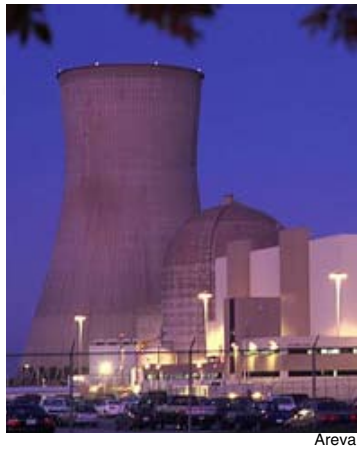
Stimulate The Economy: Build New Nuclear Plants!

by Marsha Freeman

NPCIL

Nuclear plants are the most capital-intensive investments made in the utility sector, and they produce millions of times more power in terms of energy flux density than any other power source. Here Units 5 and 6 of Nuclear Power Corporation of India Ltd.'s Rajasthan nuclear power plant under construction in Rajasthan state.



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Nuclear power is essential for the United States to recover from the ongoing breakdown crisis and become economically productive again.

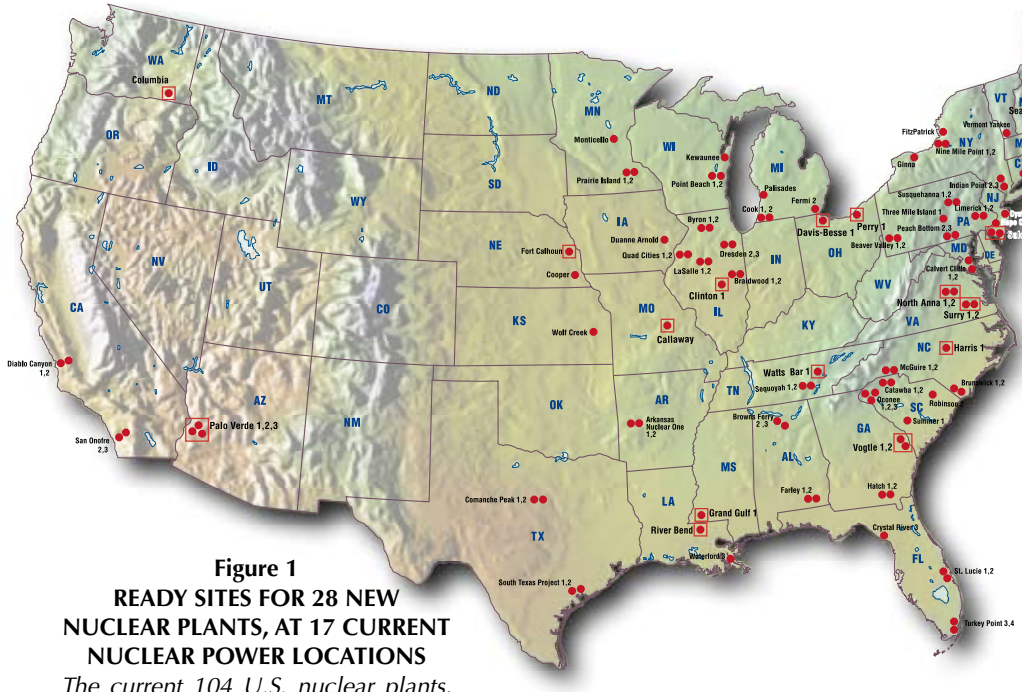
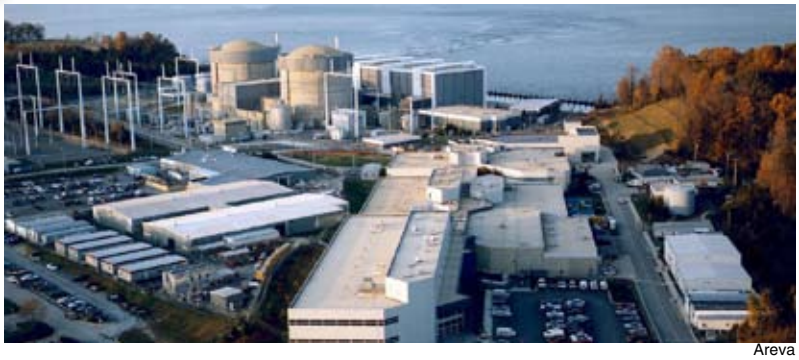


Figure 1
READY SITES FOR 28 NEW NUCLEAR PLANTS, AT 17 CURRENT NUCLEAR POWER LOCATIONS
The current 104 U.S. nuclear plants, with sites for new plants indicated.

Source: Nuclear Energy Institute



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"Shovel ready": Two of the sites at existing nuclear plants where new plants can be built. Above, Calvert Cliffs in Maryland, where UniStar Nuclear Energy has proposed to build a third nuclear plant. Above right, the Callaway Plant in Missouri, where AmerenUE plans to build a second plant.

While policymakers in Washington try to determine how an infusion of Federal funds should be vectored toward an economic recovery, certain fundamental principles must be at the basis for decision making.

At the present time, no attempt to pull the U.S. banking system out of a bottomless bankruptcy will be successful without a return to the U.S. Federal budget to capital budgeting rules. All reorganization of bankrupt institutions must be premissed on that general rule. This

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The core of a nuclear reactor. Today, the United States has to import large nuclear components like this one, because the nuclear manufacturing industry here has all but shut down.

means that assets which meet the standard for chartered national or state banks will be protected as if Glass-Steagall rules had been still in effect.

After the financial sector is put through bankruptcy reorganization, and the fanciful financial instruments commonly known as "toxic waste" are put to one side, so as to make no further claim on the good faith and credit of the United States, the nation can return to its Constitutional duty to initiate internal improvements, in order to promote the general welfare.

It is necessary to ensure that the basic needs of the population are met, through short-term measures, such as moratoria on housing foreclosures, extended unemployment benefits, and broadened health care insurance, and that bankrupt states continue to provide basic services for their citizens.

But economic growth will depend upon trillions of dollars of Federal investment that ameliorate the immediate situation *by laying the basis for the long-term increased productivity* of the economy, as a whole. It is not a question of simply creating jobs, but increasing the capital-intensity of the economy, and raising the productive level of the nation's workforce. This is the function of investments in basic economic infrastructure.

There will be no economic recovery, or growth, without a massive expansion and upgrading of the nation's energy supply and distribution system. Contrary to "popular opinion," which has been shaped by scam artists like T. Boone "Windbag" Pickens, and "green" ideologues like Al Gore, only a massive expansion of nuclear energy can provide the quality and quantity of energy that a 21st Century economy requires.

Although the first tentative steps have been taken by electric utilities to restart the construction of new nuclear power plants, with more than two dozen reactor license applications filed with the Nuclear Regulatory Commission, this "renaissance" in nuclear power will not materialize without a Federally directed "stimulus." Similarly, the disappearance of the U.S. nuclear manufacturing industry has begun to be reversed, but the reconstitution of a nuclear industry, based on the most modern power plant designs and advanced manufacturing techniques, will not happen without a nationally directed effort.

For decades, the mass-production auto industry, and its component manufacturers, created one out of every thirteen industrial jobs in the United States. This was the reservoir of the nation's machine tool design and industrial engineering talent. The industry, which now lies in ruin, must be retooled and mobilized to recreate a nuclear manufacturing industry.

For the past three years, the Congress, led by mis-leadership Nancy Pelosi and her supporting cast of Anglo/Dutch/Wall Street financiers, sabotaged the initiatives by Lyndon LaRouche, to bankrupt and reorganize the banking system, and redirect credit to retool the auto/machine tool industry.

LaRouche has called for the creation of a Federal corporation to assume, employ, and expand the idled portion of the machine tool and auto manufacturing industry, not to produce more cars,

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A new reactor vessel head, built by the French company Framatome for Virginia's North Anna nuclear plant, as it is loaded for air transport in 2003.

Japan Steel Works

A nuclear pressure vessel component at Japan Steel Works. JSW produces more than 80 percent of the heavy forgings needed for nuclear power plants, and there is a four-year waiting list for its forgings. Pictured is the 80-ton bottom "petal" of a reactor pressure vessel.

Japan Steel Works

The main cylinder of a JSW steel forging press, which weighs 77 tons.

but high-speed rail and magnetically levitated (maglev) transport systems, advanced nuclear power plants, desalination plants, and water control and navigation infrastructure. On January 4, he described it as a "50-year, $1 trillion-a-year technology and machine tool mission."

Why a 'Stimulus' Is Needed

There is no possibility that the dozens of nuclear power plants that need to be started immediately, will be built without Federal support.

Contrary to widespread miseducation of the public during the recent 40 years, there can be no recovery of the U.S. economy from its presently ongoing breakdown without a capital-intensive mode which places heavy emphasis on the included role of nuclear power installations.

The electric utility industry is the most capital-intensive sector of the U.S. economy, and nuclear power plants are the most capital intensive investments made in the utility sector. Nuclear reactions produce the most energy-dense form of energy; thousands-fold more dense than so-called renewables.[1] To produce usable energy from fission reactions, requires highly skilled labor for the construction and then operation of the plant, and high-quality nuclear-certified materials and components. The majority of the cost of nuclear energy is the construction of the plant. Because the amount of energy-dense fuel used is minimal compared to any fossil fuel, the operating costs are modest.

Today, utilities planning to build new nuclear plants do not have billions of dollars of cash on hand for this investment; they must raise capital, and it is Wall Street which sets the terms by which companies can borrow money. High interest rates on borrowed capital can put nuclear power plant costs out of reach.

On Dec. 9, 2008, documents sent to the Nuclear Regulatory Commission revealed that the Tennessee Valley Authority (TVA) estimated that the updated cost of building two new nuclear power plants was in a range of $9.9 to $17.5 billion. This was *more than double* the original cost estimate, largely because of last year's artificially created hyperinflationary rise in the price of steel, concrete, metal and copper wiring, and other materials.

Responding to queries and disbelief from TVA's customers that they would have to bear the burden of that inflated cost, Terry Johnson, a TVA spokesman, had a proposal on how to lower it. He explained that if the TVA built the new plants *without having to pay interest on a loan*, they would cost $4 billion to $5 billion per unit, or about half.

Last June, the accounting firm Ernst & Young released research that had been commissioned by the British government, which similarly found that the cost of *financing* construction of a new nuclear plant amounts to about *55 percent* of the final cost of electricity. Bring down the interest rate, and the cost can be cut in half.

As commercial credit has been all but frozen, interest rates have risen, putting a further strain on electric utility investments. On Dec. 17, 2008, it was reported that the Virginia Electric and Power Company paid an interest rate of 8.875 percent to sell $700 million of 30-year bonds, which was up from 6.35 percent the year before. This rise in interest rates adds hundreds of millions of dollars to any nuclear power plant cost.

The solution is to create a Federally chartered corporation, which will extend long-term credit, with a maximal 2 percent interest rate, for the most efficient construction of new nuclear plants. It is not important how much these power plants cost, per se; it is critical that they get built.

As the financial system has imploded, it has become less and less possible for U.S. utilities to gain access to credit *at any cost*. This credit crisis has become so severe, that last year, the Japanese government was asked by the Secretary of the U.S. Department of Energy to study the possibility of using the resources of the Japan Bank for International Cooperation and Nippon Ex-

1. For details on energy flux density comparisons, see Laurence Hecht, "The Astounding High Cost of 'Free' Energy," http://www.21stcenturysciencetech.com/Articles %202008/Energy_cost.pdf.

Brookhaven National Laboratory

To be really "smart," the U.S. electric grid needs modernization with advanced technologies, like superconducting cable. Here, Brookhaven National Laboratory researchers (from left) Vyacheslav Solovyov, Tom Muller, and Masaki Suenega, who developed a high-temperature superconducting cable that uses less wire but conducts five times more power than traditional copper cable. The cables, now being tested in Long Island's power grid, use the so-called first generation superconducting composite wires, made of a bismuth-calcium-copper-oxygen/silver compound.

port and Investment Insurance to support construction of nuclear plants in the United States!

To make matters worse, utility revenues have been declining, along with the productive economy as a whole. Houses that go into foreclosure no longer use electricity. Nor do empty factories. The millions of people who have lost their jobs have cut back on their use of energy, to try to save money.

People who are still employed, or still receiving their pension or Social Security checks, have also had to cut back. Over the first half of 2008, through pure speculative manipulation, primary energy costs spiraled out of control. Utilities raised rates in order to recover the hyperinflated costs they were paying natural gas and coal suppliers.

As utility rates increased, an increasing number of residential customers went into arrears, unable to keep up their payments. At the end of the 2007-2008 winter heating season, in April of last year, almost *40 million* residential consumers held nearly *$8.7 billion* in past-due utility accounts. A survey by the National Association of Regulatory Utility Commissioners reported that in calendar year 2007, 8.7 million residential consumers had their electricity or natural gas service *terminated*, due to nonpayment of bills.

Nothing Smart About 'Smart Grid'

The capital investment that is urgently required to increase generating capacity, move into next-generation high technology systems, and increase the capacity of transmission lines, is grinding to a halt.

While the Congressional economic "stimulus package" includes funding for what is described as a "smart" electric grid, do not mistake this so-called "modernization" for what is required. This "smart grid" would run time backwards—to "re-engineer" the grid to accommodate small, inefficient, unreliable, and intermittent "renewables" projects, such as wind power, solar energy, and biomass. Such a "redesign" of the grid will increase instability in the power supply, and lower the reliability of our transmission network.

The application of Internet-like communication and control technologies, touted as part of the "high technology" thrust of the stimulus plan, is simply a way for consumers to police themselves, to "adjust their energy use," meaning cut back, when they see they are using more energy than they will be able to pay for. Other "automatic control" systems would allow the utility to shut off electricity delivery when demand is too high, which, according to the environmentalists, is the alternative to building new power plants to meet demand.

The electric grid *does* need to be modernized and expanded. The incorporation of technologies such as superconducting cable, where transmission capacity is increased multiple-fold, is being done only on a small, pilot basis. This is the kind of leap in transmission technology, which would create a real "21st Century" grid.

A Federal Corporation to Rebuild Industry

Were all of the necessary steps taken to create the policy and credit to jump start nuclear power plant construction, the nuclear renaissance would still be stalled. At the present time, there is not the manufacturing capacity to build more than a handful of new nuclear power plants per year *worldwide*.

For nearly 30 years, no new nuclear power plant has been ordered and completed in the United States. From the mid-1970s through the mid-1980s, more than 100 nuclear power plants on order were cancelled. Today's 104 operating U.S. nuclear plants are not even a pale shadow of the "2000 by 2000" plants that the nuclear community expected to be in operation by the turn of the century, nine years ago.

By the mid-1980s, the U.S. nuclear manufacturing industry had all but disappeared. Today, not even one nuclear power plant could be built in the United States, without importing some of the largest and most important components from abroad.

But this is not just a crisis facing this country. Excluding Russia, which builds complete nuclear plants indigenously, and China and India, which are constructing the factories to also be able to do that, the rest of the world depends upon a small handful of major suppliers, which, with the upsurge in orders globally, is now stretched to the limit of its capacity.

Nuclear Regulatory Commission chairman Dale Klein observed in an Oct. 27, 2009 speech on the need to rebuild the nuclear manufacturing industry: "We can't make a living cutting one another's hair. At some point, you've got to make things. You can't be a total service economy." In the 1970s and 1980s, he explained, there were about 500 U.S. companies with what is called a nuclear stamp. This certifies that they meet the strict standards to manufacture nuclear plant components. Today we have 100 such companies.

As the most dramatic example, Japan Steel Works (JSW) is the only company in the world, outside of Russia, that makes the

TVO

Steam turbine at TVO's Olkiluoto nuclear power plant in Finland. Olkiluoto is a Swedish-built boiling water nuclear reactor, where steam goes directly from the reactor to the turbine.

massive forgings needed for full-sized nuclear pressure vessels, and other large components.

The ultra-heavy nuclear forgings, up to 600 tons in weight, which house the nuclear reactor core, are then machined, which is now done in a handful of plants, such as that at Chalon/Saint Marcel in northern France, of nuclear giant, Areva. Currently, JSW has a four-year waiting list for vessel forgings. Nuclear vendors planning to build new plants are now in a bidding war to make down-payments to JSW in order to reserve their place in line.

Early last year, JSW announced a $523 million expansion plan, to double its forging capacity by mid-2011. This would enable it annually to produce 8 reactor pressure vessels, and associated components, such as steam generator parts and turbine motor shafts. At the end of last year, JSW announced a second, $314 million expansion phase, to triple capacity to 12 units per year.

Recognizing that JSW's tripled capacity will not come close to meeting the global need, and that shortages of other components are almost as severe, a number of companies are planning to enter, or in some cases, reenter, the nuclear supply industry.

U.S. manufacturers which let their nuclear stamps expire are renewing their certificates. For example, Chicago Bridge and Iron (CB&I), in the past built 75 percent of the nuclear power plant containment vessels in the United States, and more than 130 worldwide, as well as 41 pressure vessels for nuclear plants. Last year, CB&I renewed its nuclear stamp. CB&I announced in October that it had been awarded a contract by Westinghouse to build two containment vessels. It plans to start fabrication of the Westinghouse units this year, with completion scheduled for 2014 and 2015.

Future nuclear powerhouses—China and India—are preparing to enter the large forgings industry. China's Harbin Boiler Works, Dongfang Boiler Group, and Shanghai Electric Group are in this category. India's Larsen & Toubro hopes to export forgings in the future, in addition to serving the Indian domestic nuclear market.

South Korea's Doosan Heavy Industries announced last May that it had completed its program to become self-sufficient in nuclear power technology, a national project begun in 2001 to manufacture plants independently. A month later, Doosan signed a contract with Westinghouse to supply equipment for new reactors in the United States. It also announced plans to spend $395 million by the end of 2011 to increase production capacity for castings and forgings.

Sheffield Forgemaster, in England, won a contract on Sept. 2, 2008 to produce nuclear-grade steel components for new Westinghouse reactors that are being built in China. Two months later, Westinghouse ordered components for new reactors that are being planned for North and South Carolina. Now, the British government is considering a $45 million financial package for Sheffield, to enable it to purchase a larger press and increase the scope of nuclear components that it can manufacture.

Since a 1722 decree of Peter the Great, manufacturing plants

Areva

Tubing for a nuclear steam generator being manufactured at the Chalon Saint Marcel plant in France. Production capacity for smaller nuclear components must be geared up worldwide.

Areva

A reactor coolant pump on the production line at France's Jeumont Plant. Each plant requires 70-100 pumps, which will require factories for mass production.

LARGE-VOLUME COMPONENTS FOR A NEW ADVANCED NUCLEAR PLANT (1,200-1,500 Megawatt 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: *US. Job Creation Due to Nuclear Power Resurgence in the United States*, Volume 2, page A-125, November 2004, Idaho National Engineering and Environment Laboratory.

that are part of the Izhora group have produced parts for ships for the Russian Navy. Today, the Uralmash-Izhora Group, (OMZ), or United Machine Building Plants, is Russia's leading company for the production of specialty steels and equipment and machines for the nuclear and other heavy industries.

Over the past decades, OMZ has supplied reactor containment vessels for more than 60 plants in Russia, countries of the former Soviet Union, India, China, and Iran. It is producing the containment vessels for the first floating nuclear plants in the world, which are being built in Russia.

More than a year ago, OMZ embarked upon a plan to modernize and expand its manufacturing capabilities. That five-year plan, costing hundreds of millions of dollars, will double its capacity, allowing Russia to meet its own ambitious nuclear build plans, to commission at least one new nuclear plant *per year*, as well as to export reactors globally.

Forges in the Czech Republic are considering retooling, to be able to produce pressure vessel forgings in two years. Additional Japanese heavy industry giants, such as Mitsubishi Heavy Industries, are planning expansions.

As impressive as some of these projects may be, they are a drop in the bucket compared to what is necessary. We must build new nuclear power plants as quickly as we can, everywhere in the world.[2] This cannot be done without a mobilization of the talent and potential industrial capabilities of the United States.

Auto to Nuclear

In the 1970s, the United States had an extensive nuclear industry, in breadth and depth, with the capacity to work on more than 100 nuclear plants simultaneously, in various stages of planning, engineering, design, and construction. That magnitude of capability must be recreated as quickly as possible.

Four years ago, Lyndon LaRouche outlined how the auto/machine tool industry should be retooled to be able to manufacture desperately needed infrastructure. Considering that six months after the start of World War II, auto parts-producing and assembly plants were manufacturing tanks, airplanes, and ammunition, this is absolutely doable.

Since 2006, more than 30 million square feet of machine tool and manufacturing capacity in the auto and related industries have been idled. More than 300,000 jobs have been lost. It is clear that reopening those plants to produce millions more cars is folly. As the reservoir of much of the engineering, design, and skilled labor resources of the United States, the auto and machine tool industries must be retooled to take the lead in rebuilding energy infrastructure.

The application of the skills of existing machine tool shops to develop the machines to convert the auto factories to nuclear manufacturing is the first step. The production of nuclear power components has been made simpler by the move from one-of-a-kind nuclear plants, typical of the 1970s and 1980s, to standardized designs and modular construction techniques.

Modular production is the approach being used in Japan, where on-site construction time has been reduced to 36 months. Integrated modules are mass produced in factories and transported to the construction site, where they are assembled. In Europe, nuclear companies expect that 18 months could be chopped off the standard construction time if modular methods,

2. Massachusetts State Nuclear Engineer James Muckerheide gives some of the dimensions of what's needed in "How to Build 6,000 Nuclear Plants by 2050," http://www.21stcenturysciencetech.com/Articles%202005/ Nuclear2050.pdf

similar to those used to build offshore oil platforms, are used for nuclear plants.

In August 2008, Westinghouse and Shaw signed a letter of intent to create a joint venture, called Global Modular Solutions LLC, for the fabrication and assembly of modules for Westinghouse AP1000 nuclear reactors. The improved AP1000 has been designed to be built with approximately 600 such standardized modules. The factory will be built at the Port of Lake Charles, Louisiana, to produce structural, piping, and equipment modules. It is scheduled to begin operating in the third quarter of this year and will employ 1,400 people. The plant will support the construction of two reactors per year. This modular approach is perfectly suited to a retooled auto/machine tool industry.

There are numerous components required for nuclear power plants that are suitable for large-scale mass production, preassembly into components, and then assembly into modular units. The Table indicates some of these large-volume components, including prefabricated equipment modules. Individual modules might comprise piping, electrical equipment units, structural elements, and even ready-built stairs and platforms for on-site assembly.

Smaller Reactors for Smaller Grids

Many of the new nuclear plants will be produced for deployment in nations that do not have large concentrations of population, or in-place electric grid systems. Large-scale, 1,000-megawatt plants will not be suitable there. Next, or fourth-generation reactors, will be designed in a variety of sizes, and by operating at higher temperatures than today's conventional plants, will bring desalination and other benefits to populations, in addition to electricity.

Professor Andrew Kadak, at the Nuclear Science and Engineering Department at the Massachusetts Institute of Technology (MIT), has supervised a student project, begun in 1998, to develop a conceptual design for a high-temperature pebble bed nuclear reactor that could be economically produced in small sizes for developing nations.

Mitsubishi Heavy Industries

A nuclear steam generator in transport. Mitsubishi delivered two replacement steam generators for the San Onofre nuclear plant in California in February, each weiging 580 metric tons and housing about 10,000 heat transfer tubes.

The students have focussed not only on the nuclear technology, but also how to build them most economically. In the MIT modular design, component manufacturers would provide all components, piping connections, electric power connections, and electronics to fit in a standard steel "space frame." The frames would than be assembled at the plant site, some components using a "lego-like" assembly process to bolt them together. In addition, modules could be replaced rather than having parts repaired, greatly reducing maintenance costs and down time. (See Figure 2).

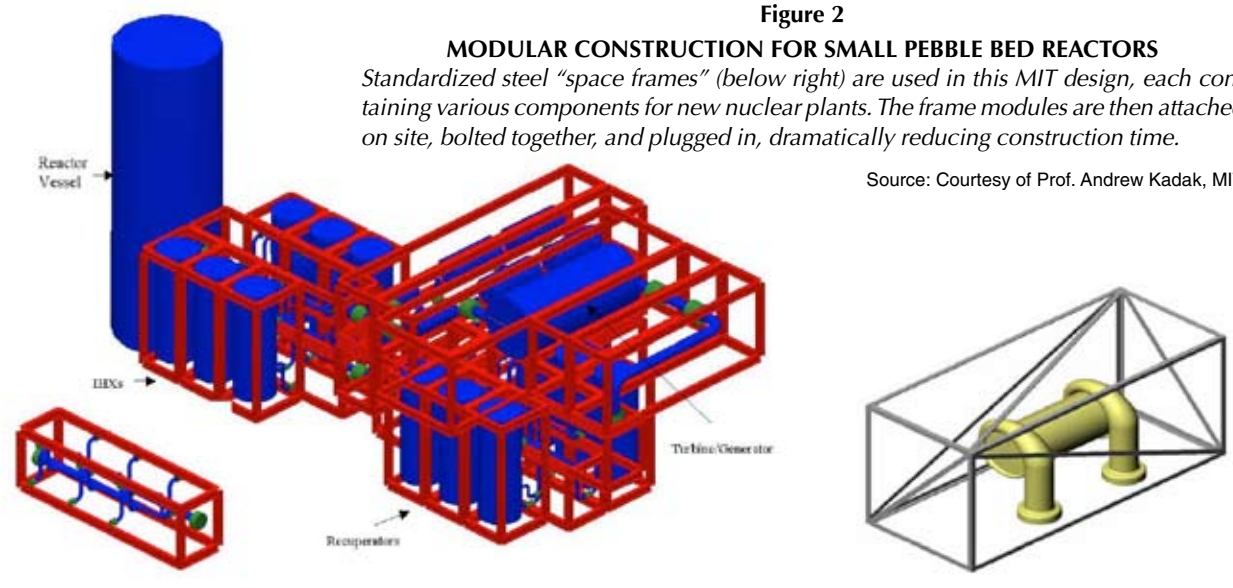
In this study, the constraint on size in transporting modules was a critical factor in the design. In order to be able to deliver components for the 120-megawatt reactor, not only by barge, but by truck or rail, an upper limit was imposed, of 200,000 pounds weight, with maximum dimensions of 8 × 12 × 60 feet.

Figure 2

MODULAR CONSTRUCTION FOR SMALL PEBBLE BED REACTORS

Standardized steel "space frames" (below right) are used in this MIT design, each containing various components for new nuclear plants. The frame modules are then attached on site, bolted together, and plugged in, dramatically reducing construction time.

Source: Courtesy of Prof. Andrew Kadak, MIT



Doosan Heavy Industries

This nuclear reactor vessel, built by Doosan Heavy Industries in South Korea, is for the Qinshan phase 2 nuclear power station in the Chinese province of Zhejiang. South Korea now has the capability to manufacture nuclear plants independently, and is ready to export.

For their current reactor design, 27 modules are required, each of which is rail and truck transportable.

The Manpower Shortage

A reconstructed nuclear industry will face the immediate problem of a lack of skilled manpower, from nuclear engineers to construction workers, welders, and electricians. At the peak of construction, approximately 4,000 workers are needed at each site, and each new plant requires 400-700 employees. Building about 35 new reactors will create about 38,000 jobs in the nuclear manufacturing industry.

Over the next five years, 35 percent of the current nuclear workforce will be eligible to retire. So, in addition to the tens of thousands of new workers required for the expansion of plant construction and operation, more than 20,000 are needed just to replace those who will leave the workforce.

To start to meet the demand for skilled jobs, Mark Ayers, president of the Building and Construction Trades Department of the AFL-CIO, has proposed that the nuclear industry "set up on-site training centers," that the union itself would build. "We would recruit from the local community and help train them to be craftsmen," he stated. The Building Trades already spend $800 million per year for job training, Ayers reported, and Federal "stimulus" support would speed the process.

'Shovel Ready'

The Congress is necessarily concerned with initiating programs that "stimulate" the economy, as quickly as possible. But this should not be an excuse to put people to work doing less-than-useless non-productive jobs, such as cleaning off solar energy reflectors.

While major modes of transportation must move from liquid fuel—in cars, trucks, and airplanes—to electric systems, such as rail, maglev transport, and electric cars, as the *Detroit News* observed in a Jan. 13 editorial: "the nation remains clueless about where the electricity will come from." The editorial adds that "anyone who thinks the additional demand can be met solely by alternative energy sources—windmills, etc.—is delusional."

There are two dozen new nuclear plants that could be built quickly on what are called brownfield sites. These are sites where there is at least one reactor in operation, and where additional reactors had been planned, but were never built. Construction could start almost immediately, because unlike new greenfield sites, much of the transport, energy, and manpower infrastructure is already there.

The recommendation to immediately start plant construction on these 28 sites was made in the June 17, 2005 issue of *EIR*, and was reiterated recently by nuclear engineer Joseph Somsel, in an article published in the Jan. 23, 2009 issue of *American Thinker*. Infrastructure investments, he points out, greatly increase economic productivity, which should be the criterion upon which "stimulus" investments are made.

All that is needed, he suggests, is "tweaking" current regulations for limited work authorizations. This would mean that companies could start "turning dirt" within a couple of months, as they start site preparation.

While construction begins on the first few dozen nuclear plants, an Apollo-style mobilization to rebuild America's steel and specialty steel industries, machine tool capabilities, and auto-related plus additional manufacturing facilities, using the most advanced technologies, must get under way. It will take some time, and trillions of dollars of credit, to restore the physical economy to a pathway of growth. The longer we wait to start, the more difficult it is going to be.

This is an expanded version of an article that appeared in Executive Intelligence Review, *Feb. 13, 2009.*

NRC

Nuclear manpower demand: In the next five years, more than one-third of the U.S. nuclear workforce will reach retirement age, which means that in addition to the tens of thousands of workers needed to expand the nuclear industry, another 20,000 nuclear workers will be needed to replace the retiring workers. Here, Nuclear Regulatory Commission chairman Dale Klein (center) visiting the control room at the Three Mile Island nuclear plant.