

The American Nuclear Society's role in global climate change mitigation

BY ANDREW C. KADAK

THE AMERICAN NUCLEAR Society is a professional society whose members come from all aspects of nuclear science and technology. While energy represents a significant number of our members, we have many professionals in the fields of biology, medicine, environmental sciences, isotopes, thermal hydraulics, criticality safety, human factors, and education and training, to name but a few of our 18 professional divisions.

As a professional society, we are not a trade association or lobbyists in the traditional sense. We are advocates of our profession. In our advocacy, we can promote a proper course for our nations using the expertise and knowledge we have. Traditionally, as scientists and engineers, we have shunned that role, since we did not believe we needed to be promoters. We presumed the logically correct course would be taken in the policy or political sense. We also did not believe that we should "lower" ourselves to the common denominator of the debate.

I hope now that we realize the error of that kind of thinking. Global decisions that could affect how we live and work are being made without our voices' being heard. The question of global climate change is now being addressed on an international level, with treaties and agreements that will affect us very directly if followed through to their ultimate conclusion.

Thus, ANS's role in global climate change mitigation should not be a passive bystander role, but one that is actively engaged in shaping the future direction of fundamental energy and sustainable development policy for all nations of the world. This issue is too important to be left to our nations' policy bureaucrats.

Before I address the specifics of what the role should be, here is a status report on what has been happening relative to our efforts at curbing the emissions of CO₂ since the Ky-

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ANS members need to become actively engaged in shaping the future direction of energy and sustainable development policy worldwide.

oto conference in December 1997 and the Earth Summit in Rio de Janeiro in 1992. It was decided that the United States should reduce its CO₂ emissions to 7 percent below 1990 levels by 2010. In addition, President Clinton proposed that by the year 2000, the U.S. should be at 1990 levels of emissions. The policy chosen was to focus on voluntary energy efficiency, conservation, and renewable energy resources that are not carbon emitting.

According to a special United Nations Framework Convention on Climate Change Report by Carlos Gay, of Mexico, the United States is not doing so well.¹ As a matter of fact, despite an annual budget of more than \$1 billion per year focused on energy efficiency, conservation, and renewables, our CO₂ emissions have not decreased, but have increased from 1990 to 1996 by more than 9 percent. In the energy sector, the emissions increase has been even more dramatic, at more than 13 percent. Estimates are that by the year 2000, the United States will not have reduced emissions to 1990 levels, nor stabilized them, but increased them by 13 percent, even if all the measures proposed by the administration were to work. The latest projection by U.S. officials in their Climate Action Report 2 is that by 2010 the country's CO₂ emissions will be 26 percent above 1990 values. That is hardly a success story for the billions of dollars that are being spent. Congress is unwilling to ratify the Kyoto accords and is not willing to fund additional programs or order mandated restrictions on the use of fossil fuels. Congress is even unwilling to provide credits for emission-free portfolios. By any measure, the global climate change initiative is not working and can be safely described as a failure.

What is the problem? Is not global climate change a serious problem that requires serious and determined action? Apparently not serious enough. One of the indications of the lack of a serious assessment of the issue is the reluctance of the sustainable development community in the United States to use the "N" word in discussions about either en-

ergy alternatives or nuclear applications. Ignored are nuclear applications such as food irradiation for safety, and medical uses of radioactive isotopes for diagnosis and treatment. No one seems to consider the development of a carbon-free electric economy to provide alternatives to the use of fossil fuels in the transportation and industrial sectors, which together make up more than 95 percent of all CO₂ emissions! How serious can they really be? Until the people representing our governments that attend these conferences face reality, no real progress will be made. With this lack of meaningful progress comes opportunity.

Our challenge and opportunity is to bring the "N" word to the table by participating in the dialogue on a national, and then international, level. On a national level, we, each in our own country, should be seeking the same tax incentives and tax breaks that other non-CO₂-emitting energy sources are getting. We should be developing proposals for emission credits for non-CO₂-emitting sources. We should put nuclear energy, as a non-CO₂-emitting source, on the same plane as solar and wind, since that is where it belongs. It is a renewable, sustainable energy source that is essentially CO₂-emission-free. But I am not here to convince you of nuclear energy's virtues since you know them. Let us shift the tone and direction of the debate to include the use of nuclear energy as part of the solution.

What has the American Nuclear Society done? ANS has been recognized as a non-governmental organization (NGO) for the Conference of the Parties (COP), which has been working on the agreements on how to limit greenhouse gas emissions. We attended the 1997 Kyoto meeting and the 1998 COP4 conference in Buenos Aires. In fact, our past-president Stan Hatcher was one of three delegates. The other two were representatives of our young generation who engaged other NGO delegates in lively discussions on the proper role of nuclear energy. We found out that the younger group, who have more at stake in the outcome, are very good at presenting the case for the sensible use of nuclear

energy. ANS member Don Schutz volunteered to follow the United Nations' sustainable development (SD) activities, which are broader than simply energy and include all contributions of nuclear science and technology. ANS has been involved with the SD movement as a UN-registered NGO since its attendance at the 1992 Earth Summit in Rio de Janeiro. The lead ANS division for SD activities is the Environmental Sciences Division (ESD). It receives guidance and support from the ANS Board of Directors and coordinates support from other divisions such as Power, Fusion, Isotopes and Radiation (I&R), and Biology and Medicine (B&M) regarding the overall role of nuclear science and technology in sustainable development.

ANS sends delegates to international meetings, including meetings of the UN Commission on Sustainable Development (CSD), in New York City. It also tracks worldwide SD activities through the reporting of the International Institute of Sustainable Development over the Internet. We will focus on gaining enhanced participation in the CSD-9 meetings and preparatory sessions to be held in spring 2001. Energy will be a focus topic of CSD-9. ANS is also represented on the American Association of Engineering Societies/American Society of Engineering Education Forum for Sustainable Development.

A paper is being prepared demonstrating how nuclear science and technology support the provisions of Agenda 21 on sustainable development. ESD will lead this effort, with cooperation from the I&R, B&M, and other interested ANS divisions. The future contribution of advanced technologies of fusion and accelerator applications will help provide a futuristic element to the document's scope, although their time horizon is quite long.

At the ANS Winter Meeting, to be held in Long Beach, Calif., November 14–18, 1999, ESD will sponsor several sessions on global warming. At the summer meeting in San Diego in 2000, there will be a President's Session on Sustainable Development that will be highlighted by ANS's release of the document on the contribution of nuclear science and technology to Agenda 21. We welcome all help in this area since it is a massive effort to keep track of all that is going on.

ANS has issued a public policy statement on CO₂ emissions that has been very useful in our discussions with members of Congress and officials in government. Our statement does not take a position on global warming. ANS members do not have the technical expertise to make a determination as to whether it exists or not. What we now know is that global emissions of CO₂ are increasing and that this can be measured. There is no doubt that CO₂ is building up in the environment. Our position is, if that is a problem, we have a solution: nuclear energy. The accompanying graphs also shows that the solution works, as demonstrated by real measurements in France, where nuclear energy now makes up more than 75 percent of the electricity supply.

Our intention is to go to COP5, to be held in Bonn in November 1999. This time we will go organized and focused. To have an impact,

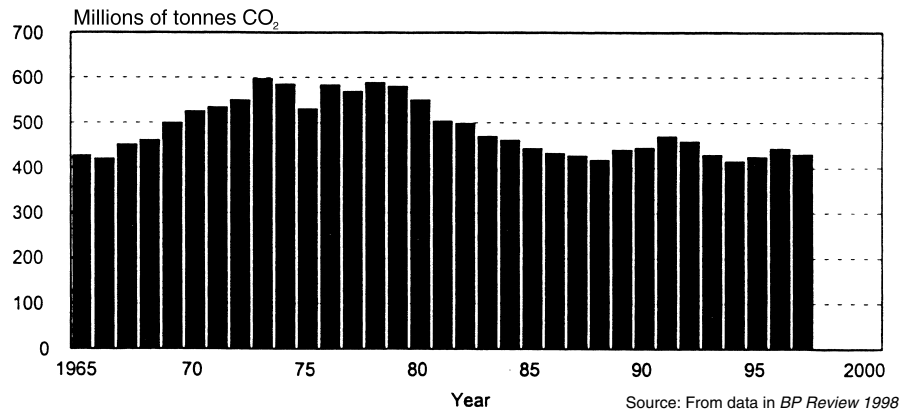


Fig. 1. Carbon dioxide emissions in France

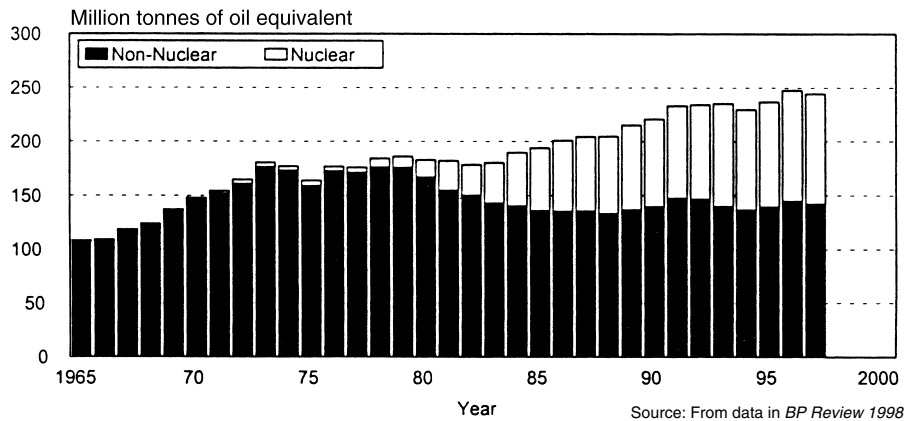


Fig. 2. Energy use in France. Note the correlating decrease in CO₂ emissions (Fig. 1) as nuclear power use has increased (Fig. 2).

we need to work to get nuclear energy on the plenary agenda now. At the last meeting, the only nuclear words mentioned by the plenary speakers were negative. We need to find a way to reach the organizers and the plenary speakers to get them to be honest about the need for nuclear in a clear and unequivocal way. This is the mission between now and November.

It is apparent that after many years of effort, the goal of reducing CO₂ emissions has not been attained since the proponents of reductions are not being taken seriously. Even those who believe in the theory of global warming are not yet politically willing to make the tough decisions that need to be made about how to reduce CO₂ emissions and the economic impact associated with those decisions. A classic example is not facing up to advocating the use of nuclear energy as a proven, large-scale energy source that is essentially CO₂-free. Without factoring in nuclear, the proponents of cutting CO₂ emissions will not be taken seriously by the public since nuclear energy, when harnessed to produce energy for transportation and electricity, can address about 95 percent of the potential sources of carbon emissions.

What else have we done? The American Nuclear Society finally realized that to effect change, its members have to be active in Washington, not as lobbyists but as information providers. If there is one thing that is lacking on Capitol Hill, it is a credible and re-

liable source of information on things nuclear. We have opened up a small Washington office that we use to maintain contact with key congressmen and -women, senators, and officials at the Department of Energy and other federal agencies, including the Office of Science and Technology Policy. I visit Washington at least once a month with prearranged meetings to discuss these and other issues with top officials.

We are working very hard to get the U.S. Department of Energy to focus on the development of new nuclear energy options. One of the projects we would like to see developed is a university consortium-sponsored reactor research facility, which would represent the next generation of small, highly efficient nuclear energy plants that can compete with natural gas. We are working to develop a vision and a future for all the young engineers who think nuclear energy is neat but don't see a long-term future. Building such a nuclear energy plant, which would have a combined research and demonstration mission, would prove that there is life after the existing generation of plants.

At the ANS Annual Meeting, held in Boston in June, Bill Magwood, director of the DOE Office of Nuclear Energy, Science and Technology, called for the development of what he called "Generation Four" nuclear energy plants.² Generation One were the early plants like Yankee Rowe, where I worked for many years. Generation Two were the later

vintage plants like Seabrook and Palo Verde. Generation Three are the advanced light-water reactors that are being built in Asia, but not in the United States. Generation Four are new plants that need to be developed that address the concerns about proliferation and safety, yet are competitive with natural gas. These small modular plants would be manufactured rather than constructed. The design could be used in all countries. We have such a plant on the drawing board at MIT. We are getting ready for Generation Four.

ANS is also attempting to build coalitions with serious environmental organizations. We need to broaden our associations with groups that should be our allies in the fight to reduce CO₂ emissions. We hope to develop working relationships with the Sierra Club and the Natural Resources Defense Council, to find common ground.

Recently, ANS, working with other nuclear organizations such as the Nuclear Energy Institute, was able to get a small amount of federal money—about \$25 million—allocated to research and development projects for nuclear energy. This is the first time in many years that there was a budget line item dedicated to development of nuclear energy. We are working on getting more money in this year's budget, not only to do R&D, but also to help in the license renewals of existing nuclear plants.

A couple of years ago, Stan Hatcher, 1997–98 ANS president, started an initiative titled the "Economic Imperative," aimed at trying to stimulate student and industry interest at finding ways to make nuclear plants more economic and competitive with natural gas. His idea focused on small, modular, factory-type plants that could be mass-produced to lower the high capital costs of nuclear plants. I am pleased to report that his initiative has borne fruit. At MIT, where I now am a Professor of the Practice in the Nuclear Engineering Department, we took on Stan's challenge but renamed it the "Economic and Environmental Imperative," and came up with a plant design that we believe can compete with natural gas. We are currently working on it with a grant from the Idaho National Engineering and Environmental Laboratory.

Hatcher's general vision was correct.³ We needed to shed our past preconceptions and look at the challenge from a fresh perspective. What we came up with was a small, 110-MWe modular pebble bed high-temperature gas reactor using direct-cycle turbines to make electricity. The idea is not new, but we have some innovative ideas that make it competitive. This high-temperature gas reactor can be built in two years and has sufficient high-temperature exhaust to be used for other process heat applications such as desalination, and perhaps even hydrogen production for the transportation sector. We are very excited about this concept and hope to build a research prototype in the next few years. Quite independently from our work at MIT, we learned that ESKOM, a South African utility, is actually going to build a plant of similar design, which, according to their calculations, is cheaper to operate than a natural gas plant.

We are also going to be working on supporting an emissions credit for all non-CO₂-emitting energy sources, such as solar and nuclear energy. We believe that by aggressively going after this issue, it will be very difficult for politicians to deny that nuclear does not emit CO₂ and should be treated equally. If there are tax credits for non-emitting sources, we should be seeking them out as well. Our role is to point out the legitimacy of nuclear power in the battle to reduce CO₂ emissions.

Our agenda is quite extensive, as you can see. We are volunteers. We do not get paid to do these things. Individually, we cannot succeed in raising the level of the dialogue. Collectively, however, we—each in our own country and as a focused and organized group on an international level—can succeed if we work together on strategically important issues, such as getting a plenary speaker at COP5 to talk realistically about nuclear energy's contribution. To assist in getting more international cooperation on specific issues that have a focused objective, I have recently formed a Special Committee on Nuclear Societies Cooperation, chaired by Jorge Spitalnik, of Brazil, to focus on how we can be more effective in promoting nuclear science and technology on an action-oriented basis. One of the tasks that I will be asking Jorge and his committee to take on is getting a plenary speaker at COP5 to talk realistically about the need for nuclear energy to address global climate change.

In the spirit of increased communication and dialogue, I have also invited all presidents of nuclear societies all over the world to attend our International Committee meetings, or at least to send a delegate to keep the lines of communication open and to be of assistance when requested.

There are challenges to the expansion of nuclear energy. In all nations, it is the high cost of building new nuclear plants which makes them noncompetitive. If this hurdle cannot be overcome, or emission credits cannot be given, the future does not look bright for new plants. For developing nations, raising the cost of capital is an obstacle, since these nations have so many other pressing needs for their capital. In short, we need new nuclear technologies that are competitive, such as the MIT project mentioned earlier, before we will see a reemergence of the nuclear option on a meaningful scale relative to the reduction of CO₂ emissions.

Having crossed the economic hurdle with new advanced designs, we then come to the question of nuclear proliferation. Before a major expansion of nuclear can occur, there needs to be either a technical alternative for making a fuel capable of such high burnup that it becomes useless as weapons material or an enhanced International Atomic Energy Agency role assuring that the deployment of this technology on a large scale can be done without undue concern about diversion for nuclear weapons. The MIT project described earlier relies on both—high burnup, and enhanced automated diversion detection and inspection.

The last and perhaps most psychologically difficult hurdle is that associated with the disposal of high-level nuclear waste. Unfortunately, we have not done too well on that issue. In the United States, progress is being made at Yucca Mountain, the site being investigated for a high-level waste repository. The political challenge associated with completing the licensing to allow for construction and operation still remains. My belief is that Yucca Mountain is a good site—a conclusion that continues to be supported in the recently completed Viability Assessment—and that it will be licensed. Once this hurdle is passed and transportation to the temporary storage facility outside the mountain takes place, people will become more relaxed about this issue. Equally good progress on a high-level waste solution is also being made in Sweden. The first one of anything is always the most difficult.

In many nations, there is a rush to use natural gas because, as some have said, it is plentiful and "too cheap to meter." But we have heard that somewhere before. The last time I looked, the burning of natural gas is a major source of CO₂ emissions to the environment. Where are our policy-makers on this point if global warming is such a problem?

In summary, I am quite optimistic about the reemergence of nuclear energy. It is an obvious answer to our CO₂ problem, and has been shown to be safe and reliable, but the public and the financial community need to see something new in terms of nuclear technology. But this won't happen by itself. We who are in this field need to become engaged and work together internationally to communicate and convince people that nuclear is important for them as well as for us, if the global climate change theory is correct—and even if it is not, for the sake of cleaner air.

The challenge for us is not easy. We have a technology that is perfectly suited to address the issues of global climate change. It is demonstrably safe and can be made even safer. It is clean, certainly cleaner than all fossil fuels, including natural gas. It is sustainable with advanced nuclear fuel cycles, even to the point of extracting uranium from seawater, if necessary. We need to make it more economic and there are ways to do that. The most important thing we need now is recognition of the enormous potential that nuclear energy offers and a chance to make the kind of contribution it can make to a cleaner and safer environment. Working with the environmental community, we can succeed.

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