

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

Tevian Dray
(tevian@math.oregonstate.edu)
Oregon State University, Corvallis

Nuclear power challenges and alternatives

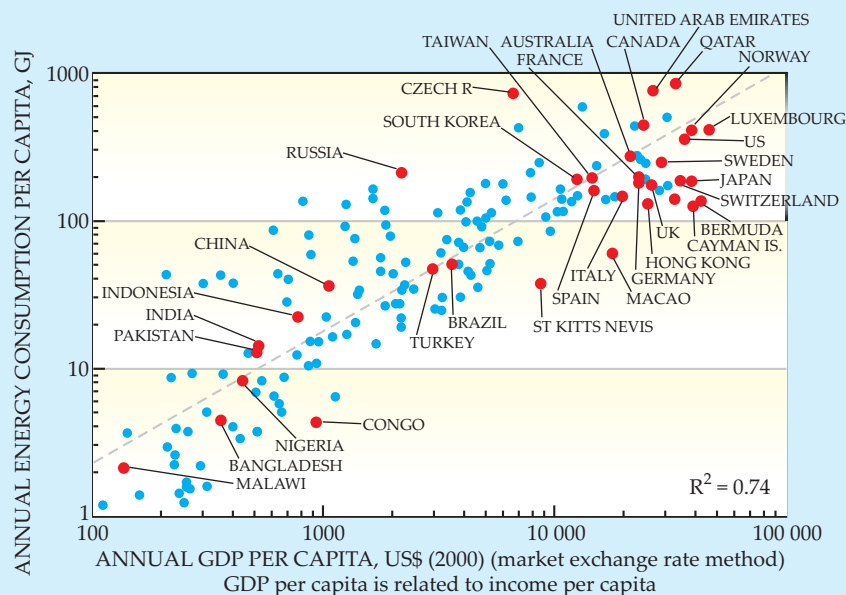
In the 1980s Long Island politicians closed and dismantled a brand new nuclear power plant at Shoreham. The reasons given were that with conservation the region didn't need a new power plant, and if the avoidance of a nuclear accident saved even one human life, closing down the plant was worth the cost. 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?

William Morse
(morse@bnl.gov)
Upton, New York

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.

Countries shown near the top of the



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

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 coun-

tries 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).

Wallace Manheimer
(wallymanheimer@yahoo.com)
Chevy Chase, Maryland

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