# The Auto Industry Can Help Build New Nuclear Plants

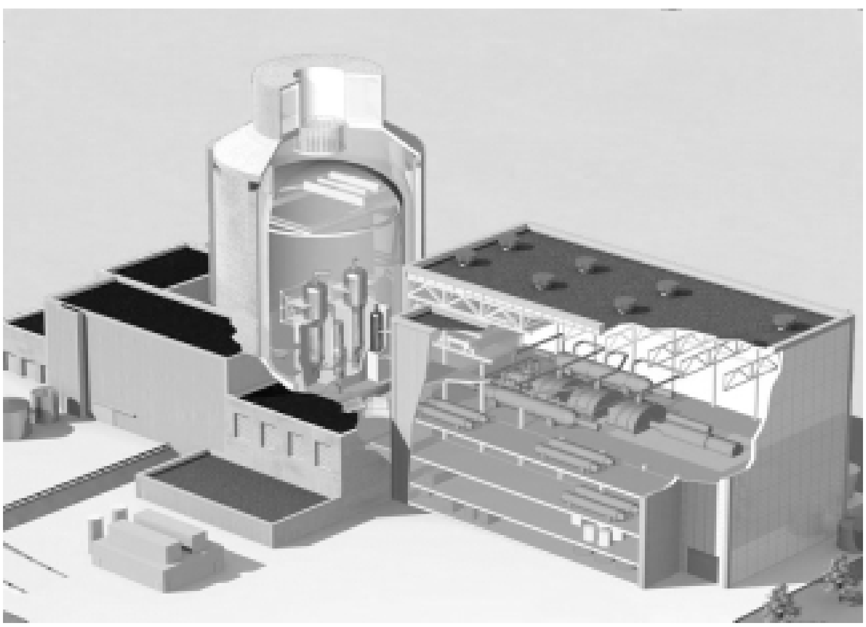
by Marsha Freeman

The recent shift in economic policy by the leadership of the Democratic Party, toward a return to the approaches of Presidents Franklin Roosevelt and John F. Kennedy, poses the question: To rebuild the economy, what infrastructure projects must be at the top of the nation's agenda? First, are the immediate critical needs, such as the rebuilding of the ravaged Gulf Coast. Beyond that, the deficit in basic U.S. infrastructure, such as safe bridges and roads, and modern transportation and clean water systems, is in the trillions of dollars.

But as the mobilization gets under way to bring infrastructure up to a level that can support the economic revitalization of the nation, the first bottleneck that will be faced, will be a shortage of electric power. The growth of electricity consumption reached 7% per year during the 1960s, when President Kennedy's program to land a man on the Moon provided the science-driver to upgrade the productivity of the entire economy; however, for the past two decades, U.S. electricity growth has been an anemic 1-2% per year. That meager increase has been fueled largely by "commercial" expansion, of shopping malls and entertainment centers, while industrial consumption of energy continues to fall as industry shuts down.

Were the United States to begin to take the necessary steps to electrify its railroads, build new, more advanced urban mass transit systems, move to hybrid cars, or in any way increase demands upon industry for basic materials and capital goods, there would not be sufficient electric generating or distribution capacity. In parts of the country, such as the Northeast and West, there are already threats of shortages, even under current economic depression conditions.

The United States currently has 103 operating nuclear power plants, which provide approximately 20% of the nation's electricity. Before the sabotage of nuclear power projects in the late 1970s, the plan was to have a thousand plants on line by the year 2000. Even just to maintain nuclear energy's paltry 20% of U.S. electric power, close to 100 new reactors will have to come on line in the next two decades. To rebuild infrastructure and upgrade U.S. productivity, while shutting down both inefficient, aging plants and those burning precious (and increasingly expensive) natural gas, hundreds more will have to be built.



Westinghouse

*A cutaway view of the next generation Westinghouse AP 1000 reactor, which has been designed with approximately 600 modules. This approach will allow converting sections of the auto industry into building modular components for new nuclear plants, as well as other much-needed infrastructure.*

The U.S. auto and machine-tool industries are now in the throes of the greatest destruction of human and physical capital in American history. This path of self-destruction began in the late 1960s, when the majority of the 400,000 highly skilled engineers and manufacturing workers in the aerospace industry lost their jobs, as spending for the Vietnam War, and "limits to growth," destroyed the post-Apollo future of the space program.

A decade later, the United States shut down much of its nuclear industry, capitulating to the hysterics of the Wall Street-funded environmentalist movement, and the overall anti-technology pessimism that the Congress for Cultural Freedom had spent decades cultivating. Today, the United States cannot even manufacture all of the components for a new nuclear plant.

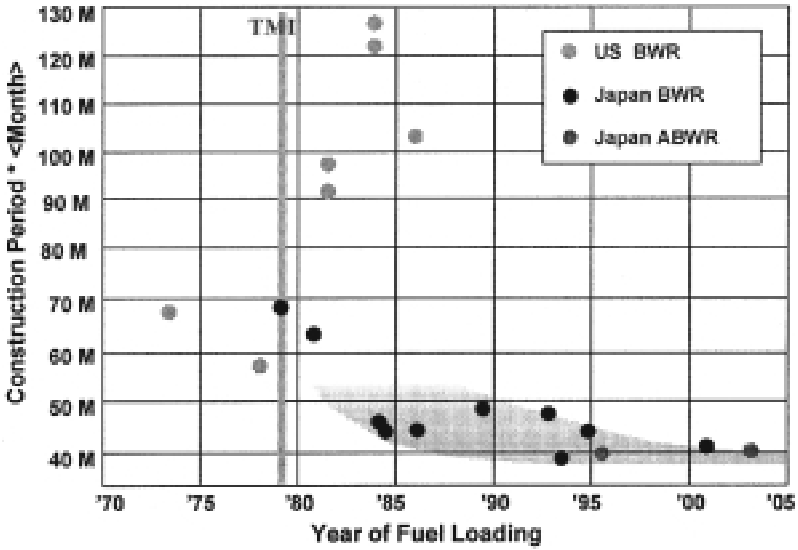
At the end of the 1980s, and the fall of the Soviet Union in 1991, the contraction in military and aerospace spending was supposed to be replaced by a "peace dividend" to keep leading-edge technologies in the civilian pipeline. It never materialized. A quarter of a million aerospace engineers lost their jobs, in California alone.

This country is now at the end of the line. The U.S. auto industry embodies the greatest concentration of mass production capacity, the most highly skilled production and machine-tool operatives, and the greatest flexibility in production mix, in the national economy.

Policymakers in Washington are considering how to deal with the crisis in auto. They must put forward a plan to convert the capacity that is not needed to manufacture cars, into rebuilding American infrastructure. And that must include components for new nuclear power plants.

FIGURE 1

**Trends in Time Required To Build Nuclear Plants in the United States and Japan**




Source: ABWR Cost/Schedule/COL Project at TVA's Bellefonte Site, DE-AI07-04ID14620.

*This chart demonstrates the reduction of the time required in Japan, since the Three Mile Island (TMI) incident, to build nuclear Boiling Water Reactors, and Advanced BWRs, compared to that of the United States. No nuclear power plant construction began in the U.S. after the Three Mile Island incident in 1979.*

## Not Your Father's Nuclear Plant

The United States' nuclear industry, and indeed those of all nuclear-supplier nations, would not even exist today, were it not for the dramatic move into nuclear energy in Asia since the mid-1980s. Since that time, 9 nuclear plants have been built in China, 8 in India, 24 in Japan, and 14 in South Korea. These projects have allowed the nuclear industry to maintain many of the critical skills and manufacturing capabilities that would otherwise have disappeared.

The prospect of the continued growth of nuclear energy in Asia, the construction of a new nuclear plant in Europe (in Finland), and the more recent optimism of a nuclear renaissance in the United States, have motivated the worldwide nuclear industry to improve technology and develop what are referred to as Generation 3+ reactor designs.

The newest operating nuclear plants incorporate standardized and simpler designs, are passively safe, have shorter construction times, require less frequent maintenance, and operate at higher efficiency.

A number of detailed studies have been undertaken recently, with support from the U.S. Department of Energy, to examine what further improvements can be made for the new nuclear power plants that will be built. The results are impressive. And the recommended modularization of the components for standardized designs, and mass production required to produce not one or two, but dozens of new nuclear plants, creates the opportunity to turn abandoned auto and machine-tool factories into the engine for nuclear power.

The nuclear plants now operating in the United States were built on a one-of-a-kind basis, with an average construction time of 66 months, or five and a half years, for those plants completed by 1979. This was comparable at that time, to construction schedules in Japan.

But 1979 was a watershed for nuclear power, as the accident at the Three Mile Island plant in Pennsylvania was used to assault the nuclear industry. Anti-nuclear ideologues were allowed to strangle the industry and utilities with onerous new regulations, many of which are now recognized as having been an "over-reaction" to the accident. Those regulations, plus the paralysis of projects through specious challenges in the courts, and then-Federal Reserve chairman Paul Volcker's double-digit interest rates, led to construction times of up to ten years, and the end of building new nuclear plants. In Japan, continuous improvements have been made in construction processes; now a 40-month schedule has become the Japanese standard. (See **Figure 1.**)

In 2004, the Department of Energy released a report on the "Application of Advanced Construction Technologies to New Nuclear Power Plants."[1] The technologies considered

1. "Application of Advanced Construction Technologies to New Nuclear Power Plants," Sept. 24, 2004, MPR-2610.

were those developed since the last American plant had gone on line about a decade earlier. Some lessons were learned from the more recent projects in China, South Korea, and Japan.

Thirteen technologies were considered and nine were considered "sufficiently mature" to be implemented, and to provide immediate economic benefits.

The technologies that do not require further research and development, include robotic welding, already used in Japan, China, and France for nuclear components; applying Global Positioning System satellite navigation technology to site preparation, which is used worldwide for precision positioning in large infrastructure projects; laser scanning for process control; and precision explosives to replace slower mechanical excavation methods, which were used in the building of the Millstone Unit 3 nuclear plant.

One of the three technologies which the report described as needing some additional development, but which would have potentially the largest impact on construction schedule reduction, is quite suitable for implementation in the auto industry—the prefabrication, pre-assembly, and modularization of nuclear plant components. This approach is already used in Japan and China, and in building U.S. fossil fuel plants, nuclear powered aircraft carriers, and submarines.

Prefabrication is a manufacturing process, where materials are joined to form a component part. Pre-assembly is a process by which various materials and prefabricated components are joined together for subsequent installation as a unit. A module, formed from a series of assemblies, is the transportable unit taken to the work site, and then placed in position. All of these production steps are already carried out in high volumes today in specialized auto parts and assembly plants in order to produce cars. Since each nuclear plant will also require high-volume production of many components for modules (see **Table 1**), such production is perfectly suited for auto-type mass production.

Modularization shifts many construction activities away from a cluttered field site, to an off-site fabrication shop, which will require new manufacturing facilities. The application of high-volume mass production techniques, means various segments can be worked on in parallel, and reduces downtime due to weather challenges. It is estimated that at least five months can be shaved from the schedule of nuclear power plant construction using modularization.

The next-generation nuclear plants will incorporate even more modular design and fabrication. Construction experience with General Electric's Advanced Boiling Water Reactor (ABWR) in Japan and South Korea, using structural modules, will be improved upon in GE's next-generation Economic Simplified Boiling Water Reactor. GE has identified 15 different module types for their new construction approach.

Similarly, Westinghouse has designed its AP600 and larger AP1000 reactors with modules as an integral part of the concept. There are approximately 600 modules in the design, some of which include all major pipe areas, electrical equipment, and structural modules, containing ready-built stairs, platforms, floors, etc.

The report cautions that facilities "may not be adequate to fabricate modules at the rate required"; a perfect opportunity to convert now-idle auto parts producing facilities to manufacturing for the nuclear industry.

TABLE 1

**Large-Volume Components for a New Advanced Nuclear Plant (1200-1500 MW range)**

| Equipment | Number (Range) | Comments |
|---|---|---|
| Pumps, large | 71-100 | |
| Pumps, small | 80-484 | |
| Tanks | 49-150 | from 600-150,000 pounds |
| Heat exchangers | 47-104 | All sizes, types, material 2,100-250,000 pounds |
| Compressors, vacuum pumps | 12-26 | |
| Fans | 61-123 | 600-45,000 pounds |
| Damper/louvers | 730-1,170 | |
| Cranes and hoists | 25-50 | |
| Diesel generators | 2 | 10 MWe |
| Prefabricated equipment modules | 64-133 | Preassembled packages including mechanical equipment, piping, valves, instruments, wiring, etc. |
| Instruments of all kinds | 1,852-3,440 | |
| Valves of all kinds | 9,633-17,891 | |

Source: *U.S. Job Creation Due to Nuclear Power Resurgence in the United States,* Volume 2, page A-125, November 2004, Idaho National Engineering and Environmental Laboratory.

## TVA Case Study

In August 2005, a study was completed by the Tennessee Valley Authority, Japan's Toshiba Corp., General Electric, U.S. Enrichment Corp., Bechtel Power Corp., and Global Nuclear Fuel-America, to determine how today's most advanced technologies could be applied to a specific project—the construction of an additional two units at TVA's Bellefonte site in Alabama.[2] The General Electric ABWR design was chosen, because such units have been built and are in operation in Japan and Taiwan, and it has been certified for use in the United States.

During the study, Toshiba and GE identified 66 improve-

2. "ABWR Cost/Schedule/COL Project at TVA's Bellefonte Site," August 2005, DE-AI07-04ID14620.

ments that could be made in the design and construction techniques, many of which incorporate those recommended by the DOE study the previous year. The improvements resulted in a schedule for each new Bellefonte plant of 40 months. One of the major factors in the schedule reduction is the extensive use of modularization. The report points out that this is particularly well suited to the Bellefonte site, since it is located on a navigable waterway. One of the challenges to using modular components will be the ability to transport them to the reactor construction site, considering the state of the nation's broken down transport system.

The study points out that additional improvements could bring the time to build a new nuclear plant below the 40-month mark. The study assumed that Toshiba, in Japan, would be supplying the nuclear reactor pressure vessel and internal components, because they no longer can be manufactured in the United States, a situation that must be rectified.

It is not only the auto industry and its skilled workforce that would benefit from the revival of nuclear plant construction. The TVA study concluded that at the construction peak at 30 months, 4,500 craft personnel would be on site. This includes 1,800 pipe fitters and 1,100 electricians, for each plant. Over the course of the project, $938 million would be spent on labor costs, with wages ranging between $29.58 and $41.38 per hour.

An earlier study, carried out by the Idaho National Engineering and Environmental Laboratory (INEEL),[3] considered broader job creation through the construction of the first approximately 40 new nuclear plants. The report assumed a five-year construction period, and stretched out the deployment of the plants from 2009 through 2020.

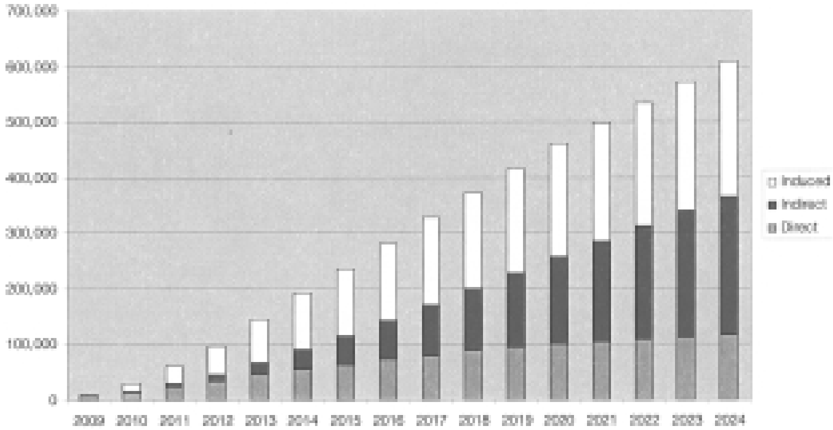
Although this timescale is unrealistic in terms of what is necessary, the data presented are a useful benchmark. A more aggressive schedule, where more plants were under construction simultaneously, would require more manpower.

The report examines various categories of jobs created. They include manufacturing jobs that would be repatriated from abroad; direct construction jobs and permanent jobs for power plant operators; indirect jobs for outside goods and services, which include nuclear fuel, maintenance and repair services, management and consulting; industrial machinery, pipes, valves, and pipe fittings; research and testing; and other services.

3. "U.S. Job Creation Due to Nuclear Power Resurgence in the United States," November 2004, INEEL/EXT-04-02384.

FIGURE 2

**Increase in Cumulative Direct, Indirect, and Induced Jobs, U.S.A.**




Source: Idaho National Engineering and Environmental Laboratory.

*Construction of the first 40 1,200 MW nuclear power generation units, by the year 2024, would dramatically increase the number of new jobs that would be generated in the U.S. economy.*

Induced jobs are non-nuclear industry employment created by the jobs added in the above categories. An example cited is a study of the economic impact of the Indian Point nuclear plant in New York, which created 918 induced local jobs (such as school teachers and home construction workers), 1,132 induced jobs in New York State, and 5,125 across the United States.

The INEEL report projects that to build the 40 or so plants, approximately 38,000 jobs that were previously lost, either to offshore companies or attrition due to the contraction of U.S. industry, would be repatriated. But this pales by comparison to the 79,000 new construction and operations jobs that would be created, plus 38,000 manufacturing jobs. As many as 250,000 indirect jobs would "ripple through the U.S. economy," the report states, and create an additional 242,000 jobs. A total of nearly 610,000 new, mainly skilled jobs, would be added to the economy. (See **Figure 2.**)

There are constant complaints that this country is dependent upon, and can be held hostage to, foreign energy suppliers. All we need do is to electrify much of the transportation that uses liquid petroleum fuels. We must electrify the railroads; replace wasteful short-haul air travel with magnetically levitated, and high-speed rail electric transport systems; replace mind-numbing car commutes with urban mass transit; and develop the next-generation high-temperature nuclear reactor technologies that will make it economical to produce hydrogen from water.

To do this, hundreds of nuclear power plants will have to be built. To do that, the mass production capabilities of the auto industry will be required.