Is Nuclear Power Our Best Bet Against Climate Change?

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For half a century the debate around nuclear energy has produced more heat than light, inspiring impassioned discourse on all sides. But given the many urgent imperatives for rapidly transitioning our energy systems from high- to low-carbon—and from centralized and vulnerable to decentralized and resilient—in the very near future, an even-handed, impartial reckoning with nuclear power is perhaps more important than ever.

High-profile accidents like Chernobyl, Fukushima, and Three Mile Island have helped to make both policymakers and the general public skittish about nuclear energy, despite the fact that the number of combined fatalities from nuclear energy is dwarfed by fatalities caused by fossil fuel-derived energy. Researchers have **estimated** that about 1 in 5 deaths globally can be attributed to fossil fuels through air pollution alone: that's about 8.7 million people each year. It would be impossible to calculate total historical deaths associated with fossil fuels, since fossilized carbon burned a ceentury ago is **still contributing** to deaths today—often in indirect ways, including global warming and **development**—and the impact of carbon energy has undoubtedly caused extinctions of species that scientists never had time to describe. We can get a sense of the contrast between nuclear and fossil fatalities, however, by comparing their orders of magnitude. Though the total number of deaths associated with nuclear power is disputed, estimates vary from the low tens of thousands to the low hundreds of thousands. Deaths by fossil fuels, by contrast, probably reach into the tens or hundreds of millions, extrapolating backward on the basis of annual air pollution deaths alone—to say nothing of mining-related deaths, transportation-related deaths, and so on. Even taking into account the significantly greater proportion of energy generated by fossil fuels than nuclear, burning fossil fuels is still significantly more dangerous.

It is unsurprising that mass evacuations and skin-melting radiation poisoning from nuclear accidents would provoke more visceral fear than the slow violence of fossil fuels. Further encumbering nuclear energy is its unfortunate, inextricable association with weapons of mass destruction, and the fact that it operates on atomic principles more opaque than the logic of burning fossilized biomass. It's college physics versus campfires. On top of all this, both ordinary citizens and policy experts have awful track records in assessing and mitigating complex risks. The massive investment in antiterrorism and simultaneous neglect of climate change mitigation measures in the early 2000s is perhaps the most vivid recent example of flawed risk assessment, but there are many others, from high tolerance for traffic deaths—**about** 38,000 in the U.S. and 1.3 million **globally** every year—to high-risk personal consumption habits like fast food, smoking, and drinking, along with widespread fear of relatively low-risk threats such as shark attacks, wolves, or vaccine complications. In many parts of the world, due to both unfounded fears and justified caution, public opinion can be deeply skeptical of nuclear energy.

Unfortunately, in some quarters this entrenched skepticism has provoked an equally unjustified reaction in the opposite direction. An active community of online proponents are quick to swarm even modest, science-based criticisms of nuclear power, displaying an insular, cult-like devotion to their cause and often invoking conspiracist thinking to justify it. On social media, I have personally been told by advocates that radiation and radioactive waste are safe, that nuclear power has no risks whatsoever, that there are shadowy forces seeking to undermine it, and that the real enemy of climate change mitigation consists primarily of environmentalists and renewable energy supporters (rather than, say, the fossil fuel industry). Meanwhile, climate denial and nuclear advocacy frequently go hand in hand. High-profile nuclear proponents like Michael Shellenberger and Bjørn Lomborg have written scientifically uncredible and widely debunked books downplaying climate change while advocating for nuclear energy, and pushing factually unfounded climate denial on websites like ***Quillette***, ***Reason***, and the ***Cato Institute***. Of Lomborg's recent pro-nuclear climate denial book, the London School of Economics **wrote**, "like his previous contributions to this issue, Dr. Lomborg's arguments are based on fantastical numbers that have little or no credibility."

These rhetorical and ideological excesses notwithstanding, nuclear energy does have important benefits that are worth taking seriously. Indeed, there is a serious argument to be made that nuclear should—**even must**—be an important component of our efforts at decarbonization. Advocates suggest that replacing fossil fuel–based energy with 100 percent renewables would require so many scarce elements, from lithium to land space, that it could be next to impossible to meet total and growing demand, especially in the short timeframe necessitated by the climate crisis. Around the world there are already conflicts related to the mining of these minerals, as well as the placement of solar and wind farms. Nuclear energy, for its part, can provide a steady supply of power for days without wind, sun, or batteries—increasingly important as weather patterns become ever more erratic—with relatively small land footprints, and future innovations may make nuclear an even more efficient option. But to be sure, nuclear also poses many real risks that should not simply be waved away.

In short, we urgently need clear-eyed, balanced discussions of the overall costs and benefits of pursuing nuclear energy, especially as some nuclear power plants reach the end of their functional lives and the public and policymakers have to decide how, or if, to replace such energy sources. As more coal and gas plants are decommissioned, meanwhile, nuclear may become an attractive alternative for some policymakers, so it is essential to weigh risks and benefits now. (As we have seen from the fracking boom, energy projects attractive to politicians are often rolled out in ways unregulated, haphazard, and harmful to the public.) Further, the debate about whether to focus on nuclear options rather than decentralized responses to climate change, like renewable energy and degrowth economics, reveals an ideological split that cuts across traditional left-right political divides. This debate speaks to larger questions about what kind of society we wish to build in an increasingly unstable Anthropocene. Parsing out the risks and benefits of nuclear can illuminate that divide and offer some ways forward.

Some downsides of nuclear energy are readily apparent and have been for years, partly explaining its slow growth as an alternative source of electricity. Building a new nuclear power plant **takes an average** of ten years, and the energy it will produce costs between $112 and $189 per megawatt hour (MWh), in contrast to $29 to $56 per MWh for wind and $36 to $44 per MWh for solar. The first new nuclear plant in the United Kingdom "in a generation" **continues to hit** cost overruns and is currently hovering at around £22 billion. Since, as physicist Amory Lovins **notes**, "most U.S. nuclear power plants **cost more** to run than they earn," profit-driven markets cannot be relied on to sustain a nuclear transition. To scale nuclear up globally would likely require mass state investment, a stark challenge in a world of near total neoliberal capture. With a problem like climate change, which requires rapid transition—scaling up of new non-carbon energy and scaling down of fossil fuels—the slowness, costliness, and inflexibility of nuclear power is a major hindrance, even if potential innovations could alleviate these problems.

Unfortunately, innovation is still far away. When critics of nuclear energy bring up problems like radioactive waste and the non-renewability of uranium, proponents frequently counter with promises of new technologies on the horizon, like using the three-times-more-abundant thorium as a replacement for uranium, improved efficiencies in recycling spent fuel, and deep salt storage. But, like fusion, the commercial viability and practical scalability of these technologies loom ever just out of reach, with projected timelines stretching years or decades into the future, with no real guarantees of ever becoming practically viable. Finland, for instance, has recently **broken ground** on the world's first deep geological repository, which purports to offer a "permanent" solution to radioactive waste, with an expected cost of $3.4 billion and completion date of 2023. In reality, this seemingly promising solution can only accommodate a small amount of waste and—depending as it does on Finland's high investment capacity, high state involvement, and particular geology—does not appear to be a scalable solution around the world.

Nuclear power is **second only to coal** in its unpopularity in the United States, with just 16 percent of U.S. adults surveyed believing the country should maintain existing reactors and build new ones. Meanwhile, only 29 percent of the public views nuclear power favorably, and 49 percent view it unfavorably. Even advocates broadly recognize (and lament) how deeply unpopular nuclear energy is. Whether justified or not, this public opinion problem presents a major political obstacle to expanding nuclear energy rapidly, particularly for those committed to democratic decision making around energy production. On top of this, continuing scholarly debates about the safety of living near nuclear facilities and its **potential** for higher cancer risks will not help nuclear's standing in popularity polls. However safe we manage to make nuclear energy, the fact remains that the risk of a catastrophic accident is impossible to bring to zero, human error and natural disaster being ineradicable risks of all human endeavors.

Another limitation of nuclear power is that it is not a long-term solution, in one crucial respect: it depends on fissile materials that are nonrenewable, namely uranium-233, uranium-235, and plutonium. At current rates of consumption, there may be between 130 and 230 years of recoverable uranium available globally. Derek Abbott, Professor of Electrical and Electronic Engineering at the University of Adelaide, **has calculated** that scaling nuclear production up to meet global demand could leave just five years of uranium supplies. Some experimental technology aims to use thorium instead, and optimistic speculation suggests that it could increase the supply of fissile material considerably. There are no commercially operating thorium reactors, and there are not likely to be in the near- and medium-term. There's also **the possibility** of accessing underwater reserves of uranium, which could increase availability as well, but this technology is also far from deployable. In the end, all these technologies still use fissile fuel—including thorium—that is ultimately nonrenewable. (Other technological prospects include using spent fuel as an energy source, but these proposals, too, are experimental and not currently scalable.)

Beyond renewability, another important aspect of the debate concerns safety. Nuclear energy is often touted by advocates as the **"cleanest" and "safest"** energy source because of its lack of carbon emissions. There are many other environmental problems associated with nuclear energy, however, that call into question the precise meaning of these claims. Put another way, one could ask, *for whom* is nuclear clean and safe? Uranium mining is highly environmentally destructive, combining all the dangers of mining in general—like blasting and drilling huge tracts of land—with the added danger of radioactive waste rock and mill tailings (an ore residue left behind as a waste product). Environmental journalist David Thorpe **calculates** that "To produce the 25 tonnes or so of uranium fuel needed to keep your average reactor going for a year entails the extraction of half a million tonnes of waste rock and over 100,000 tonnes of mill tailings. These are toxic for hundreds of thousands of years." Miners and those living near mines will be at risk, regardless of any potential technological innovations.

Of course, mining is also a problem for fossil fuel energy and for manufacturing solar panels and wind turbines, and hydropower invariably entails significant environmental and humanitarian risks. But there are other problems unique to nuclear energy: many plants are built on waterways to ensure a steady supply of cooling water. These can create hot spots that **threaten** aquatic species. Radioactive waste, too, remains a threat not just to people but to wildlife. And if risks of meltdown aren't enough, fissile material is famously explosive. Nuclear reactors contain fissile material capable of being placed into weapons that could take many lives, either in the form of combustive bombs or radioactive dirty bombs. This threat has created an imperative to militarize nuclear power plants, particularly in an age of post–9/11 hysteria. Such high-level security risks as radioactive materials will provide justifications for maintaining significant military spending and security presence into the future. Still, granting all these risks and downsides, fossil-fueled climate change and air pollution are still much greater killers than any of these threats, even including nuclear weapons.

One of the main benefits of nuclear energy, of course, is that nuclear power plants themselves do not emit carbon or fine particulates. The ominous-looking smoke stacks made iconic by the Springfield Nuclear Power Plant of *The Simpsons* in fact only emit steam, making them much less deadly than the smaller, quainter, nostalgic red brick smokestacks of traditional coal plants.

Nuclear-derived electricity would not completely eliminate the death toll due to carbon air pollution, given that a major portion of it comes from non–point source pollution like cars and trucks. But if nuclear plants were to displace existing electricity-generating coal and gas plants, they would certainly **save** many lives from air-pollution–related deaths each year; **one study** suggests, in particular, between 0.5 and 7 million lives by midcentury. Indeed, the more we learn about carbon air pollution, the more alarmed we should be, since it causes everything from **birth defects** to early-onset **dementia**. And the air pollution death toll doesn't include the hundreds of millions or billions of people who will almost certainly suffer illness, displacement, and premature death from business-as-usual global warming trends this century. Again, replacing coal and gas electricity generation with nuclear energy worldwide could theoretically remove a nontrivial chunk of global carbon emissions. (**One study**, however, suggests that the current 2-3 percent of annual emissions that nuclear mitigates is likely to decrease in the future, at least extrapolating from current planning trends and the availability of uranium.)

This is not a unique benefit to nuclear energy, of course, since renewables also do not emit carbon pollution at the point of production. The reality is that, like renewables, nuclear can only address a fraction—albeit a large one—of carbon emissions: those stemming from electricity generation. Other major greenhouse gas emitters include transportation, construction, and agriculture. While electrifying some areas where combustion predominates—like transportation—can be one way of eliminating those emissions, doing so does not eliminate **many other problems** like resource constraints, extractivist social and political relations, and outsourced emissions.

Looking beyond direct sources of carbon emissions, the processes behind nuclear electricity production are still heavily carbon-dependent, from the mining, processing, and transportation of uranium to the construction of the power plant, while nuclear plants also use emergency diesel generators as backup sources of power. Renewables share this problem because they, too, are dependent on heavy fossil fuel infrastructure for mining and shipping their components and constructing them. Balancing all these effects, it is not so clear that nuclear power would even be *low* carbon. Emeritus Professor of Physics at Imperial College London Keith Barnham **contends**, "Far from coming in at six grams of CO2 per unit of electricity for Hinkley C," the new reactor being built in the UK, "the true figure is probably well above 50 grams—breaching the [Committee on Climate Change's] recommended limit for new sources of power generation beyond 2030." Barnham goes on to suggest that "half of the most rigorous published analyses" find that nuclear power exceeds the limit of carbon dioxide emissions set by the government's climate change advisor. Energy scientist Amory Lovins even **makes the case** that "building new reactors, or operating most existing ones, makes climate change worse *compared with spending the same money on more-climate-effective ways to deliver the same energy services*," due primarily to how slow and expensive nuclear reactors are to build.

Despite the slowness of construction, there is one considerable advantage to nuclear plants when it comes to energy transition: electricity grid systems in most intensively electrified countries are highly centralized. Electricity production (e.g., at a power plant) is thus separated from energy consumption (e.g., in the household), making it easier to integrate nuclear power with the grid we already have. By contrast, due to the nature of renewables like wind and solar—intermittency of generation, low density, the need for geographic dispersion—switching to renewable energy would require rewiring and transforming the grid; some proponents argue for dismantling it entirely to build a new one. This would surely take an enormous investment of time and labor given the myriad obstacles, from zoning and planning commissions to private property and already dwindling available land area. Even with very heavy-handed government intervention—the prospects of which are never a given in the United States—we could still reasonably assume it would take a long time to fully reform the grid for renewables. On this score, nuclear comes out the clear winner. We have all this infrastructure available for providing power generated at massive economies of scale, and at least in principle, certain energy providers could more readily slot nuclear into this system much faster than a new grid could be built. And once nuclear plants are built, they can operate for decades: the longest-running reactor was **shut down in 2018** after 49 years of operations, and some reactors today are **projected** to last 80 years.

But this ease may well prove a double-edged sword. Even if electricity generation were to be fully provided by nuclear reactors, we would still live in a fossil fuel economy. In other words, while the ease of integrating nuclear onto the grid is a strong point in its favor if our goal is simply to rapidly decarbonize electricity, embracing nuclear would also do little to dismantle the rest of the infrastructure of our existing carbon economy. By contrast, decommissioning fossil fuel infrastructure—not just power plants but grids and mines—opens up the possibility of rethinking how urban and rural infrastructures are designed, how they interact, and who they serve. Decentralized, distributed energy production like renewables can have a broader disruptive impact on energy infrastructures and how they interact with social and political relations. Integrating distributed, small-scale energy generation within towns and cities can make them more self-sufficient; whereas most people now are alienated from their modes of energy production, bringing production into their spheres of governance and living can alter that relationship in **positive ways**. Neighborhood-controlled energy, for instance, can have positive civic impacts, making towns more democratic and profit-sharing more widespread. Further integrating some form of **degrowth** **economics**—such as **circular** **economy** principles—could also disrupt the fossil economy even more broadly. Nuclear is necessarily a top-down energy source; solar and wind can be (though are not inevitably) a bottom-up energy source, particularly when paired with **degrowth principles and policies**. Embracing nuclear would leave many status quo structural relations largely intact, given the way it depends on states, militaries, and command-and-control politics.

A similar sort of bind is likely when it comes to jobs. There **are about** 45,000 nuclear power employees in the United States. (Some nuclear advocacy sites attempt to inflate this number by including “secondary” jobs the industry creates, but these often include mostly temporary construction jobs, which tend to be much lower paid and very dangerous.) About 20 percent of U.S. electricity is generated by nuclear power; scaling that up to 100 percent yields the potential for about 225,000 jobs total in the industry. According to the **2020 U.S. Energy and Employment Report**, 6 percent of nuclear employees are unionized, or about the national average, (though according to a 2017 industry Pipeline Survey, that proportion could be as much as **a third**); advocates see potential in increasing this share.

But who is likely to benefit from good unionized jobs? Climate and environmental justice advocates emphasize the imperative to right both historical and contemporary wrongs done to marginalized groups who have suffered a disproportionate burden of environmental harm through pollution or the impacts of climate change. The history of nuclear energy in the United States is one of inflicting precisely this kind of harm. As historian Traci Brynne Voyles documents in her book *Wastelanding* (2015), the Navajo Nation has been particularly afflicted by U.S. uranium mining; their land "hosts upward of 2,000 now-abandoned uranium mines, mills, and tailings piles," which "litter the Navajo landscape, leaching radon gas into the air and water and scattering radioactive debris throughout the ecosystem." Decisions made about where uranium is mined, where nuclear plants are constructed, and where waste is stored have been informed by a logic of environmental racism that renders certain areas of land and its inhabitants pollutable. Voyles notes that "Radiation-related diseases are now endemic to many parts of the Navajo Nation," and that researchers have found among miners "increased incidents of tuberculosis, fibrosis, silicosis, and birth defects, all linked to exposure to uranium from mines and mills."

This context should give us pause. Even if scaling up nuclear power did create many good, middle-class, high-skilled unionized jobs, there is no reason to believe it would not continue to depend on exploiting poor and marginalized populations whose jobs are neither practically unionizable nor well-paid, and whose workers suffer the brunt of the dangers of mining and waste. (It's also worth noting that while renewable industries in the U.S. lag behind nuclear in its share of unionized workers, there is **no reason** to believe renewable jobs are intrinsically less unionizable than nuclear jobs.) There is currently a uranium rush in **countries** like **Namibia** and **Australia** with weak regulatory frameworks for ensuring public and environmental safety, and—given that many years can pass before symptoms of radiation poisoning become apparent—the companies taking advantage of those weak regulations are rarely held accountable for the damage they inflict. A vast expansion of nuclear energy would almost certainly entail more exploitation of vulnerable people and ecologies.

These are very serious objections, and ultimately they must be weighed against what is politically, technologically, and socially possible, especially in the short term. We undoubtedly face stark tradeoffs in thinking about how to transform societies that demand massive amounts of energy to function.

Even granting many of the high-tech, high-reliability arguments in favor of nuclear energy, there is a final major risk we must face head on. Operating nuclear power plants—and maintaining radioactive waste storage infrastructure—requires high levels of stability: geopolitical stability, climate and geological stability, civilizational stability, and so on. This stability must be maintained indefinitely due to the high radiation potency of operational plants and the long-term toxicity of radioactive waste, which can remain deadly for hundreds of thousands of years, even a quarter of a million years at the higher end. And yet, the spokesman for the U.S. Nuclear Regulatory Commission (USNRC) **told** *Scientific American* in 2009 that the agency is "confident that fuel can be stored safely on-site at reactors in either pools or dry casks for at least 90 years." If our best confidence extends only to ninety years, the notion that waste infrastructure could confidently be maintained for 250,000 years becomes quite absurd, especially when you consider that that amount of time is nearly equivalent to the whole length of time that *Homo sapiens* has existed. Complex states have only existed for around 5,000 years. Nuclear power plants have only been around for about **seventy years**, a minuscule patch of time when compared with the consequences it produces. Transitioning from fossil fuels to nuclear energy is supposed to protect future generations of humans and other species from catastrophic climate impacts, but if the long-term safety of radioactive waste cannot be guaranteed, nuclear energy looks less like a solution for the future and more like a stop-gap that benefits those in the present at the expense of those future beings.

The stability problem doesn't end there. Even in the nearer term, nuclear plants are vulnerable to the increasingly unstable weather of climate change and to the increasingly unstable political regimes meant to regulate these infrastructures. Given that many nuclear plants are placed near coasts, a **recent study** sought to calculate how many would be vulnerable to sea-level rise. The study found that "if seas rise about six feet—which is possible by the end of the century—more than half of the waste storage sites would be directly along the water's edge or even surrounded by water." As the Fukushima disaster illustrates, the threats posed by flooding are real. Further, the ecological crises that get worse every day threaten to fracture political orders and make those regulatory frameworks—at state, sub-state, or intergovernmental levels—incapable of maintaining safe facilities.

In the United States, for its part, *Chemical and Engineering News* **reported** last year that "aging containers have already begun leaking their toxic contents," even under relatively stable maintenance conditions. In Hanford, Washington, for example, 200 million liters of radioactive waste have been sitting for nearly half a century, waiting to be processed. According to *C&EN*, "About one-third of the nearly 180 storage tanks, many of which long ago outlived their design lives, are known to be leaking, contaminating the subsurface and threatening the nearby Columbia River." This fact, too, undermines USNRC's ninety-year safety guarantee. Moreover, the integrity of basic U.S. infrastructure like roads, bridges, and public transportation has deteriorated significantly since the advent of nuclear energy. It remains to be seen whether these trends will reverse in the near or distant future, but given the weak infrastructure investments of the recent past combined with the daily onslaught of climate impacts like record-setting wildfires, droughts, hurricanes, floods, and heatwaves, it's not looking good.

In short, resilience to climate impacts will only become more important as climate change worsens, but highly centralized nuclear power plants do little to improve grid resilience. Even simply high ambient temperatures **can be enough** to shut down nuclear power plants. The 2018 heatwave in Europe, for instance, temporarily forced plants to shut down across the continent. By contrast, distributed energy forms like wind and solar have **higher potential** to achieve resilience in the face of climate disruptions.

Some of these problems with nuclear power may not be inherent. Nuclear is a proven technology that has room for innovation, even if much of that innovation is still a ways out. With 450 reactors operating globally, and half a century of mostly safe operation, there is a wealth of knowledge about how to build and operate them. The situation is quite different with renewables, which have only quite recently started to match the power output of nuclear reactors. Small modular reactors manufactured at scale could give nuclear dexterity comparable to rapidly deployed, decentralized renewables. Storing nuclear waste deep underground could be a potentially permanent solution to the dangers of radioactive materials lying around for millennia. Nuclear energy advocates are keenly waiting for reactors that recycle nuclear waste back into a source of energy to become commercially viable, effectively doing away with the need for much nuclear waste storage. But, to reiterate, these innovations are far from guaranteed; even in the best cases they likely would not arrive for decades, a period of time in which continued technologically advancements cannot reasonably be presumed.

Where do all these considerations leave us? A **study** recently found that the Atlantic meridional overturning circulation (AMOC), a component of the global oceanic conveyors like the Gulf Stream, has destabilized more thoroughly than previously believed. Although scientists cannot predict when or if it will collapse, this new evidence suggests that thresholds may have already been crossed that make collapse likely, even within the span of decades. This collapse would make Europe colder and stormier, raise sea levels globally, and threaten food supplies across the Global South. One of the researchers involved in the study **told** the *Guardian*, "the only thing to do is keep emissions as low as possible. The likelihood of this extremely high-impact event happening increases with every gram of CO_2 that we put into the atmosphere." This is just one of the many Earth systems now in critical condition, any one of which could throw the capacity for complex states and economies into question in the relatively near future.

On one hand, the best case for nuclear energy is that it is vital we rapidly reduce every gram of greenhouse gases being emitted. If nuclear energy could be proven to substantially reduce carbon emissions, that alone may be enough reason to replace coal and gas electricity generation with nuclear as fast as possible, in as many places as it is reasonably safe. There are still open questions about whether this could be achieved faster than fully reforming grids to accommodate 100 percent renewable electricity generation. In some places, the former may be faster; in other places, the latter undoubtedly will be. There is no simple answer to this question. It is likely that in very particular places where conditions are ideal and relatively stable, opening new nuclear reactors could make good sense, while in most other places, new nuclear reactors do not make sense, and investing in solar, wind, and other renewables is the better option. We should remain wary of commentators making overly strident claims one way or the other.

If thresholds like ocean conveyor collapse—or others like permafrost melt, forest diebacks, and polar glacier melt—have already been crossed or are likely to be crossed in the near future, then we need to be preparing for a world that is much less stable than the one nuclear energy, and indeed all of modern civilization, has taken for granted. As such, we cannot assume that the technologies that have served us reliably in the latter twentieth century will still serve us reliably in the latter twenty-first century and beyond.

Either way, this destabilization of civilizational order will open new possibilities—and close others—for how we are able to structure society, both its physical infrastructures and social ones. Decisions we make about infrastructure today limit the possibilities for the sorts of civilizations we can build in the destabilized future. Nuclear energy—with its dependence on heavily militarized and organized states—relies on one kind of civilization. Renewable energy—with its capacity to be owned and managed at local levels, cooperatively—opens the potential for radically different ones. Neither course, nor both combined, doom society to particular paths, but they certainly narrow the range of possible options, especially in the short term. The debate that needs to occur around nuclear is not just whether it can reduce carbon emissions, or provide efficient electricity, or whether it is “safe and clean,” but also whether it should be part of the vision for how human societies adapt and, with any luck, thrive in the new and more dangerous world we have created.