Chapter 13 — The Benefits of Nuclear Electricity

The benefits of nuclear electricity have emerged in recent years as the guiding doctrine for managing growth, the environment and the use of energy in the future. Nuclear energy, with its ability to support growth and conserve environmental resources, should be an underpinning of sustainable growth.

Sustainable development has been defined as the ability “to meet the needs of the present without compromising the ability of future generations to meet their own needs” [1]. The concept embraces the idea that investments in the production of energy be made wisely, so that they contribute to long-term economic development without charting a course to environmental ruin.

There are two elements to the concept of sustainable development, that of sustainability and development, and in most discourses the emphasis is surely on sustainability. There is no argument here that development should be capable of sustaining itself indefinitely by conserving environmental resources. Not to be overlooked, however, is the other half of the concept—economic development that results in jobs, prosperity, and an improvement in the quality of life, particularly in those parts of the world where there is a disparity between rich and the poor. As the President’s Council on Sustainable Development wrote:

“We believe that to achieve our vision of sustainable development, some things must grow—jobs, productivity, wages, capital and savings, profits, information, knowledge and education—and others—pollution, waste, and poverty—must not.” [2]

More to the point, the same authors stated:

“Both in the world and in the United States, there will be more people and they will aspire to better lives. Responding to those aspirations, particularly if prevalent patterns of consumption continue, will require the production of more goods and services. The challenge of sustainable development is to find ways to meet those needs without destroying the resources upon which future progress depends.” [3]

Nuclear energy meets the test of sustainability. It provides both economic and environmental benefits. We have seen, repeatedly, that countries which have invested in nuclear programs have been demonstrably rewarded with low cost electricity, economic growth, and remediation of the deleterious effects of burning fossil fuels.
Economic Benefits

The economic benefits of nuclear electricity are the greatest when two conditions occur:

- The electricity grid is at least 20 GWe and the demand on that grid is growing consistently at about 2.5% or more per year.

- The cost of natural gas reaches the level of $3.50 per MBtu.

The first condition establishes the need for a large, baseload plant and ensures that the entire output of the nuclear plant can be sold. The exception is when there is excess capacity on the grid. In this case, the new demand will be met not by building new plants, but by putting the under-utilized capacity to work. This happens sometimes in the immediate aftermath of deregulation but is a short-term effect.

The second condition results in the “indifference point” between nuclear and natural gas based generation. At about $3.50 MBtu (and no escalation) for natural gas, a combined cycle plant and the ABWR have the same cost of electricity.

Figure 13-1 illustrates the sensitivity of this economic comparison to increases in natural gas prices.

Of course, many countries are faced with exactly these conditions. Taiwan, for example, has a grid of over 20 GWe, is experiencing 12% per year increases in demand for electricity, has little or no reserve capacity and must import fossil fuels, including natural gas in the form of LNG at high costs. The Taiwanese energy plan includes the addition of two nuclear units every five years.

In the United States, gas prices have ranged between $2.00 and $2.50 per MBtu. There is excess capacity in certain regions of the country and demand has been between 1% to 2%. When these conditions change, as invariably they must, new nuclear plants will once again be built. Regardless, operating nuclear plants in the U.S. are considered to be valuable financial assets that generate significant shareholder value by virtue of the fact that nuclear production costs are far less than those of other options. For this reason, the output of operating plants will be increased (power uprate) and the plants’ lifetime will be extended via license renewal.
Indirect Economic Benefits

Countries around the world have introduced and systematically expanded the use of nuclear power for other reasons as well.

Energy Independence and Diversity

The OPEC oil embargo of 1973 was a landmark event. It showed once and for all that the economies of countries which depended upon imported oil were vulnerable to supply disruptions and cost increase. Many countries, notably France and Japan, adopted policies to diversify its sources of energy to decrease this vulnerability. These policies included the systematic expansion of nuclear energy and is still a sound policy for both industrialized and developing economies. The United States itself reduced its dependence on imported oil by expanding the use of nuclear electricity. Since 1973, over 40 nuclear plants have been built in the U.S., and nuclear electricity has gone from being only 4% of the total electricity to being 20% of the total. Electricity produced by oil has declined over the same period from 17% to 3%.

This policy is especially important for export-driven economies. In addition to assuring energy independence, a policy of energy diversity ensures that there will be a stable supply of low cost electricity, a key advantage for countries competing in international markets. As the previous chapter discussed, nuclear electricity is not only low cost, it is predictable over the life of the plant.

A good way to look at nuclear energy is that once the plant is built, it essentially becomes an indigenous energy resource.

Jobs, Technology and Economic Growth

A flourishing nuclear energy industry provides the opportunity for thousands of well-paying, highly technical jobs. An individual nuclear plant project provides engineering, manufacturing and construction jobs in the host country and has an economic “ripple” effect on the entire economy. One study of this effect showed that a nuclear project stimulated the Gross National Product (GNP) of an entire country to grow by 1%, the result of new wages and spending working its way through the local and then national economy.

For developing economies, a nuclear project attracts new technologies and know-how that build the infrastructure of the host country. For example, the same study alluded to above reported that 80% of all licensed welders in the country received their training on the nuclear construction project.

Environmental Benefits

“Nuclear energy should play a major role in contributing to electricity provision and in strategies to combat global warming.” This was the conclusion of the 17th World Energy Congress whose participants included 4,000 energy ministers and other government representatives from over 100 countries. The same sentiment was expressed in a study done by the Energy Information Agency, a branch of the U.S. Department of Energy, that concluded that the U.S. could not achieve the carbon emission reductions envisioned under the Kyoto Protocol.
agreement unless nuclear energy plays a substantial or increased role in U.S. electricity production. Figure 13-2 illustrates why. Nuclear power comprises 65% of all emission-free electricity produced in the U.S. year and saves nearly 150 MT of carbon every year—at a time when the U.S. has set a national goal of reducing CO₂ emissions by 108 MT by the year 2000.

Without these nuclear plants, CO₂ emissions will be well above the 1990 levels. Even with these existing plants in operation, it is clear that there will be a significant gap between actual and desired emissions, as shown in Figure 13-3. Only the addition of new zero-emission plants, which include nuclear, hydro and some renewables, will close the gap.

References


3) IBID, page 6.