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FEATURES

Going Nuclear

Entergy has figured out a way to make aging atomic power plants pay -- and is fueling the industry's unlikely resurgence.

By G. Pascal Zachary, [May 2005 Issue](#)

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On a raw winter afternoon, the training manager at Cooper Nuclear Station, a power plant run by Entergy Corp. on the bleak plains of eastern Nebraska, sits across a conference table from his boss, Randy Edington. Outside, it's 27 degrees. For the trainer, it's about to get even colder.

Edington is Entergy's roving troubleshooter for sick nuclear plants. The trainer is showing him his plan for improving control-room operators' performance, crucial to nuke-plant safety. Edington thumbs through the report, aimlessly stirring a cup of instant coffee, eyes narrowing -- and then drops the thick binder on the table and leans forward. "Frankly, this is a piece of trash," he says. The trainer sits in stricken silence as Edington ticks off the plan's shortcomings: no schedules, no concrete due dates, no milestones to gauge progress. He orders the trainer to start over. "I'm about as livid on this one as I've ever been," he says.

The trainer is mad too -- at himself. After the encounter, he retreats to a nearby men's room and stares at the walls. A colleague who overheard Edington's eruption comes in. "Glad that didn't happen to me," he says. But the trainer owns up. "I deserved it," he admits.

Painful though the scene is, it symbolizes what for Entergy and others in the nuclear power business is actually a pleasant development: Nuclear energy is experiencing a well-chronicled resurgence. The conventional wisdom is that the nuclear boom stems from the high price of oil, aided by a touch of concern about global warming. But there's a far more important, if little-understood, factor in the revival, and it's reflected in the demands for perfection that Edington makes as he rides the circuit of Entergy's 11 nuclear plants. He embodies a new business model pioneered by Entergy for the industry, one that, for the first time in decades, provides a powerful economic incentive for utilities to play the nuclear game. That model depends on something that even a few years ago would have seemed ludicrous: acquiring and then rehabilitating a fleet of aging nuclear plants -- the more the better.

In 1999, Entergy bought a troubled nuke plant in Massachusetts and, through rigorous cost controls and process improvements, transformed it into an earnings gusher within a matter of months. Since then, Entergy has bought four more plants and agreed to run another, reducing their operating costs by a third on average. The company's success has prompted other big utilities like Chicago's Exelon and Baltimore's Constellation Energy to mimic the strategy.

The curious result is that nuclear plants have become among the most sought-after assets in the country. The most recent one to change hands, the Ginna facility in New York, sold for \$408 million, 27 times what Entergy paid for its first plant. "Nuclear plants are so valuable that there aren't any for sale right now," says Michael Wallace, a top executive of Constellation, which bought the Ginna station.

Huge problems still confront the nuclear industry. There remains no good system for storing the deadly poisons created when uranium atoms are split to create energy. The waste -- 50,000 glowing tons of it -- is piling up at power plants across the country, making them potential targets for terrorists. But if nuclear power continues to gain momentum, it will be in large measure because Entergy has figured out how to convert some of the whitest elephants on the industrial landscape into highly efficient profit machines. The impact on Entergy itself has already been electric: The company has doubled its revenue from nuclear power to \$1.4 billion since 2001, it has been ringing up record earnings, and its [stock](#) recently hit an all-time high.

How long Entergy can run at those peak levels has a lot to do with Cooper Station -- and whether Randy Edington can change its reputation for being one of the worst-performing nuclear plants in America.

Few industries have ever needed new thinking as much as nuclear power did when Entergy began developing its fleet approach. From commercial atomic energy's birth in the 1960s, the operators had seemed almost dismissive of business basics like economies of scale, standardization, and intensive training. Reactor makers Westinghouse and [General Electric \(GE\)](#) promoted the idea of plants so automated and cheap to operate that almost every local utility could have one and owners would merely have to "turn a key" to run the plant.

LIGHTING IT UP

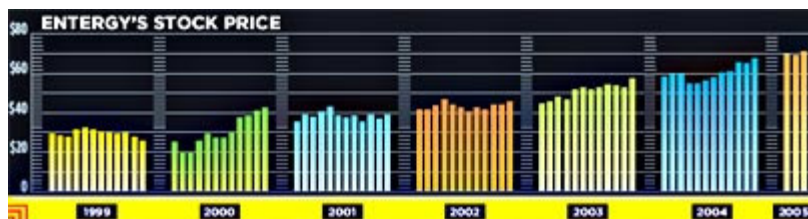
Entergy's strategy of acquiring and rehabilitating creaky nuclear power plants has helped reenergize its profits and stock price.

	ENTERGY REVENUE	NUCLEAR REVENUE	NUCLEAR PORTION OF TOTAL REVENUE
2005*	\$10,362.4	\$1,395.2	13.5%
2004	\$10,123.7	\$1,321.2	13.1%
2003	\$9,194.8	\$1,275.0	13.9%
2002	\$8,271.4	\$1,200.2	14.5%
2001	\$9,617.3	\$789.2	8.2%
2000	\$10,036.6	\$298.1	3.0%

*Projected. Notes: Dollar amounts in millions. Nuclear revenue does not include plants operated by Entergy's regulated-utility subsidiaries.
Sources: Entergy; UBS Equity Research

	ENTERGY NET INCOME	NUCLEAR NET INCOME	NUCLEAR PORTION OF NET INCOME
2005*	\$1,015.7	\$285.1	28.1%
2004	\$878.5	\$241.3	27.5%
2003	\$982.0	\$196.9	20.1%
2002	\$866.9	\$200.5	23.1%
2001	\$724.9	\$127.9	17.6%
2000	\$713.6	\$49.2	6.9%

*Projected. Notes: Dollar amounts in millions. Nuclear net income does not include plants operated by Entergy's regulated-utility subsidiaries.
Sources: Entergy; UBS Equity Research



Epic cost overruns and other problems had already shredded such notions before the near meltdown at Three Mile Island in 1979 froze the U.S. nuclear industry in its tracks. But even as recently as 1990, the benefits of standardization -- fundamental to all industries -- weren't obvious to nuclear utilities. Entergy, for instance, found itself owning four plants based on incompatible technologies. Two reactors in Arkansas, built side by side, used totally different reactor designs, cooling systems, and plant layouts.

From such craziness sprang Entergy's ideas for remaking nuclear power's economic model. In the early 1990s, the company began integrating its nuclear operations, promising regulators that the plan would save \$27 million over three years. Randy Hutchinson, the Entergy executive who directed the effort, started by tackling chaotic purchasing procedures. Each plant had its own separate purchasing department; some of those departments had multiple units. "We had contracts scattered everywhere," Hutchinson recalls. He forced through common contracts to get volume discounts. The move, an everyday affair at most large corporations, was considered revolutionary in nuclear. Hutchinson generated the promised \$27 million in savings in 12 months.

By 1996, gains from standardizing Entergy's existing plants had convinced Donald Hintz, then head of its nuclear division, that the company could make money by buying or managing more plants. "This was completely the opposite of the industry's thinking of the day," he recalls. Some of his own colleagues thought he had come unhinged. But Hintz made the case that deregulation, then gaining steam in the Northeast and California, would force some utilities to sell their nukes; in many areas regulators were urging utilities to scale back on atomic power. In the end, Hintz persuaded Entergy's board to authorize a big nuclear ramp-up -- and give him a \$2 billion budget.

His first major deal was for Pilgrim Nuclear Station. Located in Plymouth, Mass., Pilgrim was the only nuclear plant owned by Boston Edison. The facility was plagued by operational problems, and Boston Edison was considering shutting it down. But in July 1999, Entergy bought the 670-megawatt plant -- which produced enough juice to power about 675,000 homes a year -- for a mere \$15 million and set about overhauling its operations. The contrast was swiftly evident to Ted Sullivan, Pilgrim's manager, who stayed on after the purchase. "Being a single unit, when a problem arises you feel like you're alone in the desert," he says. As part of Entergy, he had a wide network to tap into during a crisis.

Good thing too. Not long after the purchase, Sullivan got a report of a mysterious buzzing in the main turbine. Pilgrim's technicians were baffled, and Sullivan prepared to shut down the reactor -- and he would have if he hadn't had Entergy to fall back on. "I was a phone call away from getting all the help I needed," he recalls. Within hours a specialist from an Entergy plant in Arkansas had arrived on a company jet. He diagnosed the problem in 20 minutes.

CHAIN REACTION

Following Entergy's lead, other major utilities are putting together their own nuclear fleets and fueling the atomic energy revival.

COMPANY	TOTAL NUMBER OF PLANTS	NUCLEAR CAPACITY (IN MEGAWATTS)	NUCLEAR PORTION OF TOTAL CAPACITY	PROFIT
EXELON	20	20,600	39%	\$1.9B
ENTERGY	11	9,675	30%	\$933M
NUCLEAR MANAGEMENT	8	4,600	100%	N/A*
DOMINION	7	6,100	22%	\$1.2B
CONSTELLATION	5	3,740	32%	\$540M
PROGRESS ENERGY	5	4,300	18%	\$759M

*Private company. Source: Company reports

Entergy's overhaul soon boosted Pilgrim's average output from about 80 percent of capacity to 94 percent, and the plant earned a profit within a year of the purchase. By mid-2003, Entergy had expanded its fleet to 10 stations and was increasingly benefiting from scale. For instance, in the key area of nuclear fuel -- the single largest cost in running a nuclear plant -- Entergy now accounts for about 10 percent of the U.S. market. "We do have more clout," says Frank Rives, Entergy's director of nuclear fuels. That has translated into savings on volume purchases of uranium and processed fuel and allowed individual plants to carry lower fuel inventories, another cost cutter.

Other benefits of Entergy's fleet approach are less tangible. Ask the company's managers about the biggest gains from the strategy and they cite the advantages of being part of a wider tribe. That's facilitated by a conference call held every Monday at 7 a.m., during which senior plant managers compare notes. There's not much small talk. At a recent meeting, the executive running the show, Bill Campbell, kicks things off by saying, "Let's remember that there were no good old days in this industry. We have to make sure we don't repeat the mistakes of the past."

During the next two hours, rhetoric becomes reality. The chief of an Arkansas plant reports that he has suspended a reactor operator because of a control-room error that caused a momentary surge in power. The Arkansas manager is chagrined. "This error was because of a poor, nonconservative decision and is absolutely unacceptable," he says. The group talks about how to avoid the problem, and Campbell distills the lesson: "You must not compound a bad decision with another bad decision," he says. "Keep hammering that point home."

The meeting ends on a somber note. Over the weekend a security guard at one of Entergy's New York plants came to work, checked out his weapon, went home, and killed himself. There's no prohibition on guards taking their weapons home, and the procedures for allowing it vary from plant to plant. Campbell wonders whether taking weapons offsite should be banned or otherwise restricted. "Whatever we do," he says, "I'd like to know there's an absolute companywide standard in place."

A large part of Edington's mission at Cooper Station is to make sure that Entergy's standards are drummed into every worker at the plant. Edington, 51, got his nuclear engineering training, and a good deal of his exacting managerial approach, in the U.S. Navy's atomic sub program. He's been at Entergy for 23 years. Cooper Station has been the toughest assignment of his career; before he and about 10 other Entergy managers arrived, the plant's performance was "abysmal," he says.

Cooper Station is owned by the Nebraska Public Power District. In 2003, after a string of lapses that included a clumsy response to a fire, the federal Nuclear Regulatory Commission designated Cooper Station for intensified scrutiny, a rare step that marks a plant as one of the most troubled in the country. Entergy contracted with the utility district to try to fix Cooper Station for \$1 million a month, plus expenses. Edington arrived in October 2003. His first move was to instill what he believes is the single most important requirement for running a nuclear power plant: an absolute mania for detail.

For Edington, that extends to scooping up a stray earplug from an otherwise spotless corridor floor "because I don't like litter in my house," he says. It also includes less orthodox approaches. On a recent morning, Edington drives to the plant in predawn darkness. On his approach, he eyeballs the lights flickering on a tower, a warning to planes. Edington softly counts as he passes the lights. The act seems baffling until later in the day, when Edington asks an employee how many tower lights the worker saw that morning. The point of the exercise: Edington wants his colleagues to be keenly aware of their surroundings at all times -- even before they get through the front door. He pops the lights question to a few workers every day. "It's about learning to focus, noticing everything in your environment, always being on your game," he explains. The idea is that intently tuned-in workers will instantly recognize anything that's out of place or unusual and respond by the book.

Other techniques are more straightforward. Edington set up an offsite training center so maintenance workers could practice the many maneuvers required to keep a plant running smoothly. Entergy's status within the industry as a leading plant-turnaround expert also helps: Edington is able to get quick responses from suppliers eager to keep the company happy.

By December 2004, 14 months into Edington's tenure, Cooper Station's key operating metrics have improved. But as January approaches, he faces his toughest test: readying the plant for the complex task of refueling, required every 18 months. Cooper Station has been lousy at refueling, typically taking 50 days to load new fuel rods, compared with 30 days at Entergy's other plants. Reactor shutdowns -- necessary for refueling -- can cost a utility \$1 million a day. Edington is demanding that Cooper Station hit the 30-day standard and has instituted a sweeping planning effort; virtually every step in the refueling -- there are thousands -- is to be detailed and practiced in advance. But less than a month before the refueling is to start in mid-January, the project has fallen far behind schedule, and some of Cooper Station's managers are on the verge of panic.

One day John Christensen, a plant veteran who leads the refueling effort, tells his team that to stay on track they must complete 158 separate tasks in eight days. It doesn't help that the person in charge of 40 of the tasks is out sick. "There's frustration over the lack of progress," Christensen tells his team. "We've got to do something different." All his colleagues can do is groan.

Edington has made it clear to his employees that missing the 30-day target is unthinkable. But even as the clock ticks on refueling, he takes some comfort in how far Cooper Station has already come. The plant has been running at more than 90 percent capacity, up from 67 percent when Entergy took over. The gain is typical: Overall, the five facilities acquired by Entergy improved their output from 77 percent to 92 percent. Last year Entergy's nukes ran at 93 percent capacity, among the best in the industry. Nuclear power typically contributes at least 40 percent of Entergy's net income; last year nuclear profits approached \$400 million.

Entergy expects those profits to grow as it pursues its nuclear strategy. But any number of issues could trip the company up. A reactor accident -- or terrorist attack -- would devastate the entire industry. And the surging value of nuclear plants is making it hard to find any stations to buy, much less at bargain-basement prices. Increasingly, Daniel Keuter, Entergy's [acquisition](#) chief, has been trying to persuade utilities that own a single plant, like California's PG&E, "that they'd be better off turning it over to a fleet operator." The company has also received feelers from plant owners overseas that are interested in having Entergy run their facilities. Gary Taylor, CEO of Entergy's nuclear division, says the company's nuclear fleet will inevitably expand, "either through acquiring or managing other companies' reactors."

Edington's work at Cooper Station, the first plant the company has managed without owning, will likely serve as a model. In January the plant pulls off what had seemed impossible months earlier: It completes the refueling in 34 days and 22 hours -- shy of the target but still two weeks faster than ever before. Edington's intense planning has paid off: After shutdown, technicians remove the reactor head and disassemble its components in a mere 61 hours, compared with 281 hours during the previous outage. In part that happens because Edington is able to borrow a critical tool from an Entergy plant in Arkansas to quickly remove the 52 four-foot-long, 450-pound bolts used to secure the reactor head. Not everything goes right. Technicians discover that 10 miles of cable must come out, an unexpected mess that throws workers far behind schedule. Edington adds 15 people to the 30 already on the cable job and gets things back on track. Among those most impressed by the plant's refueling performance: the NRC, which recently removed the plant from its list of troubled nukes.

That validation of Entergy's approach -- and of Edington's deft execution of it at Cooper Station -- is sweet. "We're getting this one turned around," Edington says. Even the training chief, reamed out by Edington a month earlier, has played his part. His do-over on the plan for control-room operators wins high praise from Edington. Still, Edington figures there's another year or two of work ahead before Cooper Station achieves the state of near perfection he demands. For Entergy, that means additional lucrative management fees to come. For Edington, it means many more mornings of counting lights in the darkness. ◆

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