Abstract. Although the present average costs of generating electricity from nuclear reactors are less than the average cost of power from fossil fuel plants, the pressures for additional regulatory controls on nuclear power plants raise the possibility that nuclear power might become unavailable as an energy alternative. With the help of a model of U.S. interfuel competition developed at SRI, some of the implications of various alternative assumptions about the future availability of nuclear power are examined. The economic costs of a nuclear moratorium are evaluated for two different forecasts of energy demand growth. Although the loss of the nuclear option is offset by a substantial increase in eastern and western coal production, the net cost of this replacement—over 20 billion dollars annually by 2000—is substantial.

1. Introduction

In recent months, the use of nuclear power from conventional light water reactors has been criticized on the basis of waste disposal, fuel management, safety, environmental impacts, and lifestyle considerations as well as a rapid escalation of costs. Nevertheless, nuclear power is cheaper than coal, its nearest competitor, for generating base load electric power in most parts of the country. Unless the addition of more safety devices increases its capital cost, nuclear power will likely remain cheaper than coal in regions of the country far from our coal resources. Even if nuclear fuel prices increase as some predict, the cost of electricity from nuclear power will increase at a much slower rate than fuel prices because it is determined almost entirely by the capital cost of the nuclear plant. On a purely economic basis then, nuclear power should be attractive relative to coal for some time to come. However, because nuclear power plants house large quantities of radioactive material during operation and because this material must be transported between the power plant, the reprocessing and fabrication plants and waste disposal sites, there is some possibility of a radiation release to the environment depending on the reliability of the safety systems being used. Thus, it is not apparent a priori from a social point of view whether nuclear power is attractive relative to electricity from coal. On the other hand, the environmental and social impacts of widespread coal burning, strip and underground mining, particulate emissions, SO$_2$ emissions, NO$_x$ emissions, ash disposal, land disruption, development of a large coal transportation system, mine safety, and the social effects of the rapid development of coal in the West and in the East are potentially quite serious. Thus, it is not clear that a switch to coal-based power generation will pay net environmental or safety benefits.

Other proposed electric power generation technologies will not likely offer an economic alternative to the coal versus nuclear decision until a great deal of research and development work has been done over the next 25 years [1]. Generation of
baseload power from oil is very expensive relative to nuclear and coal, and tends to create greater demand for crude oil imports, increasing the national dependence on foreign supplies of oil. Baseload power generation from gas will not compete economically as gas prices will continue to increase toward the price of imported or synthetic gas as domestic reserves are depleted. Baseload power generation using solar technologies is several times today’s price of coal and nuclear power, and the technology will not be available for many years to come. Similarly, it is not likely that either breeder or fusion technologies will be commercially available before the end of the century. Thus, for the next 25 years, most baseload power will be generated from either coal or nuclear fuel, or both, and it must be determined in individual cases which is the more attractive from a total social point of view including all economic and other considerations.

Barrager et al. [2] have directly compared coal and nuclear power at a hypothetical eastern U.S. location and have found that even though coal and nuclear power have almost identical economics, from a total social point of view, nuclear power is significantly more attractive. This conclusion is based on the fact that the expected cost of a nuclear accident is substantially less than the expected environmental damage from coal burning, principally because of SO2 emissions.

In this paper, we will focus on the economics of coal and nuclear power generation, referring to Barrager et al. [2] for a detailed evaluation of environmental impacts. Our intent is to compute the economic cost incurred by U.S. energy users if no new nuclear capacity is ever allowed. We will calculate the economic loss to the country of a nuclear ban both in the case of ‘normal’ energy demand and in the case where a successful conservation program decreases energy demand substantially. Our conclusion is that the national economic cost of a nuclear moratorium is large even if conservation is highly successful. This observation, together with the conclusions of Barrager et al. [2] that the ‘non-economic’ impacts of coal-based power in most cases are significantly worse than those of nuclear power, appears to imply that a national nuclear moratorium would be a serious mistake.

2. Economic Cost of a National Nuclear Ban

In mid-April 1976, there were 60 nuclear reactors operating in the United States with a total capacity of about 42 000 MW. This means that nuclear energy presently provides 8% of the total U.S. electric generating capacity and about 9% of the total production of electricity. There were also 69 reactors with construction permits totaling 73 000 MW capacity and another 100 000 MW on order. If existing construction projects are completed according to schedule, by 1980 the United States will have about 80 000 MW installed nuclear capacity representing 18% of electricity production, or about 6% of total U.S. primary energy consumption. Some projections indicate that by 2000 nuclear energy may account for about 60% of electricity production and about 20% of total primary energy. Thus, we might expect the economic consequences of a nuclear ban to grow over time because nuclear energy is projected to become increasingly attractive relative to other sources.