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Monitored this issue:

What are we to make of Saudi Arabia's nuclear program?

M.V. Ramana

On November 18, 2025, the United States and Saudi Arabia "signed a Joint Declaration on the Completion of Negotiations on Civil Nuclear Energy Cooperation" that promised "a decades-long, multi-billion-dollar nuclear energy partnership" between the two countries, confirming "that the United States and American companies will be the Kingdom's civil nuclear cooperation partners of choice" and promises to ensure "that all cooperation will be conducted in a manner consistent with strong nonproliferation standards". Although there is much to be concerned about this agreement, one potential worry that is unlikely to materialize is a rapid buildout of nuclear plants in Saudi Arabia—thanks in part to the long history of efforts to establish a nuclear program in the country.

That history can be dated back to 1978, when the country entered into a multi-year Technical Cooperation Project entitled "Nuclear Energy Planning" with the International Atomic Energy Agency. The Atomic Energy Research Institute was established in 1988 to promote various nuclear technologies. Not much resulted from those projects and plans. The impetus for the latest round of efforts is the December 2006 meeting of the Gulf Cooperation Council, when officials from these states announced that they intended to start a joint nuclear energy development program.

The first agreement between the United States and Saudi Arabia dates back to May 2008 when the two countries signed a memorandum of understanding on nuclear energy cooperation. According to that agreement, the United States promised to assist Saudi Arabia "to develop civilian nuclear energy for use in medicine, industry, and power generation" while the latter "stated its intent to rely on international markets for nuclear fuel and to not pursue sensitive nuclear technologies, which stands in direct contrast to the actions of Iran". The term "sensitive nuclear technologies" is code for the capacity to enrich uranium, the technology that is at the heart of the multi-decade dispute between the United States and Iran. That clause has also been a source of dispute with Saudi Arabia.

Plans to build nuclear reactors in Saudi Arabia go back to 2010 when the The King Abdullah City for Atomic and Renewable Energy (KA-CARE) was established through a Royal decree. The following year, the "coordinator of scientific collaboration at KA-CARE" announced plans "to construct 16 nuclear power reactors over the next 20 years at a cost of more than 300 billion riyals ($80 billion)". The same year, a KA-CARE report suggested that "work on the kingdom's first nuclear reactor could start by 2014, for completion by 2020". These announcements were welcomed by the nuclear industry, which was reeling from the impact of the Fukushima accident.

Progress in the last decade and a half has been slow at best, and mostly involves officials reiterating plans to build nuclear plants. For example, in September 2024, Saudi Minister of Energy declared at the General Conference of the International Atomic Energy Agency "the Kingdom is moving towards utilizing nuclear energy and its radiation applications for peaceful purposes… including the construction of the first nuclear power plant in

the Kingdom". And it was exactly the same declaration once again the following year, in September 2025. The other development over the same period involved Saudi Arabia signing a series of agreements with other countries and their nuclear agencies, including Argentina, France, Russia, China, and South Korea.

Saudi Arabia is also reported to have shortlisted two sites on the coast near the UAE and Qatari borders for nuclear construction. KA-CARE has since entered into a contract with the French company Assystem to conduct site characterization and impact studies for the first nuclear power plant.

In 2017, KA-CARE announced that it was soliciting nuclear capacity proposals with a combined capacity of roughly 2.8 GW from China, Japan, Russia and South Korea. During the same year, Westinghouse was reportedly discussing a bid for two nuclear power reactor tenders in Saudi Arabia. By 2023, Saudi Arabia had reportedly received bids from Korea Electric Power Company (KEPCO), China National Nuclear Corporation (CNNC), Russia's state-owned Rosatom, and France's EDF.
No U.S. company put in a bid. This was partly because, as the Congressional Research Service pointed out in September 2024, this could not happen "until the kingdom has a 123 agreement 'in effect'; 'has committed to renounce uranium enrichment and reprocessing on its territory under that agreement'; and has 'signed and implemented' an Additional Protocol with the IAEA".

The Trump Administration seems to be upending that agreement. In April 2025, U.S. Secretary of Energy Chris Wright declared that it "has revived talks with Saudi officials over a deal that would give Saudi Arabia access to U.S. nuclear technology and potentially allow it to enrich uranium" that is meant to "enable the kingdom to develop a commercial nuclear power industry". The November 2025 joint declaration is presumably a result of that revival of talks.
The interest shown by the Trump administration in furthering a nuclear agreement between the United States and Saudi Arabia is not surprising. Even during his earlier stint as President, Trump and others in his administration had moved forward on providing nuclear technology to Saudi Arabia, propelled in part by lobbyists pushing a deal, and insiders who stood to profit from the deal. This time around, there is much greater openness in how countries can use money to get the Trump administration to cut them a deal—and Saudi Arabia has promised to pay a trillion dollars.

Understanding the motivation
Money, and lots of it, is definitely one motivation for the United States, and other countries, wanting to sell nuclear reactors to Saudi Arabia. But what about Saudi Arabia's intentions behind the interest in nucelar power.
According to the royal decree of 2010: "The development of atomic energy is essential to meet the Kingdom's growing requirements for energy to generate electricity, produce desalinated water and reduce reliance on depleting hydrocarbon resources". At that time, hydrocarbon resources produced nearly all of Saudi Arabia's electricity—and they still do. Given concerns about climate change and economic diversification, switching away from hydrocarbons makes enormous sense. However, switching to nuclear energy does not.

Nuclear energy is among the most expensive ways to produce electricity. According to the Wall Street company Lazard's 2025 estimates, electricity from a new nuclear power plant in the United States costs roughly three times the corresponding costs at solar or wind energy plants. Globally, the share of electricity from nuclear reactors has come down from 17.5 percent in 1996 to only 9 percent in 2024.

The contrast with renewables couldn't be greater. In 2024, modern renewables (i.e., not including power from large hydroelectric dams) produced 17.3 percent of the world's electricity, up from around 1 percent in the mid 1990s. Solar photovoltaics, especially when built at large (utility) scale, has become the least costly option for new electricity capacity in recent years; in 2020, the International Energy Agency pronounced that solar is "the new king of the world's electricity markets". In the United States, the levelized cost of electricity from utility scale solar photovoltaics and wind energy have declined by roughly 84 percent and 55 percent respectively over approximately this period. According to the International Renewable Energy Agency (IRENA), Saudi Arabia has expanded its renewable energy capacity during this period, from 2 MW in 2010 to 4743 MW in 2024. The bulk of the renewable capacity is solar energy, which had a total capacity of 4340 MW. But, according to the Energy Institute's Statistical Review of World Energy, in 2024, Saudi solar and wind power plants generated only 8.2 TWh and 1.6 TWh respectively, a paltry 2.2 percent of the total electricity produced in the country.

This low share of electricity is at odds with two realities: Saudi Arabia has high levels of solar irradiance, with studies showing that "photovoltaic technologies would perform well at any location" in the country. And, Saudi Arabia has been successful at commercial solar projects; in 2024, it achieved a new global record for the lowest levelised cost of electricity from a solar photovoltaic project.

All of this suggests that Saudi Arabia should be just pouring financial resources and political capital into accelerating solar energy, and not even bother with developing nuclear energy. Unless there is some other motivation.

A not-so-hidden purpose?

One attribute of nuclear energy that "its advocates, for the most part, avoid mentioning" is "its innate and inseparable connection to nuclear weapons, and more generally, to the military". The earliest nuclear reactors were, after all, built not to generate electricity but to produce atomic weapons. And something along these lines has been mentioned by the most powerful individual in Saudi Arabia, Prince Mohammed bin Salman. In March 2018, MBS explained the context for the Saudi interest in nuclear technology in an interview with *CBS News*:

CBS: Does Saudi Arabia need nuclear weapons to counter Iran?

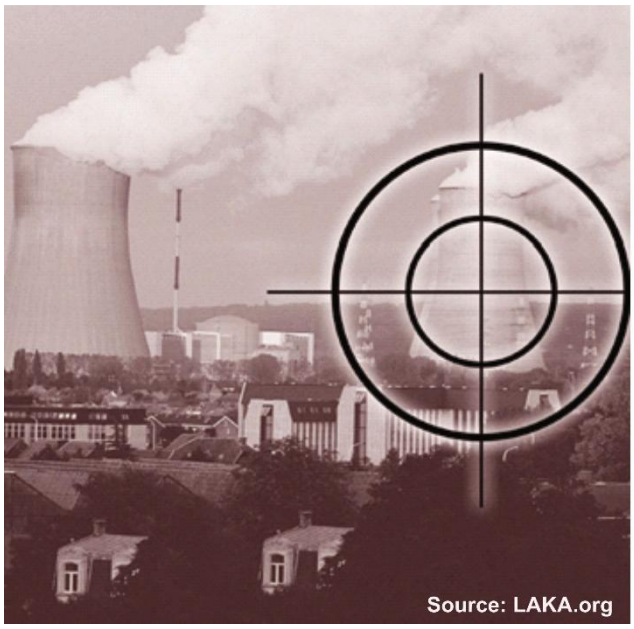
MBS: Saudi Arabia does not want to acquire any nuclear bomb, but without a doubt if Iran developed a nuclear bomb, we will follow suit as soon as possible.

It is certainly possible that Saudi Arabia's desire to develop a nuclear bomb "as soon as possible" is a powerful motive for the country's interest in nuclear energy. But unambiguous proof of that interest is unlikely to become visible for decades. As was the case with India, which set up its Atomic Energy Commission in 1948 ostensibly for "peaceful" purposes but tested its first nuclear weapon in 1974, and then a range of weapons in 1998. Absence of proof is not proof of absence, and it is better to be safe than sorry.

Drones are an increasing security problem for nuclear power plants

Jan van Evert

On November 10th five drones were observed flying above the Doel nuclear power plant in Belgium, energy company Engie said. "Initially we had detected three drones, but then we saw five drones. They were up in the air for about an hour," Engie spokesperson Hellen Smeets told POLITICO Monday morning. The Belgium police are investigating the incident. Doel is not far from the Dutch border, so inhabitants of the region reacted concerned when they heard about the drones. This is not the first time drones were spotted above the Doel nuclear power plant. In 2014 the same thing happened with one drone. In the same year drones flew over several nuclear facilities in France. In 2023, multiple drones were spotted flying near French nuclear power plants, prompting investigations into potential sabotage attempts.



What are the risks posed by drones? The first, of course, is the possibility of an attack with explosives. Although nuclear power plants are shielded by a thick concrete dome, according to a British security expert, many barriers are 'outdated' and not designed to keep out advanced UAVs (Unmanned Aerial Vehicles). Some incidents suggest that drones equipped with small explosives or flammable payloads could target cooling systems, transformers, or spent nuclear fuel storage facilities.

The most realistic scenario in which a drone could cause damage is when the power plants connection to the high-voltage grid is sabotaged. A well-coordinated flight by a drone equipped with a long piece of electricity cable could cause a short circuit and fire in the high-voltage section. This may require the power plant to be disconnected from the grid for an extended period of time.

Several countries, including France and Germany, have introduced drone-neutralizing technology. However, defending a nuclear power plant against drones remains challenging, as they can be operated remotely and are increasingly difficult to track.

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The Parallel Universe of Small Modular Reactors (SMRs) Scotland's Place in the Narrative

Tracy Patrick

As a fiction writer, I'm faced with alternate narrative possibilities, and the different ways a story might end. But even in the strangest fantastical tales, for example, Lewis Carrol's *Alice in Wonderland*, or Herman Hesse's, *The Glass Bead Game*, there has to be a certain amount of believability.

The same might be said of theoretical physics. In 1983, Professors Stephen Hawking and James Hartle, published a seminal paper, 'Wave Function of the Universe,' implying that the Big Bang created not just one universe, but an infinite number of parallel universes, existing simultaneously: universes in which anything was possible.

Fast forward to May 1986. It's a beautiful spring day, and I'm standing in the garden of my grannie's council house, under a vast blue sky dotted with cotton wool clouds, unable to believe that, floating above me, is radioactive fallout. Chernobyl has just happened and, in the aftermath, heavy rain has caused widespread contamination in the UK and Europe, resulting in the FSA (Food Standards Agency) imposing restrictions on nearly ten thousand farms in Cumbria, Wales, Scotland and Northern Ireland due to the risk of Caesium-137 entering the food chain. In Scotland, those restrictions remained in place until 2010, and in Cumbria until 2012.

Like many of us who grew up during the Cold War, fear of nuclear annihilation is hard-wired into my DNA. In 1979, in the wake of media panic surrounding the NORAD (National Emergency Airborne Command Post) incident, when a computer error simulated a full-scale Soviet nuclear attack, resulting in retaliatory alerts across the US and Europe, I remember asking my father if I would wake up as a skeleton after the bomb was dropped.

This fear has lingered on in my fascination with the story of nuclear power, a technology so mythical in proportion, so ingenious, grotesque (some people call the mushroom cloud beautiful), it's impossible to turn away. What happened at Three Mile Island, Chernobyl, and Fukushima is well known. As well as the atrocities of Nagasaki, Hiroshima, the Marshall Islands. Mistakes that could never be repeated. Right?

In 2005, then Scottish First Minister, Jack McConnell, stated he was not in favour of new nuclear and, in 2007, the newly elected SNP government formalised the no new nuclear strategy; Scotland has maintained that stance ever since. As the Scottish government website clearly states: 'We oppose the building of new nuclear stations using current technologies. We believe that nuclear power represents poor value for consumers.' It goes on to argue against the cost of new nuclear developments such as Hinkley Point C which will see 'consumers subsidising its operation until 2060.' As for Scotland's own nuclear stations, Hunterston, Dounreay and Chapelcross are in the process of being decommissioned, and Torness is set to close by 2030.

But with elections coming on 7 May 2026, almost forty years to the day since fallout from Chernobyl first reached our shores, Scotland's nuclear future is up for debate. In October 2025, twenty years after McConnell instigated the no new nuclear policy, UK Energy Secretary, Ed Miliband, attacked the SNP claiming they are holding back Scotland's

nuclear future with their ‘anti-growth, anti-jobs ban.’

The piece, in *New Civil Engineer*, shows a marked change in policy, in which Scottish Labour now says, ‘yes to new nuclear in Scotland.’

What has changed? Contrary to Johnson’s slogan, ‘Go nuclear, go large,’ Miliband and Starmer have joined the bandwagon of billionaires who see the future of nuclear energy in small modular reactors (SMRs), sold to the public as a kind of ‘nuclear light,’ or watered down version of the big thing. The IAEA (International Atomic Energy Agency) classifies an SMR as a nuclear reactor with a power output of up to 300 Mwe, enough to supply 300,000 homes. Full-scale nuclear stations are 1GW or over, powering one million plus homes. The key word is, ‘modular,’ meaning SMR components (theoretically) will be built in factories and assembled on site along the lines of an IKEA flatpack. I say theoretically because the technology is vastly underdeveloped, with only one SMR currently in existence: China’s HTR-PM reactor in Shandong. US and European SMR companies such as NuScale, Terrapower (owned by Bill Gates), and Rolls Royce SMR, despite having received billions of government investment, have yet to come up with a successful and economically viable design. Go Nuclear, Go Nowhere.

Yet, on 13 November 2025, the UK government announced that Wylfa, on the coast of Ynys Môn (Anglesey) in North Wales, will host the country’s first SMR power plant.

In his 2024 book, *Nuclear is not the Solution*, M V Ramana calls SMRs a ‘diseconomy of scale,’ claiming these projects have failed because the overwhelming financial costs of research, development and construction, and the time scales involved, are simply not viable in terms of the power they produce. A good example is NuScale whose SMR design, after being approved by the US Nuclear Regulatory Commission (NRC), and receiving billions in funding from private investors and the US Department of Energy, was cancelled because its estimated cost rose from $4.2 billion in 2018 for a 720-megawatt plant, to 'an eye-popping $9.3 billion for just 462 megawatts of power capacity' (M V Ramana).

It would take five NuScale reactors to achieve the same projected output as Hinkley Point C at around the same price tag, yet the SMRs would power only 1.5 million homes, compared with Hinkley’s projected 6 million. That’s without considering decommissioning, an additional cost, not borne by the operators, but by the public. Assuming it all goes without a hitch.

Nevertheless, in Miliband’s new nuclear golden age, there will be ‘a network of small modular reactors across the UK’ providing us all with cheap, safe, clean electricity. It seems that Miliband is living in something akin to a parallel universe. At the very least, it’s an alternative narrative without any real believability.

So where does Scotland fit in? ‘Enlighten,’ Scotland’s ‘Independent Think Tank,’ whose board of trustees is chaired by none other than Jack McConnell, says this on the subject of nuclear power: ‘the current view of the SNP that nuclear is unsafe and too costly collapses under scrutiny,’ because nuclear is, ‘safer on a deaths-per-unit-of-power basis than wind’ and, furthermore, ‘Most of the fatalities associated with nuclear have come not from radiation, but from poorly managed evacuations, such as after Fukushima.’ Without nuclear, says ‘Enlighten,’ Scotland ‘will lose its last source of zero-carbon baseload power… the backup will not be more

wind farms or batteries, it will be fossil fuels or imports from Norway.'

Have we been enlightened on the road to Damascus, or is it just radioactive glow? On the subject of evacuations, perhaps Ed and Jack can tell us how fast we *should* run from nuclear fallout? Oh, they're gone.
After rummaging through the internet for statistics on deaths per unit of power (yes, someone has actually carried out that fool's errand) I found: wind power is responsible for 0.04 deaths per TWh (Terawatt hour), nuclear for 0.03, and solar for 0.02. It's not clear if this figure includes birds flying into turbines. According to Morgan Legal Group PLLC who, if not paragons of virtue, have at least done some research: 'no central database tracks all accidents caused by wind turbines… of over 200 reported accidents at wind farms in the United States since 2009… most of these accidents result from malfunctioning equipment or human error rather than the wind turbines themselves.' As for Scotland's data, unless the Nuckelavee (that Orcadian skinless sea monster who sought revenge on communities for burning seaweed) has now turned its attention to wind farms, I'll assume it's not dissimilar.

Of course, McConnell et al. are not the only ones running alternative rings around nuclear fission. The World Nuclear Organisation claims only 28 people died as a direct result of Chernobyl, going so far as to state that the accident records are 'of little consequence in terms of human fatalities.' Animal casualties are not included. To be fair, fatalities are difficult to measure due to the challenges of gathering long-term data, but a good indicator is that, in 2019, the Ukrainian government was paying survivors' benefits to 35,000 families 'owing to the loss of a breadwinner whose death was deemed to be possibly related to the Chernobyl accident.' Ukrainian and Belarusian physicians treating large numbers of former liquidators suggested the IAEA had under estimated the toll of disaster-related deaths from long-latency health consequences, claiming the true figure to be around several thousand per year.

Perhaps the sacred cow of alternative realities around new nuclear power is that, without it, we will be unable to keep global warming below 1.5°C, the figure set by the Paris Agreement to achieve net zero emissions. There is no doubt that achieving this target is urgent. Current estimates show we are on course for a modest 2.2°C rise, with 2024 being the warmest year on record. In the UK, this trend continued into 2025.

So how would it work? According to *New Civil Engineer*, to bridge the shortfall left by large nuclear, forty to fifty SMRs would have to be built in the UK by 2050, an unprecedented annual build rate requiring highly efficient levels of factory-based manufacturing. The components of SMRs are complex and difficult to design and manufacture. Testing and evaluation alone for China's HTR-PM took 26 months; the entire reactor took ten years to build. Starmer's promise to use 'all the tools in our armoury – cutting red tape, changing planning laws, and backing growth – to deliver the country's first SMR in North Wales,' cannot downplay the complexity, nor make it go faster.

The same goes for full scale nuclear power. Taishan 1, China's EPR (European Pressurised Reactor), built on the same model as Hinkley C, took ten years to complete. If Hinkley is operational by 2030, it will have taken twelve years. Given that nuclear engineering is a process which even large centralised power systems cannot fast track, then what hope is there for capitalist systems, with their complicated financing through SPACs (special

acquisition companies), mergers and endless requests for government funding, before a result has even been produced.

As a final aside, most SMRs currently in development (including that of Wylfa) are expected to run on a more highly enriched form of uranium 235 known as HALEU (High Assay Low Enriched Uranium). Currently, the only supplier of HALEU is Rosatom, Russia's state-owned nuclear energy company. This small matter of energy security knocks the 'imports from Norway' argument out the park.

My favourite novel, *Greenvoe*, by Orcadian author and poet, George Mackay Brown, is, in effect, a parallel universe in which a mysterious development called Black Star arrives on Orkney in order to mine uranium, thus destroying millennia of life on the island. Where's Nuckelavee when you need him?

But before we plunge ourselves into a dystopian future where Ed Miliband clones in trilby hats sell upcycled SMRs in second hand junkyards, it is worth considering how our energy needs are actually being met in present-day reality: 98% of Scotland's energy comes from renewables. Published statistics show that, 'in 2024, a record 38.4 TWh of renewable electricity was generated in Scotland… an 8.4% increase on the previous high of 35.5 TWh generated in 2022' (https://www.gov.scot/publications/energy-statistics-for-scotland-q4-2024/pages/renewable-electricity-generation/). In 2022, renewables actually provided an excess of energy, the equivalent of 113% of Scotland's electricity needs (https://www.gov.scot/news/record-renewable-energy-output/), with wind providing 78% of all renewable energy (https://www.scottishrenewables.com/our-industry/statistics). Although Scotland imports gas from Norway, oil and gas together account for only 11% of Scotland's electricity production, with gas often forming only 2.2% (https://electricityproduction.uk/in/scotland/) of the overall mix, and gas consumption continuing to decline. Wind farms do require more land than a nuclear plant, but that land will remain uncontaminated and can still be used for other purposes like agriculture.
Long duration battery storage is frequently cited as a drawback for renewables, the claim being it will lead to power cuts. However, solutions such as compressed air energy storage (CAES), hydrogen storage, and flow batteries, are advancing considerably. In 2022, global grid-scale battery storage capacity saw an over 75% increase in installations, and 'is expected to rise by 67 per cent to 617GWh this year and to grow tenfold by 2035, according to energy research firm BNEF' (https://ig.ft.com/mega-batteries/). Large-scale grid modernization programs, such as the UK's 'The Great Grid Upgrade,' to build new high-voltage lines and subsea cables, are underway.

Furthermore, the cost of renewables, including infrastructure and battery storage, has plummeted by around 90% over the past ten years and, according to Bloomberg, the fall is expected to continue. In terms of the levelized cost of energy (LCOE) nuclear is by far the most expensive option at £109 per MWh, four times more expensive than wind which costs only £38 MWh (https://www.gov.scot/publications/foi-202400420100/), making renewables the default lowest-cost option for new power generation worldwide.

While writing this article, the MWh price of electricity in the UK is £72.50 per MWh. The annual strike price for Hinkley Point C (referred to earlier) is £128.09 per MWh (at today's inflation), and this price is guaranteed for 35 years, adding considerably to the MWh price of electricity for every household in the

UK. The deal for Sizewell C is no better. It allows the developers to start charging us for electricity before the plant is even built. The fancy name is Regulated Asset Base (RAB), designed to avoid companies incurring interest on loans during the construction phase. The abandoned V C Summer project in South Carolina was financed on this model, leaving customers paying for electricity they never received to the tune of £1.4 billion. Years later, one of the parties involved, Westinghouse, was in the running to build the proposed SMRs at Wylfa in Wales.

In short, the UK government wants to commit the UK and Scotland to a programme of unproven nuclear technology, that is less safe and that will drastically increase the cost of living, while failing to reduce emissions, and leaving future generations with the problem of decommissioning and toxic waste. All this while cleaner and cheaper forms of renewable energy are readily available, that will not only reduce emissions but create jobs in what is now a rapidly developing, and lucrative, industry.

Which universe would you choose?

The nuclear industry and its political cheerleaders are barking so loudly over tried and tested reality, that I feel it's important for people to have information with which to contradict them. It's not a political issue, it's common sense.

In his final paper, 'A Smooth Exit from Eternal Inflation,' Hawking claimed that parallel universes could be potentially detected in the cosmic microwave background of the Big Bang, making them subject to the laws of physics, rather than just theoretical possibilities. He knew believability was important. Unlike McConnell, Miliband, and their new nuclear golden age.

Imagine a pro-nuclear earth where everything that can go wrong has gone wrong: cyber terrorist attacks on power stations, infrastructure failure, catastrophic environmental disaster caused by the effects of global warming, radiation leaks, core meltdowns, large scale fallout, widespread contamination, mutual nuclear annihilation, an uninhabitable earth.

By the same token, a parallel universe also exists where this will never happen. An earth where people decide against a risky, costly, and unpredictable programme of nuclear technology. Where society puts aside those ideas on the basis that just because you could, doesn't mean you definitely should. A world where people focus instead on expanding renewables. Where governments, whatever their systems, expend valuable public money on healthcare, education, equality, the restoration of biodiversity…

Does it have to be a parallel universe?

This article is reprinted with permission from the author, Tracy Patrick. She is a a poet and novelist from Paisley, Scotland.

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New Greenpeace report shows risks of radioactive waste storage

Jan van Evert

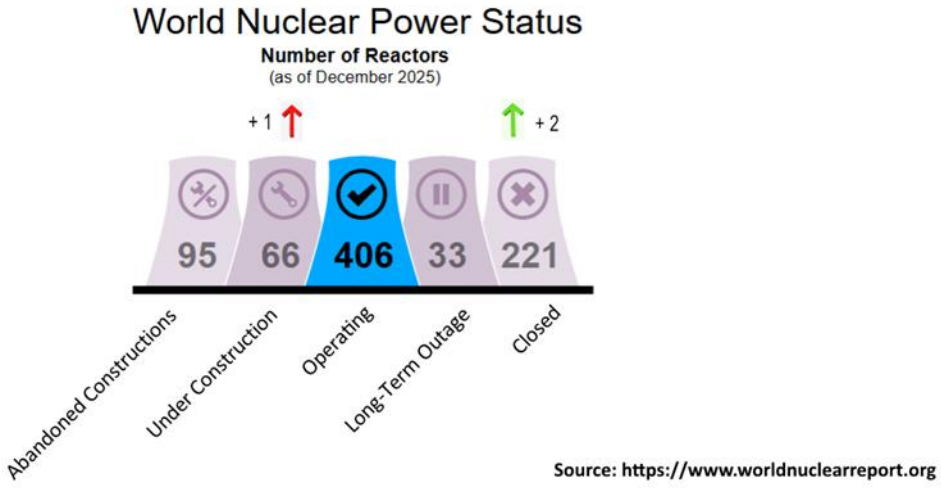
Greenpeace Switzerland has published a report by GeneWatch UK consultancy concerning the problem of radioactive waste. The literature review identifies a number of scenarios in which a significant release of radioactivity could occur from a deep geological disposal facility.

High radioactive waste will have to be stored for at least a hundred thousand years. The design life of a deep geological repository is even intended to be up to a million years. The report investigates two repository concepts: in clay rocks and in hard (crystalline) rocks. In clay rocks, the design-life of steel canisters is too short to outlast the long period of time during which the intense heat from the radioactive wastes would affect the physical and chemical processes occurring in the repository. In hard rocks, disputes regarding the corrosion rate of copper have not been

resolved, bentonite can also be damaged, and groundwater and gas flow through complex networks of fractures is still not fully understood.
Future glaciation could cause faulting of the rock, rupture of containers and penetration of surface waters to the repository, leading to failure of the barriers and faster dissolution of the waste. Claims that repositories in Sweden and Finland in hard rocks would withstand expected future earthquakes and glaciations are highly speculative. Moreover, a new study

by an international team of researchers has uncovered that the next ice age should naturally begin in about 10,000 years.
Several processes could cause serious problems when storing radioactive waste in both clay rocks and hard rocks. The first is the significant disturbance to the rock caused by the excavation of the tunnels and the extreme heat and radioactivity emitted by the wastes. The second is that copper or steel canisters could corrode more quickly than expected. Another problem is that the effects of intense heat generated by radioactive decay could impair the ability of backfill materials to protect the canisters from stresses in the rock and to trap radioactive substances. The heat is also sufficient to create an uplift of the rock at ground level of around ten centimetres or more, around one thousand to two thousand years after the radioactive wastes are buried around 500 meters beneath the surface. Even more serious is the increase of gas pressure in the repository caused by the corrosion of metals or the degradation of organic material. This could damage the barriers and force fast routes for the escape of radionuclides through crystalline rock fractures or clay rock pores.

The full report can be downloaded here:
https://www.greenpeace.ch/static/planet4-switzerland-stateless/2025/11/ed8ea7f1-rock-solid-2_bericht-mit-summary_de.pdf
Other sources:
https://scitechdaily.com/ice-ages-follow-a-hidden-pattern-and-scientists-just-cracked-it/



Source: https://www.worldnuclearreport.org

Compared to the last edition of the Nuclear Monitor (932)

- ✓ Construction of Ningde-6 has started in China.
- ✓ In Belgium, Doel-2 is closed.
- ✓ Bilibino-2, Russia is closed.