

Bulletin of the Atomic Scientists

IT IS 6 MINUTES TO MIDNIGHT

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We are poised to bend the arc of history toward a world free of nuclear weapons. For the first time since atomic bombs were dropped in 1945, leaders of nuclear weapons states are cooperating to vastly reduce their arsenals and secure all nuclear bomb-making material. And for the first time ever, industrialized and developing countries alike are pledging to limit climate-changing gas emissions that could render our planet nearly uninhabitable.

These unprecedented steps are signs of a growing political will to tackle the two gravest threats to civilization—the terror of nuclear weapons and runaway climate change. This hopeful state of world affairs leads the boards of the Bulletin of the Atomic Scientists—which include 19 Nobel laureates—to move the minute hand of the Doomsday Clock back from five to six minutes to midnight. By shifting the hand back from midnight by only one additional minute, we emphasize how much needs to be accomplished, while at the same time recognizing signs of collaboration among the United States, Russia, the European Union, India, China, Brazil, and others on nuclear security and on climate stabilization.

Beginning with the joint letter of Presidents Barack Obama and Dmitri Medvedev of April 1, 2009, a growing partnership between the United States and Russia is resulting in nuclear arms negotiations that could bring down our deployed strategic warheads from more than 2,000 to about 1,500 warheads each. To put this in perspective, just a little more than a year ago, tensions over actions on Russia's borders—sparring over Georgia and U.S. missile defense systems in Eastern Europe—threatened to push each country into hostile corners. Instead, this bilateral relationship—perhaps the most important for nuclear disarmament—is on the mend.

On issues of climate change, the foundation of a more collaborative orientation was laid in the November 17, 2009, joint agreement by China and the United States to reduce carbon emissions. Without the concerted effort of these two largest contributors to greenhouse gases, the Copenhagen Accord would have been unthinkable. These are first steps in the direction of multinational problem-solving which provides the only basis upon which societies can hope to address the threats from disruptive climate change.

A key to the new era of cooperation is a change in the U.S. government's orientation toward international affairs brought about in part by the election of Obama. With a more pragmatic,

problem-solving approach, not only has Obama initiated new arms reduction talks with Russia, he has started negotiations with Iran to close its nuclear enrichment program, and directed the U.S. government to lead a global effort to secure loose fissile material in four years. He also presided over the U.N. Security Council last September where he supported a fissile material cutoff treaty and encouraged all countries to live up to their disarmament and nonproliferation obligations under the Nuclear Nonproliferation Treaty. These actions constitute, in part, Obama's efforts to make good on his campaign promise—the first ever by a U.S. president—to work toward a world free of nuclear weapons.

Indeed, we may be at a turning point, where major powers no longer see the value of nuclear weapons for war-fighting or even for deterrence. As recent intelligence estimates have concluded, threats to security are more likely to come from groups bent on terrorizing civilians, or from economic collapse, or even from resource scarcity exacerbated by climate change, than from conflict between nuclear-armed superpowers. Against these new threats, nuclear weapons have no use.

The changing views of former government leaders in Europe, North America, and elsewhere, led since 2007 by George Schultz, Henry Kissinger, William Perry (a member of the Bulletin's Board of Sponsors) and Sam Nunn, have lent credibility to the goal of a world free of nuclear weapons. Their arguments, in the tradition of the 1996 Canberra Commission study and the 1997 U.S. National Academy report, are beginning to persuade others and have opened a wider public debate among a range of civic and religious leaders, including Evangelicals, on the role of nuclear weapons in national security.

These discussions have led to actions in other nuclear nations. Britain has offered to use its nuclear laboratories to develop new verification technologies. France has begun to reduce nuclear arsenals, and Germany is quietly discussing whether it might send back the U.S. tactical weapons currently on German soil.

At the same time that the international community seems nearly ready to consider prohibiting nuclear weapons, many countries are seeking civilian nuclear power to meet their energy needs for economic growth. The interest in base-load nuclear power comes in response, as well, to the need for energy sources that drastically reduce carbon emissions into the atmosphere—a major cause of global warming.

Along with the renewed interest, we see signs of a more robust and measured discussion about the risks of civilian nuclear power expansion. Out of these talks have come several alternatives that would reduce risks of bomb fabrication at the same time that they provide for increased energy production. Among proposed models are ones by Russia and Kazakhstan and by the European Union. While differences still remain about the optimal choice for secure nuclear energy production, each of these begins from a starting point of multinational management and oversight rather than national control. This is a singular development that we applaud.

As we see it, however, the world is not now safe for a rapid global expansion of nuclear energy. Such an expansion carries with it a high risk of misusing uranium enrichment plants and separated plutonium to create bombs. The use of nuclear devices is still a very dangerous possibility in a world where Russian and U.S. ballistic missiles are on hair trigger and long-standing conflicts between countries and among peoples too often escalate into military actions. As two of our board members have pointed out, "Nuclear war is a terrible trade for slowing the pace of climate change."

We can no longer prevent global warming—it is upon us. Rapidly melting polar icecaps, acidification of the oceans, loss of coral reefs, longer droughts, more devastating wildfires, and sea level rise that threatens island nations and seacoasts everywhere are clear signs of change in Earth's climate. Disruptions of the monsoon seasons in India and China already threaten crop yields resulting in more frequent and severe food shortages than in the recent past. Disappearing glaciers are decreasing available fresh water supplies in regions that rely on these sources for drinking and agriculture.

Scientists have been warning of changes in the atmosphere for the past 50 years, and we are now experiencing at least some of the effects they forecasted. If we continue “business as usual” our habitat could be disrupted beyond recognition, with consequences for our way of life that we cannot now foresee. Without vigorous and immediate follow-up to the Copenhagen conference and well-conceived action we are all threatened by accelerating and irreversible changes to our planet.

We can slow these adverse trends by both drastically decreasing CO₂ emissions and increasing forestation and other carbon sinks. Many of the technologies needed to reverse climate change are already known, and there are pockets of progress in industrialized and developing countries. Some already have adopted efficiency measures, invested in new technologies, and are enjoying the benefits in lower electricity costs and new jobs. Several European countries, for example, have invested in wind and solar technology development, as has China. Within the United States, localities are experimenting with tighter standards to control harmful auto and industrial emissions. Brazil is beginning to protect the remaining forests of the Amazon region by subsidizing indigenous farmers who live in and preserve the forests. To deploy these and other schemes on a global scale, however, requires determination, investment, and coordination.

At the Copenhagen meeting on climate change last month, and for the first time in the 17-year history of UN climate conferences, developing and industrialized countries all agreed to take responsibility for emissions. Industrialized countries made pledges to cut greenhouse gases and promised more financial resources than ever before to developing countries for mitigation, adaptation, and forest conservation. Developing nations will seek to restrict the growth of their emissions. Together, all governments agreed to limit global temperature rise to no more than 2 degrees C and undertook to limit the rise to 1.5 degrees C, if possible. To implement these pledges, provisions in the Copenhagen Accord require committed parties to submit their plans for emission reductions by the end of January 2010 and to report and verify pollution reductions based on publicly available guidelines.

The negotiations in Copenhagen have raised expectations that governments will begin to reduce carbon emissions through regulatory schemes, public and private investments in alternative energy sources, and promotion of energy efficiency. Joint programs to meet new emissions targets and share technological developments could set the stage for binding agreements at the 2010 meeting in Mexico, and, ultimately, for slowing the pace of climate change.

Technologies in the life sciences show promise for developing new energy sources that do not emit climate-changing gases and for creating food supplies that cannot be disrupted by climate change. Based on potential parallels with the history of nuclear energy, however, we are mindful of the risks of poorly channeled developments in synthetic biology and combinatorial genetics, either inadvertent or intentional. Many life scientists recognize the risks inherent in the dual-use technologies they invent and are establishing research protocols and regulations

to protect societies from harm. Advances in this area are very rapid, however, and deserve our continued attention.

The emerging trends in international cooperation will provide a basis for collaborative problem-solving for a safer world. But a handful of government officials, no matter how bold their vision, will not be able, on their own, to deal with the threats to civilization that we now face. Leaders and citizens around the world will need to summon the courage to overcome obstacles to nuclear security and climate protection. The most urgent actions include:

- Developing new nuclear doctrines that disavow the use of existing nuclear weapons, reduce the launch readiness of U.S. and Russian nuclear forces, and remove them from the day-to-day operations of their militaries;
- Finishing the job of consolidating and securing military and civilian nuclear material in Russia, the United States, and elsewhere and continuing to eliminate the excess;
- Completing negotiations, signing and ratifying as soon as possible the new U.S.-Russia treaty providing for reductions in deployed nuclear warheads and delivery systems;
- Upon signing of the treaty, immediately embarking upon new talks to further reduce the nuclear arsenals of Russia and the United States;
- Completing the next review of the Nuclear Nonproliferation Treaty in May 2010 with commitments to weapons reduction and nuclear nonproliferation by both the nuclear haves and have-nots;
- Implementing multinational management of the civilian nuclear energy fuel cycle with strict standards for safety, security, and nonproliferation of nuclear weapons, including eliminating reprocessing for plutonium separation;
- Strengthening the International Atomic Energy Agency's capacity to oversee nuclear materials and technology development and transfer;
- Adopting and fulfilling climate change agreements to reduce carbon dioxide emissions through tax incentives, harmonized domestic regulation and practice;
- Transforming the coal power sector of the world economy to retire older plants and to require in new plants the capture and storage of the CO₂ they produce;
- Vastly increasing public and private investments in alternatives to carbon-emitting energy sources, such as solar and wind, and in technologies for energy storage, and sharing the results worldwide.

For the first time in decades we have an opportunity to free ourselves from the terror of nuclear weapons and to slow drastic changes to our shared global environment. We encourage scientists to continue their engagement with these issues and make their analysis widely known. We urge leaders to fulfill the promise of a nuclear weapon-free world and to act now to slow the pace of climate change. Finally, we call on citizens everywhere to raise their voices and compel public action for a safer world now and for future generations.

The Clock is ticking.

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