



NUCLEAR OPTION

Vermont Yankee, a nuclear power plant on the Connecticut River, is up for re-licensing, a process that in Vermont requires the Legislature's approval.



POWER

SO FAR, ALL SIGNS POINT TO THE NATIONAL NUCLEAR RENAISSANCE PASSING BY NEW ENGLAND. [BY BARBARA MORAN]

On February 24, Randy Brock, a Republican state senator in Vermont, did something he never expected to do. He voted to close Vermont Yankee, the state's only nuclear power plant. A longtime supporter of the plant, Brock did not want to vote this way. He considers nuclear power safe, environmentally

friendly, and reliable and wants the plant to stay open. But a series of problems at Vermont Yankee forced his hand. "If their board of directors and its management had been thoroughly infiltrated by anti-nuclear activists," he says, "they could not have done a better job destroying their own case." Vermonters – including the senator – were fed up with the way the plant was being run, so he voted no.

PHOTOGRAPH BY ASSOCIATED PRESS/
ENERGY; GLOBE STAFF PHOTO-ILLUSTRATION



The Vermont vote, coming just a week after President Barack Obama announced \$8.33 billion in federal loan guarantees for companies building two new nuclear reactors in Georgia, would seem to show a New England stuck in the no-nukes 1980s, out of step with the nuclear fever sweeping the rest of the country. In March, Gallup reported that support for nuclear power as “one of the ways to provide electricity” had climbed to a new high of 62 percent. In the same poll, 28 percent of Americans said they “strongly favor” nuclear power, the highest Gallup has measured since it first asked the question in 1994.

While no new nuclear power plants have been ordered in the United

States since the Three Mile Island reactor accident in 1979 (several opened after the accident), in other countries – France in particular, and China – nuclear power is increasingly common, and new technologies that create less waste and offer better containment have lowered the risk of environmental contamination and accidents. Congress in 2005 approved a program of loans to help the US nuclear industry, and today the federal Nuclear Regulatory Commission is reviewing applications to build 22 new plants.

Even environmental activists, including Greenpeace cofounder Patrick Moore and *Whole Earth Catalog* creator Stewart Brand, have come out in favor of nuclear power because, they argue, it is safe and carbon-free. But

Vermont's most prominent environmentalists have remained resolutely opposed to the state's one nuclear power plant. It's "time to figure out how we replace Yankee with local, renewable power," writes activist and author Bill McKibben in an e-mail. "It won't be easy, it is necessary." Ben & Jerry's has weighed in, siding with a group called Vermont Businesses for Social Responsibility in calling for the plant's retirement.

And beginning in 2007, a series of embarrassments and blunders shook the plant, bringing a previously ambivalent public into the anti-Yankee camp. Now, even as Americans take a fresh look at nuclear power, even as President Obama, in his State of the Union address in January, pledged to build a new generation of safe, clean nuclear power plants, events in Vermont show that a nuclear renaissance may not come so easily to New England.

VERMONT YANKEE SITS on the banks of the Connecticut River in the town of Vernon, five miles north of the Massachusetts border and just across the river from New Hampshire. Along with Seabrook in New Hampshire, Pilgrim in Massachusetts, and Millstone in Connecticut, it is one of four nuclear power plants in New England. Vermont Yankee supplies about 30 percent of the state's power (another third comes from Hydro-Quebec, a Canadian utility with mostly hydroelectric and nuclear plants), helping Vermont claim the title of lowest-carbon-emitting state in America, according to the United States Energy Information Administration.

The story of Vermont Yankee's fall from grace begins on January 27, 2006, when the plant applied to the Nuclear Regulatory Commission for a scheduled license renewal. Like many nuclear reactors in the United States, Vermont Yankee, which opened for business in 1972, is nearing the end of its initial 40-year license. Of the country's 104 power reactors, 59 have already had their licenses extended for 20 years and 19 renewals are pending. So far, most of the extensions have moved through the system with few bumps.

In Vermont, however, the rules are different. To obtain a license renewal, Vermont Yankee is required to first get a "certificate of public good" from the state's Public Service Board. And for the board to grant the certificate, both houses of the state Legislature must give it permission. Despite this cum-



bersome process, both friends and foes of Vermont Yankee expected a relatively smooth ride. They were wrong.

Trouble started on August 22, 2007, when a section of one of Vermont Yankee's cooling towers collapsed. The plant's two towers were not the iconic concrete, hourglass-shaped structures, but long, low buildings made chiefly of wood. In one of these buildings, where steam used to generate electricity at the plant cools and turns back into water, wooden beams had rotted and collapsed, dislodging a 20-foot section of plastic pipe carrying 90,000 gallons of water per minute. While the gashed wall looked "pretty nasty," according to Larry Smith, manager of communications for Vermont Yankee, the spilled water was not radioactive and there was never any danger to the plant or the public. But the event was, he admits, "a game-changer." People who had never thought much about Vermont Yankee suddenly wondered what on earth was going on down there. If they let part of a cooling tower collapse, should they be trusted with the rest of an aging nuclear power plant?

There were other problems, too. In 2008, Entergy, the Louisiana-based owner of Vermont Yankee since 2002, announced plans to spin off the plant – and the four other nuclear power plants it owns, including Pilgrim in Massachusetts – into a new company called Enexus. Many Vermonters, even nuclear fans like Randy Brock, were suspicious. They thought Entergy was trying to dump an old reactor without setting aside enough funds to decommission it, possibly leaving the state to care for an abandoned plant if the Legislature voted to deny the certificate of public good, and the plant were to close in 2012. "I found it very difficult to discern a bona fide business reason" for the spinoff, says Brock, "other than to strip out assets for the benefit of Entergy shareholders, leaving a highly debt-ridden plant." (Entergy recently shelved the spinoff plan after facing opposition in both Vermont and New York.)

That same year, re-licensing hearings began

Barbara Moran is a science writer in Brookline. Her book The Day We Lost the H-Bomb came out in 2009. Send comments to magazine@globe.com.



62 percent of Americans support using nuclear power to generate electricity 104 nuclear reactors generate power in the US today

PROTESTERS PHOTOGRAPH BY JEB WALLACE-BRODEUR/THE TIMES ARGUS; SHUMLIN, DOUGLAS, AND REPAIR PHOTOGRAPHS BY TOBY TALBOT/ASSOCIATED PRESS; BROCK AND TRENCH PHOTOGRAPHS BY GLENN RUSSELL/BURLINGTON FREE PRESS;



[1] Anti-nuclear activists in Montpelier in January
 [2] Vermont Senate President Pro Tempore Peter Shumlin
 [3] Vermont state Senator Randy Brock
 [4] Vermont Governor Jim Douglas
 [5] A trench dug at Vermont Yankee to find the source of a tritium leak
 [6] The monitoring well at the plant where tritium was found
 [7] Vermont Yankee (in an undated photo from before 2002)
 [8] Repairing damaged cooling tower in 2007
 [9] Maintenance at the towers earlier this year



Vermont Yankee
 HERE TO STAY

TRITIUM PHOTOGRAPH BY JASON R. HENSKE/ ASSOCIATED PRESS;
 VERMONT YANKEE PHOTOGRAPH BY ASSOCIATED PRESS;
 MAINTENANCE PHOTOGRAPH BY JONATHAN WIGSS/GLOBE STAFF

before the state's Public Service Board. One question that emerged was the risk of radioactive materials contaminating soil or groundwater around the plant. Of special concern was tritium, a radioactive form of hydrogen that both occurs naturally and is created when nuclear power plants generate electricity. Water used to regulate the temperature of the reactor core becomes "tritiated," picking up the extra neutrons that make it radioactive. And when plants pump this water into storage tanks to cool for reuse, leaky pipes can introduce tritium into the soil and groundwater.

According to federal data, 33 US plants have reported tritium leaks, including Seabrook and Millstone. While these leaks have not endangered the public – the Nuclear Regulatory Commission says the tritium levels leaked were much lower than exposures from natural background

radiation – any radiation leaks are considered serious. At Vermont Yankee, plant officials had assured state officials that such leaks couldn't happen, since no underground pipes carried radioactive materials.

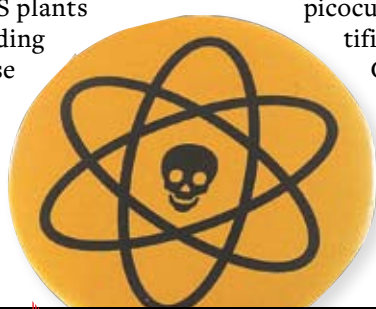
But on January 7 of this year came the news that Vermont Yankee had found tritium in a groundwater testing well near the eastern edge of the facility. The water sample, taken in November, showed a tritium concentration of 705 picocuries per liter, just above the level of detection. Company officials re-sampled the well. Not only did they find tritium, but the levels were much higher: 17,000 picocuries per liter. Though the levels were below the Environmental Protection Agency's groundwater threshold of 30,000 picocuries per liter, the plant notified the Nuclear Regulatory Commission and officials in Vermont, New Hampshire, and Massachusetts.

The three drinking-water wells at the plant, which are drilled deep

into bedrock and generally isolated from the groundwater, were not contaminated with tritium, and neither were nearby drinking water supplies. And though groundwater under the plant flows toward the Connecticut River, testing did not pick up more than trace amounts there. According to federal regulators and the Vermont Department of Health, the leaking tritium posed no threat to the public.

Nonetheless, Vermonters were angry. Hadn't Vermont Yankee officials said, under oath in front of the Public Service Board, that groundwater leaks were impossible? "They had to know," says James Moore, the clean energy program director at the Vermont Public Interest Research Group, a nonprofit consumer and environmental advocacy organization. "So they were either lying or incredibly incompetent, neither of which is acceptable when you're dealing with a nuclear power plant."

As plant officials struggled to find and stop the leak, which ultimately was discovered to be from pipes Entergy officials didn't realize or didn't disclose were there, the story made headlines. Amid



all the attention, Peter Shumlin, the Democratic president pro tempore of the Vermont Senate – an opponent of re-licensing the plant and a candidate for governor – made a decision. He called for a Senate vote on the future of Vermont Yankee.



IN VERNON, residents followed the news with dismay. Townspeople generally regard the plant as a good neighbor, and are loath to see it close. Mike Hebert, chairman of the Vernon School Board, has nothing but praise for Vermont Yankee, which sits directly across the road from the elementary school his grandchildren attend. The plant, says Hebert, sponsors a basketball team and donates food for the county's annual hunger drive. "I can't think of a nonprofit in the county that hasn't benefited from VY," he says. "It's everything to this town."

In January, Mike Ball, an engineer at Vermont Yankee and then-chair of the Vernon Selectboard, led a contingent from the town to the state capitol in Montpelier. They distributed fact sheets about tritium and Vernon, noting that Vermont Yankee is the largest taxpayer in the town and provides high-paying jobs to the region. Despite his efforts, Ball says, he felt the tide turning against Vermont Yankee.

Two weeks after Ball's visit, Governor Jim Douglas, a longtime supporter of the plant, called for a "timeout" in the Vermont Legislature. "With so many ongoing investigations, unanswered questions, and my own unease with previous information we have received from Entergy management," he said in a statement, "I can no longer ask legislators to vote this year on whether the Public Service Board should be allowed to decide the case for re-licensing." Like many Vermonters, he had lost trust in the people running Vermont Yankee. But this was not the time for a vote, he argued.

Mike Ball hoped the Senate would wait. "There was no way the legislators could process all that information and make a rational decision," he says. In his view, a legislative vote would prevent the Public Service Board from doing its job. "Let the technical people make the technical decision," he says. "Don't let the nontechnical people make an emotional decision."

Of course, most people's views on nuclear power are influenced by emotion. Once there was contaminated groundwater, the battle – regardless of the actual danger to public health – was probably lost.

Despite the governor's plea, Shumlin and the Senate marched ahead with the vote. On February 24, hundreds of Vermonters crowded the

state capitol to watch the debate. Outside, opponents of the plant stood in the snow holding protest signs. James Moore's group supplied a custom-made, 12-foot-high, inflatable caricature of an aging cooling tower sporting spectacles, a bandaged nose, and Depends.

After four hours of debate, the Senate voted 26 to 4 to block re-licensing. Senator Shumlin, a charismatic politician who leans forward to make a point, calls the vote an act of courage. "This is what democracy is intended to be," he says.

His critics have a different take. "The bill was ultimate political theater for the benefit of Senator Shumlin's gubernatorial campaign," says Republican Randy Brock. Shumlin counters that the governor and Entergy had been encouraging a vote for months, but backed off when things looked bad. "The governor and lieutenant governor have acted as if they are a wholly owned subsidiary of Entergy," he says. "I finally said, 'Enough is enough. It's time to vote. We need to retire this plant on time.'"

THE VOTE IN VERMONT was not a referendum on the future of nuclear power in America or even New England: It was about local politics and a local plant. And yet it could have lasting impact far beyond Vermont Yankee and the Green Mountain State.

The most immediate repercussions may be for the Pilgrim plant in Plymouth, which filed for re-licensing on the same day as Vermont Yankee. Pilgrim is the same age as Vermont Yankee, has the same type of reactor, and is also owned by Entergy. Pilgrim, however, has thus far avoided Vermont Yankee's trail of woe. The plant has six monitoring wells testing for tritium and is installing six more, sharing all samples with the Massachusetts Department of Public Health. Pilgrim spokesman David Tarantino says that testing has detected trace quantities of tritium, but the amounts – in the hundreds of picocuries – are too small to signify a leak.

Citizen groups, including one called Pilgrim Watch, have called for more extensive monitoring and safety measures at the plant. Mary Lampert, the volunteer group's founder and director, was invigorated by the Vermont decision. "Clearly it will have repercussions," she says. "Certainly the public, local and state officials, and the [Nuclear Regulatory Commission] can't help but be alarmed at the rash of leaks." While the Massachusetts Legislature does not have the same regulatory power that Vermont lawmakers do, state officials have been mak-

ing their presence known to federal regulators. In February, Governor Deval Patrick wrote to the commissioners, asking them not to re-license Pilgrim or Vermont Yankee until the leak issues were resolved. The Massachusetts attorney general's office has asked the commission to address whether Pilgrim's spent fuel pool is vulnerable to accidents, terrorist attacks, or natural disasters. Despite these actions, spokesman Tarantino expects that the plant will be re-licensed. "It's unfortunate what happened in Vermont," he says, but "we have met – and [the Nuclear Regulatory Commission] has accepted – the conditions of renewal."

There is another way for states to influence the nuclear debate, says James Moore of the Vermont Public Interest Research Group. He points out that states have jurisdiction over energy planning, reliability of facilities, and certain environmental standards. Vermont exercised its right to weigh in, says Moore, and "all of the other states in this country have those same rights" and could create their own new re-licensing procedures. Since the Vermont Senate vote, says the young man with a sometimes-mischievous smile, several other states have asked him for information on the subject. He declines to give specifics, however, saying that he doesn't want to alert the nuclear industry to future challenges.

And then there's the question of new plants. A true nuclear resurgence will require new plants – lots of them, says Henry Jacoby, an economist who works on energy and environmental issues at MIT's Sloan School of Management. According to Jacoby, for nuclear power to even begin to supplant coal in the United States would require at least doubling the current fleet of nuclear plants, building 100 new reactors at a cost of \$5 billion to \$10 billion apiece.

Even if investors can overcome financial and regulatory hurdles, they probably won't choose to build plants in the Northeast because of New England's perceived qualms about nuclear energy. Polling by Harvard political scientist Stephen Ansolabehere has shown that New England is no more hostile to nuclear power than other areas of the country. But industry leaders still perceive the region as less supportive, according to Tom Kauffman, senior media relations manager for the Nuclear Energy Institute, a nuclear trade and lobbying group. This may be partly because New England has stronger environmental activism and more vocal town politics than, say, the Southeastern states.

Right now, according to Kauffman, nobody is planning to build a



30 percent of the electricity consumed in New England comes from nuclear power plants

13 percent

new nuclear power plant in New England. And with a vote like Vermont's, and with more states possibly pushing for similar powers, it seems extremely unlikely that anyone will.

Anti-nuclear activists in Vermont insist that they don't need Vermont Yankee. In fact, they say that its closure will push the state toward reducing energy consumption through conservation and generating more energy through renewable sources like wind and solar. It's not clear if this goal is realistic in Vermont or in the rest of New England. The four nuclear power plants in the region produce about 30 percent of the electricity consumed here, well above the national average of 19.6 percent. (New England gets most of the rest of its energy from coal, oil, and natural gas, with 13 percent coming from hydroelectric and other renewable sources, according to ISO New England, the not-for-profit that operates the region's power grid.) And because of start-up costs and other barriers – think Cape Wind – it's doubtful that renewable energy can step up immediately to meet growing demand. Some say that it simply can't. The US Energy Information Agency predicts a 40 percent rise in elec-

tricity demand over the next 30 years. To meet this rising demand with the current mix of energy sources, according to agency numbers, will require approximately 230 new coal plants, 160 wind farms, and 10 nuclear power plants. "There is no free stuff," says MIT's Jacoby. "There is no way to power society that has no cost at all." If Vermont offers any indication, New England is facing some tough choices.

ON MARCH 25, Mark Savoff, a vice president with Entergy, stood at a podium in a drab conference room at Vermont Yankee and announced that the tritium leak had been found and stopped. The plant was now beginning remediation, excavating about 150 cubic feet of contaminated soil from the area around the leak for disposal, and pumping out 300,000 gallons of irradiated groundwater to be reused in the plant as coolant for the reactor core.

Savoff expressed regret and embarrassment over the leak itself and Entergy's actions. "We realize that these events have impacted the trust and confidence that you place upon us," Savoff said to the gathered crowd of reporters, towns-

people, and other stakeholders. "We know we have to rebuild that trust." Within days of the press conference, Vermont Yankee restarted a television, radio, and newspaper ad campaign with the theme of restoring trust. But it may be too little too late. "Short of the replacement of the CEO, the board of directors, and senior management, I'm not sure that they can do a lot," says Senator Brock, "and I see no sense that they've done much of anything."

The Vermont Yankee story is not over. Vermont will vote on a new Legislature and governor in November. Plant officials hope for a revote on Vermont Yankee next year and are proceeding as if the reactor will remain open. Some Vermont legislators, including Randy Brock, have suggested building a new reactor on the Vermont Yankee site, an idea that so far has gone nowhere. The nuclear industry is watching closely. In the short term, its expansion depends not on building new nuclear reactors, but on expanding the power output and extending the lives of existing ones. "In that regard, the Vermont Yankee story is telling," says Harvard's Ansolabehere. "Even that won't be easy." ■



NEW ENGLAND'S NUCLEAR POWER PLANTS

MILLSTONE POWER STATION

WATERFORD, CONNECTICUT

OWNED BY Dominion (Richmond, Virginia)

BEGAN COMMERCIAL OPERATIONS Unit 2, 1975; Unit 3, 1986 (Unit 1, which went online in 1970, no longer in use)

COST TO BUILD Unit 2, \$424 million; Unit 3, \$3.7 billion

POWER CAPACITY Two reactors, 2,097 megawatts

EMPLOYEES 1,085

ACCIDENTS/INCIDENTS In November 2007, radioactive tritium seeped into the foundation drain sump outside Unit 3. Public drinking water supplies were not affected.

STATUS Unit 2 renewed license expires 2035; Unit 3, 2045

⚡ PILGRIM POWER PLANT

PLYMOUTH, MASSACHUSETTS

OWNED BY Entergy (New Orleans)

BEGAN COMMERCIAL OPERATIONS 1972

COST TO BUILD \$231 million

POWER CAPACITY One reactor, 680 megawatts

EMPLOYEES 650

ACCIDENTS/INCIDENTS None

STATUS Initial 40-year license will expire on June 8, 2012. Plant is in the process of renewing license until 2032.

Sources: Dominion, Entergy, NextEra Energy

SEABROOK STATION

SEABROOK, NEW HAMPSHIRE

OWNED BY NextEra Energy Resources

(Juno Beach, Florida)

BEGAN COMMERCIAL OPERATIONS 1990

COST TO BUILD \$7 billion

POWER CAPACITY One reactor, 1,244 megawatts

EMPLOYEES 700

ACCIDENTS/INCIDENTS In 1999, workers found trace amounts of tritium in the space between the two containment-dome structures. The leak posed no threat to public health or the environment.

STATUS Renewed license expires 2030.

VERMONT YANKEE

VERNON, VERMONT

OWNED BY Entergy (New Orleans)

BEGAN COMMERCIAL OPERATIONS 1972

COST TO BUILD \$180 million

POWER CAPACITY One reactor, 650 megawatts

EMPLOYEES 650

ACCIDENTS/INCIDENTS In August 2007, a section of a cooling tower collapsed. In January of this year, the plant reported tritium in a test well, which was eventually traced to two leaking pipes.

STATUS Initial 40-year license will expire on March 21, 2012. Plant is in the process of renewing license until 2032. In February of this year, the Vermont Senate voted 26 to 4 against allowing re-licensing.

comes from hydroelectric and other renewable sources  57 percent comes from other nonrenewables, including coal, oil, and natural gas