



Nuclear facilities around the world: the old, the new and the crisis-affected

Following the German government's decision to phase out nuclear power, it is clear that Germany's last nuclear power plant will be shut down in 2022. However, it is equally clear that this does not mark the end of Germany's responsibility for this high-risk technology. The dismantling of its nuclear installations, the management of the interim storage facilities and the still unresolved issue of a repository site will continue to preoccupy Germany for the foreseeable future.

It is important, too, to look beyond Germany's borders. Nuclear facilities are currently in operation in many European countries and elsewhere in the world. According to the International Atomic Energy Agency (IAEA), there were 443 nuclear reactors in operation in 31 countries (including Taiwan) in February 2020, and 52 new facilities are under construction. And although other countries besides Germany are phasing out nuclear power, plants will remain in operation around the world for years or even decades to come.

Nuclear power plants age too

Many of the European nuclear power plants have been on stream for decades, and the older they get, the more risks they pose. Due to wear and tear and component fatigue, the technology in use in these older installations is more likely to break down.

What's more, the safety and radiation protection standards which applied when these nuclear power plants were being planned were much less stringent than they are today. As a result, many nuclear installations are less resilient to earthquakes and extreme weather events and are more vulnerable to attack. Upgrading is essential but only feasible to a limited extent.

The French power plants at Fessenheim and Cattenom near the border with Germany and the Beznau nuclear power plant in Switzerland are examples of facilities whose safety level is below current German and international standards. The safety status of these plants therefore gives real cause for concern.

New construction projects in Europe and elsewhere

Although it is often said that nuclear energy is enjoying a resurgence, its contribution to the energy supply is steadily decreasing. New-build projects in Western European countries are losing

momentum, often accompanied by soaring costs; this is the case with the French plant at Flamanville and Finland's Olkiluoto. However, in Eastern Europe, some governments are still taking an interest in nuclear power – partly to compensate for the coal phase-out, which is essential to protect the climate. As a result, some countries such as Poland are considering moving into nuclear power for the first time.

Other countries – like China and India – still rely on nuclear power, but new plant construction has slowed considerably since Fukushima. In these countries, the expansion of renewable energies is progressing more rapidly than growth in nuclear.

The introduction of nuclear energy is also being considered by countries such as Egypt, Nigeria and Turkey. With Russia's support, Turkey has begun constructing two nuclear power plants, with Russia promising an all-inclusive package from design to construction and the take-back of radioactive materials.

But what happens to a nuclear plant if a contract partner becomes insolvent – or if the host state is drawn into a military conflict, as with Turkey and Russia in Syria? For new nuclear states in particular, there are numerous challenges: setting up an independent supervisory authority, providing skills training for technical staff, and managing and storing the high-level radioactive waste produced by the plant, for example.

Nuclear safety in crisis regions

Even in stable countries, nuclear power generation is fraught with risk. But what happens if the political situation changes or, worse still, if an armed conflict breaks out? Instability in crisis regions can severely impact the infrastructure that is essential for the safe operation of nuclear facilities. The effects are felt all along the chain, from the work of the supervisory authorities to reactor upgrading, the supply of replacement parts and the provision of training for technical staff.

Armed conflicts can also lead, for example, to outages in the external power supply that is vital for the safe operation of nuclear power plants. Moreover, nuclear facilities are vulnerable to targeted attacks.

Nuclear expertise still needed for many years

Although Germany is in the process of phasing out nuclear power, it is vital that it maintains its nuclear energy expertise. The dismantling of the plants and the final storage of the nuclear waste that is the industry's legacy will require highly skilled professionals and their knowledge for decades to come. Internationally, too, Germany should continue to be able to speak with authority, not least because the impacts of nuclear accidents do not stop at national borders. The Oeko-Institut's scientists are therefore working on the international aspects of reactor safety as well.

Safety deficits at Cattenom nuclear power plant

In a study commissioned by the German federal states of Rhineland-Palatinate and Saarland, Oeko-Institut researchers analysed the current technical status of France's Cattenom nuclear power plant and identified various safety deficits.

The analysis determined the relevant safety assessment criteria for the nuclear power plant, which is located near the border with Germany. From this starting point, the Oeko-Institut experts then

detailed a number of deficits at various safety levels. The aim was to identify the deficits which pose particular risks to human health and the environment.

The study noted that there were serious deficits at all levels of safety. For example, the design of the plant does not currently offer sufficient resilience to enable it to withstand an earthquake or an aeroplane crash in all scenarios: this type of incident could potentially result in multiple failures of safety systems. The level of redundancy – *in other words, the additional provision of the same or comparable components or functions* – is also too low: this means that a fire, transmission line failure or internal sabotage of safety systems could cause an incident with potentially very serious consequences.

[Analysis of existing safety deficits of the Cattenom NPP: study by the Oeko-Institut on behalf of the federal states of Rhineland-Palatinate and Saarland](#)

Nuclear safety and conflicts: the Nuclear Crisis Barometer

Nuclear power plants are in operation in crisis regions all over the world. In Ukraine, Pakistan, Iran and North Korea, for example, there are simmering crises which periodically erupt into armed conflict and military clashes. The nuclear power plants in regions such as these are therefore especially vulnerable, with a question mark over their safety. However, the nuclear safety/conflict nexus generally receives very little public attention.

Scientists at the Oeko-Institut conducted a research project, funded by the [German Foundation for Peace Research \(DSF\)](#) and the Oeko-Institut itself, to investigate the nexus between nuclear safety and conflicts. As part of the project, an interactive website is currently being developed in order to cluster all the information. A database is used to generate global and regional maps showing where nuclear power plants are in operation in conflict regions worldwide. The resulting global Nuclear Crisis Barometer is regularly updated.

[Oeko-Institut donation-funded project: „Krisenreport und Nuklearkrisenbarometer“ \(= Crisis Report and Nuclear Crisis Barometer\)](#)

Further information

[Oeko-Institut case studies: Nuclear safety and conflicts](#)

[Assessment of the current state of research on new reactor concepts: study by the Oeko-Institut on behalf of the Swiss Energy Foundation](#)

[„Sicherheitsstatus des Kernkraftwerks Beznau“ \(= Safety status of Beznau nuclear power plant\): study by the Oeko-Institut on behalf of the Baden-Württemberg Ministry of the Environment, Climate Protection and Energy Sector](#)

[„Sicherheitsstatus des Kernkraftwerks Fessenheim“ \(= Safety status of Fessenheim nuclear power plant\): study by the Oeko-Institut on behalf of the Baden-Württemberg Ministry of the Environment, Climate Protection and Energy Sector](#)

[„Neue Staaten mit Nuklearenergie“ \(= New states with nuclear energy\): presentation by the Oeko-Institut at the Wiener Nuklearsymposium \(Vienna Nuclear Symposium\) 2019](#)

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