

By Farhad Manjoo

WHENEVER I write about the plummeting costs and growing capabilities of wind power, solar power, and batteries, I'm usually met with a barrage of radioactive responses from the internet's overheated nuclear reactors — social-media-savvy environmental activists who insist that nuclear power should play a leading role in the world's transition away from fossil fuels.

The sun doesn't always shine and the wind doesn't always blow, they point out, but nuclear power plants produce carbon-free energy day and night, rain or shine. Their argument that nuclear power is unfairly maligned has been bolstered by Russia's invasion of Ukraine; Germany, which shut down many of its nuclear plants in the past decade while building natural gas pipelines to Russia, now faces a deep energy crunch. It has had to burn more coal to keep the lights on.

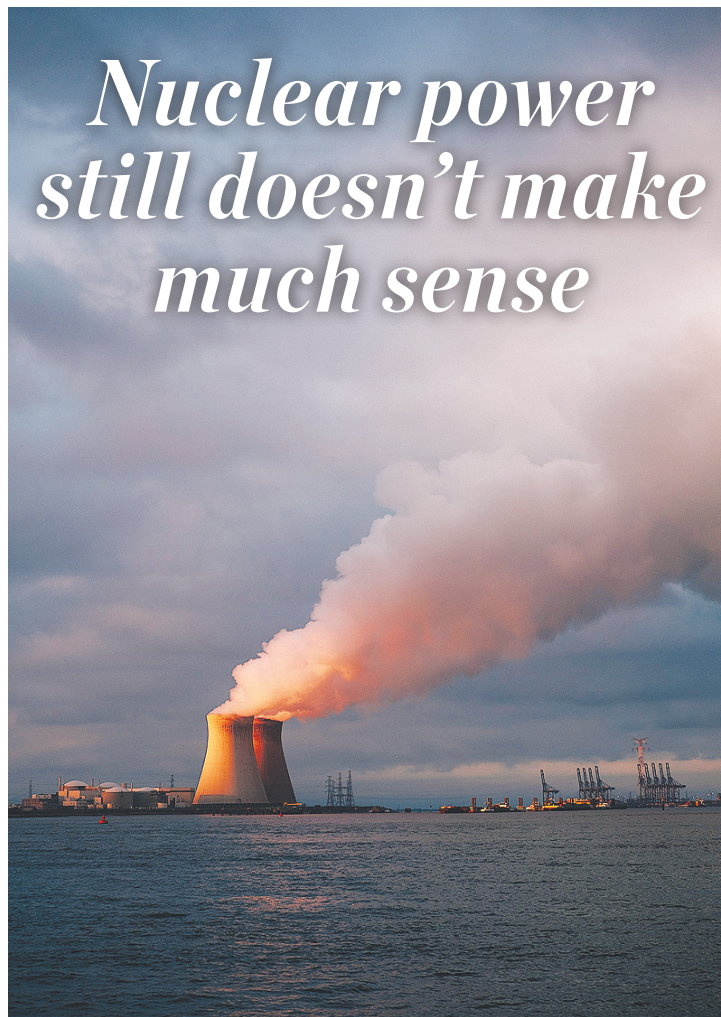
I'm not a never-nuke, but I've had my doubts about atomic power. Still, I wanted to keep an open mind. So last week I flew to London to attend the World Nuclear Symposium, an annual conference put on by the nuclear industry's global trade group, the World Nuclear Association. I heard an earful from industry executives, analysts, lobbyists and government officials who are giddy about nuclear power's prospects for powering the world of tomorrow.

I'll give the pro-nuclear folks this: They do make a good case that nuclear has gotten a too-bad rap. Nuclear power is relatively safe, reliable, and clean; compared to the planetary destruction wrought by fossil fuels, nuclear power looks like a panacea. Patrick Fragman, the CEO of the large American nuclear manufacturer Westinghouse, said his industry had to "unwind decades of brainwashing of public opinion in many countries" about the dangers of nuclear power.

But the argument for significantly ramping up the production of nuclear power — especially in places where overall energy consumption isn't growing, like in the United States and Europe — falls short. That's because the nuclear industry has long been hobbled by two problems that its boosters can't really wish away: Nuclear is far slower to build than most other forms of power, and it's far more expensive, too. And now there is a third problem on the horizon. As battery technology improves and the price of electricity storage plummets, nuclear may be way too late, too — with much of its value eclipsed by cheaper, faster, and more flexible renewable power technologies.

In order to limit global warming to 1.5 degrees Celsius above preindustrial levels — the goal set in the Paris Agreement to avert the worst effects of global warming — experts say that we need to reduce global carbon dioxide emissions to a net of zero by 2050. Responding to such a climate emergency with nuclear power is like calling on a sloth to put out a house fire. The 63 nuclear reactors that went into service around the world between 2011 and 2020 took an average of around 10 years to build. By comparison, solar and wind farms can be built in months; in 2020 and 2021 alone, the world added 464 gigawatts of wind and solar power-generation capacity, which is more power than can be generated by all the nuclear plants operating in the world today.

The nuclear industry has been notorious for cost overruns and delays. The only nuclear reactors under construction in the United States — a Westinghouse project at the Plant Vogtle power station in Georgia — were started in 2013 and projected to be finished in 2017. They are still not done — and an initial budget of \$14 billion has more than doubled to more than \$28 billion. In 2017, utilities in South Carolina canceled two reactors midway through construction after cost projections ballooned from \$11.5 billion to more than \$25 billion.



And after all this build time, you get a very expensive source of energy. In a common energy industry measure known as "levelized cost," nuclear's minimum price is about \$131 per megawatt-hour, which is at least twice the price of natural gas and coal, and four times the cost of utility-scale solar and onshore wind power installations. And the high price of nuclear power doesn't include its extraneous costs, such as the staggering price of disasters.

Cleanup and other costs for the 2011 Fukushima disaster, caused by an earthquake and a tsunami off the Japanese coast, may approach \$1 trillion. Nuclear boosters say that these problems can be solved. There was much talk at the conference

about streamlining regulations and reducing costs and build times by constructing smaller, more advanced and less disaster-prone reactors. Once we start building more, the industry will start seeing the benefits of scale and efficiency, several industry insiders told me.

"The best way to become good at building nuclear power plants is to build nuclear power plants," said Sama Bilbao y León, the director general of the World Nuclear Association. John Kotek, an executive at the Nuclear Energy Institute, the industry's American trade group, pointed out that the US Navy builds nuclear-powered submarines and aircraft carriers in a matter of years — suggesting that quick build times for small reactors could be doable.

Perhaps. But the much-vaunted small reactors are still novel,

mainly untested technology. In another era, it may have been worth taking a gamble on these systems in order to avert climate disaster.

But Mark Jacobson, a professor of civil and environmental engineering at Stanford University and a longtime proponent of renewable energy, told me that such a bet makes less sense today, when wind and solar power keep getting better — because any new money put in nuclear is money you aren't spending on renewable projects that could lower emissions immediately.

There's an opportunity cost "of waiting around for a nuclear reactor to be built when you could have spent that money on wind or solar and got rid of emissions much faster," Jacobson said. This cost may be particularly onerous when you consider the rapid advancement in battery technology, which can help address the main shortcoming of renewable power: its intermittency. The price of lithium-ion batteries has dropped by about 97% since they were introduced in 1991, and prices are projected to keep falling.

Jacobson is one of several researchers who have argued that such advances will render nuclear power essentially obsolete. As we build more renewable energy systems — onshore and offshore wind, solar power everywhere — and improve technologies to store energy (through batteries and other ideas), wind and solar can meet most of our energy needs, Jacobson said. In a 2015 paper, he argued that the world can be powered through renewable energy alone. His findings have been hotly disputed, but other researchers have come to similar conclusions.

On the other hand, the International Energy Agency's projections for reaching net-zero energy still rely on nuclear. The agency says that nuclear capacity will need to double by 2050, with two-thirds of that growth occurring in developing economies. Still, even with nuclear's

doubling, the IEA says nuclear power will contribute less than 10% of global electricity in 2050; over the same period, the agency says renewable generation will grow eightfold, contributing 90% of electric power in 2050.

Clearly, then, nuclear's problems don't mean we should shut down all nuclear plants; existing plants are quite valuable in our energy mix as we ramp up solar and wind. And in places like China, India, and other regions where demand for energy is growing, new nuclear plants may have a big role to play — and if the small, advanced reactors become viable, perhaps we'll see some of those, too.

But it's unlikely that nuclear can play anything close to a dominant role; its share of electricity production is quite likely to fall over time.

Which isn't really a surprise. A quick glance at daily headlines suggests nuclear power is plagued by too many problems for comfort. I landed in London at around the same time that international energy regulators were making emergency plans for maintaining the safety of Ukraine's Zaporizhzhia nuclear plant, which had come under shelling from Russian troops. In South Korea, operators of the Kori nuclear power plant were cutting production in anticipation of a massive typhoon. And this summer in France, which gets about 70% of its electricity from nuclear power, plant operators had to cut production because hot weather had raised the temperature of river water used to cool the reactors — kind of a big problem on a planet that keeps heating up.

Tyson Slocum, the director of the energy program at the advocacy group Public Citizen, summed up these problems neatly: "Nuclear power has simply been eclipsed," he said. "It was an incredible zero-emission resource for its day. But for much of the energy system today, that day has long passed." ■

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LETTER TO THE EDITOR

Inclusion of Taiwan for the global good

THE 77th session of the United Nations General Assembly takes place from 13 to 27 September 2022 in New York City under the theme "A watershed moment: transformative solutions to interlocking challenges." As the world's most important forum of global cooperation began, the global community is confronting a number of unprecedented crises: from the ongoing COVID-19 variants and stalled efforts on climate change, to supply chain disruptions and China's increasing rhetorical and military intimidation of Taiwan. At this juncture, it is worth reminding these leaders that all people — including the people of Taiwan — deserve to have their voices heard and efforts included for the global good.

A beacon of democracy in Asia and a force for good in the world, Taiwan is a reliable and valuable partner and Taiwan is committed to implementing the UN Sustainable Development Goals, and combating climate change with a blueprint for net-zero carbon emissions by 2050. As the world's 22nd largest economy in terms of GDP and a major semiconductor manufacturer, Taiwan plays a key role in global supply chains. And as a defender of democracy, Taiwan is working to safeguard the status quo and support the rules-based international order.

By deliberately conflating its "One China" principle with the UNGA Resolution 2758 — the resolution that determined who represents "China" in the organization some 50 years ago — Beijing is misleading the world by spreading the fallacy that Taiwan is part of the PRC. Contrary to these false claims, the resolution does not take a position on Taiwan, nor does it include the word "Taiwan." The long-term status quo is, the ROC (Taiwan) and the PRC are separate jurisdictions, with neither subordinate to the other. The people of Taiwan can only be represented in the international community by their free and democratically elected government.

Taiwan will resolutely defend its sovereignty and security. As a responsible member of the international community, Taiwan will also continue to exercise restraint in response to China's provocations, and work together with like-minded countries, including the Philippines, to uphold peace and stability in the region.

As close neighbors and maritime nations, Taiwan and the Philippines uphold the values of freedom, democracy and the rules-based international order. Taiwan and the Philippines enjoy longtime cordial people to people relations. We sincerely hope that our Filipino brothers and sisters could continue to voice their support for Taiwan's meaningful participation in the UN system.

In promoting post-pandemic recovery and reconnecting the world, now is the best time for UN to reconnect with Taiwan. Taiwan aspires to contribute. The 23.5 million resilient Taiwanese people surely should be included for the global good.

Peiyung Hsu
Representative Taipei Economic
and Cultural Office in the Philippines

By Martin Ivens

ALL WEEK, a river of mourners has queued for hours alongside the banks of the Thames in London to pay their respects to their longest-reigning monarch as she lies in state in Westminster Hall. Tens of thousands also lined the narrow streets of Edinburgh to gaze on the hearse bearing the queen's body last week.

Pilgrimage to bid farewell to a loved monarch is not limited to Britons: World leaders, including Presidents Joe Biden and Emmanuel Macron, Prime Minister Justin Trudeau and Chinese Vice-President Wang Qishan, are gathering to attend her funeral service at Westminster Abbey on Monday.

These are not the modest obsequies of a Scandinavian monarchy. Nor is this the hysteria of an oppressed people who take to the streets when a long-lived dictator — a Stalin or a Mao — finally dies. Of course, there is media hype, but the heightened emotions are not all manufactured. Walking in Westminster last week as the royal coffin arrived, the stillness of the crowds and reflective silence among usually noisy Londoners was striking.

For many secular Britons, the pomp and pageantry of royal ceremonies are a substitute for religion, but even agnostics and non-believers in monarchy are slightly awed by the scale and solemnity of the occasion. Few of those who watched were not moved when the queen's coffin was drawn in a gun carriage from Buckingham Palace to Westminster, while her eldest son, King Charles III, and his sons followed her to the accompaniment of somber strains from military bands.

Courtesy of the television cameras, millions outside the UK get to be spectators and even participants too. The country's gift to the world represents a theatrical display of soft power. Royalty is the biggest British brand, bigger than James Bond, bigger than the Bard, bigger even than the Beatles. How did it happen?

Among all modern nations, the British have been more successful at inventing traditions that appear linked to an immemorial past, but are in fact late 19th and early 20th century innovations. The Scottish kilt was the invention of an Englishman, and the idea of a tartan for every Scottish clan was dreamed up as a marketing ploy by canny textile manufacturers. (The Welsh managed to invent their own national dress without English help.)

The modern monarchy, however, has been the most successful British invention — or reinvention — of them all.

For the royals didn't always put on such a good show. After watching Queen Victoria open Parliament in 1860, Lord Robert Cecil observed:

Some nations have a gift for ceremonial. This aptitude is generally confined to the people of a southern climate and of a non-Teutonic parentage. In England the case is exactly the reverse. We can afford to be more splendid than most nations; but

The Monarchy is Britain's most successful (re)invention



some malignant spell broods over all our most solemn ceremonies, and inserts into them some feature which makes them all ridiculous.

William IV's drab coronation was derided as the "Half Crown-nation" (a skit on the half crown coin, worth only a fourth of a pound sterling), while at Victoria's unrehearsed coronation, the clergy lost their place in the order of service and the choir was pronounced "inadequate." Those who carried her long train gossiped throughout.

But as the Crown's power waned in the dawn of the democratic era, the ceremonial grew more elaborate and its execution became flawless — the beginning of what historian David Cannadine calls a "cavalcade of impotence." By the time Victoria died, the once reclusive and unpopular Queen Empress had celebrated two highly successful jubilees and become the unofficial grandmother of Europe. Hundreds of thousands also lined the streets on the death of her son Edward VII in 1910 and for Queen Elizabeth II's father, George VI, in 1952.

The same inventiveness was shown in the final hours of the British empire.

There was no great ceremony after the redcoats lost the Battle of Yorktown and with it the original 13 American colonies. When London was forced to abandon Ireland — its oldest overseas colony — soon after World War I, its last chief official quietly drove away from Dublin Castle. And it was a member of the royal family, Lord Mountbatten, the last imperial viceroy of India, who in 1947 decided it was better to foster feelings of goodwill to the former imperial power and to go with dignity. Speeches were given by the elites on both sides, the Union Jack was low-

ered at midnight and the flags of India and Pakistan were raised. The process was designed to give the appearance of an orderly transition, although afterward partition led to appalling violence.

Soon the British had got decolonization down to a tee. Independence ceremonies held in purpose-built stadiums sometimes occurred at the rate of four a year in the 1960s, with a royal usually in attendance. The folks back home could see from TV that the British had left the place in reasonable order while the new rulers enjoyed being treated as equals and gladly signed up to the new democratic Commonwealth of Nations.

Dissenting opinion has always held that both the vanished empire and today's ceremonial monarchy are "a Tory racket," opium for the masses. Cynicism, however, needs to be tempered. Labor leaders have often been more royalist than Conservatives. Constitutional monarchies preside over some of the most stable and successful democratic countries on the planet. The queen and her family grasped the implications of decolonization more quickly than much of the political class. Flinty-hearted Tories would have let the Commonwealth wither but for the queen. Some English Conservatives even harbor the wish that Scotland should go its own way to save the expense, but the Crown keeps the Union alive.

After the queen's funeral, "the Firm," as the royal family is known, will continue to modernize, doubtless becoming less formal in manner. Yet the pageantry that still moves millions — the golden carriages, military salutes and strange ceremonials — has turned out to be one of Britain's most durable creations. ■

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