every stakeholder concern could be satisfied. The containerized waste was sent to two disposal facilities, one DOE's and one commercial.

Most of the site (3900 of 6200 acres) has been transferred to the Interior Department to become a national wildlife refuge. The former industrial area will remain restricted and under DOE jurisdiction. The cleanup has significantly reduced risk, but ongoing monitoring and maintenance by the DOE Office of Legacy Management remain vital to ensuring long-term protection of human health and the environment. In addition, the US Congress approved legislation in 2004 creating the Rocky Flats Stewardship Council to focus on issues central to the site's post-closure care and management.

Regarding independence, anyone in the US who has experience and expertise with plutonium has been funded at some time by DOE, including us and the Rocky Flats Citizens Advisory Board. As scientists, we always hope that our science is brought out in public discussions and then used to improve the technical basis for decision making, so that decisions will be more transparent, repeatable, and thus scientifically defensible. Describing the value, process, and results of our participation was a major driver in developing the article for PHYSICS TODAY. For us, the invitation to become involved in cleaning up Rocky Flats was an ultimate opportunity for science in the public interest. We remain committed to working with all participants—site contractors, regulators, governments, stakeholder organizations, individuals, and the international scientific community.

Rocky Flats, the largest, most complex environmental cleanup in US history, was completed nearly 50 years sooner and $30 billion lower than initial estimates. The cleanup removed plutonium and reduced risks to metropolitan Denver. It was many things, but through broad-ranging community participation, it is certainly not a cover-up.

Additional resources

- US Department of Energy, Office of Legacy Management, http://www.lm.doe.gov.
- US DOE, Office of Legacy Management, Rocky Flats site, http://www.lm.doe.gov/land/sites/co/rocky_flats/rocky.html.
- Rocky Flats Stewardship Council, http://www.rockyflatssc.org/index.html.
- National Research Council, Commission on Geosciences, Environment, and Resources, *Long-Term Institutional Management of US Department of Energy Legacy Waste Sites (2000)*, National Academy Press, Washington, DC (2000), http://books.nap.edu/openbook.php?record_id=9949&page=R1.

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Weighing the need to accommodate women in physics

Vicente Aboites (PHYSICS TODAY, December 2006, page 10) asks for a logical answer to "why it is important to have more women as physicists . . . or any other profession." This letter is an effort to provide one.

Today more than half the class in a typical US medical school is female, and many people feel that women make better physicians than men. The increase in the numbers of female medical students represents a dramatic change from a few decades ago, when women were actively discouraged from pursuing a medical career and when female physicians were regarded as odd, threatening, and unfeminine. Books have been written about how the change took place, but surely factors like aggressive antidiscrimination policies and the development of a generation of role models were very important.

We who work in educational institutions have a duty not only to foster the development of our academic fields, but to ensure that students have every opportunity to reach their highest potential. Given the example of medicine, surely the default hypothesis is that women have the talent and energy to merit much increased representation in any male-dominated academic field. Their entry is inhibited by factors like those that kept women out of medicine for so long. It is, in fact, very difficult to discover what the barriers to entry are. But many fields in addition to medicine have demonstrated that active support and encouragement can allow women to overcome obstacles and develop their innate interests and talents in new areas.

I do not believe there exists any magic percentage for women in any pursuit, including physics. But I do think that many women who have the talent, intrinsic desire, and interest to take up physics are discouraged from doing so, and that the sources of their discouragement are complex. The highest calling of a university is to give all students a freer path.

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I fear that the discussion of women in physics is turning away from one of the most important points—the women in physics. As a female PhD candidate in nuclear physics, I have been waist deep in this issue for almost my entire scholastic career, and I disapprove of many of the methods being used to bring more women into physics or to help retain them in the field. How easily we can advocate the use of preferential treatment to help the women "catch up," but we can just as easily forget what that action does to the very people we are trying to help.

I do not want to be treated preferentially. I do not want to be the token woman, the one who receives attention in the form of stares, heads nodded knowingly, and whispers about "why she was really hired." I want to work hard, and struggle through difficulties, and earn every single thing I get.

Coercing an increase in diversity through preferential treatment of the minority in question—women, in this case—directly subverts the goal by introducing the idea that we suffer some handicap that must be accounted for. Thus, my value as a student, teacher, researcher, or job applicant will seem lower if I am a member of that minority. Either I will end up being forced to accept the underlying argument that I am worth less than my "obviously" more successful male counterparts, or I will have to work much harder to stand out, effectively making extra effort just to be equal. Either way, preferential treatment, even with the noblest intentions, is destructive and detrimental to my career and my own self-worth.

We cannot continue to argue about what is best for the women and minorities in physics if we do not acknowledge that each individual has the most important opinion on the issue of her own future.

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Nothing so clearly indicates how far the physics community still has to go to

achieve gender equity as the letters in the December 2006 issue purporting to claim otherwise.

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Nuclear power challenges and alternatives

In the 1980s Long Island politicians closed and dismantled a brand new nuclear power plant at Shoreham. The reasons given were that with conservation the region didn't need a new power plant, and if the avoidance of a nuclear accident saved even one human life, closing down the plant was worth the cost. However, since then the Long Island Power Authority has built several new fossil-fuel power plants on Long Island and is now considering building one in Yaphank. Most people don't realize that burning a ton of fossil fuel puts more than a ton of toxic waste into the air: nitrogen oxides, hydrocarbons, ozone, acid rain, smog, and carbon dioxide, which is a greenhouse gas. The Environmental Protection Agency says that the toxic waste from fossil fuels kills tens of thousands of people in the US each year.

In the January 2007 issue of PHYSICS TODAY (page 13), Walter Scheider writes, "When all costs are accounted, nuclear energy is not cost-competitive with fossil energy." But fossil fuel is not the answer for the future. In that same issue (page 14), Alan Robock writes, "The most important reason why nuclear power is a bad idea is that it results in nuclear weapons proliferation." The latest nation to test nuclear weapons was North Korea. The next one may be Iran. Does anyone think they got their weapons from US power plants?

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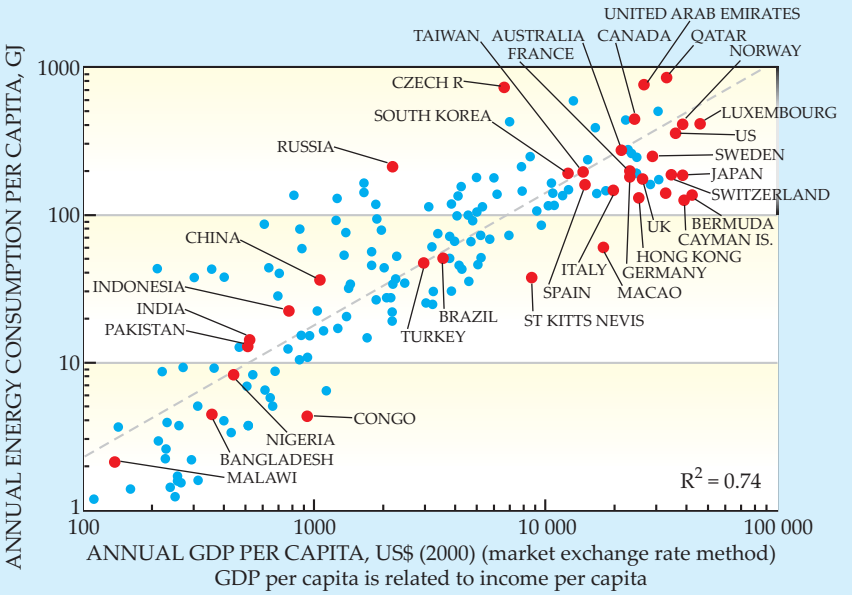
Walter Scheider and Alan Robock both write that they oppose nuclear power, largely because of safety and proliferation considerations. It would be wonderful if there were a vast, risk-free, universally agreed-on power source, but that is not the case. Yet the world needs energy. Consider the figure, compiled by mechanical engineer H. Douglas Lightfoot from information available from the US Energy Information Administration. It plots per capita energy consumption versus per capita gross domestic product. The correlation is nearly absolute; there are no points in the upper-left and lower-right corners.



Source: Energy Information Administration, *International Energy Annual 2003*, Washington, DC (8 July 2005).

Countries shown near the top of the chart have generally well-educated populations that live relatively comfortable, longer lives; people in the countries near the bottom have much less education, shorter life spans, and few comforts. Civilization can largely be defined in terms of per capita energy use. The goal of world development must be to improve the conditions of countries low on the list; this must happen if the 21st-century world is to find a measure of peace. Even if the United States were to cut its energy use in half and the rest of the world were brought up to that level, it would mean a tremendous increase in energy use.

Scheider and Robock reject nuclear power, but the alternatives are little better. Oil and natural gas will only provide energy for the planet for 20 or 30 years. Coal supplies are adequate for a long time, and China and India are rapidly developing that resource. However, coal is a heavy contributor to global warming. Wind and solar power depend on climate conditions and daylight. And biofuels require a great amount of acreage because of the extremely low efficiency of photosynthesis. By any reasonable measure, nuclear power must be an important part of the mix.

Even nuclear fuel is in very short supply—shorter than coal—for a once-through fuel cycle. Breeding nuclear fuel must play an important role in the mid to late 21st-century world. As a fusion scientist, I have advocated using fusion neutrons to breed nuclear fuel as well.[1] But if we find no new energy sources by midcentury, not only will we be unable to improve the lot of countries low on the chart, the countries now high up will begin to slide back down. Energy depletion, not nuclear power, is the real threat to civilization.

Reference

1. M. Hoffert et al., *Science* **298**, 981 (2002); W. Manheimer, *J. Fusion Energy* **25**, 121 (2006).

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The comment by Walter Scheider that Three Mile Island "remains an icon of a profit-driven industry cutting corners" echoes one by Anatoly Alexandrov, president of the Soviet Academy of Sciences and a strong supporter of the "RBMK" reactor, a particular type built only in Russia and used in the Chernobyl nuclear power plant. Alexandrov said that "such an accident [as TMI] can only happen in America where they put profits ahead of safety." Lecturing in Dubna, Moscow, and Gatchina just after TMI, I told listeners that if they believed Alexandrov, they were condemned to have a serious accident in the country within a decade. Alas, I was right. The centrally planned economy of the Soviet Union did far worse in ensuring safety than the US, and the Chernobyl accident occurred.

The profit motive, if suitably guided by good analysis tools, can enhance safety. Fortunately, we now have "risk-informed regulation."

Much of the improvement in safety since TMI has been profit driven. It was the industry that set up the Institute of Nuclear Power Operations and the