

Public Interest Report

THE FEDERATION OF AMERICAN SCIENTISTS

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THE NEW AMERICAN CENTURY

Barack Obama's decisive victory, based on the theme of change, provides a unique opportunity to make changes in the key areas of national security and domestic policy. There will be a narrow window during which a new team can come forward with specific plans to implement the bold commitments made during the campaign and work with the Congress to get them passed quickly. It will be critical to propose bold plans and be prepared to argue forcibly for the urgency of the goals and the utility of the proposed solutions. *More on page 3.*

U.S. AND CHINA: HOW TO GREEN THE ECONOMY AND CLEAR THE SKIES

No topic has risen more quickly in recent years than procuring green energy alternatives and combating climate change. How can China and the United States work together to stop global climate change? What can the new U.S. president do to help China become more energy efficient? The Federation of American Scientists hosted a conference to answer these questions at the University of California, Berkeley. *More on page 11.*

MOVING TOWARD THE PATH TO ZERO

The future of the world's nuclear security is uncertain. The United States must lead the way to reducing nuclear weapons worldwide and supporting the Comprehensive Test Ban Treaty (CTBT) and the Nuclear Nonproliferation Treaty (NPT) are two of the ways the U.S. can strengthen nonproliferation efforts worldwide. FAS hosted a conference to discuss U.S. nuclear weapons policy in the 21st century at the Commonwealth Club in San Francisco. *More on page 17.*

About FAS

The Federation of American Scientists (FAS), founded on 8 December 1945 as the Federation of Atomic Scientists by Manhattan Project scientists, works to ensure that advances in science are used to build a secure, rewarding, environmentally sustainable future for all people by conducting research and advocacy on science public policy issues. Current weapons nonproliferation issues range from nuclear disarmament to biological and chemical weapons control to monitoring conventional arms sales and space policy. FAS also promotes learning technologies and limits on government secrecy. FAS is a tax-exempt, tax-deductible 501(c)(3) organization.

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PRESIDENT'S MESSAGE**Political Landscape
Ushers in a New Era
for Science and Technology**

The election of Barack Obama and a new political landscape in the Congress inaugurates a renewal for Washington science and technology policy. We at FAS are working hard to understand the priorities of the new leadership and the people we should work with. This PIR covers two themes that we will be pursuing with increased emphasis in the coming year: technologies that can address energy and climate challenges around the world, and developing a practical path to a world free of nuclear weapons. FAS hosted two major conferences on these subjects in California during our most recent Board meeting.

One meeting focused on the shared interests of the U.S. and China in energy technologies. It included the 2008 FAS Public Service Award ceremony, which honored Mark Levine, a long-time FAS member who pioneered efforts to collaborate with China on energy technologies. His remarks are summarized in this issue. A number of senior Chinese officials participated in the conference. Chinese emissions of carbon dioxide now slightly exceed those of the U.S. Together the two countries produce 40 percent of all global carbon emissions. Each country arrived at this situation from very different histories and face different challenges in meeting climate goals. But both nations understand that solutions hinge on the development of dramatically more efficient methods for using energy and a new generation of clean fuels and sources of electricity. There are many areas where collaborative research could pay important results.

The second meeting focused on implementing strategies for the worldwide elimination of nuclear weapons. Henry

Kissinger, George Schultz, William Perry, and Sam Nunn wrote a powerful opinion piece in the *Wall Street Journal* that laid out the rationale for doing this and a series of practical steps forward. This was followed by a year of detailed work at the Hoover Institute, which led to a second *Wall Street Journal* article by the same authors laying out an even more detailed set of proposals. FAS, the Natural Resources Defense Council, and the Union of Concerned Scientists crafted a set of proposals in the new edition of their report, *Toward True Security*. There was a remarkable amount of overlap between the proposals. George Shultz participated enthusiastically and made clear that he and his colleagues intend to pursue the mission of reducing U.S. and world nuclear arsenals vigorously next year. He repeatedly made the point that Ronald Reagan was deeply sincere about his desire to eliminate nuclear weapons and had been for years before becoming president. The 2008 Hans Bethe Award was given to Raymond Jeanloz who delivered introductory remarks at the session. These are also summarized in this issue.

We look forward to an exciting year and hope we can count on all of you to help us.

FAS

The New American Century

Barack Obama's decisive victory, based on the theme of change, provides a unique chance to make some basic approaches in key areas of national security and domestic policy. There will be a narrow window during which a new team can come forward with specific plans to implement the commitments made during the campaign and work with the Congress to get them passed quickly. It will be critical to pick the right list, to propose plans bold enough to match the need, and be prepared to argue forcibly for the urgency of the goals and the utility of the proposed solution.

Coming in the midst of the worst financial crisis in a generation, there will be powerful pressures to shy away from programs requiring new funding. But failing to make the investments President-elect Obama promised for reestablishing U.S. leadership in research, innovative businesses, education, and infrastructure would put the country on a path to irrelevance. The inability of the Japanese to escape the sclerotic thinking of their establishment managers has not only lost a decade of growth, but undercut the confident tone of a nation that once seemed poised to lead the world with technology and invention. This is one of the few times when a president may be able to slay some sacred cows saying plainly that we simply can't afford to be hemorrhaging money in federal programs that have long outlived their original purposes.

There is general agreement that a new fiscal stimulus package is needed and that it should focus on government spending most likely to generate economic activity quickly. Carefully constructed, this short term stimulus can also build an infrastructure that will pay long term dividends. The

investments should focus on accelerating the revolutionary changes already underway in national security, in the economy, in the way energy is used and produced, and in education.

A National Security Revolution

While Americans are all in sticker shock at spending \$700 billion to bail out Wall Street, we've been spending nearly this much every year on national security programs at the Department of Defense and Department of Energy. In 2008 the U.S. spent \$676 billion.

And it seems that the base budget, reported at the beginning of the year, is basically a kind of retainer. You have to pay extra (in the form of an annual "supplemental") if the military is actually asked to fight. It's time to take a careful look at what we're

getting for the retainer.

While only a small portion of the budget, one essential part of the base budget must be a revitalized investment in defense research and development. The Defense Advanced Research Projects Agency (DARPA) and other programs have filled the pipeline of innovation and led to key advances in materials, communication systems, and computation that have underpinned U.S. security for generations. These innovations have led to spinoffs of great benefit to the civilian economy. Defense research – particularly basic research – needs to be put back on its feet with funding and creative new management.

The United States is maintaining a defense infrastructure largely unaffected by a dramatically changed security environment. Repeated fights over closing bases
*See **New American Century**, p. 4*



New American Century, from p. 3

and laboratories, and cutting pointless hardware have resulted in some savings – but not nearly enough. Weapons systems like the ballistic missile defense are not counted as earmarks but should be. We continue to fund outlandishly expensive programs that would be near the bottom of any list of priorities for defense spending prepared by a team trying to build a defense system tailored to real 21st century threats to our security. The U.S. spends roughly twice the NSF budget to dig holes in Alaska for missiles that don't work. Can we really afford this?

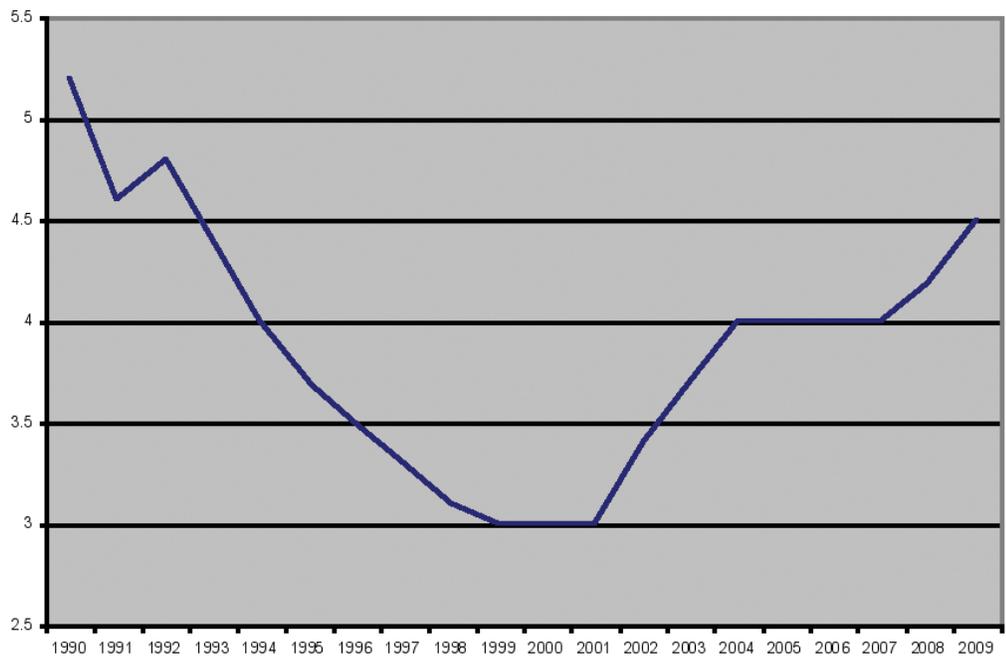
But the worst thing an earmark does is waste money. There are cases where military pork can do real harm – as the missile defense deployments have clearly already done so. These legacy programs rob investments badly needed to address new challenges: cyber attacks, rapid and real time intelligence, robotics, and flexible operations in dense urban environments.

The U.S. nuclear weapons program is another pointless legacy. We are maintaining nearly 10,000 weapons of which about 1000 are on a hair trigger alert. We continue to operate the full Cold War contingent of weapons laboratories. No one seems able to explain what logic drives these huge numbers. On the other hand it's easy to explain the harm they do – the risk of accidents, and the way they undermine any serious effort to rebuild international nonproliferation efforts.

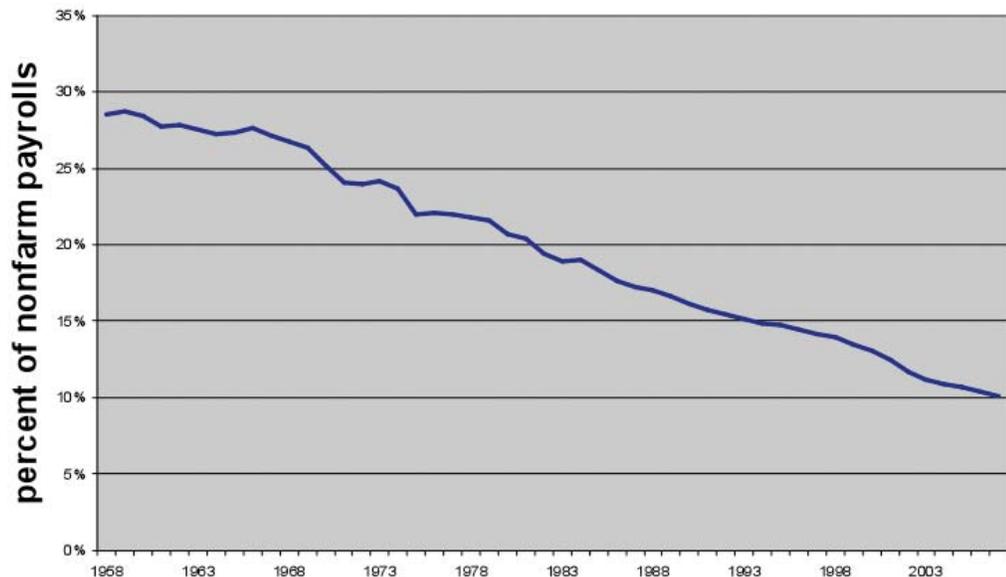
The good news here is that the Kissinger, Shultz, Nunn, and Perry “gang of four” have forced the nation to ask the obvious questions about its nuclear policy and both political parties have shown an interest in a dramatic rethinking of U.S. nuclear policy. What we lack is an accompanying strategy for building a global nonproliferation system that makes technical, political, and economic sense.

Most importantly, however, we seem unable to accept the recommendations from

National Defense Outlays



US Manufacturing Employment



field commanders that skillful diplomacy and civilian economic development can almost always achieve security objectives at a lower cost than direct military intervention. The personal history of the new president and his skill in building coalitions, positions the U.S. to finding ways to be a full partner

in solving problems that are global in nature – energy supplies, water, food, and disease prevention. Investing in collaborative projects in these areas, while not a substitute for an ability to project power, can provide security at a far lower cost.

An Economic Revolution

The twin pressures of a tightly integrated global economy and a revolution in production technology is transforming the U.S. economy like the profound movement in an earlier generation that took Americans off the farm and onto factory floors, and out of sweat shops into modern manufacturing plants. But the effects thus far have been frightening.

Income inequality has grown sharply and gaps are as great as they were in the 1920s. The U.S. trade deficit continues to widen. Last year we imported \$800 billion more than we exported. About 40 percent of this deficit resulted from petroleum imports. This year our petroleum imports alone may be more than \$500 billion.

We're even getting clobbered in high technology products. The U.S. went from a \$30 billion trade surplus in advanced technology products in 2000 to a \$40 billion deficit in 2006. In Asia the trade balance in advanced technology products increased from \$25 billion to \$72 billion over the same period as China and other nations, led by highly competent engineers, implemented a program to move from imitation to innovation. Employment in U.S. manufacturing that has provided solid middle class incomes for generations is vanishing at breathtaking rates—they're now less than 10 percent of all jobs. The number of manufacturing jobs today is lower than it was in the 1950s.

There is no way to restore the glories of the U.S. manufacturing juggernaut of the late 20th century. The production process has moved irrevocably away from a system that could be operated by a high school graduate to one that relies on sophisticated equipment integrated into an international network. Even non-manufacturing jobs are redefined as information technology tools replace the routine tasks of many service employees. Service sector productivity has been increasing at an astonishing 3 percent per year.

While much remains uncertain, it is increasingly clear that a prosperous future U.S. economy will automate most anonymous, routine physical tasks and depend on people skilled in invention and managing change. The new economy will rely on new tools that educate, heal, persuade, communicate, and counsel with unprecedented connections to each other and a reservoir of worldwide information. Success will depend on our ability to maintain an unrelenting pace of innovation and reinvention coupled with an effective system.

The U.S. needs to make investments in the ingredients we know must be part of any successful strategy to build an economy that provides sustainable growth in output and employment. These include strong research and development programs capable of focusing funding on areas most likely to be productive in expanding our understanding of how the world works – even when there is no clear connection to contemporary problems. Applied research in areas like energy, agriculture, and health should find ways to define

problems in ways that invite innovative solutions from many sources and disciplines. Recent research suggests, for example, that advances in silicon nano-wires may provide breakthroughs in solid-state refrigeration.

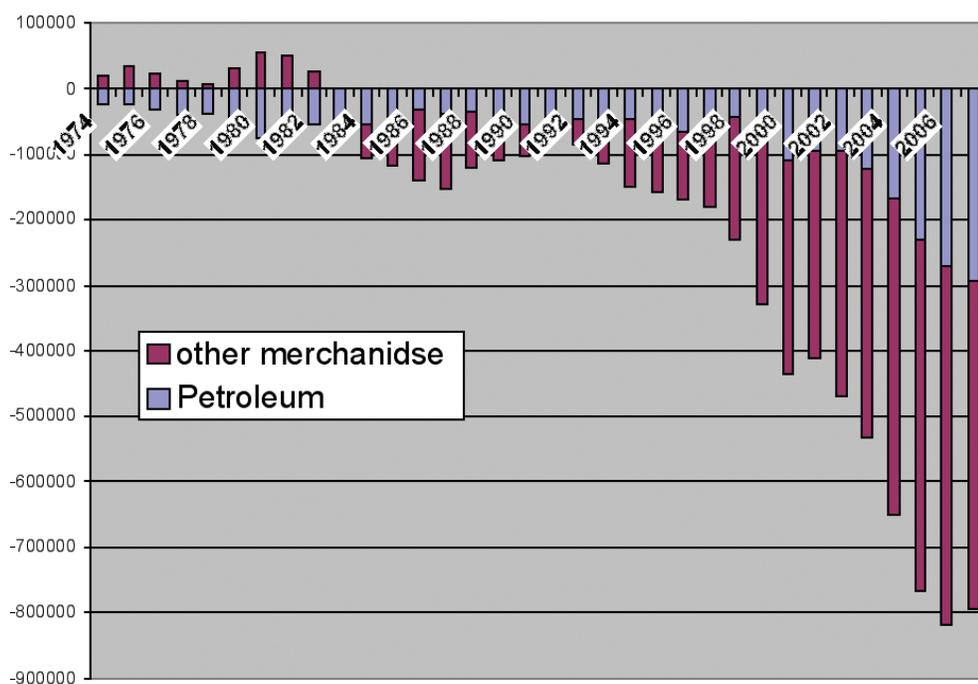
The energy and climate policies discussed below can provide a powerful set of tools for creating markets for innovative products and production systems. Among other things, this can provide strong incentives for increases in private research investment. Skillful use of stimulus funding can also provide key infrastructures – the introduction of broadband, smart electric grids and transportation networks, and new industrial facilities designed to produce highly efficient cars with highly productive processes.

Energy and Climate

President-elect Obama supports cutting U.S. CO₂ production 80 percent by 2050. This simply can not be achieved unless a key ele-

*See **New American Century**, p. 6*

US Merchandise Trade



New American Century, from p. 5

ment of the economic transformation involves a fundamental shift in the connections between energy use and economic activity. The momentum of current patterns of economic growth is not encouraging and, worldwide, is leading to huge growth in energy use and emissions. The recession will slow growth but unless something dramatic changes, economic recovery will be accompanied by a rapid growth in energy demand.

Achieving the dramatic climate goals while accommodating economic growth will be an unprecedented achievement. And it must be accompanied with a strategy that allows poor nations to sharply increase per capita income without offsetting gains achieved here. The good news is the innovation-driven economic recovery just described is consistent with the changes needed to drastically increase the productivity of energy use and a shift to a new generation of energy supplies. It is also consistent with a program to build a transportation and communications infrastructure consistent with a

new economy. The investments needed to achieve this massive transformation are so large, and touch so many parts of the economy, that an innovation-driven energy and climate program can be the engine to drive needed changes in the entire economy.

Reconstructing existing infrastructure – buildings, even entire urban areas and transportation systems – requires special focus. Clearly we don't want to rebuild the 1950s highway system without careful thought to mass transit, urban design, and novel transportation modes that could lead to more livable, more sustainable, and healthier urban areas. About 70 percent of all U.S. electricity goes to power residential and commercial buildings – and the turnover rate of these structures is very slow; there are 130 million homes in the United States while only 1-2 million new homes are built each year. Then so, in most cases, the cost of renovating these homes to reduce electricity use is far lower than the cost of building new electric generating facilities. A strategy that could get an ambitious retrofit for every building sold (roughly every seven years for housing) is essential. This means

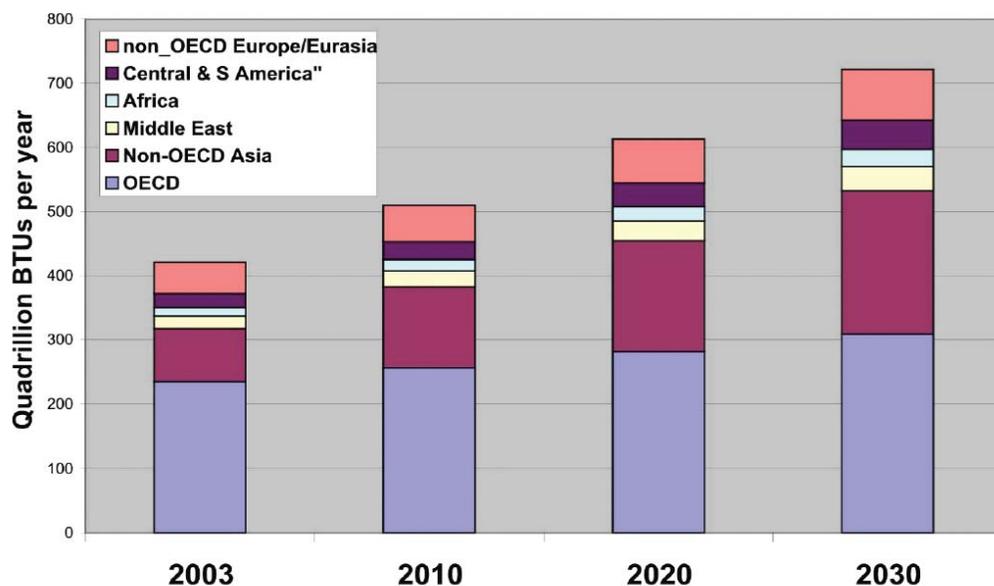
making full use of the regulatory authorities and incentives available through agencies not traditionally associated with energy and environmental issues, such as Housing and Urban Development, Transportation, and Agriculture.

Education and Training

People will only benefit from the kinds of changes envisioned here, as workers, as consumers, or as citizens, if they are able to enter the workforce trained to take intellectually challenging jobs, and if they able to keep learning in response to relentless innovation. This is already evident in the growing gap separating the income of people with college degrees from those with a high school education. Soon it will no longer be possible to have a middle class job with a high school education.

The challenge is that while the need is growing, the cost of providing sophisticated education and training is also rising. After years of effort, U.S. K-12 students still compare poorly with students in Europe and parts of Asia. Costs continue to soar – college tuition outpaces growth in incomes. As we've argued in these pages before, the only affordable way to provide a highly diverse population with the education and training required to make them part of a fast-paced, flexible economy will involve using the same information technology tools that have made other service enterprises more productive. This means making use of simulations, personalized tutors, and continuous embedded assessments. The process requires building an infrastructure that can continuously improve upon itself based on reviews from scholars and teachers from many disciplines around the world. And it will require a way to ensure the persistence of material developed – such as learning modules, virtual objects, and simulated tours. The world is littered with many small efforts that can't interoperate with modern systems and are trapped in formats rapidly rendered obsolete.

World Energy Use



note: OECD = Organization of Economic Cooperation and Development



A Path Forward

The federal government has always played a central role in the research needed to develop technologies to drive American growth, and it clearly must do so again. It must ensure that the market for innovations is strong – by encouraging private research investment and providing a strong pull for creative new approaches through clever design of energy and environmental regulations. Efforts to do this have faltered and repairing the damage must be a central focus of the new president. A report from the National Academies of Science titled “The Gathering Storm” sounded the alarm that a new level of federal research investment is needed. This led to the *America Competes* legislation that – while filled with a laundry list of pet projects – showed bipartisan determination to double federal

research spending in key agencies.

Virtually none of the promises were backed with appropriations. This has to change. It would be disastrous to cut back on research and education investments essential to build a strong economy and meet the energy and climate changes we face. An economic crisis will force some tough choices but it may also provide a rare opportunity to take a tough look at legacy defense programs, water projects, agricultural subsidies, and a tax code with hundreds of pages of manipulations designed to protect businesses. Doubling budgets for the National Science Foundation, the Department of Energy’s Office of Science, and the National Institute of Standards and Technology would cost roughly \$21 billion a year. This is the annual amount we spend on agricultural price supports. Eliminating the

Strategic Defense Initiative would save enough money to increase the NSF budget 150 percent. In spite of all the rhetoric, the real buying power of U.S. energy research programs is less than half that in the late 1970s. A 5-fold increase has been suggested and would clearly be justified.

There are many ways to go wrong at this critical moment, and a lot of pressure to build walls around familiar terrain instead of looking forward. But if any nation can continue to reinvent itself around a revolution in technology it’s the United States. We have the intellectual infrastructure, superb research populations, and talent drawn from around the world. With the right leadership, we can maintain the perpetual revolution that is the real America.

FAS

Mark D. Levine Receives 2008 Public Service Award for Energy Efficiency Research

By Monica Amarelo

Mark D. Levine, director of the China Energy Group at the Lawrence Berkeley National Laboratory, is the recipient of the 2008 FAS Public Service Award for "his extraordinary contributions to energy efficiency research and for his work in China to build a strong energy program."

Levine is a pioneer on energy efficiency research. He was part of a major study, "A Time to Choose," funded by the Ford Foundation in 1972 that, along with the 1973 American Physical Society study, created the mandate and agenda for energy efficiency in the United States. He has been a leader in energy efficiency since that time, having played significant roles in key studies of the American Physical Society, the World Energy Council, the U.S. Department of Energy, the Energy Foundation, and other organizations.

He was also a part of the Intergovernmental Panel on Climate Change (IPCC) team of scientists that won the 2007 Nobel Peace Prize, awarded jointly to former Vice President Al Gore, Jr., "for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change."

For the last 20 years, Levine led the China Energy Group (<http://china.lbl.gov/>) at LBNL. The group formed as a result of a U.S. Department of Energy sponsored conference on China's energy markets held in Nanjing, China in 1988 and has worked collaboratively with Chinese organizations to further energy efficiency policy in China.

"Through my work with the China Energy Group, we've introduced techniques for analyzing appliance efficiency standards in China, created voluntary energy efficiency agreements between China's government



Mark D. Levine receives congratulations from FAS Board Chair Arthur Rosenfeld.

and industry, and developed state-of-the-art tools and data collection to permit analysis of China's energy future," said Levine, listing some of the many contributions made that enhance the collaboration between experts in the U.S. and China. "It is extremely important to promote clean technology policies here and abroad that result in buildings, industry, and motor vehicles that are safe, affordable and energy efficient."

In testimony before the U.S.-China Economic and Security Review Commission on August 13, 2008, Levine stated that there are misunderstandings in both China and the U.S. that cause both countries to miss opportunities for fruitful cooperation. Perhaps the greatest misunderstanding is the failure to recognize that China has in the past (1980-2000) and is again putting tremendous effort into reducing growth of energy-related CO₂ emissions through the design and implementation of aggressive and innovative energy efficiency policies.

"Together China and the United States account for nearly 40 percent of current global energy-related CO₂ emissions and have the largest potential to reduce emissions growth," said Henry Kelly, president of the Federation of American Scientists. "Solutions depend critically on both China and the U.S., and it is essential that the two countries work cooperatively – particularly in energy efficiency. Mark Levine has been instrumental in helping both countries understand that efficiency technologies are essential for meeting energy and climate change goals at the lowest possible price."

"As long as China appears to do little to reduce growth of greenhouse gas emissions it will be politically difficult for the U.S. to sign an international treaty that commits to a serious cap on emissions. And as long as the U.S. appears to do little, China won't commit to any limits on its own emissions," said Arthur Rosenfeld, commissioner of the California Energy Commission and Chairman of the FAS Board of Directors. "It's a vicious circle that Mark and the China Energy Group are trying to break."

In addition to his continuing role in leading the China Energy Group at Lawrence Berkeley National Laboratories, Levine served as director of the Environmental Energy Technologies Division from 1996-2006. The division is at the forefront of research on indoor air quality, buildings energy efficiency, and a variety of clean energy technologies, and Levine expanded its mission to include taking on a leadership roll in analyzing energy efficiency issues.

The 2008 FAS Public Service Award was presented on Thursday, 25 September 2008, in the Sibley Auditorium of the University of California, Berkeley. To learn more, please visit http://www.fas.org/press/events/2008sept_publicserviceaward.html. **FAS**

Excerpt from the Acceptance Speech by Mark D. Levine

25 September 2008 at the University of California, Berkeley, CA

“I’m very much honored to receive this award. And now I’m going to talk about three topics. I want to tell you about the China Energy Group because my colleagues deserve the credit and even more so our colleagues in China.

Secondly I’m going to talk about the myths and realities of energy and carbon dioxide emissions in China. I imagine few of you will know that all of the myths are incorrect.

And finally I’ll make observations about working with China on energy efficiency.

The China Energy Group started with a 1988 conference on energy markets in China in Nanjing, China. I saw a view graph that said the saturation of refrigerators in China in 1983 was close to zero. Later on someone else gave a talk and said the saturation of refrigerators in China in 1985 was 15 or 17 percent. Something dramatic had happened in Beijing in a two-year period.

Later I saw data that showed that energy demand in China had grown less than half as fast as the economy from 1980 – 1986. I knew that couldn’t be the case because everyone knew that in developing countries energy grew faster than the economy.

So I resolved to get to the bottom of what was happening. Therein lay the event that led to all this collaboration with China.

I arranged for Steve Nadel with the American Council for an Energy Efficient Economy (ACEEE) to take a sabbatical in China. He worked at the Energy Research Institute, which was then part of the state development and planning commission. Later Steve returned the favor by getting me to train the Chinese on appliance efficiency standards in exchange for their agreeing that they would issue the standard and implement it in a certain time period. And sure enough, 18 months later, the Chinese came out with refrigerator standards.

The Chinese were much smarter politically than we’ve been here in the U.S. Since this was very new for China and difficult for refrigerator manufacturers, they started with lenient and easy standards. But they told the industry that in five years they were going to come out with much tougher standards. And that five years after that they’d do it again.

I think the important point about this is – and this happened not only with refrigerators but with every single other product we trained the Chinese on appliance standards – they made a commitment up front and kept every single commitment they made.

The refrigerator standards training probably cost half a million dollars and will save 10 billion dollars worth of carbon dioxide emissions, if you treat carbon dioxide as \$20 a ton, by 2020.



Arthur Rosenfeld

We created the Beijing Energy Efficiency Center and the Beijing Energy Efficiency Center in turn talked the Chinese government into moving energy efficiency into the top priority. By creating this organization we helped influence the government to pursue big energy efficiency projects.

Now let me talk about China. I’ll start with the bad news. The reality is China has terrible air pollution. However for the first time, policies to improve air quality throughout China are taking effect. In fact overall air pollution has diminished in the last several years, year by year.

The first myth is that China’s subsidized energy prices cause them to use more energy and gives their firms a competitive advantage. Electricity is very expensive in China. Residents of Guangzhou pay more (\$0.16/kWh) for electricity than residents of San Francisco. Natural gas prices in Shanghai are the same as in San Francisco

See *Acceptance Speech*, p. 10

“We created the Beijing Energy Efficiency Center and the Beijing Energy Efficiency Center in turn talked the Chinese government into moving energy efficiency into the top priority. By creating this organization we helped influence the government to pursue big energy efficiency projects.”

Acceptance Speech, from p. 9

(\$10/mcf). And coal prices throughout China (\$147/t) are higher than in the U.S.

Until two years ago oil and gasoline was at world prices and only in the last two years have there been subsidies for oil-related products. China does not have low energy prices. This is just not true.

Energy demand growth is faster than GDP in developing countries during periods of industrialization. China, virtually unique in the developing world, has demonstrated since 1980 that this need not be the case. Imagine what the world would be like if energy had followed GDP. Today China would be using four times as much.

It wasn't a fluke or a coincidence that energy demand growth was restrained in China. This was conscious policy established by Deng Xiaoping in 1980. And to give proper

credit, it was a group of about 100 academics working on energy research that put together a confidential report that said the following: China's energy crisis is not a shortage of energy, but rather an energy policy crisis.

They told Deng Xiaoping his policy was wrong. At that time, it was decided that energy would grow half as fast as GDP. The goal was to double energy growth in 20 years while GDP increased by a factor of four. In fact GDP increased more than a factor of four and energy did less than double.

Some people think that China is profligate in its energy use and becoming more so. The reality is the per capita energy use is only $\frac{1}{8}$ U.S. and $\frac{1}{4}$ EU.

Myth – China will soon overtake the United States as the largest contributor to energy related CO₂ concentration in the

atmosphere. That is to say China is destroying the atmosphere. The reality by any measure of contribution to atmospheric CO₂ is that the Chinese have done far less harm than the United States.

Now I will acknowledge that in the last five years China's emissions of CO₂ have increased dramatically. China's emissions are now at the U.S. level. However per capita emissions in China are much lower than those of the U.S.

Myth – China is doing little to reduce its growth of CO₂ emissions. The reality is China has a target to reduce energy intensity by 20 percent in five years. They're very likely to achieve at least $\frac{2}{3}$ of that goal which would reduce CO₂ emissions by 1.0 billion metric tons in five years.

Next myth – China is inefficient in its use of energy and continues to be inefficient. Energy demand in China has rapidly grown, not because of increasing inefficiency, but because of the demand for industrial output. China now manufactures 50 percent of the cement in the world. But the efficiency of cement production in China has been increasing at several percent per year.

Here are some of my observations on working with China on energy efficiency. There has been high-level government support for energy efficiency in China since 1980, with the exception of the years 2000 – 2005. In China, people are interested in energy efficiency and are willing to do things about it. I can't say that's been true in the United States at governmental levels.

And to conclude, in China, scientific analysis leads to high receptivity for advice on policy. If you're a scientist and you have analysis, the leaders will listen. The well-being of the country for many people in government and at research institutions is still more important than individual satisfaction."

To listen the entire presentation, please visit http://www.fas.org/press/events/2008sept_publicserviceaward.html. FAS

About the Public Service Award

Since 1971, the Federation of American Scientists (FAS) has recognized an outstanding statesman or public interest advocate who has made a distinctive contribution to public policy at the intersection of science and national security. Past recipients include Senator Edward M. Kennedy, Richard Garwin, Carl Sagan, and Phillip Morrison.

- 1971 Richard L. Garwin
- 1972 Matthew S. Meselson
- 1973 Wolfgang K.H. Panofsky
- 1975 Bernard T. Feld
- 1976 Hans A. Bethe
- 1977 Bruce N Ames
- 1978 William A. Shurcliff
- 1979 John P. Holdren
- 1980 Jerome B. Weisner
- 1981 Philip Morrison
- 1982 Randall Forsberg
- 1983 Edward M. Kennedy
- 1984 Ruth Adams
- 1985 Carl Sagan
- 1986 Charles B. Archambeau
Jack F. Evernden
Lynn R. Sykes
- 1987 Thomas B. Cochran
- 1988 Hugh E. Dewitt
- 1989 Frank von Hippel
- 1990 John H. Gibbons
- 1991 John E. Pike
- 1992 Herbert F. York
- 1993 George Soros
- 1994 Jeremy J. Stone
- 1995 Lester R. Brown
- 1996 Sally Lillienthal
- 1997 Richard L. Garwin
- 1998 Morton H. Halperin
- 2007 Edward J. Markey
- 2008 Mark Levine

United States and China: How to Green the Economy and Clear the Skies

By Monica Amarelo

FAS event on U.S. and China energy efficiency held on 25 September 2008 in San Francisco

No topic has risen more quickly in recent years than procuring green energy alternatives to help combat climate change. How can China and the United States work together to stop global climate change? What can the new U.S. president do to help China become more energy efficient? On 25 September 2008, the Federation of American Scientists hosted a panel discussion on this topic at the University of California, Berkeley.

The participants included 2008 FAS Public Service Award recipient Mark Levine, Jiang Lin of the Energy Foundation, David Fridley of Lawrence Berkeley National Laboratory, Tom Gold of the University of California at Berkeley, Robert Collier of the San Francisco Chronicle, and Professor He Jianhuan of Tsinghua University and the director of the Low Energy Carbon Center in Tsinghua, China.

What United States policies will have the greatest impact in helping China go green?

Several international studies show that China has surged past the U.S. to become the world's largest source of greenhouse gas emissions. According to a recent study by scientists at Lawrence Berkeley National Laboratory, China accounted for 55 percent of the total increase in the world's greenhouse gas emissions between 2000 and 2006.

The environmental and political consequences of China's tremendous growth are profound. If China does not succeed in greening its economy and cleaning its skies, negotiations for a new climate change

treaty will have little chance of success. A solution to the problem of greenhouse gas emissions depends on both China and the U.S. and it is essential that the two countries do this cooperatively.

To watch the panel discussion "What policies should the next U.S. president adopt to help China save energy and reduce greenhouse gas emissions?" please visit http://www.fas.org/press/events/2008sept_publicserviceaward.html.

FAS



China's Energy Policies and their Environmental Impacts

Excerpts of testimony by Mark D. Levine before the U.S.-China Economic and Security Review Commission

I wish to thank the Commission for giving me the opportunity to participate in this hearing. I consider the topic, "China's Energy Policies and their Environmental Impacts," to be one of great importance. I believe there are misunderstandings in both China and the United States surrounding this topic that cause both countries to miss opportunities for fruitful collaboration. Perhaps the greatest of these misunderstandings is the failure to recognize that China has in the past (1980-2000) and is again putting tremendous effort into reducing growth of energy-related CO₂ emissions through the design and implementation of aggressive and innovative energy efficiency policies.

I wish to stress two points: The first is that China and the United States, accounting for nearly 40% of current global energy-related CO₂ emissions and having the largest potential to reduce emissions growth, need to work cooperatively to establish a global regime in which these emissions are contained. The second is the need for assistance from outside for China to successfully limit these emissions. I suggest that China, without assistance in reducing greenhouse gas emissions, could triple or even quadruple emissions over the next 20 to 25 years. With serious assistance from industrialized countries, especially the United States, the increase in emissions could be cut in half. The second outcome makes it possible to conceive of a future in which the worst effects of global climate change are averted; in the first case, such a future is difficult to imagine.

I have three major recommendations for the United States government:

1. The United States and China should engage in formal and regular discussions of ways of working together to reduce greenhouse gas emissions, with the goal of influencing

global negotiations, a serious proposal that both the United States and China agree to is likely to be acceptable to both industrialized and developing countries.

2. In the near term, the greatest support that the United States can provide to China (and other developing countries) is to build capacity in those countries to create and implement policies and programs that reduce greenhouse gas emissions. The United States should play a leadership role, creating a program at the level of \$500 million per year (~\$200 million of which is for China). The United States should strongly encourage other industrialized nations to fund such programs as well.
3. In the long term, the solution to climate change will have to rely on technology that is not yet commercialized. The United States government should play a key role in establishing a basis for performing R&D on these technologies with other nations (including China) and the sharing of intellectual property of these future technologies among nations of the world.

I urge the Commission to consider these ideas and recommendations seriously, in light of the statement that I provide below.

Issues

Progress toward a solution to the problem of greenhouse gas emissions depends critically on both China and the United States and that deepened bilateral cooperation would greatly increase the likelihood of finding an effective way to move forward. China and the United States produce approximately equal levels of energy-related CO₂ emissions and together account for almost 40% of such emissions worldwide. China is projected to account for 40% to 50% of new energy-related

CO₂ emissions globally between the present and 2030, thus being by far the largest future contributor to increased concentrations of CO₂ in the atmosphere. The United States, meanwhile, has the greatest potential of any country in the world to reduce energy-related greenhouse gas emissions, for two reasons: first, because the U.S. per-capita intensity of these emissions is considerably higher than those of other large industrial countries (e.g., 2.5 times that of the European Union and 2.1 times that of Japan); and second, because the United States has the scientific, technical, and economic capability of developing viable alternatives to fossil energy technologies and is likely to be the world leader in any breakthrough technology if one is developed.

It is not enough that China and the United States both take steps to reduce CO₂ emissions. *It is essential that the two countries do this cooperatively.* As long as China does little to reduce growth of greenhouse gas emissions or appears to be doing little, it will be politically difficult for the United States to sign a binding international treaty that commits to a serious cap on emissions. And as long as the United States either does little or appears to be doing little, it's impossible to imagine China committing to any international treaty that limits its own emissions. This is a vicious circle in which neither country will act boldly unless the other acts first, and neither appears willing to act first.

The point here is the one I emphasize throughout this statement: If we succeed in working cooperatively with China to reduce CO₂ emissions, the world stands a far greater chance of reducing the threat of global climate change. If we do not, it's difficult to see how China will do it all alone. This is a choice that two great nations – who contribute by far the largest CO₂ emissions to the atmosphere – have to make.”

FAS

FAS Recognizes Professor of Geophysics and Astronomy with 2008 Hans Bethe Award

By Monica Amarelo

The Federation of American Scientists has chosen Raymond Jeanloz, a professor of geophysics and astronomy at the University of California at Berkeley, as the recipient of the 2008 Hans Bethe Award for "his demonstration of the reliability of the U.S. nuclear stockpile in the presence of a moratorium on nuclear testing."

"His conclusion that the U.S. stockpile will be stable for periods of at least 60 years took the wind out of the sails of advocates for new nuclear weapons."

In addition to his primary scientific work on the behavior of matter at high temperatures and pressures and its application to planetary interiors, Jeanloz applies his expertise to vital questions of national security as the chair of the National Academy of Science's Committee on International Security and Arms Control (CISAC). Under his leadership, CISAC published several studies and analyses of major security issues such as nuclear weapons policy, the management of weapons-useable material, and on the future of U.S. nuclear forces (<http://www.nas.edu/cisac>).

At the conclusion of his review of the National Nuclear Security Administration's Stockpile Stewardship Program, Jeanloz

proclaimed it an amazing success and confirmed the ability of the United States to sustain its nuclear weapons stockpile.

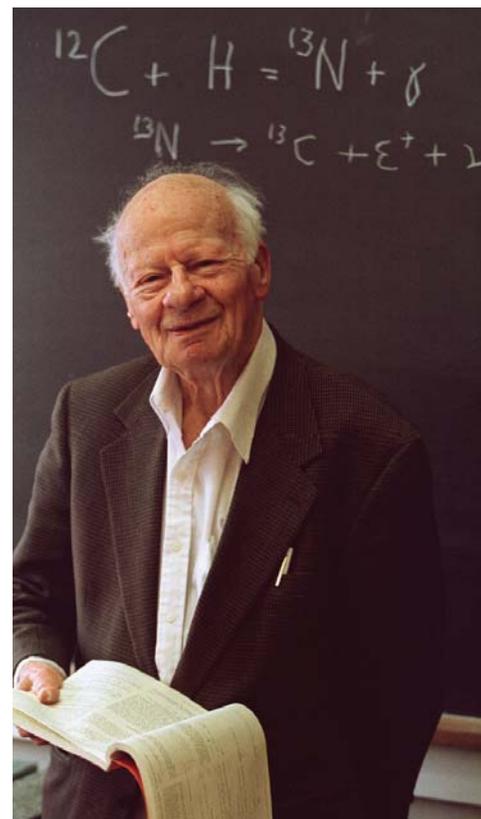
"Raymond Jeanloz's investigation into the effects of aging of materials, components, and systems within the U.S. nuclear arsenal found that the materials that make up the nuclear core are far more stable and predictable than anyone would have anticipated," said Ivan Oelrich, vice president of the strategic security program at the Federation of American Scientists. "His conclusion that the U.S. stockpile will be stable for periods of at least 60 years took the wind out of the sails of advocates for new nuclear weapons."

Jeanloz's analysis demonstrated the resilience of the U.S. nuclear weapons establishment provides an opportunity for an extensive examination of post-Cold War nuclear weapons policy and its role in the 21st century.

"The world's only superpower would send a negative signal to the non-nuclear states if it felt the need to develop new types of nuclear weapons," wrote Raymond Jeanloz in the March 2003 edition of *Arms Control Today*.

Throughout the 1990s, Jeanloz advised the U.S. Department of Energy, adding a responsible voice to the National Nuclear Security Administration Advisory Committee. He is also the 1988 recipient of a fellowship, often called a "genius award," from the John D. and Catherine T. MacArthur Foundation.

As a Berkeley professor, Jeanloz has served on committees and panels including the National Security Panel and Nonproliferation, Arms Control and International Security Advisory Committee



Hans A. Bethe

of the Lawrence Livermore National Laboratory. He has also served on National Academy studies, including the Committee on Technical Issues Related to Ratification of the Comprehensive Test Ban Treaty and the Committee on Effects of a Nuclear Earth-Penetrator Weapon. In 1979, he received his Ph.D. from the California Institute of Technology then joined the faculty of Harvard University before moving to Berkeley.

The 2008 FAS Hans Bethe Award was presented on Friday, 26 September 2008, at the FAS Symposium "Paths to Zero" at the Commonwealth Club in San Francisco. Video is online at http://www.fas.org/press/events/2008sept_hansbetheaward.html. **FAS**

Acceptance Speech by Raymond Jeanloz

26 September 2008 at the Commonwealth Club in San Francisco, CA

Thank you. It was a complete surprise learning of the award, and it is an overwhelming honor to have one's name associated with that of Hans Bethe. Consummate citizen-scientist, a leader of the Manhattan Project that built the first atomic bombs during a time of war, he was the one to explain to the world how nuclear fusion makes the Sun shine, and makes life possible. Fusion also powers thermonuclear weapons – the hydrogen bomb – and may someday provide vast amounts of energy to sustain our civilization.

Why should the average person care about nuclear weapons and non-proliferation? After all, we seem to have more immediate problems, whether the current economic instabilities or the scourge of terrorism that can affect any nation at any time.

Hiroshima there were thirty-three modern fire stations; twenty-seven were made useless by the bombing. Three-quarters of the fire-fighting personnel were killed or severely injured. At the same instant, hundreds, perhaps thousands, of fires broke out in the wrecked area. How could these fires be brought under control? There were some quarter of a million people injured in a single minute. The medical officer in charge of the public health organization was buried under his house. His assistant was killed, and so was *his* assistant... The power substation which served the center of the city was destroyed... Every hospital but one in the city was badly damaged; not one was able to shelter its patients from the rain – even if its shell of concrete still stood without roof, partitions, or case-

than one million times that of TNT: the effect so intense in the devastated area as to demolish the infrastructure on which survival – let alone civilization – depends.

Think about modern society in comparison with former times, especially a war-hardened society. Our great advances and efficiencies depend on massive interdependencies in jobs and capabilities. We as individuals do not have to grow our own food, create our own shelter or clothing, and find drinkable water every day for ourselves and our families. Most of us cannot repair our appliances or our vehicles; we're not supposed to – they are more advanced than that. Loss of electric power can be more than an inconvenience, if extended enough: heat may not be available because the control systems are electrical, and water may be inaccessible because pumps don't work.

In short, we are no longer self-sufficient, but live in a highly integrated web of occupations that provide for enormous capabilities and efficiencies. The result is an incredibly advanced society, yet one that can also be profoundly fragile. And we understand this fragility from a different perspective, because we *do* prepare for devastation that comes from natural causes. We evacuate populations as hurricanes approach or as firestorms threaten a community, and we have seen the consequences of poorly managing those efforts. Here in the San Francisco Bay Area, we prepare ourselves as best as possible against the threat of earthquakes, with emergency kits and special engineering of buildings and structures.

One nuclear detonation in an urban area can have the impact of the worst of these disasters, or more, with hundreds of thousands killed or gravely injured in an instant. But the key difference is that this would be a

“We have many reminders that focusing on the crises of the moment, and ignoring long-standing problems can bring on unexpectedly large catastrophes in the future; and the future seems inevitably to come upon us more quickly than we can imagine.”

Events far worse than those of September 11, 2001 are possible, however. Let me quote the words of Philip Morrison, along with Hans Bethe a founder of the Federation of American Scientists. Also part of the Manhattan Project, he was among the first U.S. scientists to visit Hiroshima after the bombing, and observed:¹

“The atomic bomb is pre-eminently the weapon of saturation. It destroys so large an area so completely and so suddenly that the defense is overwhelmed. In

ments. There were whole sections of the outer city undamaged, but the people there were unable to give effective aid....”

The point is not to judge the past – it was a time of terrible, *total* war – but of reminding ourselves of the devastation caused by one nuclear weapon. A small one by modern standards, and of a design that could readily be constructed by terrorists or stockpiled by a failing state, should they get their hands on the necessary materials. Yet the power of a nuclear explosion can be more

human-induced catastrophe, with perhaps hundredfold the casualties of 9/11, and with local collapse of society's infrastructure. The horror of immediate deaths and injuries is compounded by the fate of those who survive the event, but then succumb due to loss of that infrastructure – whether shelter, medical care or potable water.

No one can know whether such a calamity will happen soon, or ever. But we do know that the possibility of a nuclear detonation exists, and in some terrible sense grows more likely with time. This is because the knowledge and materials of nuclear technologies are relentlessly spreading around the globe. In particular, the world at large is embracing nuclear power, and with good reason because energy is needed for growing economies. Especially for those nations lacking natural resources, nuclear energy provides an important avenue for growth. And concerns of global climate change are also motivating demand for nuclear power. So, in addition to the normal diffusion of scientific knowledge, much accelerated these days by the Internet, the drive for energy and resource security is distinctly hastening the spread of nuclear technology.

There is no intent here to equate nuclear energy and nuclear weapons, but the fact is that there are important technical overlaps between these domains. With time, relevant knowledge, materials and people are spreading worldwide, and increasing numbers of countries inevitably become latent nuclear-weapons states. That is, even if they have no desire for nuclear weapons at the present time, latent states have the technical capability to develop a nuclear arsenal in the future, should they feel the need to do so.

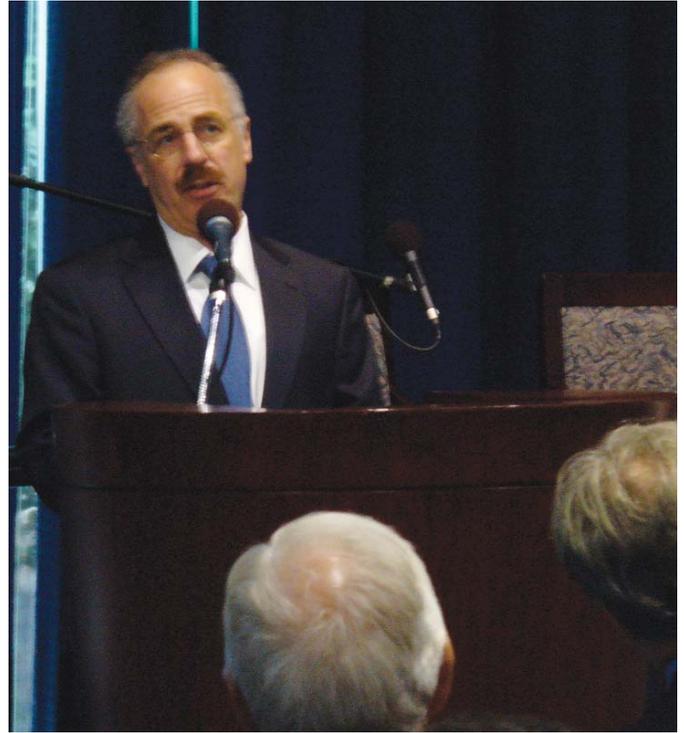
And, with more than 30,000 weapons' worth of nuclear explosive material – highly enriched uranium and weapons-grade plutonium – available around the world in *civilian stockpiles* alone, there is significant reason for concern about control of materials.

There is over 100,000 weapons' worth of material when military stockpiles are also taken into account. Even if protected with 99.99 percent perfection, the corresponding loss of a few weapons' worth of material could have a catastrophic impact. For a single nuclear detonation, whether caused by terrorists or a nation's military actions, would not only devastate the target but would also shatter the 60-year – more than 2 generation-long – taboo against the use of nuclear weapons.

The world would instantly be changed, with consequences that are hard for us to imagine.

Given the pressing urgencies of everyday events, it is all too easy to look the other way and ignore the real, long-term dangers potentially associated with these technologies. Yet nuclear technologies are also necessary, and at present inevitable, in a world of growing economies with concerns about greenhouse-gas emissions. Recent events show that our society runs grave risks if we look only to the near term, planning only to respond to today's polls or to maximize profits in the next financial quarter. We have many reminders that focusing on the crises of the moment, and ignoring long-standing problems can bring on unexpectedly large catastrophes in the future; and the future seems inevitably to come upon us more quickly than we can imagine.

My intent here has been to remind us why these issues of nuclear weapons and nonproliferation need broader public discussion. It is time for the U.S. to become more of a leader: we need to develop a clearer idea of the role of nuclear weapons in the post Cold-War, post-9/11 era, and be viewed



Raymond Jeanloz accepting award.

as leading the global efforts against nuclear proliferation and the potential of nuclear terrorism.

In these matters, the vision of a world free of nuclear weapons described by George Shultz, Bill Perry, Henry Kissinger and Sam Nunn is the most powerful call to action in recent times. It is motivated by the recognition that we do not live in a world with a balance of power between two deterring arsenals. Instead, the presence of multiple arsenals is almost an invitation for mistakes or misunderstandings. And even we in the U.S. have seen dangerous mishandling of our own nuclear weapons. Compounded with the emergence of well-funded and technologically sophisticated terrorism, the potential for catastrophic events can no longer be overlooked.

It is not clear when or under what circumstances the world might ever be rid of nuclear weapons, but the most important reason for the vision is to motivate *all* of us

See Jeanloz, p. 16

FAS Hans A. Bethe Award

Hans A. Bethe co-founded the Federation of Atomic Scientists, now the Federation of American Scientists (FAS), with the belief that scientists had an obligation to participate in the difficult choices that were forced on the U.S. by the extraordinary advances in nuclear physics demonstrated by the development and use of atomic weapons. The FAS Hans Bethe Award is presented annually to an outstanding individual for science in service to a more secure world.

In more than sixty years since the founding of FAS, the range and complexity of issues hinging on sound scientific advice has increased.

In 2003, Hans Bethe presented the award to Philip Morrison for his unflinching

ethical compass to America's most critical decisions.

In 2005, the award went to Steve Fetter in recognition of his outstanding contributions as an advocate for arms control and nonproliferation and for his rigorous analysis of nuclear energy climate change and a carbon-free energy supply.

In 2007, Matt Bunn was recognized for his work to understand and promote the global control of dangerous nuclear materials and to stop the spread of nuclear weapons.

This year the Hans A. Bethe Award goes to Raymond Jeanloz for his demonstration of the reliability of the U.S. nuclear stockpile in the presence of a moratorium on nuclear testing.



Hans Bethe meets President John F. Kennedy.

Jeanloz, from p. 15

to devise specific, constructive steps that could be taken in that direction. Today's Panel Discussion is a case in point, and I would like to move quickly toward starting that discussion.

In closing, I should emphasize that I could never have worked alone on issues of nuclear weapons and non-proliferation. Essential technical research is performed by hundreds of scientists and engineers at the national laboratories. Their value to the nation and to the world at large is in informing policy through high-quality technical understanding, unbiased by politics. It is my good fortune if I have been in a position to help communicate their findings. Without their technically outstanding efforts – working quietly behind the scenes – there would have been nothing to communicate.

And, of course, nothing is possible without one's immediate family. In fact, they provide the motivation for caring so much about these issues. But, I have also been privileged to work with many dedicated and highly talented colleagues, from top-quality researchers in universities to amazingly conscientious individuals in Washington, DC and elsewhere: numerous members of government agencies; members and staff of Congress; active and retired military officers; colleagues at the National Academy of Sciences, where we use the network of scientific communication to pursue discussions among security experts around the world.

It is urgent that we in the United States focus on the most effective means of countering nuclear proliferation, and this calls especially for cooperative measures. Partnering with nations around the world offers the most promising means of addressing the growing threat of nuclear arms." **FAS**

¹ "If the Bomb Gets Out of Hand" in *One World or None: A Report to the Public on the Full Meaning of the Atomic Bomb*, edited by Dexter Masters and Katharine Way, New Press, New York, NY, 240 pp., reprinted in 2007.

The Path to Zero - U.S. Nuclear Policy for the 21st Century

By Monica Amarelo

FAS event on moving towards a world free of nuclear weapons held on 26 September 2008 at the Commonwealth Club in San Francisco

Despite the financial meltdown and impending energy crisis, the most important issues the next president of the United States will face are in the areas of nuclear security, nuclear terrorism, and nonproliferation and arms control. What will U.S. nuclear policy look like for the 21st century?

On 26 September 2008, FAS hosted a discussion on this issue and nuclear energy with a distinguished panel that included 2008 Hans Bethe Award recipient Raymond Jeanloz, former Secretary of State and fellow at the Hoover Institution George Shultz, Joseph Cirincione of the Ploughshares Fund, Harold Palmer Smith, Jr. of the University of California at Berkeley, Gloria Duffy of the Commonwealth Club, and FAS Vice President of Strategic Security Ivan Oelrich.

The United States must lead the way to reduce nuclear weapons worldwide. While support in the U.S. grows for major reductions in nuclear weapons, there is a continuing danger of the proliferation of nuclear weapons to more countries. The future of the world's nuclear security is uncertain.

As George Shultz said, "There's one real threat to the national security of the United States, and it's a nuclear weapon — however it's delivered by a ballistic missile or cruise missile or in a suitcase, it will be devastating."

Steps toward a Nuclear Free World

The new president must put people first, according to Shultz. He recommends that

President Barack Obama focus on personnel, staffing his administration with the best and the brightest people. That should be the priority.

Shultz went on to explain that if the nuclear initiative becomes a true global enterprise, it could have a transforming effect on the world. If world leaders are able to tackle this important issue and change policy, then all of a sudden a problem like climate change won't seem as daunting to overcome.

Joseph Cirincione of the Ploughshares Fund believes the new U.S. president must first deal with the nuclear programs in Iran and North Korea. The president must also work to renew the Strategic Arms Reduction Treaty (START) or risk losing the ability to

verify Russian nuclear weapons and their disposal. While working to extend START, a process should be developed to make significant reductions in U.S. and Russian arsenals.

"The START agreement is going to expire in December of 2009," said Shultz. "If that doesn't get renewed it's a catastrophe."

According to Cirincione, there are three categories of nuclear issues the president will confront.

"There's the 'must-do' list, driven by external events beyond the president's control. Iran will be one of those. The collapse of the nuclear deal with North Korea will be one of those. Then there's the 'will do' list.

See *Path to Zero*, p. 18



Former Secretary of State George Shultz and Gloria Duffy of the Commonwealth Club in San Francisco, CA.



From left to right: Ivan Oelrich, George Shultz, Gloria Duffy, and Raymond Jeanloz.

Path to Zero, from p. 17

Start a process for the comprehensive test ban treaty. Start a process of reductions with the Russians. And finally there's the 'should do' list. Things the president will have to do in order to have a comprehensive policy," said Cirincione.

Comprehensive Test Ban Treaty

Ivan Oelrich, vice president of the FAS Strategic Security Program, stated that, "the ratification of the Comprehensive Test Ban Treaty will be the biggest single thing that we can do early on in the next administration."

Throughout the ratification process of the Comprehensive Nuclear Test Ban Treaty (CTBT), the United States has questioned the verification process. Raymond Jeanloz reported that the international organization charged with the verification of the treaty is now making the monitoring system a reality.

"The system has been successfully used

to analyze the North Korean test. And so in fact it has been tested by a real event. But another way it's been tested is with the hundreds of academic instruments, seismometers and tsunami observations and the like, that complement the international treaty monitoring system," said Jeanloz. "If something happens that isn't picked up by the international system and is picked up by the researcher working late at night, we'll know about that. And vice versa. If the international monitoring system comes up with a fallacious and invalid result, it will be corrected."

Shultz added, "There is in a sense a feeling that the Comprehensive Test Ban Treaty is a test. If we can't ratify that then where are we?"

In addition to verification, the other essential part of the CTBT is the certification of the nuclear stockpile.

"I think one of the things I would tell a president to do right away is to fund science adequately. If we don't have a stream of talented scientists coming into our labs, they're

not going to be able to do that job," said Shultz. "They're laying people off at the labs. That's not the atmosphere in which you're going to attract bright young people to come work."

U.S. – India Nuclear Deal and the Nonproliferation Treaty (NPT)

"I am strongly opposed to the deal that the Bush administration made with India, which overturns almost 40 years of restrictions," said Joseph Cirincione. "We banned the export of nuclear technology to countries that had not signed up to the Nuclear Nonproliferation Treaty and were not part of global efforts to reduce and restrict nuclear weapons. We're now saying to India, you can keep your nuclear weapons, you don't have to sign the treaty, and we will still sell you nuclear materials and will encourage others to as well."

Cirincione thinks the deal is a body blow to the nuclear nonproliferation regime.

Oelrich agrees that this path is fraught with peril and the United States will come to regret in the long term.

"There's a synthesis coming out of this India deal that could lead to a very hopeful conclusion, namely a new and better, more up-to-date, enforceable, verifiable Nonproliferation Treaty," said Harold Palmer Smith, Jr.

The acknowledged five countries with nuclear weapons have not lived up to the Nonproliferation Treaty. Smith thinks it is time to rewrite the NPT to include all nuclear weapon states and a date to bring nuclear arsenals down to specific levels, as opposed to the more vague conditions of the present treaty.

Internationalization of the Nuclear Fuel Cycle

Concerns about climate change and energy prices are driving a resurgence of

interest in nuclear power. There is an overlap with nuclear power technology — whether it's enriching uranium or extracting plutonium from used reactor fuel. These processes can be used to nuclear weapons.

"Science can contribute a great deal in the analysis of the international fuel cycle. I don't know if we'll have a nuclear renaissance but clearly there's going to be a continuation of expansion of nuclear power," said Oelrich. "We have to have a real, practical scheme for providing people with the benefits of nuclear power, although those are themselves controversial, without the risks of nuclear weapons."

Shultz agreed. "Everyone can see the potential importance of nuclear power plants. But if we don't get control of the nuclear fuel cycle in some effective way, we're asking for trouble."

There are two parts to the international fuel cycle, enrichment and disposal. The first part, the enrichment, involves the creation of nuclear materials, the enriched uranium or in the case of reprocessing, of plutonium. The international community also has grave concerns about stably handling nuclear waste. Though there are a number of technical options, there are no easy solutions.

"It's essential if there's going to be a sustainable, stable situation in the future, that it be one that everyone essentially buys into. The United States, the then president of Russia, also the head of the International Atomic Energy Agency, each have very sincerely proposed various ideas, concepts for an internationalized fuel cycle," said Jeanloz. "There's not yet a consensus that has emerged and more than that very few have even asked the client nations, what they think."

Global Nuclear Energy Partnership

The United States government has introduced the Global Nuclear Energy

Partnership (GNEP), which involves a proposal to separate plutonium from used spent fuel. According to Oelrich, while this may one day be a good idea, economically it doesn't work right now. The world reserves of cheap uranium, where cheap is defined as cheaper than getting the plutonium out of the used fuel, will last through 2070 at the very minimum.

"These schemes only make sense if we have fast neutron reactors that can burn the plutonium. And we don't have any of those that are currently available commercially," said Oelrich. "The American proposal is to burn up plutonium in breeder reactors. Most people who look forward to nuclear power in

the year 2100 imagine that we will have a plutonium-based economy. So the last thing we should do is burn that seed fuel today so that in the year 2100 when we want these breeder reactors we won't have any plutonium to fuel them."

These are complex problems and major issues in the expansion of nuclear power. The decision-making in terms of the civilian nuclear power industry is more diffuse than the decision-making on nuclear weapons. To watch the entire discussion, co-sponsored by the Federation of American Scientists and the Commonwealth Club, please visit http://www.fas.org/press/events/2008sept_hansbetheaward.html. **FAS**



James C. Warf, Manhattan Project Chemist, Author, Activist

By Steven Aftergood

Prof. James C. Warf, a veteran of the Manhattan Project and an early member of the Federation of American Scientists, died last November 7 at age 91.



James C. Warf in 1988. Photo courtesy of the Warf family.

During World War II, he led the analytical chemistry section of the Manhattan Project. He held multiple patents on the separation of plutonium from high-level nuclear waste.

"This was a matter of some regret to him because the technology was then used to proliferate nuclear weapons worldwide," Daniel Hirsch of the Committee to Bridge the Gap told the Los Angeles Times (Nov. 9, 2008). "He spent much of his life trying to reduce the risks that erupted when the genie was let out of the bottle."

Dr. Warf taught chemistry at the University of Southern California for forty years, specializing in rare earth metals. He

also taught for ten years in Indonesia and Brunei and, his son recalled, he wrote the first textbooks on organic and inorganic chemistry in the Indonesian language. He was a skilled amateur vintner and happily gave away samples of his product.

Dr. Warf also gave generously of his time and expertise to public interest groups concerned with controlling nuclear weapons and

nuclear reactor safety. He authored an intelligent layman's guide to the subject, entitled "All Things Nuclear."

Over the course of 40 years, he made audio recordings of chemistry textbooks for Reading for the Blind and Dyslexic. His family suggested that contributions in his name be made to that organization at www.rfbd.org.

FAS



Congress Launches the First National Research Program Focused on Technology and Learning

By Monica Amarelo

Congress has authorized a major new research center, the National Center for Research in Advanced Information and Digital Technologies, that will bring the same focused, sustained research funding to technology and learning that the federal government has funded for years in technology for health care at the National Institutes of Health and technology for energy at the Department of Energy.

"This new National Center will help move schools, universities, and training facilities nationwide into the 21st century," said Senator Chris Dodd of Connecticut, one of the proposal's original sponsors. "America's reputation as an international leader rests in the hands of our youth, and it should be among our top priorities to provide our students with the tools they need to maintain and build upon this standing. The National Center will help future American workers compete in the global marketplace."

"The National Center couldn't come at a more critical time," said Congressman John Yarmuth of Louisville, Kentucky, who spearheaded efforts to move the bill through the House. "American businesses know that they need a well-educated workforce to face growing competition from China, India, and Europe. Americans need to constantly upgrade their skills to keep pace with technology and international competition, and people who are losing their jobs often need to acquire new skills to rejoin the workforce."

Learning scientists and educators have known for years that people learn faster if education can be personalized, and if students are motivated by seeing how their knowledge can help them solve problems they, and their future employers, actually care about. These new technologies can

help deliver on this promise. Students in today's schools were born into a digital world -- able to gather information, communicate and collaborate using the constantly expanding tools of the internet and the computers, wireless devices, game devices also attached to it.

"This initiative is built on historical precedents. Once each century, during a time of national crisis, our country has made a transformative investment in education -- the Northwest Ordinance brought public education in the 18th century; the Land Grant Colleges Act brought public higher education in the 19th century; and the GI Bill of the 20th century. Creating the National Center will bring learning and skills training into the 21st century," said the co-chairs of the Digital Promise Project, former president of PBS and NBC News Lawrence K. Grossman,

former chairman of the FCC and PBS Newton N. Minow, and former American Arts Alliance president Anne G. Murphy.

This new National Center will do research that is essential for the United States in this digital age. The creativity that developed extraordinary new information technologies has not focused on finding ways to make learning more compelling, more personal, and more productive in our nation's schools. People assumed that the explosion of innovation in information tools in business and service industries would automatically move into classrooms.

The National Center is unique not only in its mission but in the way it will be managed. This will not be another government bureaucracy but a not-for-profit organization with

See *Research Program*, p. 22



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- | | |
|--|------------|
| <input type="checkbox"/> Regular Member | \$ 50.00 |
| <input type="checkbox"/> Premier Member | \$ 250.00 |
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Research Program, from p. 21

an independent Board that will include educators, scientists, people from business, and professionals familiar with managing research that has transformed the way businesses use information technology.

“For the first time education research will benefit from the kinds of creative research management that has been so effective in driving innovation in other parts of the economy. It will be able to focus research talent across the nation – in many fields and many institutions on one of the nation’s most pressing problems,” said Henry Kelly, president of the Federation of American Scientists.

Initial funding will come from the Department of Education but the National Center will be able to take funds from other agencies – including the Departments of Defense and Homeland Security that have an enormous interest in education and training. It will also be able to receive funds from companies and other private donors interested in supporting research that can benefit the nation as a whole. It will be a unique public private partnership. The goal is to keep the National Center’s staff small so that the bulk of the funds will go to researchers nationwide capable of focusing the best of emerging technologies on what surely is one of the nation’s most pressing challenges.

The National Center is part of the reauthorization of the Higher Education Act, approved by Congress on July 31, 2008, and signed into law by President Bush on August 14, 2008. The National Center will be organized as a Congressionally originated 501(c)(3) nonprofit corporation located within the Department of Education. Supporters are seeking a \$50 million appropriation for the National Center for FY 2009.

To learn more about the National Center, please visit <http://www.fas.org/press/faq/nationalcenter.html>.

FAS

Membership: Help FAS Make the World a More Secure Place

By Jeff Aron

Entering our 64th year, the Federation of American Scientists continues to pursue the best use of science and technology for the benefit of mankind.

In the next three years, the Strategic Arms Reduction Treaty (START) with its critically important verification procedures will expire, the Non-Proliferation Treaty (NPT) will come up for international review, and the Comprehensive Test Ban Treaty (CTBT) may be resubmitted to the United States Senate for ratification. All of this will occur in a new political environment that includes an ever growing momentum for working toward the global abolition of nuclear weapons. At no time since the end of the Cold War has there been a greater need for

the sound scientific, technical, and policy analysis provided by FAS.

The Learning Technologies Program continues to advance the goals of learning and professional training. FAS advances education from the archaic methods of the past to take advantage of the techniques and technologies of the 21st century. The progress in commercial video game technology will create a humanities and a science focused learning experience for middle and high school students. Ongoing research is conducted into the benefits of computer games and online environments, such as virtual worlds, as tools for learning and training.

The Building Technologies Program uses innovative building design and construction to improve quality, affordability, energy efficiency and hazard protection while lowering construction and operating costs. Since its inception, the Building Technologies project has combined the talents of renowned architects and engineers along with the nation's

leading energy experts to embark upon housing issues in U.S. and abroad.

In the normal sense it is difficult to quantify or benchmark FAS's impact on the reduction of nuclear weapons in the arsenals of the world – but we can show we've made a difference. We can provide metrics about the number of schools, children and scholars that are using our research. With regard to building technologies, FAS is collaborating with groups to revise codes and standards. Our demonstration houses stand as a testament that the FAS way is the right way to build.

The question then is: If you *do* believe that *your* support of FAS makes the world a better place, then please contribute and renew your membership. If you wish, you can designate your gift go to the project of your choice.

Visit us online at: http://www.fas.org/member/member_contribute.html. **FAS**

Call for Articles

Attention FAS Members

In our continuing effort to provide the FAS community with timely articles about national security policy, learning technologies and other areas of science and technology policy, we are inviting members to submit proposals for articles (maximum of 1,500 words). Selection of articles is at the discretion of the editor and completed articles will be peer-reviewed.

Proposals should be sent to:

Editor, PIR
Federation of American Scientists
1725 DeSales Street, NW
Washington, DC 20036
Or email press@fas.org.



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