



BRIEF ANALYSIS

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Constructive Thinking about Climate Change, Part I: Energy

by Pete Geddes and H. Sterling Burnett

If human use of fossil fuels (coal, oil and natural gas) is largely responsible for global warming — and this warming is reasonably likely to cause harms that society would like to avoid or minimize — the technologies that fuel the world's economies must be reassessed. In particular, nuclear power could be the best choice to reduce the climate change risks posed by fossil fuels.

Challenge of Climate Change. Combating climate change is difficult. Consider the world's most significant climate change effort so far: the Kyoto Protocol — an international treaty to reduce CO₂ emissions by developed countries.

Designing effective institutions to reduce emissions worldwide would require unprecedented levels of international cooperation. But such a concerted effort is unlikely anytime soon. The United States and Australia rejected Kyoto, and only a few of the countries that did adopt it are on track to cut their emissions by the required amount. For example, Canada, Japan and 12 of the 15 original European Union countries have indicated that they will miss their emissions targets for the years 2008 through 2012. One reason for the difficulty of achieving the Kyoto targets is that the benefits of burning fossil fuels accrue to individuals, but the costs of climate change are borne by all.

Yet the Kyoto Protocol is only a modest step. Despite costing billions of dollars, meeting its emissions reduction targets would have little effect on climate change. It would delay the warming of the planet by a mere six

years. Hence, the Earth would be as warm in 2106 with Kyoto as it would be without it in 2100. Furthermore, it is known that a significant portion of the CO₂ emitted by humans stays in the atmosphere for 50 to 200 years. Thus, even if every source of human-caused CO₂ emissions were eliminated overnight, the atmosphere would continue to warm for 100 years or more.

Growing Energy Demand. Sustaining economic growth in developed countries and accelerating growth in the developing world means that energy demand will increase dramatically in the coming century. The International Energy Agency

projects world energy demand will grow 65 percent by 2020. In particular, developing countries will demand more electricity because electric power removes drudgery, multiplies human labor and increases productivity. It also reduces the health risks of indoor air pollution from the burning of wood and animal waste for cooking, heating and lighting.

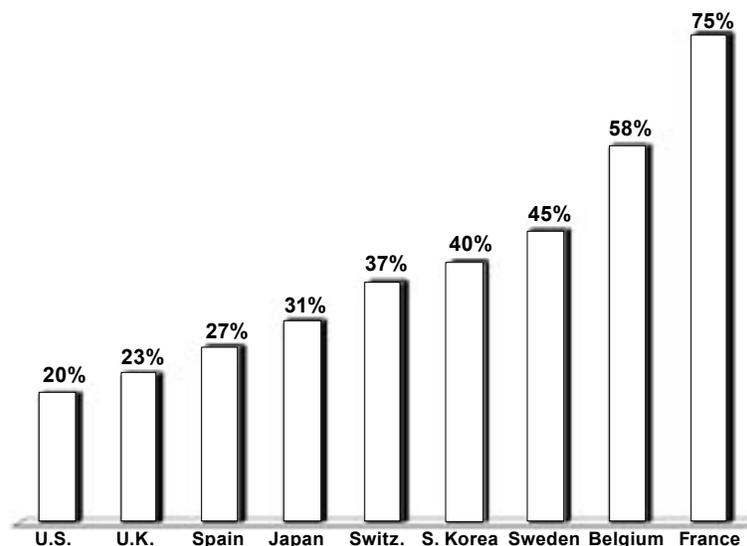
Role of Fossil Fuels. Fossil fuels are our cheapest, most available sources of energy, especially coal. For instance, the United

States is the Saudi Arabia of coal, with 25 percent of the world's reserves — double those of the next largest source, China. Coal currently generates 52 percent of the electricity in the United States.

But the generation of coal-fired electricity contributes more greenhouse gases to the atmosphere than any other technology — 2,249 pounds of CO₂ per megawatt hour of energy produced. And reducing the use of coal worldwide, or even in the United States, would be difficult because of its abundance, relatively low price and reliability.

Role of Renewable Energy. Less-polluting, renewable energy sources (that is, wind, solar, geothermal, biofuels, excluding large-scale hydro power) emit little

Percentage of Electricity from Nuclear Power



Source: Richard Rhodes and Denis Beller, "The Need for Nuclear Power," *Foreign Affairs*, January/February 2000.

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if any CO₂ at the point of generation, but currently meet only about 2 percent of U.S. energy demand and less than 4 percent worldwide. By even the most optimistic estimates, renewable energy sources could supply 10 percent of new electric power, and reaching even that goal will take decades. In addition, sunlight, wind, tides and waves are intermittent power sources; they cannot be relied on to provide the continuous base-load electricity necessary to maintain power flows across the electric grid or the peak-load power needed when demand surges. Thus, renewable power sources require almost 100 percent back-up capacity generated by fossil fuels, large-scale hydro or nuclear power plants.

The most promising role for renewable energy in developing countries is distributed power generation at the point of use, via roof-top solar panels, wind turbines and so forth. In Third World regions like sub-Saharan Africa, chaotic economic and political conditions make it unlikely that national power grids will be developed soon to serve most of the rural population. Thus, the best opportunity to electrify isolated areas in the short term is on-site generation.

Role of Nuclear Energy. Reducing the amount of CO₂ humans put into the atmosphere, while still meeting the energy demands of an expected population of more than 9 billion people by 2050, requires reconsidering nuclear power — a safe, practical alternative.

James Lovelock, a leading environmentalist, agrees. He writes: “Opposition to nuclear energy is based on irrational fear fed by Hollywood-style fiction, the Green lobbies and the media.... [N]uclear energy ... has proved to be the safest of all energy sources. We must stop fretting over the minute statistical risks of cancer from chemicals or radiation. I entreat my friends ... to drop their wrongheaded objection to nuclear energy.”

Despite opposition, nuclear power currently produces much of the electric power in developed countries. [See the figure.]

- Nuclear power provides about 75 percent of the electricity in France and 20 percent in the United States.
- With 434 operating reactors worldwide, nuclear power meets the electrical needs of more than a billion people.

- China alone is planning to build 30 nuclear reactors over the next five years.

However, the use of nuclear power to generate electricity could be vastly expanded.

Expanding the Role of Nuclear Energy. Nuclear power has advantages over fossil fuels. A single, quarter-ounce pellet of uranium generates as much energy as 3.5 barrels of oil, 17,000 cubic feet of natural gas, or 1,780 pounds of coal, with none of the CO₂ emissions. However, conventional reactors only utilize approximately 3 percent of the energy contained in nuclear fuel. If the United States joined France and Japan in recycling used fuel, and recycled the more than 15,000 plutonium pits removed from dismantled U.S. nuclear weapons, existing and recycled supplies would provide an almost unlimited amount of nuclear fuel.

A quarter-ounce of uranium generates the energy of 1,780 pounds of coal.

Nuclear power could also help reduce CO₂ emissions from transportation. For instance, running new light rail and subway systems on electricity generated by nuclear plants — rather than coal or gas-fired power plants — would prevent new emissions. Moreover, Stanford University’s Henry Miller has pointed out that nuclear power plants could also power the next generation of automobiles — pure electric or plug-in electric-gasoline hybrids. This would reduce CO₂ emissions from cars and decrease demand for foreign oil imports.

Conclusion. Combating climate change requires creative thinking about the world’s energy needs. For the short to medium term, fossil fuels will continue to meet most of the world’s energy demand, but nuclear power holds the most promise as a clean, practical alternative that could help satisfy the world economy’s growing demand for energy while slowing the growth in demand for CO₂-emitting fossil fuels.

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