Nuclear Spring

It has been more than 27 years since any utility company proposed to build a new nuclear power plant in the United States and 10 years since a new reactor began commercial service. Although the accidents at Three Mile Island (1979) and Chernobyl (1986) played a role in the abandonment of plans for new plants, the key factor was high costs. The landscape has changed, however. Regulations have been streamlined, costs have come down, NIMBYism has started to retreat, and government policies are making nuclear power viable once again. The long nuclear winter may finally be coming to an end.

Utility executives are finally beginning to look toward nuclear power again as a viable solution to future electricity needs. Three early site plan applications are under review by the Nuclear Regulatory Commission (NRC), one will be submitted shortly, and another six are under consideration or development. This is a remarkable turnaround. “Just five years ago, utility executives were saying they wouldn’t be caught dead even talking about a new plant” according to one industry source. U. S. companies were actually shutting down plants: during the 1990s, eight units were permanently shut, and another has been inoperable for more than two decades.

Although the Three Mile Island and Chernobyl disasters are often cited as the reason for the halt of nuclear plant construction in the 1980s, they were not the only factor, or even the most important one. A key reason was the financial cost of building new plants.

There are various ways to estimate the cost of providing electric power. One standard measure used by the utility industry is the “overnight construction cost.” As the phrase implies, this measure assumes that the plant is built “overnight” and thus excludes capital costs, such as the interest that would be charged on funds borrowed to build it. According to the Energy Information Administration (EIA), a federal agency, the overnight cost of building a nuclear plant increased sharply during the 1970s, rising from $1,500 per kilowatt of capacity for plants started in the 1960s to $4,000 per kilowatt for plants started in the 1970s (both figures are in constant 2002 dollars).

The lead time for building a nuclear plant also increased, from about eight years to more than ten years. (In one case, the Tennessee Valley Authority’s Watts Bar plant, it took 24 years to start operation.) This growth in overnight costs and lead times was not expected when utilities announced plans in the early 1970s to build many more nuclear power plants; many of the planned projects were subsequently canceled.

Why were the nuclear plants of the 1970s so much more expensive to build than expected? A key reason was the tortuous regulatory process for approving new reactors. Owners had to get multiple licenses and go through exhaustive reviews and multiple hearings. Each plant was treated as if it were a completely new design—which it often was. Utilities compounded the problem by taking a “design as you go” approach, starting construction before design and engineering were complete (and, in many cases, had hardly begun). This further extended the regulatory approval process, because the NRC could not finish its review and grant approval of the design until construction was completed.

A New Regulatory Era

Since passage of the Energy Policy Act of 1992, however, the regulatory and construction process has been streamlined. Prior to 1992, a utility had to get two licenses, one for construction and a second one for commercial operation. Hearings and reviews were required for both. Now, it only has to get one combined construction and operation license. As long as the utility follows all procedures and passes NRC inspections, a second hearing is not required for operation. Importantly, the threshold for intervention after this license is issued has been set high to discourage frivolous lawsuits and costly delays.

Another important change made by the 1992 Act was to allow nuclear plant designs to be pre-approved, or “certified,” by the NRC. Once a design is certified, an electric utility can order a plant in that design with the assurance that all design and safety issues have been resolved. A number of designs, known as “generation III,” already have been certified and more are in the process of certification. This standardization is expected to significantly reduce design and engineering costs as well as construction lead times.

The new licensing regime and plant design certification process should ensure that all major issues and risks related to design, safety, siting, and public concerns are settled before a company starts to sink billions into a nuclear plant.

Cost Comparisons: Nuclear Power vs. Coal and Gas

Now that regulatory, design, and engineering issues have been addressed, the key remaining question is cost. Specifically, can a nuclear plant be built at a cost similar to, or even lower than, what it costs to build a coal-fired or gas-fired plant?

Overnight construction costs for a
coal plant currently range from $1,000 to $1,300 per kilowatt of capacity. Natural gas plants, at $500 to $700 per kilowatt, are substantially cheaper than coal, not to mention cleaner. Not surprisingly, according to the Natural Gas Association 90 percent of power plants under construction last year were gas-fired.

Estimating the overnight cost for a nuclear plant is harder, simply because none have been ordered in the United States in nearly three decades and the regulatory and design environment has changed so much since then. Two major reactor manufacturers, GE and Westinghouse, have estimated it at $1,200 to $1,600 per kilowatt. These estimates were made back in 2000, however, and costs have likely increased since then. They also assume some form of government financial support; without that, costs would be higher. A more recent estimate from the EIA pegs the cost at nearly $2,000 per kilowatt.

In other words, even in the new streamlined regulatory era, nuclear power still cannot compete with either coal or gas on an overnight basis. Moreover, lead times for building coal and gas plants are also lower: four and three years, respectively, versus an estimated six to seven years for nuclear plants.

However, overnight costs and lead times are not everything. The cost of producing electricity—that is, operating costs—must also be factored into the comparison.

From an operational perspective, a nuclear power plant is the least expensive means of producing electricity. According to the Federal Energy Regulatory Commission (FERC) in 2004 the cost of fuel averaged 0.42 cents per kilowatt hour (kWh) for a nuclear plant. This is less than a third of the fuel costs for a coal-fired plant (1.46 cents) and less than a tenth of that for a gas-fired plant (4.91 cents).

Add in other operating and maintenance costs, and nuclear’s advantage shrinks. However, it still comes out ahead: the total operating cost to produce a kWh of electricity is 1.68 cents for nuclear, 1.92 cents for coal, and 5.87 cents for gas. In other words, gas-fired plants cost far more to operate than nuclear plants, largely because of higher fuel costs.

Another key factor to consider, however, is the cost of capital. This is not included in overnight costs or in operating costs, but it is, in fact, a major consideration. When capital costs are factored in, it turns out that nuclear power, despite its low operating costs, is not competitive with coal and gas.

The Bushbar

The most comprehensive estimate of all the costs that go into generating electricity is the “busbar” cost. In a power plant, a busbar is the place at which electricity leaves the plant. The busbar cost is the total cost of getting the current ready for transmission; it includes capital, operating, and fuel costs.

According to a study conducted by the University of Chicago for the Department of Energy, in 2003 the busbar cost of the first “generation III” nuclear plant was estimated to be $67 per megawatt hour (mWh)—comprising $45 for gas and $41 for coal. A “learning curve” was expected to reduce nuclear’s busbar cost to $50 by the time the fourth plant is constructed, but this is still higher than coal or gas.

The Chicago study suggested that government subsidies could substantially lower this cost. Loan guarantees, tax credits, or other incentives could reduce first-year busbar costs to as low as $40 in one scenario, with learning curve effects eventually lowering that to $31.

At these levels, a new nuclear power plant is competitive with coal and gas.

A more recent analysis from the Nuclear Energy Institute (NEI) confirms that without government help, nuclear power comes up short. It shows that in 2005, first-year busbar costs were $68 per mWh for nuclear, $57 for gas, and $49 for coal. All of these figures are higher than those in the earlier Chicago study, partly because the assumed rate of interest is higher (thereby pushing up capital costs). The gas busbar is markedly higher, mostly because gas prices were higher when the 2005 study was done.

In short, busbar (and other) cost estimates are not fixed. They vary as the cost of inputs change. But virtually all estimates show that it is more expensive to build a nuclear plant than a coal or gas-fired plant.

Uncle Sam to the Rescue

On a purely financial basis—which is what matters to Wall Street and the banks that finance new plants—nuclear energy cannot compete with coal or gas without support from a third party: the Federal Government. The environmental argument for such support is that, in terms of greenhouse gases and other airborne pollutants, nuclear power is one of the cleanest sources of energy. It emits zero carbon dioxide, sulfur dioxide, nitrous oxide, and particulates. The geopolitical argument is that relying more on nuclear power would reduce the electricity industry’s demand for natural gas, allowing more gas to be used as a substitute for petroleum products (for example, heating oil).

Perhaps in recognition of these benefits, Congress and the Administration included a number of provisions in last year’s energy bill to jump-start nuclear plant construction.

The 2005 Energy Policy Act provides for: 1) Federal loan guarantees of up to 80 percent of a nuclear plant’s cost, thereby enabling utility companies to borrow more and to borrow at lower interest rates; 2) a production tax credit of $18 per mWh for eight years to the first six “generation III” plants, capped at $125 million annually per plant; 3) $2 billion in risk insurance to cover certain costs in the event of regulatory delays during construction; and 4) extending the Price-Anderson Act to all nuclear plants brought on line by 2025 rather than 2015; this act limits the financial liability of plant operators in the event of a nuclear accident, while ensuring that funds are available to satisfy liability claims.

These provisions will significantly reduce the estimated cost of building and operating nuclear plants. The NEI study found that the loan guarantees alone would reduce nuclear’s busbar cost to $46 per mWh. Factoring in the tax credit, these two subsidies could reduce the cost of the first “generation III” plant to $31–$33 per mWh—a level well below all coal and gas busbar cost estimates.

What About NIMBY?

With the regulatory licensing process streamlined, design and engineering simplified, and financial risk issues mitigated, one major consideration remains. Will NIMBY—the Not In My Backyard phenomenon—derail the prospects for a resurgence of nuclear power? A growing body of evidence suggests not.

A poll conducted by Bisconti Research in May 2005 found that 70 percent of Americans favor nuclear power. By comparison, only 46 percent favored it in 1995. Another poll conducted last
PRIMARY LEADING INDICATORS

- **M1 Money Supply (1)** (constant dollars, billions)

- **Yield Curve Index (1)** (cumulative total)

- **Index of Manufacturers’ Supply Prices (2)** (percent)

- **New Orders for Consumer Goods (3)** (constant dollars, billions)

- **New Orders for Nondefense Capital Goods (4)** (constant dollars, billions)

- **New Housing Permits (3)** (thousands)
Notes: 1) Shaded areas indicate recessions as dated by the National Bureau of Economic Research. 2) The number in parentheses next to the name of a series is an estimate of the minimum number of months over which cyclical movements of a series are greater than irregular fluctuations. That number is the span of each series’ moving average, or MCD (months for cyclical dominance), used to smooth out irregular fluctuations. The data plotted in the charts are those MCDs and not the base data. The number in brackets is the latest month for which the moving average is plotted. 3) The insets in selected charts show recent trends more clearly. These insets have arithmetic scales, even when the main chart is plotted on a ratio scale.
PRIMARY LAGGING INDICATORS

- **Average Duration of Unemployment (2)**
  (weeks, inverted)

- **Manufacturing and Trade Inventories (1)** →
  (constant dollars, billions)

- **Commercial and Industrial Loans (1)** ←
  (constant dollars, billions)

- **Ratio of Consumer Debt to Personal Income (1)** →
  (percent)

- **Percent Change from a Year Earlier in Manufacturing Labor Cost per Unit of Output (2)** ←

- **Composite of Short-Term Interest Rates (1)** →
  (percent)

Graph showing various economic indicators over time.
BUSINESS CYCLE CONDITIONS

The percentage of primary leading indicators appraised as expanding this month is unchanged at 75. Three leaders attained new highs and all of the primary roughly coincident indicators are still expanding. Although two leaders were downgraded, overall the data suggest that ongoing expansion is more probable than recession.

The moving averages of three of our primary leading indicators of business cycle conditions reached new highs this month and are appraised as clearly expanding. These are the yield curve index, the ratio of manufacturing and trade sales to inventories and the average workweek in manufacturing.

The yield curve index is based on the spread between the 10-year Treasury note and the short-term federal funds rate. As long as the spread is positive, the index increases. However, if the yield curve inverts, the index will decline. Although the yield curve flattened a bit this month, it did not invert, thus the yield curve index continued to increase.

The moving average of the ratio of manufacturing and trade sales to inventories increased, despite a decrease in the March base data. Preliminary data for April indicate that wholesale sales, which are a major component of this indicator, increased a strong 1.3 percent while inventories rose only 0.9 percent.

The moving average of the average workweek in manufacturing increased and has now been above 41 hours for three months in a row. The last time it topped 41 hours was more than five years ago, in October 2000. By contrast, after the 1990-1991 recession it took less than two years for the manufacturing workweek to rebound to this level.

New orders for non-defense capital goods, a key indicator of business investment in new machinery and equipment, decreased for the second straight month. (This series and all other dollar-denominated series are adjusted for price inflation). The moving average, however, is only two months removed from its most recent cyclical peak: it remains appraised as clearly expanding. The April decline was mostly due to a steep fall in new orders for aircraft, which fell 32 percent (on a current-dollar basis) after rising sharply the previous two months. But even new orders excluding aircraft fell 1.7 percent (in current dollars), including orders for machinery, computers, electronic products, and motor vehicles.

The moving average of initial claims for unemployment insurance (inverted) decreased for the second month in a row, largely due to a budget-related shutdown of the Puerto Rico government during the week ending May 13. According to the Labor Department, the shutdown increased claims by 46,000 during that week, causing the May average to balloon to 333,500; as a result, our inverted series decreased. The impact was temporary and we continue to appraise this series as clearly expanding.

The M1 money supply continues to show no discernable trend. It peaked a year and a half ago and subsequently trended downward, until six months ago. Since then it has increased slightly (and erratically) and it remains well off that earlier peak. The overall decline since 2004 likely reflects the Federal Reserve’s tighter monetary policy since then.

The moving averages of the index of manufacturers’ supply prices increased sharply in May following smaller increases in the prior two months. The index of vendor performance, after five months of decline, also increased sharply. However, both indexes are still well below their most recent peaks in April 2004 and their cyclical trends remain indeterminate.

The data for new orders for consumer goods were revised back to 1992, and the revisions paint a less favorable picture for recent years. Previously reported data showed that new orders increased sharply in 2004 to a new high for the cycle; the revised data show they actually peaked back in 2002. The data for the past six months also were revised downward. The series remains cyclically indeterminate but could soon be downgraded if the recent weakness persists.

We downgraded the cyclical status of the index of 500 common stock prices to probably expanding, reflecting the decrease in the S&P 500 index in May and the continued weakness during the
first half of June. The decline in the equity markets appears to have been partly a reaction to comments by Fed Chairman Bernanke and several Fed regional bank presidents that seemed to imply that the widely expected pause in interest rate hikes at the next Fed meeting would not transpire.

We also downgraded the cyclical status of new housing permits, to clearly contracting. The moving average has decreased by 10 percent from the cyclical peak reached last summer. The monthly base data has decreased even more: it peaked last September and has since fallen by 14 percent. The housing market is experiencing a broad-based slowdown as mortgage rates have ratcheted up during the past year.

The 3-month percent change in consumer debt rose for the third month in a row, indicating that consumer borrowing has accelerated from the exceptionally low rates of last year’s fourth quarter. Even so, consumer debt is increasing at a slower pace than it did in 2004 and much of 2005; the series remains appraised as clearly contracting.

Overall, we downgraded the cyclical status of two leaders and left ten unchanged. The percentage of leading indicators appraised as clearly or probably expanding (among those for which a trend is evident) remains 75 (six out of eight), the same as last month.

The cyclical score, which is based on a separate, purely mathematical analysis of the leaders, increased to 74 from a revised score of 70 for last month. Both the score and the percentage of leaders expanding remain well above 50, suggesting that recession is not imminent.

The six primary roughly coincident indicators all continue to expand, with four reaching new highs for the cycle. All are appraised as clearly expanding. Nonagricultural employment set another record as the economy created 75,000 net new jobs. However, net job creation during the previous two months was revised downward by a total of 37,000 jobs.

The index of industrial production decreased slightly in May, as manufacturing and mining posted declines of 0.1 and 0.2 percent, respectively. Durable goods production was particularly hard hit, falling 0.8 percent.

Personal income less transfer payments rose again, to the second highest level on record. The moving average of manufacturing and trade sales increased to a record high.

The ratio of civilian employment to population increased to 63 percent, a new high for the current cycle and the highest level since October 2001. Finally, the first-quarter increase in Gross Domestic Product was revised upward to an annual rate of 5.3 percent, compared with the previous estimate of 4.8 percent.

Among the primary lagging indicators, the moving average of the average duration of unemployment (inverted) fell slightly in April to 17 weeks. It remains appraised as clearly expanding. The moving average of manufacturing and trade inventories rose in March to a new high, more than reversing the declines posted in the previous two months.

Commercial and industrial loans posted a big gain April, increasing to a new high for this cycle. The composite of short-term interest rates rose to 4.85 percent, reflecting yet another hike in rates by the Federal Reserve. Both series are clearly expanding. There were no new data for the J2-month change in labor cost per unit of output in manufacturing.

Finally, the ratio of consumer debt to personal income reached a new cyclical low in April and is clearly contracting.

The percentage of lagging indicators appraised as expanding remains at 80, unchanged since December. In combination, the three groups of business cycle indicators point to continued growth for the balance of 2006.

### Statistical Indicators of Business-Cycle Changes

<table>
<thead>
<tr>
<th>Change in Base Data</th>
<th>Primary Leading Indicators</th>
<th>Cyclical Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb.</td>
<td>Mar.</td>
<td>Apr.</td>
</tr>
</tbody>
</table>