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Nuclear Energy

A Dangerous Distraction

The climate change crisis requires a massive shift to renewable, low-carbon electricity generation. Nuclear energy is promoted as an important component of the alternative energy mix needed to mitigate the climate crisis. But is it?

This issue of Making Every Day Earth Day (MEDED) explores concerns about nuclear energy. Many of these concerns are well-known: the risk of catastrophic accidents such as Three-Mile Island, Chernobyl, and Fukushima, the prohibitive cost of time and construction overruns, the dependence on federal loan guarantees, the need for federally-backed liability insurance, and the unsolved problem of nuclear forever-waste including the ongoing failure to create permanent geological repositories of highly radioactive spent fuel.

To answer the question of nuclear energy's role in mitigating climate change requires understanding what nuclear expansion involves compared to the alternatives and their costs. This MEDED issue looks at the history, current status, and future of the nuclear industry. We examine the links between nuclear energy and weapons, how that relationship has shaped today's nuclear industry, and what climate change and advancements in renewable energies will mean for nuclear energy's viability in the decades to come.

"The history of the nuclear industry (nuclear weapons and nuclear power) has been one of secrecy, coverup, and minimization."

– Physicians for Social Responsibility

Historic Links: Nuclear Weapons and Energy

The history of nuclear energy is intimately entwined with the history of nuclear weapons. The Manhattan Project laid the path for developing nuclear-powered naval propulsion and

nuclear power plants, with the latter then providing capacity and cover for further nuclear weapons development. For example, when the U.K. opened its first nuclear power plant at Calder Hall in 1956, news reports spoke about providing cheap and clean electricity for British citizens. In fact, the only electricity the site produced was strictly for itself, as it processed uranium into plutonium for use in the British nuclear weapons program. In the U.S., similar sentiments were expressed by the Atoms for Peace Initiative and the "Too cheap to meter" meme in the 1950s.

Uranium was chosen over potentially safer alternatives like thorium to fuel the first generation of nuclear reactors for just this reason; to produce atomic bombs. This decision came despite the significant risk of meltdown, a lack of indigenous uranium reserves (the U.S. imports 95% of its uranium), the toxicity of the waste due to multiple fission products that produce lethal levels of radiation lasting for many tens of thousands of years.

The links between nuclear energy and weapons also led to the nuclear industry enjoying protection from scrutiny and accountability, as it fell under national security. During the Cold War, the nuclear arms race was such a priority that incentives to conduct rigorous, consequential studies on the health and ecological impacts of uranium-based nuclear energy were severely suppressed, leaving us with scant radiation health data today.

For instance, the U.S. Nuclear Regulatory Commission (NRC) continues to cite the only federal study published in 1990 that has ever been conducted on the health risks associated with living near nuclear reactors. The study claims that the health impact is non-existent. These conclusions are highly contested, and the NRC has dismissed efforts to replicate and update the study as too complex and too costly.

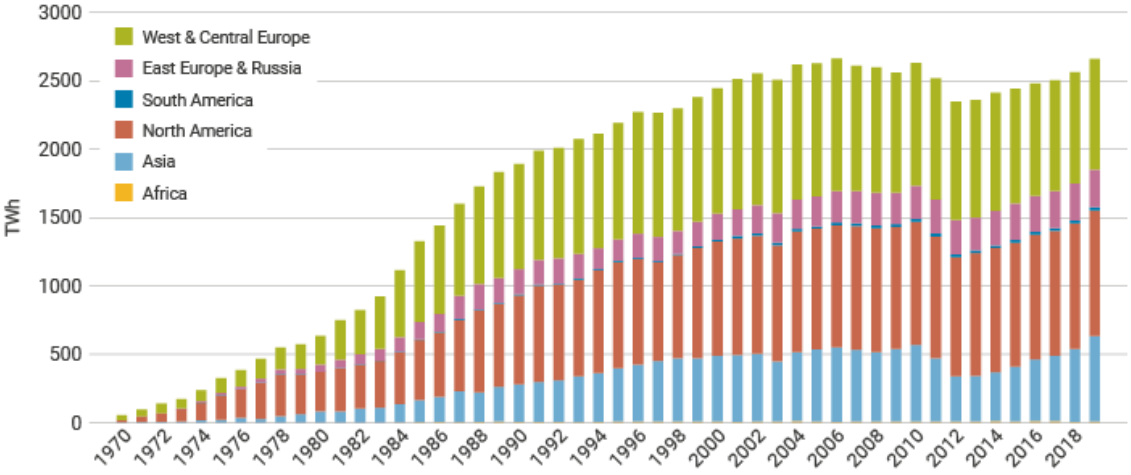
Potentially disastrous incidents involving nuclear energy have happened with regularity and will continue to increase in frequency as aging infrastructure meets worsening climate change. The same can be said about worryingly accident-prone nuclear weapons. Given the systematic political, economic, and cultural protection afforded to the nuclear industry by nuclear states, these events remain relatively unknown despite the dangers posed.

It is impossible to keep full-scale nuclear disasters a secret, however. Disasters at Three Mile Island, Chernobyl, and Fukushima all badly damaged the reputation of nuclear as a safe source of electricity, highlighting the dangers involved not just to nearby areas but globally.

Another drag on the nuclear industry's economic viability was the trend toward reducing nuclear weapon stockpiles since the end of the Cold War. Diluting weapons-grade uranium to power reactor fuel temporarily subsidized the industry. Loss of cheap fuel has left nuclear power disadvantaged compared to the plummeting cost of renewable energy sources like solar and wind.

Nuclear Energy Now

Nuclear Electricity Production



Source: World Nuclear Association and IAEA Power Reactor Information Service (PRIS)

The rate of expansion in the nuclear sector continued through the end of the Cold War, driven in part by the arms race in nuclear weapons. By the early 2000s, the expansion of global electricity output from nuclear energy began to slow and peaked around 2006. The Fukushima Dai-ichi nuclear power station disaster (2011) caused a noticeable drop in production, something the earlier Chernobyl meltdown failed to cause. Other states closed aging reactors due to heightened safety concerns. After 2012, production levels began to recover, reaching record levels in 2019. The nuclear industry now faces irrelevance with nuclear weapons production much reduced, no game-changing developments in efficiency or cost, and the maturing of credible alternatives.

The nuclear energy industry is vigorously lobbying to be included in post-pandemic economic recovery planning to play a larger role in climate change mitigation and achieving the 2030 Sustainable Development Goals (SDG). Yet, the industry is not getting much traction. In September 2020, for example, the European Union banned nuclear energy from its Just Transition Fund—a financial instrument for the European Green Deal. Nevertheless, United Nations member states are not prohibited from including nuclear energy in their efforts to achieve SDG 7: "Ensure access to affordable, reliable, sustainable and modern energy for all."

Recent devastating climate events, like the Iowa August 2020 derecho and the unprecidented February 2021 Texas winter storm, have undermined the industry's efforts to greenwash its reputation and have brought to the fore how vulnerable nuclear power stations are to natural disasters.

Duane Arnold Energy Center (DAEC) — Palo, Iowa

Two great rivers border Iowa. Both are dotted with nuclear power stations in Wisconsin, Minnesota, Illinois, and Nebraska. The Ft. Calhoon station, near Omaha and Council Bluffs, has been permanently closed due to severe repeated and worsening flooding.

Iowa's only nuclear power plant, DAEC, opened in 1974. Its installation sparked widespread concern over possible environmental and health impacts.

The Cedar River provided water for the plant's cooling water system. Over the years, worsening climate change-related heat waves and droughts caused river water levels to drop and temperatures to rise. Another concern was accumulated river sediment reducing flow rates.

The aging plant was closed permanently after the August 2020 derecho caused extensive damage to the facility while it was in operation. Fortunately, according to the NRC, only "non-safety-related portions of the plant, including the cooling towers," were damaged. The nuclear reactor fuel (uranium) was removed two months later, in October 2020. More than

500 tons of spent nuclear fuel will remain at the site for decades, much of it in cooling pools that require off-site electrical power for constant water circulation and monitoring.

The DAEC Post-Shutdown Decommissioning Activities Report (PSDAR) submitted to the NRC contains the stated intention to move all of the site's spent nuclear fuel into safer dry cask storage as soon as possible and put the plant into SAFSTOR, before starting the expensive full decommissioning of the facility to be completed by 2075.

A PSDAR public meeting scheduled for July 28, 2020 was canceled due to COVID-19. The PSDAR public meeting will be rescheduled once conditions allow for in-person gatherings. Serious public health risks remain and should be addressed at the public meeting.

"The plan is to wait. We have up to 60 years to decommission the power plant...Any of the components inside the power plant that have some radioactive activity, that radioactivity actually breaks down by itself over time. So, by waiting you allow that process to happen and we can go in there at a future date, and kind of disassemble things more if we need to."
—Peter Robbins, Spokesperson for DAEC
KCRG TV interview December 2020

The statement above by the DAEC spokesperson is dangerously misleading about the radioactivity inside the DAEC and the time over which the radioactivity will "break down." According to a Governmental Accounting Office report in 2003, the spent fuel stored at at all nuclear power stations like DAEC is described as:

"One of the most hazardous materials made by man is spent nuclear fuel—the used fuel periodically removed from reactors in nuclear power plants. Without protective shielding, the fuel's intense radioactivity can kill a person exposed directly to it within minutes or cause cancer in those who receive smaller doses. As the fuel ages, it begins to cool and becomes less radiologically dangerous—some of the radioactive particles decay quickly, within days or weeks, while others exist for many thousands of years."

Some research has indicated that cancer levels in Linn County, in particular, have increased since the plant opened, and rates of certain cancer types have, at times, been higher than the state average. Yet, we could not find a comprehensive study linking this health data to the DAEC. As mentioned earlier, the NRC considers such studies too complex and expensive to conduct.

Fukushima Ten Years On

March 11, 2021 will be the tenth anniversary of the Fukushima nuclear power station disaster. Since the 3/11 disaster, global media attention has drifted away, but the situation remains a barely controlled disaster. The Japanese government currently provides regular reports to the International Atomic Energy Agency on progress to remove the melted fuel cores, dismantle the damaged structures, and monitor radiation levels in the sea and radioactivity in food produced in the Fukushima Prefecture.

Recent reports from the Dai-ichi station conclude that radiological pollution remains below the targets set by Tokyo Electric Power Company Holdings (TEPCO), but significant risks and challenges remain. Further increasing the urgency, the huge tanks storing the contaminated water used to cool the damaged reactor cores are expected to be full by the summer of 2022. The decision over what to do with the accumulating stored radioactive water is still pending. Suggestions to begin slowly releasing the stored water into the sea were met with a global outcry, even though since the accident, millions of gallons of groundwater have been steadily leaking from the reactor building basement and flowing uncontrolled into the sea. And the threat from earthquakes continues: in February, a 7.4 magnitude earthquake caused a drop in cooling water level inside the Unit 1 Reactor

possibly exposing the damaged fuel core and necessitating the injection of nitrogen gas to reduce the risk of another hydrogen explosion.

The Future of Nuclear Energy

The future of nuclear energy does not look bright. Its largest competitor, natural gas, is already much cheaper to exploit; and the cost of wind and solar and other forms of already competitive low-carbon power will continue to fall. Nuclear power, on the other hand, could continue to get *more* expensive. In 2019, a World Nuclear Industry Status Report showed that over the previous decade, the cost of solar and wind energy had reached as low as $36 and $29 per megawatt-hour, a reduction of 86% and 69%, respectively. Meanwhile, nuclear power had actually increased in cost by 23%, ranging between $112 to $189 per megawatt-hour. This discrepancy in cost will only grow with time.

However, with so much money invested and so much still to make, such concerns will not stop the nuclear industry from trying to adapt and thrive in the 21st century. One strategy is through innovating new technologies that solve specific problems associated with traditional nuclear energy but fail to address all of the problems—any one of which could reasonably be deemed disqualifying.

Efforts continue to develop new, better nuclear technology such as Small Modular Reactors (SMRs), molten salt cooled fast neutron reactors that can partially burn conventional spent nuclear fuel, thorium-based technology, and fusion reactors. All of these technologies are unproven and are in various stages of development but decades from possible commercial use.

Nuclear fission reactors require water and continuous external power for shutdowns during emergencies or scheduled maintenance and remain vulnerable to extreme storms and natural disasters. Climate change is more likely to end nuclear power than the other way around. A future destabilized by climate change may see increased violent conflicts, with nuclear power plants as potential targets in wars or terrorists seeking to either cause a disaster or steal materials. All these possibilities and more *will* occur if enough time accrues before decommissioning nuclear power and abolishing nuclear weapons entirely.

Conclusion

Nuclear energy is dangerous, expensive, and unpopular. For generations, the industry has produced toxic waste that will last for thousands of years, and we still have no plan for disposing of or even storing it safely. The opportunity costs, as described in our previous MEDED issue with nuclear weapons, are enormous. Designing and building out new generations of nuclear power reactors will be ***slow***, expensive, hindered by path dependencies, and civic and political opposition.

Mitigating climate change demands a ***fast*** transition to non-carbon energy production, while biodiversity and ecosystem loss demands a focus on sustainability. In particular, in the U.S. and U.K., questions of competence and corruption cast doubt on some nuclear states' capacity to scale up nuclear energy in-time and on-budget.

More sustainable, less toxic, alternative energy sources like solar and wind are being installed rapidly with steadily falling costs and increasing efficiency. The nuclear industry will continue to struggle in market-driven states. While it’s conceivable that China could begin to build a new generation of fusion reactors by 2040, it would be too late, and global buildout would take decades more. To avoid climate disaster, the whole world needs to be in full transitioning well before 2040.

We have, now, faster, cheaper, cleaner alternatives with solar, wind, hydro-electric, wave, tide, geothermal, and the list goes on. We have no need, time, nor money to continue pursuing either nuclear energy or nuclear weapons.

Note: Nuclear power reactors are not needed to manufacture the radiopharmaceuticals used in medical diagnosis or therapeutics. Manufacture is accomplished with small research reactors, cyclotrons, and a number of emerging alternative techniques that were outlined in a 2019 International Atomic Energy Association technical symposium.

Steps We Can Take

- Call for the phasing out of nuclear power and the repurposing of infrastructure, e.g., electricity grid access, for renewable energy projects where possible.
- Support transitions to safe, sustainable energy sources.
- Join efforts to close nuclear energy stations, prevent new ones from being built, and the safe clean up of those sites.
- Demand that the federal government fully fund and cooperate with extensive research into all U.S. nuclear energy facilities' environmental and health impacts.
- Call for more research into the long-term environmental and health impacts of the shuttered DAEC plant.

Learn More

Backgrounder on Analysis of Cancer Risks in Populations Near Nuclear Facilities [webpage] *U.S. Nuclear Regulatory Commission*

Nuclear Power in the World Today [webpage] *World Nuclear Association*

Fears Rise Over More Damage at Fukushima (2021) *Energy Central*

History of Nuclear Energy in Iowa (2021) *Sierra Club, Iowa Chapter*

Shutdown of Iowa's Only Nuclear Power Plant Will Mean Less Cancer by Joseph Mangano (September 8, 2020) *Des Moines Register*

Duane Arnold Energy Center Moves Forward to Decommission, Future of Site Undetermined (December 29, 2020) *KCRG*

Post-Fukushima Order Implementation Status (August 18, 2020) *U.S. Nuclear Regulatory Commission*

Post-Fukushima Flooding and Seismic Hazard Reevaluation Status (August 18, 2020) *U.S. Nuclear Regulatory Commission*

EU Lawmakers Ban Nuclear from Green Transition Fund, Leave Loophole for Gas by Kate Abnett and Marine Strauss (July 6, 2020) *Reuters*

Nuclear Energy Too Slow, Too Expensive to Save Climate: Report by Marton Dunai and Geert De Clercq (September 23, 2019) *Reuters*

USGS Assesses Uranium Potential in Southern High Plains (November 14, 2017) *U.S. Geological Survey*

The Cancer Burden of Linn County by Scott Seltrecht (April 2016) *Linn County Public Health*

Lessons from Fukushima and Chernobyl for U.S. Public Health
(2011) Physicians for Social Responsibility Briefing Book

Nuclear Power and Public Health: Lessons from Fukushima, Still Dangerously Unprepared (2012) *Physicians for Social Responsibility*

"What are the Odds? US Nuke Plants Ranked by Quake Risk" by Bill Dedman (March 17, 2011) *NBC News*

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Physicians for Social Responsibility - Iowa Chapter

Authors: Angela de Prairie @deprairie and Benjamin J. King @grimeandreason