# It's Time for Next-Generation U.S. Nuclear Plants

by Marsha Freeman

While dozens of nations start building their first nuclear power plants, a parallel effort is under way to deploy more advanced, next-generation nuclear technology to supplement, and then replace, today's light-water fission reactors. The United States is decades behind in this effort, upon which future economic survival depends. Although there is an acknowledged lack of skilled manpower and industrial infrastructure, the greatest obstacle to moving forward has been the lack of political will.

Next-generation nuclear reactors include an array of technologies. The most immediately necessary is a family of high-temperature reactors (see p. 55). Through the production of outlet temperatures up to three times that of today's power plants, high-quality heat can be applied to create desperately needed freshwater, through desalination, and to produce synthetic fuels, like hydrogen.

Efforts in Russia, China, India, Japan, and South Africa to carry out research, build prototypes, and deploy fourth-generation nuclear technologies, are under way. In the United States, although there are small-scale concept development and design activities, there is no plan to *build* anything for more than a decade. How could there be? Adjusted for inflation, the budget for nuclear energy R&D today is *11 percent* what it was in 1980.

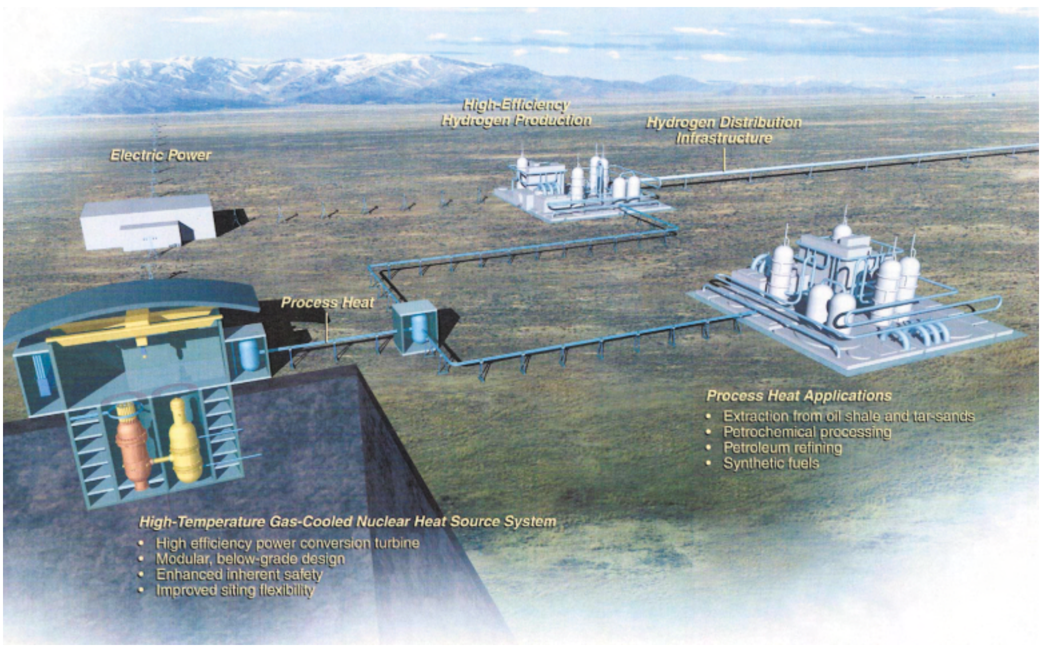
Congress has recently taken a small step to reorient the Bush Administration's nuclear R&D program, which is geared not toward economic development, but toward "nonproliferation," in order to get the next-generation reactor program moving. We need a crash effort, with the massive infusion of resources, which characterized President Eisenhower's Atoms for Peace program.

### A Budget-Driven 'Strategy'

In 2002, the Department of Energy started a new program to design and demonstrate a Next-Generation (also referred to as a fourth-generation) Nuclear Plant project. In 2004, the Department approved the development of a full-scale nuclear plant that would be combined with a facility for producing hydrogen. The very-high-temperature reactor was chosen as the power source, to operate at about 950°C, or 1,742°F, nearly three times that of today's commercial nuclear power plants. Recognizing that it was years behind other nations in nuclear R&D, a Generation IV International Forum was initiated by the United States, to "cooperate" with other nations already engaged in advanced nuclear R&D.

But from the beginning, the program had no sense of urgency, too little funding, and a schedule that was determined not by the pace of technical progress, but mainly by the budget-driven strategy of spending smaller amounts of money, over a longer period of time.

The roadmap for a $2.4 billion demonstration program has construction on the very-high-temperature reactor scheduled to begin in 2016, and the plant to be operational by 2021. The Department of




Idaho National Laboratory

*The Idaho National Laboratory's conception of the Next Generation Nuclear Plant, which would be used to produce electricity and high-quality heat for the production of synthetic fuels, like hydrogen, and for process heat applications in industry. This artist's drawing is similar to the Nuplex concept, nuclear centered agro-industrial complexes, designed by Oak Ridge National Laboratory in the 1960s.*

Energy proposes commercial introduction by 2030! Even were this a revolutionary new technology, never before engineered, this schedule would be a bit conservative.

But consider the following: The United States operated two higher-temperature gas-cooled reactors in the past—the Peach Bottom Unit One reactor (1969-1974), and the Fort St. Vrain reactor (1979-1989); Japan and China have operated small high-temperature gas-cooled reactors, demonstrating the feasibility of the concept; and South Africa is building a fuel fabrication facility and completing the R&D to begin mass producing small, modular, high-temperature gas-cooled reactors, using the pebble bed design, in the next decade.

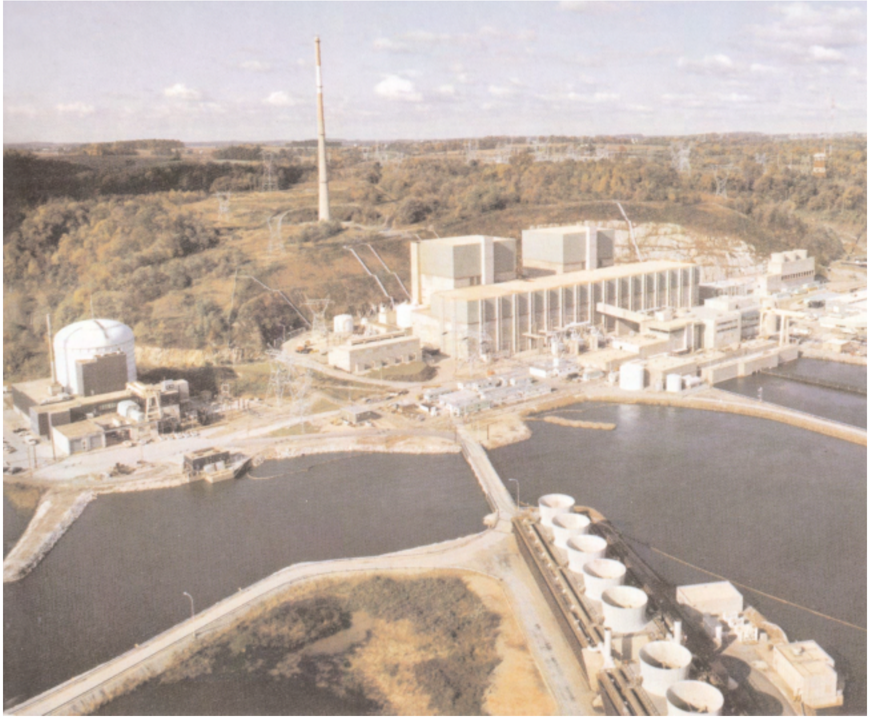
To make matters worse, in February 2006, President Bush announced his Global Nuclear Energy Partnership (GNEP). This program is a *25-year* effort to engage other nuclear-energy nations to develop "proliferation-proof" nuclear designs. The purpose is to limit access by the new nuclear energy nations to the full nuclear fuel cycle, including uranium enrichment to produce fuel, and reprocessing of spent fuel. When GNEP became the Administration's focus, the Next-Generation Nuclear Reactor became a lower priority.

Concerned that this next-generation nuclear program was floundering, Rep. Darrell Issa (D-Calif.), chairman of the Subcommittee on Energy and Resources of the Government Reform Committee, asked the General Accountability Office (GAO) to examine the progress of the program.

**Moving Forward, Faster**

In its September 2006 report, "Status of DOE's Effort to Develop the Next Generation Nuclear Plant," the GAO reviewed the progress made, and the recommendations by two independent advisory groups. A group of experts gathered by Idaho National Laboratory, where the next-generation reactor will be built, and the DOE's Nuclear Energy Research Advisory Committee (NERAC), both recommended that the DOE accelerate its schedule for completing the plant. As the GAO notes, what good will an "even more advanced" reactor be in 2030, when other countries already have high-temperature systems for sale?

The Idaho group suggested that three years could be trimmed off the schedule, by scaling back some of the technology advances planned for the project, and taking a more incremental approach. The reactor could be designed to incorporate more advanced fuels and materials as they are developed, rather than waiting for the "best" to be ready before building anything.



*Peach Bottom Unit 1 (far left), in York County, Pennsylvania, was a 40-megawatt experimental high-temperature, helium-cooled reactor that gave the United States experience with this type of reactor, during its 1967-1974 operation.*

NERAC pointed out that accelerating the schedule will make the project more "attractive to industry," which is supposed to pay a share of its development. In testimony before the Senate Committee on Energy and Natural Resources on June 12, 2006, NERAC member Dr. Douglas Chapin stated that a "completion date of 2021 greatly decreases the chances of substantial industry and international contributions." NERAC recommended that a reactor facility "that can be built soon, to gain experience, and then upgraded as the technology advances," would be preferable. It could be a "technology demonstrator," and a smaller machine.

As it now stands, the very-high-temperature reactor needed to meet the Department of Energy's design criteria would require a pressure vessel (which houses the nuclear reactor core) that is more than twice the size of that of a conventional nuclear power plant. There is only one company, Japan Steel, that could even scale up production to manufacture such a vessel, the GAO notes.

In Senate testimony on June 12, 2006, Dr. Regis Matzie, senior vice president of Westinghouse, stressed that the U.S. program could also be accelerated by leveraging the large-scale testing facilities developed in South Africa, enabling the program here to be "demonstrated within a 10-year period."

The GAO states that in addition to the efforts in China, South Africa, and Japan, the General Atomics company in the United States, and the French nuclear giant Areva, are advancing their own designs. General Atomics has started activities with the Nuclear Regulatory Commission, that could lead to an application for design certification, and has a research reactor design that could lead to a commercial prototype.

South Africa's Eskom, in partnership with Westinghouse, has also started pre-design-certification activities with the Nuclear Regulatory Commission. If the U.S. program stays on its current track, one or both of these fourth-generation nuclear reactors could be on sale to U.S. utilities, years before the U.S. demonstration reactor is up and running.

The Idaho National Lab group estimated that completing the plant three years earlier would reduce the total cost, but would require more funding in the near term. In FY2007, the Lab states, funding for design work would need to be increased from $23 million, the Administration request submitted to Congress, to $100 million. The Department of Energy's response was that although the current design work could support doubling the department's FY07 request of $23 million ... DOE has limited funding for nuclear energy R&D and has given other projects ... priority over the Next Generation Nuclear Plant."

Congress was not satisfied with this response.

In a June 11, 2007 report on the FY2008 Department of Energy budget, the House Committee on Appropriations states that its bill includes an increase to $70 million for the Next-Generation program. The money for the increase was taken from the ill-conceived GNEP program. The Committee directed the Department of Energy to make the Next-Generation program a higher priority than GNEP.

Highest priority and sufficient resources would put the next-generation nuclear reactor on the right pathway.

INTERVIEW: PHIL HILDEBRANDT

# INL Plans to Put Next-Generation Nuclear Plant Online by 2018

*Phil Hildebrandt is the project director for Idaho National Laboratory's Next-Generation Nuclear Plant, and is Special Assistant to the Laboratory Director for Prototype Reactors and Major Projects. He has more than 39 years of experience in the nuclear and power industries, including in the Naval Nuclear Propulsion Program.*

*Hildebrandt was interviewed by Marsha Freeman on Aug. 2, 2007.*

**Question: In June, the House Appropriations Committee increased the budget for the Next-Generation Nuclear Plant to $70 million, and urged that it become a priority for the Department of Energy.... How far does the $70 million the Appropriations Committee voted on go toward reducing the schedule?**

I think it's a very important starting point. The amount of money in the budget that you'd like to have in FY|08, to keep on the schedule that we'd like to stay on, would be considerably more than that—a factor of three to four more than the $70 million. However, the $70 million makes a very important first step in putting the Next-Generation Nuclear Plant, and the demonstration plant for high temperature reactor gas technology, on the road. Let me give you the context for that.

The Next-Generation Nuclear Plant and the commercialization of the gas reactor is, in practical fact, going to be driven by private industry, not by government. We are putting together a commercial alliance. It will have members including end-users and vendors, and will be a partnership with government to help share costs.

That commercial alliance is pressing very heavily toward completing, and making operational, the Next-Generation Nuclear Plant as a demonstration plant, by 2018. That is the press of the private sector. That is a different schedule than what comes out of the Energy Policy Act [passed by Congress in 2005].

**Question: Is the drive to get industry involved due to the fact that you don't see the government putting the level of funding into it that it requires?**

That's correct. The government would start it off the ground, but as it's practically starting to occur, the private sector will be the driving force behind this.

**Question: What industries do you see participating in the commercial alliance?**

The private sector membership for the commercial alliance has end users that are considerably different than the traditional nuclear industry. In this case, they are the broader energy industry—the petroleum industry, the petrochemical industry. This involves the use of process heat; process heat, and hydrogen being one of the energy carriers from that process heat, is the primary focus here. Industry wants the capability to exist as soon as possible, but no more than a decade out.

With what has been provided by the Congress, we still could achieve a 2018 start-up, with the House Appropriations Committee budget mark. It just means we're pushing a bow wave of funding ahead of us.

**Question: What level of contribution will be required from the private sector?**

I would expect that by the end of the project, the government and industry would share it about equally. There would be 20/80 split early on, when we're in the developmental aspects of the program, and it flips around the other way as you get into construction of the demonstration unit.

**Question: What kind of interest have you had from industry?**

The broader end-users in the petroleum and petrochemical industry are beginning to be interested, based on the prices of premium fuel, like natural gas and oil. In the petroleum industry, they use a large amount of hydrogen, and depending upon which company it is, they use a tremendous amount of natural gas. Natural gas is used as a source to make heat, and they're looking at what their options are.

There is some interest in the traditional nuclear industry in this technology. A couple of utilities are showing interest in the high-temperature gas reactor. Some of that interest is in producing hydrogen and selling it into the pipeline that exists along the Gulf coast. Other interest is in being the owner-operator of the nuclear facility that supplies process heat to industry. The company that has been most vocal about that is Entergy.

**Question: There is quite a bit of international interest in this technology—in South Africa, and General Atomics has worked with the Russians. It has been proposed that the U.S. program could advance more quickly by taking advantage of this work.**

The Westinghouse interests and the South Africa Pebble Bed Modular Reactor (PBMR) people participate in this emerging commercial alliance. There's an ongoing conversation as to how we can achieve the benefits from the work that has already been done in South Africa. You have a competitive marketplace, and other vendors have interests in this. There are three teams: the Westinghouse team, which includes the PBMR group; an Areva team; and a General Atomics team. About 26 international companies are involved, and we are discussing how we use work that has already been done—by the South Africans and also the Russians, in their plutonium burner work with General Atomics—how we bring in the experience that goes back decades, and also the current work, that has been done.

**Question: One of the suggestions to accelerate the program was to start with a smaller reactor, at a lower temperature, which is not so challenging from a materials standpoint.**

In fact, irrespective of the size, we will start at a lower temperature, because technically we need to step our way up. We are starting at a lower temperature than originally conceived of for the very-high-temperature reactor, which was in excess of 1,000°C. In the range of 950-1,000°, you get to the point where conventional metals will not work. The review group said to get below that temperature, and we have taken that step.

The second step in that discussion is, what temperature do we need for the process applications? The third step, is, at what temperature should we start the demonstration activity, so we are technologically successful, and to what extent can that reduce the time required? This is a very active conversation. I would not be surprised that when that is complete, in about a year, that we'll be lower than 950°C, in the range of 850-900°, which makes a big difference.

The three teams of companies will have their pre-conceptual design reports done in the September time frame, with opinions and recommendations. But temperature alone is not the only issue. The other is licensing time by the Nuclear Regulatory Commission, also being actively discussed.

**Figure 1**
**ARTIST'S ILLUSTRATION OF A PBMR PLANT**
*The first prototype PBMR is expected to be online by 2013, and a plant to fabricate the fuel pebbles is now under construction. The first reactor will be built at Koeberg, near Cape Town, and the pilot fuel plant is being built at Pelindaba, near Pretoria. South Africa has an ambitious program planned for the mass production of PBMRs for domestic use and export.*
Source: Courtesy of PBMR

# Fourth-Generation Reactors Are Key to World's Nuclear Future

by Marjorie Mazel Hecht

By 2050, the world will need 6,000 more nuclear reactors in order to keep up with population growth and electricity demand. We will need all kinds of reactors: large advanced reactors for industrialized nations, fast reactors (breeders) that can create more new fuel than they burn, floating nuclear plants, thorium-fueled reactors, and other innovative designs. But the workhorse of the next generation of nuclear reactors will be the modular high-temperature gas-cooled reactor, both the Pebble Bed Modular Reactor (PBMR) and the Gas-Turbine High Temperature Reactor (GT-MHR), because of their inherent safety and versatility.

The PBMR, originally a German design (a 30-megawatt prototype operated there from 1967-1989), is being built in South Africa (Figure 1). The GT-MHR, designed by San Diego-based General Atomics, is being engineered in prototype in Russia, with the aim of burning excess plutonium from decommissioned weapons. Also, China has had a small (10 megawatt)

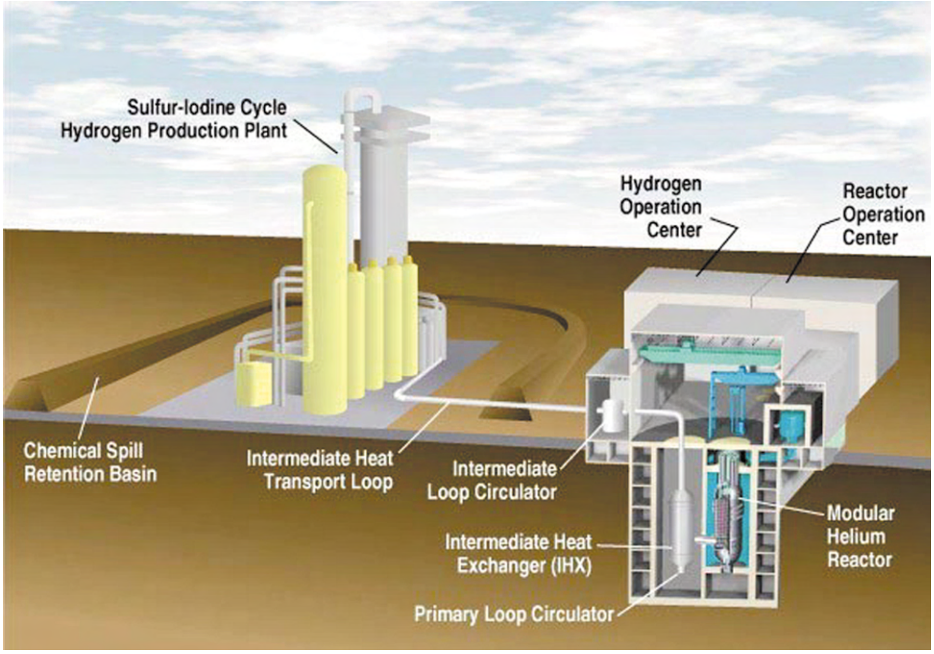



**Figure 2**
**GT-MHR HYDROGEN PRODUCTION**
*This General Atomics design couples a modular helium reactor, the GT-MHR, to a sulfur-iodine cycle hydrogen production plant. The sulfur-iodine cycle, which uses coupled chemical reactions and the heat from the high-temperature reactor, is the most promising thermochemical method for hydrogen production.*
Courtesy of General Atomics

high-temperature reactor of the pebble bed design in operation since 2000, with plans for a large-scale demonstration reactor by 2010. Japan also has a high-temperature test reactor.

One advantage of these reactors is that they are small enough to be modularly produced on an assembly line and shipped to the plant site for assembly, thus cutting the production costs. The nuclear site can be configured to start with one or two units and built up to six or eight, as needed, making use of a single control building. Thus a developing country, where the electricity grid is small, can start off with one unit, and build up as the country develops.

Another advantage is their high-temperature output. For the GT-MHR, output is almost three times hotter than today's conventional reactors—1,560°F, compared to 600°F. (The PBMR output is about the same.) These high temperatures can be coupled with a wide range of industrial processing, from steel-making to hydrogen production for fuel (Figure 2).

The PBMR is a 165-megawatt plant, while the GT-MHR is a 285-megawatt plant. Both have passive and inherent safety features that make a meltdown impossible. The reactors can shut down without any operator intervention.

These reactors are meltdown proof because of their unique fuel design (Figure 3). Tiny uranium fuel particles are encased in ceramic spheres (0.03 inch or 0.75 millimeter for the GT-MHR), which serve as "containment buildings" for the fission process. The several concentric layers of temperature-resistant materials—porous carbon, pyrolytic carbon, and silicon carbide, "contain" the fission reaction of the uranium, even at very high temperatures. The overall design prevents the reactor from ever getting hot enough to melt the

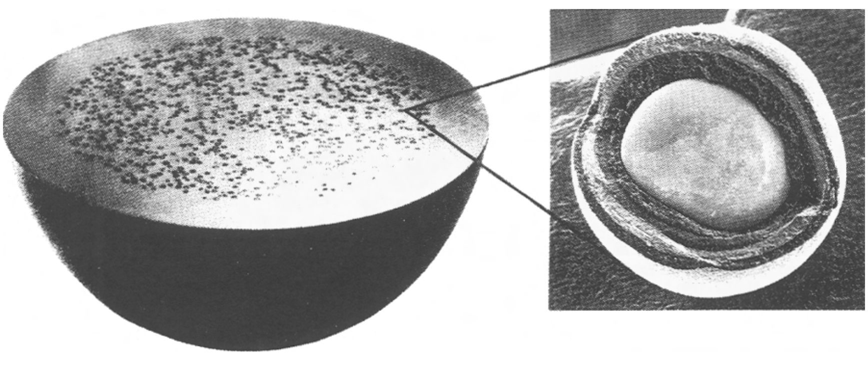


**Figure 3**
**CROSS-SECTION VIEW OF FUEL PEBBLE**
*A cutaway view of a coated PBMR fuel particle is at right. Each particle has a 0.5 mm kernel of uranium dioxide surrounded by several concentric layers of high-temperature-resistant ceramics that "contain" the fission reaction. The coated fuel particles are then embedded in a graphite matrix and formed into fuel spheres the size of tennis balls, about 60-mm diameter, which circulate in the reactor core.*
Courtesy of PBMR

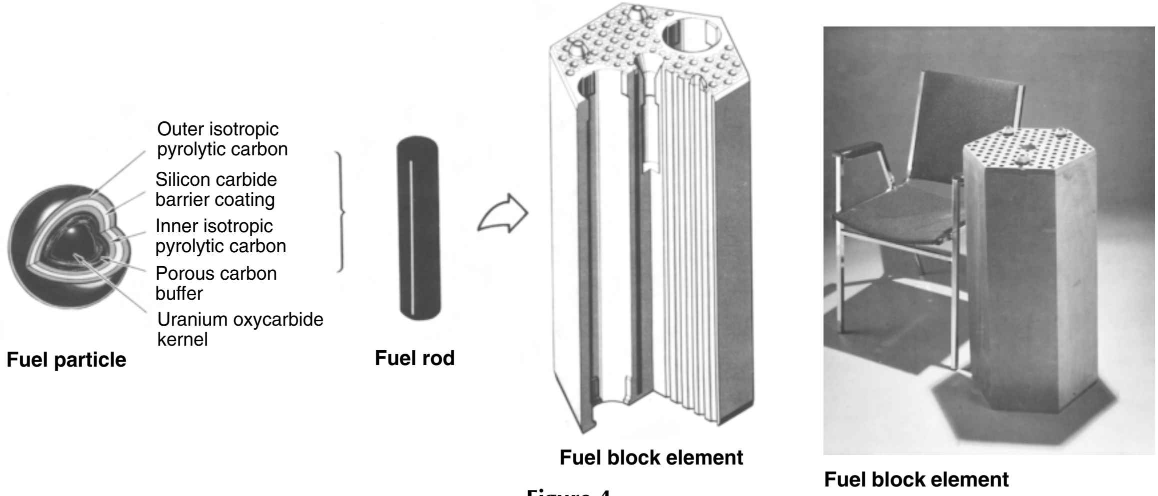



**Figure 4**
**GT-MHR FUEL COMPONENTS**

*The tiny fuel pellet (a) is about 0.03 inch in diameter. At the center is a kernel of fissile fuel, uranium oxycarbide, which is coated with a graphite buffer and then surrounded by three successive layers of carbon compounds. The fuel particles are mixed with graphite and formed into cylindrical fuel rods, about 2 inches long (b). These rods are then inserted into holes drilled in the hexagonal graphite fuel element blocks (c) and (d). These are 14 inches wide and 31 inches long. The fuel blocks, which also have helium coolant channels, are then stacked in the reactor core.*

ceramic spheres that surround the nuclear fuel.

The fuel particles can withstand heat of 3,632°F, and the reactor core temperature remains below 2,912°F. In fact, the fuel pebbles can withstand temperatures at which the metallic fuel rods in conventional light water reactors would fail.

In the GT-MHR, the spheres are mixed with graphite and shaped into cylindrical fuel rods, which are then inserted into hexagonal fuel blocks that make up the reactor core (Figure 4). General Atomics pioneered this fuel particle design in the 1950s, and operated two high-temperature reactors in the United States.

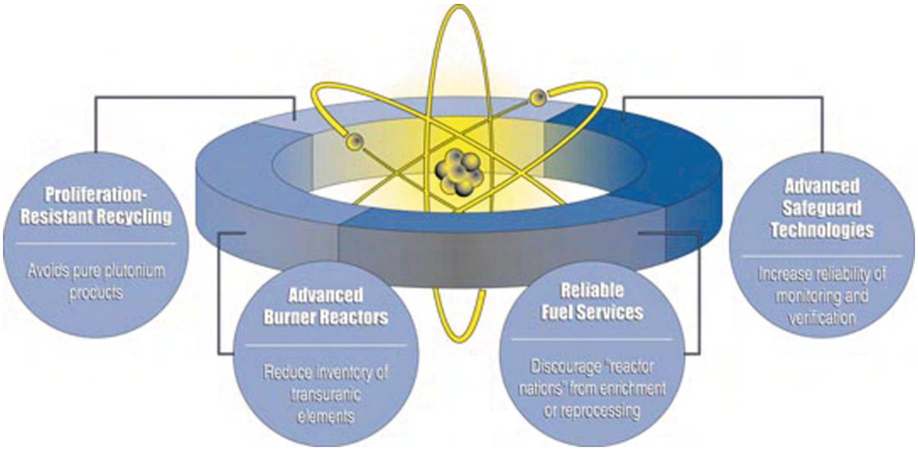
The PBMR fuel design is similar. Tiny nuclear fuel particles are coated with layers of ceramics. But unlike the GT-MHR, the fuel particles are then embedded into fuel balls the size of tennis balls. Each of these balls contains about 15,000 fuel particles and about one-quarter ounce of uranium. The balls, 456,000 of them, circulate around the reactor core. One advantage of this design is that the reactor can be continuously refueled, adding new fuel pebbles at the top, and removing spent fuel pebbles from the bottom of the reactor.

### Efficiency and Safety

The high-temperature output of these reactors gives them greater generating efficiency, in addition to allowing a wide range of industrial applications. Both use a direct-conversion gas turbine, with no steam cycle—a big improvement. The heat is carried by the helium gas, which is also the coolant. This simplifies the system, reducing material requirements, and increases efficiency. Other technological breakthroughs have also contributed to simplifying the design and making the reactors more efficient. The GT-MHR is 50 percent more efficient than conventional light-water nuclear reactors.

Both the GT-MHR and the PBMR are located underground, with the auxiliary systems and control room above ground. The overall design of the reactor contributes to its safety. In addition to the usual control rods, which can slow down the fission process, there are two coolant systems, a primary system and a shutdown coolant system. If both of these were to fail, the reactor is designed to shut down on its own. There is a passive back-up system, whereby the heat from the reactor core is transferred by natural conduction to the reactor walls, which naturally convect the heat to an external sink. The concrete walls of the underground structure are lined with water-cooled panels to absorb the core heat from the vessel walls. Should these panels fail, the concrete of the structure alone is designed to absorb the heat.

In any type of loss-of-coolant accident, the reactor can withstand the heat without any operator intervention.



DOE

*GNEP: "Cradle-to-grave" U.S. control over the world's nuclear fuel cycle?*

# Bush Nuclear Program, GNEP, Is Technology Apartheid

by Marjorie Mazel Hecht

The Bush Administration's Global Nuclear Energy Partnership, or GNEP, is a program of technological apartheid dressed up as nuclear development. Unveiled in 2006, it is the civilian side of the British geopolitical strategy, first put forward by Bertrand Russell and H.G. Wells in the first half of the 20th Century, to consolidate power in a single or small group of states, and deny technological development to most of the world. Like the global warming hoax, behind it lies a Malthusian program for checking population growth, especially of non-white populations.

Under GNEP, the United States would provide selected nations with all aspects of the nuclear fuel cycle—in a "black box." The recipient countries must agree not to develop those technologies on their own, thus denying those nations knowledge of uranium enrichment, fuel fabrication, and reprocessing, as well as nuclear applications like desalination or medical isotopes. The program aims to control the nuclear fuel cycle "from cradle to grave," as U.S. Energy Secretary Samuel Bodman said. Recipient nations will have only a leased black box—as long as they stay on the good side of the supplier.

GNEP is thus an attack on the national sovereignty of recipient nations, which must give up control over their energy resources and over the training of nuclear scientists and engineers.

From the beginning of the civilian nuclear age, just after World War II, there were two views of the nuclear future. One faction saw nuclear energy as a boon for all mankind, providing virtually unlimited energy to develop industry and raise living standards. The other were the proponents of the Bertrand Russell/H.G. Wells policy, who aimed to prevent Third World development and population growth, by keeping the nuclear genie bottled up. Their program was conveyed in the 1946 Baruch Plan, an earlier version of GNEP, which intended to put a United Nations agency in control of all nuclear fuel.

This policy was carried forward from the 1950s by a school of truly mad strategic analysts centered for a time in the Rand Corporation. The leading figure was Albert Wohlstetter, the real model for Stanley Kubrick's fictional "Dr. Strangelove," whose students included the prominent neo-con strategists, Richard Perle and Paul Wolfowitz.

**Selling Points vs. Reality**

GNEP was sold to the U.S. nuclear community on the basis that it will fund research and construction of three new facilities: (1) a nuclear reprocessing facility using new methods that will make it harder to divert nuclear fuel for bomb making; (2) a nuclear fast reactor, which would be geared not to breed new fuel, but instead just to burn up the long-lived radioisotopes (actinides) in spent fuel; and (3) an advanced fuel cycle research facility, to look into new methods of reprocessing and new fuel cycles.

Eleven sponsors for potential sites for the first two facilities have been selected to receive grants to prepare "detailed siting studies." One is the Hanford Site in Washington State, where, in 2005, the Bush Administration shut down the Fast Flux Test Facility, a working research fast reactor that was perfectly suited to perform the R&D proposed by GNEP, and to burn up actinides.

There is no question that the United States needs an advanced nuclear program, which will include recycling, enrichment, fuel cycle research, and development of the fast reactor and other advanced reactors. But GNEP is a go-slow program, which may (or may not) produce a new reactor or new technologies in the next 10-15 years. It is not a crash development program to build the research facilities and the advanced reactors the nation—and the world—need. GNEP's focus is nonproliferation enforcement, at home and abroad.

The Department of Energy's funding for GNEP is up to $60 million in the next two years, for conceptual studies, scheduling, and design. It has managed to hook in the nuclear community, as well as all the national laboratories, because it is the only Federal nuclear show in town.

As for the initial foreign countries participating, most of them—Russia, China,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*Energy Secretary Samuel Bodman (center) at a GNEP press conference with energy officials from China, France, Japan, and Russia at the DOE-hosted ministerial meeting to discuss GNEP international cooperation.*

and Japan, for example—already reprocess their spent fuel, and have ambitious programs for research and construction, including fast breeder reactors. They have nothing to lose by participating in GNEP—unless they get so tangled in the web of bureaucracy that they stop forging ahead with their own programs.

### U.S. No Longer a Nuclear Leader

Although the United States now has nearly one-fourth of all the world's nuclear reactors (104 out of 435), more than any other country, it has taken a back seat to other nuclear nations in the development of nuclear technology. The U.S. shut down its commercial reprocessing (recycling) capability in the 1970s, although its PUREX reprocessing facility was working well. Since then, the United States has had a once-through nuclear fuel cycle, instead of recovering the 97 percent of the spent nuclear fuel that could be turned into new fuel.[1] The reason for the shutdown was ostensibly to prevent "proliferation," because reprocessing spent fuel separates out plutonium (about 1 percent of the spent fuel), which might be stolen and used for bomb-making.

The real reason is that by allowing reprocessing, nuclear energy becomes fully "renewable" and therefore fully able to supply increasing amounts of energy for a growing world. This is what the Russellites wanted to prevent, using the banner of nonproliferation to do it. Meanwhile, spent fuel rods—containing a valuable resource—are sitting in storage.[2]

In addition to the shutdown of reprocessing, there was a virtual shutdown of enrichment technology. Enrichment involves increasing the ratio of fissionable uranium (U-235) to unfissionable uranium (U-238) from the 0.7 percent found in natural uranium to 3-4 percent required for fission reactors. The U.S., which had pioneered uranium enrichment methods for nuclear fuel, now must import more than 80 percent of the enriched uranium for its 104 nuclear plants. The nation also shut down its fast breeder program, though fast reactors are essential to the future of nuclear.

GNEP has captured the allegiance not only of the nuclear community, but of the national laboratories, which historically have been leaders of U.S. nuclear research, both civilian and military. When this writer posed the question of GNEP and its coercive nonproliferation function to Dr. Robert Rosner, the director of the Argonne National Laboratory, he replied, "I'll give you the reason why it's a good thing. It's not so much proliferation, it's economic." In Rosner's view, countries that want to develop nuclear power plants will choose the GNEP way because it's cheaper. As for the political control, Rosner said that countries could choose a supplier from among the seven or so advanced nuclear nations—including Russia and China.

As for proliferation, Rosner said: "The key point here is that what GNEP does, if you really put this regime in place—then if someone refuses to be part of it, it's perfectly clear why. It could only be one reason. So at least there's this wonderful element of clarity. With GNEP, if you don't participate, then you basically are interested in proliferation."

And so, we do have clarity: GNEP is about policing nonproliferation, removing national sovereignty, and ensuring technological apartheid, not about advancing nuclear technologies for the benefit of mankind. Much of the U.S. nuclear community has bought into it, along with the fraud of global warming, thus crippling their capability to fight for the kind of nuclear development program that will build the 6,000 nuclear power plants the world needs by the year 2050.[3]

Instead of siding with Prometheus, the giver of fire (the atom) to mankind, these supporters of GNEP are working with Zeus to keep Promethus bound.

**Notes**

1. See "The Beauty of the Nuclear Fuel Cycle," www.21stcenturysciencetech.com/2006_articles/NuclearFuel.W05.pdf
2. The spent fuel from one 1,000-MW nuclear plant, operated over 40 years, is roughly equivalent to 130 million barrels of oil, or 37 million tons of coal.
3. See "How to Build 6,000 Nuclear Plants by 2050," by James Muckerheide, State Nuclear Engineer of Massachusetts, http://www.21stcenturysciencetech.com/Articles%202005/Nuclear2050.pdf

An update on the GNEP program appears in this issue's editorial, page 2.

Courtesy of *VirtualPRO*


*Panelists at the Biofuels workshop sponsored by VirtualPRO and the Manuel Beltrán University had nothing to say to Maximiliano Londoño Penilla's exposé of the bad economics of biofuels and his support for nuclear energy as Colombia's future. Londoño is second from left.*

REPORT FROM COLOMBIA

# LaRouche Movement Organizes For a Nuclear Renaissance

by Miriam Nelly Redondo

The way an audience can be transformed from today's pervasive pessimism, to technological optimism, was beautifully demonstrated at a July 28 forum in the capital of Colombia. Two hundred people attended the First Biofuel Workshop and Seminar in Bogotá, organized by the publication, *VirtualPRO*, and the Manuel Beltrán University. There they heard a presentation given by the guest speaker invited by Colombia's Lyndon LaRouche Association, Marjorie Mazel Hecht, managing editor of *21st Century Science & Technology*, who spoke on the theme "The World Nuclear Renaissance Is in Progress! Will Colombia Join In?"

Hecht's address infected the audience with the optimism generated by the revived worldwide turn to nuclear power as a source of energy that can replace today's fossil fuels, oil, coal, and natural gas.

In the afternoon, Maximiliano Londoño Penilla, president of the LaRouche Association, followed up Hecht's polemic during his participation in a panel discussion which also included Mauricio Rojas Quintian of Cenipalma, Carlos Fernando Márquez of the Colombian Automobile Association (SCA), Marcela Bonilla of the Environment Ministry, and Carlos Díaz of Brazil's oil company Petrobras.

During the forum, the majority of the questions were focussed on how to solve Colombia's energy crisis, which opened the way for Londoño to elaborate on the idea—first developed in the morning by Hecht—that nuclear energy in Colombia is inevitable, while attacking the fraud of both global warming and of biofuels as a viable energy source. The other panel members were left with nothing to say.

Not to develop nuclear energy would pose for Colombia a serious risk of cutting itself off from opportunities that would mean an unlimited energy source for the country, Londoño argued. Since the era of U.S. President Dwight D. Eisenhower (1952-1960), Colombia has already received benefits from the U.S. "Atoms for Peace" program, which put atomic energy, the most valuable area of scientific-technological knowledge at the time, at the disposal of the underdeveloped countries of the world.

### Colombia's Nuclear History

In Colombia, the institutionalization of nuclear technology followed directly from the Atoms for Peace policy. It was initiated by President Gen. Gustavo Rojas Pinilla, who established the first nuclear institution in the country, the Colombian Institute of Nuclear Affairs (ICAN), which operated from 1956-1959, later replaced by the Institute of Nuclear Affairs (IAN). Rojas proposed collaborative efforts between the state and national industry, for the purpose of industrializing the country, taking advantage of the use of man-made nuclear radioisotopes in medicine, agriculture, and industry.

In the field of medicine, Colombia cooperated with France, which had been working since 1934 through the Radium Institute—now known as the National Institute of Cancerology—on the application of nuclear radioisotopes. Unfortunately, investment has been inadequate to meet the demand for application of this technology, with the result that there has been no program of modernization and expansion of equipment for urgent programs in the treatment of cancer patients in Colombia.

As director of ICAN, Maj. Gerardo Cabrera Apraez (ret.) signed a bilateral agreement with the United States in June 1955, for the peaceful use of nuclear energy, which was considered the first

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agreement of its kind. One year later, Colombia was visited by a geological mission of the U.S. Atomic Energy Commission, led by Glendon Collis and William Isaclasen, who reported on the possible exploitable reserves of uranium in Colombia's Santander province. Toward that end, the company Minuraniu was created.

In October 1959, the Institute of Nuclear Affairs was created under the direction of Tulio Marulanda, a chemical engineer, who specialized in metallurgy and nuclear energy at the University of Colorado. Four ministries made up the directorship of the Institute: Development, Health, Education, and War. Unfortunately, the role of the institute in education was marginal. There was no formal link with the National University, and the Institute operated initially with chemical engineers and agronomists who were to specialize in nuclear material, through scholarships abroad.

Here is where one can perceive a notable difference between the Institute and the National Atomic Energy Commission (CNA) of Argentina, which took on the challenge of higher education in the field of nuclear science from the very beginning, thereby guaranteeing its continuity and its current resurgence.

In July 1961, the Argentine nuclear chemist Sonia Nassif, representing the International Atomic Energy Organization, and in cooperation with the Institute's Marulanda, proposed the construction of a regional nuclear center, to carry out joint research. This was on the occasion of the arrival in Colombia of the IAN-R1 reactor, which, at the time, was considered the first in a series of developments that would keep the country up to date in nuclear technology.

But political nearsightedness killed Colombia's nuclear program when, in 1958, President Alberto Lleras Camargo labelled the nuclear commission a project of the Rojas Pinilla dictatorship, thereby freezing all budget transfers to the Institute, without any understanding that material development and human welfare urgently requires ongoing scientific research.

**Time for a Nuclear Revival**

It is time to correct these errors of the past. As *21st Century* editor Hecht explained, the world today is experiencing a nuclear renaissance, and it is urgent that Colombia join in. Bilateral U.S.-Colombian relations need to be re-established on the basis of principles of cooperation for development, such as that seen during the period of Eisenhower's Atoms for Peace.

Hecht documented how the Asians have become the pioneers in nuclear development. China has 10 operating nuclear plants, producing 8.6 gigawatts of energy, and intends to produce 40 gigawatts by 2020, and between 120 and 160 gigawatts by 2030. Taiwan is producing 22 percent of its energy with six nuclear reactors, and has two more under construction. India has 17 nuclear plants producing 3.5 gigawatts of energy. South Korea has 20 nuclear reactors that provide 40 percent of its electricity, 26.6 gigawatts. Japan has 55 reactors, which provide 30 percent of that nation's energy needs, or 47.5 gigawatts.

And the revival is not only going on in Asia. Russia has 31 nuclear plants which provide 16 percent of its energy, and it is planning to reach 25 percent by 2030. South Africa has two conventional nuclear plants in operation, which generate 6 percent of its electricity, and is carrying out an intensive program to develop the German-designed PBMR (pebble bed modular reactor) nuclear plant model.

The United States, on the other hand, although it has more than 100 plants generating about 20 percent of the nation's electricity, has not built a single new reactor since the 1970s, and its nuclear program is still struggling to escape from the barrage of environmentalist and deindustrialization propaganda.

In the rest of Ibero-America, Argentina and Brazil are returning to nuclear energy, after a long period of inactivity. Argentina will finish the Atucha 2 nuclear center by 2010, and has plans to build a

*Colombia's first nuclear reactor, the IAN R-1, operated in the early 1960s. But shortsighted political leaders sidelined Colombia's nuclear program.*

*Colombian President Gen. Gustavo Rojas Pinilla, who established the first nuclear institution in the country, which operated from 1956 to 1959.*

*The author (center) at a pedagogical exhibition sponsored by the LaRouche Association at Villamar College in Bogotá.*

small reactor, CAREM, an Argentine design developed in the 1980s, which could be used to generate electricity and to desalinate water. Recently, one of the CAREM models was sold to Australia.

In Brazil, the government has made the decision to build a third nuclear plant, Angra 3; the three Angra plants combined will produce 1.896 gigawatts, nearly 4 percent of Brazil's electricity. Mexico has two nuclear reactors at Laguna Verde, and these produce 5 percent of its electricity. Chile and Peru have also shown interest in conducting nuclear research and are working toward that end.

**What Colombia Must Do**

We should remember that it was the narco-government of Ernesto Samper Pizano in Colombia which shut down the Institute of Nuclear Affairs, preventing our country from advancing in this field. Colombia should join with other nations that have begun or reactivated their nuclear programs. And since we have restarted the research reactor, we should promote anew the development of nuclear energy. We should reopen the Institute of Nuclear Affairs as an autonomous body, functioning directly under the executive branch, with the participation of the Ministry of Agriculture on its board of directors, and with total financial autonomy. Further, the nation should call on all Colombians and others who have specialized knowledge in the nuclear field, to come forward and join this national initiative.

Faculties of nuclear physics and nuclear engineering should be immediately created in the National University, so that Colombia can join the programs of Argentina, Brazil, and Mexico. There should also be efforts to establish a Regional Nuclear Institute, and this could be one of the challenges undertaken by President Alvaro Uribe, as part of a larger Ibero-American integration initiative.

**Down with Biofuels**

In Colombia, the lobbyists for biofuels seek to create a financial bubble, similar to the housing bubble which is currently blowing out in the United States, because biofuels could never be profitable without the huge subsidies that governments provide.

For example, it was for that purpose that Law 693 of 2001 was created in Colombia, which established that, by September 2005, all cities with more than 500,000 inhabitants—like Bogotá, Cali, Medellín, and Barranquilla—would have to use gasoline with at least 10 percent ethanol content. Law 788 of 2002 introduced exemptions to the Value-Aded Tax for the ethanol component of oxygenated fuels, and introduced tariff exemptions for the import of equipment necessary to mount ethanol refineries. Together with this law, the Ministry of Mines and Energy put out Resolution 1080836 of July 25, 2003, to establish the price structure for oxygenated regular gasoline.

If one does the calculations, it becomes clear that to satisfy the mix of 10 percent ethanol in gasoline required by law, they will have to build at least 10 to 12 ethanol refineries to produce 2.5 million liters a day. According to Agriculture Minister Andrés Felipe Arias, the idea is for Colombia to become the leading biofuel producer in Latin America, which would require an investment of half a billion dollars. But it appears that the Minister has not considered how this will directly affect the price of food, because he is not simultaneously projecting the preparation of new lands, with infrastructure and agricultural technology, to bring more food under cultivation—with the result that foods will dramatically rise in price.

He also is not considering the reduced tax revenues implied by this strategy, given the exemptions of 98.1 million pesos a year. Over the long term, this bubble too will burst, creating a new source of frustration for Colombians.

In sum, considering the ongoing global nuclear renaissance, and the failure of biofuels, the only solution to the high cost of fuel, and to the eventual exhaustion of oil reserves, is nuclear energy.