

With a Big Nuclear Push, France Transforms Its Energy Equation

A 30-Year Program Has Cut Oil Use, Greenhouse Gases; Safety Concerns Linger

'The Trash Can for the World'

By JEFFREY BALL

BEAUMONT-HAGUE, France—Tourist brochures for this peninsula of farms and stone villages tout its fresh mussels, tart cider and creamy butter. But what really distinguishes the region is another home-grown product: nuclear power.

Over the past three decades, the French government has transformed this 15-mile finger of land from a provincial backwater into one of the world's most concentrated patches of nuclear infrastructure. On an earthen pad carved from the cliffs squats a power plant with two nuclear reactors. It's expected to get a third. At the tip of the peninsula, which juts into the English Channel, sprawls a tightly guarded factory that processes spent nuclear fuel—not just from France, but from throughout the world.

Some in France look at this landscape and cringe. Others see it as a point of national pride. One thing is clear: It stems from one of the world's most unflinching campaigns to curb fossil-fuel consumption.

With oil dependence and global warming at the top of the international energy agenda, France's experience with nuclear energy is drawing interest from the U.S. to China. Today, France produces 78% of its electricity from nuclear power—more than four times both the U.S. share and the world average. The policy has slashed France's dependence on foreign energy and given it one of the lowest rates of greenhouse-gas emissions in the industrialized world.

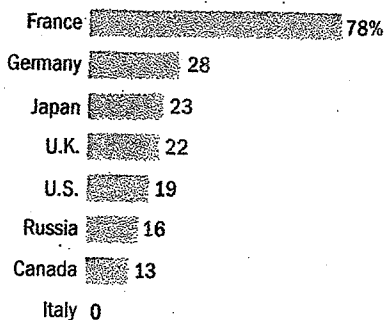
France's push hasn't been painless and isn't a panacea. The French government hatched and coddled a nuclear industry that has cost an estimated \$120 billion. In doing so, the country has accepted risks. French plants have been hit by sporadic radiation leaks. Officials are now preoccupied by the possibility of terrorist attacks. Still unresolved is how to safely dispose of waste that will remain radioactive for millennia.

France, moreover, still needs a lot of oil to function. Nuclear reactors generate electricity, which accounts for only 20% of the country's energy consumption. Oil makes up 49%. Though the country burns less oil today than before its nuclear push, its oil use is creeping up because of the rising number of cars and trucks on the road.

France's experience spotlights a daunting aspect of today's energy crunch: The

Power Play

Nuclear power as percentage of domestic electricity production among the Group of Eight leading nations, in 2003.



Source: International Energy Agency

world will have to face hard choices long before science comes up with definitive answers. There's mounting evidence that global warming is happening and that finding big new pools of oil is getting harder. But it's not yet clear how serious global warming will be or whether petroleum is running dry. If politicians and businesses act and these concerns prove overblown, they could waste vast sums of money. If they postpone action and the facts validate today's concerns, the future choices could be a lot harder.

One recent day, Monique Prunier, tourism director for the region that includes the Beaumont-Hague plant, was pointing out how tax income from the nuclear industry has improved the area: fresh flowers in a pot outside a renovated church, ornate street lights with buried electrical lines, a sleek new indoor public swimming pool. "It's a bit like paradise," she said. "We have everything and we have it easily."

Over lunch of fish and cider at a restaurant overlooking the sea, she also conceded the costs. The cider was made by a local farmer but isn't named for the region, as is typical elsewhere in France. The name "Hague" is synonymous with nuclear power. Then she held up a tourist brochure for the region. A few weeks earlier, Ms. Prunier was in Nantes, passing out copies to drum up visitors. One man "refused to touch this paper," she recalled, shaking her head. "He thought it was radioactive."

Inside a nuclear reactor, enriched uranium is broken down in a process called fission that creates massive amounts of heat. The heat boils water into steam, which powers turbines to generate electricity. The reaction also produces plutonium, which is hugely potent; one gram of it holds as much energy as about 15 barrels of oil. After the "spent" nuclear fuel is removed from a reactor, the pluto-

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nium can be extracted and used to make a bomb.

Some nuclear reactors are better for making heat, some plutonium. To burnish its credentials as a world power, France opted for a plutonium version when its engineers designed their first reactor in the 1950s. In 1960, France detonated its first nuclear bomb.

Tackling the Problem

At the same time, France started thinking about how to harness nuclear power for electricity. The country, which has no sizeable fossil-fuel deposits of its own, was almost totally dependent on imports for its oil. To help tackle that problem, French engineers developed a reactor called a "fast breeder."

Unlike a conventional nuclear reactor, which runs on fresh, enriched uranium, a fast breeder runs on leftover uranium combined with plutonium. It was envisioned as the ultimate vehicle for a self-sustaining French energy system—a guard against what French planners predicted would be a rise in the global price of uranium.

In 1956, French oil imports were disrupted after Egypt blocked the Suez Canal. France, along with the United Kingdom and Israel, had invaded the area following Egypt's nationalization of the waterway. In 1973, Arab countries again threatened to cut off France's supply, prompting price spikes, and France vowed never again to be laid flat by a few oil-rich countries in the Middle East. It encouraged consumers to trim energy use and it launched a massive nuclear campaign, banging out six reactors a year.

"En France, on n'a pas de pétrole, mais on a des idées ("France doesn't have oil, but it has ideas"), declared an advertisement that ran on what at the time was France's sole state-run television station.

The campaign was carried out by two state-controlled companies: Cogema, which is now part of Areva SA, and Electricité de France, then the country's electricity monopoly. The reactors were designed by Westinghouse Electric Co., based in Monroeville, Pa., near Pittsburgh. In February, Japan's Toshiba Corp. agreed to buy Westinghouse.

"It was Pittsburgh technology. We Frenchified it," says Bernard Dupraz, an EDF senior vice president.

In the mid-1970s, the Beaumont-

Hague region got two big pieces of news. The government said it would build two Westinghouse-designed reactors in Flamanville, a tiny village on its west coast. The government also said it would enlarge an existing nuclear-reprocessing plant at Beaumont-Hague to treat the spent fuel coming out of the civil reactors. Processing plants separate spent fuel into uranium and plutonium, which can be reused, and high-level nuclear waste, which has to be disposed.

To finance the expensive refitting job, France signed long-term deals with other countries—those that didn't have the political stomach to recycle nuclear waste in their own backyards. In effect, France defrayed the cost of its own nuclear pro-

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gram by contracting itself out as a global nuclear-waste processor.

To French officials, the move was ingenious. France's recycling technology "was good. We needed to sell it. We needed to make money," explains Claude Gatignol, a member of the French National Assembly representing the region that includes Beaumont-Hague. "That's economic success."

The decision to reprocess nuclear waste from countries such as Germany and Japan also sparked a series of demonstrations in the late 1970s and early 1980s. "The people understood taking our own waste," but they "couldn't accept becoming the trash can for the world," says Yannick Rousselet, who participated in his first antinuclear protest in 1979 when he was 19. Today he works full time as the Beaumont-Hague region's representative for Greenpeace, the environmental advocacy group.

In return, French consumers have enjoyed some of the lowest electricity rates in Europe. Opponents of nuclear power argue that rates are low because France's nuclear industry, like that in other countries, is heavily subsidized by the government.

As the French plowed ahead, the U.S. was pulling back. The economic effects of the 1973 oil shock slowed the growth of electricity demand, leading utilities to scale back on ambitious plans to build nuclear plants. In the late 1970s, concerns that plutonium would fall into rogue hands led President Carter to clamp down on civil nuclear reprocessing. After the 1979 Three Mile Island accident, the federal government ramped up nuclear oversight, leading some utilities to conclude that the cheapest option was to mothball their reactors.

Today, the U.S. has more reactors than any other country—nearly double the number in France—but they provide only 19% of the nation's electricity. It's proved far harder to construct an efficient nuclear industry in the U.S., where lots of utilities compete, than in France, where the government is in control. The lack of standardization in the U.S. market has created inefficiencies and higher costs.

A Constant Worry

France's nuclear program has never suffered a major accident along the lines of the 1986 nuclear disaster near Chernobyl, Ukraine, or even a smaller incident such as Three Mile Island. Nonetheless safety has been a constant worry.

In 1981, a serious fire at the Beaumont-Hague plant released a radioactive element into the air. After the fire the government created local committees to monitor the operations of French energy sites.

Sixteen years later, activists including Greenpeace's Mr. Rousselet said they found radiation levels higher than typical for the region at an exposed portion of pipe carrying treated waste water from the Beaumont-Hague plant to the sea. Coming into contact with radiation in certain doses can cause cancer and other serious health problems. Normally, the pipe would be covered by the sea, which would shield the radiation. At particularly low tides, it was exposed.

gy Equation

for short periods.

Cogema's engineers had long known the pipe could be exposed but concluded that it didn't release levels of radiation into the air that exceeded legal limits or that were dangerous. Bertrand Barré, scientific adviser to the chairman of Areva, says the company's assessment was right but that failing to cover the pipe was a public-relations mistake. How much of a mistake became clear when

nuclear facilities. The government is doing further work on the part of the study dealing with chemicals.

Since the Sept. 11, 2001, attacks, France has grown increasingly protective of its nuclear industry. At the Flamanville nuclear plants, officials beefed up fire-fighting capabilities, supplementing water used to fight conventional fires with special foam designed to extinguish blazes caused by jet fuel. At the reprocessing plant, which has always been heavily guarded, the French army dispatched a unit of soldiers who

bal nuclear expansion, uranium prices have risen. Some in France think fast breeders one day may be economically viable.

Areva is now hoping to take advantage of provisions in last year's U.S. energy bill to win contracts to build a fleet of reactors in the U.S. Last month, after declaring in his January State of the Union address that the U.S. is "addicted to oil," President Bush cited the success of France's nuclear strategy. "The best way to meet our growing energy needs," he said in a radio address, "is through advances in technology."

Areva recently hired as chairman of its U.S. unit the Bush administration's newly retired energy secretary, Spencer Abraham.

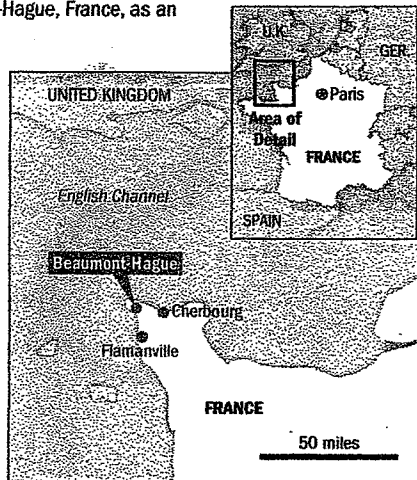
Back at home, a series of public debates about a proposed new Areva reactor in Flamanville has exposed an unexpected fissure in French thinking. France, like its neighbors, faces a European Union target to produce more electricity from "renewable" sources, such as the sun and wind. Because of its nuclear reliance, France lags behind many countries, notably Germany, in solar and wind power. This has led some to question whether the country's focus on nuclear power has been a strategic mistake.

Wind farms are creating their own political storm. There's one near Beaumont-Hague with five gray turbines about 250 feet tall. On a recent afternoon, the blades weren't moving amid a still wind. Germaine DuPont, who lives with her husband and children about 380 yards away, said she wishes that were always the case. When the blades whirl, "the noise is crazy," she said, adding that she takes sleeping pills to get some rest. "It's intolerable."

The man in charge of national energy policy says France is right to continue on the nuclear course. "We were convinced that renewable energy cannot provide enough [power] and that oil is not infinite—so you must find something else," says François Loos, the country's industry minister, sitting in his Paris office and puffing on a Cuban cigar. "Everybody makes his choice."

Landscape Debate

Some see the nuclear processing plant at Beaumont-Hague, France, as an eyesore. Others see it as a point of national pride.



Greenpeace called the French media, which publicized the incident widely.

Cogema sent in workers to remove calcium buildups it concluded were causing the higher readings. The cleanup dislodged this material into the water, prompting Cogema to scrub the sea floor.

The same year, a researcher at a French university issued a study that found "some convincing evidence" that children who used beaches near the plant were more likely to get leukemia than those who didn't. That prompted the French government to order a review. In 2002, the study concluded it was impossible to link the additional incidences to either radiation or chemical releases from

stayed on site for six months. After that, the army set up a radar post at a nearby local airport.

The state-run nuclear effort sometimes placed bets that turned sour. The grandest part of France's nuclear vision—to run plants using left over uranium instead of the fresh kind—flamed out in the late 1990s. France had built three fast breeders for that purpose, including one called the "Super Phoenix," which cost several billion dollars. But the country decided that the Super Phoenix was unnecessary. Contrary to planners' expectations, fresh uranium remained affordable on the global market.

In recent years, amid talk of a glo-