

France needs the Superphénix

Emmanuel Grenier reports on the political fight raging around the fast breeder reactor program, which the government decided to terminate.

Even in France, the country with the highest share of nuclear electricity in the world (80%), it is highly unusual to see a grassroots movement in defense of nuclear power. That is nevertheless what is going on around Creys-Malville, near Lyon, where the Superphénix fast breeder reactor has been constructed. In April, anticipating the parliamentary elections in June, the Socialist Party and the Greens signed an agreement committing the new government to stop two of France's major infrastructure projects. One was the Rhine-Rhône canal, an important waterway between central Europe and the Mediterranean countries, whose construction had just begun. That project is now completely stalled. The second is the Superphénix, a 1,200 megawatt fast breeder reactor, jointly built by French, Italian, German, and Belgian electricity utilities. After many initial problems, it operated excellently in 1996, reaching a 95% availability rate. It has now been condemned to death by the Red-Green coalition, for purely ideological reasons. On June 19, newly elected Prime Minister Lionel Jospin announced to the National Assembly that he would close the plant.

Up to now, people working in the French nuclear industry have felt somewhat protected, unlike their colleagues from other countries. They have relied on a consensus existing in the country, for the continuation of a strong nuclear industry as a science driver. After World War II, Gen. Charles de Gaulle created the Commissariat of Atomic Energy, which led the national effort to master nuclear technology, both for military and civilian purposes. This was supported by all the political forces coming out of the wartime Resistance movement, from the Gaullists to the Communist Party. In the 1970s, a massive effort led to the building of 54 nuclear plants, producing 75% of France's electricity.

But, with the gradual replacement of the generation of pioneers, the situation has changed. Baby boomers, having no experience of the fight necessary to implement a new technology, are now in command in the nuclear industry. Living under the umbrella of administrative support inherited from the past, they have never had to fight on a matter of principle.

But there is a new generation coming up, some members of which were shocked by the loss of the plant. These young nuclear engineers have joined local entrepreneurs and elected officials to form a Committee to Save the Superphénix, and

they are waging a non-violent guerrilla war against the Greens. The employment of 3,000 people depends on the Superphénix, and the life of the whole region is threatened, if the plant is closed. Moreover, this is only the first domino: After the Superphénix, the plutonium recycling plant at La Hague, in Normandy, will be threatened, and then the entire nuclear industry. For one year, the facility at La Hague has been subjected to constant attacks from the green lobby. The antinuclear militants allege that a small cluster of leukemia cases in the region is due to effluents from the plant. Greenpeace, which has sharply reduced its operations in France, has nevertheless dedicated a number of its irrational media shows to La Hague, which it considers as its number-one priority in the country. There is also an offensive going on, jointly led by free-marketeers and greenies, in order to make sure that the next electricity utilities built in France use gas as their fuel. According to them, gas is the least costly way of producing electricity.

In this situation, the members of the Committee to Save the Superphénix have understood that they must wage a fight on the highest level possible. It cannot be just a defense of "our jobs," but requires that the operation of the world's most advanced fast breeder be continued, in a global context of expanded use of nuclear energy (China, Korea, Iran, etc.).

Technology for the 21st century

Propaganda against the fast breeders has been so strong, playing on people's irrational fears of plutonium and sodium, that it is useful here to recall why France, Russia, Japan, and India have planned and implemented this kind of nuclear technology.

First, imagine yourself back in the 1970s, the time of Henry Kissinger's "oil crisis," when people were told that we were running out of natural resources. The Club of Rome forecasts that there will be no more oil by the beginning of the 1990s. Hysteria reigns. In Belgium, it is forbidden to drive a car on the weekend. In France, you can't heat your apartment to more than 19°C (69°F). In this context, nuclear energy appears as the optimal solution, to overcome a shortage of resources.

France invests heavily in nuclear technology, and is not the only country to do so. But this poses the question of the



Members of the Committee to Save the Superphénix. These nuclear engineers are battling the propaganda of the Greens.

world's uranium resources: Far from being inexhaustible, these would run out in about 60 years, at current rates of consumption.

So along comes the idea of the breeder reactor, which "produces more fuel than it burns." Sounds like magic? Let us explain. Imagine mariners shipwrecked on a desert island. It is raining, and everything is wet, except a tiny bit of dry wood. The mariners light a fire, but know it will not last long. One clever mariner comes up with the idea that, by putting some wet wood around the fire, maybe it will dry out. They

try that, and realize that you can dry more wet wood than you burn dry wood. The shipwrecked mariners have just invented the "breeding" of wood. They can consume all the wood on the island, not only the tiny dry part.

This is exactly what goes on in a fast breeder. Here, the dry wood is the plutonium; the wet wood corresponds to natural uranium, which, submitted to neutrons from the fission reaction, transforms itself into plutonium. The neutrons have to move at a high speed: hence, the word "fast" breeder.

As shown in **Table 1**, the breeder functions as an amplifier

TABLE 1
Fast breeders compared to standard pressurized water reactors (PWRs)

	Fast breeder	PWR
Energy provided by 1 kg of natural uranium (1 kg of oil gives 5.5 kWh)	5,000,000 kWh	50,000 kWh
Consumption of natural uranium for a 1,000 MW reactor producing 7 TWh per year, with an availability factor of 80% (reference reactor)	<2 tons/year	330 tons/year
Quantity of plutonium in the reactor (kilograms)	200	1,000
Gaseous radioactive effluents of the reference reactor in Terabecquerels per year (TBq/yr); rare gas plus iodine	0.3	14
Liquid radioactive waste of the reference reactor, before conditioning		
Volume in cubic meters per year	75	300
Activity in TBq/yr	2	20
Theoretical time before exhaustion of the uranium resources reasonably usable for 4,000 TWh/yr (today, the nuclear plants of the world produce 2,000 TWh/yr)	1,700 years	30 years

Source: *Fusion*.

of natural resources, because it allows us to multiply by 100, approximately, the energy that is generated by classical nuclear reactors. This makes nuclear energy a renewable resource, whose fuel is relatively inexpensive. In a fast breeder, the operating costs are mainly the salaries of the highly qualified men and women working on it.

What went wrong?

In view of all this, how is it that the fast breeder has not met with success? The first reason is, of course, the worldwide dismantling of the nuclear industry. The number of reactors built turned out to be much smaller than predicted, and uranium reserves were not strained at all. On the contrary, prices went down, when post-Soviet Russia dumped its enriched uranium on the world market. Second, the greenies concentrated all their forces against the breeder, which appeared to them as the “lead duck” of the flock: If you stop it, you stop the rest of the nuclear industry. They succeeded, first in the United States, during the Carter and Reagan administrations, then in Germany, and now in France.

In a situation where leaders are thinking on a very short-term basis, and where very specific conditions, such as a low value for the dollar, allowed gas-fired plants to be competitive, leaders of the energy sector come to the conclusion that breeder reactors are unnecessary. That is the kind of linear reasoning that led bankers to plunge into real estate speculation, with disastrous results.

The situation today gives one the illusion that uranium reserves will never run out; but this is untrue. The greenies often wax rhetorical about “future generations.” Let’s take them at their word, and see what the perspective will be, for



The core of the Superphénix reactor, while under construction. This vital project has been halted, thanks to an agreement between the Socialist Party and the Greens.

TABLE 2
The world’s fast breeder reactors

	Electric power	Start-up date
France		
Creys-Malville (Superphénix)	1,240 MW	1986
Marcoule (Phénix)	250 MW	1973
Russia		
Obninsk (BR5)	(10 MW th)	1958
Melekes (BOR 60)	12 MW	1969
Beloyarsk (BN 600)	600 MW	1980
Kazakhstan		
Aklau (BN 350)	150 MW	1973
Japan		
Oarai (Joyo)	—	1977
Monju (DFBR)	300 MW	1995
India		
Kalpakkam (FBTR)	15 MW	1985

Source: *Fusion*.

the grandchildren of today’s decision-makers, some 50 years from now. (The reasoning presented here proceeds from a European standpoint, but it remains more or less valid for other members of the Organization of Economic Cooperation and Development, OECD.)

Fifty years from now, North Sea gas will be completely exhausted. The uranium price will have increased greatly, making nuclear energy scarcely competitive. As for oil, it may be necessary to wage “bloody little wars,” as Margaret Thatcher, François Mitterrand, and George Bush did against Iraq, in order to make sure that the nations possessing the greatest reserves behave themselves. Of course, there is the potential of nuclear fusion. But, with the freezing of credits for the International Experimental Reactor (ITER), its advent seems to be forever pushed back in time. And it is difficult to base humanity’s future on a technology that has not yet been proven from an industrial standpoint.

What is left? Renewable energy sources? They will not allow us to meet the needs of modern industrialized societies at an acceptable economic and environmental cost. Therefore, the fast breeder is absolutely necessary in the long term. The fight to defend the Superphénix is, therefore, not a fight to defend nuclear energy per se, but a fight for the continuation of the fast breeder option.

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