois until 1965 and contributed substantially the understanding of quantum mechanics, properties of solids, and radiation effects.

In 1962, Dr. Seitz became the first full time President of the National Academy of Sciences, which position he held until 1969. From 1968 until his retirement in 1978, he served as President of Rockefeller University. With Drs. Robert Jastrow and William Nierenberg, Dr. Seitz founded the George C. Marshall Institute in 1984 to conduct assessments of scientific issues affecting public policy. As Chairman, he spoke out frequently against political pressure and unfounded claims in climate and defense issues.

During his long career, Dr. Seitz served on numerous governmental and academic committees, including the President's Science Advisory Committee, the Defense Science Board and the policy advisory board of the Argonne National Laboratory. He advised a wide range of institutions including NATO, the Library of Congress, the Guggenheim Memorial Foundation, Memorial Sloan Kettering Cancer Center, the National Cancer Advisory Board, and the Office of Strategic Defense Initiative. Dr. Seitz's awards include the Hoover Medal, the Distinguished Public Service Award (NASA), the Compton Award (American Institute of Physics), the National Medal of Science, the

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Vannevar Bush Award (National Science Foundation), and the Loveland Memorial Award (American College of Physicians).

His books include *The Modern Theory of Solids*; *Solid State Physics* (with Donald Turnbull); *The Science Matrix*; *Stalin's Captive: Nikolaus Riehl and the Soviet Race for the Bomb* (with Nikolaus Riehl); *Electronic Genie: The Tangled History of Silicon* (with Norman Einspruch); *A Selection of Highlights from the History of the National Academy of Sciences 1863-2005*; and his autobiography *On the Frontier – My Life in Science*.

Dr. Robert Jastrow

Dr. Robert Jastrow, astronomer, author and science administrator, passed away at his home in Arlington, Virginia on February 8, 2008. Dr. Jastrow's long and eminent career took him from Dartmouth College to National Aeronautics and Space Administration (NASA) to the Mount Wilson Observatory, but he was best known to the public as a clear and cogent speaker and writer who explained the complexities of atmospheric science to the lay audience.

Born in New York in 1925, Robert Jastrow was a prominent American scientist who worked in the U.S. lunar landing program, established and managed two significant scientific research centers, and played an active role in national public policy debates on national security and environmental policy. He earned A.B., A.M. and Ph.D. degrees in theoretical physics at Columbia University. Following post-doctoral studies, he became an assistant professor at Yale before joining the staff at the Naval Research Laboratory. In 1958, Homer Newell, the Assistant Director for Space Sciences of the newly formed NASA, created its theoretical division to devote attention to basic research in cosmology, astronomy, and planetary sciences and recruited

Jastrow to head it. Dr. Jastrow's contributions to the American presence in space were felt almost immediately.

With permission from NASA and in association with Columbia University, Dr. Jastrow organized the Goddard Institute for Space Studies and became its first Director when it opened its doors near the Columbia University campus in 1961. As a U.S. government laboratory charged with carrying out research in astronomy, atmospheric science, and weather and climate prediction, Goddard Institute scientists played a key role in the Pioneer, Voyager, and Galileo planetary missions, under Jastrow's guidance. In recognition of his work at NASA, Jastrow received the NASA Medal for Exceptional Scientific Achievement and the Arthur Fleming Award for Outstanding Service to the U.S. Government.

While serving Director of the Goddard Institute, Dr. Jastrow held joint professorial appointments in the Astronomy and Geology Departments at Columbia University. He stayed at the helm of the Goddard Institute for twenty years before becoming joining the faculty at Dartmouth College, where he held the position of Professor of Earth Sciences until 1992. In that year he resigned to become Chairman of the Board of Trustees of the Mount Wilson Institute, which manages the Mount Wilson Observatory in California on behalf of the Carnegie Institution of Washington. Dr. Jastrow retired as Director of the Mount Wilson Institute in January 2003. He was a member of the Board of Governors of the National Space Society.

Dr. Jastrow was a prolific author and public commentator on the space program, astronomy, earth science, and national security. Following his tenure at NASA, he worked to popularize atmospheric science and hosted more than 100 CBS-TV network programs on space science. He was the special guest

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of NBC-TV with Wernher von Braun for the Apollo-Soyuz flights, and he was the featured guest of the TODAY show on the 10th anniversary of the landing on the moon. Dr. Jastrow's articles in issues in science have appeared in the New York Times, Time, Reader's Digest, Foreign Affairs, Commentary, Atlantic Monthly and Scientific American.

Dr. Jastrow's books include *Red Giants and White Dwarfs—The Evo-*

lution of Stars, Planets and Life; Until the Sun Dies; God and the Astronomers; The Enchanted Loom—Mind in the Universe; Astronomy—Fundamentals and Frontiers; Journey to the Stars—Space Exploration Tomorrow and Beyond, How to Make Nuclear Weapons Obsolete, and Scientific Perspectives on the Greenhouse Problem with William Nierenberg and Frederick Seitz. ❖

A limited number of Dr. Seitz's last book, *A Selection of Highlights from the History of the National Academy of Sciences, 1863–2005* (University Press of America, 2007), written with Institute support, are available from the Marshall Institute for \$16.99 plus shipping.

This work relates selected events in the history of the National Academy focusing on the terms of the various presidents from the first, Alexander D. Bache, the great grandson of Benjamin Franklin, to the most recent, Ralph Cicerone. In its early days, the Academy was fostered by the Smithsonian Institution to support the cultivation of science in the United States. In its current state, the Academy can be regarded as an almost independent organization representative of the basic and applied science, including engineering and medicine. Special attention is given to roles played by the Academy and Academy members in three great wars, as well as side developments made possible through wartime ventures and advances in technology. ❖

The Marshall Founders' Fellowship

The Institute plans to create the Founders Fellows to continue the work of Bob Jastrow, Fred Seitz and Bill Nierenberg. The Fellows program will support individuals interested in assisting policy makers and the public in understanding scientific and technological developments and their effect on public policy.

Please contact Lynn Miller (202-296-9655) for more information or to make a contribution. ❖

State Department Official Discusses Space Arms Control

Paula A. DeSutter, Assistant Secretary of State for Verification, Compliance, and Implementation addressed a Marshall Institute audience at the National Press Club on March 8, 2008 on the question of *Is an Outer Space Arms Control Treaty Verifiable?* She outlined criteria necessary for effectively verifiable arms control and outlined the challenges in constructing such agreements for outer space. After discussing problems associated with defining space weapons, she addressed concerns about the technical capacity to monitor compliance, the risk that cheating could occur, and the potential that break-out would occur.

She concluded:

“After considerable review, my government has concluded that it does not support additional arms control restrictions on space activities. Only part of the reason we have come to this conclusion has to do with the foregoing verification issues. Put broadly, we have reached this conclusion for two reasons: First the types of restrictions that have been suggested by some states and some non-governmental groups are not verifiable. Second, even if they could be made verifiable, which we believe they could not, they would unduly constrain legitimate self-defense, commercial and other activities.

As our National Space Policy makes clear, the United States will oppose the development of new legal regimes or other restrictions that seek to prohibit or limit U.S. access to or use of space. Proposed arms control agreements or restrictions must not impair the rights of the United States to conduct research, development, testing, and other operations or activities in space for U.S. national interests. Thus, we do

not support such binding arms control approaches.

That is why, in part, the Bush Administration has concluded that additional arms control restrictions on space activities beyond the existing Outer Space Treaty are not necessary. In our view, the Outer Space Treaty is sufficient to meet today’s and tomorrow’s needs. It establishes guiding principles for space operations by all nations: that space shall be free for all to explore and use; that space activities shall be carried out in accordance with international law, including the Charter of the United Nations, which guarantees the right of self-defense; that weapons of mass destruction shall not be put into orbit; that States Party shall not interfere with the assets of other states; and that States Party shall bear responsibility for the activities carried on by governmental and non-governmental entities in territories and locations under their jurisdiction and control. These are the principles according to which space faring nations have and should continue to conduct themselves.

We do not need to enter into new agreements. Rather, we need universal adherence to the existing Outer Space Treaty and to the other existing international conventions designed to provide for cooperation in space and to promote an understanding of the obligations associated with being responsible space faring nations. It is for these reasons that the United States will continue to encourage others in the international community to examine the prospect of space arms control with a critical eye.”

Copies of her prepared remarks are available at <http://www.state.gov/t/vci/rls/rm/101754.htm>. ❖

Third Edition of *Climate Issues and Questions* Released

For well over a decade, the world has debated climate policy and now the United States Congress is poised to take up legislation to cap carbon dioxide (CO₂) emissions, the Supreme Court has ruled that EPA had the authority to regulate CO₂, and many states are moving to establish their own restrictions on emissions. Underlying all of these actions are perceptions about the certainty of scientific information about climate change and the human effect on the climate. There remain many questions over what science does and does not tell us about human influence on the climate and the potential impacts of global warming.

We believe that sound public policy must be based on a sound factual foundation. For this reason, the George C. Marshall Institute has released a newly updated report offering perspective on some of the fundamental questions concerning the science of climate change. *Climate Issues and Questions* (<http://www.marshall.org/pdf/materials/577.pdf>) provides clear and succinct summaries of what we know and do not know about our climate system and the human influence on it.

As the public considers the risks, consequences, and costs of responding to climate change, we hope this report will be a valuable basic reference and help policy makers to better match actions with the state of knowledge. Only by doing that can policy makers limit unintended consequences and not jeopardize the economic well being of this and future generations.

This is the third edition of *Climate Issues and Questions*. Like the others,

this edition addresses fundamental questions about climate change by summarizing the best available scientific information. The information provided is not intended to rebut claims about human impacts on climate or the potential for adverse impacts later this century. It is intended to separate fact from speculation and to demonstrate that while concerns are legitimate, there is not a robust scientific basis for drawing definitive and objective conclusions about the extent of human influence on climate, past, present, or future. The presentation moves from what is well established, to what is not certain, to what is unknown, and what may be unknowable.

Climate Issues and Questions considers 30 important questions, including:

- ❖ How is the scientific consensus on climate change established and what does it mean?
- ❖ Is the Arctic warming faster than the rest of the Earth?
- ❖ Are satellite and surface temperature trends different?
- ❖ What influence does the Sun have on global climate?
- ❖ What is the basis for forecasts of large temperature increases and adverse climate impacts between 1990 and 2100?
- ❖ What do we know about the extent of human influence on climate? To what extent has the temperature increase since 1975 been the result of human activities? ❖

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Environmental Aspects of Biofuels Considered

A Marshall Institute *Policy Outlook* report released in 2007, *Greenhouse Gas Emissions from Biofuels* (<http://www.marshall.org/pdf/materials/565.pdf>), argues that expanded use of corn-based fuels will produce gains in greenhouse gas emission reductions is inaccurate. When a life cycle assessment is used to evaluate emissions produced from growing crops, processing them into fuel, and using them in transportation, it reveals that the N₂O resulting from use as fertilizer eliminates the benefits derived use of corn ethanol as a transportation fuel.

This Policy Outlook's thesis received additional support from a recent report in *Science*, written by Timothy Searchinger of the Woodrow Wilson School at Princeton University and several others, which concludes that land-use changes resulting from greater production of biofuels actually produces more carbon dioxide emissions than conventional gasoline when evaluated on a per kilometer basis (*Science*, 319, 1238-1240). ❖

Implications of an 80% Reduction in CO₂ Emissions

In an effort to better understand the impact of the massive reductions of carbon dioxide being recommended by presidential candidates and the Congress, we published a short study, *Considerations for an 80% Reduction in Carbon Dioxide Emissions* (<http://www.marshall.org/pdf/materials/572.pdf>). This paper examines the result of drastic CO₂ emissions reductions on individual Americans using two popular on-line emissions calculators, the Personal Emissions Calculator created by the Environmental Protection Agency and the calculator featured on the website for Al Gore's movie *An Inconvenient Truth*.

Actions such as driving smaller, more fuel-efficient vehicles and switching incandescent bulbs for compact fluorescent ones have been touted as major steps toward reducing U.S. greenhouse gas emissions,

but the calculators indicate that, in the current state of affairs, only draconian cuts in living standards can achieve the desired reductions. The *Inconvenient Truth* calculator shows that an American household of two people would have to give up automobile and airplane travel and consume energy at a third to a half the current rate to meet their quota. To meet a goal of stopping 80% of *global* emissions, the world's population would have to match the energy consumption of a nearly pre-industrial society.

Since other emission reduction strategies such as energy rationing and population control are not politically acceptable, the paper concludes, "Technology is the only feasible and humane means to both reduce greenhouse gas emissions and maintain an acceptable standard of living." ❖

What is Cap and Trade? What is required for such a system to work? What are the costs and benefits?

Kate Lally, Research Associate

Cap and Trade is a program in which a government entity would set specific emissions targets for greenhouse gases (GHGs) and distribute allowances to emit carbon dioxide equaling those levels to selected economic sectors. These include the electricity generation, transportation, and industrial sectors, which together make up over 80% of U.S. GHG emissions.¹ When the overall “cap” on emissions is established, emissions are divided into individual permits that are equal to one ton of carbon. If the permits made available to selected GHG-emitting sectors are not enough to meet their particular needs, they can then buy extra allowances (“trade”) from sources that can reduce emissions at a low cost.

The first requirement for a cap and trade system is to put it under the control of a government entity, most likely the Environmental Policy Agency (EPA). The EPA administers the U.S. sulfur dioxide (SO₂) trading program, which is a trading scheme similar to what cap and trade will be, albeit on a much smaller scale. The EPA would be responsible for administering and monitoring the cap and trade program, with its most vital responsibility being to set the cap for overall emissions.

The cap is the second requirement—the point of implementing cap and trade is to reduce GHG emissions, so an effective cap must be set at a level that makes a noticeable impact on emissions while allowing for stability and predictability within the market.²

Accountability is the third element of a cap and trade system, since emissions data must be accurate and transparent, and must be evaluated periodically to ensure the regulated entities are meeting the cap for emissions. The EPA would

be tasked with keeping records of allowance transactions and enforcing penalties for non-compliance or fraud.³ Cap and trade would be pointless without ensuring that all firms subject to its regulations were being treated equally and complying with its requirements.

The final requirement is simplicity and clarity of the rules. Rules that are consistent and easily understood will be necessary in a program the size and scope of cap and trade. Such rules would be applied at every level, from determining which industries fall under cap and trade’s scope to compliance requirements.⁴ One of the more important rules will be setting the point of regulation, that is, determining the parties responsible for tracking their emissions and turning in allowances. Historically, regulations are imposed upon the sources that emit GHGs, because they are the ones that install controls to reduce what they emit. This is known as “downstream” regulation. For some activities, downstream regulation is impractical; for example, in the transportation sector, millions of individual cars emit the bulk of GHGs and requiring individual drivers to purchase emission allowances is considered unrealistic. Instead, most cap and trade proposals place points of regulation farther up the economic stream of activity, otherwise known as “upstream.” In the transportation sector, this could mean that fuel refiners would be responsible for obtaining allowances and keeping track of emissions.⁵ Any cap and trade proposal must clearly define the upstream and downstream points of regulation to allow for the most effective methods of obtaining allowances and compliance.

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Institute Commemorates Anniversary of Chinese ASAT Test by Considering U.S. Responses

A year ago, China destroyed one of its own satellites in a test of an anti-satellite system (ASAT). This test prompted sharp commentary and numerous recommendations on how to react. A year later the direction of the U.S. response remains shrouded in the mists of classified programs and secret information. Nevertheless, the public defense budget offers some glimpses of priorities at the highest level. Creation of a major force program and increased funding for situational awareness activities were the main priorities expressed in the FY 2008 defense appropriations bill (see <http://www.marshall.org/article.php?id=566> for more details).

In a *Policy Outlook* released in January, Dr. Robert Butterworth, President of Aries Analytics and a Fellow at the George Marshall Institute, summarizes the responses available to the U.S. and concludes that providing “supplemental capability ... to meet surging needs and to replace lost or failed sensors” ranks as a foremost priority amongst those options.

He goes on to outline how this supplemental capability might be provided.

Each of the options will require trade-offs between cost, capability, and speed of response. Butterworth argues: “Within each option there are competing priorities; in pursuit of rapid augmentation, for example, one can find demands for new industrial practices, common aero vehicles, reusable upper stages, and new launch site developments. But if priorities are set by military needs, surely an initial operational capability takes precedence.”

Assuring Space Support Despite ASATs is available at <http://www.marshall.org/article.php?id=575>.

Institute President Jeff Kueter made several appearances in January and February commenting on space security issues. At a conference hosted by the Eisenhower Center for Space and Defense Studies, Kueter discussed steps the U.S. could take to improve its security in space in the face of new challenges there. Several weeks later at an Independent Institute event discussing arms control in space, he reiterated concerns about whether such agreements could be monitored, verified, and enforced. ❖

Aegis Missile Defense System Examined

On November 28, 2007, Rear Admiral Alan B. Hicks, Program Director of the Aegis Ballistic Missile Defense program spoke at a Roundtable entitled *Aegis Ballistic Missile Defense System Status and Upgrades*. Adm. Hicks described how the Aegis Ballistic Missile Defense, the sea-based element of the Missile Defense Agency’s Ballistic Missile Defense System, is operational and prepared to perform its strategic role in Homeland Defense. Its regional defense capabilities have resulted in significant international interest in the program from friends and allies. The Aegis BMD program achieved its tenth and eleventh successful interceptions out of thirteen attempts this past November, in its first-ever simultaneous engagement of two targets outside the atmosphere. The program’s successful track record has established it as a mature program, and one of the highlights of the national missile defense system.

Adm. Hicks’s remarks are available at <http://www.marshall.org/article.php?id=573>. ❖

Use of Non-Lethal Weapons Considered

The Institute sponsored a panel discussion on *The Emerging Role of Non-Lethal Weapons: Issues and Implications for the United States* on December 7, 2007. The panelists were Dr. Steven Bucci, Deputy Assistant Secretary of Defense, Homeland Defense and Americas' Security Affairs; Col. Kirk Hymes, Director, Joint Non-Lethal Weapons Directorate; and Dr. William R. Graham, former Science Advisor to the President and Director of the White House Office of Science and Technology Policy. They provided an overview and update on the current state of systems development and discussed their role in improving the safety and security of the U.S. and its forces and in homeland security.

Col. Hymes outlined the rationale for developing non-lethal systems by simply stating "We really need to provide the warfighter with a means to act beyond shouting, but short of shooting." As our young warfighters are asked to deal with missions involving crowd control, securing areas without inflicting permanent damage, or targeting individuals in crowded settings, lethal options are less attractive and non-lethal options much more so.

Dr. Bucci described the need for an expanded set of options for the National Guard, and by extension law enforcement and border security agents. Specifically, Bucci mentioned the following missions:

- ❖ area denial to personnel and vehicles,
- ❖ incapacitation of targeted individuals,
- ❖ disabling of targeted vehicles,
- ❖ stand-off interrogation of intent (that is, trying to figure out what it is that these people really want when they are far enough away for us to do something about it), and
- ❖ the security and defending of fixed sites.

Dr. Graham suggested that "non-lethal weapons are qualitatively different from conventional weapons, and as such require being addressed in a significantly different, larger range of issues that affect their deployment and employment."

In particular, Dr. Graham mentioned concerns about the misuse of non-lethal systems as instruments of coercion or torture, and the prospect of future claims of physical or psychological harm from exposure to non-lethal systems like the Active Denial System, as items that must be addressed before widespread use of non-lethal capabilities will be seen. He recommended the development of "a national policy for non-lethal weapons for presidential review, and, when approved by the President, promulgate it as an executive order of the President of the United States."

Copies of the transcript of this event are available at <http://www.marshall.org/pdf/materials/574.pdf>. ❖

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Proponents of cap and trade point believe that the industries involved will have an incentive to find ways to reduce emissions at the lowest cost. They claim this method promotes innovation that might not occur under a more traditional command and control structure by placing a value on the reduction of

GHGs.⁶ Also, cap and trade is said to provide certainty that GHG reductions will occur, something that other options, such as performance standards or taxation, could not guarantee.⁷ Cap and

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trade proponents also point to the benefits of utilizing a market structure over the more traditional method of command and control. Emission reduction would become a marketable asset under the system and those sources that achieve excess reductions can obtain financial rewards from selling their extra allowances. Some businesses favor a cap and trade system above others, such as command and control or a carbon tax, because they feel the flexibility a carbon market provides allows them to work out the least expensive methods for reducing emissions.⁸

Another oft-cited point for supporters of cap and trade is the success of the Acid Rain Program, which has used a trading scheme to reduce sulfur dioxide (SO₂), the main contributor to acid rain. Enacted in 1990, the emission allowance trading program required electric utilities to reduce their SO₂ by 50 percent of 1980 levels by 2010.⁹ In 1980, emissions accounted for 17.5 million tons; current levels are down to about 10.5 million tons, and are by all accounts on target to reach the desired goals.¹⁰ However, critics of cap and trade will point out that the success of the Acid Rain Program would not automatically translate into success for a GHG emissions trading scheme. SO₂ trading is only applied to a single sector—coal fired power plants. Although a GHG trading scheme would include coal-based utilities that emit CO₂, it would also have to apply to various other sectors across multiple industries, making it extremely complex and much more costly.¹¹ In fact, the criticism that the Acid Rain Program is an inappropriate model for a GHG trading scheme gains credence when looking upon the European Union Emissions Trading Scheme (EU ETS). Modeled after the SO₂ trading scheme in the U.S., emissions under the EU ETS actually rose between 2005 and 2007 due to extreme price volatility that provided firms with

no incentive to reduce their CO₂ output.¹² Critics point out that it is this system and not the Acid Rain Program that would be the most similar parallel to cap and trade, due to its size and regulation of multiple sectors.

In the case of the EU ETS, the extreme price volatility was due to an over-abundance of permits given out for free by the governments of the EU. Permit allocation is a major challenge for cap and trade proposals. Due to concerns about the huge costs to specific and vital sectors of the economy under cap and trade, allowances can be given for free to sources that are most burdened or especially affected by the policy. These sources include those least able to pass along costs, such as the direct cost of allowances or the higher costs of energy resulting in an upstream-regulated system, to their customers.¹³ The questions regarding which sources, exactly, would be eligible to receive the free permits leads to the specter of “rent seeking,” or petitioning the federal government for free emission permits. Since billions of dollars could potentially be at stake by lobbying for free permits, the resources spent fighting for access to those permits would be, on its own, a multi-billion dollar deadweight cost to the economy.¹⁴

There is another consequence to the allocation of free permits—the fact that for many companies, cap and trade will be a means of wealth creation. Emissions permits create valuable tradable assets and the businesses that can lobby early and effectively for free allocation stand to make significant profits.¹⁵ A recent Congressional Budget Office issue brief estimated that initial allowances could be worth between \$50 and \$300 billion annually.¹⁶ There is evidence from what the EU ETS has experienced that larger firms with the resources and ability to rent-see will

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make profits totaling millions of dollars at the expense of smaller firms without those rent-seeking avenues. Basically, they would be receiving free money in the form of allowances solely based on the resources they would be able to employ to petition the government for them. The economic costs and public skepticism of this method is a large cost for cap and trade plans.

A cap and trade program is one potential way of controlling GHG emission levels in the U.S. Proponents point out that its attributes make it superior to a command and control system and also provide certainty that emissions levels will decrease. They speak of the success of the Acid Rain Program and its similarities as an emissions based trading scheme. Critics of cap and trade say that it would be disingenuous to use the Acid Rain Program as a model for a GHG based cap and trade program because of its complexity, cost, and application covering multiple sectors and industries. They point to the EU ETS as a more appropriate model and its failures in controlling emissions, and use the problems with that system to predict what could happen with cap and trade in the U.S. Criticism of cap and trade also extends to the possibility it will be an avenue for billions of dollars of rent-seeking, as well as a wealth creation mechanism for some firms at the expense of others. It is clear that cap and trade has both advocates and detractors, and with so much at stake it is only fair to proceed with caution to ensure that no detail is overlooked when weighing its benefits against its costs.

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Book Review

Cool It: The Skeptical Environmentalist's Guide to Global Warming by Bjorn Lomborg (A. A. Knopf, 2007)

"I predict that within 100 years, computers will be twice as powerful, ten thousand times larger, and so expensive that only the five richest kings of Europe will own them." – Professor John Frink, late 1970s (*The Simpsons*, Episode 3F20)

"We will bury you." – Nikita Khrushchev, 1956

Failed predictions about the future make fascinating reading. With the smugness born of hindsight, we wonder how famous scientists, economists and political leaders – “the experts” – could have been so wrong in dismissing automobiles, human flight, radio, television, space travel, and rock music, or expressing faith in the inexorable arrival of flying cars, a new Ice Age, and the triumph of world communism. Innovation has turned the world in new and unexpected directions: it would have been impossible in the 1880s to predict the automobile economy of the 1920s and beyond or to predict in the 1960s the computer and internet economy of the 21st century. Clearly, predictions of the state of the world twenty or fifty years hence should be taken with a large dose of salt.

In response to predictions of dire cataclysms caused by rising temperatures, Bjorn Lomborg has written *Cool It: The Skeptical Environmentalist's Guide to Global Warming*, a short and very readable plea for cost-effective solutions to the problems that face humanity, climate change among them. Lomborg is a Danish political economist who first made his name as author of *The Skeptical Environmentalist* (2001), a controversial book which offered an unexpectedly optimistic view of the world and its future. In 2002, he organized the Copenhagen Consensus, a team of economists which analyzed and ranked the world's health, social and economic challenges by the costs and benefits of addressing them, and edited

its conclusions under the title *Global Crises, Global Solutions* (2004). *Cool It* continues Lomborg's argument that while climate change is real and a genuine concern, its solution or remediation will not be accomplished by massive spending and drastic near-term reduction of carbon emissions, and that the world's well-being is better served by dealing with more pressing and more easily solved problems first.

Cool It begins with a chapter on polar bears. Polar bears look like huge, friendly stuffed animals. We hate the thought that a warming Arctic climate may drive them to extinction and this makes polar bears a good rallying point for stopping climate change. But Lomborg argues that in some areas, bear populations are actually increasing in spite of the observed warming, and that the quickest and most cost-effective way to protect them is to stop hunting them, which would save the lives of the forty-nine bears which are killed, on average, every year. (Of course, a ban on killing polar bears would also infringe on the rights of the Inuit peoples of the Arctic to follow their traditional hunting and fishing lifestyle.) He concludes, “We must ask ourselves if it makes more sense to help 49 bears swiftly and easily or 0.06 bears slowly and expensively [by reducing CO₂ emissions].”

Cost-benefit analysis, an economist's version of making sense, is Lomborg's guiding principle and his critique of the Kyoto Protocol shows it to best advan-

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tage. He points out that the Kyoto Protocol will be very expensive and accomplish very little in curbing warming: "If no other treaty replaces Kyoto after 2012, its total effect will have been to postpone the rise in global temperature a bit less than seven days in 2100." (p. 23). This criticism is accepted by Kyoto supporters, who have admitted that the Protocol is only the first of a series of increasingly restrictive treaties on carbon reduction. But however carbon reductions are stabilized, "it turns out that for the first 170 years the costs are greater than the benefits," and we have other social responsibilities, such as combating malaria and AIDS, providing clean water, etc. To put climate change into perspective, he dedicates ample space to skewering widespread misrepresentations of future climate change and sea-level rise and the hostile responses of some leading environmentalists to people who question their conclusions.

As carbon emissions are currently closely tied to energy use and thus economic growth, Lomborg emphasizes that reducing them must be done in a cost-effective manner, by shifting to low-carbon or non-carbon energy sources and especially by supporting research and development in these areas. While many governments currently sponsor such R&D, they are also bound by political constraints and special interests, which inhibit a comprehensive strategy. He accepts the inevitability, if not the desirability, of carbon taxes and attempts to estimate a tax which would yield the best balance of carbon reductions, technology stimulus and economic effects, arriving at \$2 a ton. While this may be an optimal level, his argument would be improved by more documentation on this point, since other estimates vary considerably.

Cool It is targeted at a general audience and intended as a corrective to

alarmist predictions of climate change, and for that reason suffers in places from over-broad arguments and generalizations. The author does not always examine the full range of possibilities in either his own or his opponents' arguments, and like them he can be astonishingly confident about the world's future condition. Cost-benefit analysis, like many economic methodologies, can appear rather cold-blooded. For example, Chapter 2 points out that a warming world will see more heat-related deaths, but fewer cold-related ones, and in balance it is likely that fewer people will die from extreme temperatures globally. Humanity may benefit, but that is little comfort to those at greater risk of dying. Still, Lomborg demonstrates that cost-benefit analysis offers a valuable metric to use in deciding policy. One argument that Lomborg fails to make is about the likelihood of public acceptance of the lower standard of living which will result from carbon reductions. Austerity is a very hard sell. It is hard to imagine an American or Italian agreeing to reduce his energy consumption by half or more, and a Chinese or Indian agreeing to forego anticipated improvements in his living standard, for the sake of a benefit which may not be seen for decades or centuries.

By encouraging his readers to question orthodoxy, and by implication to question his own conclusions, Lomborg advances the possibility of a much wider and potentially more successful range of policies and approaches to deal with current and future challenges. His message is that lacking infinite resources, we must make wise decisions on which problems to address and which steps to take to improve both quality of life and the environment on a global scale. *Cool It* is a thought-provoking argument for rethinking our goals and our strategies to achieve them. ❖

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