Unresolved problems in dealing with nuclear energy

Facts, experiences and conclusions from Emil Brütsch*

by Ursula Cross

In the future, an ever-increasing share of our growing energy needs is to be covered by electricity. But where is the required energy going to come from? Dark and windless skies, energy fluctuations, a lack of electricity storage options, unresolved grid problems and security of supply, environmental issues and, last but not least, speculative prices caused by the stock market also raise justified doubts about so-called green technologies. A comprehensive analysis of all options, beyond ideology, is needed as a basis for long-term planning. This article takes a closer look at the unresolved issues surrounding nuclear energy.

In 2011, the Swiss Federal Council and parliament decided to phase out nuclear energy and ban the construction of new nuclear power plants. However, in view of the energy problem and the disillusionment that renewable energies cannot meet the growing demand for energy, calls for new "small" nuclear power plants are now on the increase. The Federal Council would like to keep all energy options open again for the longer-term security of supply, including nuclear power plants.

Several countries in and outside the EU want to rely even more on nuclear energy in the future. But have nuclear power plants become safer? The following is a contribution to the discussion.

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Decades of research

In September 2024, the extensive research of the German mechanical engineer *Emil Brütsch* was kindly provided to the "Swiss Standpoint".

All aspects of nuclear energy are meticulously and objectively presented over 40 pages, the pluses and the minuses, including seven pages of source references. Apart from the fact that it is most interesting and fascinating for the reader, it provides a well-founded overview of

Europe at night. How will the energy demand be met? (Picture © NASA Earth Observatory)

this specialised field. The state of the art is made tangible with the most important details. The diverse technical details are formulated in such a way that even laymen can understand or at least get a sense of what each single point is about.

The experiences from nuclear energy production are presented. In doing so, it becomes clear how central the "human factor" is. Open questions round off *this research paper.*[1]

Motivation and professional experience

During the 1970s, nuclear energy was discussed as possibly the best way forward.

Emil Brütsch: "That's what prompted me, as a prospective mechanical engineer, to choose the in-depth field of nuclear energy. After successfully completing my studies, I worked in the nuclear energy sector of the 'fast breeder'. For years, I was involved in the development of techniques for so-called fuel element damage detection experiments. My research was carried out both at my desk and in the development and practical testing in the laboratory, in experimental plants and in nuclear power plants.

* *Emil Brütsch,* He has a degree in mechanical engineering and lives in Bergisch Gladbach, Germany. He has worked in the nuclear energy sector of the "fast breeder" and was particularly involved in the development of techniques for so-called fuel element failure detection experiments. This also included practical testing in the laboratory, in experimental plants and in nuclear power plants. He later worked in the field of superconducting magnets and spent 15 years working on the instrumentation and control of gas turbines. Today he is an editor at the "Bürgerbrief für Frieden und Demokratie" (Citizens' Letter for Peace and Democracy).

When the 'fast breeder' project was discontinued, I was initially able to get involved in the supply and instrumentation of superconducting magnets and, most recently, in the instrumentation and control of gas turbines for over 15 years."

"Nuclear energy – not a sensible path for the future"

This research paper is based on Emil Brütsch's decades of experience and insights, as well as knowledge proven by sources.

The comprehensive analysis is divided into five chapters, which can be read independently of each other, as a reference work, so to speak:

1 Raw material resources for nuclear power plants
2 Energy from nuclear fission
3 Energy from nuclear fusion
4 Experience with nuclear energy production to date
5 Overall views

In the following, parts are selected from each chapter. This is done in the order of the chapters, using the respective titles and subtitles.

Chapter 1 – Supplies of raw materials for nuclear power plants

Raw materials for nuclear fission

Uranium and plutonium are presented; the focus is on the properties of the raw materials and the available deposits. According to the German Federal Institute for Geosciences and Natural Resources, the mining reserves of uranium are located in Kazakhstan (27%), Canada (20.8%), South Africa (13.4%) and Brazil (12.5%).

There is also a lot of interesting data on thorium and lithium. Lithium is mined at great expense and with serious environmental and health risks, which are described in more detail. "The current mining process consumes gigantic amounts of water and destroys the livelihoods of the people in the affected region."

Raw materials for nuclear fusion

The central elements are hydrogen, deuterium and tritium, which in turn requires lithium.

Chapter 2 – Energy from nuclear fission

Previous reactor types and plants

The reader is given access to a worldwide overview of all nuclear power plants.

To date, *pressurised water reactors, boiling water reactors, breeder reactors* and *thorium reactors* have been built.

They are described and compared with their respective "driving mechanisms" and safety-related properties, underpinned with assessments of risks, and the problems are recorded in a differentiated manner.

Nuclear energy of the future

The newer developments are *liquid salt reactors* and *dual-fluid reactors* (DFR). The paper contains illustrations from a video lecture by physicist *Michael Bockhorst,* in which a complete representation of a DFR is presented.

According to Emil Brütsch's research, the effects of radiation on human health are played down by the inventors, the German Canadian company "Dual Fluid Energy Inc." This is explained in detail.

Chapter 3 – Energy from nuclear fusion

The state of research in Germany and the USA regarding energy generation from nuclear fusion is described, i.e. from *magnetic fusion* and *laser fusion.*

"Even if everything goes according to plan, the first economic fusion reactor would not be operational until 2060." […] "Since the development of magnetic fusion is repeatedly delayed, some researchers are now focusing more on other projects such as laser fusion, although here, too, at least another decade and a half will pass before the completion of a first test facility."

In the USA, physicists at the *National Ignition Facility* (NIF) are conducting research into laser fusion from a military perspective.

Chapter 4 – Experiences with nuclear energy production to date

"These experiences include how people deal with a technology that, at critical moments, can cause enormous and lasting damage, especially to human health. The following also considers how radioactive waste is handled and its consequences."

We not only learn what happened and when, but also, with selected details, what the problematic points are and why.

The *uranium ore mining* in the Black Forest resulted in radioactive contamination of the wastewater. The radon exposure led to cancer and the mine was closed in 1990. The uranium mine in Saxony and Thuringia was also closed in 1998. Uranium oxide, known as *yellowcake,* was produced there. This is the raw material for atomic bombs and nuclear power plants. For every kilo of uranium extracted, over a ton of radioactive rock was left behind. This radioactive waste from stockpiled material and many millions of cubic metres of sludge still pollutes the air and water, depending on the weather.

"The extraction of uranium not only contaminates the food and groundwater of the local population, but often leads to their displacement and thus the uprooting of their centuries-old culture. The Canadian province of Sakatchewan is the largest uranium producer in the world."

"What remains is waste containing radioactive elements, metals and poisons such as nickel, arsenic, iron and aluminium, sulphides, sulphates and radon; these substances remain in the very sensitive environmental cycle of nature in northern Canada for many thousands of years. In Niger, uranium mining is based on secret contracts. [...] After the coup in the summer of 2023, the export of uranium to France was immediately stopped."

Decommissioning of nuclear power plants

"Radioactive waste (i.e. 2% of the total mass of the nuclear power plant) is to be disposed of in an 'orderly' manner. The fuel elements (with 99% of the radioactivity of a nuclear power plant) must decay for several years after reactor operation in cooling ponds – the cooling and water supply are safety-relevant – before they can be transported for reprocessing or final disposal." [...] "a complete dismantling can take up to 15 years or significantly more time; for example, the Greifswald nuclear power plant has still not been completely dismantled after 28 years."

"According to a 2016 estimate, the dismantling of German nuclear power plants by the end of the century is expected to cost around 170 billion euros".

Due to the entanglement of politics with the nuclear lobby and political failure, part of the multi-billion-euro cost risk for the decommissioning of the plants and the final disposal of the nuclear waste threatens to fall at the expense of taxpayers.

Disposal of radioactive waste

Final repositories and interim storage facilities are suppressed issues, as the documentary "Die Reise zum sichersten Ort der Erde" ["Journey to the Safest Place on Earth"] illustrates. As recently as 2013, no solution for safe final disposal was in sight. However, the problem that radioactive waste must be stored safely for millions of years should be addressed by independent and democratically controlled politics.

The research paper provides a chronological account of the processes in Germany since the 1960's. Countless lawsuits are taking place, but professional project planning is not recognisable.

"In mid-2023, the *Federal Company for Final Storage* (BGE) announced that the location for a final storage facility for highly radioactive nuclear waste will not be determined in 2031 as required by law, but at the earliest in 2046."

Numerous conflicts of interest and illegal shady dealings have come to light in the examples on organisation, personnel and transparency. Here, the human factor directly emerges as a security risk. Responsibility, security and trust are at stake.

In 2014, *no final storage facility* was yet in operation worldwide.

In *Japan,* a final storage facility is not in sight even in 2023.

In *Finland,* the world's first repository for highly radioactive waste in a crystalline rock cavern near Eurajoki was approved in 2015. The first fuel rods are to be placed in the world's first repository in 2025.

In *Sweden,* the green light was given in 2022 for the construction of a high-level radioactive waste repository in granite rock.

In *France,* an operating licence for a repository for the period 2025–2040 is being sought.

In *Switzerland,* a site for a high-, intermediate- and low-level radioactive waste repository is planned in the "Nördliche Lägern" area in the Canton of Zurich. The documents for the general licence application have been submitted at the end of 2024. If approved by parliament and the people, the storage facility in the 800-metre-deep clay rock could be available after 2060.

DU munitions

To use natural uranium for nuclear reactors or even nuclear weapons, the isotope U-235 must be enriched. The higher the level of enrichment, the more depleted uranium is left over, which must be disposed of. Over the years, very large quantities of this *depleted uranium* (DU) have accumulated. To avoid the expensive and as yet unresolved disposal of the depleted uranium, it is now sometimes used to manufacture ammunition with a very high penetrating power.

But wherever uranium ammunition has been used, there has been an abrupt increase in cases of aggressive cancers, not only among the population of the affected areas, but also among soldiers. There are examples of this from Italy, Iraq and the former Yugoslavia.

Its harmfulness has been legally established but is still being denied by the *World Health Organisation* (WHO), the *International Commission on Radiological Protection* (ICRP), leading politicians and military leaders.

The government of Iraq has announced that it has been scientifically established that in Iraq, resulting from the 1991 and 2003 wars, at least 18 regions have become virtually uninhabitable due to DU dust and that the population must therefore be evacuated.

3% of Italian soldiers have died because of exposure to DU munitions while serving in Iraq.

Germany has also repeatedly tested this munition, a fact that has been kept secret by the German Ministry of Defence.

In March 2023, the UK announced that it would supply Ukraine with depleted uranium munitions. Israel has already used the GBU-28 bunker-penetrating bomb several times in previous conflicts with Hamas, and since 7 October 2023, as the conflict escalated, there has been public speculation that Israel could also use this DU weapon in the Gaza Strip.

Reactor accidents

– *Tschernobyl*

  According to the German magazine “Der Spiegel”, the meltdown that occurred in Chernobyl on 26 April 1986 in Unit 4 was due to human error.

  The film “The Battle of Chernobyl” (“Die Schlacht von Tschernobyl”, Planet-Schule.de) gives an insight into the course of the disaster and its consequences across Europe.

  Emil Brütsch has compiled further important data on this tragic event near the Ukrainian city of Prypjat, which was founded in 1970: the events in Russia and the radioactivity measured in Germany, Switzerland and France.

– *Fukushima*

  On 11 March 2011, the first waves of the strongest earthquake in Japanese history reached the power plant site. They triggered the emergency shutdown of boiling water reactors 1–3 and led to the loss of the external power supply. The rising tsunami waves destroyed the seawater pumps, which led to a complete failure of the emergency power supply and thus to the regular cooling of the reactors.

  On 16 May 2011, the operator Tepco confirmed that there had also been core meltdowns in reactors 2 and 3.

  Details of the radiochemical analysis, major investments in untested technology to secure the reactor buildings and the high levels of radioactivity in the seawater are explained. Since 24 August 2023, Japan has also been discharging radioactive contaminated cooling water from the former Fukushima nuclear power plant into the Pacific Ocean.

Health problems caused by radioactivity and heavy metals

This section is about radiation risks, the sensitivity of human life to radiation, the partially outdated current recommendations of the *International Commission on Radiological Protection* (ICRP) and increased health risks of radiation for cancer in the low-dose range.

The consequences of radioactive radiation are made tangible by the example of the US aircraft carrier Reagan, which was to provide assistance after the meltdowns in Fukushima. 5000 soldiers were deployed. The contaminated ship was refused to dock anywhere for two and a half months. Many of the crew still suffer from the effects of radiation today.

Chapter 5 – Overall views

Empirically based views on costs and risks

The focus is on a report by the *German Institute for Economic Research* (DIW), an analysis of the state of research on new reactor concepts by the *Öko-Institut e.V.* and a comprehensive interview by *Paul Schreyer* with the German physicist and civil rights activist *Sebastian Pflugbeil* on the risks of nuclear energy.

View on nuclear weapons

According to *Axel Mayer,* from *Lebenshaus Schwäbische Alb,* the list of accidents and near-disasters involving nuclear weapons, nuclear submarines and faulty warning systems is alarmingly long and incomplete in all nuclear-weapon states. The USA alone is still “missing” at least eight fully explosive bombs. This is just one of many disturbing examples.

For Emil Brütsch, one thing is clear: “In my view, nuclear weapons, but also uranium ammunition, are unacceptable for life on this planet.”

Personal conclusion of Emil Brütsch

Based on factual arguments, facts and conclusions from the individual chapters, Emil Brütsch sums up that nuclear energy is not a sensible path for the future:

“The catastrophes that have occurred with nuclear power plants, and also the attempt at blackmail by firing on nuclear facilities during the war in Ukraine, do not lead me to believe that humanity is willing to deal with the risk potential of this form of energy in a sufficiently responsible manner.”

(Translation Swiss Standpoint, U. Cross)

1 *Link to the PDF version of Emil Brütsch's research paper (available in German only).*