

THE NEW YORKER

## Is Nuclear Power Worth the Risk?

*The Fukushima disaster sparked a worldwide phaseout of nuclear reactors. As climate change worsens, it may be time to reconsider.*

By [Carolyn Kormann](#) December 22, 2019

On a blustery Sunday in Okuma last spring, a crowd was seated under red-and-white tents awaiting the arrival of Prime Minister Shinzo Abe. They had gathered to celebrate the opening of a new town hall, and the reopening, just a few days earlier, of the town of Okuma itself. In March, 2011—after a magnitude-nine earthquake, one of the most powerful in recorded history, triggered a twelve-story tsunami—the nearby Fukushima Daiichi nuclear-power plant flooded and lost power, prompting three of the plant’s six reactors to partially melt down. Radioactive water flowed into the sea, and plumes of radioactive particles spewed into the sky. The fallout contaminated Okuma and the surrounding towns. More than a hundred thousand people were ordered to leave their homes, with little sense of when, if ever, they would be able to return. Many more people across Fukushima Prefecture—which is slightly larger than Connecticut—self-evacuated, afraid and uncertain about the danger the fallout posed.

“It’s been 2,956 days since 3/11,” Jin Ishida, Okuma’s vice-mayor, told me, referring to the date of the disaster. We were standing near the entrance to the new town hall, a glass-and-cedar building next to a stubby field that had once been rice paddies. Ishida, who is sixty-five, had returned to live in Okuma alone, without his family. He had given the day’s opening speech, followed by a parade of officials, including Fukushima’s governor, a member of the national assembly, representatives from Japan’s Ministries of Environment and Economics, and the Okuma mayor. Abe, who was late, was coming from a nearby sports complex known as J-Village, which had, until recently, served as a logistics base for disaster-response workers. In 2020, the Japan leg of the Tokyo Olympic-torch relay will begin on its grounds, to celebrate the region’s recovery—at least, that is the hope.

After years of decontamination efforts, as well as the natural decay of certain radioactive isotopes, the Japanese government has gradually lifted the evacuation orders for the towns that were contaminated. Okuma was among the last towns to reopen, and, even so, only partially; some of its territory was still part of the so-called difficult-to-return zone, where radiation levels remained above acceptable limits. Cleanup efforts included the demolition of buildings with high radiation levels and the removal of the top metre of soil from what had once been highly productive farms and rice paddies throughout the region. By 2022, Ishida said, another 2,125 acres of topsoil—the nutrient-rich dirt that had been like gold for local farmers—would be removed. “Ideally,” Ishida said, “if it’s possible to totally clean up to pre-3/11 levels, we should.”

The unit of measurement for the impact of ionizing radiation on a person’s health is called a sievert. One sievert, absorbed at once, can make you very sick, and a few more will kill you. One millisievert—a thousandth of a sievert—will have no effect; a chest *CAT* scan, for example, delivers a dose of seven millisieverts. The concern is long-term exposure, and the science around how much low-dose exposure increases the risk of cancer and other illnesses is contentious. The lowest annual dose that has clearly

shown a link to cancer is a hundred millisieverts. The Japanese government decided that once the radiation dose in evacuated areas got down below twenty millisieverts per year it would allow people to return. This was roughly the dose in the newly opened areas of Okuma.

There were other problems, though—in particular, meltdown fuel remained inside the power plant’s core reactor. “Another severe earthquake could happen tomorrow,” Ishida said. The reactor complex is built to be earthquake-proof, and its owner, Tokyo Electric, which is in the process of decommissioning the Daiichi plant, has built structures to contain the spent fuel and contaminated water, but such measures cannot entirely eliminate the risk. The radioactive waste will likely sit around the plant for generations to come.

Around one per cent of the former population, which was nearly twelve thousand, have registered to live in Okuma. Most of the people I spoke to at the opening ceremony were visiting from other cities, where they planned to stay. Some feared that the region was still not safe; others believed that life would be too difficult and lonely here—there is no good grocery store, for instance, and aggressive wild boar are on the prowl. “There are many evacuees who want to come back, mostly elders,” Masumi Kowata, the only woman on Okuma’s twelve-member town council, told me. “Two children will come back this month.” They were, as far as she knew, the only two children.

Kowata, who is sixty-four, with a pixie haircut and a youthful face, had lived most of her life in Okuma, where she previously ran a tutoring program. But, she told me, she would not be returning, either; her house remained in the difficult-to-return zone. She lived in Aizu now, the mountainous western swath of Fukushima Prefecture, beyond the contamination. “I’m a second-generation radiation victim,” she said. Her father, who died in 2015, told her in their last conversation that he had worked as a medical aide in Hiroshima after the United States dropped the atomic bomb. At thirty-three, Kowata got lung cancer, which she now believes was the result of her father’s radiation exposure; she survived thanks to surgery.

Kowata was elected to the town council the year that her father died. She is anti-nuclear, and her campaign was motivated by a feeling that local officials had not sufficiently communicated townspeople’s anxieties to the national government. Abe’s party, the Liberal Democratic Party, or L.D.P., is decidedly pro-nuclear power. As Abe’s motorcade finally pulled up, Kowata told us that residents had prepared soup and rice, made with some local ingredients, for the officials, including the Prime Minister. “It’s very ironic,” she said, smiling. He was pushing for people to return, emphasizing that it was safe. “But will he eat our food?”



Prime Minister Shinzo Abe came to Okuma to celebrate the opening of a new town hall, and the reopening of the town of Okuma itself.

Photograph from The Asahi Shimbun / Getty

A few minutes later, Abe emerged from a tent, wearing a gold tie and a red ribbon on his gray suit jacket. He bowed before the Japanese and Okuma flags, then took his place behind a lectern. “During prolonged evacuation,” the people of Okuma had “retained their passion to return,” he said. “Now is the time of a new beginning.” The 2020 Tokyo Olympic Games would have great significance for Fukushima, he went on. The evacuation order near the local train station was expected to be lifted soon. “We’ll continue doing our best until the day when the reconstruction and revitalization in Okuma town will outshine the time before the earthquake,” he said.

Video From The New Yorker

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After the speech, the crowd moved to the entrance of the town hall, where there was a red carpet, a red ribbon, and a glittery gold sphere. Men in suits lined up, with Abe at the center. A woman passed out scissors to each man, and an excited command came over the loudspeaker. They cut, the ribbon fell, and the gold sphere opened in half, sending down a flurry of confetti and a banner congratulating Okuma on its new town-hall building. Abe smiled for the cameras, scissors still awkwardly in hand. Later, as I walked back to where the food was being served, the governor of Fukushima stopped to shake my hand. “We’ve had a very tough time since the disaster on 3/11,” he said, in English. “I would like to express sincere appreciation and gratitude for the world’s friendship and solidarity. Thank you for being here today.” I was surprised and touched, but, before I could respond, he was gone.

I sat down for lunch with Kowata. The soup and rice were delicious. (Later, a news broadcast showed Abe taking a bite from a locally made onigiri.) Music began; flutists, drummers, and dancers wearing elaborate animal costumes and masks approached the tents and paraded to the front of the crowd. They were performing a deer dance, called *chigo shishimai*, to ask the Shinto gods for a rich harvest and to welcome the arrival of spring. “In the past, they would dance in front of the town’s Shinto shrine,” which was located a few miles away, Kowata said. “But the shrine area is still too highly contaminated.” She pointed out that all of the performers were adults. “It’s actually supposed to be children dancing,” she said. “But most of the children haven’t come back.”



After years of decontamination efforts and the natural decay of radioactive isotopes, the Japanese government has gradually lifted the evacuation orders for the towns that were contaminated.

Photograph by Richard Atrero de Guzman / NurPhoto / Getty

A week before the ceremony in Okuma, Steven Pinker, a Harvard University psychology professor, Joshua S. Goldstein, an international-relations professor at American University, and Staffan Qvist, a Swedish nuclear engineer, published an Op-Ed in the *Times*, headlined, “[Nuclear Power Can Save the World](#).” The only way to supply the growing global demand for electricity without fossil fuels, they argue, is through a mix of renewable energy *and* nuclear power—not just with what we currently have but through a buildup of safer, advanced nuclear plants. Their position has been around for decades, but it is gaining currency again, as the climate crisis increases in urgency and the memory of Fukushima, the last of the world’s three major nuclear-power disasters (after Three Mile Island, in 1979, and Chernobyl, in 1986), grows more distant. Before the Fukushima disaster, there was serious discussion among energy experts about a nuclear “renaissance.” Countries had started gingerly planning new nuclear-power plants, largely owing to high oil prices and a growing conviction that next-generation nuclear was both safer and a necessary stopgap to confront the climate crisis. After the accident, however, several countries changed course, deciding, yet again, that the risks of nuclear were too great.

France announced a major decrease, and Belgium, Switzerland, and Germany announced complete phaseouts. Germany’s deadline, set for 2022, as part of its ambitious *Energiewende* (energy transition) to a hundred per cent renewable energy, is the most aggressive. Over the past decade, Germany has made impressive progress—roughly doubling its renewable-energy generation. And yet the country has seen, so far, almost no reductions in its carbon emissions, and is far behind schedule for its climate-mitigation goals. While installing large solar and wind farms, the country has simultaneously been retiring its nuclear fleet. Meanwhile, lignite, which is a particularly dirty form of coal, continues to be strip-mined and burned, and it now accounts for a significant portion of Germany’s electricity mix.

“Germany is an example of getting the order of operations wrong,” Jesse Jenkins, an energy-systems engineering professor at Princeton University, told me. “While you are growing new sources of low-carbon electricity, from a climate perspective, you simultaneously shut down coal as rapidly as possible, then natural gas and oil.” Once you have eliminated fossil fuels, increased renewables, and reconfigured your electric grid, he added, “then you can start retiring your nuclear plants.”

Proponents of a renewables-only solution often point to the fact that the energy landscape has changed dramatically since Germany accelerated its *Energiewende*, in 2011; over the last decade, the cost of solar has dropped by around ninety per cent, and the cost of wind has dropped by seventy per cent. Battery-storage technology, which would help solve the problem of intermittency, is advancing rapidly, with declining costs, as well. Still, economic models show that once roughly eighty per cent of a grid's electricity comes from solar, wind, and battery storage, an additional low-carbon source of energy—something that is reliable and consistent (not weather-dependent, for instance)—is required. Nuclear power is the only such broadly scalable technology commercially available today.

At the same time, a vast buildup of new nuclear-power plants is not the silver bullet that Pinker and other nuclear evangelists claim it to be. Even if new nuclear technologies are safer, the high cost and long construction time is prohibitive—especially for the kind of rapid decarbonization needed in the next decade—and the social opposition is likely to remain strong in places like Japan. What is key is that nuclear remains part of the mix until the fossil-fuel economy no longer exists. “Our window of time to mitigate the climate crisis is shrinking by the day,” Pushker Kharecha, a scientist at Columbia University's Climate Science, Awareness, and Solutions Program, said. “Given this urgency, it simply makes no sense to curtail a non-fossil source like nuclear power in countries that produce significant power from fossil fuels.” To avert the statistically remote possibility of a local disaster would add to the certainty of global catastrophe. “Climate change is a trolley moving inexorably but slowly toward the people on the tracks,” Steven Davis, an earth-system science professor at the University of California, Irvine, said. “Maybe nuclear is scarier because a person could be run down before she even sees the trolley.”

Nowhere is this tension more pronounced than in Japan, a country with a traumatic atomic history and limited domestic energy supplies. After the Fukushima disaster, all of Japan's fifty operating nuclear-power reactors, situated around the country, were shut down, pending safety reviews and improvements. (As [Evan Osnos reported](#) for *The New Yorker*, in 2011, Tokyo Electric had a long history of falsifying safety records and ignoring experts' warnings.) Many observers expected that the disaster would lead Japan to overhaul its energy policy and make a progressive plan for the future. Instead, coal and gas largely filled the gap, and the country's electricity-sector greenhouse-gas emissions increased.

Abe, who was first elected Prime Minister in 2006, and again in 2012, has always been an ally of Japan's so-called nuclear village—the coalition of corporations, electrical utilities, and government that controls and profits from nuclear power—and he has backed the industry's attempt to return to business as usual. In his administration's 2018 strategic energy plan, nuclear energy is expected to provide at least twenty per cent of the country's electrical power through 2050. So far, a handful of reactors have been restarted, and others have received the necessary permits to restart. National officials say that they have learned from what went wrong at Fukushima Daiichi. The Japanese public disagrees. According to a survey concluded in 2018, nearly seventy-four per cent of the Japanese population reported feeling insecure and anxious about nuclear energy. When I told a couple in Tokyo that I had borrowed a Geiger counter from the Fukushima Prefecture's central office, they laughed and said that they don't trust the government's equipment. Surfers in the city of Shimoda, a hundred miles south of Tokyo, told me, inaccurately, that I might get cancer if I surfed in Fukushima. According to Ryohei Kataoka, from the Citizens' Nuclear Information Center, about sixty-five per cent of the population is no-nuke. “That number has been quite consistent,” he said, “even if people don't outwardly protest.”





The Japanese government decided that once the radiation dose in evacuated areas got down below twenty millisieverts per year it would allow people to return.

Photograph by Tomohiro Ohsumi / Bloomberg / Getty

The first person to move back to Okuma was a man named Seiichi Idogawa, who returned on April 24, 2018, after seven years away. My interpreter, Aihara Hiroko, and I visited him last April, just before Okuma's opening ceremony. The previous afternoon, we had driven fifty miles through a spring snowstorm, from Fukushima city, over white-capped mountains, to the coast. We saw few people along the way, apart from helmeted men in Tyvek jumpsuits who dug up contaminated dirt with heavy machinery. Every few miles there were pyramids of black garbage bags plopped, like some kind of political art installation, in vast muddy fields, each bag stuffed with contaminated soil. After the meltdown, the wind blew east for four days, taking the growing cloud of radioactive dust to sea. If it had been blowing in the opposite direction, as it often does, the contamination could have been much worse. (Fukushima means "Fortune Island.")

In Okuma, we got lost looking for Idogawa's house and arrived at a dead end, next to a small, mossy cemetery, bordered by overgrown woods. When the government began the cleanup, residents and their extended families had asked officials to decontaminate the town's cemeteries, including this one, before any other area. A yellow sign posted at the cemetery's edge gave the latest radiation reading: on March 18, 2019, the contamination level had been 0.6 microsieverts per hour, down from 2.63 microsieverts per hour—a dangerous level—before the cleanup. Around the gray stone tombs, pagodas, and narrow wooden slats, called *sotoba* (traditional Buddhist signs of devotion to the deceased), the ground was covered in white patches of crunchy snow, snapped branches, and freshly felled red camelia flowers. For such a remote, uninhabited place, the cemetery felt alive and well-tended.

Idogawa's home was just down the street. He was waiting outside the front door, next to a large white mailbox decorated with French phrases: "*Bienvenue chez moi*" ("Welcome to my home") and "*Je vous souhaite bonne chance*" ("I wish you good luck"). In his front yard, a peach tree was in bloom, and a large vegetable garden, which he was in the process of planting, was surrounded by an electric fence, to keep out the wild boar. Idogawa, who is stocky, with a buzz cut, rimless glasses, and a limp, welcomed us inside. He wore a gray fleece vest printed with snowflakes. Next to the mailbox was a small, solar-powered Geiger counter.

In the living room, Idogawa gestured for us to sit on pillows on the floor, next to one of two tables, and served black coffee in ceramic mugs designed to look as if many tiny shards had been lacquered back together—a style of Japanese ceramic called *kintsugi*, or the art of broken pieces. People in Fukushima often start their stories of the disaster with the exact moment the shaking began. Idogawa sat, with his legs crossed, in front of the other table, and said, “On March 11, 2011, at 2:46 *p.m.*, I was working at my job at a newsstand in town.” The power at the store went out, he said, and he returned home, where his father also lived. Though the earthquake damaged the roof and the foundation of the house, they were able to stay there overnight. The next morning, a firefighter arrived in his own car and told them to evacuate immediately, without mentioning the onset of a meltdown. Idogawa and his father fled to Matsumoto, on the opposite coast, where they lived in a complex originally built as teachers’ housing. A year later, he moved in with his sister in Iwaki, a city thirty minutes south of Okuma that had been spared the fallout and where many other evacuees eventually settled, as well.

Ultimately, the government did most things right to protect the public—rapidly evacuating areas that had been contaminated and restricting the food supply. Investigations by various groups—the World Health Organization, the United Nations Scientific Committee on the Effects of Atomic Radiation, the International Atomic Energy Agency—all found extremely low exposure among the population. But it failed in one main way: public relations. “The Japanese government and some scientists unfortunately have not communicated well to their population, both during the accident and afterward,” John Boice, an epidemiologist and the director of science for the U.S. National Council on Radiation Protection and Measurements, told me. “There’s no question that there is still a fear or perception that radiation is more hazardous than it actually is.”

In March, 2011, a radiation health expert named Shunichi Yamashita, whom the government had appointed as the prefecture’s health-management adviser, gave a speech in Fukushima city that many people cite as an example of why the government could not be trusted. He told the audience that the environmental levels of radiation were not dangerous, apart from the areas that had been evacuated, and that “the name Fukushima will spread all over the world,” that “it already beat Hiroshima and Nagasaki,” and that “crisis is an opportunity—the biggest opportunity. Fukushima became really famous without doing anything.” The crowd laughed nervously. He went on, “If you smile, you will not experience any radiation impact. It does not come to those who smile, it comes to those who are gloomy. This is made clear by experiments on animals.”

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After a year in Iwaki, Idogawa found work as a cleanup operator in Okuma. “I got my license to operate a backhoe,” he said. “We cart off soil from the rice paddies, the vegetable fields.” Initially, the radiation levels were quite high. “Before we started the cleanup,” he said, “it was fifteen microsieverts per hour; some areas higher, others lower. I wore a white Tyvek suit, coveralls, gloves, and a mask.” Idogawa was unconcerned, especially now, about his exposure levels. “I’m old,” he said, shrugging. He got up and went to retrieve his dosimeter, a digital device the same size as my recorder. It was branded, in English, “MyDose MINI,” and read, “This side faces your body.” He showed us his reading, and it was safe.

In 2017, a town that neighbored Okuma was reopened. “I saw that the area around my home might reopen soon, too, so I started to prepare to come back,” Idogawa said. He destroyed his old house, and the government and Tokyo Electric paid for the construction of a new one. The home was nice, with every modern convenience. (The toilet even had a motion sensor, so that the lid lifts when someone enters the bathroom.) A neighbor, a man slightly younger than him, had since moved back, too. Idogawa hoped that stores would reopen soon, and more people would return. When we arrived, I had noticed a leash on the door and a tiny dog coat—pink plaid with a white fringe—on the couch, but no other signs of a pet. “My dog died last week,” he told us. She was a toy poodle named Maruko. She was thirteen when she died, and had been with Idogawa throughout his years as an evacuee. “I miss her,” he said, and looked down at his hands, folded in his lap.



The Japan leg of the Tokyo Olympic-torch relay will begin on the grounds of the Daiichi nuclear-power plant, to celebrate the region’s recovery—at least, that is the hope.

Photograph by Behrouz Mehri / AFP / Getty

After visiting Idogawa, my translator and I went to a farm in Okuma called Moo Mow Garden, whose caretaker, Satsuki Tani, has become a minor local celebrity. In 2013, Tani quit her job with a nonprofit organization in Tokyo and moved to Fukushima, to help save abandoned cows and the elderly farmers who owned them. Thousands of cows have been abandoned during the disaster, and many were locked in their sheds, where most of them starved to death. Government officers killed some of the irradiated cows that were wandering loose and, a few months later, asked the farmers to kill or castrate the remaining animals. “I was asked to save the cows by a farmer,” Tani said. “At first, the cows ran away from me because they were scared to be killed by a human, just like their families and colleagues who were killed in front of them.” To entice them into a fenced area she had built with other farmers, Tani said, “I pretended to be a cow with four legs, walking and saying, ‘Moo, moo, I am not your enemy, I come here to save you.’ ”

At the time of the meltdown, Tani, who is thirty-seven, tan, with shoulder-length black hair and a toothy grin, thought that anyone exposed to radiation would be at risk of getting cancer. Then she did more research. The impact of radiation from a flight from Japan to New York—as much as ninety-three microsieverts over the course of fourteen hours—is worse, she pointed out, than the level to which she would be exposed. (At the farm, my Geiger counter showed a dose of 0.5 microsieverts per hour, or



seven microsieverts per fourteen hours.) “My calculations are like this,” Tani said. “The risk of getting cancer in this area is not much higher than in the course of one’s life elsewhere.”

Tani blogged about her efforts. In her posts, she often took the voice of the cows. She gained a following and was able to raise enough money to help restore Moo Mow Farm, which is still within the exclusion zone, and buy hay for the winter. The name of the place refers to the cows’ new job: because their milk is considered unsafe, as is their meat, for which they had previously been raised, Tani argues that the animals’ practical use is to eat the grass, which keeps the abandoned land clear and encourages people to return.

The morning we arrived, Tani was outside, delivering marching orders to a semicircle of twelve people. Farther from the road, eleven cows lolled in a narrow green valley—“enough for a soccer team,” Tani said—and farther still, in the hills, radioactive wild boar and snow monkeys roamed. During the week, Tani does a lot of the cow work herself, but on the weekends she recruits volunteers, via Facebook, to help. The volunteers often come from Tokyo and are unfamiliar with rural life. As Tani explained the chores to the crew—the main task would be rolling out hay bales—one man put on a helmet.

For Tani, the farm has been a chance to start over with wild land. She was able to crowdfund enough money to buy farm equipment, and the harvests from her vegetable garden continue to improve. “I want to create a model that fits people, animals, and other species together, living together, coexisting and co-prospering in this environment,” she said. “In other places, the ecosystem, it is collapsing. Here, too, on 3/11, human beings destroyed the ecosystem. I want to see balance restored.” I later asked her how she felt about nuclear power. “I do feel deep pain in regards to the nuclear accident,” she said. But she couldn’t help but note that, for her cows, the disaster was not the worst thing that ever happened to them. “The cattle of Okuma-machi used to be ready for shipping, as wagyu beef, after two years,” she said. “Ironically, because of the nuclear accident, after eight years, they still live.”

Tani took us to a nearby farm, which looked like Vermont in Japan, with a big red barn, a wooden fence, and black cattle grazing under a stand of blooming cherry-blossom trees. The owner, a spry senior citizen named Yukio Yamamoto, who wore a red Ferrari cap, had invested ten thousand dollars to buy a breed of cow known for producing prize-winning wagyu beef. He had refused to kill his cows after the disaster. “Our cows are survivors,” he said, proudly. He now wanted to restart the business, with new cows bought outside the area, and continue breeding: he hoped that his farm, like Moo Mow, might also become a center of tourism. Tani was helping him. “She is small, but she can move a roll of hay bigger than her,” Yamamoto said. “She was unusual, coming here alone. But we are so grateful, she has been helping us all a lot by posting our situation on social media.”

The most famous cowboy in Fukushima is a sixty-five-year-old man named Masami Yoshizawa. He was one of the few people who had refused to evacuate at all, despite the high levels of contamination around his land and the mandatory evacuation order for his town, Namie, which neighbors Okuma. (Over the years, police officers had forced Yoshizawa to sign apologies whenever they caught him entering the exclusion zone.) Like Tani and Yamamoto, he also refused to kill his cattle. Instead, he had turned his ranch into a center of anti-nuclear protest, calling it the Ranch of Hope. He is, he likes to say, “the cowboy resistance.” He had received visitors and donations from around the country and the world, been the subject of a French documentary and a beautifully illustrated children’s book (featuring a painting of him caressing a cow’s face), and had even run for mayor of Namie. He lost.

His farm had a decidedly more outlaw feel than the others. Cattle skulls and bones lined the entrance road, and a scratchy green gully, where a herd of black cows roamed, stretched toward the coast. Yoshizawa drove up to meet us in a tractor and brought us into a little shack—the walls covered with newspaper clippings about the accident, anti-nuclear protests, and photos of himself—then proceeded to give a lecture on how the accident happened, how the government failed the people, how the fallout has caused damage. In the mountain forests, for instance, where the radiation has not been cleaned up, contamination levels can be as much as ten or fifteen times higher than in the surrounding reopened areas. His cows had been afflicted with strange white spots, similar to the white spots found on animals in Chernobyl. “This situation has two faces, the light and the dark,” Yoshizawa said, about Okuma’s reopening and the community’s future. “We have to focus on both sides.”



The wind blew east for days after the meltdown, taking a growing cloud of radioactive dust to sea. If it had been blowing in the opposite direction, the contamination could have been much worse.

Photograph by Behrouz Mehri / AFP / Getty

“There is a phenomenon in Japan,” Jusen Asuka, an expert on climate change and energy policy and a distinguished economist at Tohoku University, just north of Fukushima, told me. “The Japanese government keeps saying that nuclear power is very important for climate-change mitigation. So, some people who have dedicated their lives to anti-nuclear activism, they have a motivation to not believe in the climate-change arguments.” Several anti-nuclear activists told me that coal is preferable to nuclear power; others, especially from the postwar generation, are even vocally skeptical that hydrocarbon emissions cause climate change. When I told Ian Shimizu, an environmental activist in Tokyo and a former organizer of Japan’s chapter of the international climate-activism group 350.org, that I was reporting on nuclear power’s future role for addressing climate change, he told me, “You’re gonna have a hard time with that here.”

Asuka suggested that the Kyoto Protocol, the first major international climate agreement, signed in 1997, was, in part, responsible for the general complacency. “People think, Global warming? We already did our part. That’s settled.” Another reason for the lack of concern has been, possibly, Japan’s relatively mild climate. “We haven’t had wildfires or, relatively speaking, bad heat waves or floods,” Asuka said. That, of course, is quickly changing. A [recent study](#) by eleven hurricane scientists found that anthropogenic climate change has likely contributed to typhoons in the Northwest Pacific reaching their

maximum intensity farther north, directly affecting Japan. In 2018, Typhoon Jebi, the worst typhoon in twenty-five years, killed eleven people in Japan, injured hundreds, and caused an estimated \$12.6 billion in damages, while an extended summer heat wave killed more than a hundred people. This year, in September, Typhoon Faxai flooded Chiba Prefecture, east of Tokyo, destroying nearly two hundred homes and damaging thousands more. Typhoon Hagibis slammed Tokyo in October, bringing the heaviest rain and winds in sixty years and killing more than ninety people in the country.

Asuka believes it is possible for the world to get to a hundred per cent renewables by 2050. He is currently trying to come up with a concrete energy plan for Japanese policymakers, along the lines of a Green New Deal. Nuclear power would not be included. Asuka and other climate activists in Japan argue that the nuclear and coal industries are inextricably linked, so the country must get rid of both. “The government says that it is a trade-off between coal and nuclear power, but it’s not that way,” he told me. “It’s a trade-off between nuclear and coal versus energy conservation and renewables.”

Steven Davis, of the University of California, Irvine, is currently doing some work that shows that, if Japan built enough wind and solar capacity to generate a hundred and fifty per cent of its annual electricity demand, along with energy storage for twelve hours of its average electricity use, and a new electrical grid for the entire country, it could meet ninety-eight per cent of its electricity demand with solar and wind alone, and get the remaining two per cent from neighboring countries, carbon capture and storage (C.C.S.), and geothermal energy. “So it’s doable,” Davis said, “but the price tag is the question.”

Asuka acknowledged that, at the very least, the political will is lacking. “Japan,” he said, “is the only developed country in the world that is building coal plants.” After the Fukushima disaster, fifty new coal-fired plants were scheduled to be built; since then, fifteen have opened, twenty-two are still in the preliminary stages of construction, and thirteen have been cancelled. (Japan imports most of its coal from Australia, a country that reelected an industry-friendly Prime Minister this year.) At the same time, Asuka said, the Japanese government has made an effort to convince the public that nuclear is not only very cheap but the best option for climate mitigation. “They are saying that with misleading data,” he said. In the latest data from the U.S. Energy Information Agency, he noted, solar is the cheapest option. Nevertheless, he said, because the government did not make early investments in solar or wind, “the public still believes renewables are very expensive.”

In part because Japan is generally not a protest culture, Asuka said, the Japanese system is “very difficult to change.” He mentioned that some young Japanese activists recently brainstormed what they could do to bring attention to climate change. One young woman had suggested an action at Shibuya Crossing—the famous five-way intersection in Tokyo’s center. They could walk a bit slower than the rest of the pedestrians, she said. His exasperation reminded me of a recent interview I had conducted at an Earth Day festival in Tokyo’s Yoyogi Park. I had scheduled a meeting with two women from a Japanese nonprofit that advocates for “zeronomix,” an economic plan that relies on zero fossil fuels and zero nuclear. (It’s a response to so-called Abenomics—the Prime Minister’s economic-revitalization plan, which is heavily reliant on nuclear and fossil fuels.) When I arrived to the meeting spot, the women introduced me to a green bear mascot named Zeronomikuma (“*kuma*” means “bear” in Japanese), who presented me with his business card.

Given Asuka’s commitment to combatting climate change, and the public’s reluctance to stage massive protests demanding a hundred per cent renewables, I asked him whether nuclear was, at least in the

immediate future, a preferable option to coal and gas. A recent study by Pushker Kharecha and Makiko Sato, of Columbia University, found that if Japan and Germany had reduced coal power, instead of nuclear, they could have prevented twenty-eight thousand premature air-pollution-induced deaths and twenty-four hundred million metric tons of cumulative carbon-dioxide emissions. In Germany, pausing its nuclear phaseout would be the equivalent of removing about two hundred million passenger cars from the road for an entire year. It would also prevent an additional sixteen thousand premature deaths.

Asuka is well aware of coal's danger—he is a co-plaintiff in a lawsuit against a new coal plant in Sendai province, arguing that its operations have resulted in nineteen premature deaths. And yet he hates this argument. “Air pollution and a nuclear accident are so different,” he said. “You cannot compare.” In 2014, in response to an open letter written by the legendary climate scientist James Hansen, of Columbia University, and three other scientists, which had urged the adoption of a new generation of nuclear reactors in order to address climate change, Asuka and his co-authors pointed out that, while the Fukushima nuclear disaster had not directly killed anyone, some fourteen hundred people had died indirectly as a result of the evacuation—“people who died due to difficult and long-term evacuation,” they wrote, “or those who committed suicide, lamenting the radioactive pollution of their farm lands and farm animals, who had lost hope to ever rebuild their lives.” Women had even decided not to give birth, fearing the effects of fetal radiation exposure, the authors noted. The birth rate in Koriyama, one of the most populated cities in the region, had dropped by thirty-four per cent in the two years after the disaster.

Ultimately, Asuka argued that the most preferable option for mitigating climate change is to move as quickly as possible to renewables and energy conservation. They are better for the environment and, in the long run, the most economically and politically sensible option. They can create new jobs *and* they are safe. It is just a matter of overcoming the industry's vested interests—eighty per cent of government energy subsidies go to coal and nuclear, he noted—and accepting the upfront costs. “We are lacking an A.O.C.,” he said, referring to the U.S. congresswoman Alexandria Ocasio-Cortez. “We have to figure out how to disrupt the system, in the Japanese context.”



Climate activists in Japan argue that the nuclear and coal industries are inextricably linked, so the country must get rid of both.

Photograph by Kimimasa Mayama / AFP / Getty

Kaori Suzuki, an elegant, lanky mother of three and a former yoga teacher, co-founded Tarachine, or, the Mothers' Radiation Lab Fukushima, soon after the disaster, in the city of Iwaki. "Many people were anxious about food safety," Suzuki said, "so we set up the lab to test anything anyone wanted tested." The fears were understandable. Radiation is invisible—no smell, no color, nothing. Donors funded radiation-detection machinery and purchased equipment from Belarus, where communities were affected by the Chernobyl disaster. At first, Suzuki and other volunteers had to translate the instructions as best they could, but they eventually received training from experts. "Many people rushed our lab," she said. "It was trial and error for the first three months to find a system that worked."

Tarachine's lab now includes equipment sufficient to test food, liquids, dirt, and any other household items for isotopes like strontium-90, beta rays, and gamma rays. The day I visited, there were samples on the counter, which people had mailed to the lab—wild chestnuts, a bag of vacuumed dust, sea salt. Most recent tests showed nothing to worry about, but there have been occasional high levels, found in wild mushrooms and pine cones from the mountains. The office also has a whole-body counter to determine radioactive material in humans; I sat for a reading in a colorfully painted homemade booth, watching a computer screen that showed what were meant to be relaxing images: a little nautilus propulsing its way through watery blue depths; a clown fish nibbling on coral reefs. Although the government conducts widespread testing, Suzuki saw Tarachine as a check on their efforts. "We don't think that, if the government is doing the testing, that means we're not needed," she said. "It's good to feel like we can make a decision independently, by ourselves, about whether something is safe."

As the recent HBO miniseries "Chernobyl" so terrifyingly depicts, in the aftermath of the Chernobyl nuclear explosion, the Soviet government lied and withheld information from the public. Six years after the disaster, an epidemic of thyroid cancer spread among young children—with more than six thousand cases observed and, as of 2005, fifteen deaths. There will likely be more cancer cases, but, fortunately, thyroid cancer is highly treatable. Radiologists have concluded that the children in the Ukraine, Belarus, and Russia who were diagnosed with thyroid cancer had consumed heavily contaminated milk. This is not a concern in Fukushima, but families have been, nonetheless, scared that they would face the same outcome.

At a thyroid-cancer screening hosted by Tarachine, I met Noriko Tanaka. When the tsunami hit, she was three months pregnant. She and her husband evacuated for ten days before returning to their home in Iwaki. Her son, who is now seven, was born healthy, but Tanaka is still apprehensive, and carefully monitors where she gets her food. "At first, my husband wasn't concerned about radiation," Tanaka said. "So I told him, in a firm voice, 'You have to think about the kids' health.' Finally, he gave up and accepted my position." Their son, who had just been screened, was now chasing his sister around the parking lot. "In a Tarachine clinic, doctors explain in detail why they are checking the thyroid, what they are doing, they answer any questions we have," Tanaka told me. "If someone only gets screened by the government, they might feel even more scared because the government does not explain the situation." The clinic doctor told me they have never identified a patient with thyroid cancer.

In the 2018 landmark report from the United Nations Intergovernmental Panel on Climate Change, scientists presented [four mitigation pathways](#) for limiting global heating to 1.5 degrees Celsius above the preindustrial average. In each one, nuclear power expanded substantially until 2050 (although far outpaced by the growth in renewables). In the best-case scenario, in which innovation led to significantly lower energy demand coupled with a higher living standard worldwide, especially in the



Global South, nuclear power would increase a hundred and fifty per cent from 2010 levels by 2050. In the most resource- and energy-intensive scenario, in which our only hope would be carbon-dioxide-removal technologies, which are currently nonexistent at a useful scale, nuclear would increase by four hundred and sixty-eight per cent by 2050.

Nuclear power, which currently provides about ten per cent of the world's electricity, remains a profoundly risky technology. Of the world's four hundred and fifty reactors, most are decades old, and rely on systems that have previously caused accidents, however few. There are other long-standing problems. Nuclear waste can be deadly, and no one, [except Finland](#), has figured out what to do with it. (After a decades-long planning and negotiation process with a remote island community, the country will bury the waste in copper tubes, in a tomb thirteen hundred feet below the bedrock.) There is a stockpile of spent fuel rods—a quarter-million metric tons in some fourteen countries, according to the International Atomic Energy Agency—mostly collecting in cooling pools at nuclear plants themselves. These repositories are potential terrorist targets. More nuclear plants could also lead to greater nuclear-weapons proliferation. As Eric Schlosser, a journalist who has written extensively about nuclear weapons and risk, told me, ultimately, with a technology that complicated and powerful, “We don't know what the fuck we are doing.”

Still, relative to the amount of energy produced, the amount of spent fuel is small compared with the waste of fossil fuels—like coal ash, not to mention greenhouse gases. Five grams of uranium-oxide powder, baked into a one-centimetre-by-one-centimetre pellet, can power a typical American household for half a year. Unfortunately, there is no way to obtain that much power from a source that fits inside a thimble without the possibility of tragedy. Managing this trade-off comes down to good governance, and to layers and layers of safety checks and contingency plans. Of course, people will inevitably make mistakes. And yet, over the last few decades, most of the world has grossly underestimated the threat of climate change while, in some cases, overreacting to nuclear's risks.

Suzuki, at Tarachine, recognizes that radiation exposure is no longer her organization's only concern, and she has recently expanded its scope to offer mental-health and healing services—like massage and yoga—to children and their mothers. At a new annex, a clinical psychologist came a few times a week to meet with kids, and sometimes their mothers, too. Suzuki said they've already had success. One mother brought her son to the clinic after he stopped speaking and leaving the house. “After a few months, he has started to go to school again,” Suzuki said, with a smile. “This all came about because people have asked how they can manage to stay here. The parents' stress causes problems with the child.” She added, “We now have a bigger mission: to mentally support the children, to provide therapy, and to make a future for this place.”



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