



Nuclear power in a restructured market

THROUGH MAY OF this year, 23 states have enacted electric utility restructuring legislation and two more have issued regulatory orders. This action, based on information from the Energy Information Administration, represents 54 percent of electric capacity (394 000 MW) in the United States and 60 percent (62 700 MW) of nuclear capacity. Twelve other states that are home to nuclear power units are considering retail choice.

The subject of restructuring was discussed at a session during the ANS Annual Meeting held in San Diego on June 4–8. A panel assembled to debate the topic included representatives from the Department of Energy, Electric Power Research Institute (EPRI), Stanford University, and private industry.

Positives of nuclear power restructuring outweigh the negatives, according to John Stamos, associate director of management, planning, and analysis for the DOE. These positives include stranded cost recovery and discussion of decommissioning costs; environmental issues that favor nuclear (but not as much as renewables, Stamos said); industry consolidation, which could lead to economic efficiencies; and increased competition that could favor nuclear provided competitive operating and maintenance costs are maintained, which would be a major stimulus for plant license renewal.

The only negative seen by Stamos is federal legislation that mandates that utilities increase their renewables portfolios within the coming decade, which could reduce market opportunities for nuclear.

To stay competitive in an open market, Stamos said, the “going forward” costs of a nuclear plant will probably be in the range of 2.0–2.5 ¢/kWh. By comparison, going-forward costs of a new gas-fired combined-cycle plant are estimated at 3.0–3.5 ¢/kWh.

For generation III and IV nuclear power plants yet to be built in the U.S., “they will be able to compete” with other load sources, Stamos said, if their generating costs are in the 3.5–4.0 ¢/kWh range and capital costs in the \$100–\$1500/kW range.

More “good news” was presented by John Taylor, EPRI vice president (retired), who now is a consultant to that organization. Production costs of nuclear are already competitive with gas-fired plants, Taylor said. For the 1996–1998 time period, nuclear plant costs averaged less than 3.0 ¢/kWh, compared with 3.0–3.5 ¢/kWh for gas-fired plants.

Other issues making nuclear an attractive generator, Taylor added, include the industry’s improved capacity factor (86 percent average plant capacity factor in 1999, compared with 57 percent in 1980); safety system per-

The positives outweigh the negatives, observe some industry analysts.



Taylor

formance indicators that improved to an average of 95 percent in 1999, compared with 70 percent in 1989; and the writeoff of nuclear plant assets.

Value adders are also evident in industry consolidation and nuclear’s emission-free generation, even though no credit is

given for this factor in the marketplace, Taylor said.

It is highly likely, he speculated, that the near-term expansion of nuclear power in the United States will be through advanced light-water reactors (ALWRs), principally because the costly infrastructure and vast operating experience in the light-water systems are in place.

There is “bad news,” however, Taylor admitted. Rate deregulation makes it much tougher to build new nuclear plants in this country. To build a plant, private investment will be required, but without the guaranteed rate of return that existed in the rate-regulated system. Thus, he said, the rate of return on investment will have to be comparable, if not better, than competitive alternatives.

This, Taylor added, leads to three requirements for building a new plant: production costs must be maintained or reduced; capital costs must be 30 percent lower than the present estimates for ALWRs (assuming no credit is given for reducing carbon emissions from nuclear plants); and investment costs and planning uncertainties need to be reduced by constructing the plant, from first concrete pour to power operations, in three years.

Geoffrey Rothwell, economics professor at Stanford University, expressed the importance of further cutting O&M costs in a deregulated market. Nuclear’s average cost per kWh fell dramatically during the 1990s, Rothwell said. In 1989, the median cost of operating a nuclear plant was about 32 mills/kWh, or \$32/MWh. Ten years later, by 1998, the median cost had declined each year by about 4.1 percent, to about 19 mills/kWh, or \$19/MWh.

During 1989–1998, according to Rothwell, half the decline in cost/kWh was attributable to declines in cost (2 percent per year) and half to increases in capacity factor (2 percent per year). Looking closer, half the decline in cost was due to drops in O&M costs (1 percent per year) and half to other costs (1 percent per year).

For the same time period, median capacity factor increased from 68 percent in 1989 to 88 percent in 1998, with more than 80 percent of the nuclear units having capacity factors above 75 percent by 1998.

Capacity factor, Rothwell explained, is the



Rothwell

sum of parts, one being capacity utilization rate, which is a measure of how close the reactor is to potential when it is running. The median capacity utilization rate (the capacity factor when the unit is operating) increased to 99.3 percent in 1998, Rothwell noted, the implication being that additional increases would be difficult for most of the industry.

Further, the forced outage rate declined to a median value of 0.5 percent in 1998, i.e., less than two days per year, another implication that further improvement in this area would be difficult, Rothwell said.

Although increases in unit availability are possible, he said, the median value for capacity factor in 1998 was 88.8 percent, which means that planned outages lasted less than six weeks per unit per year. If this average were to decline to three weeks per year, the median capacity factor would increase from about 88 percent to about 93 percent. Although this improvement is possible, Rothwell said, it is unlikely the median capacity factor could increase above 93 percent. Therefore, he concluded, with capacity factors now approaching theoretical limits, the industry must cut O&M costs to maintain the decline in costs seen in the 1990s.

Chaim Braun, vice president of Altos Management Partners Inc., presented results of a modeling project’s conducted by his company that looked at nuclear power’s importance in cost control in the northeast United States. The project’s results showed that the higher the regional nuclear fraction (and the higher the installed coal plant capacity), the lower the energy prices would be, particularly in the crucial summer season. With a higher degree of nuclear, he noted, greater opportunities would exist for a region to export power, earn extra revenues, and lower the region’s own energy prices.

The results further indicated, Braun added, that a premature shutdown of significant nuclear

capacity, such as the Millstone plant in Connecticut, would result in substantially higher energy prices not only in the affected region itself, but also through other interconnected regions. The higher prices would result from inadequate low-cost capacity to satisfy baseload demand. This would necessitate greater reliance on imports and would call into service a larger fraction of high-cost peaking plants to meet the large summer intermediate and peak loads.

Due to the interconnected nature of the nation's transmission system, he said, a large-scale system perturbation in a particular region would affect various nearby and remote regions. Thus, Braun concluded, improved nuclear plant performance in New England, for example, would have a positive economic benefit in New York State and Quebec, Canada, while an unplanned nuclear plant shutdown in New York State would have deleterious economic effects on most neighboring regions.

Ted Quinn, vice president of MDM Services, of California, and a former ANS president, looked at California's restructuring journey as a lesson for what other states may experience. California passed its electricity restructuring law in 1996, with implementation expected by March 31, 1998. The law included recovery of stranded costs for utilities and provided for a 10 percent electricity rate reduction for residential and small business customers. California was the first state to pass such sweeping legislation, with full competition in that state to take effect in 2003.

Restructuring, Quinn noted, established the

formation of an independent system operator (ISO) and power exchange (PX), required the ISO to "efficiently use" and "reliably operate" the California transmission grid, opened the California electricity market to competition via direct access and the PX, and required three utilities—Southern California Edison, Pacific Gas & Electric, and San Diego Gas and Electric—to sell at least 50 percent of all generation.

The restructuring process, said Quinn, is complex and results in a number of issues that apply particularly to nuclear generation assets. These are, according to Quinn, as follows:

1. In considering the source and reliability of offsite power, the licensing basis and design basis considerations for offsite power have moved from under the licensee's control to an external entity (the ISO).
2. The ISO should operate the grid such that it remains "operable" with respect to technical specifications, licensing basis, and design basis requirements.
3. The Federal Energy Regulatory Commission "has apparently" injected itself into the nuclear regulatory business, Quinn said.
4. Activities governed by the NRC are being and will be moved to a non-NRC regulated entity.
5. Nuclear's interests appear to be lacking in the restructuring process.



Quinn

6. The level of nuclear business risk is still unknown.

For the transition to a deregulated environment, nuclear utilities need to consider the following, Quinn noted:

■ A utility must use lessons learned from its transition period to operate effectively after the transition has ended, when it finds itself in a deregulated market.

■ Nuclear safety concerns must be met, Quinn stressed, and sufficient resources must be devoted to operations in the new world of deregulation. The NRC will be paying particular attention to nuclear utilities in restructuring transition.

■ Lessons learned in the separation of ownership from transmission and distribution need to be written down.

■ Questions remain to be answered: If generating plants continue to run only if their costs are at or below the wholesale price of electricity, how will nuclear compete? Should the owners of nuclear plants choose to accept a price below running costs for some interim period in the hopes of increased profitability in later years?

■ The issue of fuel diversity and environmental concerns needs to be studied, Quinn said.

■ According to a DOE report released in January 2000, the nation's power system is less reliable because of deregulation, said Quinn.

In the end, what effects will increased competition have on the safe operation and decommissioning of nuclear power plants, with California as the first case study? This chapter has yet to be written, Quinn concluded. ■■